Modicon TM5 / TM7 Flexible System

System Planning and Installation Guide

04/2014

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Schneider Electric

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 guide provides the information you will need in order to plan and install a TM5 / TM7 System.

This guide contains:
- an overview and description of the TM5 / TM7 System,
- information and requirements to plan your installation,
- installation procedure for your TM5 / TM7 System,
- information for commissioning and diagnosing your installation.

Validity Note

This document has been updated with the release of SoMachine V4.0.

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

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

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

Related Documents

Title of Documentation	Reference Number
Modicon M258 Logic Controller Hardware Guide	EIO0000000432 (Eng), EIO0000000433 (Fre), EIO0000000434 (Ger), EIO0000000435 (Spa), EIO0000000436 (Ita), EIO0000000437 (Chs)
Modicon LMC058 Logic Controller Hardware Guide	EIO0000000438 (Eng), EIO0000000439 (Fre), EIO0000000440 (Ger), EIO0000000441 (Spa), EIO0000000442 (Ita), EIO0000000443 (Chs)
Modicon TM5 CANopen Interface Hardware Guide	EIO0000000691 (Eng), EIO0000000692 (Fre), EIO0000000693 (Ger), EIO0000000694 (Spa), EIO0000000695 (Ita), EIO0000000696 (Chs)
Modicon TM5 Compact I/O Modules Hardware Guide	EIO0000000456 (Eng), EIO0000000457 (Fre), EIO0000000458 (Ger), EIO0000000459 (Spa), EIO0000000460 (Ita), EIO0000000461 (Chs)
Modicon TM5 Digital I/O Modules Hardware Guide	EIO0000000444 (Eng), EIO0000000445 (Fre), EIO0000000446 (Ger), EIO0000000447 (Spa), EIO0000000448 (Ita), EIO0000000449 (Chs)
Modicon TM5 Analog I/O Modules Hardware Guide	EIO0000000450 (Eng), EIO0000000451 (Fre), EIO0000000452 (Ger), EIO0000000453 (Spa), EIO0000000454 (Ita), EIO0000000455 (Chs)

Title of Documentation	Reference Number
Modicon TM5 Expert (High Speed Counter) Modules Hardware Guide	EIO0000000462 (Eng), EIO0000000463 (Fre), EIO0000000464 (Ger), EIO0000000465 (Spa), EIO0000000466 (Ita), EIO0000000467 (Chs)
Modicon TM5 Transmitter and Receiver Modules Hardware Guide	EIO0000000468 (Eng), EIO0000000469 (Fre), EIO0000000470 (Ger), EIO0000000471 (Spa), EIO0000000472 (Ita), EIO0000000473 (Chs)
Modicon TM5 PCI Modules Hardware Guide	EIO0000000474 (Eng), EIO0000000475 (Fre), EIO0000000476 (Ger), EIO0000000477 (Spa), EIO0000000478 (Ita), EIO0000000479 (Chs)
Modicon TM7 Digital I/O Blocks Hardware Guide	EIO0000000703 (Eng), EIO0000000704 (Fre), EIO0000000705 (Ger), EIO0000000706 (Spa), EIO0000000707 (Ita), EIO0000000708 (Chs)
Modicon TM7 Analog I/O Blocks Hardware Guide	EIO0000000709 (Eng), EIO0000000710 (Fre), EIO0000000711 (Ger), EIO0000000712 (Spa), EIO0000000713 (Ita), EIO0000000714 (Chs)
Modicon TM7 CANopen Interface I/O Blocks Hardware Guide	EIO0000000685 (Eng), EIO0000000686 (Fre), EIO0000000687 (Ger), EIO0000000688 (Spa), EIO0000000689 (Ita), EIO0000000690 (Chs)

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.

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.

The following information applies to the TM5 System:

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.

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

The following information applies to the TM7 System:

⚠ DANGER

POTENTIAL FOR EXPLOSION

- Only use this equipment in non-hazardous locations or in locations that comply either with the Class I, Division 2, Groups A, B, C and D, or with the ATEX Group II, Zone 2 specifications for hazardous locations, depending on your local and/or national regulations.
- Do not substitute components which would impair compliance to the hazardous location specifications of this equipment.
- Do not connect or disconnect equipment unless power has been removed or the area is known to be non-hazardous.

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

Part I
Introduction to the TM5 / TM7 System

Overview

This manual provides an overview of the TM5 and TM7 system:

- The TM5 System is comprised of IP20-rated components with which you can create local, remote and / or distributed I/O architectures. A typical TM5 System includes a controller and may include field bus interface, slices, compact I/O and accessories. These components must be installed in enclosures appropriate to the intended operating environment.
- The TM7 System is comprised of IP67-rated components with which you can create remote and / or distributed I/O architectures. TM7 System including field bus interface I/O blocks, expansion blocks and accessories can be used in environments conforming to IP67 (splashing water, oil, dust, etc...).

What Is in This Part?

This part contains the following chapters:

Chapter 1
Basics of the TM5 / TM7 System

Overview

This chapter provides an overview of the TM5 / TM7 System architecture (local, remote and distributed). Also the color coding principle of the TM5 System is described.

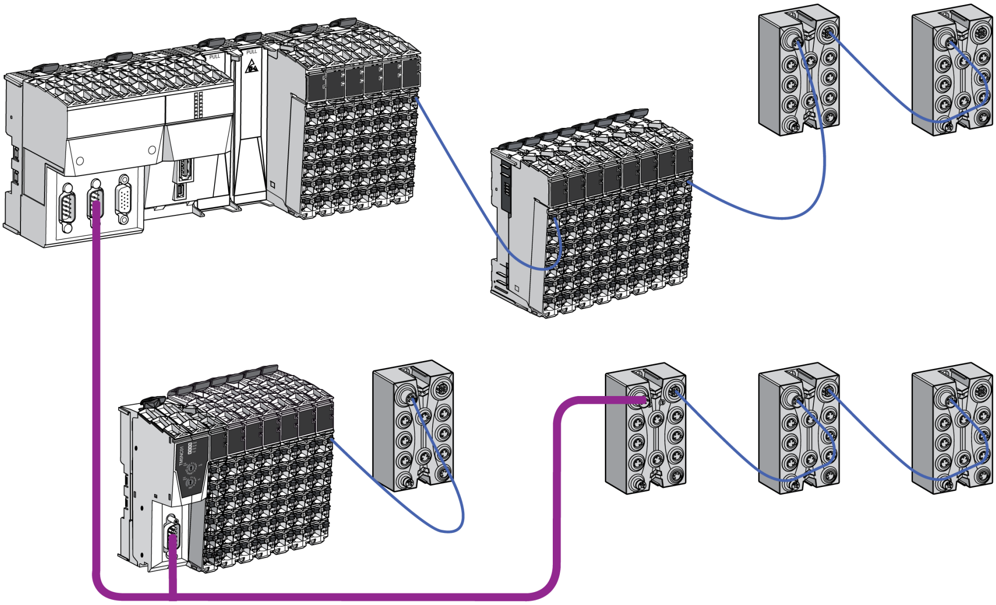
What Is in This Chapter?

This chapter contains the following topics:

TM5 / TM7 Controller System Architecture

Introduction

The TM5 / TM7 System is a flexible control system:



The flexibility is obtained by the association of:

- TM5 System
  - Controller
  - Field bus interface module
  - Compact I/O
  - Slices
  - Accessories
- TM7 System
  - TM7 Field bus interface I/O blocks
  - Blocks
  - Accessories

The controller with embedded I/Os and networking is the main component of the TM5 / TM7 System. It can be expanded by compact I/O, slices and/or blocks.

An expansion module is a compact I/O or a slice in this documentation.

The compact I/O is used to expand and adjust the number of I/O in the TM5 System to the exact needs of your application.

A slice has one of the following functions in the TM5 System:

- Expansion I/Os or
- Power distribution or
- Common distribution or
- Expansion bus

A block has one of the following functions in the TM7 System:

- Expansion I/Os or
- Power distribution

The expansion modules and blocks are used:

- to expand and adjust the number of I/O in a TM5 / TM7 System to the exact needs of your application.
- to manage the distribution of power for electronic modules and I/O (for example separation of 24 Vdc inputs from 24 Vdc outputs...)

Application requirements determine the architecture of your TM5 / TM7 System.

Depending on your needs, the local configuration architecture may optionally be expanded to include remote expansion I/Os and/or distributed I/O systems.

Remote I/O expansions are made by extending the internal TM5 data bus through the use of TM5 Transmitters and Receivers.

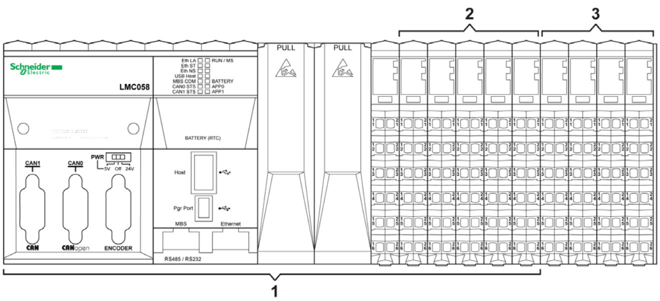
Distributed I/O expansions are made through the use of industrial networks (such as CANopen, Ethernet,...). These networks can be created using the integrated communication ports on the controller or the optional TM5 PCI modules.

Local Configuration Architecture

The local configuration architecture is composed of the controller and its embedded power distribution and I/O modules, as well as any installed PCI and local expansion I/O modules.

NOTE: A local configuration is only possible with the TM5 system.

The following figure represents a controller with expansion I/Os on a local TM5 bus:



1 Controller
2 Embedded I/Os
3 Local expansion I/Os

NOTE: Embedded I/Os cannot be separated from the controller.

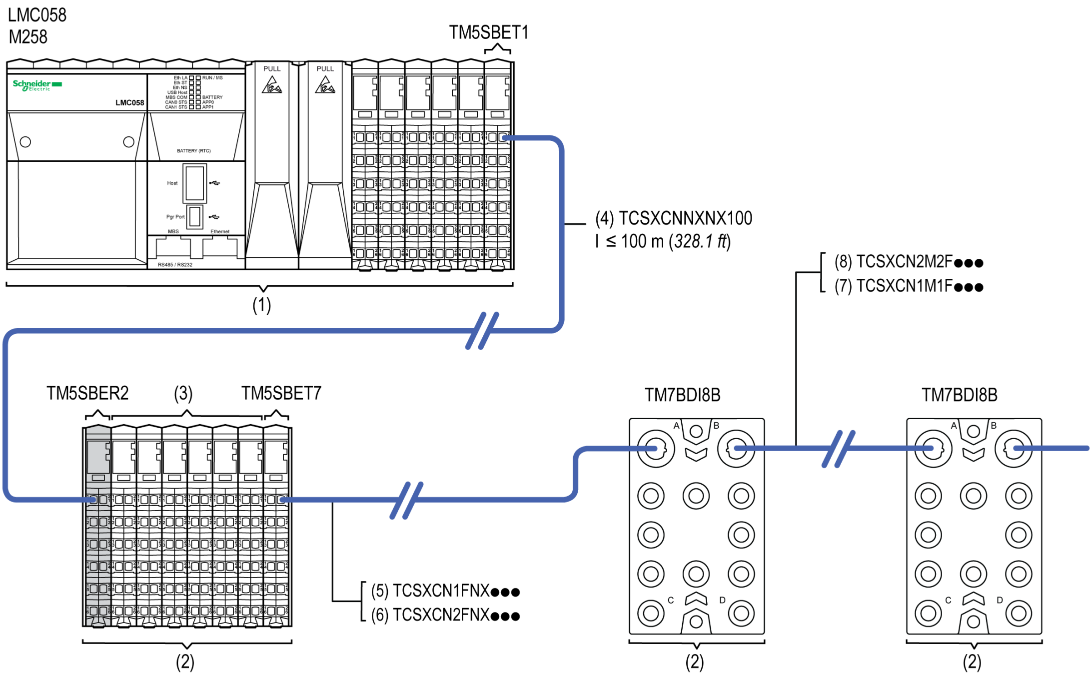
Remote Configuration Architecture

In addition to your local configuration you can place remote I/Os at a distance up to 100 m (328.1 ft) from the controller.

NOTE: You can create remote I/Os with TM5 expansion modules and/or TM7 expansion blocks.

Refer to *Modicon TM5 Transmitter and Receiver Modules Hardware Guide* to design remote configurations.

The following figure represents a global TM5 / TM7 System architecture including a controller with expansion I/Os and remote I/Os:



1 Local configuration
2 Remote configuration
3 Remote expansion I/Os
4 TM5 Expansion bus cable
5 TM7 expansion bus IN attachment cable straight
6 TM7 expansion bus IN attachment cable elbowed
7 TM7 expansion bus drop cable straight
8 TM7 expansion bus drop cable elbowed
TM5SBET1 & TM5SBET7 Transmitter modules
TM5SBER2 Receiver module

TM5 / TM7 Distributed I/Os Architecture

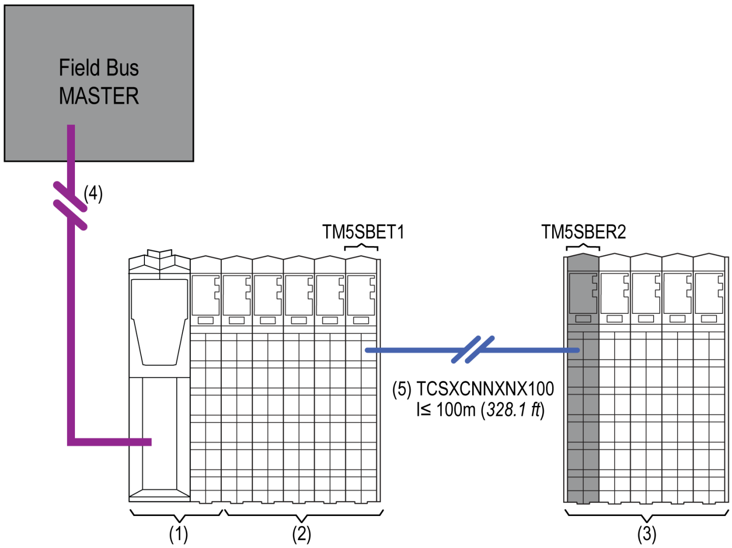
Introduction

The TM5 / TM7 System is an open system and can operate with the following open field bus standards:

- CANopen
- sercos

TM5 Distributed I/Os

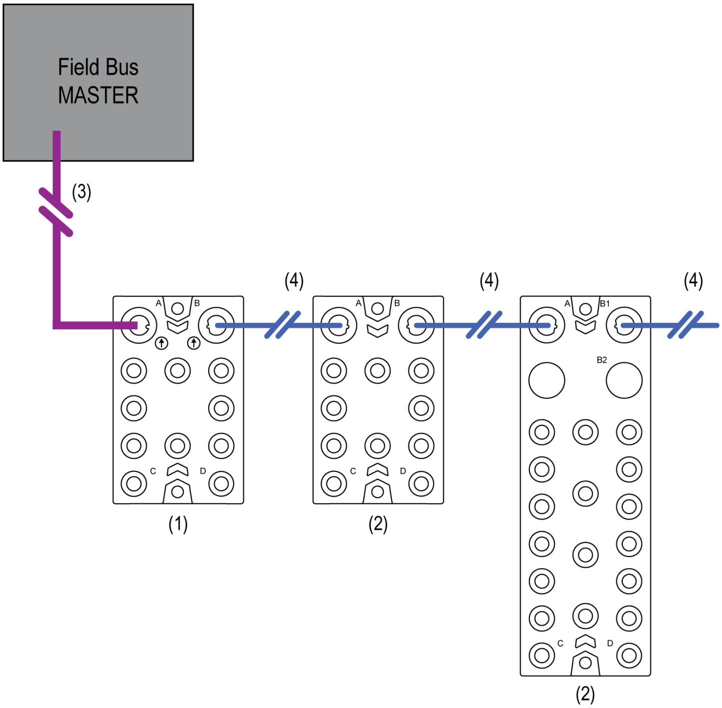
The following figure represents TM5 distributed I/Os connected to a field bus master:



1 TM5 field bus interface
2 TM5 distributed expansion I/Os
1 + 2 TM5 distributed I/O island
3 TM5 remote I/O island
4 Field bus cable
5 TM5 expansion bus cable

TM7 Distributed I/Os

The following figure represents TM7 distributed I/Os connected to a field bus master:

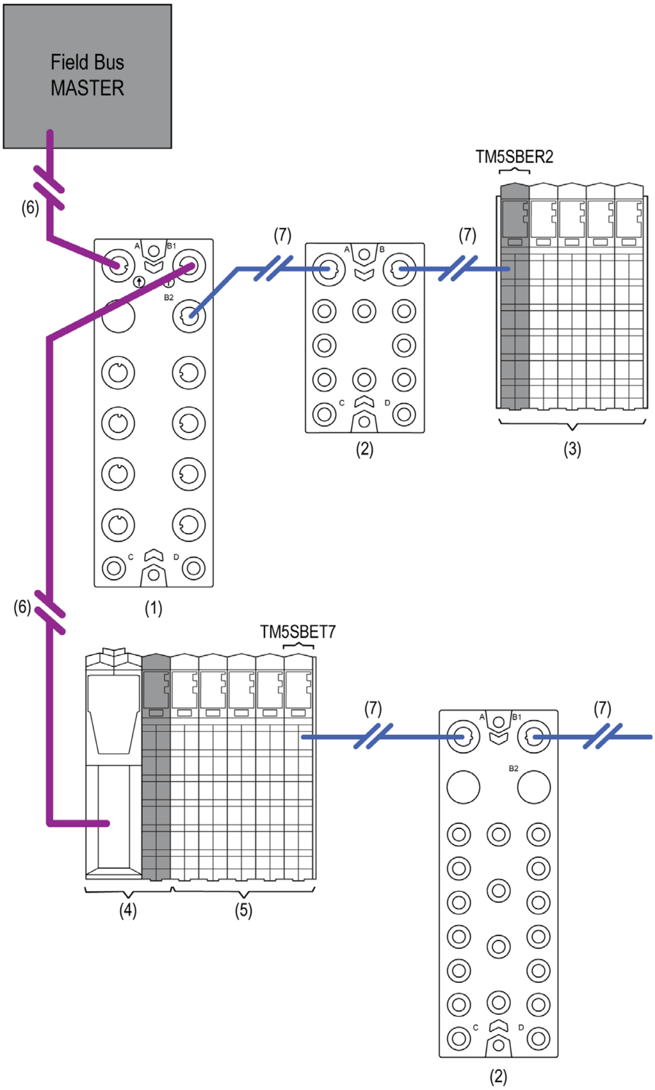


1 TM7 field bus interface I/O block
2 TM7 expansion I/O blocks
3 Field bus cable
4 TM7 expansion bus cables

TM5/TM7 Mixed Distributed I/Os

In addition to your distributed configuration you can place remote I/Os at a distance up to 100 m (328.1 ft) and create a TM5 / TM7 mixed distributed I/Os configuration.

The following figure represents a global TM5 / TM7 System architecture including TM5 / TM7 mixed distributed I/Os:



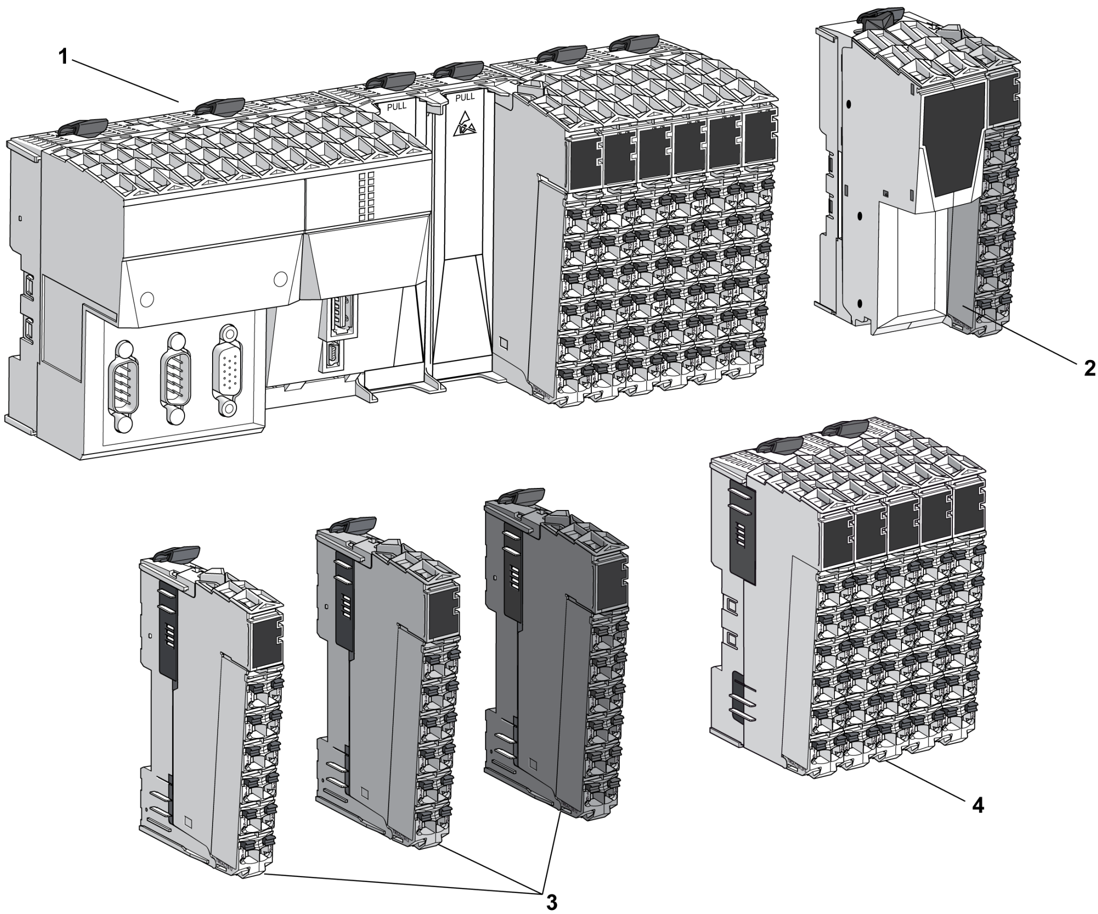
1 TM7 field bus interface I/O block
2 TM7 expansion I/O blocks
3 TM5 remote I/O island

4 TM5 field bus interface
5 TM5 distributed expansion I/Os
4 + 5 TM5 distributed I/O island
6 Field bus cables
7 TM7 Expansion bus cables

Color Coding of the TM5 System

Overview

The following figure shows colors of the TM5 components:



1 Controller
2 Field bus interface
3 Slices
4 Compact I/O

Controller Color Assignment

The color of all the controllers and their removable terminal blocks is white.

Field Bus Interface Color Assignment

Two colors are used for the four components of a field bus interface *(see page 38)*:
- White for the:
  - field bus interface bus base and,
  - field bus interface module.
- Gray for the:
  - Interface Power Distribution Module (IPDM) and,
  - associated terminal block.

Slice Color Assignment

For modules other than the Compact I/O, an assembled TM5 module (referred to as a slice) is composed of a bus base, an electronic module, and a terminal block. Each slice *(see page 45)* of the TM5 System is color coded for improved identification.

Three colors are used for the modules:
- White
- Gray
- Black

The color of a slice is defined by a combination of:
- Input or output voltage,
- Functionality.

The following table gives the colors of the different types of slices:

Voltage	Functionality	White	Gray	Black
24 Vdc	I/Os	X	–	–
	Power distribution	–	X	–
	TM5 bus transmission	X	–	–
	TM5 bus reception	–	X	–
100...240 Vac	I/Os	–	–	X
24 Vdc / 230 Vac	Relay	–	–	X

DANGER

INCOMPATIBLE COMPONENTS CAUSE ELECTRONIC SHOCK OR ARC FLASH

- Do not associate components of a slice that have different colors.
- Always confirm the compatibility of slice components and modules before installation using the association table in this manual.
- Ensure that a correct terminal block is installed on the appropriate electronic module.

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

NOTE: Check the compatibility of components with the association table *(see page 248)* before installation.

Compact I/O Color Assignment

The color of the compact I/O and their removable terminal blocks is white.

Color Coding of the TM7 System

TM7 System Modules Color Assignment

The color of the TM7 System modules is gray.

Chapter 2
Description of the TM5 System

Overview

This chapter provides a brief description of the constituent parts of the TM5 System. It describes the controller, the field bus interface, the slice, the compact I/O module and the accessories.

What Is in This Chapter?

This chapter contains the following topics:

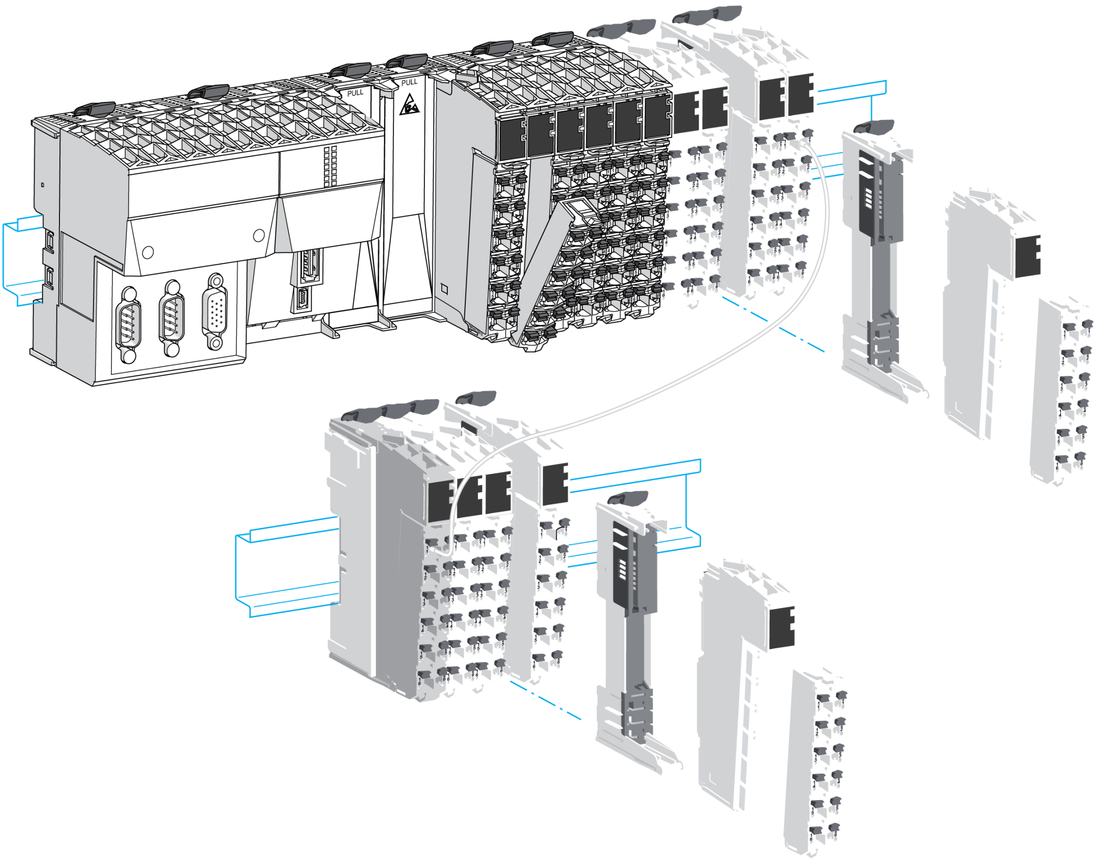
Controller Description

Introduction

The controller is the main element of the TM5 System.

There are two families of controllers:
- Modicon M258 Logic Controller
- Modicon LMC058 Motion Controller

The following figure shows the location of the controller within the TM5 System:



Modicon M258 Logic Controller

The Schneider Electric Modicon M258 Logic Controller is a high performance controller with a variety of powerful features. The controller controls a wide range of applications.

Mechanical, hardware, and firmware features are described in the *Modicon M258 Hardware Guide*.

The following tables describes the controller references available for your TM5 System:

	PCI	CAN	USB A	USB Pgr	Eth	SL
TM258LD42DT	0	0	1	1	1	1
TM258LD42DT4L	2	0	1	1	1	1
TM258LF42DT	0	1	1	1	1	1
TM258LF42DT4L	2	1	1	1	1	1
TM258LF66DT4L	2	1	1	1	1	1
TM258LF42DR	2	1	1	1	1	1

	Embedded expert I/O				Embedded regular I/O				
		Fast Inputs	Fast Outputs	Regular Inputs		Digital Inputs	Digital Outputs		Analog Inputs
TM258LD42DT	2x	5	2	2	1x	12	12	0x	0
TM258LD42DT4L	2x	5	2	2	1x	12	12	1x	4
TM258LF42DT	2x	5	2	2	1x	12	12	0x	0
TM258LF42DT4L	2x	5	2	2	1x	12	12	1x	4
TM258LF66DT4L	2x	5	2	2	2x	12	12	1x	4
TM258LF42DR	2x	5	2	2	2x	6	6 Relays	0x	0

Modicon LMC058 Motion Controller

The Schneider Electric Modicon LMC058 Motion Controller (LMC058) is a high performance motion controller with a variety of powerful features. The LMC058 controls a wide range of applications.

Mechanical, hardware, and firmware features are described in the *Modicon LMC058 Hardware Guide*.

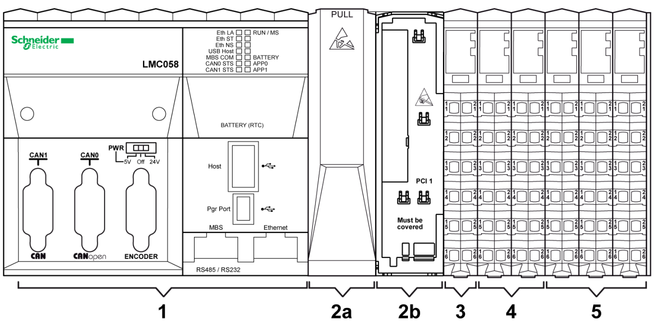
The following tables describes the controller references available for your TM5 System:

	PCI	CAN	USB A	USB Pgr	Eth	SL	ENC
LMC058LF42	0	2	1	1	1	1	1
LMC058LF424	2	2	1	1	1	1	1

	Embedded expert I/O				Embedded regular I/O				
		Fast Inputs	Fast Outputs	Regular Inputs		Digital Inputs	Digital Outputs		Analog Inputs
LMC058LF42	2x	5	2	2	1x	12	12	0x	0
LMC058LF424	2x	5	2	2	1x	12	12	1x	4

Controller Main Features

The following figure gives the main features of a controller:

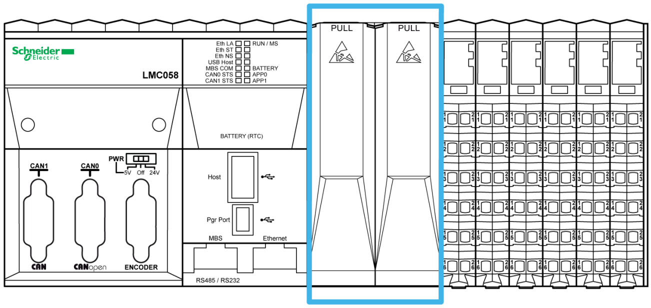


1 Controller
2a PCI slot with cover
2b PCI slot with cover removed
3 Controller Power Distribution Module (CPDM)
4 Embedded expert I/Os
5 Embedded regular I/Os

PCI Slots

There are two PCI slots to connect up to two interface modules depending on the controller reference.

The following figure shows the location of PCI slots of the controllers:



The PCI modules are used for specific application expansions of the controller. They are inserted in the PCI slots of the controller:

Reference	Type	Description
TM5PCRS2	Serial line	TM5 interface electronic module, 1 RS-232, electrically isolated
TM5PCRS4	Serial line	TM5 interface electronic module, 1 RS-485, electrically isolated
TM5PCDPS	Profibus DP	TM5 interface electronic module, 1 RS-485, electrically isolated

For more details refer to the *Modicon TM5 PCI Modules Hardware Guide*.

NOTICE

ELECTROSTATIC DISCHARGE

- Ensure that empty PCI slots have their covers in place before applying power to the controller.
- Never touch an exposed PCI connector.

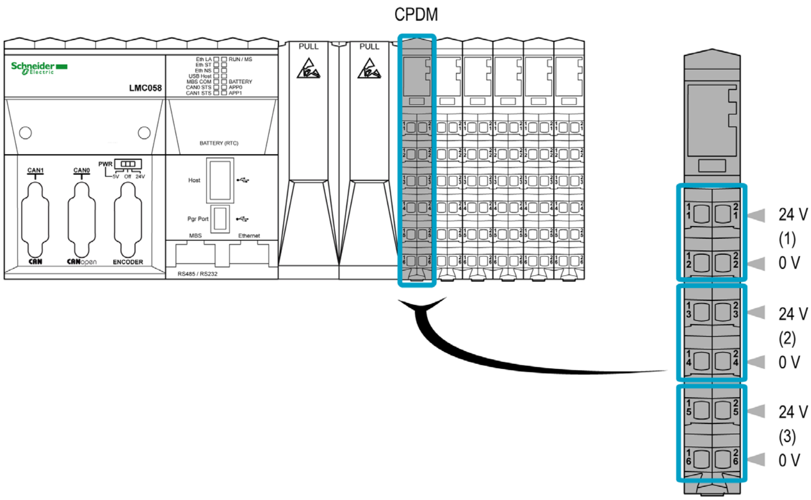
Failure to follow these instructions can result in equipment damage.

Controller Power Distribution Module (CPDM)

The distribution of power by the CDPM consists of three dedicated electrical circuits:

Designation	Description
24 Vdc embedded expert modules power	24 Vdc power that serves the embedded expert I/O modules of the controller and the encoder (depends on references)
24 Vdc Main power	24 Vdc power that serves the electronics of the controller and generates independent power for: ● PCI communication modules (depends on references), ● Modbus connected devices, ● USB keys, ● Electronics of the embedded regular I/O, ● TM5 power bus that serves the expansion modules.
24 Vdc I/O power segment	The 24 Vdc power that serves: ● the embedded regular I/O, ● the sensors and actuators connected to the embedded regular I/O, ● the expansion modules, ● the sensors and actuators connected to the expansion modules, ● the external devices connected to the Common Distribution Modules (CDM).

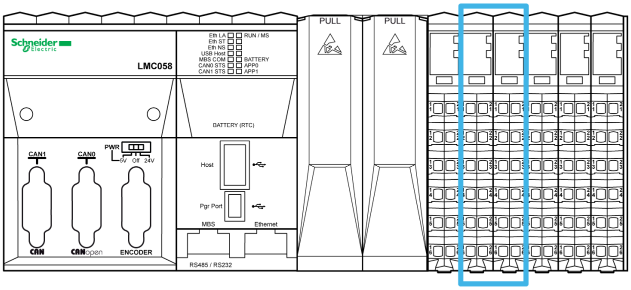
The following figure shows the terminal block assignments of the CPDM:



1 24 Vdc embedded expert modules power
2 24 Vdc Main power
3 24 Vdc I/O power segment

Embedded Expert I/Os

The following figure shows the location of the expert I/Os of the controller:



The controllers have two embedded expert I/O groups. Each group contains:

- 5 fast inputs
- 2 regular inputs
- 2 fast outputs

Each group can be configured as:

- 1 to 4 simple High Speed Counters (HSC)
- 1 main HSC
- 1 Pulse Width Modulated (PWM) output
- 1 frequency generator
- 1 encoder interface

Fast inputs resolution is up to 200 kHz.

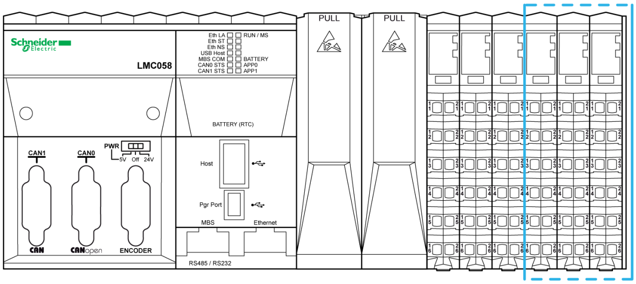
NOTE: When a fast input is not used by special function, it can be used as a regular input.

Fast outputs resolution is up to 100 kHz.

NOTE: When a fast output is not used by special function, it can be used as a regular output.

Embedded Regular I/Os

The following figure shows the location of the embedded regular I/Os of the controller:



The following table gives a short description of the different regular I/Os embedded in the controller, depending on the controller reference:

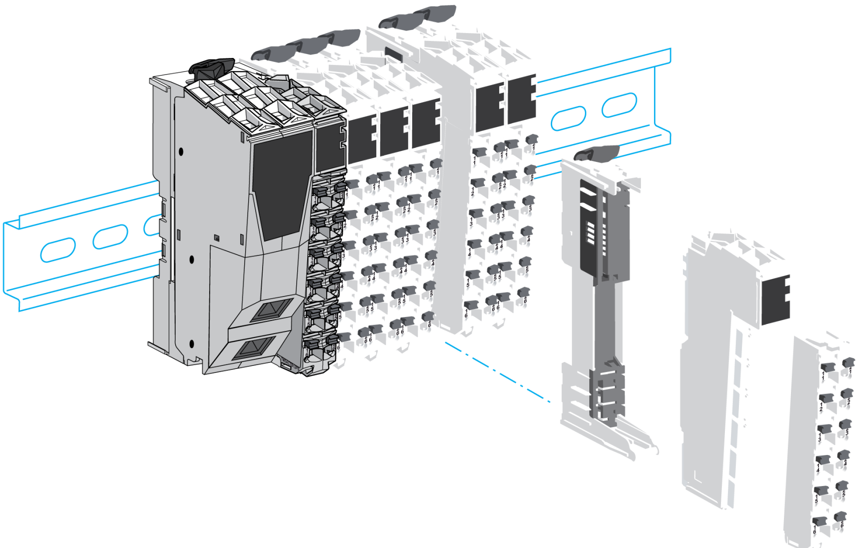
Regular I/Os	Short Description
Digital Inputs	24 Vdc sink / 1 or 2 wires / input Type 1
Digital Outputs	24 Vdc source / 1 wire / transistor / 0.5 A
Analog Inputs	12 bit resolution / -10...+10 Vdc / 0...20 mA / 4...20 mA
Relay Outputs	2 A / 30 Vdc / 240 Vac

Field Bus Interface Description

Introduction

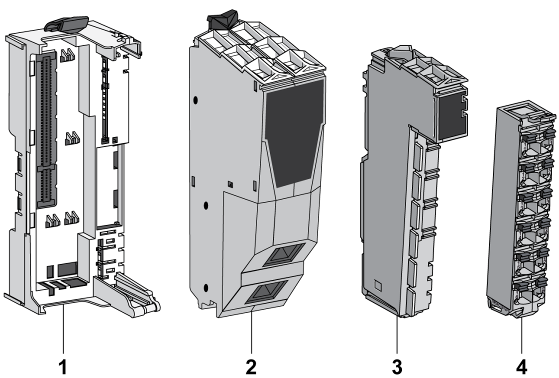
The TM5 field bus interface is the first element of the TM5 distributed I/O island (*see page 21*).

The following figure shows the location of the TM5 field bus interface in a distributed I/O island:



Field Bus Interface Overview

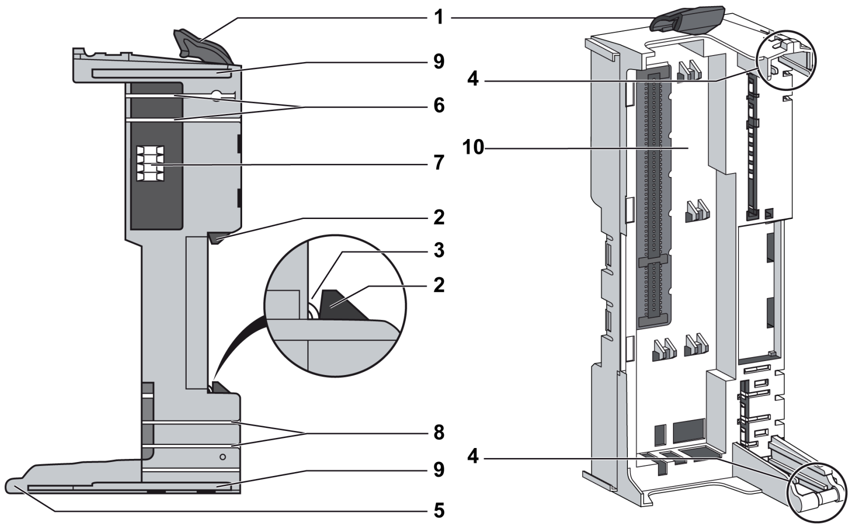
The TM5 field bus interface with built-in power distribution is composed of four different parts to be ordered separately as shown below:



Item	Description
1	Field bus interface bus base *(see page 38)*
2	Field bus interface module
3	Interface Power Distribution Module (IPDM) *(see page 39)*
4	Terminal block *(see page 40)*

Field Bus Interface Bus Base Description

The following figure shows the different parts of the field bus interface bus base:



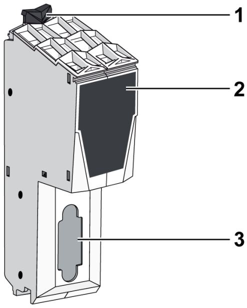
1 Locking lever
2 DIN rail locking mechanism
3 DIN rail contact
4 Guides for assembly of the IPDM
5 Rotation axle for terminal block
6 TM5 bus power contacts
7 TM5 bus data contacts
8 24 Vdc I/O power segment contacts
9 Interlocking guides
10 Slot for bus interface module

The following table gives the available reference:

Reference	Field Bus Interface Bus Base Description	Color
TM5ACBN1	Bus base for field bus interface module and Interface Power Distribution Module (IPDM)	White

Field Bus Interface Module Description

The following figure shows the front view of the field bus interface module:



1 Locking clip
2 Front view
3 Field bus connector

The following table gives the available reference:

Reference	Field Bus Interface Module Description	Color
TM5NCO1	CANopen interface module	White
TM5NS31	sercos interface module	White

Interface Power Distribution Module (IPDM)

The following table gives the available reference:

Reference	IPDM Description *(see page 47)*	Color
TM5SPS3	Bus interface 24 Vdc power supply	Gray

The distribution of the power by the IPDM consists of two dedicated electrical circuits:

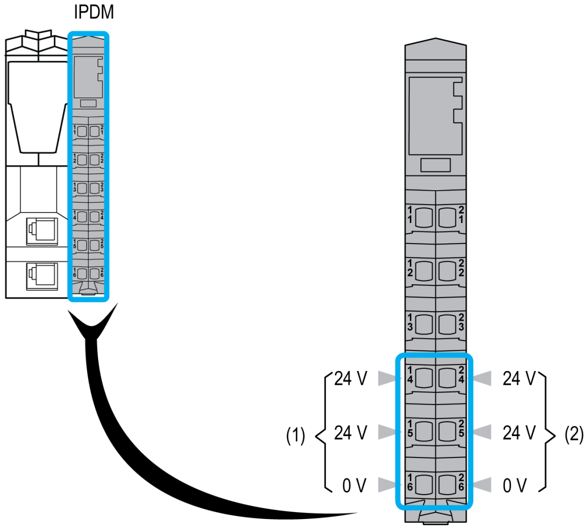
Designation:	Description:
24 Vdc Main power	24 Vdc power that serves the electronics of the bus Interface Module and generates independent power for the TM5 power bus that serves the expansion modules.
24 Vdc I/O power segment	The 24 Vdc power that serves: ● the expansion modules, ● the sensors and actuators connected to the expansion modules, ● the external devices connected to the Common Distribution Modules (CDM).

Terminal Block Description

The following table gives the available reference:

Reference	Terminal Block Description *(see page 48)*	Color
TM5ACTB12PS	24 Vdc, 12-pin terminal block for PDM, IPDM and Receiver electronic module *(see page 343)*	Gray

The following figure shows the terminal block assignments of the IPDM:



(1) 24 Vdc Main power
(2) 24 Vdc I/O power segment

Compact I/O Description

Introduction

The TM5 Compact I/O are I/O expansion modules for your TM5 system. The compact I/O are a group of regular TM5 electronic I/O modules under a single reference. The individual electronic modules are identified by an abbreviated designation on their front face, while the reference of the entire group can be found on the side of the compact I/O module. The abbreviated designation on the individual module faces corresponds to the last characters of the individual module references.The terminals blocks are assembled on the compact I/O when delivered.

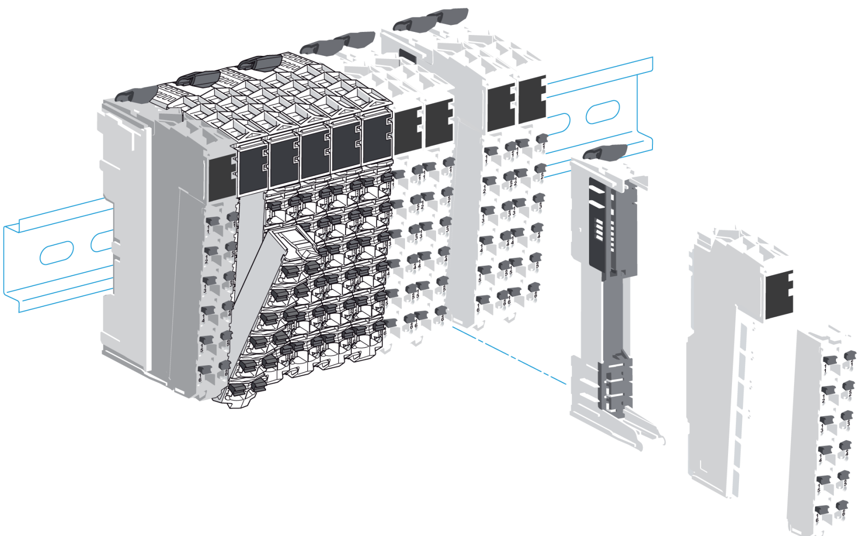
The compact I/O uses a single address on the TM5 Bus.

The electronic modules included in the compact I/O are not individually replaceable.

NOTE: Unlike the TM5 digital and analog I/O electronic modules, the compact I/O do not have hot-swap capability. Do not attempt to hot swap these modules.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION Do not attempt to hot swap TM5 Compact I/O. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

The following figure shows a TM5 Compact I/O as the second component of a remote island:



Compact I/O

The range of compact I/O includes:

- digital input electronic modules
- digital output electronic modules
- analog input electronic modules
- analog output electronic modules

Every electronic module channel has a status LED.

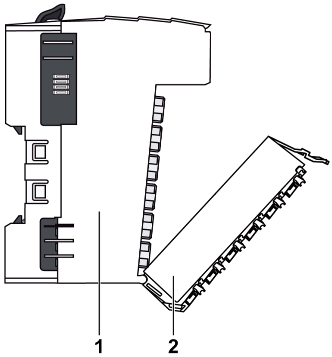
Mechanical and hardware features are described in the *Modicon TM5 Compact I/O Modules Hardware Guide*.

The following table describes the compact I/O reference available for your TM5 System:

Reference	Number and Channel Type							
	Digital Inputs		Digital Outputs		Analog Inputs		Analog Outputs	
TM5C24D18T	2x12In	24	3x6Out	18	–	0	–	0
TM5C12D8T	3x4In	12	2x4Out	8	–	0	–	0
TM5C24D12R	2x12In	24	2x6Rel	12 Relays	–	0	–	0
TM5CAI8O8VL	–	0	–	0	2x4AI ±10 V	8	2x4AO ±10 V	8
TM5CAI8O8CL	–	0	–	0	2x4AI 0-20 mA / 4-20 mA	8	2x4AO 0-20 mA	8
TM5CAI8O8CVL	–	0	–	0	1x4AI ±10 V	4	1x4AO ±10 V	4
					1x4AI 0-20 mA / 4-20 mA	4	1x4AO 0-20 mA	4
TM5C12D6T6L	2x6In	12	1x6Out	6	1x4AI ±10 V / 0-20 mA / 4-20 mA	4	1x2AO ±10 V / 0-20 mA	2

Compact I/O Physical Description

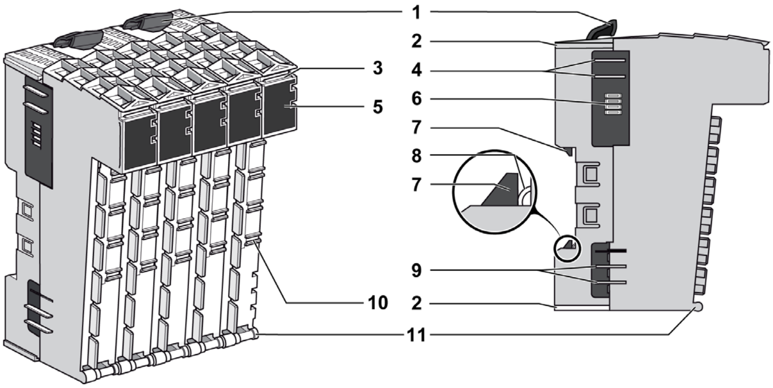
The electronic modules included in each compact I/O are not replaceable and the terminals blocks are delivered assembled on the compact I/O.



1 Integrated bus base and electronic modules of the compact I/O (inseparable)
2 Terminal blocks

NOTICE
ELECTROSTATIC DISCHARGE ● Never touch the contacts of the electronic module. ● Always keep the connector in place during normal operation. **Failure to follow these instructions can result in equipment damage.**

The following figure shows the physical description of the bus base and electronic modules of the compact I/O:



1 Locking levers
2 Interlocking guides

3 Slot for labeling
4 TM5 bus power contacts
5 Display (LEDs)
6 TM5 bus data contacts
7 DIN rail locking mechanism
8 DIN rail contact
9 24 Vdc I/O power contacts
10 Slot to code the electronic module with the associated terminal block
11 Rotation axle for terminal block

NOTE: The terminal blocks *(see page 48)* associated to the compact I/O are 12-pin white terminal blocks.

Inputs and Outputs Modules Features

The following table gives a short description of the input and output modules of the compact I/Os:

I/Os Type	Short Description
Digital Inputs	24 Vdc / 3.75 mA / sink / 1, 2 or 3 wires
Digital Outputs	24 Vdc / 0.5 A / source / 2 or 3 wires
Analog Inputs	12 bit resolution / –10...+10 Vdc / 0...10 Vdc/ 0...20 mA / 4...20 mA
Analog Output	12 bit resolution / –10...+10 Vdc / 0...10 Vdc/ 0...20 mA
Relay Outputs	2 A / 30 Vdc / 240 Vac

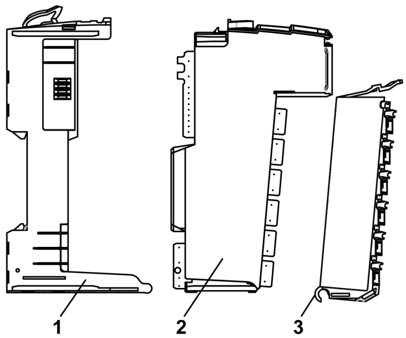
Slice Description

Overview

A slice is an expansion module that has one of the following functions in the TM5 System:

- Expansion I/Os or
- Power distribution or
- Common distribution or
- Expansion bus

The following figure shows the three components of a slice:



1 Bus base
2 Electronic module
3 Terminal block

The Safety bus base and the Safety terminal block for the Safety electronic module, must be ordered separately. For the references see respective sections below.

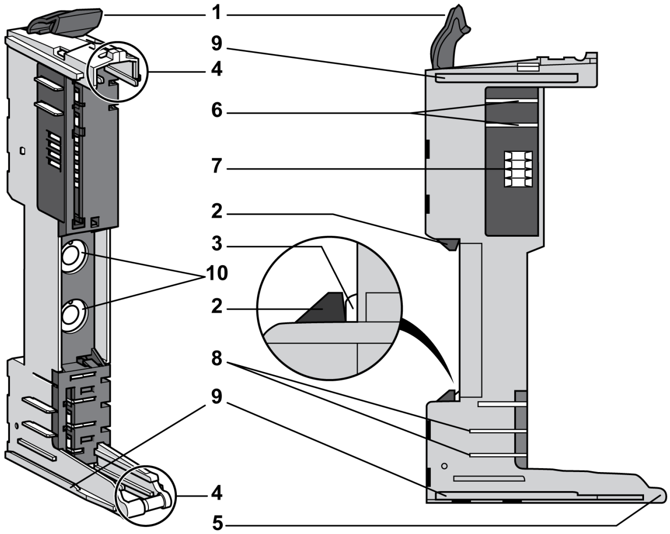
When assembled the three components form an integral unit that resists vibration and electrostatic discharge.

NOTICE
ELECTROSTATIC DISCHARGE ● Never touch the contacts of the electronic module. ● Always keep the connector in place during normal operation. **Failure to follow these instructions can result in equipment damage.**

The compatibility table *(see page 248)* gives the possible associations between components of a slice.

Bus Base Description

The following figures shows the different parts of the bus base:



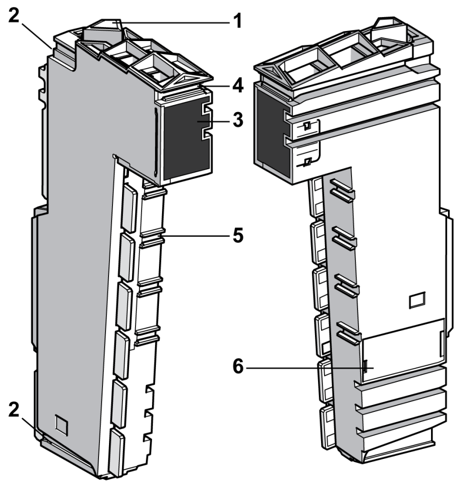
1 Locking lever
2 DIN rail locking mechanism
3 DIN rail contact
4 Guides for assembly of the electronic module
5 Rotation axle for terminal block
6 TM5 bus power contacts
7 TM5 bus data contacts
8 24 Vdc I/O power segment contacts
9 Interlocking guides
10 Address setting rotary switches (optional, depending on references)

This table gives the different types of bus bases *(see page 340)*:

Reference	Bus Base Description	Color
TM5ACBM11	Bus base 24 Vdc 24 Vdc I/O power segment pass-through	White
TM5ACBM15	Bus base 24 Vdc 24 Vdc I/O power segment pass-through with address setting	White
TM5ACBM01R	Bus base 24 Vdc for PDM and Receiver modules 24 Vdc I/O power segment left isolated	Gray
TM5ACBM05R	Bus base 24 Vdc for PDM and Receiver modules 24 Vdc I/O power segment left isolated with address setting	Gray
TM5ACBM12	Bus base for AC modules 24 Vdc I/O power segment pass-through	Black

Electronic Module Description

The following figure shows the different parts of the electronic modules:



1 Locking lever
2 Guides for assembly
3 Display (LEDs)
4 Slot for labeling
5 Slot to code the electronic module and the associated terminal block
6 Internal fuse exchangeable (depending on references)

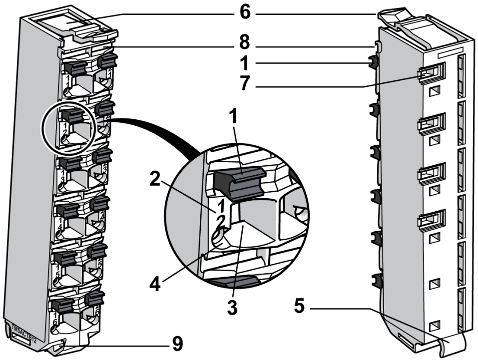
This table gives the different types of electronic modules:

Reference	Electronic Module Description	Color	Refer to
TM5SD••	Digital modules	White or black	Modicon TM5 Digital I/O Modules Hardware Guide
TM5SA••	Analog modules	White	Modicon TM5 Analog I/O Modules Hardware Guide
TM5SPS1•	Power Distribution Modules (PDM)	Gray	TM5 Power Distribution Modules *(see page 267)*
TM5SPS2•			
TM5SPS3	Interface Power Distribution Module (IPDM)	Gray	TM5 Interface Power Distribution Module IPDM *(see page 299)*
TM5SE••	Expert modules	White	Modicon TM5 Expert (High Speed Counter) Modules Hardware Guide
TM5SBET••	Transmitter modules	White	Modicon TM5 Transmitter and Receiver Modules Hardware Guide
TM5SBER••	Receiver module	Gray	
TM5SPD••	Common Distribution Modules (CDM)	White	TM5 Common Distribution Modules *(see page 307)*
TM5SD000	Dummy module	White	TM5 Accessories Modules *(see page 337)*

Terminal Block Description

The main features of the Safety terminal block are:
- Tool-free wiring with spring clamp push-in technology
- Simple push-button wire release
- Ability to label (see page 174) each terminal
- Plain text labeling (see page 181) also possible
- Test access (see page 184) for standard probes
- Can be custom-coded (see page 167)

The following figure shows the different parts of the terminal block:



1 Wire release push-button
2 Pin assignment
3 Spring clamp connector
4 Test access point
5 Hinge for the axle on the bus base
6 Latch for the electronic module
7 Back slot for coding
8 Front slot for labeling
9 Slot for cable tie

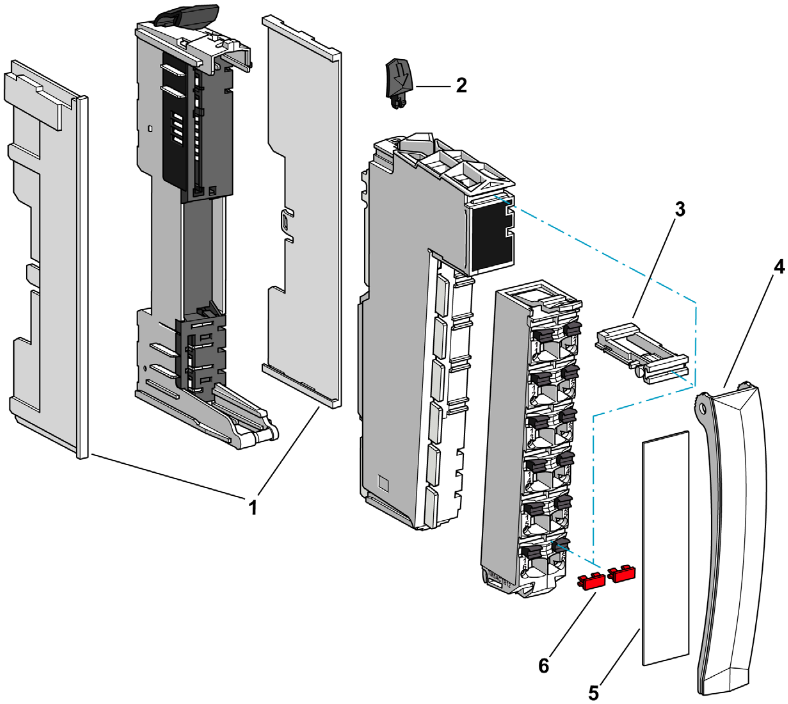
This table gives the different types of terminal blocks (see page 343):

Reference	Terminal Block Description	Color
TM5ACTB06	24 Vdc, 6-pin terminal block	White
TM5ACTB12	24 Vdc, 12-pin terminal block	White
TM5ACTB12PS	24 Vdc, 12-pin terminal block for PDM, IPDM and Receiver electronic module	Gray
TM5ACTB16	24 Vdc, 16-pin terminal block	White
TM5ACTB32	240 Vac, 12-pin terminal block	Black

Accessories

Overview

The TM5 accessories include the following:

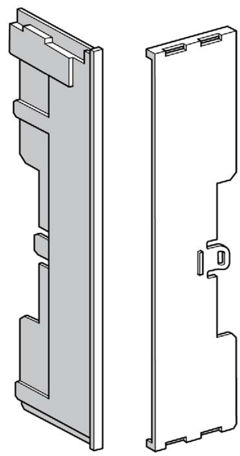


1 Left and right bus base locking plates
2 Electronic module locking clip
3 Terminal locking clip
4 Plain text cover holder
5 Legend strips
6 Label tab

NOTE: The controller is delivered with the right bus base locking plate.

Bus Base Locking Plate

The bus base locking plate helps protect the TM5 bus exposed contacts on either the right and/or the left side of the TM5 system configuration:

Reference	Description	
TM5ACLPL10	10 left bus base locking plates	
TM5ACLPR10	10 right bus base locking plates	

You must use the bus base locking plate to help avoid damage to the TM5 during installation from electrostatic discharge.

NOTICE

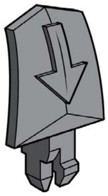
ELECTROSTATIC DISCHARGE

- Install a right bus base locking plate to the rightmost slice of all configurations.
- Install a left bus base locking plate to the first slice of all remote configurations.

Failure to follow these instructions can result in equipment damage.

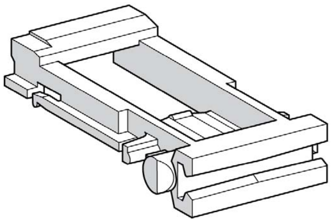
Electronic Module Locking Clip

The locking clip *(see page 178)* helps to securely lock the electronic module to the bus base:

Reference	Description
TM5ACADL100	Locking clip (x100) 

Terminal Locking Clip

The terminal locking clip *(see page 178)* helps to secure the terminal block to the electronic module:

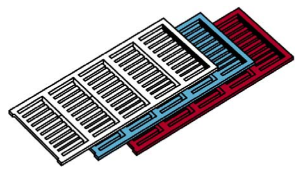
Reference	Description
TM5ACTLC100	Terminal locking clip (x100) 

Label Tabs and Labeling Tool

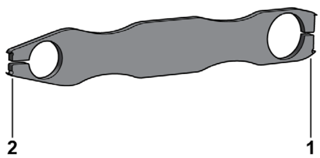
The label tabs are used for:

- labeling *(see page 173)*,
- coding *(see page 167)*.

The following table gives you the references of the three colored label tabs:

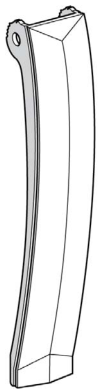
Reference	Description	
TM5ACLITW1	White label tabs, for 16 modules	
TM5ACLITR1	Red label tabs, for 16 modules	
TM5ACLITB1	Blue label tabs, for 16 modules	

The following labeling tool is needed for installing the label tabs, and the coding system between the connectors and the electronic modules:

Reference	Description
TM5ACLT1	Labeling insert tool for label tabs  **1** Double-width cutters **2** Single-width cutters

Plain Text Cover Holder

In addition to the label tabs, the cover holder allows plain text labeling. The plain text cover holder *(see page 181)* is attached to the terminal locking clip:

Reference	Description	
TM5ACTCH100	Plain text cover holder (x100)	
TM5ACTLS100	Legend strip for cover holder (x100)	

TM5 Bus Expansion Cable

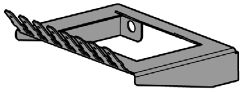
The TM5 bus expansion cable is used between Transmitter and Receiver modules for TM5 data bus:

Reference	Description
TCSXCNNXNX100	Expansion bus cable 100 m (328 ft) 

Refer to *Modicon TM5 Transmitter and Receiver Modules Hardware Guide* for connections.

TM2XMTGB Grounding Bar

The TM2XMTGB Grounding Bar is an accessory used in the TM5 grounding step *(see page 130)* of the TM5 System installation:

Reference	Description
TM2XMTGB	Grounding Bar 

⚠ WARNING

ACCIDENTAL DISCONNECTION FROM PROTECTIVE GROUND (PE)

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

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

Chapter 3
Description of the TM7 System

Overview

This chapter provides a brief description of the constituent parts of the TM7 System. It describes the field bus interface I/O block, the expansion block and the accessories.

What Is in This Chapter?

This chapter contains the following topics:

Field Bus Interface I/O Block Description

Field Bus Interface I/O Blocks

The TM7 field bus interface I/O block is the first element of a TM7 distributed I/Os *(see page 22)* and allows distributed connection of sensors and actuators via a field bus.

Additionally to the field bus interface function, the TM7 field bus interface I/O blocks provides:
- an integrated power supply *(see page 58)*.
- digital connections *(see page 59)*, which can be configured as inputs or outputs.

Each model of field bus interface I/O block is distinguished by the field bus connectors, the number of I/O and its overall size (1 or 2) *(see page 197)*.

The following table describes the field bus interface I/O block references available for your TM7 System:

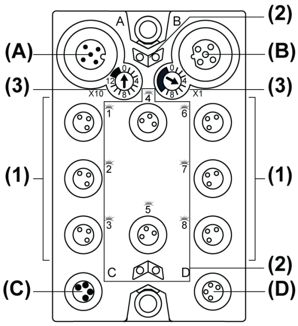
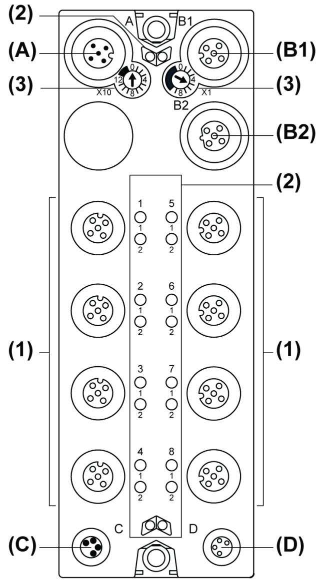
Reference	Field Bus Connection			Digital Channels			Refer to
	Type	IN	OUT	Number	Type	Connector	
TM7NCOM08B	CANopen	Yes	No[1]	8	Input or Output Configurable	M8, 3-pin	Modicon TM7 CANopen I/O Blocks Hardware Guide
TM7NCOM16A		Yes	Yes	16		M12, 5-pin	
TM7NCOM16B		Yes	Yes	16		M8, 3-pin	

[1] To connect a TM7NCOM08B CANopen interface I/O block in a CANopen network use one of the following accessories:
- TM7ACYC
- TM7ACYCJ

If the CANopen interface I/O block is at the end of the line, connect a TM7ACTLA M12 CAN bus terminating resistor *(see page 64)*:
- to the accessory TM7ACYC• for a TM7NCOM08B.
- to the field bus OUT connector for a TM7NCOM16A or TM7NCOM16B.

Field Bus Interface I/O Blocks Main Features

The following figures give the main features of the field bus interface I/O blocks:

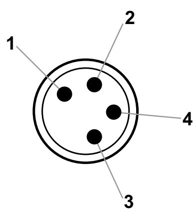
<table>
<tr><th>Size 1: TM7NCOM08B</th><th>Size 2: TM7NCOM16•</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td colspan="2">(A) Field bus IN connector
(B) & (B2) TM7 bus OUT connector
(B1) Field bus OUT connector
(C) 24 Vdc power IN connector
(D) 24 Vdc power OUT connector
(1) Input / Output connectors
(2) Status LEDs
(3) Field bus settings rotary switches</td></tr>
</table>

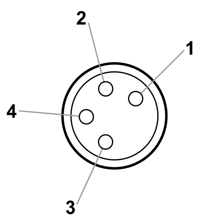
24 Vdc Power Distribution

The distribution of power by the field bus interface I/O block consists of two dedicated circuits:

Designation	Description
24 Vdc Main power	24 Vdc power that serves the electronics of the field bus interface I/O block and generates independent power for the TM7 power bus that serves the TM7 I/O blocks.
24 Vdc I/O power segment	The 24 Vdc power that serves: ● the electronics of the I/O block, ● the sensors and actuators connected to the field bus interface I/O block, ● the expansion blocks, ● the sensors and actuators connected to the expansion blocks.

The following figure shows the pin assignment of the power IN (C) and OUT (D) connectors of the field bus interface I/O blocks:

Connector (C)	Pin	Designation
	1	24 Vdc Main power
	2	24 Vdc I/O power segment
	3	0 Vdc
	4	0 Vdc

Connector (D)	Pin	Designation
	1	24 Vdc I/O power segment
	2	24 Vdc I/O power segment
	3	0 Vdc
	4	0 Vdc

Digital I/O Connections

The following table gives a short description of the digital I/O embedded in the field bus interface I/O blocks:

I/O Configurable	Description
Input	24 Vdc sink / input Type 1
Output	24 Vdc source / transistor / 0.5 A

Expansion Blocks Description

Introduction

There are two main types of TM7 expansion blocks:
- TM7 Power Distribution Block (PDB) *(see page 347)*
- TM7 I/O block

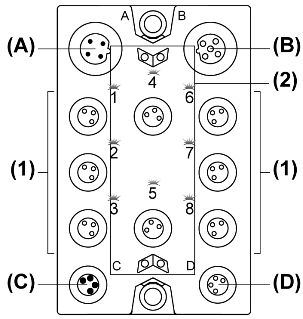
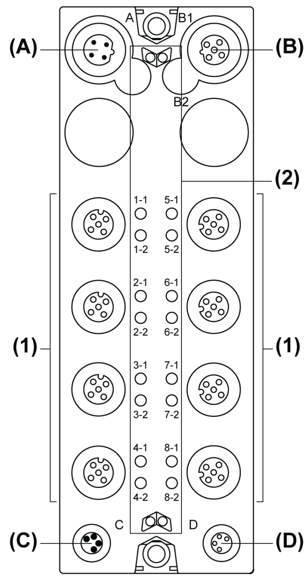
Both the TM7 Power Distribution Blocks and TM7 System I/O blocks make use of two power buses and a data bus to perform their functions. These buses are organized as follows:
- **TM7 bus:** this bus includes one data bus and one power bus, named as follows:
  - **TM7 power bus:** distributes power to supply the electronics of the TM7 System I/O blocks. This bus receives its power from a TM5SBET7 Transmitter module. If necessary, the power on the TM7 power bus can be reinforced by adding a TM7 PDB.
  - **TM7 data bus:** passes data between the controller and the TM7 expansion blocks.
- **24 Vdc I/O power segment:** distributes power to the inputs, outputs and the connected sensors and actuators of the TM7 System I/O blocks. Each TM5 / TM7 System can have multiple 24 Vdc I/O power segments, depending on considerations such as power consumption and separation of I/O types.

I/O Block Main Features

Each I/O block reference is distinguished by its type and number of I/O and its physical size. TM7 System I/O blocks come in two sizes, designated as size (1 or 2) *(see page 197)*.

Reference	Description	Refer to
TM7BA••	Analog input, or output or mixed input and output block	*Modicon TM7 Analog I/O Block Hardware Guide*
TM7BD••	Digital input, or output or mixed input and output block	*Modicon TM7 Digital I/O Block Hardware Guide*

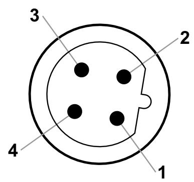
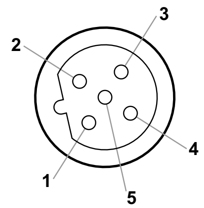
The following figure represents the main features of the I/O blocks:

<table>
<tr><th>Size 1</th><th>Size 2</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td colspan="2">(A) TM7 bus IN connector
(B) TM7 bus OUT connector
(C) 24 Vdc power IN connector
(D) 24 Vdc power OUT connector
(1) Input / Output connectors (depending on references)
(2) Status LEDs</td></tr>
</table>

NOTE: For more information on the pinouts of these various connectors, see Hardware Guides *TM7 Analog I/O Block* and *TM7 Digital I/O Blocks*

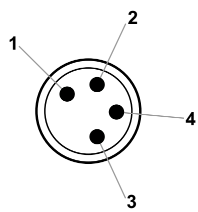
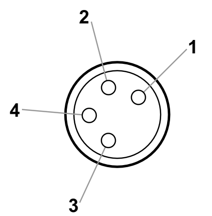
Connector Pin Assignment for TM7 Bus

The following figure shows the pin assignment of the TM7 bus IN (A) and OUT (B) connectors:

Connector (A)	Pin	Designation	Connector (B)
	1	TM7 V+	
	2	TM7 Bus Data	
	3	TM7 0V	
	4	TM7 Bus $\overline{\text{Data}}$	
	5	N.C.	

Connector Pin Assignment for 24 Vdc I/O Power Segment

The following figure shows the pin assignment of the power IN (C) and power OUT (D) connectors of the expansion I/O blocks:

Connector (C)	Pin	Designation	Connector (D)
	1	24 Vdc I/O power segment	
	2	24 Vdc I/O power segment	
	3	0 Vdc	
	4	0 Vdc	

Accessories

Overview

The TM7 accessories include the following:

- useable with all expansion blocks:
  - M8 and M12 sealing plugs,
  - support for block label,
  - expansion bus, power distribution and sensor cables,
  - torque wrench.
- useable with analog temperature input blocks only:
  - M12 thermocouple plug.
- useable with the smaller size 1 expansion blocks:
  - DIN rail mounting plate
- useable with field bus interface I/O blocks only:
  - CAN bus Y connector,
  - CAN Y cable
  - CAN bus cables,
  - CAN bus terminating resistor.

DIN Rail Mounting Plate

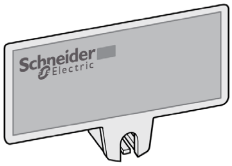
The following accessory is used to install blocks onto a 35 mm DIN Rail *(see page 236)*:

Reference	Description	Description
TM7ACMP	Mounting plate on DIN rail	

NOTE: Only small (Size 1) blocks can be installed on DIN rail with the TM7ACMP mounting plate.

Support For Block Label

The support for block labels allows labeling the blocks *(see page 241)*:



M12 CAN Bus Terminating Resistor

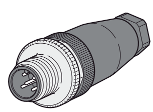
The M12 CAN bus terminating resistor is connected on the last field bus interface I/O block of the CANopen network. It is connected:

- to the accessory TM7ACYC• for a TM7NCOM08B.
- to the field bus OUT connector for a TM7NCOM16A or TM7NCOM16B.

Reference	Description	
TM7ACTLA	M12 CAN bus terminating resistor	

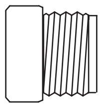
M12 Thermocouple Plug

The M12 thermocouple plug *(see Modicon TM7, Analog I/O Blocks, Hardware Guide)* is used for compensation of the temperature at measurement points:

Reference	Description	
TM7ACTHA	M12 thermocouple plug	

M8 and M12 Sealing Plug

The following table gives you the references of the sealing plugs for unused M8 and M12 connectors:

Reference	Description	
TM7ACCB	M8 Sealing plug	
TM7ACCA	M12 Sealing plug	

CAN Bus Y Cable

The CAN bus Y cable is used to connect the TM7NCOM08B in a CANopen network:

Reference	Description	
TM7ACYCJ	CAN bus Y cable	

CAN Bus Y Connector

The CAN bus Y connector is used to connect the TM7NCOM08B in a CANopen network:

Reference	Description	
TM7ACYC	CAN bus Y connector	

TM7 Cables

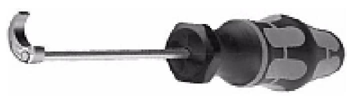
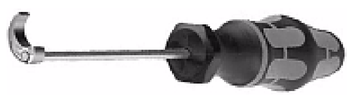
The connections for TM7 System are designed as circular plugs. The following types of pre-assembled cables are required to connect and build your TM7 System:

- Expansion bus cables *(see page 356)*
- CANopen cables *(see page 366)*
- Power cables *(see page 375)*
- Sensor cables *(see page 384)*

Torque Wrench

Two torque wrenches (M8 and M12) are available as accessories to help you mount and fasten the TM7 cables *(see page 240)*.

Each torque wrench has a screwdriver-type handle and a 4 mm (0.16 in.) hexagonal drive shaft. The torque of the drive shaft is preset and cannot be adjusted. The bit mounted on the drive shaft is appropriately sized for either an M8 or M12 plug:

Reference	Description	
TM7ACTW	Torque wrench with preset torque of 0.2 Nm (1.8 lbf-in) for M8 size plug	
	Torque wrench with preset torque of 0.4 Nm (3.5 lbf-in) for M12 size plug	

Part II
TM5 System

Overview

Part II of this manual provides information to help you plan, install, commission, and maintain your TM5 System.

What Is in This Part?

This part contains the following chapters:

Chapter 4
Initial Planning Considerations

Overview

This chapter provides information that is helpful in the early planning stages for a TM5 System. It includes the requirements for enclosing the TM5 System in a protective housing and for determining the type of power supply source required for the configuration you choose.

What Is in This Chapter?

This chapter contains the following sections:

Section 4.1
Operating Environment

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	
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)[3]
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).

3 All controllers with a battery installed must be stored in the temperature range between -30...70 °C (-22...158 °F).

Battery replacement

NOTE: Replacement of the battery in the controllers other than with the type specified in this documentation may present a risk of fire or explosion.

For more important information concerning the procedures for replacing lithium batteries, please consult the hardware guide for your controller.

⚠ WARNING
IMPROPER BATTERY CAN PROVOKE FIRE OR EXPLOSION
Replace battery only with identical type: Renata Type CR2477M.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

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

Section 4.2
Mechanical Requirements

Introduction

This section provides information for enclosing the TM5 System in a protective housing.

What Is in This Section?

This section contains the following topics:

Enclosing the TM5 System

Introduction

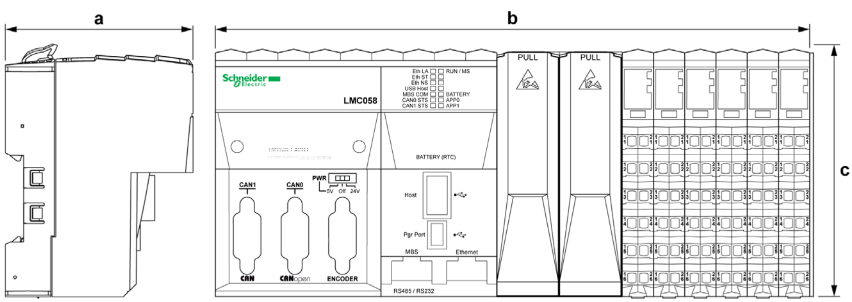
Components of the TM5 System are mounted "side by side". There is no space between the TM5 components.

The TM5 System components have an IP20 rating and must be enclosed. For optimal cooling and air circulation, an adequate clearance must be respected between your TM5 System (installed in the enclosure) and surrounding fixed objects (such as wire ducts and inside surfaces of the enclosure).

Size of the Enclosure

The size of the enclosure is determined by the number of expansion modules that are used with the controller, the field bus interface and any other auxiliary equipment. Spacing requirements *(see page 76)* must be included in determining the size of the enclosure.

Controller Dimensions

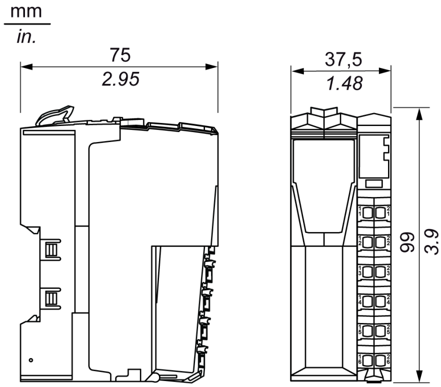


The following table gives the dimensions of the controllers:

Reference	Depth (a)	Width (b)	Height (c)
Modicon M258 Logic Controller			
TM258LD42DT	75 mm (2.95 in.)	177.5 mm (6.99 in.)	99 mm (3.90 in.)
TM258LD42DT4L		240 mm (9.45 in.)	
TM258LF42DT		177.5 mm (6.99 in.)	
TM258LF42DT4L		240 mm (9.45 in.)	
TM258LF66DT4L		265 mm (10.43 in.)	
TM258LF42DR		265 mm (10.43 in.)	
Modicon LMC058 Motion Controller			
LMC058LF42	75 mm (2.95 in.)	177.5 mm (6.99 in.)	99 mm (3.90 in.)
LMC058LF424		240 mm (9.45 in.)	

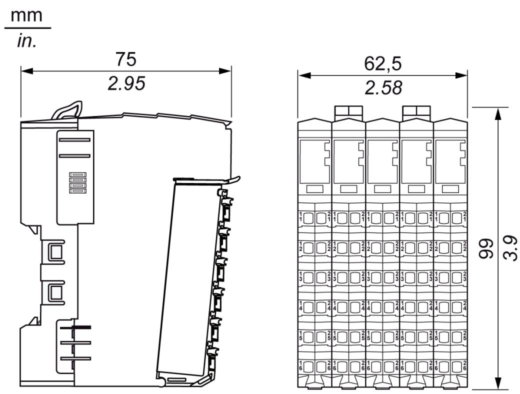
Field Bus Interface Dimensions

The following figure gives the dimensions of the field bus interface:



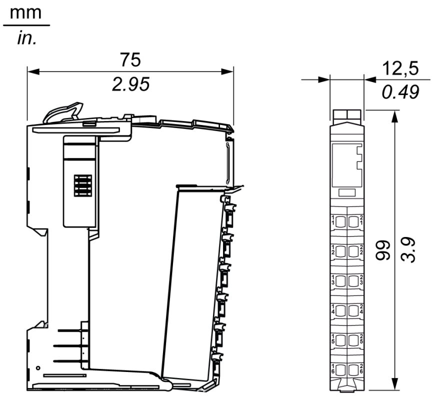
Compact I/O Dimensions

The following figure gives the dimensions of the compact I/O:



Slice Dimensions

The following figure gives the dimensions of the slice:



Spacing Requirements

NOTE: Keep adequate spacing for proper ventilation and to maintain an ambient temperature as described in the environmental characteristics *(see page 70)*.

Clearances must be respected when installing the product.

There are 3 types of clearances:

- Between the TM5 System and all sides of the cabinet (including the panel door). This type of clearance allows proper circulation of air around the TM5 System.
- Between the TM5 System terminal blocks and the wiring ducts. This distance helps avoid electromagnetic interference between the controller and the wiring ducts.
- Between the TM5 System and other heat generating devices installed in the same cabinet.

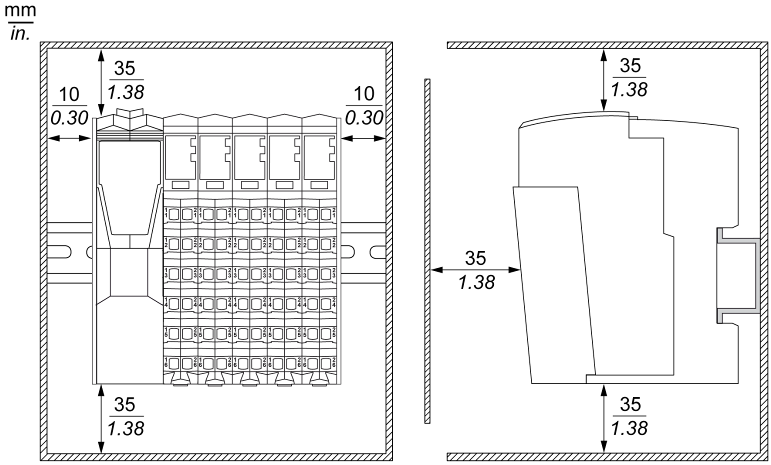
⚠ WARNING

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.

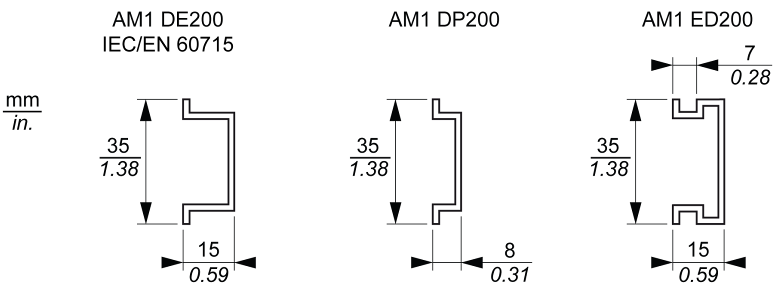
Failure to follow these instructions can result in death, serious injury, or equipment damage.

The following graphic represents the minimum clearance requirements for a TM5 System in a cabinet:



Mounting

You can mount the TM5 System on a DIN rail. For EMC (Electromagnetic Compatibility) compliance, a metal DIN rail must be attached to a flat metal mounting surface or mounted on an EIA (Electronic Industries Alliance) rack or in a NEMA (National Electrical Manufacturers Association) cabinet enclosure.



You can order a suitable DIN rail from Schneider Electric:

Rail Depth	Catalog Part Number
15 mm (0.59 in.)	AM1DE200
8 mm (0.31 in.)	AM1DP200
15 mm (0.59 in.)	AM1ED200

Thermal Considerations

For proper heat dissipation, keep adequate spacing around your TM5 System. Mount the TM5 System in the coolest area possible, most often at the bottom of the enclosure.

The following tables list some maximum dissipation values for estimating the wattage dissipation when you plan the cooling for your TM5 System and enclosure:

Controller Family	Reference	Maximum[1] Dissipation Value (W)
Modicon M258 Logic Controller	TM258LD42DT	12.3
	TM258LD42DT4L	14.6
	TM258LF42DT	12.5
	TM258LF42DT4L	14.8
	TM258LF66DT4L	18.2
	TM258LF42DR	14.8
Modicon LMC058 Motion Controller	LMC058LF42	11.9
	LMC058LF424	13.4
Note: **1** The maximum consumption value of a controller does not take into account the optional PCI communication modules nor the optional expansion modules wattage values.		

PCI communication modules	Reference	Maximum Dissipation Value (W)	De-rating
Serial Line	TM5PCRS2	0.33	No
Serial Line	TM5PCRS4	0.4	No
Profibus DP	TM5PCDPS	1.8	No

Field Bus Interface Family	Reference	Maximum Dissipation Value (W)	De-rating
CANopen Interface Module	TM5NCO1	1.5	No
Sercos	TM5NS31	1.72	No
Interface Power Distribution Module (IPDM)	TM5SPS3	1.82	Yes[1]
Note: **1** Temperature de-rating *(see page 303)*.			

Compact I/O Reference	**Maximum Dissipation Value (W)**	**De-rating** [1]
TM5C24D18T	3.71	Yes
TM5C12D8T	2.36	No
TM5C12D6T6L	7.3	No
TM5C24D12R	4.3	Yes
TM5CAI8O8VL	5.25	No
TM5CAI8O8CL	5.25	No
TM5CAI8O8CVL	5.25	No
Note: **1** De-ratings are specific to each device. Please refer to the *Modicon TM5 Compact I/O Module Hardware Guide* for details.		

Type of Slice	**Electronic Module Reference of the Slice**	**Slice Maximum Dissipation Value (W)**	**De-rating** [1]
Digital input	TM5SDI2D	0.54	No
	TM5SDI4D	0.86	No
	TM5SDI6D	1.16	No
	TM5SDI12D	2.06	Yes
	TM5SDI16D	1.78	Yes
	TM5SDI2A	0.82	No
	TM5SDI4A	1.21	No
	TM5SDI6U	1.02	No
Note: **1** De-ratings are specific to each device. Please refer to the expansion hardware guides for details.			

Type of Slice	Electronic Module Reference of the Slice	Slice Maximum Dissipation Value (W)	De-rating [1]
Digital output	TM5SDO2T	0.59	No
	TM5SDO4T	0.78	No
	TM5SDO4TA	0.79	No
	TM5SDO6T	1.02	No
	TM5SDO8TA	0.35	Yes
	TM5SDO12T	1.54	Yes
	TM5SDO16T	1.95	Yes
	TM5SDO2R	0.58	Yes
	TM5SDO4R	0.93	No
	TM5SDO2S	2.13	Yes
Mixed input/output	TM5SDM12DT	1.44	Yes
	TM5SMM6D2L	1.75	Yes
Analog input	TM5SAI2L	0.94	No
	TM5SAI2H	1.34	No
	TM5SAI4L	1.24	No
	TM5SAI4H	1.64	Yes
	TM5SAI2PH	1.24	No
	TM5SAI2TH	0.86	No
	TM5SAI4PH	1.24	No
	TM5SAI6TH	1.05	No
	TM5SEAISG	1.25	No
Analog output	TM5SAO2L	1.24	No
	TM5SAO2H	1.34	No
	TM5SAO4L	1.64	Yes
	TM5SAO4H	1.64	Yes
Expert module	TM5SE1IC02505	1.64	No
	TM5SE1IC01024	1.54	No
	TM5SE2IC01024	1.64	No
	TM5SE1SC10005	1.64	No
	TM5SDI2DF	1.10	No
Note: **1** De-ratings are specific to each device. Please refer to the expansion hardware guides for details.			

Type of Slice	Electronic Module Reference of the Slice	Slice Maximum Dissipation Value (W)	De-rating [1]
Transmitter modules	TM5SBET1	1.23	No
	TM5SBET7	1.84	Yes
Receiver module	TM5SBER2	2.35	Yes
PDM (Power Distribution Module)	TM5SPS1	0.93	No
	TM5SPS1F	1.15	No
	TM5SPS2	1.04	Yes
	TM5SPS2F	2.26	Yes
CDM (Common Distribution Module)	TM5SPDG12F	1.25	No
	TM5SPDD12F	1.25	No
	TM5SPDG5D4F	1.40	No
	TM5SPDG6D6F	1.40	No
Dummy module	TM5SD000	0.13	No

Note:
1 De-ratings are specific to each device. Please refer to the expansion hardware guides for details.

The values above assume maximum bus voltage, maximum field-side voltage and maximum load currents. Typical values are often considerably lower.

⚠ 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.

NOTE: Keep adequate spacing for proper ventilation and to maintain an ambient temperature. Maximum ambient temperature depends on the mounting position.

Mounting Positions

Introduction

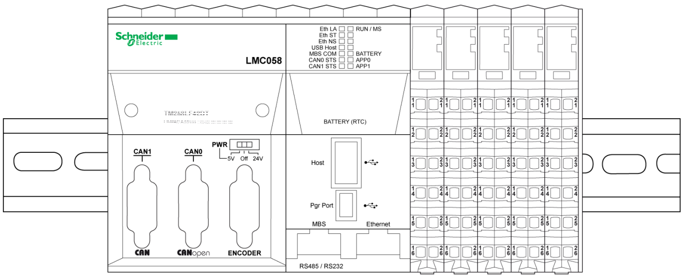
This section shows the correct mounting positions for the TM5 System.

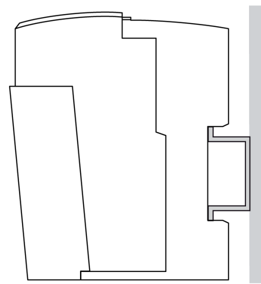
Local, remote and distributed configurations follow the same rules.

The TM5 System should only be positioned as shown in the correct *(see page 82)* or acceptable *(see page 83)* mounting position figures.

Correct Mounting Position

The TM5 System must be mounted horizontally on a vertical plane as shown in the figures below:



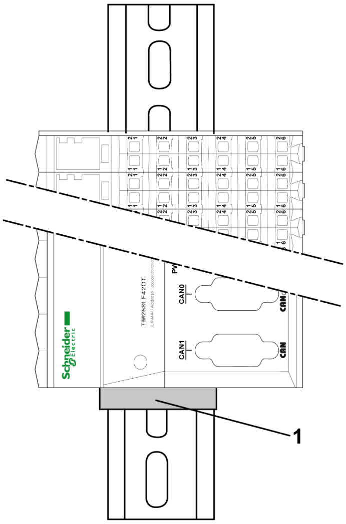


NOTE: Keep adequate spacing for proper ventilation and to maintain an ambient temperature as described in the environmental characteristics *(see page 70)*.

Acceptable Mounting Positions

Whenever possible, the TM5 System should only be positioned as shown in the figure above.

The TM5 System can also be mounted sideways on a vertical plane as shown below.



1 End bracket

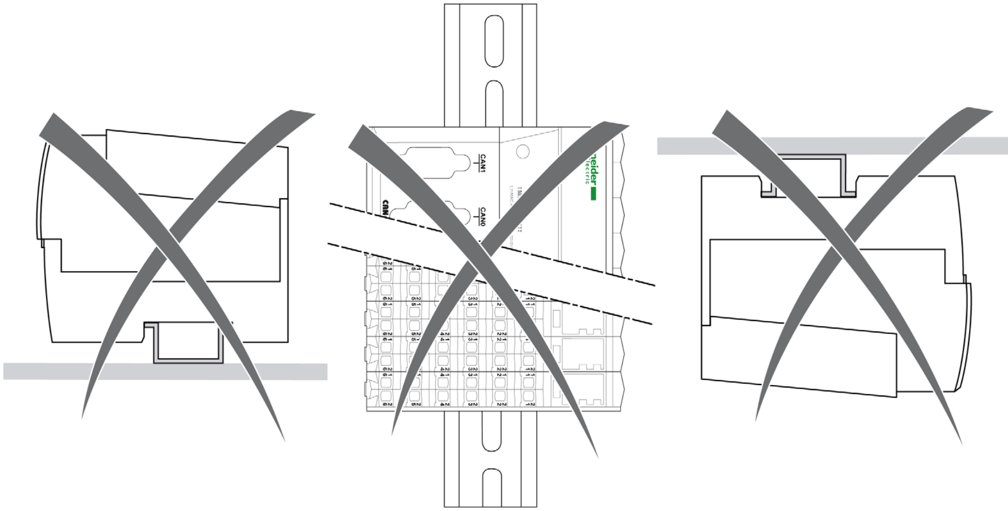
NOTE: For a local configuration in this mounting position, expansion modules must be on top of the controller.

NOTE: The first element of the TM5 configuration (controller or slice) must be secured against slipping. An end bracket (reference AB1 AB8R35 for example) can be used to help secure the configuration.

NOTE: The temperature range is limited to –10...50 °C (14...122 °F) when installing TM5 configuration vertically.

Incorrect Mounting Position

The figures below show incorrect mounting positions:



Section 4.3
TM5 Power System

Introduction

In the planning phase, the type of expansion modules that you select for your TM5 System determines the required power distribution. The following section will help you establish a power budget and select the correct power and common distribution modules for your system.

What Is in This Section?

This section contains the following topics:

TM5 Power Distribution Description

Power Distribution Overview

The first (leftmost) component in the local *(see page 19)*, remote *(see page 20)* and distributed *(see page 21)* configurations of the TM5 System distributes power for the 24 Vdc I/O power segment and generates power for the TM5 power bus. There are other components that distribute power to create separate 24 Vdc I/O power segments, and others that distribute power and additionally generate supplemental power to the TM5 power bus.

The Controller Power Distribution Module (CPDM) is the beginning of the power distribution for the local configuration.

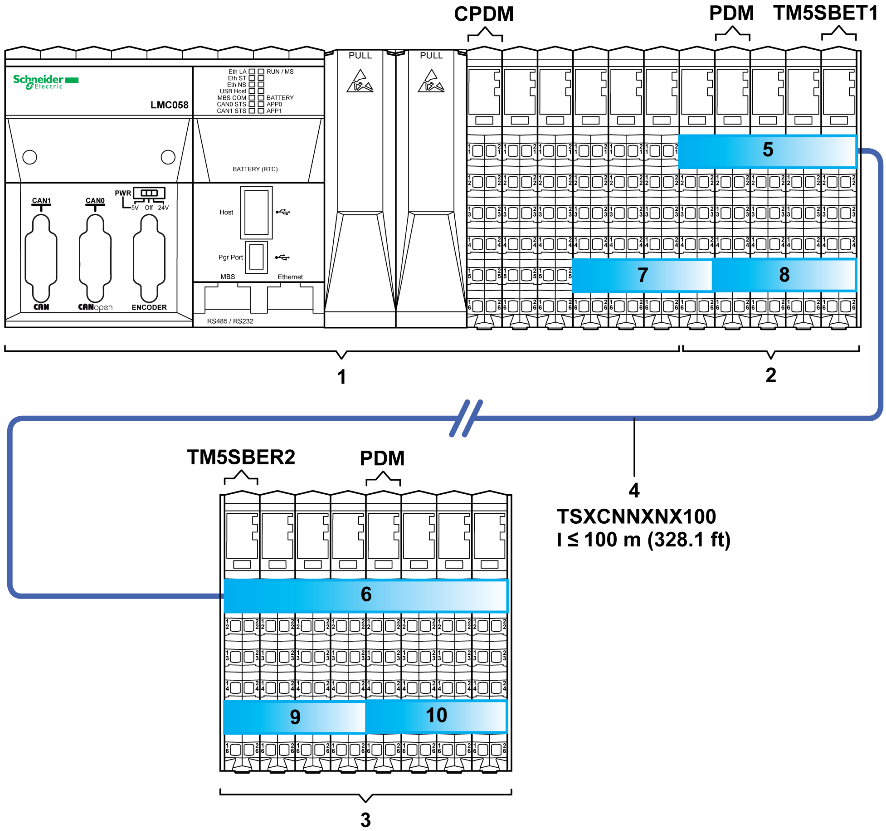
The TM5SBER2 Receiver module is the beginning of the power distribution for the remote configuration.

The TM5SBET7 Transmitter module *(see page 203)* is the beginning of the power distribution for the TM7 power bus.

The Interface Power Distribution Module (IPDM) of the field bus interface is the beginning of the power distribution for the distributed configuration.

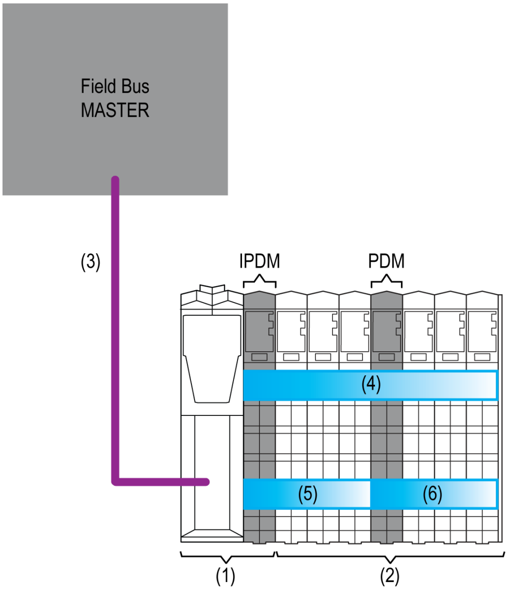
Where and when needed, Power Distribution Modules (PDM) could be added to:
- Divide the 24 Vdc I/O power segment into several separated 24 Vdc I/O power segments, or;
- Divide the 24 Vdc I/O power segment into several separated 24 Vdc I/O power segments and provide supplementary power to the TM5 power bus if required by your I/O configuration.

The figure below shows the power distribution overview of local and remote configurations:



(1) Controller
(2) Local expansions
(3) Remote expansions
(4) Expansion bus cable
(5) TM5 power bus of the local configuration
(6) TM5 power bus of the remote configuration
(7...10) 24 Vdc I/O power segments
TM5SBET1 Transmitter module
TM5SBER2 Receiver module
CPDM Controller Power Distribution Module
PDM Power Distribution Module

The figure below shows the power distribution overview of a distributed configuration:



(1) Field bus interface
(2) Distributed expansions
(3) Field bus cable
(4) TM5 power bus of the distributed configuration
(5...6) 24 Vdc I/O power segments
IPDM Interface Power Distribution Module
PDM Power Distribution Module

24 Vdc I/O Power Segment Description

Power is distributed to the inputs and outputs of the TM5 System through the 24 Vdc I/O power segment.

The 24 Vdc I/O power segment of the local configuration begins with the first embedded regular I/O of the controller and is terminated at the point where another PDM has been inserted into the TM5 System or at the end of the configuration.

The following table gives the first and last devices of the 24 Vdc I/O power segment(s):

TM5 Configuration		Segment Begin	Segment End
Local *(see page 19)*	First 24 Vdc I/O power segment	The first embedded regular I/O	The last expansion module or the first PDM (from left to right) of the configuration.
	Second 24 Vdc I/O power segment	The first PDM (from left to right) of the configuration.	The last expansion module or the second PDM (from left to right) of the configuration.
	...	...	...
Remote *(see page 20)*	First 24 Vdc I/O power segment	The Receiver module	The last remote expansion module or the first PDM (from left to right) of the configuration
	Second 24 Vdc I/O power segment	The first PDM (from left to right) of the configuration.	The last expansion module or the second PDM (from left to right) of the configuration.
	...	...	...
Distributed *(see page 21)*	First 24 Vdc I/O power segment	The IPDM	The last remote expansion module or the first PDM (from left to right) of the configuration
	Second 24 Vdc I/O power segment	The first PDM (from left to right) of the configuration.	The last expansion module or the second PDM (from left to right) of the configuration.
	...	...	...

A segment is a group of expansion modules that are supplied by the same power distribution module.

The power provided on the 24 Vdc I/O power segment is consumed by the 24 Vdc modules placed in this segment.

The reasons to build a new segment are:
- To separate groups of modules. For example, a group of inputs separated from a group of outputs.
- To provide power to the 24 Vdc I/O power segment (in the case that the power of the previous segment has been consumed by other I/O modules).
- To provide supplementary power to the TM5 power bus.

TM5 Power Bus Description

The TM5 bus consists in two parts:
- TM5 data bus
- TM5 power bus

The TM5 power bus distributes the power to supply the electronics of the expansion modules of a local, remote or distributed configuration. If needed the power on the TM5 bus can be reinforced by adding specific PDMs depending on the reference.

The following table gives the first and last devices of the TM5 power bus:

TM5 Configuration	Power Bus Begin	Power Bus End
Local *(see page 19)*	The first local expansion I/O	The last local expansion I/O or the Transmitter module
Remote *(see page 20)*	The Receiver module	The last remote expansion I/O or Transmitter module
Distributed *(see page 21)*	The IPDM	The last distributed expansion I/O or Transmitter module

NOTE: The TM5SBET1 transmitter module must be the last electronic module in either the local or remote TM5 configuration that you intend to extend.

Controller Power Distribution Module (CPDM)

The Controller Power Distribution Module (CPDM *(see page 34)*) is the connection of the controller to the external 24 Vdc power supplies and distributes the power to the different parts of the controller.

Among other things, the CPDM connects:
- Directly the external power supply to the 24 Vdc I/O power segment.
- The external power supply to the internal power supply that generates the power distributed on the TM5 power bus, which is derived from the 24 Vdc Main power connection.

The following table describes the parts powered by the 24 Vdc I/O power segment and the TM5 power bus:

Designation	Description
24 Vdc I/O power segment	Serves: ● the embedded regular I/O, ● the sensors and actuators connected to the embedded regular I/O, ● the expansion modules, ● the sensors and actuators connected to the expansion modules, ● the external devices connected to the Common Distribution Modules (CDM).
TM5 power bus	Serves the expansion slice electronics (bus bases and electronic modules) of the local configuration.

Interface Power Distribution Module (IPDM)

The Interface Power Distribution Module (IPDM *(see page 39)*) is the connection of the field bus interface to the external 24 Vdc power supplies.

Among other things, the IPDM connects:
- Directly the external power supply to the 24 Vdc I/O power segment.
- The external power supply to the internal power supply that generates the power distributed on the TM5 power bus, which is derived from the 24 Vdc Main power connection.

The following table describes the parts powered by the 24 Vdc I/O power segment and the TM5 power bus:

Designation	Description
24 Vdc I/O power segment	Serves: ● the distributed expansion modules, ● the sensors and actuators connected to the distributed expansion modules, ● the external devices connected to the Common Distribution Modules (CDM) of the distributed configuration.
TM5 power bus	Serves the electronic of the expansions (bus bases and electronic modules) of the distributed configuration.

Receiver Module (TM5SBER2)

The TM5SBER2 integrates an electronic power supply that generates the power distributed by the TM5 power bus.

It also connects the external 24 Vdc power supply to the 24 Vdc I/O power segment.

The following table describes the parts powered by the 24 Vdc I/O power segment and the TM5 power bus:

Designation	Description
24 Vdc I/O power segment	Serves: ● the remote expansion modules, ● the sensors and actuators connected to the remote expansion modules, ● the external devices connected to the Common Distribution Modules (CDM) of the remote configuration.
TM5 power bus	Serves the electronic of the expansions (bus bases and electronic modules).

Power Distribution Module (PDM)

Depending of the TM5 configuration and the current consumed on either the TM5 power bus or the 24 Vdc I/O power segment(s), you may need to add PDMs to create another 24 Vdc power segment and/or supplement power to the electronic of the expansions via the TM5 power bus.

The following table describes the parts powered by the 24 Vdc I/O power segment and the TM5 power bus:

Designation	Description
24 Vdc I/O power segment	Serves: ● the expansion modules of the segment determined by the PDM, ● the sensors and actuators connected to the expansion modules of the segment determined by the PDM, ● the external devices connected to the Common Distribution Modules (CDM) in the segment determined by the PDM.
TM5 power bus (depends on PDM references)	Serves the electronic of the expansions (bus bases and electronic modules) of the expanded configuration.

Supplying the 24 Vdc I/O Power Segment and the TM5 Power Bus

TM5 Power System, Power Distribution Description, Supplying the 24 Vdc I/O Power Segment and the TM5 Power Bus:

Equipment		**Maximum Current Distributed on the 24 Vdc I/O Power Segment**	**Current Supplied to the TM5 Power Bus**	
Function	**Reference**		**- 10...55 °C (14...131° F)**	**55...60 °C (131...140 °F)**
CPDM	–	10 A	400 mA	400 mA
Receiver module	TM5SBER2	10 A	1156 mA	750 mA
PDM	TM5SPS1	10 A	No	No
	TM5SPS1F	6.3 A	No	No
	TM5SPS2	10 A	1136 mA	740 mA
	TM5SPS2F	6.3 A	1136 mA	740 mA
IPDM	TM5SPS3	10 A	750 mA	500 mA

TM5 Power Distribution Mounting Rules

PDMs Mounting Rules

Installing a PDM according to these rules automatically establishes a new 24 Vdc I/O power segment for I/O expansions to the right of the PDM.

The TM5SPS2• PDM can be placed at the end of the configuration. In this case, it supplies only the TM5 power bus.

Rules:
- Do not mount PDMs side by side
- Do not mount a PDM and a Transmitter or Receiver module side by side
- Do not mount a PDM and an Interface Power Distribution Module (IPDM) side by side
- Do not mount a PDM next to any of the following modules: TM5SAI2H, TM5SAI4H, TM5SAO4L or TM5SAO4H

SoMachine software is designed to help prevent the installation of incompatible modules side by side.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not mount a Power Distribution Module (PDM) next to any one of the following modules:
- Power Distribution Module (PDM)
- Transmitter module TM5SBET1 or TM5SBET7
- Receiver module TM5SBER2
- Interface Power Distribution Module TM5SPS3 (IPDM)
- Analog input module TM5SAI2H or TM5SAI4H
- Analog output module TM5SAO4L or TM5SAO4H

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

Mounting Rules After an IPDM

Rules:
- Do not mount a PDM next to an IPDM
- Do not mount a Transmitter or Receiver module next to an IPDM
- Do not mount any of the following modules: TM5SAI2H, TM5SAI4H, TM5SAO4L or TM5SAO4H next to an IPDM

Performance Distributed I/O Configuration software is designed to help prevent the installation of incompatible modules side by side.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION Do not mount any one of the following modules next to an Interface Power Distribution Module (IPDM): ● Power Distribution Module (PDM) ● Transmitter module TM5SBET1 or TM5SBET7 ● Receiver module TM5SBER2 ● Analog input module TM5SAI2H or TM5SAI4H ● Analog output module TM5SAO4L or TM5SAO4H **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

TM5 Power Distribution System Implementation

Power Distribution Planning

The power distribution system supplies the 24 Vdc I/O power segment and the TM5 power bus for local, remote and distributed configurations.

The planning of your TM5 power distribution system should follow this order:

Step	Description
1	Plan your TM5 System (controller and expansion modules, remote and distributed islands).
2	(Optionally) Create some 24 Vdc power segments by adding PDM type TM5SPS1•, for example, to separate the input slices from output slices. Another example is to separate the AC slices from DC slices.
3	Calculate the current consumed on each 24 Vdc I/O power and insert additional PDM type TM5SPS1• to create segments where and when needed.
4	Calculate the current consumed on the TM5 power bus segment(s) and replace PDM type TM5SPS1• with type TM5SPS2• or provide additional PDM type TM5SPS2• where and when needed.

To plan the power distribution of the TM5 System you must calculate the:
- Current consumption on the 24 Vdc I/O power segment(s)
- Current consumption on the TM5 power bus segment or segments in the case of remote configurations(s).

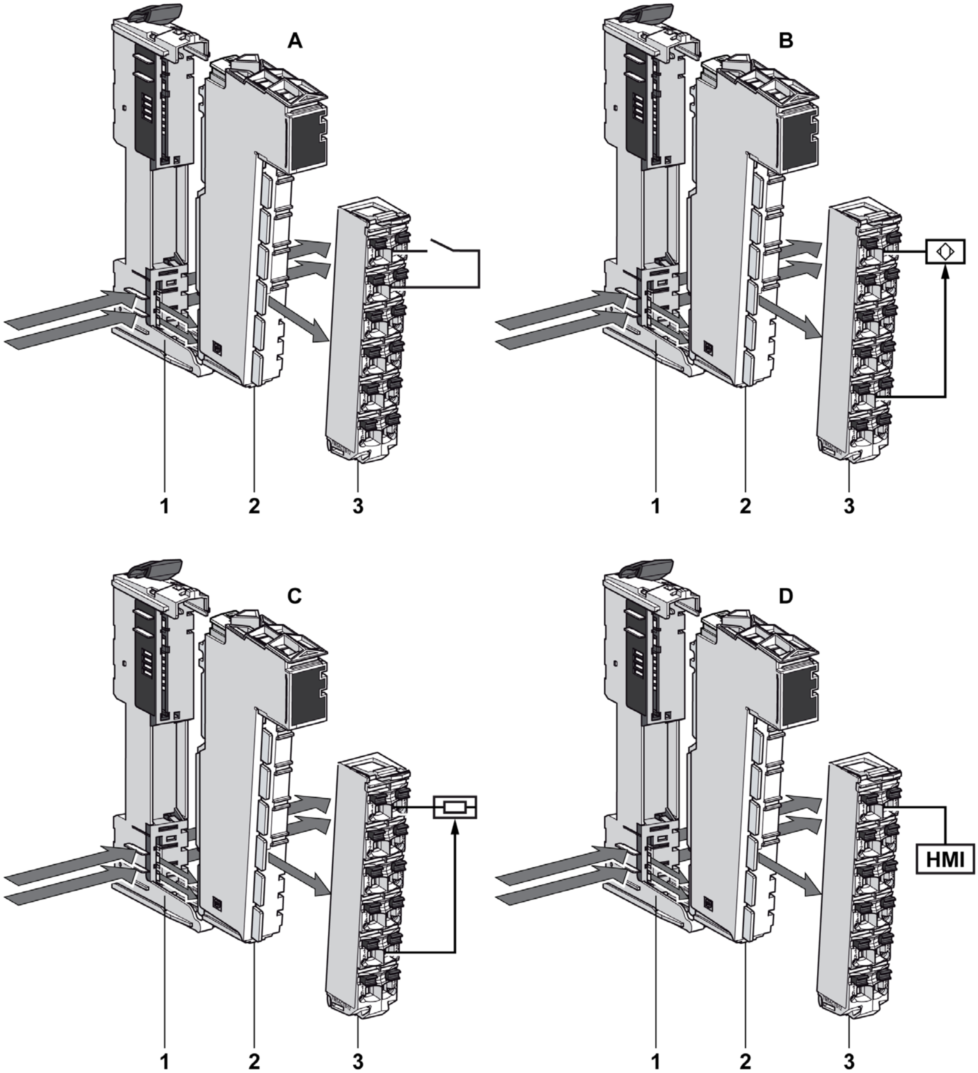
Current Consumed on the 24 Vdc I/O Power Segment

The current consumed on the 24 Vdc I/O power segment is composed of
- The current consumed by the electronic modules[1].
- The current consumed by the loads connected to the DC outputs of the modules supplied by the 24 Vdc I/O power segment.
- The current consumed to supply the sensors and actuators connected to the electronics modules.
- The current consumed to supply external devices connected to the Common Distribution Modules (CDM)

Note:

1 For the electronics modules with 24 Vdc inputs, this current includes the input signal currents for all inputs in activated state.

The following figure shows how the 24 Vdc I/O power segment is created, and power is distributed, by the association of the I/O slices:



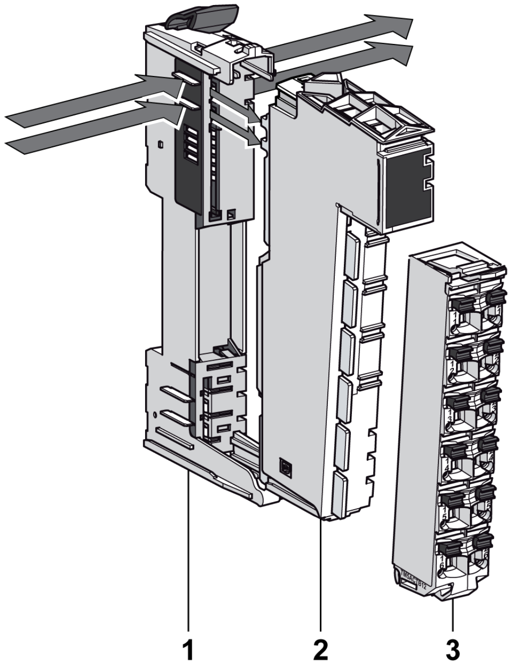
1 Bus base
2 Electronic module
3 Terminal block
A DC Input or output slices
B DC Input slices with sensor supply
C DC Output slices with actuator supply
D CDM with external device

Current Consumed on the TM5 Power Bus

The current consumed on the TM5 power bus is composed of:

- The current consumed by the bus bases
- The current consumed by the electronic modules.

The following figure shows how theTM5 power bus is created, and power is distributed, by the association of the I/O slices:



1 Bus base
2 Electronic module
3 Terminal block

Example 1: Current Consumed by a Local Configuration

Introduction

This first example is for a local configuration (controller and its local expansion modules). A later example *(see page 105)* is based on a remote configuration (TM5 Receiver module and its remote expansion modules). From these examples, you should be able to make the calculations necessary for your TM5 System.

In a local configuration, the Controller Power Distribution Module (CPDM) connects:
- directly the external power supply to the 24 Vdc I/O power segment.
- the external power supply to the internal power supply that generates the power distributed on the TM5 power bus, which is derived from the 24 Vdc Main power connection.

All current consumption values are documented in the TM5 Consumption Table *(see page 257)*.

Planning Example

This configuration example includes:
- The controller TM258LF42DT equipped with embedded DI12DE and DO12TE electronic modules.
- Some expansion modules:
  - TM5SAI4L
  - TM5SDI12D
  - TM5SDI4D
  - TM5SDM12DT
  - TM5SDI4A
  - TM5SDO4TA
  - TM5SDO12T
  - TM5SDO2T
  - TM5SDO2R
- Assumptions used for the purposes of calculating the consumption of this example:
  CPDM: The maximum current distributed on the 24 Vdc I/O power segment is limited by an external isolated power supply of 6300 mA.
  DO12TE: Only 50 % of the outputs are active at any given time, and that the maximum current draw of any given output is 500 mA, or 3000 mA total for the module.
  TM5SDI4D: The current to supply the electronic sensors of this example has been estimated at 50 mA per sensor, or 200 mA total for the module.
  TM5SDM12DT: The sum of the current draw for all outputs connected to the module is never more than 1500 mA at any given time.
  TM5SDO12T: Only 50% of the outputs are active at any given time, and that the maximum current draw of any given output is 500 mA, or 3000 mA total for the module.
  TM5SDO4TA: The sum of the current draw for all outputs connected to the module is never more than 2000 mA at any given time.
  TM5SSDO2T: The sum of the current draw for all outputs connected to the module is never more than 600 mA at any given time.

The following table shows the current supplied and consumed in mA on the TM5 power bus and the 24 Vdc I/O power segment:

TM258LF42DT			TM5SAI4L	TM5SDI12D	TM5SDI4D	TM5SDM12DT	TM5SDI4A	TM5SDO4TA	TM5SDO12T	TM5SDO2T	TM5SDO2R	Legend
CPDM	DI12DE	DO12TE										
			400									(1)
			26	26	26	26	26	26	26	26	26	(2)
			2	36	28	42	34	32	52	26	90	(3)
			28	62	54	68	60	58	78	52	116	(4)
			372	310	256	188	128	70	–8	–60	–176	(5)
	6300 max.											*(6)*
	73	*48*	*46*	*73*	*25*	*46*	*–*	*21*	*48*	*14*	*–*	*(7)*
	–	*3000*	*–*	*–*	*–*	*1500*	*–*	*2000*	*3000*	*600*	*–*	*(8)*
	–	*–*	*–*	*–*	*200*	*–*	*–*	*–*	*–*	*–*	*–*	*(9)*
	73	*3048*	*46*	*73*	*225*	*1546*	*0*	*2021*	*3048*	*614*	*0*	*(10)*
	6227	*3179*	*3133*	*3060*	*2835*	*1289*	*1289*	*–732*	*–3780*	*–4394*	*–4394*	*(11)*

Legend:
External isolated main power supply, 24 Vdc
(1) Current supplied on TM5 power bus
(2) Consumption of the bus base
(3) Consumption of the electronic module
(4) Sum of (2) and (3)
(5) Remaining current available after slice consumption
External isolated I/O power supply, 24 Vdc
(6) Current supplied on the 24 Vdc I/O power segment
(7) Consumption of the electronic module
(8) Consumption of the loads of the output slices
(9) Consumption of the supply to sensors, actuators or external devices
(10) Sum of (7), (8) and (9)
(11) Remaining current available after slice consumption

Current Consumed on the 24 Vdc I/O Power Segment

The 24 Vdc I/O power segment begins with the embedded DI12DE electronic module and finishes with the TM5SDO2R expansion module. The capacity of this 24 Vdc I/O power segment is limited to 6300 mA in this example.

In this example, the total current consumed on the 24 Vdc I/O power segment is 10694 mA and exceeds the 6300 mA capacity of this segment.

This requires you to divide the existing segment into two segments by adding a PDM. For this example, a TM5SPS1F (internal fuse of 6300 mA max.) between the TM5SDI4A and TM5SDO4TA electronic modules is needed.

The first 24 Vdc I/O power segment begins with the embedded DI12DE module and finishes with the TM5SDI4A expansion module once the PDM is installed.

The second 24 Vdc I/O power segment begins with the TM5SPS1F PDM and finishes with the TM5SDO2R expansion module.

The following table shows, the current supplied and consumed in mA on the 24 Vdc I/O power segment after the addition of the PDM:

TM258LF42DT			**TM5SAI4L**	**TM5SDI12D**	**TM5SDI4D**	**TM5SDM12DT**	**TM5SDI4A**	**TM5SP1F**	**TM5SDO4TA**	**TM5SDO12T**	**TM5SDO2T**	**TM5SDO2R**	**Legend**
CPDM	**DI12DE**	**DO12TE**											
			400										*(1)*
			26	*26*	*26*	*26*	*26*	*26*	*26*	*26*	*26*	*26*	*(2)*
			2	*36*	*28*	*42*	*34*	*40*	*32*	*52*	*26*	*90*	*(3)*
			28	*62*	*54*	*68*	*60*	*66*	*58*	*78*	*52*	*116*	*(4)*
			372	*310*	*256*	*188*	*128*	*62*	*4*	*–74*	*–126*	*–242*	*(5)*
	6300 max.							6300 max.					(6)
	73	48	46	73	25	46	–	25	21	48	14	–	(7)
	–	3000	–	–	–	1500	–	–	2000	3000	600	–	(8)
	–	–	–	–	200	–	–	–	–	–	–	–	(9)
	73	3048	46	73	225	1546	0	25	2021	3048	614	0	(10)
	6227	3179	3133	3060	2835	1289	1289	6275	4254	1206	592	592	(11)

Legend:
External isolated main power supply, 24 Vdc
(1) Current supplied on TM5 power bus
(2) Consumption of the bus base
(3) Consumption of the electronic module
(4) Sum of (2) and (3)
(5) Remaining current available after slice consumption
External isolated I/O power supply, 24 Vdc
(6) Current supplied on the 24 Vdc I/O power segment
(7) Consumption of the electronic module
(8) Consumption of the loads of the output slices
(9) Consumption of the supply to sensors, actuators or external devices
(10) Sum of (7), (8) and (9)
(11) Remaining current available after slice consumption

The total current consumed on the first 24 Vdc I/O power segment is 5011 mA and does not exceed the 6300 mA capacity of this segment.

The total current consumed on the second 24 Vdc I/O power segment is 5708 mA and does not exceed the 6300 mA capacity of that segment.

The next step is to calculate the current consumed on the TM5 power bus to validate the configuration of this example.

Current Consumed on the TM5 Power Bus

The controller generates 400 mA on the TM5 power bus to supply expansion slices. The TM5 power bus begins with the TM5SAI4L expansion module and terminates with the TM5SDO2R expansion module.

The following table shows, the current supplied and consumed in mA on the TM5 power bus:

TM258LF42DT													
CPDM	**DI12DE**	**DO12TE**	**TM5SAI4L**	**TM5SDI12D**	**TM5SDI4D**	**TM5SDM12DT**	**TM5SDI4A**	**TM5SP1F**	**TM5SDO4TA**	**TM5SDO12T**	**TM5SDO2T**	**TM5SDO2R**	**Legend**
			400										(1)
			26	26	26	26	26	26	26	26	26	26	(2)
			2	36	28	42	34	40	32	52	26	90	(3)
			28	62	54	68	60	66	58	78	52	116	(4)
			372	310	256	188	128	62	4	–74	–126	–242	(5)
	6300 max.							*6300 max.*					*(6)*
	73	*48*	*46*	*73*	*25*	*46*	*–*	*25*	*21*	*48*	*14*	*–*	*(7)*
	–	*3000*	*–*	*–*	*–*	*1500*	*–*	*–*	*2000*	*3000*	*600*	*–*	*(8)*
	–	*–*	*–*	*–*	*200*	*–*	*–*	*–*	*–*	*–*	*–*	*–*	*(9)*
	73	*3048*	*46*	*73*	*225*	*1546*	*0*	*25*	*2021*	*3048*	*614*	*0*	*(10)*
	6227	*3179*	*3133*	*3060*	*2835*	*1289*	*1289*	*6275*	*4254*	*1206*	*592*	*592*	*(11)*

Legend:
External isolated main power supply, 24 Vdc
(1) Current supplied on TM5 power bus
(2) Consumption of the bus base
(3) Consumption of the electronic module
(4) Sum of (2) and (3)
(5) Remaining current available after slice consumption
External isolated I/O power supply, 24 Vdc
(6) Current supplied on the 24 Vdc I/O power segment
(7) Consumption of the electronic module
(8) Consumption of the loads of the output slices
(9) Consumption of the supply to sensors, actuators or external devices
(10) Sum of (7), (8) and (9)
(11) Remaining current available after slice consumption

The total current consumed on the TM5 power bus is 642 mA, and exceeds the 400 mA capacity of the segment.

You must supplement the TM5 power bus by substituting the TM5SPS1F PDM with a TM5SPS2F type PDM .

The CPDM and the TM5SPS2F PDM provide 1576 mA (400 mA + 1176 mA) of current to the TM5 power bus.

The following table shows, the current supplied and consumed in mA on the TM5 power bus:

TM258LF42DT													
CPDM	**DI12DE**	**DO12TE**	**TM5SAI4L**	**TM5SDI12D**	**TM5SDI4D**	**TM5SDM12DT**	**TM5SDI4A**	**TM5SP2F**	**TM5SDO4TA**	**TM5SDO12T**	**TM5SDO2T**	**TM5SDO2R**	**Legend**
			1576										(1)
			26	26	26	26	26	26	26	26	26	26	(2)
			2	36	28	42	34	–	32	52	26	90	(3)
			28	62	54	68	60	26	58	78	52	116	(4)
			1548	1486	1432	1364	13046	1278	1220	1142	1090	974	(5)
	6300 max.							*6300 max.*					*(6)*
	73	*48*	*46*	*73*	*25*	*46*	*–*	*25*	*21*	*48*	*14*	*–*	*(7)*
	–	*3000*	*–*	*–*	*–*	*1500*	*–*	*–*	*2000*	*3000*	*600*	*–*	*(8)*
	–	*–*	*–*	*–*	*200*	*–*	*–*	*–*	*–*	*–*	*–*	*–*	*(9)*
	73	*3048*	*46*	*73*	*225*	*1546*	*0*	*25*	*2021*	*3048*	*614*	*0*	*(10)*
	6227	*3179*	*3133*	*3060*	*2835*	*1289*	*1289*	*6275*	*4254*	*1206*	*592*	*592*	*(11)*

Legend:
External isolated main power supply, 24 Vdc
(1) Current supplied on TM5 power bus
(2) Consumption of the bus base
(3) Consumption of the electronic module
(4) Sum of (2) and (3)
(5) Remaining current available after slice consumption
External isolated I/O power supply, 24 Vdc
(6) Current supplied on the 24 Vdc I/O power segment
(7) Consumption of the electronic module
(8) Consumption of the loads of the output slices
(9) Consumption of the supply to sensors, actuators or external devices
(10) Sum of (7), (8) and (9)
(11) Remaining current available after slice consumption

The total current consumed on the TM5 power bus is 602 mA, and does not exceed the 1576 mA capacity of the TM5 power bus.

The preceding table shows the final configuration of the example with the current supplied and consumed in mA on the TM5 power bus and the 24 Vdc I/O power segments.

Example 2: Current Consumed by a Remote Configuration

Introduction

This example is for a remote configuration (TM5 Receiver module and its expansion modules). From this example, you should be able to make the calculations necessary for your TM5 System.

In a remote configuration, the TM5SBER2 Receiver module connects:
- directly the external power supply to the 24 Vdc I/O power segment.
- the external power supply to the internal power supply that generates the power distributed on the TM5 power bus.

All current consumption values are documented in the TM5 Consumption Table *(see page 257)*.

Planning Example

This configuration example includes:
- The TM5SBER2 Receiver module.
- Some expansion slices:
  - TM5SAI4L
  - TM5SDI12D
  - TM5SDI4D
  - TM5SDM12DT
  - TM5SDI4A
  - TM5SDO12T
  - TM5SDO2T
  - TM5SDO2R
- Assumptions used for the purposes of calculating the consumption of this example:
  TM5SBER2: The maximum current distributed on the 24 Vdc I/O power segment is limited by an external isolated power supply of 6300 mA.
  TM5SDI4D: The current to supply the electronic sensors of this example has been estimated at 50 mA per sensor, or 200 mA total for the module.
  TM5SDM12DT: The sum of the current draw for all outputs connected to the module is never more than 1500 mA at any given time.
  TM5SDO12T: Only 50 % of the outputs are active at any given time, and that the maximum current draw of any given output is 500 mA, or 3000 mA total for the module.
  TM5SSDO2T: The sum of the current draw for all outputs connected to the module is never more than 600 mA at any given time.

The following table shows the current supplied and consumed in mA on the TM5 power bus and the 24 Vdc I/O power segment:

TM5SBER2	**TM5SAI4L**	**TM5SDI12D**	**TM5SDI4D**	**TM5SDM12DT**	**TM5SDI4A**	**TM5SDO12T**	**TM5SDO2T**	**TM5SDO2R**	**Legend**
1156									(1)
26	26	26	26	26	26	26	26	26	(2)
–	2	36	28	42	34	52	26	90	(3)
26	28	62	54	68	60	78	52	116	(4)
1130	1102	1040	986	918	858	780	728	612	(5)
6300 max.									*(6)*
25	*46*	*73*	*25*	*46*	*–*	*48*	*14*	*–*	*(7)*
–	*–*	*–*	*–*	*1500*	*–*	*3000*	*600*	*–*	*(8)*
–	*–*	*–*	*200*	*–*	*–*	*–*	*–*	*–*	*(9)*
25	*46*	*73*	*225*	*1546*	*0*	*3048*	*614*	*0*	*(10)*
6275	*6229*	*6156*	*5931*	*4385*	*4385*	*1337*	*723*	*723*	*(11)*

Legend:
External isolated main power supply, 24 Vdc
(1) Current supplied on TM5 power bus
(2) Consumption of the bus base
(3) Consumption of the electronic module
(4) Sum of (2) and (3)
(5) Remaining current available after slice consumption
External isolated I/O power supply, 24 Vdc
(6) Current supplied on the 24 Vdc I/O power segment
(7) Consumption of the electronic module
(8) Consumption of the loads of the output slices
(9) Consumption of the supply to sensors, actuators or external devices
(10) Sum of (7), (8) and (9)
(11) Remaining current available after slice consumption

Current Consumed on the 24 Vdc I/O Power Segment

The 24 Vdc I/O power segment begins with the TM5SBER2 Receiver module and finishes with the TM5SDO2R expansion module. The capacity of this 24 Vdc I/O power segment is limited to 6300 mA in this example.

The total current consumed on the 24 Vdc I/O power segment is 5577 mA, and does not exceed the 6300 mA capacity of this segment.

The following step is to calculate the current consumed on the TM5 power bus to validate the configuration of the example.

Current Consumed on the TM5 Power Bus

The TM5SBER2 Receiver module generates 1156 mA on the TM5 power bus to supply remote expansion I/Os. The TM5 power bus begins with the TM5SBER2 remote expansion module and terminates with the TM5SDO2R remote expansion module.

The total current consumed on the TM5 power bus is 544 mA, and does not exceed the 1156 mA capacity of the TM5 power bus.

Final Configuration of the Example

This configuration does not need an additional PDM for power distribution.

Depending on the application, a PDM can be inserted to create separated groups *(see page 89)*.

Example 3: Current Consumed by a Distributed Configuration

Introduction

This example is for a distributed configuration (a CANopen interface module and its expansion modules). From these examples, you should be able to make the calculations necessary for your TM5 System.

In a distributed configuration, the Interface Power Distribution Module (IPDM) connects:
- directly the external power supply to the 24 Vdc I/O power segment.
- the external power supply to the internal power supply that generates the power distributed on the TM5 power bus, which is derived from the 24 Vdc Main power connection.

All current consumption values are documented in the TM5 Consumption Table *(see page 257)*.

Planning Example

This configuration example includes:
- TM5NCO1 CANopen interface module
- TM5SPS3 IPDM
- Some expansion modules:
  - TM5C12D8T
  - TM5SDO16T
  - 2 TM5SDO4R
  - TM5SD000
  - TM5SAI4L
  - TM5SBET1
- Assumptions used for the purposes of calculating the consumption of this example:
  IPDM: The maximum current distributed on the 24 Vdc I/O power segment is limited by an external isolated power supply of 10000 mA.
  TM5C12D8T: The sum of the current draw for all outputs connected to the module is never more than 4000 mA at any given time.
  TM5SDO16T: The sum of the current draw for all outputs connected to the module is never more than 4500 mA at any given time.

The following table shows, the current supplied and consumed in mA on the TM5 power bus and the 24 Vdc I/O power segment:

TM5NCO1	**TM5C12D8T**											
IPDM (TM5SPS3)	**4 In**	**4 In**	**4 In**	**4 Out**	**4 Out**	**TM5SDO16T**	**TM5SDO4R**	**TM5SDO4R**	**TM5SD000**	**TM5SAI4L**	**TM5SBET1**	**Legend**
750												(1)
						26	26	26	26	26	26	(2)
	68					56	160	160	50	2	100	(3)
	68					82	186	186	76	28	126	(4)
	682					600	414	228	152	124	–2	(5)
10000												*(6)*
25	*80*					*40*					30	*(7)*
				2000	*2000*	*4500*				*46*		*8*
	500	*300*	*200*	*500*	*300*							*9*
25	*580*	*300*	*200*	*2500*	*2300*	*4540*	*0*	*0*	*0*	*46*	*30*	*10*
9975	*9395*	*9095*	*8895*	*6395*	*4095*	*-445*	*-445*	*-445*	*-445*	*-491*	*-521*	*11*

Legend:
Internal TM5 Power Bus 5 Vdc
(1) Current supplied on TM5 power bus
(2) Consumption of the bus base
(3) Consumption of the electronic module
(4) Sum of (2) and (3)
(5) Remaining current available after slice consumption
External isolated I/O power supply, 24 Vdc
(6) Current supplied on the 24 Vdc I/O power segment
(7) Consumption of the electronic module
(8) Consumption of the loads of the output slices
(9) Consumption of the supply to sensors, actuators or external devices
(10) Sum of (7), (8) and (9)
(11) Remaining current available after slice consumption

Current Consumed on the 24 Vdc I/O Power Segment

The 24 Vdc I/O power segment begins with the embedded TM5SPS3 IPDM and finishes with the TM5SBET1 transmitter module. The capacity of this 24 Vdc I/O power segment is limited to 10000 mA in this example.

In this example,when you add the TM5SDO16T electronic module, the total current consumed on the 24 Vdc I/O power segment exceeds the 10000 mA capacity of this segment.

This requires you to divide the existing segment into two segments by adding a PDM. For this example, a TM5SPS1F (internal fuse of 6300 mA max.) between the TM5C12D8T compact I/O module and the TM5SDO16T electronic module is needed.

The first 24 Vdc I/O power segment begins with the embedded TM5SPS3 IPDM and finishes with the TM5C12D8T compact I/O module once the PDM is installed.

The second 24 Vdc I/O power segment begins with the TM5SPS1F PDM and finishes with theTM5SBET1 expansion module.

The total current consumed on the first 24 Vdc I/O power segment is 5905 mA and does not exceed the 10000 mA capacity of this segment.

The total current consumed on the second 24 Vdc I/O power segment is 4650 mA and does not exceed the 6300 mA capacity of that segment.

The next step is to calculate the current consumed on the TM5 power bus to validate the configuration of this example.

The following table shows, the current supplied and consumed in mA on the TM5 power bus:

TM5NCO1	**TM5C12D8T**												
IPDM (TM5SPS3)	**4 In**	**4 In**	**4 In**	**4 Out**	**4 Out**	**TM5SPS1F**	**TM5SDO16T**	**TM5SDO4R**	**TM5SDO4R**	**TM5SD000**	**TM5SAI4L**	**TM5SBET1**	**Legend**
750													(1)
						26	26	26	26	26	26	26	(2)
	68					40	56	160	160	50	2	100	(3)
	68					66	82	186	186	76	28	126	(4)
	682					616	534	348	162	86	58	–68	(5)
10000						6300							*(6)*
25	*80*					34	*40*					30	*(7)*
				2000	*2000*		*4500*				*46*		*8*
	500	*300*	*200*	*500*	*300*								*9*
25	*580*	*300*	*200*	*2500*	*2300*	34	*4540*	*0*	*0*	*0*	*46*	*30*	*10*
9975	*9395*	*9095*	*8895*	*6395*	*4095*	6266	*1726*	*1726*	*1726*	*1726*	*1680*	*1650*	*11*

Legend:
Internal isolated main power supply, 24 Vdc
(1) Current supplied on TM5 power bus
(2) Consumption of the bus base
(3) Consumption of the electronic module
(4) Sum of (2) and (3)
(5) Remaining current available after slice consumption
External isolated I/O power supply, 24 Vdc
(6) Current supplied on the 24 Vdc I/O power segment
(7) Consumption of the electronic module
(8) Consumption of the loads of the output slices
(9) Consumption of the supply to sensors, actuators or external devices
(10) Sum of (7), (8) and (9)
(11) Remaining current available after slice consumption

Current Consumed on the TM5 Power Bus

The IPDM generates 750 mA on the TM5 power bus to supply expansion slices. The TM5 power bus begins with the TM5C12D8T compact I/O module and terminates with the TM5SBET1 expansion module.

The total current consumed on the TM5 power bus is 818 mA, and exceeds the 750 mA capacity of the segment.

You must supplement the TM5 power bus by substituting the TM5SPS1F PDM with a TM5SPS2F type PDM .

The following table shows, the current supplied and consumed in mA on the TM5 power bus:

TM5NCO1	**TM5C12D8T**												
IPDM (TM5SPS3)	**4 In**	**4 In**	**4 In**	**4 Out**	**4 Out**	**TM5SPS2F**	**TM5SDO16T**	**TM5SDO4R**	**TM5SDO4R**	**TM5SD000**	**TM5SAI4L**	**TM5SBET1**	**Legend**
750						1136							(1)
						26	26	26	26	26	26	26	(2)
	68					0	56	160	160	50	2	100	(3)
	68					26	82	186	186	76	28	126	(4)
	682					1792	1710	1524	1338	1262	1234	1108	(5)
10000						6300							*(6)*
25	*80*					34	*40*					30	*(7)*
				2000	*2000*		*4500*				*46*		*8*
	500	*300*	*200*	*500*	*300*								*9*
25	*580*	*300*	*200*	*2500*	*2300*	34	*4540*	*0*	*0*	*0*	*46*	*30*	*10*
9975	*9395*	*9095*	*8895*	*6395*	*4095*	*6266*	*1726*	*1726*	*1726*	*1726*	*1680*	*1650*	*11*

Legend:
Internal isolated main power supply, 24 Vdc
(1) Current supplied on TM5 power bus
(2) Consumption of the bus base
(3) Consumption of the electronic module
(4) Sum of (2) and (3)
(5) Remaining current available after slice consumption
External isolated I/O power supply, 24 Vdc
(6) Current supplied on the 24 Vdc I/O power segment
(7) Consumption of the electronic module
(8) Consumption of the loads of the output slices
(9) Consumption of the supply to sensors, actuators or external devices
(10) Sum of (7), (8) and (9)
(11) Remaining current available after slice consumption

The IPDM and the TM5SPS2F PDM provide 1886 mA (750 mA + 1136 mA) of current to the TM5 power bus.

The total current consumed on the TM5 power bus is 778 mA, and does not exceed the 1886 mA capacity of the TM5 power bus.

The preceding table shows the final configuration of the example with the current supplied and consumed in mA on the TM5 power bus and the 24 Vdc I/O power segments.

Section 4.4
Electrical Requirements

Introduction

The following section provides the general wiring rules and recommendations for the TM5 System. Considerations and techniques for grounding the TM5 System are also presented.

What Is in This Section?

This section contains the following topics:

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 fieldbus (CAN, serial, Ethernet).

WARNING

IMPROPER GROUNDING CAN CAUSE UNINTENDED EQUIPMENT OPERATION

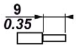
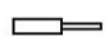
- Use cables with insulated shielded jackets for analog I/O, fast I/O and communication signals.
- Ground shielded cables for analog I/O, fast I/O and communication signals at a single point [1].
- Always comply with local wiring requirements regarding grounding of cable shields.

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

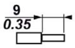
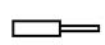
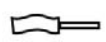
[1]Multipoint grounding is permissible if connections are made to an equipotential ground plane dimensioned to help avoid cable shield damage in the event of power system short-circuit currents.

Refer to the section Grounding the TM5 System *(see page 130)* to ground the shielded cables.

This table provides the wire sizes to use with the removable spring terminal blocks (TM5ACTB06, TM5ACTB12, TM5ACTB12, TM5ACTB12PS, TM5ACTB32):

mm / *in.* 				
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

This table provides the wire sizes to use with the TM5ACTB16 terminal blocks:

mm / *in.* 			
mm²	0,08…1,5	0,25…1,5	0,25…0,75
AWG	28…16	24…16	24...20

⚠ 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.

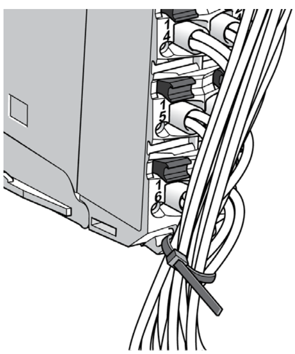
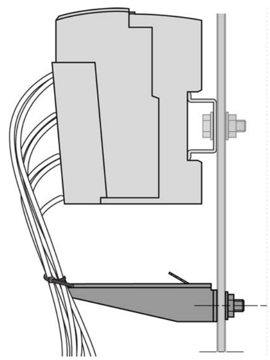
NOTE: To help prevent a terminal block from being inserted incorrectly, clearly and uniquely code and label each terminal block and electronic module according to the instructions in Coding the TM5 System *(see page 167)*.

Stress Relief Using Cable Tie

There are 2 methods to reduce the stress on cables:

- The terminal blocks *(see page 48)* 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 page 132)*, wires can be bundled and fixed to the grounding plate tabs using wire ties to reduce stress on the cables.

This table provides the size of the cable tie and shows the 2 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 illustration		

Protecting Outputs from Inductive Load Damage

Depending on the load, a protection circuit may be needed for the outputs on the controllers and certain modules. Inductive loads using DC voltages may create voltage reflections resulting in overshoot that will damage or shorten the life of output devices.

⚠ CAUTION

OUTPUT CIRCUIT DAMAGE DUE TO INDUCTIVE LOADS

Use an appropriate external protective circuit or device to reduce the risk of inductive direct current load damage.

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

If your controller or module contains relay outputs, these types of outputs can support up to 240 Vac. Inductive damage to these types of outputs can result in welded contacts and loss of control. Each inductive load must be with a protection device such as a peak limiter, RC circuit or flyback diode. Capacitive loads are not supported by these relays.

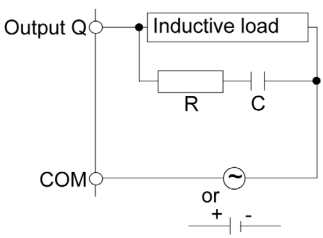
⚠ WARNING

RELAY OUTPUTS WELDED CLOSED

- Always protect relay outputs from inductive alternating current load damage using an appropriate external protective circuit or device.
- Do not connect relay outputs to capacitive loads.

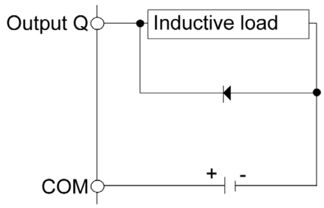
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Protective circuit A: this protection circuit can be used for both AC and DC load power circuits.



- C represents a value from 0.1 to 1 µF.
- R represents a resistor of approximately the same resistance value as the load.

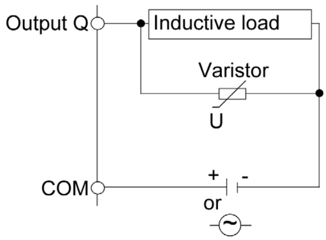
Protective circuit B: this protection circuit can be used for DC load power circuits.



Use a diode with the following ratings:

- Reverse withstand voltage: power voltage of the load circuit x 10.
- Forward current: more than the load current.

Protective circuit C: this protection circuit can be used for both AC and DC load power circuits.



NOTICE

EQUIPMENT DAMAGE

In applications where the inductive load is switched on and off frequently and/or rapidly, ensure that the continuous energy rating of the varistor exceeds the peak load energy by 20% or more.

Failure to follow these instructions can result in equipment damage.

Selecting an External 24 Vdc Power Supply

Characteristics of the 24 Vdc Power Supply

The TM5 System requires power supplies with a nominal voltage of 24 Vdc. The 24 Vdc power supplies must be rated Safety Extra Low Voltage (SELV) or Protective Extra Low Voltage (PELV) according to IEC 61140. These power supplies are isolated between the electrical input and output circuits of the power supply.

⚠ WARNING

POTENTIAL OF OVERHEATING AND FIRE

- Do not connect the 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.

Calculating the Power Supply Requirement

Refer to Power Distribution System Design *(see page 96)*.

Wiring the Power Supply

Overview

To distribute current for the 24 Vdc I/O power segment(s) and TM5 power bus according to the power distribution description *(see page 86)*, the following modules are connected to an external source:
- Controller Power Distribution Module (CPDM)
- Interface Power Distribution Module (IPDM)
- Receiver module (TM5SBER2)
- Power Distribution Module (PDM) TM5SPS1•
- Power Distribution Module (PDM) TM5SPS2•

Source power for these can come from one or more supplies. Your requirements are dictated by:
- voltage and current needs
- isolation requirements

⚠ 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.

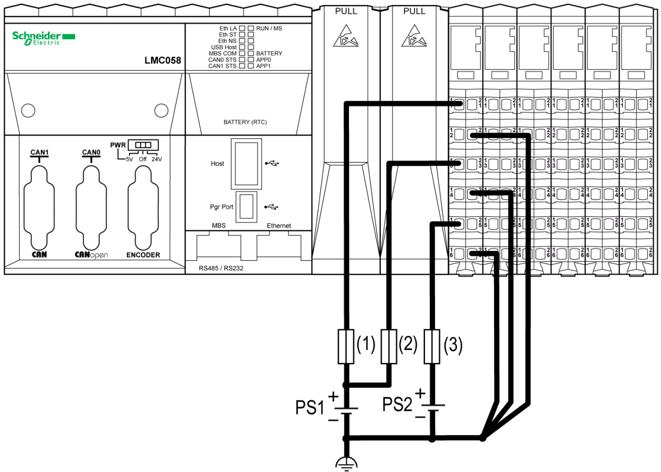
Wiring the Controller Power Distribution Module (CPDM)

The CPDM *(see page 91)* is the connection of the controller to the external 24 Vdc power supplies and the beginning of the power distribution for the local configuration. Power can be supplied by two or three external isolated power supplies depending on current needs and capabilities.

There are three power connections to be made to the CPDM from your source power supplies:

Connections	2 Power Supplies	3 Power Supplies
24 Vdc embedded expert modules power	PS1	PS0
24 Vdc Main power that generates power for TM5 power bus		PS1
24 Vdc I/O power segment	PS2	PS2

The following figure shows a CPDM wired with two separate external 24 Vdc power supplies:



(1) External fuse, Type T slow-blow, 3 A, 250 V
(2) External fuse, Type T slow-blow, 2 A, 250 V
(3) External fuse, Type T slow-blow, 10 A max., 250 V
PS1/PS2 External isolated power supplies 24 Vdc

NOTE: Connect the 0 Vdc power circuits together and to the functional ground (FE) of your system. If you do not interconnect the 0 Vdc circuits of the external power supplies, the status LEDs may not function correctly. In addition, there may potentially be more significant consequences such as an explosion and/or fire hazard.

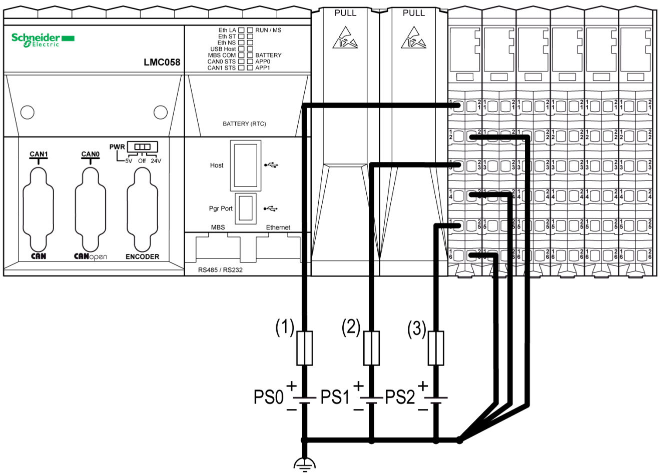
⚠ WARNING

POTENTIAL EXPLOSION OR FIRE

Always connect the 0 Vdc terminals of the external power supplies to the functional ground (FE) of your system.

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

The following figure shows the wiring of the CPDM with three separate external 24 Vdc power supplies:



(1) External fuse, Type T slow-blow, 3 A, 250 V
(2) External fuse, Type T slow-blow, 2 A, 250 V
(3) External fuse, Type T slow-blow, 10 A max., 250 V
PS0/PS1/PS2 External isolated power supply 24 Vdc

NOTE: Connect the 0 Vdc power circuits together and to the functional ground (FE) of your system. If you do not interconnect the 0 Vdc circuits of the external power supplies, the status LEDs may not function correctly. In addition, there may potentially be more significant consequences such as an explosion and/or fire hazard.

⚠ WARNING

POTENTIAL EXPLOSION OR FIRE

Always connect the 0 Vdc terminals of the external power supplies to the functional ground (FE) of your system.

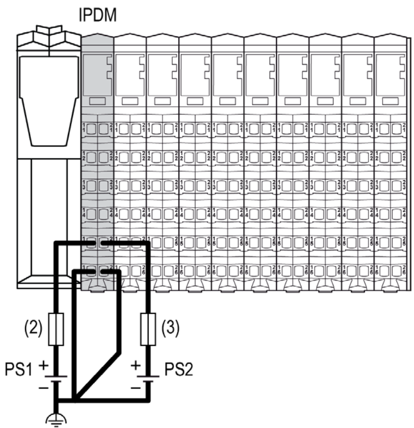
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Wiring the Interface Power Distribution Module (TM5SPS3)

The IPDM (TM5SPS3) (*see page 91*) is the first connection of the distributed configuration to the external 24 Vdc power supplies. Power is supplied by two external isolated power supplies.

There are two power connections to be made to the IPDM (IPDM TM5SPS3) from your source power supplies:

Connections	2 Power Supplies
24 Vdc Main power that generates power for TM5 power bus	PS1
24 Vdc I/O power segment	PS2



(2) External fuse, Type T slow-blow, 1 A, 250 V
(3) External fuse, Type T slow-blow, 10 A max., 250 V
PS1/PS2 External isolated power supply 24 Vdc

NOTE: Connect the 0 Vdc power circuits together and to the functional ground (FE) of your system. If you do not interconnect the 0 Vdc circuits of the external power supplies, the status LEDs may not function correctly. In addition, there may potentially be more significant consequences such as an explosion and/or fire hazard.

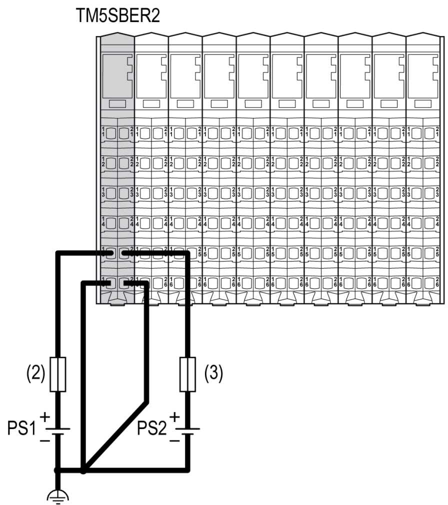
⚠ WARNING
POTENTIAL EXPLOSION OR FIRE Always connect the 0 Vdc terminals of the external power supplies to the functional ground (FE) of your system. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Wiring the Receiver Module (TM5SBER2)

The receiver module (TM5SBER2) *(see page 92)* is the first connection of the remote configuration to the external 24 Vdc power supplies. Power is supplied by two external isolated power supplies.

There are two power connections to be made to the receiver module (TM5SBER2) from your source power supplies:

Connections	2 Power Supplies
24 Vdc Main power that generates power for TM5 power bus	PS1
24 Vdc I/O power segment	PS2



(2) External fuse, Type T slow-blow, 1 A, 250 V
(3) External fuse, Type T slow-blow, 10 A max., 250 V
PS1/PS2 External isolated power supply 24 Vdc

NOTE: Connect the 0 Vdc power circuits together and to the functional ground (FE) of your system. If you do not interconnect the 0 Vdc circuits of the external power supplies, the status LEDs may not function correctly. In addition, there may potentially be more significant consequences such as an explosion and/or fire hazard.

⚠ WARNING
POTENTIAL EXPLOSION OR FIRE Always connect the 0 Vdc terminals of the external power supplies to the functional ground (FE) of your system. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

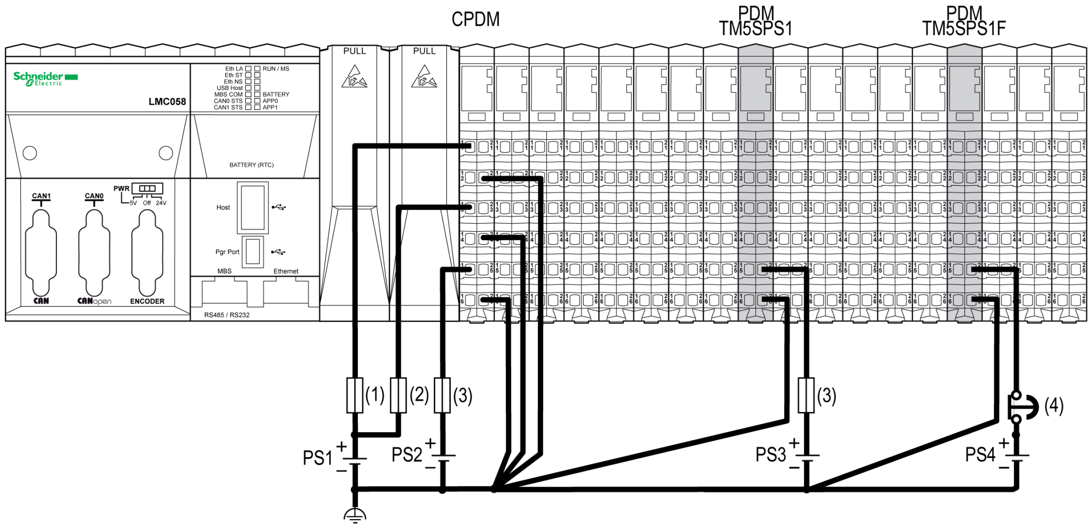
Wiring the Power Distribution Module TM5SPS1•

The TM5SPS1• (PDM) divides the 24 Vdc I/O power segment into several separated 24 Vdc I/O power segments *(see page 89)*. Each separated 24 Vdc I/O power segment is supplied by one external isolated power supply depending on current needs and capabilities.

There is one power connection to be made to each TM5SPS1• (PDM) from your source power supplies:

Segment Begin	Connection	Power Supplies
CPDM for local configuration or the receiver module for remote configuration or the IPDM for distributed configuration	24 Vdc I/O power segment 1	PS2
First PDM (from left to right) of the configuration	24 Vdc I/O power segment 2	PS3
Second PDM (from left to right) of the configuration	24 Vdc I/O power segment 3	PS4
...	...	...

The following figure shows the wiring to supply the 24 Vdc I/O power segments of a local configuration:



(1) External fuse, Type T slow-blow, 3 A, 250 V
(2) External fuse, Type T slow-blow, 2 A, 250 V
(3) External fuse, Type T slow-blow, 10 A max., 250 V
(4) Approved emergency stop device
PS1/PS2/PS3/PS4 External isolated power supply 24 Vdc

NOTE: Connect the 0 Vdc power circuits together and to the functional ground (FE) of your system. If you do not interconnect the 0 Vdc circuits of the external power supplies, the status LEDs may not function correctly. In addition, there may potentially be more significant consequences such as an explosion and/or fire hazard.

⚠ WARNING

POTENTIAL EXPLOSION OR FIRE

Always connect the 0 Vdc terminals of the external power supplies to the functional ground (FE) of your system.

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

NOTE: The requirements for the power supply are different for the input and the output slices. An emergency stop is generally used with the power supply providing power for output slices.

Wiring the Power Distribution Module TM5SPS2•

The TM5SPS2• (PDM) divides the 24 Vdc I/O power segment into several separated 24 Vdc I/O power segments *(see page 89)* and reinforces the TM5 power bus *(see page 90)*.

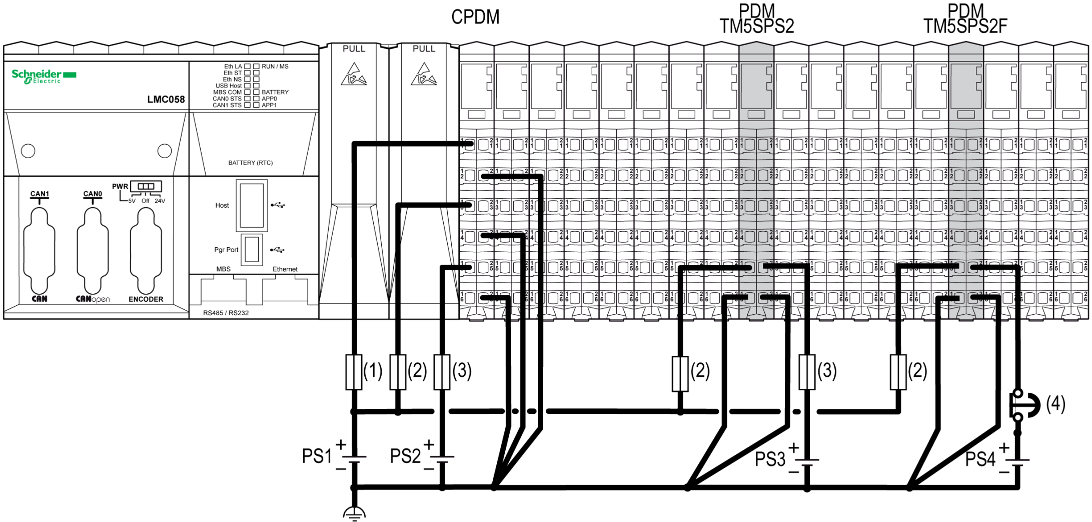
Selecting a 24 Vdc power supply *(see page 120)* should be based on current needs and capabilities.

Each separated 24 Vdc I/O power segment is supplied by one external isolated power supply depending on current needs and capabilities.

There are two power connections to be made to each TM5SPS2• (PDM) from your source power supplies:

<table>
<tr><th>Segment Begin</th><th>Connection</th><th>2 Power Supplies</th><th>3 Power Supplies[1]</th></tr>
<tr><td rowspan="3">CPDM for local configuration or the receiver module for remote configuration or the IPDM for the distributed configuration</td><td>24 Vdc embedded expert modules power</td><td rowspan="2">PS1</td><td>PS0</td></tr>
<tr><td>24 Vdc Main power that generates power for TM5 power bus</td><td>PS1</td></tr>
<tr><td>24 Vdc I/O power segment 1</td><td colspan="2">PS2</td></tr>
<tr><td rowspan="2">First PDM (from left to right) of the configuration</td><td>24 Vdc Main power that generates power to reinforce the TM5 power bus</td><td colspan="2">PS1</td></tr>
<tr><td>24 Vdc I/O power segment 2</td><td colspan="2">PS3</td></tr>
<tr><td rowspan="2">Second PDM (from left to right) of the configuration</td><td>24 Vdc Main power that generates power to reinforce the TM5 power bus</td><td colspan="2">PS1</td></tr>
<tr><td>24 Vdc I/O power segment 3</td><td colspan="2">PS4</td></tr>
<tr><td>...</td><td>...</td><td colspan="2">...</td></tr>
<tr><td colspan="4">[1] Only for the CPDM (see page 121).</td></tr>
</table>

In the following example, the PS1 is connected to the Main power and to the Embedded Expert I/O connections of the CPDM. In this case the 2 TM5SPS2• PDMs are connected to PS1 to supply the TM5 power bus:



(1) External fuse, Type T slow-blow, 3 A, 250 V
(2) External fuse, Type T slow-blow, 1 A, 250 V
(3) External fuse, Type T slow-blow, 10 A max., 250 V
(4) Approved emergency stop device
PS1/PS2/PS3/PS4 External isolated power supply 24 Vdc

NOTE: Connect the 0 Vdc power circuits together and to the functional ground (FE) of your system. If you do not interconnect the 0 Vdc circuits of the external power supplies, the status LEDs may not function correctly. In addition, there may potentially be more significant consequences such as an explosion and/or fire hazard.

⚠ WARNING
POTENTIAL EXPLOSION OR FIRE Always connect the 0 Vdc terminals of the external power supplies to the functional ground (FE) of your system. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

NOTE: The requirements for the power supply are different for the input and the output slices. An emergency stop is generally used with the power supply providing power for output slices.

Grounding the System

Introduction

To help minimize the effects of electromagnetic interference, cables carrying the fast I/O, analog I/O, network and field bus communication signals must be shielded.

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.

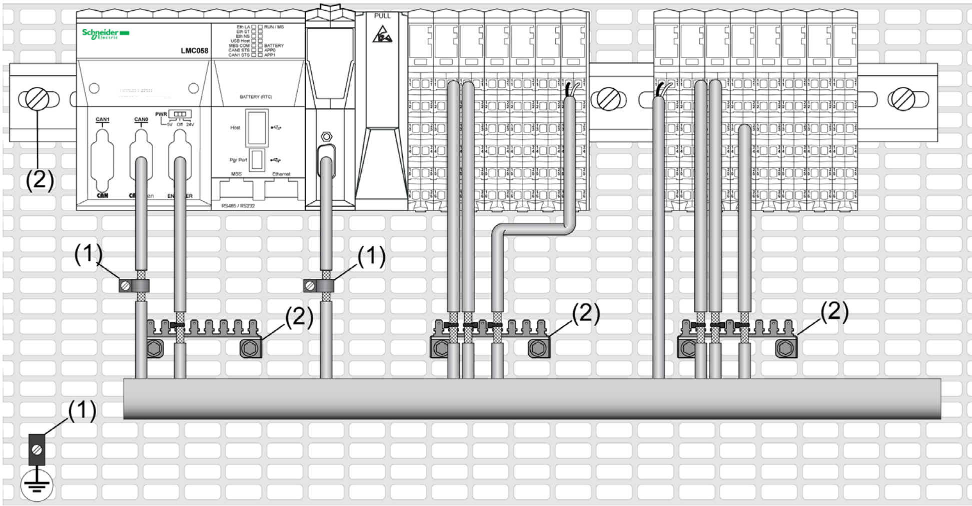
Failure to follow these instructions can result in death, serious injury, or equipment damage.

[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.

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 functionnal 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.

The figure below represents a TM5 System with shielded cables:



1 Protective ground (PE)
2 Functional ground (FE)

Protective Ground (PE) on the Backplane

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

Functional Ground (FE) on the DIN Rail

The DIN Rail for your TM5 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.**

The connection between the functional ground (FE) and your TM5 System is made by the DIN Rail contacts *(see page 46)* on the back of the controller and the bus base of the expansion modules.

Shielded Cables Connections

Cables carrying the fast I/O, analog I/O, network and field bus communication signals must be shielded. The shielding must be securely connected to ground. The fast I/O and analog I/O shields may be connected either to the functional ground (FE) of your system via the TM2XMTGB grounding bar or to the protective ground (PE). 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.

⚠ WARNING

ACCIDENTAL DISCONNECTION FROM PROTECTIVE GROUND (PE)

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

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

The shielding of the following cables must be connected to the protective ground (PE):
- CANopen
- Modbus

⚠ DANGER

HAZARD OF ELECTRIC SHOCK

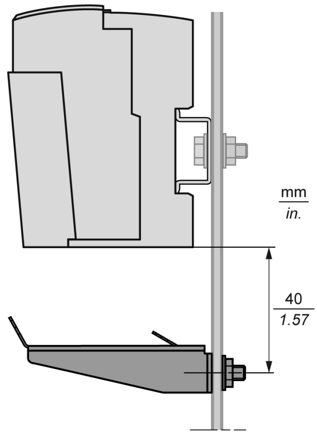
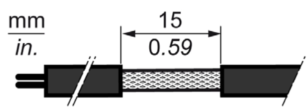
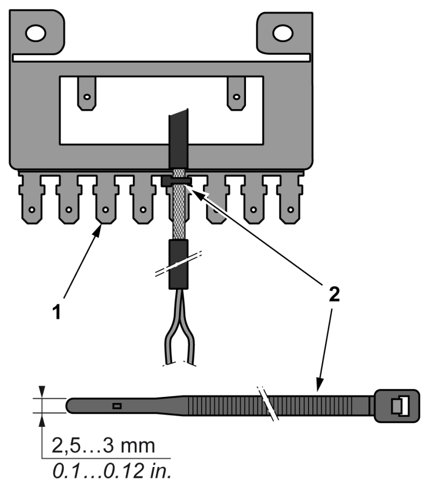
Make sure that CANopen and Modbus cables are securely connected to the protective ground (PE).

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

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

Functional Ground (FE) Cable Shielding

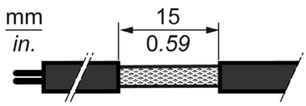
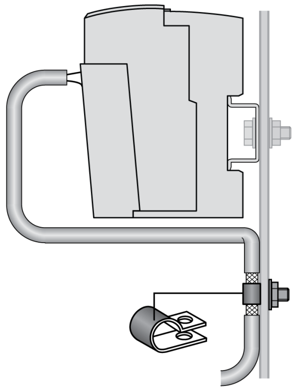
To connect the shield of a cable via the Grounding Bar:

Step	Description	
1	Install the Grounding Bar *(see page 54)* directly on the conductive backplane below the TM5 System as illustrated.	
2	Strip the shielding for a length of 15 mm (0.59 in.)	
3	Tightly clamp on the blade connector **(1)** using nylon fastener **(2)**(width 2.5...3 mm (0.1...0.12 in.)) and appropriate tool.	

NOTE: Schneider Electric recommends the use of the TM2XMTGB Grounding Bar.

Protective Ground (PE) Cable Shielding

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

Step	Description	
1	Strip the shielding for a length of 15 mm (0.59 in.)	
2	Attach the cable to the conductive backplane plate by attaching the grounding clamp to the stripped part of the shielding as close as possible to the TM5 System base.	

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

Chapter 5
Installation Procedures

Overview

This chapter focuses on procedures for construction of a TM5 System. The installation quick start guide summarizes the steps involved in the installation process.

What Is 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.

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

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.

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

Installation Quick Start Guide

Introduction

This section provides a summary of the installation process covered in detail throughout the rest of this guide. The information is presented in generalized steps which convey each of the basic operations that are required in the installation process. Each step is accompanied by a reference that locates the detailed information associated with it. This "quick start guide" should allow you to accomplish the installation of a TM5 System more efficiently.

NOTE: There are several ways to assemble a TM5 System. The recommended and described method is to install and assemble directly on the DIN rail.

The installation process is divided into three phases described below.

Installation-Phase 1

In the first phase of the installation, you install the DIN rail, the controller or the field bus interface and any bus bases for any expansion modules that may be part of your TM5 System configuration:

Step	Action	For Details See
1	Develop an installation plan that covers all aspects of the installation.	Making a Plan *(see page 140)*
2	Fasten the DIN rail to the mounting plate of the enclosure.	DIN Rail Installation *(see page 141)*
3	For local configuration, install the controller at the first (leftmost) location on the rail or for distributed configuration install the field bus interface at the first (leftmost) location on the rail. **NOTE:** In case of vertical installation the controller or the field bus interface must be at the lowest location and secured. **NOTE:** Refer to Acceptable mounting positions *(see page 83)*. **NOTE:** Go to Installation-Phase 2 *(see page 139)* if there are no expansion modules.	Controller Installation *(see page 144)* or Field Bus Interface Installation *(see page 145)*
4	Determine the left-to-right arrangement of the expansion modules on the rail.	–
5	Attach the bus base (for slices) and compact I/O to the DIN rail in accordance with your expansion modules layout, working left to right from the controller (step 3, above).	Mounting the Bus Bases *(see page 152)* or Compact I/O Installation *(see page 149)*
6	Optional: Assign the module addresses in accordance with your expansion modules layout.	Addressing *(see page 163)*

Installation-Phase 2

In the second phase of the installation, you install the electronic modules and terminal blocks with or without coding:

Step	Action	For Details, see
1	Develop a coding scheme for the electronic modules that matches the expansion modules layout (step 4).	Coding the TM5 System *(see page 167)*
2	Install the electronic modules in their bus bases in accordance with your slice layout. **NOTE:** In case of slice after a compact I/O block remove the last terminal block of the compact I/O block before. **NOTE:** Refer to Acceptable mounting positions *(see page 83)*.	Inserting the Electronic Module *(see page 153)*
3	Install a left bus base locking plate to the first slice of all remote configurations.	Mounting the Left Bus Base Locking Plate *(see page 157)*
4	Install a right bus base locking plate to the rightmost expansion module of all configurations.	Mounting the Right Bus Base Locking Plate *(see page 156)*
5	Mount the terminal blocks in accordance with your expansion modules layout.	Mounting the Terminal Blocks *(see page 154)*

Installation-Phase 3

In the final phase, you install cable ducts, connect all grounding points, make the necessary signal and power connections, and commission your TM5 System.

Step	Action	For Details, see
1	Install the TM2XMTGB grounding plate.	Grounding the TM5 System *(see page 130)*
2	Install cable ducts, conduits and any wiring harnesses.	–
3	Make Functional Ground (FE) connections.	Functional Ground (FE) Cable Shielding *(see page 133)*
4	Make Protective Ground (PE) connections.	Protective Ground (PE) Cable Shielding *(see page 134)*
5	Make all field wiring connections.	Specific Hardware Guides
6	Make all power connections.	Wiring the Power Supply *(see page 121)*
7	Reduce stress on the wires with adequate cable ties.	Stress Relief Using Cable tie *(see page 117)*
8	Commission the TM5 System.	Configuring the TM5 System (refer to your controller programming guide)

The Layout of your TM5 System

Making a Plan

Before you begin to install your TM5 System, you need to establish a plan that identifies:

- the type of enclosure for the TM5 System
- the number and type of expansion modules on your TM5 System
- the order in which any TM5 expansion modules are assembled together to form the TM5 bus
- the power requirements of your TM5 System configuration
- a coding scheme that helps match the correct terminal blocks with their electronic modules
- a labeling plan

Establishing and following a clear plan is invaluable. The local TM5 bus is constructed as a series of interconnected bus base units. The structure of the TM5 backplane is defined by the type and order of electronic modules that will reside in it. You will need to make these decisions in advance and the association table *(see page 248)* can help you. There is a color coding system *(see page 25)* in the TM5 System. In addition, there is a coding system for optional coding *(see page 167)* of the electronic modules and terminal blocks that is recommended. Careful labeling *(see page 173)* of your TM5 System is also recommended.

Selecting Expansion Modules

When you plan a TM5 System layout, some important things you need to know are the number and type of expansion electronic modules and their matching bus bases and terminal blocks.

NOTE: There are restrictions and regulations associated with certain module types. Please refer to the TM5 expansion I/O hardware guides for more information

Once the number and type of modules has been established, it becomes possible to determine power distribution requirements *(see page 96)*, your external power source requirements *(see page 120)* and the overall hardware design.

DIN Rail Installation

Grounding Function

The DIN rail must be attached to a conductive backplane that itself is connected to a protective ground (PE) *(see page 131)*.

In the mounting channel of each piece of the TM5 equipment is a metal spring contact. When properly mounted on a metal DIN rail, these contacts provide connection to the functional ground (FE) *(see page 131)* for the entire TM5 System.

Mounting the DIN Rail

The TM5 System components are designed for mounting on rail conforming to IEC 60715.

To help achieve the stated TM5 System performance characteristics, the mounting hardware must be installed at the end positions and at 100 mm (3.94 in.) maximum increments along the length of the rail.

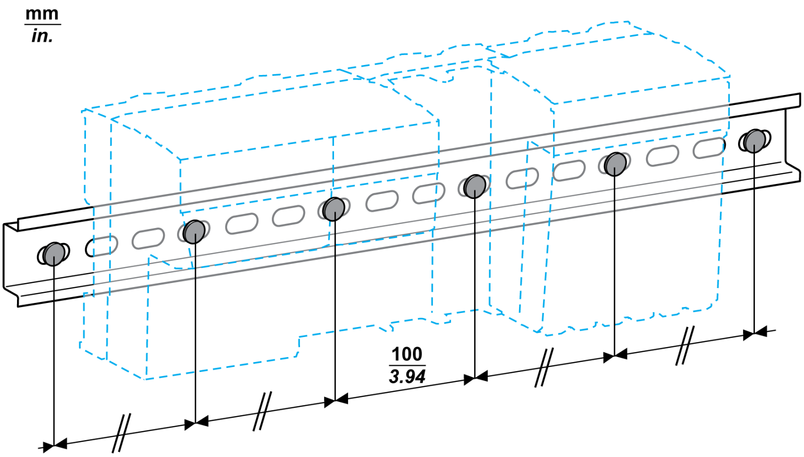
⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that the DIN rail is securely installed with mounting hardware at the end positions and at 100 mm (3.94 in.) maximum increments along the length of the rail.
- Be sure that the DIN rail is firmly connected to a conductive backplane, and that the conductive backplane is secured to a protective ground as specified in this guide and in accordance with local regulations.

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

The following figure illustrates the mounting requirements for the DIN rail:



Low profile NSYSDR200D DIN rail may be used with low profile mounting hardware such as flat head screws with countersunk mounting holes.

NOTE: If you use NSYSDR200D DIN rail, ensure that the maximum fastener screw head protrusion does not exceed 1.0 mm (0.039 in.) above the inner surface of the DIN rail.

Controller Installation

Introduction

The following procedure describes how to mount a controller on the DIN rail.

NOTE: If the controller is already installed and wired, or the slice connectors are prewired, be sure to remove all power before attempting these procedures.

DANGER

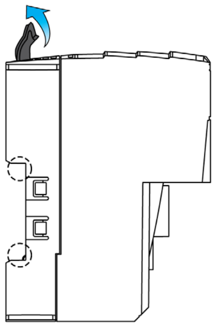
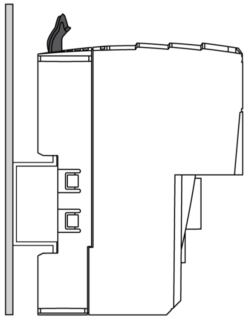
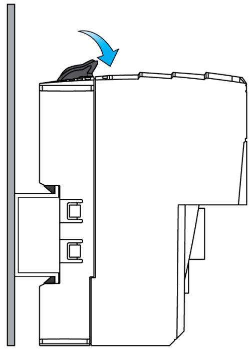
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- 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.

Controller Installation

The following table gives step by step instructions to install a controller on a DIN rail:

Step	Action	
1	Push all the locking levers all the way up. This opens the locking mechanism for controller installation.	
2	Hang the controller in the desired position on the mounting rail.	
3	Close the locking mechanism by pushing all levers down.	

Field Bus Interface Installation

Introduction

The installation procedure of the field bus interface is to assemble the 4 components and then install it directly on the DIN rail.

NOTE: If the field bus interface is already installed and wired, or the connectors are pre-wired, be sure to remove all power before attempting these procedures.

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

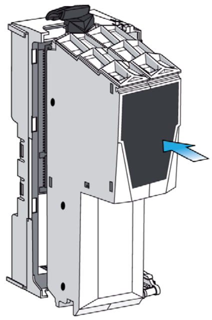
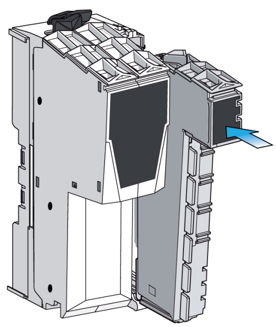
ELECTROSTATIC DISCHARGE

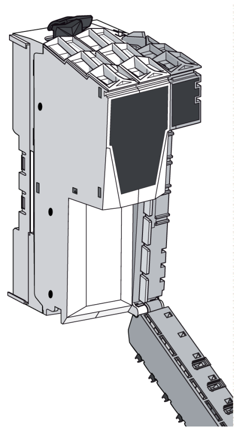
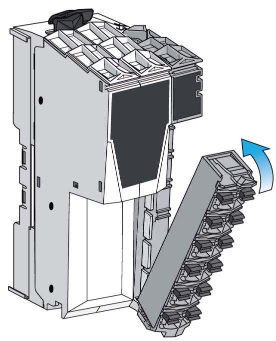
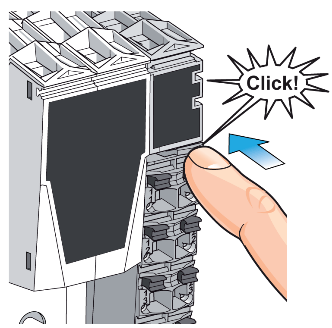
- Store electronic components in their protective packaging until immediately before assembly.
- Only touch modules on the housing.
- Take the necessary protective measures against electrostatic discharges.

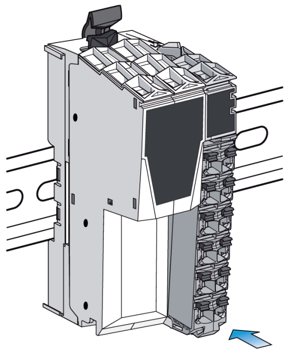
Failure to follow these instructions can result in equipment damage.

Field Bus Interface Installation

The following procedure gives step by step instructions to assemble and install a field bus interface on a DIN rail:

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Remove bus base, the electronic modules and terminal block from protective packaging. Check for obvious mechanical damage.</td></tr>
<tr><td>2</td><td>Insert interface electronic module in the slot of the bus base (see page 38).</td><td></td></tr>
<tr><td>3</td><td colspan="2">Push the interface electronic module straight into the bus base until it clicks.</td></tr>
<tr><td>4</td><td>Insert the IPDM electronic module in the guides of the bus base (see page 38).</td><td></td></tr>
<tr><td>5</td><td colspan="2">Push the electronic module straight into the bus base until it clicks.</td></tr>
</table>

Step	Action	
6	Hang the bottom edge of the terminal block in its hinge on the bus base *(see page 38)*.	
7	Rotate upward.	
8	Press the terminal block until it clicks in place.	
9	Push the locking lever all the way up on all of the bus base. This opens the locking mechanism.	

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>10</td><td>Hang the field bus interface in the desired position on the mounting rail.</td><td></td></tr>
<tr><td>11</td><td colspan="2">Close the locking mechanism by pushing the lever down.</td></tr>
</table>

Compact I/O Installation

Introduction

The compact I/O is always preceded by a controller, a field bus interface or a slice. The installation procedure of the compact I/O is to install it directly on the DIN rail.

NOTE: If the controller is already installed and wired, or the slice connectors are pre-wired, be sure to remove all power before attempting these procedures.

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

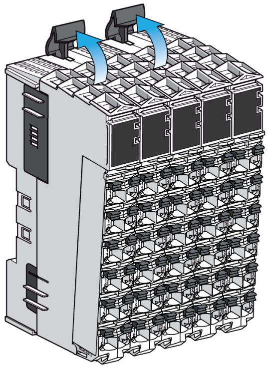
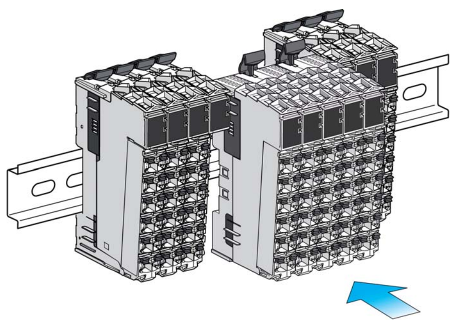
ELECTROSTATIC DISCHARGE

- Store electronic components in their protective packaging until immediately before assembly.
- Only touch modules on the housing.
- Take the necessary protective measures against electrostatic discharges.

Failure to follow these instructions can result in equipment damage.

Mounting the Compact I/O

The following procedure describes how to mount the compact I/O:

Step	Description	
1	Remove compact I/O from the protective packaging. Check the compact I/O for obvious mechanical damage.	
2	Push the locking levers all the way up. This opens the locking mechanism.	
3	Remove the terminal block of the preceding TM5 component (last embedded module of the controller or the last expansion module prior to the compact I/O to remove). **NOTE:** Remember to reinstall the removed terminal block *(see page 154)* after installation of the slice. If already installed, remove the right locking plate *(see page 161)* of the preceding TM5 component.	
4	Insert the compact I/O in the guides of the preceding TM5 component, slide the compact I/O in against the mounting rail and secure it by pushing both locking levers down.	
5	Install the right locking plate *(see page 156)*.	

Slices Installation

Introduction

The installation procedure of the slices is to install and assemble them directly on the DIN rail:

1 Mount the bus bases.
2 Insert the electronic modules.
3 Mount the terminal blocks.

NOTE: If the controller or a field bus interface is already installed and wired, or the slice connectors are pre-wired, be sure to remove all power before attempting these procedures.

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 installation procedure for the first bus base depends whether it is a local, remote or distributed configuration.

NOTICE

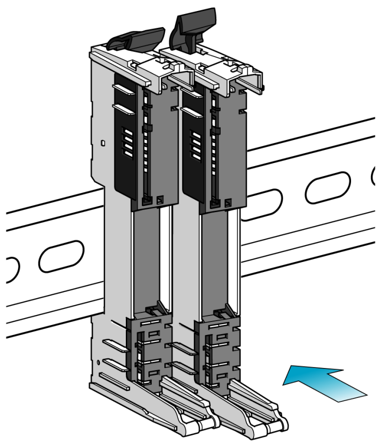
ELECTROSTATIC DISCHARGE

- Store electronic components in their protective packaging until immediately before assembly.
- Only touch modules on the housing.
- Take the necessary protective measures against electrostatic discharges.

Failure to follow these instructions can result in equipment damage.

Mounting the Bus Bases

The following procedure describes how to mount the bus bases:

Step	Description
1	Remove bus bases from protective packaging. Check the bus bases for obvious mechanical damage.
2	Push the locking lever all the way up on all of the bus bases. This opens the locking mechanism.
3	**Local configuration:** Remove the terminal block of the last embedded module of the controller. **Remote configuration:** Go to next step. **Distributed configuration:** Remove the terminal block of the IPDM of the field bus interface.
4	**Local configuration:** Insert the first bus base in the guides of the controller, slide the bus base in against the mounting rail and secure it by pushing the lever down. **Remote configuration:** Hang the first bus base in the desired position on the mounting rail and close the locking mechanism by pushing the lever down. **Distributed configuration:** Insert the first bus base in the guides of the field bus interface bus base, slide the bus base in against the mounting rail and secure it by pushing the lever down.
5	Insert the next bus base in the guides of the previously mounted bus base. 
6	Slide the bus base in against the mounting rail and secure it by pushing down the locking lever.
7	According to the installation plan, proceed like this with the rest of the bus bases.
8	If using bus bases with address setting, assign the bus base address *(see page 163)* at this step of the installation procedure of the slices.

NOTE: Remember to reinstall the removed terminal block *(see page 154)* after installation of the slice.

Inserting the Electronic Modules

A slice must only be composed of a single color. For example, a gray bus base should only be assembled with a gray electronic module and a gray terminal block. However, color alone is not sufficient for compatibility; always confirm that functionality of slice components matches as well.

DANGER

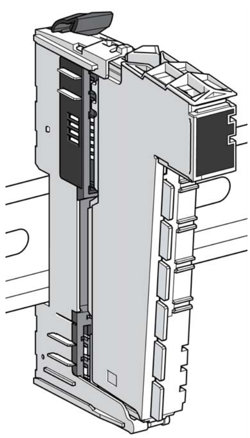
INCOMPATIBLE COMPONENTS CAUSE ELECTRONIC SHOCK OR ARC FLASH

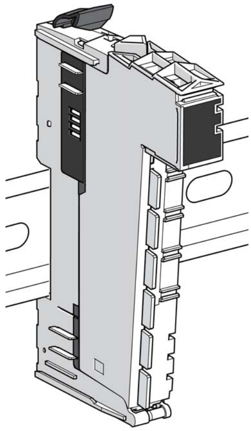
- Do not associate components of a slice that have different colors.
- Always confirm the compatibility of slice components and modules before installation using the association table in this manual.
- Ensure that a correct terminal block is installed on the appropriate electronic module.

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

NOTE: If the controller or field bus interface is already installed and wired and you are replacing an existing electronic module, be sure to follow the Hot-swap guidelines *(see page 188)* in association with the following procedures.

The following procedure describes how to mount the electronic modules:

Step	Action	
1	Remove electronic module from protective packaging. Check the electronic module for obvious mechanical damage.	
2	Insert electronic module in the guides of the bus base *(see page 46)*.	

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>3</td><td>Push the electronic module straight into the bus base until it clicks.</td><td></td></tr>
<tr><td>4</td><td colspan="2">According to the installation plan, proceed like this with all the electronic modules.</td></tr>
</table>

Mounting the Terminal Blocks

A slice must only be composed of a single color. For example, a gray bus base should only be assembled with a gray electronic module and a gray terminal block. However, color alone is not sufficient for compatibility; always confirm that functionality of slice components matches as well.

DANGER

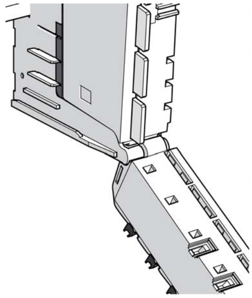
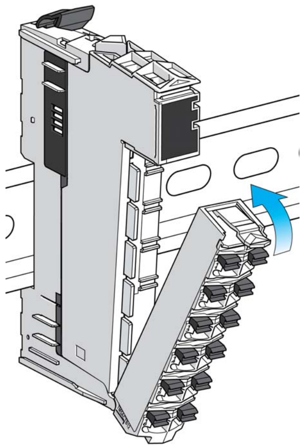
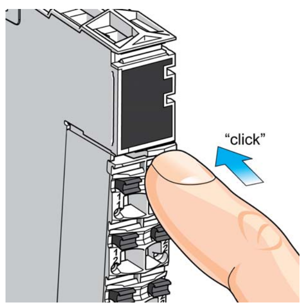
INCOMPATIBLE COMPONENTS CAUSE ELECTRONIC SHOCK OR ARC FLASH

- Do not associate components of a slice that have different colors.
- Always confirm the compatibility of slice components and modules before installation using the association table in this manual.
- Ensure that a correct terminal block is installed on the appropriate electronic module.

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

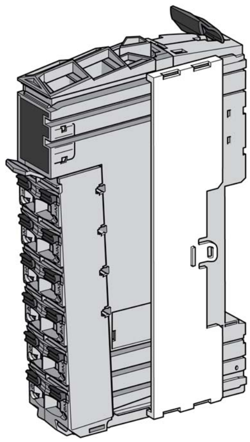
See Coding the TM5 *(see page 167)* for assistance in labeling and associating components correctly.

The following procedure describes how to mount the terminal block:

Step	Action	
1	Hang the bottom edge of the terminal block in its hinge on the bus base.	
2	Rotate upward.	
3	Press the terminal block until it clicks in place.	
4	According to the installation plan, proceed like this with all the terminal blocks.	

Right Bus Base Locking Plate

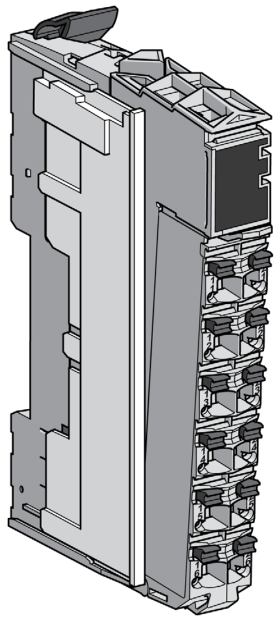
The right bus base locking plate must be attached to the rightmost slice of the controller or the rightmost expansion module of the local, remote configuration, or distributed island:

Step	Action
1	Remove the terminal block of the rightmost expansion module .
2	From the front, insert the right bus base locking plate into the bus base interlocking guides *(see page 46)*. 
3	Push it in all the way.
4	Replace the terminal block of the rightmost expansion module.

NOTE: The controller is delivered with the right bus base locking plate.

Left Bus Base Locking Plate

The left bus base locking plate is attached to the first slice (receiver slice) of the remote islands:

Step	Action	
1	Place the left bus base locking plate on the left slice and insert it in the interlocking guides *(see page 46)* of the terminal block.	
2	Slide the bus base locking plate forward.	

Equipment Removal

Introduction

The following procedures describe how to remove a TM5 System or part of a system from the DIN rail.

NOTE: When replacing a controller, a field bus interface or expansion modules and their bus bases, be sure to remove all power before attempting these procedures.

DANGER

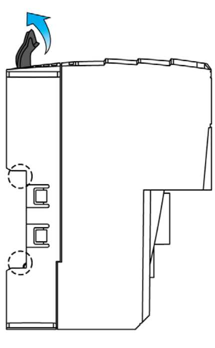
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- 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.

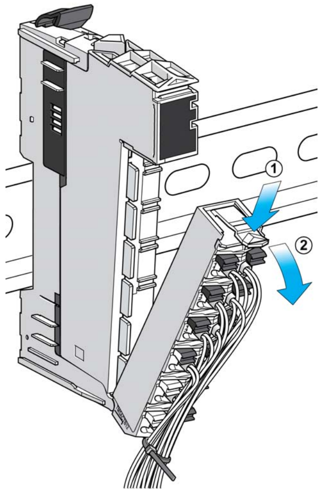
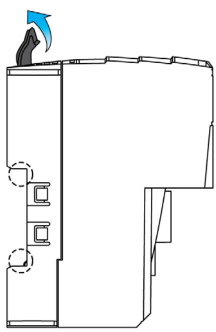
Failure to follow these instructions will result in death or serious injury.

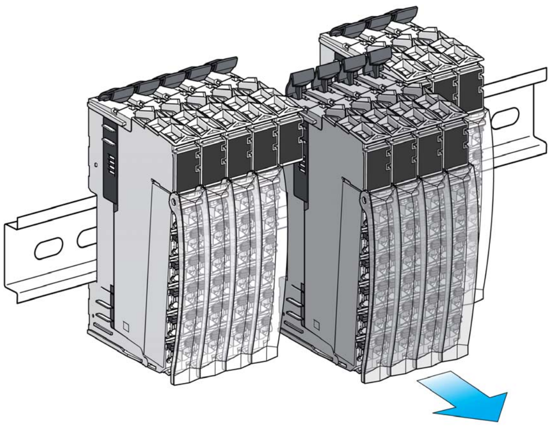
Complete Configuration Removal

The following procedure describes how to remove a complete configuration *(see page 18)*:

Step	Action	
1	Remove all power from all equipment.	
2	Push all the locking levers all the way up. This opens the locking mechanism for equipment installation.	
3	Remove the TM5 System configuration from the mounting rail.	

Partial Configuration Removal

Step	Action	
1	Remove all power from all equipment.	
2	For mechanical reasons, remove the terminal block of the electronic module at the left of the partial configuration to be removed. To do this: **1** push down on the locking lever on the terminal block **2** rotate the terminal block out and down	
3	Push all the locking levers of the partial configuration to be removed all the way up. This opens the locking mechanism for equipment installation.	

Step	Action
4	Remove the partial configuration from the mounting rail. 
5	Put the removed terminal block *(see page 154)* back on the electronic module.

Expanding the TM5 System

How to Expand the TM5 System

When adding expansion modules be sure to remove all power before attempting these procedures.

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.

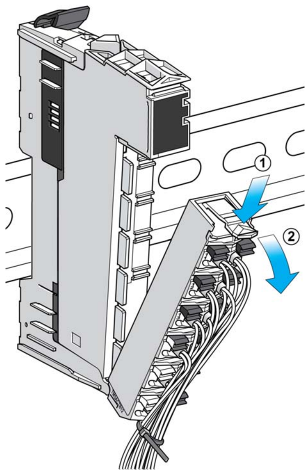
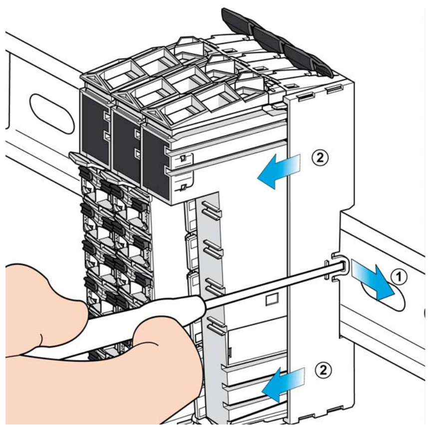
WARNING

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.

The following procedure describes how to expand the TM5 System:

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Remove all power from all equipment.</td></tr>
<tr><td>2</td><td>Remove the terminal block from the rightmost slice:
1 Push down on the locking lever on the terminal block.
2 Rotate the terminal block out and down.</td><td></td></tr>
<tr><td>3</td><td>Remove the locking plate from the rightmost slice:
1 Use a screwdriver to unhook the locking clip of the right locking plate.
2 Pull the locking plate off the bus base and electronic module.</td><td></td></tr>
<tr><td>4</td><td colspan="2">Install expansion modules according to your expansion layout as described in the slice (see page 151) or compact I/O (see page 149) installation procedures.
Install the rightmost terminal block removed at the step 2.</td></tr>
<tr><td>5</td><td colspan="2">Install the right locking plate (see page 156) to the rightmost expansion module of your new configuration.</td></tr>
</table>

Addressing

Introduction

The TM5 backplane of bus bases, which holds the individual I/O modules together, is self-addressing. It is usually not necessary to set the address setting numbers.

However, in certain cases, it may be necessary to define specific slices or potential groups at fixed addresses, regardless of the preceding modules in the backplane. For this purpose, there are bus bases in the TM5 System with rotary switches, which allow you to set the address of an individual slice. All subsequent slices refer to this offset and are again automatically addressed from this point forward.

Addressing Principle

In the TM5 System, the address setting number begins at 1 and is the address number of:
- The first embedded regular I/O module of the controller. The embedded Expert I/O integrated in the controllers do not have physical addresses.
- The Interface Power Distribution Module (IPDM) of the distributed configuration.

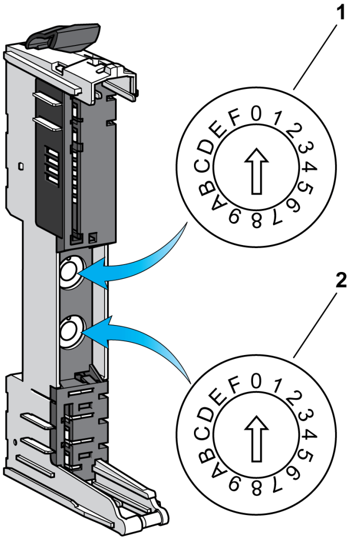
The following modules and expansion modules addresses are assigned according to their positions in the TM5 backplane (+1 regarding the left preceding module address).

Bus Bases with Address Setting

The following table gives you the references of the bus bases *(see page 340)* with address setting:

References	Description	Color
TM5ACBM05R	24 Vdc / 24 Vdc I/O power segment left isolated with address setting	Gray
TM5ACBM15	24 Vdc / 24 Vdc I/O power segment pass-through with address setting	White

Address Setting Rotary Switches



1 x16
2 x1

The address of the slice is set using the address setting rotary switches (01 - FD hex).

The address setting 00 hex causes automatic assignment of the address of the expansion module.

NOTE: In SoMachine software the address setting number is in decimal.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION ● Verify that the addressing of the bus base modules is ordinal within the physical layout of the configuration from left to right. ● Verify that the physical configuration (order and references of the I/O modules and any addressed bus bases) corresponds exactly to that defined in the software configuration for your application. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

As a matter of good practice, set the rotary switches before installing the bus base on the DIN rail and making a connection to the other components of your TM5 system. If the bus base is already installed before its address has been set, then remove all power to your TM5 system before setting the address.

⚠ ⚠ 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.

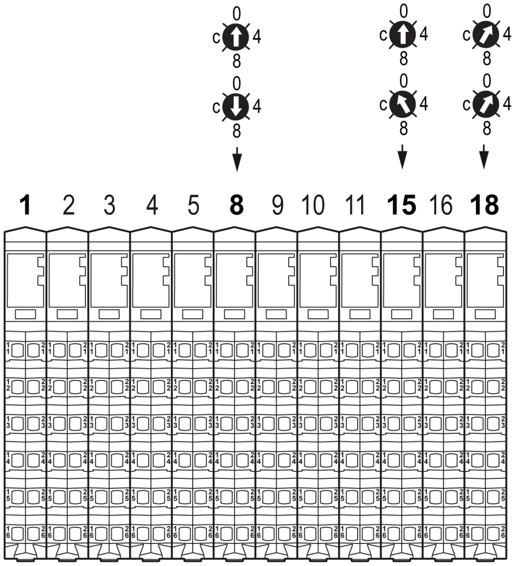
Failure to follow these instructions will result in death or serious injury.

You must use a flat-head screwdriver of the size noted below to turn the rotary address selection switches.

 0,5 x 1,8 mm (*0.02 x 0.07 in.*)	

Example

The example below demonstrates the automatic addressing of the slices up to the point of a bus base with an address setting rotary switch. This bus base forces the address for the slice, in the example, to 8. From that point, the automatic sequential addressing continues until the next bus base with an address setting rotary switch is encountered.

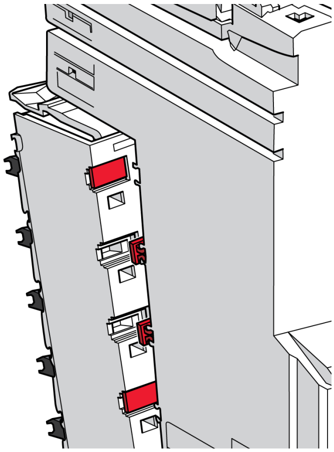


Coding the TM5 System

Introduction

To reduce the likelihood of mismatches during mounting and maintenance operations, the association between the terminal blocks and the electronic modules can be coded.

The following image illustrates how to help prevent a terminal block from being inserted into the incorrect electronic module:



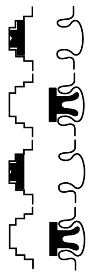
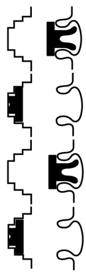
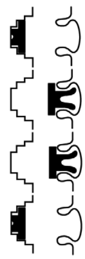
The label tabs and labeling tool *(see page 52)* accessories are required to code the terminal block and the electronic module.

Creating a Coding Scheme

There are many coding schemes you can use for the TM5 System. Here are some strategies to keep in mind:

- Code adjacent modules differently.
- Code each type of slice (input, output, digital, analog, 24 Vdc, 120 Vac, 240 Vac...) with a different pattern.
- Be sure your coding scheme is unique.

The following table shows you some unique combinations to code your TM5 System:

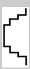
1		2		3		4		5		6	
A	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
											

A Slots on the terminal block
B Slots on the electronic module

 represents an electronic module slot *(see page 47)* with a label tab.

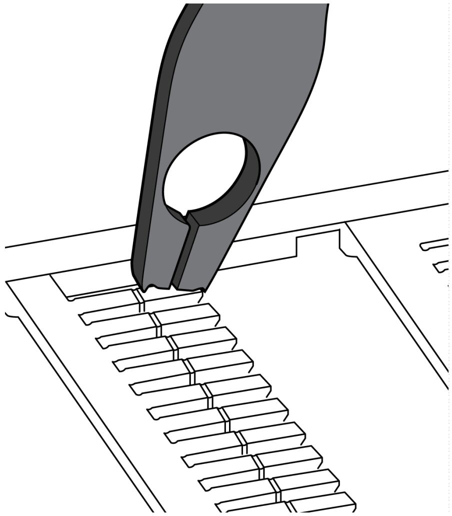
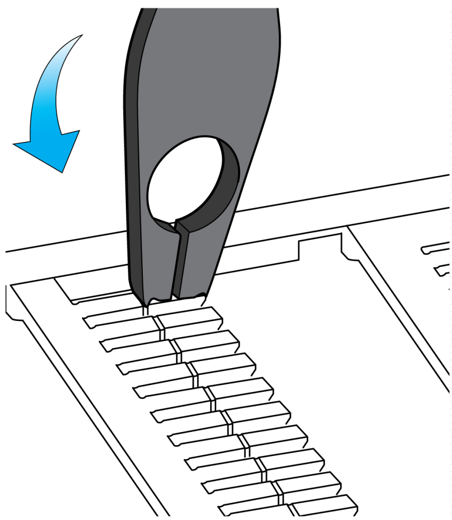
 represents an electronic module slot without a label tab.

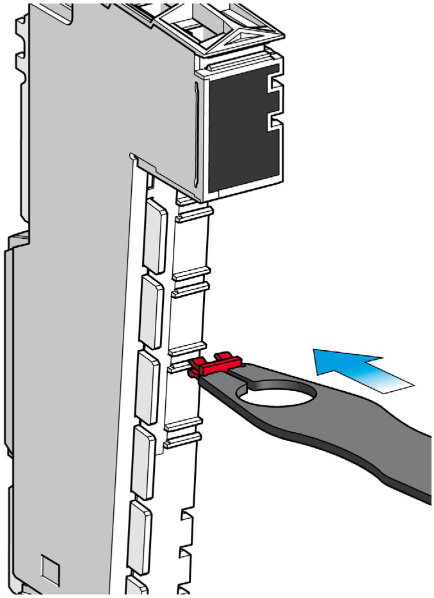
 represents a terminal block slot *(see page 48)* with a label tab.

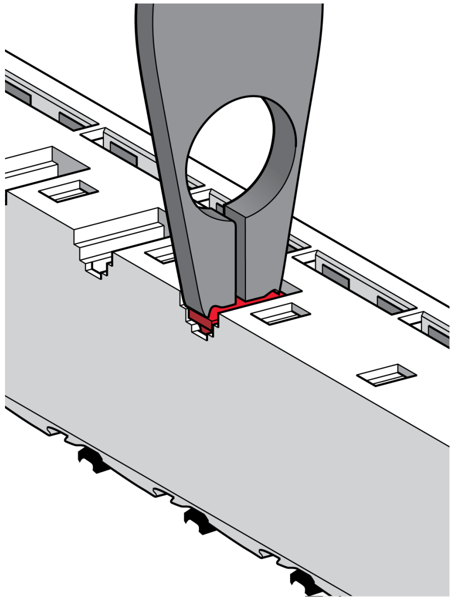
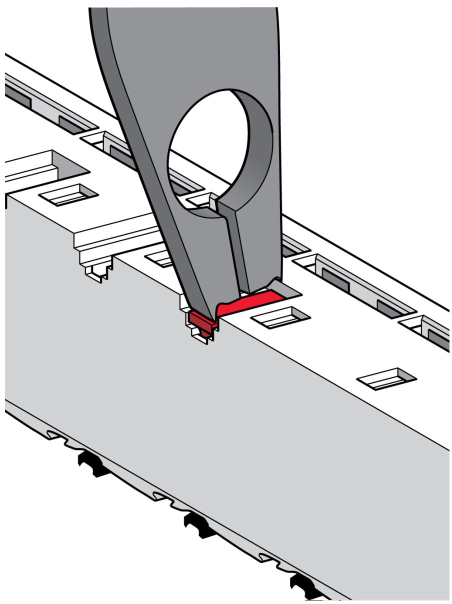
 represents a terminal block slot without a label tab.

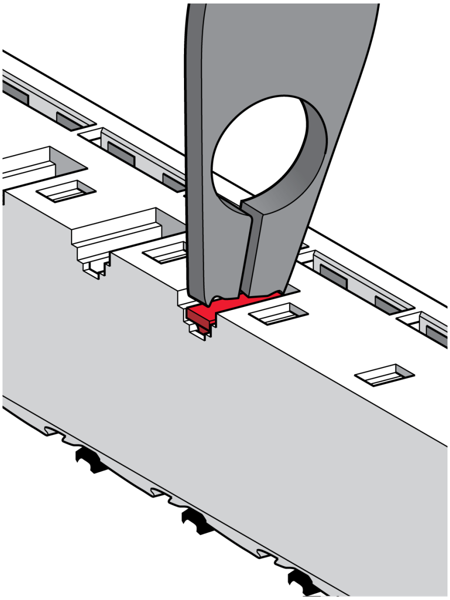
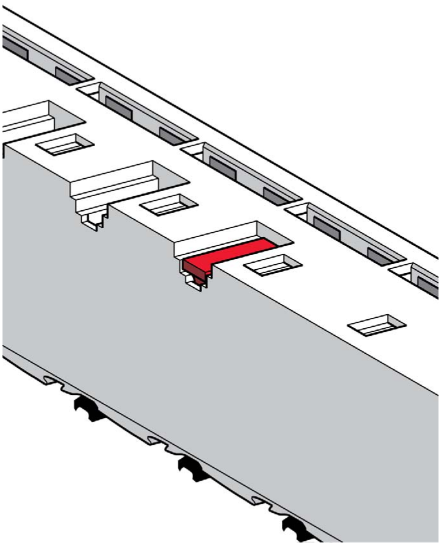
How to Install the Label Tabs for Coding

The following table describes how to code the terminal block and the electronic module:

Step	Action	
1	Grip the desired label tab with the single-width cutters of the labeling tool.	
2	Press with the labeling tool to separate the label.	

Step	Action	
3	Center the label tab over the slot *(see page 47)* on the electronic module.	
4	Hold the labeling tool at a 90° angle to the electronic module and press to insert the label's feet into the slot.	
5	Repeat step 1 and 2 to remove a label tab with the single-width cutter of the labeling tool.	

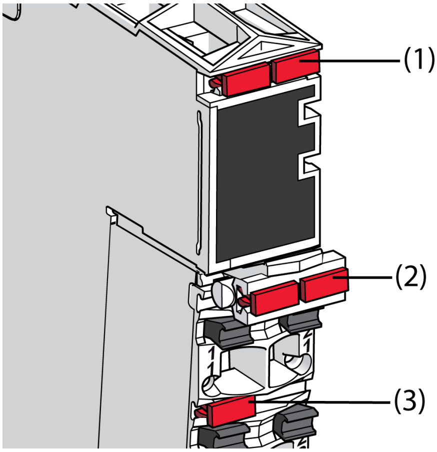
Step	Action	
6	Set the label tab in the slot (*see page 48*) on the back of the terminal block as shown.	
7	Use the labeling tool to push the left feet of the label into the slot.	

Step	Action	
8	With the labeling tool, press the right feet of the label into the slot.	
9	Inserted label for terminal coding.	

Labeling the TM5 System

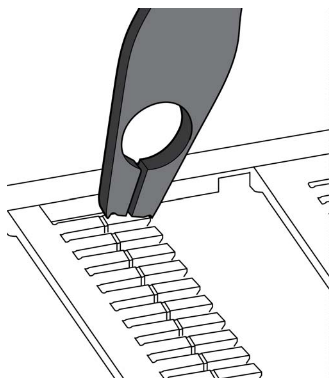
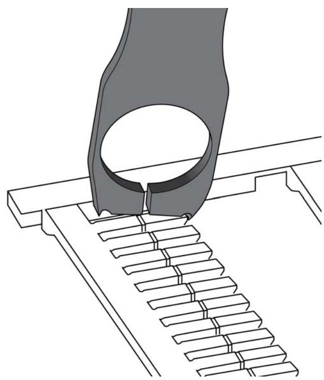
Introduction

This section explains how to label:



1 The electronic module.
2 The locking clip of the terminal block
3 The connectors of the terminal block

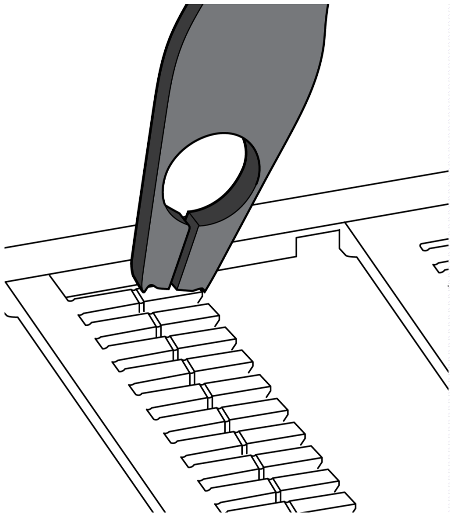
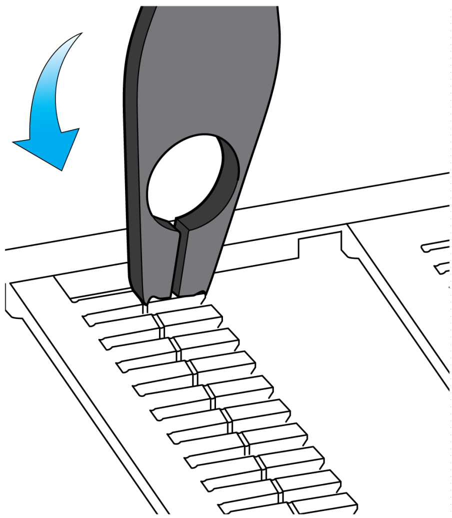
NOTE: The following procedure explains how to install one label tab by using the single-width cutters of the labeling tool. You can extrapolate with the double-width cutters of the labeling tool *(see page 52)* to install two label tabs in the same step.

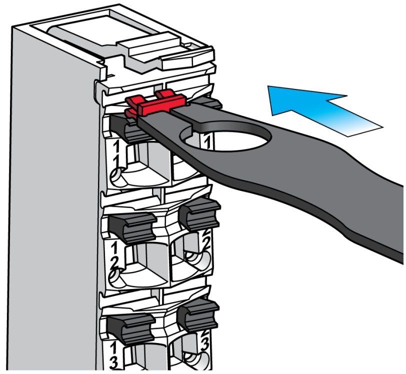
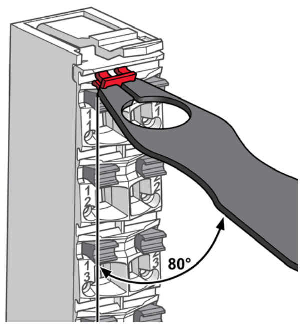
Single-width Cutters	Double-width Cutters
	

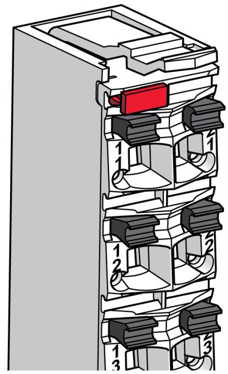
Labeling the Connectors of the Terminal Block

You can label the connectors of the terminal block as well as the locking clip of the terminal block itself.

The following table describes how to label the terminals of the terminal block:

Step	Action	
1	Grip the desired label tab with the single width cutters of the labeling tool.	
2	Press with the labeling tool to separate the label.	

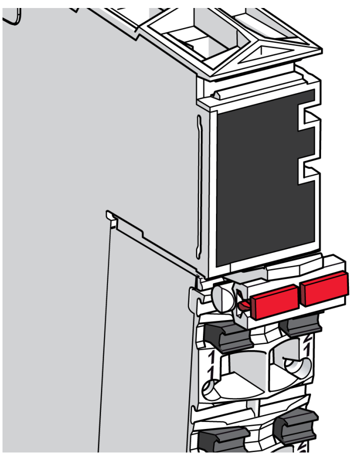
Step	Action	
3	Center the label tab over the slot on the terminal block.	
4	Hold the labeling tool at approximately an 80° angle to the terminal block.	
5	Press with the labeling tool to insert the feet of the label tab into the slot.	

Step	Action	
6	Inserted label.	

Labeling the Terminal Locking Clip

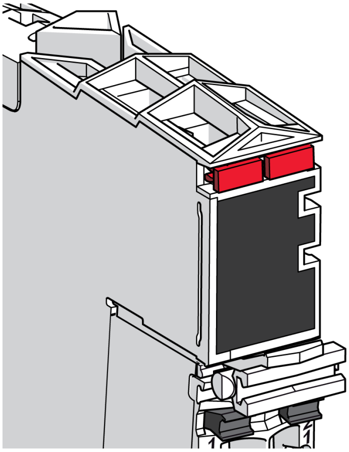
To label the terminal block itself, insert one or two label tabs in the terminal locking clip *(see page 51)* using the same procedure described above.

The following figure shows the labeled terminal locking clip:



Labeling the Electronic Module

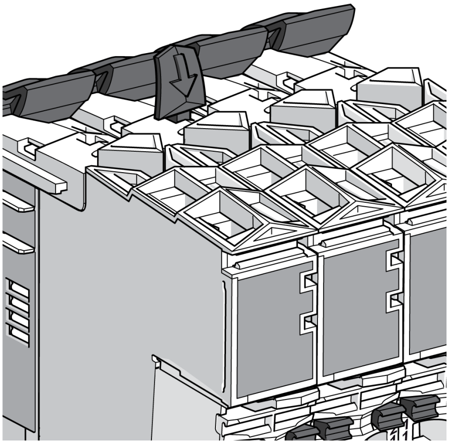
The electronic module is labeled in a manner similar to the terminal block:



Installation of Accessories

Locking Clip

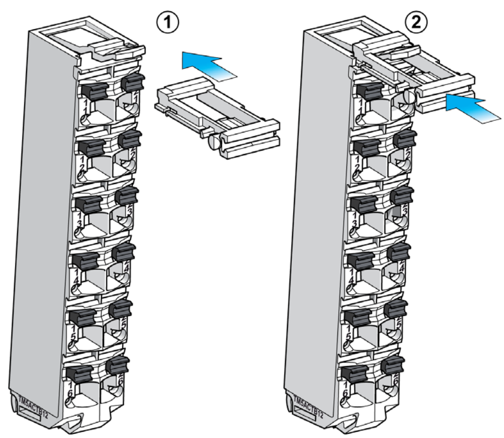
The locking clip attaches the electronic module to the bus base. The locking clip is inserted in the appropriate opening on the top of the slice and pushed down.

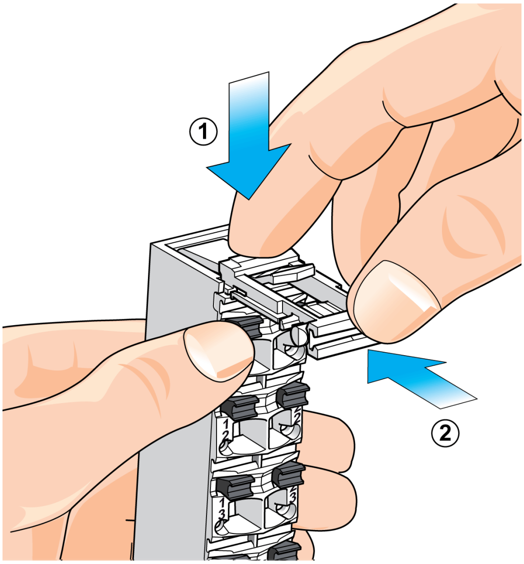
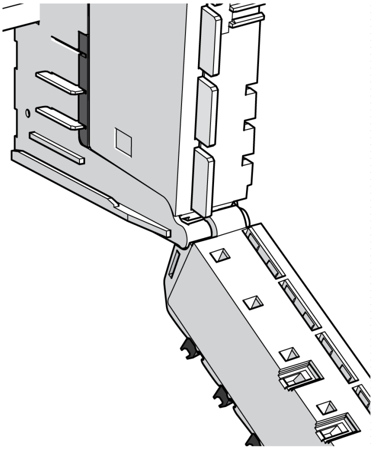


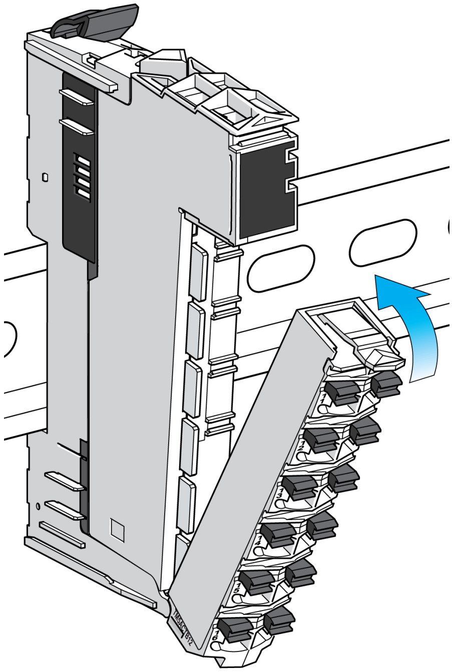
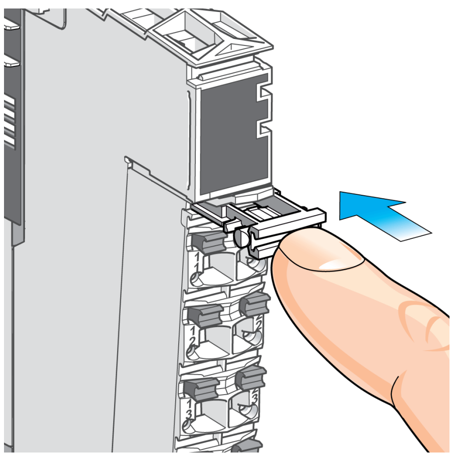
Terminal Locking Clip

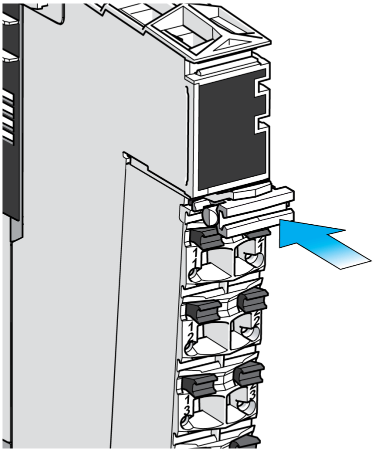
The terminal locking clip attaches to the terminal block to help secure it to the electronic module.

The following table describes how to install the terminal locking clip:

Step	Action	
1	Set the terminal locking clip on the terminal block locking lever as shown.	

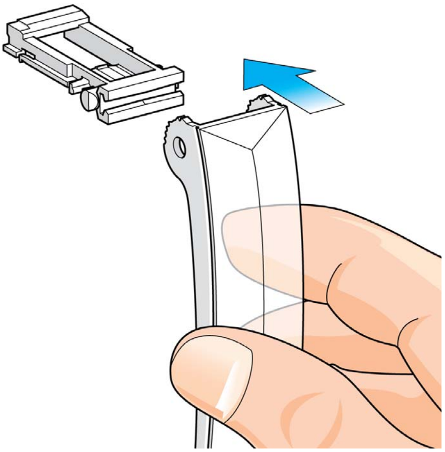
Step	Action	
2	Push down and hold the terminal locking clip and the locking lever with your index finger. Slide the terminal locking clip forward with your thumb.	
3	Hang the bottom edge of the terminal block in its hinge on the bus module.	

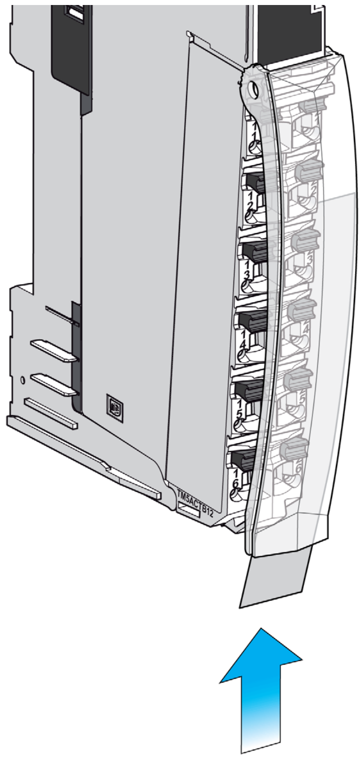
Step	Action	
4	Rotate the terminal block up into place.	
5	Secure the terminal block in the electronic module by pushing in the terminal locking clip.	

Step	Action
6	Installed terminal locking clip. 
7	To remove the terminal block, reverse Step 5 by pulling the terminal locking clip out.

Plain Text Cover

The covers are attached to the terminal locking clips:

Step	Action
1	Hold the plain text cover at a 90° angle to the terminal locking clip.
2	Push the plain text cover into the terminal locking clip until it clicks into the slot on the clip. 

Step	Action	
3	Insert the plain text legend *(see page 53)* strips.	

Chapter 6
Commissioning and Maintaining

Overview

Once your TM5 System has been installed and you have confirmed that the installation has been properly grounded and powered, you can follow the procedures in this chapter to commission and maintain your configuration.

What Is in This Chapter?

This chapter contains the following topics:

Diagnostics

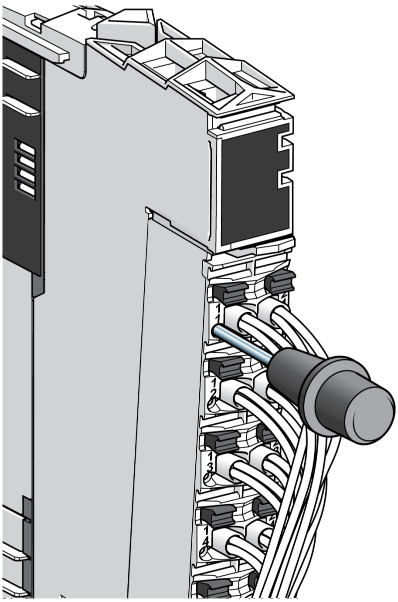
Introduction

The TM5 System offer several levels of diagnostics:
- Test points on the terminal blocks
- Directly on the module using visual LED displays
- Via SoMachine software
- Web server

Test Points

Each terminal block *(see page 48)* has an access point for a test probe. You can easily measure the terminal potential without disconnecting the wire.

The following figure illustrates the use of the test probes:

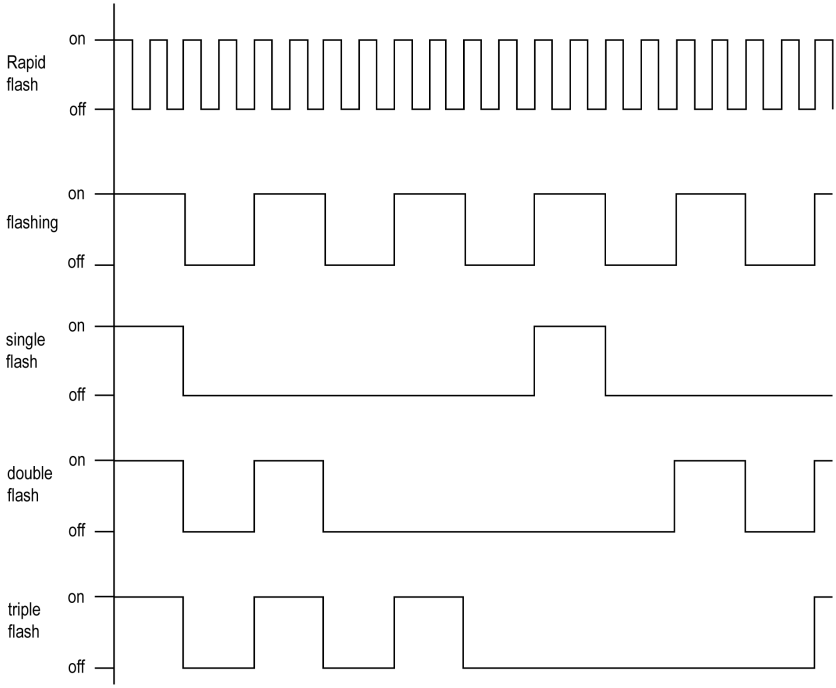


Status LEDs

TM5 bus status, power, I/O status and channel states are displayed in direct relationship to the channels or the function. The different states are displayed differently, for example green for OK, red for detected error.

Refer to the hardware guides for the products of the TM5 System for status LEDs descriptions.

The following diagram shows some LEDs states of the TM5 System status LEDs:



SoMachine Software

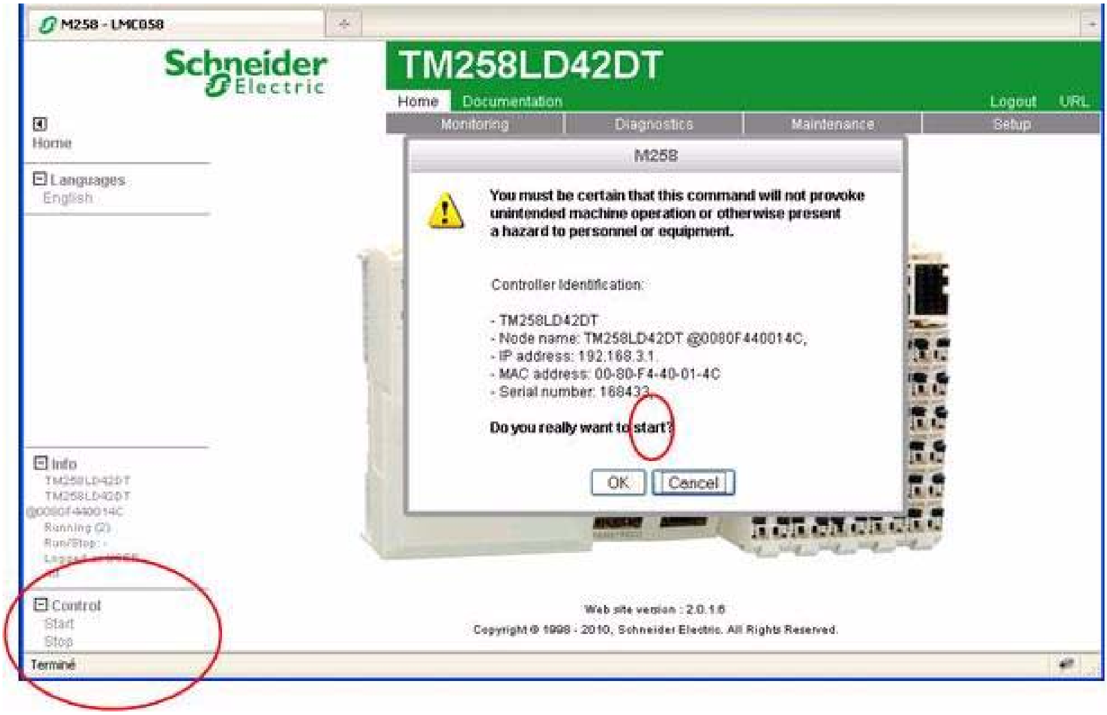
With the TM5 System, status data does not result in additional communication load, which would result in considerable differences between theoretically possible bus speeds and real requirements during operation. All necessary status data is always transferred cyclically, with no exceptions.

Please refer to the SoMachine Programming Manual.

Web Server

The controller provides as standard equipment an embedded Web server with a predefined factory built-in website. You can use the pages of the website for module setup and control as well as application diagnostics and monitoring. These pages are ready to use with a Web browser. No configuration or programming is required.

The following figure shows you the Web site home page of the Web server:



1 Generic menu bar
2 Active page Sub-menu

NOTE: Schneider Electric follows, and recommends to its customers, industry best practices in the development and implementation of control systems. This recommendation includes a "Defense-in-Depth" approach to secure an Industrial Control System. This approach places the controllers behind one or more firewalls to restrict access to authorized personnel and protocols only.

⚠ WARNING

UNAUTHENTICATED ACCESS AND SUBSEQUENT UNAUTHORIZED MACHINE OPERATION

- Evaluate whether your environment or your machines are connected to your critical infrastructure and, if so, take appropriate steps in terms of prevention, based on Defense-in-Depth, before connecting the automation system to any network.
- Limit the number of devices connected to a network to the minimum necessary.
- Isolate your industrial network from other networks inside your company.
- Protect any network against unintended access by using firewalls, VPN, or other, proven security measures.
- Monitor activities within your systems.
- Prevent subject devices from direct access or direct link by unauthorized parties or unauthenticated actions.
- Prepare a recovery plan including backup of your system and process information.

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

For more details, refer to the programming guide associated with your particular controller.

Hot Swapping Electronic Modules

Definition

Hot swapping is the ability to remove an I/O electronic module from its bus base and then replace it with an identical electronic module while the TM5 System is under power without disrupting the normal operations of the controller. When the electronic module is returned to its bus base or replaced with another electronic module with the same reference, it starts to operate again.

Hot Swapping Considerations

Before initiating a hot swap operation, confirm that the electronic module type is approved for hot swapping.

When removing or inserting an I/O module while power is applied, remove and insert the electronic module by hand. Do not use tools to hot swap modules because they may come into contact with hazardous voltages. Also, remove any locking clips and the terminal block before removing the electronic module from its bus base. Hot swapping is only allowed when replacing identical electronic modules.

⚠ DANGER

EXPLOSION OR ELECTRIC SHOCK

- Only perform a hot swap operation in locations known to be non-hazardous.
- Use only your hands.
- Do not use any metal tools.
- Do not disconnect any wires from the terminal block.
- Only replace an electronic module with an identical reference.

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

NOTE: Only the electronic module is hot swap-able. Do not attempt a hot swap operation on the bus base, or on electronic modules that are integrated with their bus bases such as the compact I/O.

You need to understand and plan for the effects of hot-swapping certain modules. Hot-swapping modules that control power distribution to other modules, for example, can impact your machine or process. Power Distribution modules, Interface Power Distribution Modules, Common Distribution modules, Field Bus Interface Modules, and Transmitter and Receiver modules all either distribute power or communications to other electronic modules. Disconnecting the connector to these modules will interrupt power or communications to the modules they service.

For example, some Power Distribution Modules (PDMs) provide power to both the TM5 power bus and 24 Vdc I/O power segment. It is possible that you may need to replace the PDM because one service is inoperable, but not both. In this case, hot-swapping the PDM would interrupt the service that is still operating, and would interrupt power to the modules drawing power from that service.

I/O configuration that employ Common Distribution modules require careful consideration when wiring is restricted by short wire lengths. It may be the case that in order to hot-swap an electronic module that has become inoperable, you need to disconnect the connector of the Common module servicing it. Further, that same Common module may be connected to modules or devices other than the module you wish to hot-swap. Disconnecting the Common module in this case would necessarily interrupt the supply to the unaffected modules and/or devices. Be sure that you know what I/O slices or devices are connected to the Common module, and the impact that this disconnection would have on your machine or process before attempting a hot-swap operation.

⚠ 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.

NOTE: Be sure you thoroughly understand the effects of a hot-swap operation on all modules and connected devices as they relate to your machine or process.

Modules that are not Hot Swap-able

Electronic modules that can not be hot swapped include:

TM5	Electronic Modules Type	Reasons
Controller	PCI communication	The replacement of the PCI communication module requires a power cycle before it will recognized by the controller.
	Controller Power Distribution Module	These modules are not removable.
	Embedded I/O Modules	
Field bus interface	CANopen interface module	The replacement of the CANopen interface module depends on CANopen master architecture. Refer to the Generic CANopen Implementation Guide and documentations associated to the CANopen master.
Compact I/O	I/O modules	These modules are not removable.

Part III
TM7 System

Overview

Part III of this manual provides information to help you plan, install, commission, and maintain your TM7 System.

What Is in This Part?

This part contains the following chapters:

Chapter 7
Initial Planning Considerations

Overview

This chapter provides information that is helpful in the early planning stages for a TM7 System. It includes the requirements for mounting and wiring the TM7 System and for determining the type of power supply source required for the configuration you choose.

What Is in This Chapter?

This chapter contains the following sections:

Section 7.1
Operating Environment

Environmental Characteristics

Introduction

The following information describes the system-wide environmental requirements and characteristics for the TM7 System.

The general environmental characteristics are common to all components of the TM7 System.

Environmental Characteristics

This equipment meets cURus, 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:

<table>
<tr><th>Characteristic</th><th colspan="2">Specification</th></tr>
<tr><td colspan="3">This product is compliant with Europe RoHS recommendations and China RoHS regulations.</td></tr>
<tr><td rowspan="8"></td><td>II 3G</td><td>Device group II, Category 3, Zone 2 suitable for explosive gas</td></tr>
<tr><td>Ex</td><td>Protection according to European standards</td></tr>
<tr><td>nA</td><td>Ignition protection "n"</td></tr>
<tr><td>T5</td><td>Temperature class</td></tr>
<tr><td>84 °C (183 °F)</td><td>Maximum surface temperature</td></tr>
<tr><td>IP67</td><td>Protection index according to EN/IEC 60529</td></tr>
<tr><td>Ta = 0...60 °C (32...140 °F)[1]</td><td>Ambient temperature range</td></tr>
<tr><td>TÜV 05 ATEX 7201</td><td>Certificate number</td></tr>
<tr><td>Standard</td><td colspan="2">IEC61131-2 ed. 3 2007</td></tr>
<tr><td>Agencies</td><td colspan="2">UL 508
CSA 22.2 No. 142-M1987
CSA 22.2 No. 213-M1987</td></tr>
<tr><td colspan="2">Ambient operating temperature</td><td>-10...60 °C (14...140 °F)[1]</td></tr>
</table>

Characteristic	Specification	
Storage temperature		-25...85 °C (-13...185 °F)
Relative humidity		5...95% (non-condensing)
Pollution degree	IEC60664	2 (non-conductive material)
Protection degree	EN/IEC60529	IP67
Operating altitude		0...2000 m (0...6560 ft.)
		2000...3000 m (6560...9842 ft.)[2]
Vibration resistance	IEC60721-3-5 Class 5M3	7.5 mm (0.295 in.) fixed amplitude from 2...8 Hz 20 m/s^2 (2 g_n) fixed acceleration from 8...200 Hz 40 m/s^2 (4 g_n) fixed acceleration from 200...500 Hz
Mechanical shock resistance	IEC60721-3-5 Class 5M3	300 m/s^2 (30 g_n) for a duration of 11 ms, half sine wave, shock type 1
Connection type		M8 or M12 depending on the I/O block

[1] For compliance to ATEX and Class I, Div 2 environment ratings, do not operate this device in locations with ambient temperatures less than 0 °C (32 °F).

[2] Reduction of ambient temperature by 0.5 °C (32.5 °F) for every additional 100 m (328 ft.) of altitude beyond 2000 m (6560 ft.).

Electromagnetic Susceptibility

The table below provides the TM7 System electromagnetic susceptibility specifications:

Characteristic	Specification	Range
Electrostatic discharge	EN/IEC 61000-4-2	± 8 kV, criteria B (air discharge) ± 6 kV, criteria B (contact discharge)
Electromagnetic fields	EN/IEC 61000-4-3	10 V/m, 80% amplitude modulation at 1 kHz (80 MHz...2 GHz) 1 V/m (2...2.7 GHz)
Fast transients burst	EN/IEC 61000-4-4	Power lines: 2 kV, criteria B I/O: 1 kV, criteria B Shielded cable: 1 kV, criteria B Repetition rate: 5 and 100 kHz

Characteristic	Specification	Range
Surge immunity 24 Vdc circuit	EN/IEC 61000-4-5	Power lines: 1 kV (12 Ω), criteria B in common mode 0.5 kV (2 Ω), criteria B in differential mode
		Unshielded lines: 0.5 kV (42 Ω), criteria B in common mode 1 kV (42 Ω), criteria B in differential mode
		Shielded lines: 1 kV (12 Ω), criteria B in common mode 0.5 kV (2 Ω), criteria B in differential mode
Induced electromagnetic field	EN/IEC 61000-4-6	Network, I/O signal connections > 10 m (32.8 ft.), functional ground connection: 10 V_{eff}, criteria A, 80% amplitude modulation at 1 kHz (150...80 MHz)
Conducted emission	EN 55011 (IEC/CISPR11)	150...500 kHz quasi peak 79 dB µV
		500 kHz...30 MHz quasi peak 73 dB µV
Radiated emission	EN 55011 (IEC/CISPR11)	30...230 MHz, 10 m (32.8 ft)@40 dB (µV/m)
		230 MHz...1 GHz, 10 m (32.8 ft)@47 dB (µV/m)

Conformity and Test Certification

These devices were developed and tested according to valid European guidelines and standards. Modules labelled ATEX meet the following EU guidelines including all changes:

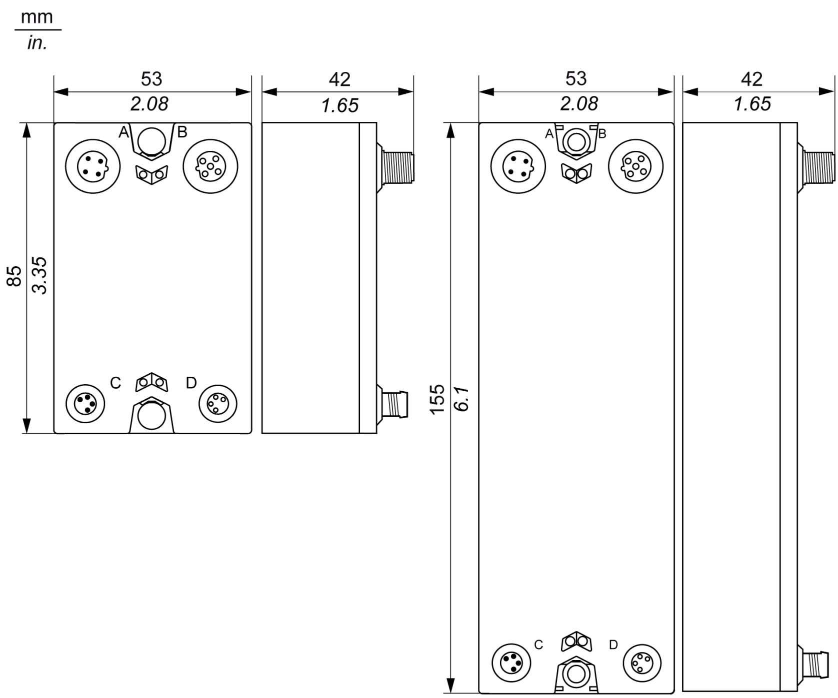
Characteristic	Specification
Electromagnetic compatibility (EMC)	2004/108/EC
Low voltage (LV)	2006/95/EC
Equipment explosive atmospheres (ATEX)	94/9/EC
Standards met	EN 61131-2, EN 61000-6-2, EN 61000-6-4, EN 60204-1, EN 50178, EN 60079-15

Section 7.2
Mechanical Requirements

Mechanical Requirements

Block Dimensions

The following figure gives the dimensions of the size 1 (left) and size 2 (right) blocks:



The following tables give the sizes of the blocks:

TM7 field bus interface I/O blocks			
Type of block	**Reference**	**Size 1**	**Size 2**
CANopen	TM7NCOM08B	x	
	TM7NCOM16A		x
	TM7NCOM16B		x

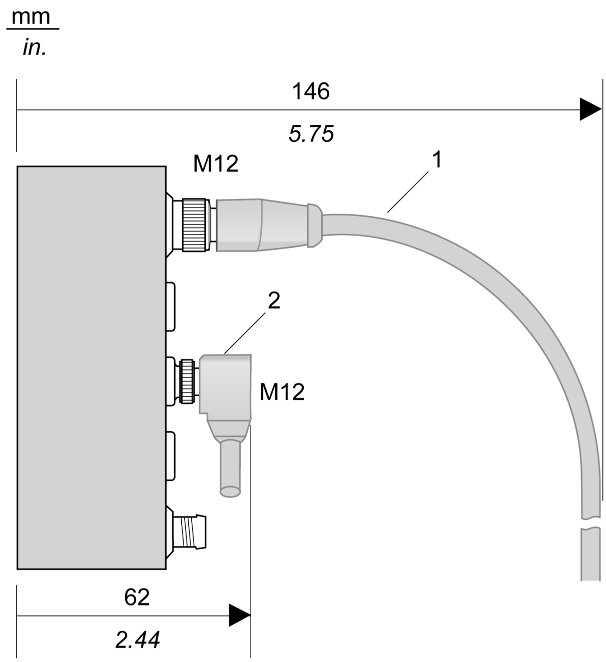
TM7 I/O Blocks			
Type of block	**Reference**	**Size 1**	**Size 2**
Digital input	TM7BDI8B	x	
	TM7BDI16B		x
	TM7BDI16A		x
Digital mixed input/output	TM7BDM8B	x	
	TM7BDM16A		x
	TM7BDM16B		x
Digital output	TM7BDO8TAB	x	
Analog input	TM7BAI4VLA	x	
	TM7BAI4CLA	x	
	TM7BAI4TLA	x	
	TM7BAI4PLA	x	
Analog mixed input/output	TM7BAM4VLA	x	
	TM7BAM4CLA	x	
Analog output	TM7BAO4VLA	x	
	TM7BAO4CLA	x	

TM7 Power Distribution Block (PDB)			
Type of block	**Reference**	**Size 1**	**Size 2**
PDB Power Distribution Block	TM7SPS1A	x	

Spacing Requirements

TM7 blocks can be installed side-by-side. However, you must observe the minimum spacings from the front face of each expansion block, based on cable connector type and cable bend radius *(see page 355)*.

The following figure shows an example of wire bending requirements for a block connected with pre-wired straight cables and elbowed cables:



1 Straight cable
2 Elbowed cable

Section 7.3
TM7 Power System

Introduction

In the planning phase, the number of I/O blocks that you select for your TM7 System, and the cable lengths between these blocks, determine the required power distribution. The following section helps you establish a power budget and select the correct power distribution and I/O blocks for your system.

What Is in This Section?

This section contains the following topics:

TM7 Power Distribution Description

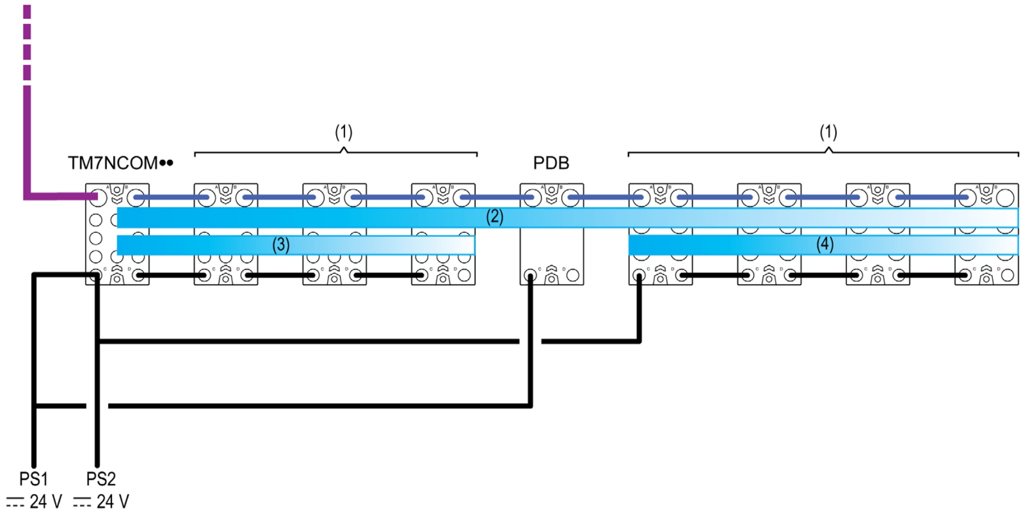
Power Distribution Overview

The field bus interface I/O block is the beginning of the power distribution for the TM7 distributed configuration *(see page 22)*, it distributes power for the 24 Vdc I/O power segment and generates power for the TM7 power bus.

In a remote configuration *(see page 20)*, the TM5SBET7 Transmitter module generates power for the TM7 power bus. The first I/O block of the remote configuration after a TM5SBET7 distributes power for the first 24 Vdc I/O power segment.

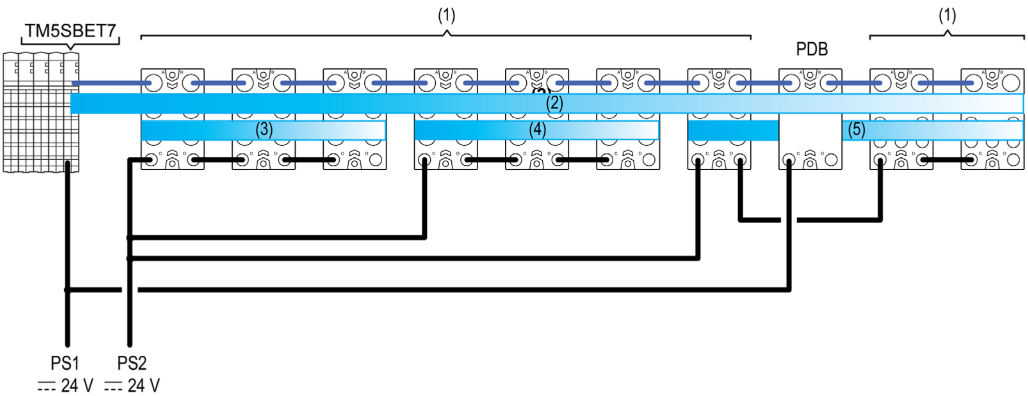
There are other components that generate supplemental power to the TM7 power bus, or distribute power to create separate 24 Vdc I/O power segments. For example, Power Distribution Blocks (PDB) can be added to provide supplementary power to the TM7 power bus if required by your I/O configuration. Another example, you connect a power supply to a I/O block to divide the 24 Vdc I/O power segment into several separated 24 Vdc I/O power segments.

The figure below demonstrates power distribution for a TM7 remote configuration. Refer to the section Wiring the Power Supply *(see page 225)* for details on connector wiring:



(1) TM7 I/O blocks
(2) TM7 Power bus
(3...4) 24 Vdc I/O power segments
TM7NCOM•• TM7 field bus interface I/O blocks
PDB Power Distribution Block
PS1 External isolated main power supply, 24 Vdc
PS2 External isolated I/O power supply, 24 Vdc

The figure below shows a representation of the power distribution overview for a remote configuration. Refer to the section Wiring the Power Supply *(see page 225)* for details on connectors wiring:



(1) TM7 I/O blocks
(2) TM7 Power bus
(3...5) 24 Vdc I/O power segments
TM5SBET7 Transmitter module
PDB Power Distribution Block
PS1 External isolated main power supply, 24 Vdc
PS2 External isolated I/O power supply, 24 Vdc

TM7 Power Bus Description

The TM7 bus consists in two parts:

- TM7 data bus
- TM7 power bus

The TM7 power bus distributes the power to supply the electronics of the I/O blocks. If needed, the power on the TM7 bus can be reinforced by adding a PDB.

In a distributed configuration, the TM7 data and power busses begin with a field bus interface I/O block.

In a remote configuration, the TM7 data and power busses begin with a TM5SBET7 transmitter module.

NOTE: The TM5SBET7 transmitter module must be the last electronic module in either the local or remote TM5 configuration that you intend to extend.

24 Vdc I/O Power Segment Description

Power is distributed to the inputs and outputs of the TM7 System through the 24 Vdc I/O power segment.

The 24 Vdc I/O power segment begins with the first TM7 component of the configuration and is terminated at the point where another I/O block is connected to a power supply or at the end of the configuration.

A segment is a group of I/O blocks connected to each other via the 24 Vdc power IN and 24 Vdc power OUT connectors.

The reasons to build a new segment are:
- To separate groups of I/O blocks. For example, a group of inputs separated from a group of outputs.
- Because the power supplied to the preceding 24 Vdc I/O power segment is fully consumed by the devices on that segment.

Field Bus Interface I/O Block

Among other things, the field bus interface I/O block connects:
- the external power supply directly to the 24 Vdc I/O power segment,
- the external power supply to the internal power supply that generates the power distributed on the TM7 power bus, which is derived from the 24 Vdc Main power connection.

The following table describes the parts powered by the TM7 power bus and the 24 Vdc I/O power segment:

Designation	Description
TM7 power bus	That serves the expansion I/O blocks of the distributed configuration.
24 Vdc I/O power segment	Serves: ● the electronics of the I/O block, ● the sensors and actuators connected to the field bus interface I/O block, ● the expansion blocks, ● the sensors and actuators connected to the expansion blocks.

Transmitter Module (TM5SBET7)

The TM5SBET7 Transmitter Module supplies power to the TM7 power bus, and also relays data from the controller to the remote expansion devices through the TM7 data bus.

Depending on the mounting position of the TM5SBET7 transmitter module, the number of TM7 expansion I/O blocks connected without a PDB is limited to:

TM5SBET7 Position	Maximum Number of TM7 I/O Blocks
Horizontal	8
Vertical	6

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not connect more than 8 blocks to a TM5SBET7 installed in a horizontal orientation.
- Do not connect more than 6 blocks to a TM5SBET7 installed in a vertical orientation.

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

NOTE: To install more than 6 or 8 blocks (according to the installation orientation of the TM5SBET7) of TM7 remote I/O, you will need to add a Power Distribution Block.

Power Distribution Block (PDB)

The Power Distribution Blocks (PDBs) are used to reinforce the voltages and currents distributed by the TM7 power bus. Any of the following may require you to add PDBs to reinforce the TM7 power bus:

- No PDBs have been installed, and the number of I/O blocks exceeds the maximum number that can be supported by the TM5SBET7 transmitter module based on installation orientation. For more information, refer to Transmitter Module *(see page 203)*.
- The installed transmitter module and PDBs are adequate to the I/O block current consumption and cable lengths, but you desire redundant power in the event a PDB becomes inoperative.
- The cumulative power consumption of the I/O block electronics exceeds the maximum output current available from the TM5SBET7 transmitter module and any PDBs already installed. For more information, refer to Current Supplied and Consumption Tables on the TM7 Power Bus *(see page 265)*.
- The maximum number of I/O blocks that can be powered by the existing transmitter module and PDBs has been installed, and the cable run from the first I/O block to the last exceeds 100 m (328 ft).

NOTE: If the distance from the first to the last I/O block on a fully populated TM7 power bus exceeds 100 m (328 ft), the voltage drop on the cable can reduce the maximum number of TM7 I/O blocks that can be powered. In these circumstances, add a PDB and verify that the supply voltage to each I/O block is within limits.

Supplying the TM7 Power Bus

The table below gives the maximum current supplied to the TM7 power bus:

Equipment	Current Supplied to the TM7 Power Bus in a Horizontal Mounting Orientation		Current Supplied to the TM7 Power Bus in a Vertical Mounting Orientation
	- 10...55 °C (14...131 °F)	55...60 °C (131...140 °F)	- 10...50 °C (14...122 °F)
TM5SBET7	304 mA	228 mA	228 mA
TM7SPS1A	750 mA		
TM7NCOM08B	150 mA		
TM7NCOM16B	750 mA		
TM7NCOM16A	750 mA		

Supplying the 24 Vdc I/O Power segment

The table below gives the maximum current distributed on the 24 Vdc I/O Power segment:

Equipment	Maximum Current
TM5SBET7	–
TM7SPS1A	–
TM7NCOM08B	4 A
TM7NCOM16B	4 A
TM7NCOM16A	4 A
TM7 I/O Block[1]	8 A
[1] When connecting the 24 Vdc I/O power IN connector to an external power supply	

TM7 Power Distribution System Implementation

Power Distribution Planning

The power distribution system supplies the 24 Vdc I/O power segment and the TM7 power bus for local and remote configurations.

The planning of your TM7 power distribution system should follow this order:

Step	Description
1	Select the combination of controllers, I/O, and accessories necessary for your application.
2	Create some 24 Vdc power segments by connecting the TM7 I/O blocks to power supplies.
3	Calculate the current consumed on the TM7 power bus and provide additional PDB where and when needed.
4	Identify any voltage drop considerations due to cable lengths in excess of 100 m (328 ft) and provide additional PDB where and when needed.
5	Calculate the current consumed on each 24 Vdc I/O power segment and connect TM7 I/O blocks to create segments where and when needed.

To plan the power distribution of the TM7 System you must calculate the:
- Current consumption on the TM7 power bus.
- Current consumption on the 24 Vdc I/O power segment(s)
  - The current consumed by the electronics of the block.
  - The current consumed by the loads connected to the DC outputs of the modules supplied by the 24 Vdc I/O power segment.
  - The current consumed to supply the sensors and actuators connected to the block.

Example 1: Current Consumed by a TM7 Distributed I/O Configuration

Introduction

This first example is for a TM7 distributed I/O configuration (TM7 field bus interface I/O block and TM7 I/O blocks). A later example *(see page 105)* is based on TM7 remote expansion I/O blocks (TM5 Transmitter module and its remote expansion blocks). From these examples, you should be able to make the calculations necessary for your TM7 System.

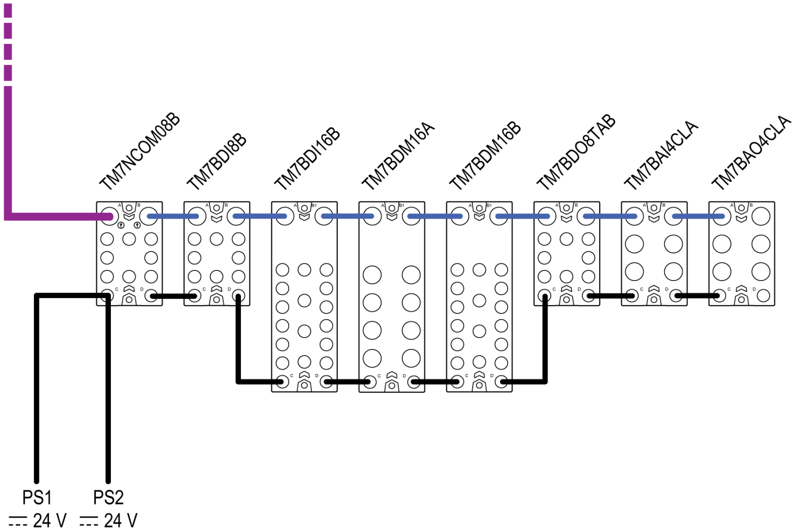
In a TM7 distributed I/O configuration, the TM7 field bus interface I/O block connects:
- the external power supply directly to the 24 Vdc I/O power segment,
- the external power supply to the internal power supply that generates the power distributed on the TM7 power bus, which is derived from the 24 Vdc Main power connection.

All current consumption values are documented in the chapter Association and Power Consumption Tables *(see page 247)*.

Planning Example

This configuration example includes:
- The CANopen interface I/O block TM7NCOM08B equipped with 8 digital input or output configurable channels.
- Some expansion blocks:
  - TM7BDI8B
  - TM7BDI16B
  - TM7BDM16A
  - TM7BDM16B
  - TM7BDO8TAB
  - TM7BAI4CLA
  - TM7BAO4CLA
- Assumptions used for the purposes of calculating the consumption of this example:
  TM7NCOM08B: The maximum current distributed on the 24 Vdc I/O power segment is limited by an external isolated power supply of 4000 mA.
  TM7BDI8B: The current to supply the electronic sensors of this example has been estimated at 25 mA per sensor, or 200 mA total for the block.
  TM7BDM16A: The sum of the current draw for all outputs connected to the block is never more than 2500 mA at any given time.
  TM7BDM16B: The sum of the current draw for all outputs connected to the block is never more than 1500 mA at any given time.
  The current to supply the electronic sensors of this example has been estimated at 25 mA per sensor, or 200 mA total for the block.
  TM7BDO8TAB: Only 5 of the outputs are active at any given time, and that the maximum current draw of any given output is 1000 mA, or 5000 mA total for the block.

The following graphic shows the example configuration connected to the power supplies PS1 and PS2:



PS1 External isolated main power supply, 24 Vdc
PS2 External isolated I/O power supply, 24 Vdc

Refer to the section Wiring the Power Supply *(see page 225)* for more information.

The following table shows the current supplied and consumed in mA on the TM7 power bus and the 24 Vdc I/O power segment:

TM7NCOM08B	**TM7BDI8B**	**TM7BDI16B**	**TM7BDM16A**	**TM7BDM16B**	**TM7BDO8TAB**	**TM7BAI4CLA**	**TM7BAO4CLA**	**Legend**
150								(1)
	38	38	38	38	38	38	38	(2)
	112	74	36	–2	–40	–78	–116	(3)
4000								*(4)*
84	*42*	*21*	*125*	*125*	*84*	*125*	*188*	*(5)*
800	*0*	*0*	*2500*	*1500*	*5000*	*–*	*–*	*(6)*
100	*200*	*0*	*0*	*200*	*–*	*–*	*–*	*(7)*
984	*242*	*21*	*2625*	*1625*	*5484*	*125*	*188*	*(8)*
3016	*2774*	*2753*	*128*	*–1697*	*–6781*	*–6906*	*–7094*	*(9)*

Legend:
External isolated main power supply, 24 Vdc
(1) Current supplied on the TM7 power bus
(2) Consumption of the TM7 I/O block
(3) Remaining current available after block consumption
External isolated I/O power supply, 24 Vdc
(4) Current supplied on the 24 Vdc I/O power segment
(5) Consumption of the electronics of the TM7 I/O block
(6) Consumption of the loads of the output channels
(7) Consumption of the supply to sensors, actuators or external devices
(8) Total TM7 I/O block consumption
(9) Remaining current available after block consumption

Current Consumed on the TM7 Power Bus

The TM7NCOM08B generates 150 mA on the TM7 power bus to supply expansion blocks. The TM7 power bus begins with the TM7NCOM08B block and terminates with the TM7BAO4CLA expansion block.

The total current consumed on the TM7 power bus is 266 mA and exceeds the 150 mA capacity of the segment.

Observing mounting PDBs rules *(see page 204)*, you must supplement the TM7 power bus by adding a TM7SPS1A. For example you can place the TM7SPS1A between a TM7BDM16B and a TM7BDM16A blocks.

The following table shows, the current supplied and consumed in mA on the TM7 power bus:

TM7NCOM08B	**TM7BDI8B**	**TM7BDI16B**	**TM7BDM16A**	**TM7SPS1A**	**TM7BDM16B**	**TM7BDO8TAB**	**TM7BAI4CLA**	**TM7BAO4CLA**	**Legend**
150				750					(1)
	38	38	38		38	38	38	38	(2)
	112	74	36	786	748	710	672	634	(3)
4000									*(4)*
84	*42*	*21*	*125*		*125*	*84*	*125*	*188*	*(5)*
800	*0*	*0*	*2500*		*1500*	*5000*	*–*	*–*	*(6)*
100	*200*	*0*	*0*		*200*	*–*	*–*	*–*	*(7)*
984	*242*	*21*	*2625*		*1625*	*5484*	*125*	*188*	*(8)*
3016	*2774*	*2753*	*128*		*–1697*	*–6781*	*–6906*	*–7094*	*(9)*

Legend:
External isolated main power supply, 24 Vdc
(1) Current supplied on the TM7 power bus
(2) Consumption of the TM7 I/O block
(3) Remaining current available after block consumption
External isolated I/O power supply, 24 Vdc
(4) Current supplied on the 24 Vdc I/O power segment
(5) Consumption of the electronics of the TM7 I/O block
(6) Consumption of the loads of the output channels
(7) Consumption of the supply to sensors, actuators or external devices
(8) Total TM7 I/O block consumption
(9) Remaining current available after block consumption

The total current consumed on the TM7 power bus is 266 mA, and does not exceed the 900 mA capacity of the TM7 power bus.

The next step is to calculate the current consumed on the 24 Vdc I/O power segment to validate the configuration of this example.

Current Consumed on the 24 Vdc I/O Power Segment

The 24 Vdc I/O power segment begins with the TM7NCOM08B and finishes with the TM7BAO4CLA block. The capacity of this 24 Vdc I/O power segment is limited to 4000 mA in this example.

In this example, the total current consumed on the 24 Vdc I/O power segment is 11094 mA and exceeds the 4000 mA capacity of this segment.

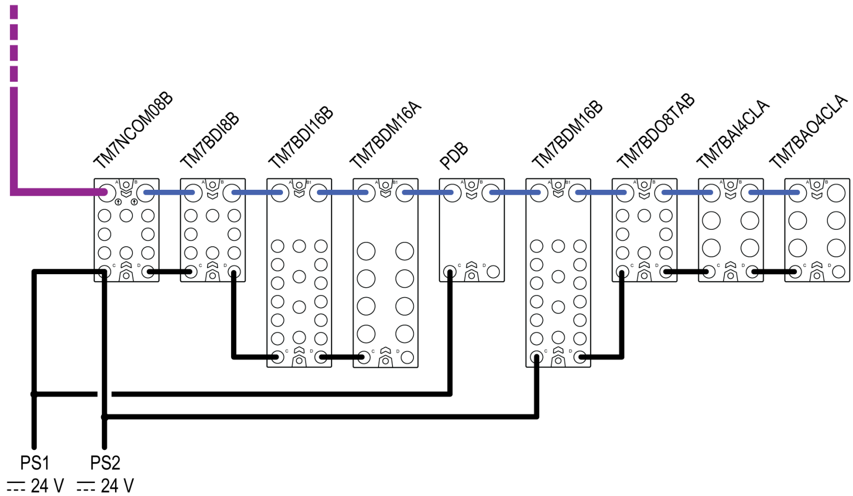
This requires you to divide the existing segment into two segments by connecting a TM7 I/O block to a power supply.

For this example, the TM7BDM16B is connected to the PS2 power supply.

The first 24 Vdc I/O power segment begins with the TM7NCOM08B and finishes with the TM7BDM16A. The capacity of this segment is limited to 4000 mA.

The second 24 Vdc I/O power segment begins with the TM7BDM16B and finishes with the TM7BAO4CLA. The capacity of this segment is limited to 8000 mA.

The following graphic shows the example configuration connected to the power supplies PS1 and PS2:



PS1 External isolated main power supply, 24 Vdc
PS2 External isolated I/O power supply, 24 Vdc

The following table shows, the current supplied and consumed in mA on the 24 Vdc I/O power segment after connection of the TM7BDM16B to the power supply PS2:

TM7NCOM08B	**TM7BDI8B**	**TM7BDI16B**	**TM7BDM16A**	**TM7SPS1A**	**TM7BDM16B**	**TM7BDO8TAB**	**TM7BAI4CLA**	**TM7BAO4CLA**	**Legend**
150				*750*					*(1)*
	38	*38*	*38*		*38*	*38*	*38*	*38*	*(2)*
	112	*74*	*36*	*786*	*748*	*710*	*672*	*634*	*(3)*
4000					8000				(4)
84	42	21	125		125	84	125	188	(5)
800	0	0	2500		1500	5000	–	–	(6)
100	200	0	0		300	–	–	–	(7)
984	242	21	2625		1825	5084	125	188	(8)
3016	2774	2753	128		6175	1091	966	778	(9)

Legend:
External isolated main power supply, 24 Vdc
(1) Current supplied on the TM7 power bus
(2) Consumption of the TM7 I/O block
(3) Remaining current available after block consumption
External isolated I/O power supply, 24 Vdc
(4) Current supplied on the 24 Vdc I/O power segment
(5) Consumption of the electronics of the TM7 I/O block
(6) Consumption of the loads of the output channels
(7) Consumption of the supply to sensors, actuators or external devices
(8) Total TM7 I/O block consumption
(9) Remaining current available after block consumption

The total current consumed on the first 24 Vdc I/O power segment is 3872 mA and does not exceed the 4000 mA capacity of this segment.

The total current consumed on the second 24 Vdc I/O power segment is 7222 mA and does not exceed the 8000 mA capacity of that segment.

Example 2: Current Consumed by a Remote Configuration

Introduction

This example is for a remote configuration *(see page 20)* (TM5 Transmitter module and TM7 expansion I/O blocks). From this example, you should be able to make the calculations necessary for your TM7 System.

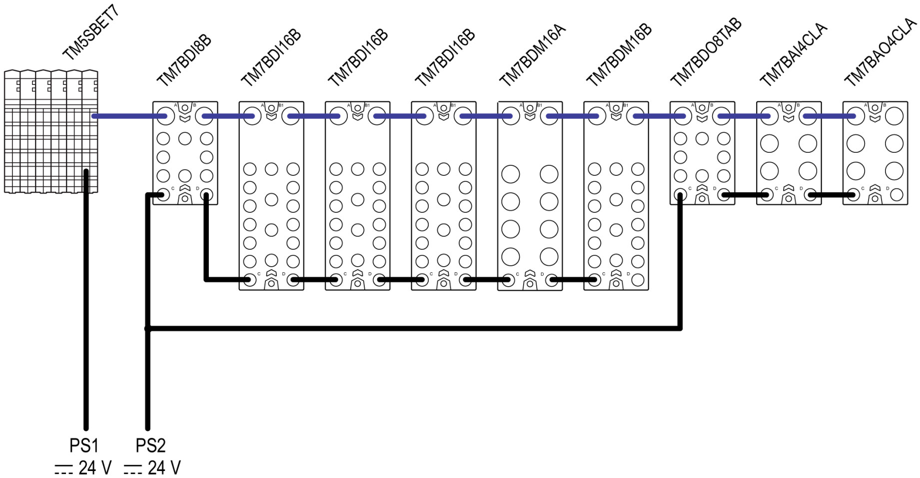
All current consumption values are documented in the chapter Association and Power Consumption Tables *(see page 247)*.

Planning Example

This configuration example includes:

- The TM5SBET7 transmitter module.
- Some expansion blocks:
  - TM7BDI8B
  - TM7BDI16B (x3)
  - TM7BDM16A
  - TM7BDM16B
  - TM7BDO8TAB
  - TM7BAI4CLA
  - TM7BAO4CLA
- Assumptions used for the purposes of calculating the consumption of this example:
  TM7BDI8B: This block is connected to the power supply to distribute 8000 mA to the 24 Vdc I/O power segment.
  The current to supply the electronic sensors of this example has been estimated at 25 mA per sensor, or 200 mA total for the block.
  TM7BDI16B (x3): The current to supply the electronic sensors of this example has been estimated at 37.5 mA per sensor, or 500 mA total for the block.
  TM7BDM16A: The sum of the current draw for all outputs connected to the block is never more than 2500 mA at any given time.
  The current to supply the electronic sensors of this example has been estimated at 12.5 mA per sensor, or 100 mA total for the block.
  TM7BDM16B: The sum of the current draw for all outputs connected to the block is never more than 2000 mA at any given time.
  The current to supply the electronic sensors of this example has been estimated at 25 mA per sensor, or 200 mA total for the block.
  TM7BDO8TAB: This block is connected to the power supply to distribute 8000 mA to the 24 Vdc I/O power segment.
  Only 6 of the outputs are active at any given time, and that the maximum current draw of any given output is 1000 mA, or 5000 mA total for the block.

The following graphic shows the example configuration connected to the power supplies PS1 and PS2:



PS1 External isolated main power supply, 24 Vdc
PS2 External isolated I/O power supply, 24 Vdc

NOTE:

For important information concerning power supply connections *(see page 225)*:
- TM5SBET7
- PDB
- I/O Block

The following table shows the current supplied and consumed in mA on the TM7 power bus and the 24 Vdc I/O power segment:

TM5SBET7	**TM7BDI8B**	**TM7BDI16B**	**TM7BDI16B**	**TM7BDI16B**	**TM7BDM16A**	**TM7BDM16B**	**TM7BDO8TAB**	**TM7BAI4CLA**	**TM7BAO4CLA**	**Legend**
304										(1)
–	38	38	38	38	38	38	38	38	38	(2)
	266	228	190	152	114	76	38	0	–38	(3)
	8000						8000			*(4)*
	42	21	21	21	125	125	84	125	188	*(5)*
	0	0	0	0	2500	2000	6000	–	–	*(6)*
	200	500	500	500	100	200	–	–	–	*(7)*
	242	521	521	521	2725	2325	6084	125	188	*(8)*
	7758	7237	6716	6195	3470	1145	1916	1791	1603	*(9)*

Legend:
External isolated main power supply, 24 Vdc
(1) Current supplied on the TM7 power bus
(2) Consumption of the TM7 I/O block
(3) Remaining current available after block consumption
External isolated I/O power supply, 24 Vdc
(4) Current supplied on the 24 Vdc I/O power segment
(5) Consumption of the electronics of the TM7 I/O block
(6) Consumption of the loads of the output channels
(7) Consumption of the supply to sensors, actuators or external devices
(8) Total TM7 I/O block consumption
(9) Remaining current available after block consumption

Current Consumed on the TM7 Power Bus

The TM5SBET7 generates 304 mA on the TM7 power bus to supply expansion blocks. The TM7 power bus begins with the TM7BDI8B block and terminates with the TM7BAO4CLA expansion block.

The total current consumed on the TM7 power bus is 342 mA and exceeds the 304 mA capacity of the segment.

You must supplement the TM7 power bus by adding a TM7SPS1A between the TM7BDO8TAB and TM7BAI4CLA blocks.

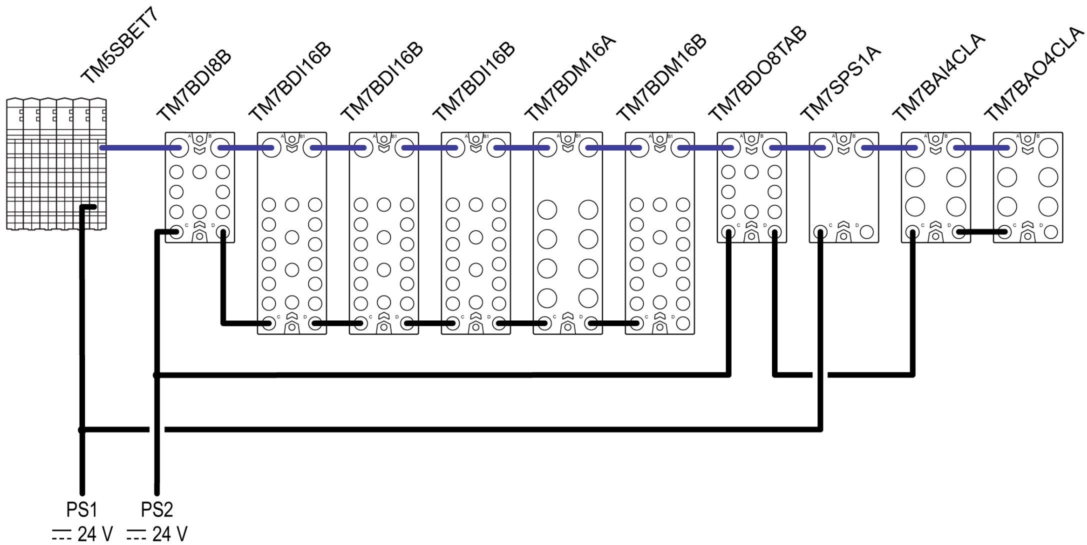
The following table shows, the current supplied and consumed in mA on the TM7 power bus:

TM5SBET7	TM7BDI8B	TM7BDI16B	TM7BDI16B	TM7BDI16B	TM7BDM16A	TM7BDM16B	TM7BDO8TAB	TM7SPS1A	TM7BAI4CLA	TM7BAO4CLA	Legend
304								750			(1)
	38	38	38	38	38	38	38		38	38	(2)
	266	228	190	152	114	76	38	788	750	712	(3)
	8000						*8000*				*(4)*
	42	*21*	*21*	*21*	*125*	*125*	*84*		*125*	*188*	*(5)*
	0	*0*	*0*	*0*	*2500*	*2000*	*6000*		–	–	*(6)*
	200	*500*	*500*	*500*	*100*	*200*	–		–	–	*(7)*
	242	*521*	*521*	*521*	*2725*	*2325*	*6084*		*125*	*188*	*(8)*
	7758	*7237*	*6716*	*6195*	*3470*	*1145*	*1916*		*1791*	*1603*	*(9)*

Legend:
External isolated main power supply, 24 Vdc
(1) Current supplied on the TM7 power bus
(2) Consumption of the TM7 I/O block
(3) Remaining current available after block consumption
External isolated I/O power supply, 24 Vdc
(4) Current supplied on the 24 Vdc I/O power segment
(5) Consumption of the electronics of the TM7 I/O block
(6) Consumption of the loads of the output channels
(7) Consumption of the supply to sensors, actuators or external devices
(8) Total TM7 I/O block consumption
(9) Remaining current available after block consumption

The total current consumed on the TM7 power bus is 342 mA, and does not exceed the 1054 mA capacity of the TM7 power bus.

The following graphic shows the example configuration (with the PDB) connected to the power supplies PS1 and PS2:



PS1 External isolated main power supply, 24 Vdc
PS2 External isolated I/O power supply, 24 Vdc

For important information concerning power supply connections *(see page 225)*:
- TM5SBET7
- PDB
- I/O Block

The next step is to calculate the current consumed on the 24 Vdc I/O power segment to validate the configuration of this example.

Current Consumed on the 24 Vdc I/O Power Segment

In this example,

- The first 24 Vdc I/O power segment begins with the TM7BDI8B and finishes with the TM7BDM16B. The capacity of this segment is limited to 8000 mA.
- The second 24 Vdc I/O power segment begins with the TM7BDO8TAB and finishes with the TM7BAO4CLA. The capacity of this segment is limited to 8000 mA.

The following table shows, the current supplied and consumed in mA on the 24 Vdc I/O power segment:

TM5SBET7	TM7BDI8B	TM7BDI16B	TM7BDI16B	TM7BDI16B	TM7BDM16A	TM7BDM16B	TM7BDO8TAB	TM7SPS1A	TM7BAI4CLA	TM7BAO4CLA	Legend
304								*750*			*(1)*
	38	*38*	*38*	*38*	*38*	*38*	*38*		*38*	*38*	*(2)*
	266	*228*	*190*	*152*	*114*	*76*	*38*		*0*	*–38*	*(3)*
	8000						8000				(4)
	42	21	21	21	125	125	84		125	188	(5)
	0	0	0	0	2500	2000	6000		–	–	(6)
	200	500	500	500	100	200	–		–	–	(7)
	242	521	521	521	2725	2325	6084		125	188	(8)
	7758	7237	6716	6195	3470	1145	1916		1791	1603	(9)

Legend:
External isolated main power supply, 24 Vdc
(1) Current supplied on the TM7 power bus
(2) Consumption of the TM7 I/O block
(3) Remaining current available after block consumption
External isolated I/O power supply, 24 Vdc
(4) Current supplied on the 24 Vdc I/O power segment
(5) Consumption of the electronics of the TM7 I/O block
(6) Consumption of the loads of the output channels
(7) Consumption of the supply to sensors, actuators or external devices
(8) Total TM7 I/O block consumption
(9) Remaining current available after block consumption

The total current consumed on the first 24 Vdc I/O power segment is 6855 mA and does not exceed the 8000 mA capacity of this segment.

The total current consumed on the second 24 Vdc I/O power segment is 6397 mA and does not exceed the 8000 mA capacity of that segment.

NOTE: When the current consumption of the devices on a 24 Vdc I/O power segment exceeds the capacity of the segment, it is necessary to create a new segment. To create a new segment, connect a separate external isolated power supply to 24 Vdc Power In connector of the block that would otherwise cause the current limitation to be exceeded.

Section 7.4
Electrical Requirements

Introduction

The following section provides the general wiring rules and recommendations for the TM7 System. Considerations and techniques for grounding the TM7 System are also presented.

What Is in This Section?

This section contains the following topics:

Wiring Rules and Recommendations

Introduction

There are several rules that must be followed when wiring a TM7 System. Refer to TM7 Cables *(see page 355)* for additional details.

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 TM7 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 only the TM7 expansion bus cables *(see page 356)*.

TM7 Blocks Grounding

The TM7 System blocks, when using Schneider Electric IP67 pre-fabricated cables, incorporate a grounding system intrinsic to the mounting and connecting hardware. The TM7 System blocks must always be mounted on a conductive backplane. The backplane or object used for mounting the blocks (metal machine frame, mounting rail or mounting plate) must be grounded (PE) according to your local, regional and national requirements and regulations. Refer to grounding of your system blocks *(see page 130)*, for more important information.

NOTE: If you do not use Schneider Electric IP67 pre-fabricated cables, you must use shielded cables and conductive connectors (metal threads on the connector), and be sure to connect the cable shield to the metal sleeve of the connector.

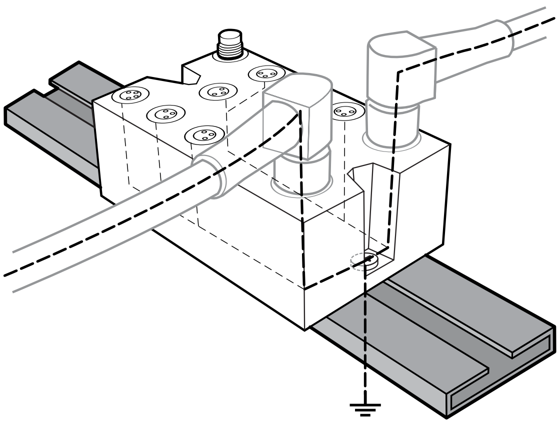
⚠ WARNING

IMPROPER GROUNDING CONTINUITY

- Use only cables with insulated, shielded jackets.
- Use only IP67 connectors with metal threads.
- Connect the cable shield to the metal threads of the connectors.
- Always comply with local, regional and/or national wiring requirements.

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

The following figure shows the grounding of the TM7 System:



Protecting Outputs from Inductive Load Damage

Depending on the load, a protection circuit may be needed for the outputs on certain blocks. Inductive loads using DC voltages may create voltage reflections resulting in overshoot that will damage or shorten the life of output devices.

NOTICE

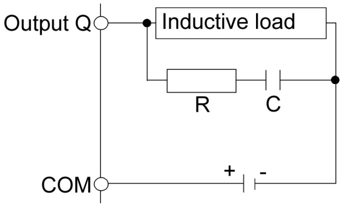
INOPERABLE EQUIPMENT

- Be sure that the actuators connected to the TM7 Digital I/O blocks have a built-in protective circuit to reduce the risk of inductive current load damage to the outputs.
- If the actuators do not have built-in protection, use an appropriate, IP67 rated external protective circuit to reduce the risk of inductive current load damage to the outputs.

Failure to follow these instructions can result in equipment damage.

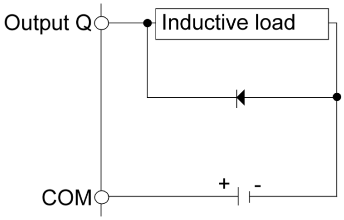
NOTE: The following wiring diagrams are conceptual and are provided as non-definitive guidance for selecting an appropriate IP67 protective device.

Protective circuit A: this protection circuit can be used for DC load power circuits.



- C represents a value from 0.1 to 1 μF.
- R represents a resistor of approximately the same resistance value as the load.

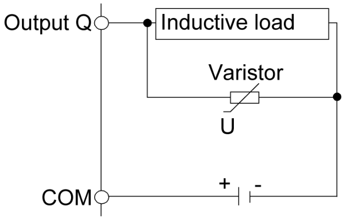
Protective circuit B: this protection circuit can be used for DC load power circuits.



Use a diode with the following ratings:

- Reverse withstand voltage: power voltage of the load circuit x 10.
- Forward current: more than the load current.

Protective circuit C: this protection circuit can be used for DC load power circuits.



NOTICE

EQUIPMENT DAMAGE

In applications where the inductive load is switched on and off frequently and/or rapidly, ensure that the continuous energy rating (J) of the varistor exceeds the peak load energy by 20% or more.

Failure to follow these instructions can result in equipment damage.

Selecting an External 24 Vdc Power Supply

Characteristics of the 24 Vdc Power Supply

The TM7 System requires power supplies with a nominal voltage of 24 Vdc. The 24 Vdc power supplies must be rated Safety Extra Low Voltage (SELV) or Protective Extra Low Voltage (PELV) according to IEC 61140. These power supplies are isolated between the electrical input and output circuits of the power supply.

⚠ WARNING

POTENTIAL OF OVERHEATING AND FIRE

- Do not connect the 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.

Calculating the Power Supply Requirement

Refer to Power Distribution System Design *(see page 206)*.

Wiring the Power Supply

Overview

To distribute current for the 24 Vdc I/O power segment(s) and TM7 power bus, and according to the power distribution description *(see page 201)*, the following modules and blocks are connected to an external power source:

- Transmitter module (TM5SBET7)
- Field bus interface I/O block
- Power Distribution Block (PDB)
- I/O blocks

Source power for these can come from one or more supplies. Your requirements are dictated by:

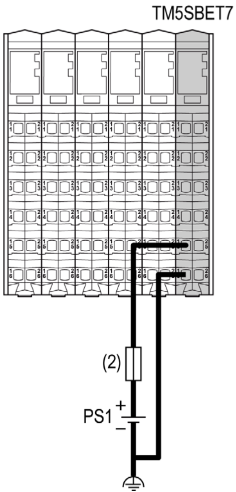
- voltage and current needs
- isolation requirements

⚠ 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.**

Wiring the Transmitter Module (TM5SBET7)

The TM5SBET7 *(see page 203)* is the connection to the external 24 Vdc power supply and the beginning of the power distribution for the TM7 remote configuration. The power is supplied by one external isolated power supply depending on current needs and capabilities.

The following figure shows the wiring of the TM5SBET7 wired with one external 24 Vdc power supply:



(2) External fuse, Type T slow-blow, 1 A, 250 V
PS1 External isolated power supply, 24 Vdc

NOTE: Connect the 0 Vdc power circuits together and to the functional ground (FE) of your system. If you do not interconnect the 0 Vdc circuits of the external power supplies, the status LEDs may not function correctly. In addition, there may potentially be more significant consequences such as an explosion and/or fire hazard.

⚠ WARNING

POTENTIAL EXPLOSION OR FIRE

Always connect the 0 Vdc terminals of the external power supplies to the functional ground (FE) of your system.

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

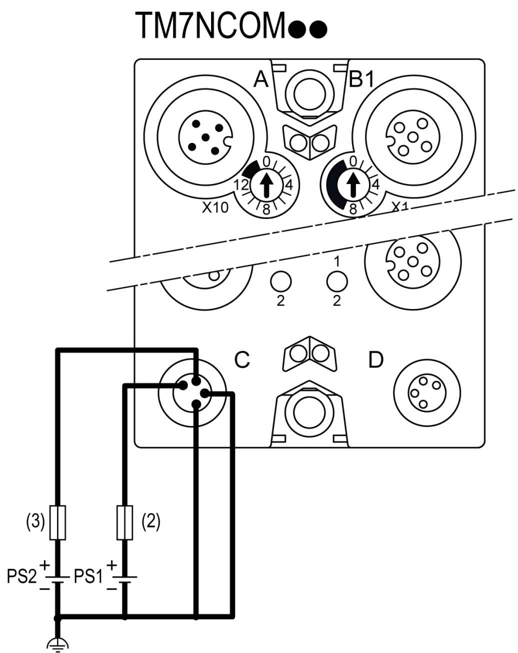
Wiring the Field Bus Interface I/O Block

The field bus interface I/O block is the beginning of the power distribution for the TM7 distributed configuration. Power is supplied by two external isolated power supplies depending on current needs and capabilities.

There are two power connections to be made to the field bus interface I/O block from your source power supplies:

Connections	2 Power Supplies
24 Vdc main power that generates power for TM7 power bus	PS1
24 Vdc I/O power segment	PS2

The following figure shows a field bus interface I/O block wired with two separate external 24 Vdc power supplies:



(2) External fuse, Type T slow-blow, 1 A, 250 V [1]
(3) External fuse, Type T slow-blow, 4 A max., 250 V
PS1 External isolated main power supply, 24 Vdc
PS2 External isolated I/O power supply, 24 Vdc

[1] Fuse limited to 1 A per PDB, maximum fuse limited to 5 A with maximum 4 PDB interconnected. If less then 4 PDBs size the fuse in accordance with the number of PDBs.

NOTE: Connect the 0 Vdc power circuits together and to the functional ground (FE) of your system. If you do not interconnect the 0 Vdc circuits of the external power supplies, the status LEDs may not function correctly. In addition, there may potentially be more significant consequences such as an explosion and/or fire hazard.

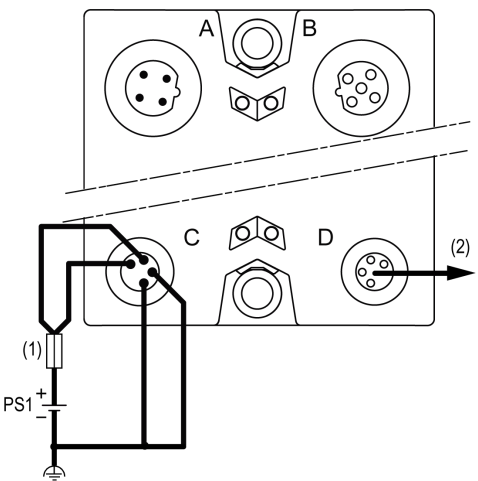
⚠ WARNING
POTENTIAL EXPLOSION OR FIRE
Always connect the 0 Vdc terminals of the external power supplies to the functional ground (FE) of your system.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Wiring the PDB

The TM7SPS1A (PDB) reinforces the TM7 power bus *(see page 202)*. Power is supplied by one external isolated power supply depending on current needs and capabilities.

The following figure shows the wiring of the PDB with one power supply:

TM7SPS1A



(1) External fuse, Type T slow-blow, 1 A minimum, 4 A maximum, 250 V
(2) Maximum current 4 A
PS1 External isolated main power supply, 24 Vdc

NOTE: Connect the 0 Vdc power circuits together and to the functional ground (FE) of your system. If you do not interconnect the 0 Vdc circuits of the external power supplies, the status LEDs may not function correctly. In addition, there may potentially be more significant consequences such as an explosion and/or fire hazard.

⚠ WARNING

POTENTIAL EXPLOSION OR FIRE

Always connect the 0 Vdc terminals of the external power supplies to the functional ground (FE) of your system.

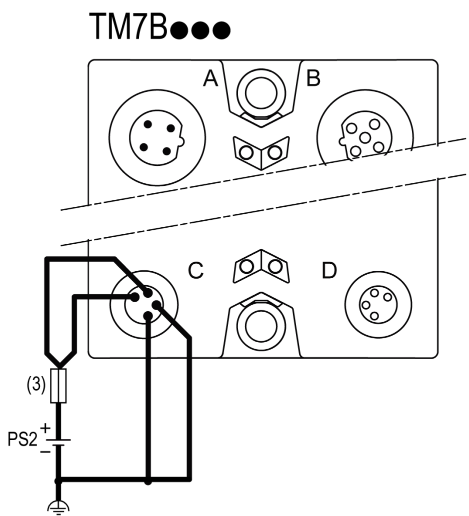
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Wiring the I/O Block

When you provide power to a TM7 I/O block using the 24 VDC Power OUT connector of the preceding I/O block, both blocks occupy the same 24 Vdc I/O power segment. However, if you connect an external isolated power supply to the 24 Vdc Power IN connector of a TM7 I/O block, you establish a new 24 Vdc I/O power segment beginning with that I/O block.

When beginning a new 24 Vdc I/O power segment, select an external isolated power supply sufficient to the power requirements of the I/O blocks planned for that segment. For more information, refer to 24 Vdc I/O Power Segment Description *(see page 201)*.

The following figure shows a I/O block wired with one external 24 Vdc power supply:



(3) External fuse, Type T slow-blow, 8 A max., 250 V
PS2 External isolated I/O power supply, 24 Vdc

NOTE: Connect the 0 Vdc power circuits together and to the functional ground (FE) of your system. If you do not interconnect the 0 Vdc circuits of the external power supplies, the status LEDs may not function correctly. In addition, there may potentially be more significant consequences such as an explosion and/or fire hazard.

⚠ WARNING

POTENTIAL EXPLOSION OR FIRE

Always connect the 0 Vdc terminals of the external power supplies to the functional ground (FE) of your system.

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

Chapter 8
Installation Procedures

Overview

This chapter focuses on procedures for construction of a TM7 System. The installation guidelines summarize the steps involved in the installation process.

What Is in This Chapter?

This chapter contains the following topics:

Installation Requirements

Before Starting

Read and understand this chapter before beginning the installation of your TM7 System.

⚠ DANGER

POTENTIAL FOR EXPLOSION

- Use devices with explosion protection as intended according to these operation instructions and corresponding documents.
- Only permit knowledgeable and qualified personnel to install, maintain and/or operate these devices.
- Conform to valid safety and accident prevention regulations and adhere to standards such as IEC/EN 60079-14.
- Be sure that all other associated equipment, such as cables and connectors, are also suitable for the operating location.
- Ground all devices, using a metal plate, terminal strip or mounting plate securely connected to the housing back plate, to an equalized potential.
- Remove all power from all equipment before installing or removing devices (including other connected devices), accessories, hardware, cables, or wires.
- Devices must remain voltage free until all installation or maintenance work is completed.
- Remove as necessary dust collecting on devices that can cause explosions.
- Be sure that all connectors and sealing plugs on the M8 and M12 connectors are in place and fastened with a torque between 0.2 and 0.4 Nm (1.8 and 3.5 lbf-in) before applying any power.
- Be sure that all connectors are firmly sealed with either properly wired connectors or sealing plugs before applying power during regular operation.

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

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.

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

POTENTIAL FOR EXPLOSION

- Only use this equipment in non-hazardous locations or in locations that comply either with the Class I, Division 2, Groups A, B, C and D, or with the ATEX Group II, Zone 2 specifications for hazardous locations, depending on your local and/or national regulations.
- Do not substitute components which would impair compliance to the hazardous location specifications of this equipment.
- Do not connect or disconnect equipment unless power has been removed or the area is known to be non-hazardous.

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

NOTE: Additional equipment used in conjunction with the equipment described herein must also be suitable for the operating location.

Requirements for use in ATEX Group II, Zone 2:

- Install and use the equipment strictly in accordance to the installation and operating instructions found here and in other related documentation.
- Respect and follow all valid safety and accident prevention regulations, as well as adhering to standards such as IEC/EN 60079-14 or those that govern the eventual locality of your application.
- All equipment must be grounded to an equipotential ground plane dimensioned to the power system of your application.
- Equipment must remain unpowered until installation work is completed, including all cable connections with the proper torque having been applied to all connector unions.
- Before applying power, be sure that all connectors that are not being used (open connectors with no cable attached) are capped with suitable sealing plugs.
- During service or maintenance, the equipment must be shut down and protected from being accidently restarted.
- Do not connect or disconnect cables or sealing plugs under power unless the equipment is in a known non-hazardous location.

⚠ 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.
- 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 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.

Installation Guidelines

Introduction

The TM7 System can be mounted using:

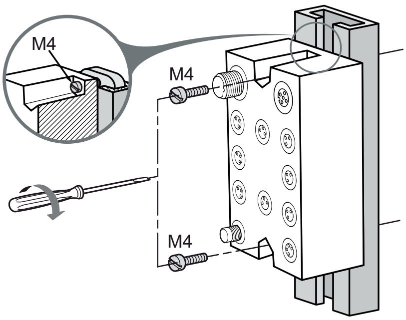
- An aluminium frame with two wedge nuts and M4 screws
- A DIN rail with TM7ACMP mounting plate
- Directly on the machine.

NOTE: Mounting on a DIN rail using the TM7ACMP mounting plate is only possible with the size 1 (smallest) block dimension *(see page 197)*.

NOTE: The TM7 System components must always be mounted to a conductive backplane.

TM7 Block on an Aluminium Frame

Blocks can be mounted on an aluminium frame with two wedge nuts and M4 screws:



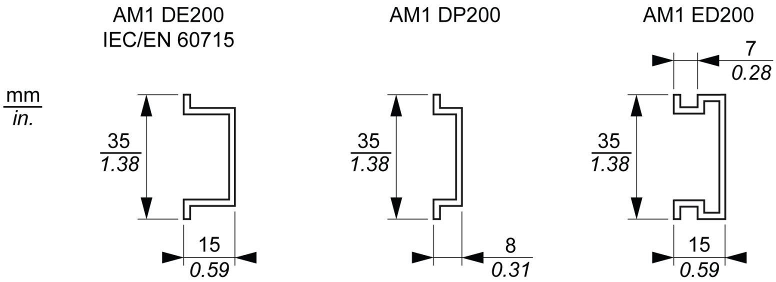
NOTE: Maximum torque to fasten the M4 screws is 0.6 N.m (5.3 lbf-in).

NOTICE
INOPERABLE EQUIPMENT ● Ensure that the block is securely affixed to its mounting surface. ● Do not tighten screws beyond the specified maximum torque. **Failure to follow these instructions can result in equipment damage.**

TM7 Block on a DIN Rail

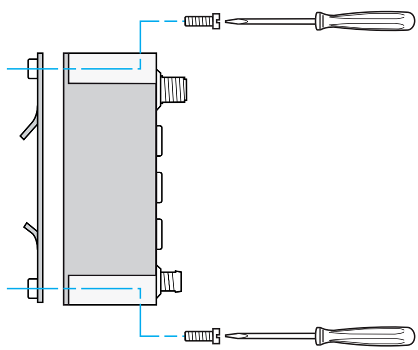
You can mount the size 1 blocks on a DIN rail with the TM7ACMP *(see page 63)* mounting plate. For EMC (Electromagnetic Compatibility) compliance, a metal DIN rail must be attached to a flat metal mounting surface or mounted on an EIA (Electronic Industries Alliance) rack or in a NEMA (National Electrical Manufacturers Association) enclosure. In all cases, the mounting surface must be properly grounded *(see page 130)*.

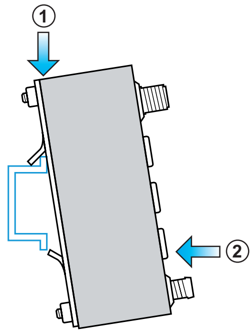
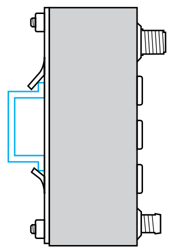
You can order a suitable DIN rail from Schneider Electric:



NOTE: Only size 1 (smallest) blocks can be installed on DIN rail with the mounting plate.

The following procedure gives step by step instructions to assemble and install a block on a DIN rail:

Step	Action	
1	Screw the block to the mounting plate. The required screws are supplied with the mounting plate. **NOTE:** Maximum torque to fasten the required screws is 0.6 Nm (5.3 lbf-in).	

Step	Action	
2	Place the upper protruding catches of the mounting plate on the top edge of the DIN rail (1). Rotate the block to the DIN rail until it clicks (2).	
3	The block is correctly installed to the DIN rail	

NOTICE

INOPERABLE EQUIPMENT

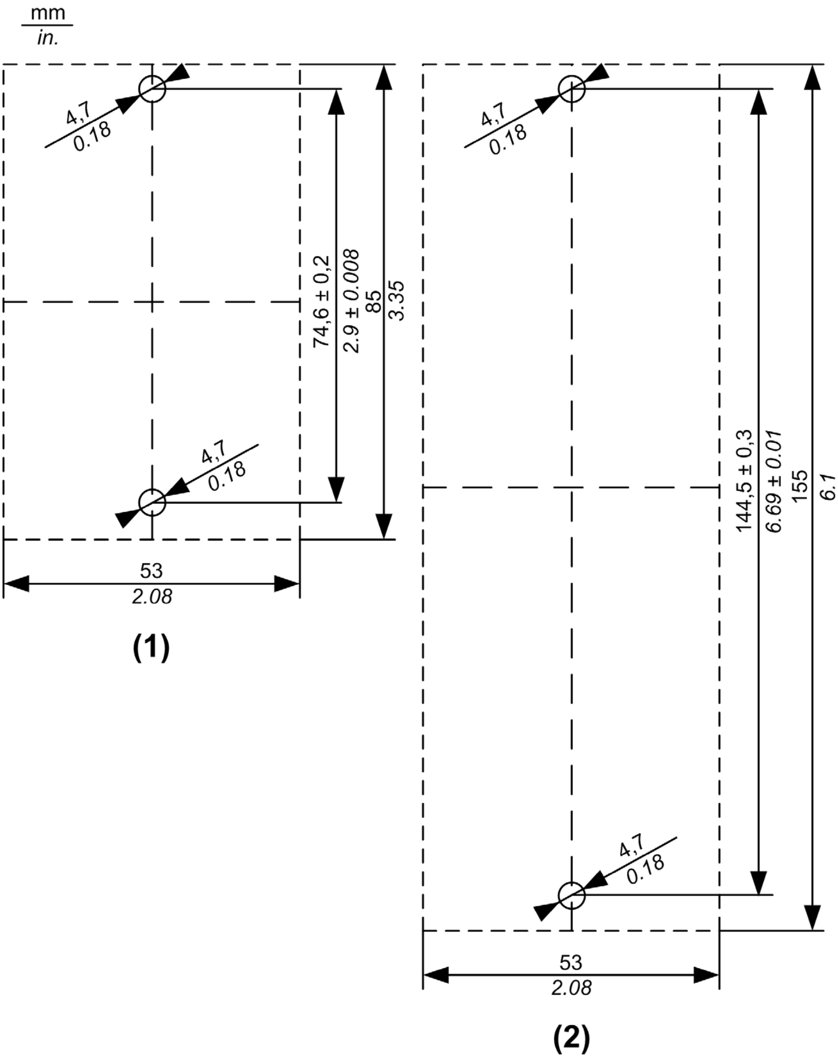
- Ensure that the block is securely affixed to its mounting surface.
- Do not tighten screws beyond the specified maximum torque.

Failure to follow these instructions can result in equipment damage.

For more information on mounting the DIN rail refer to the TM5 section DIN Rail Installation *(see page 141)*.

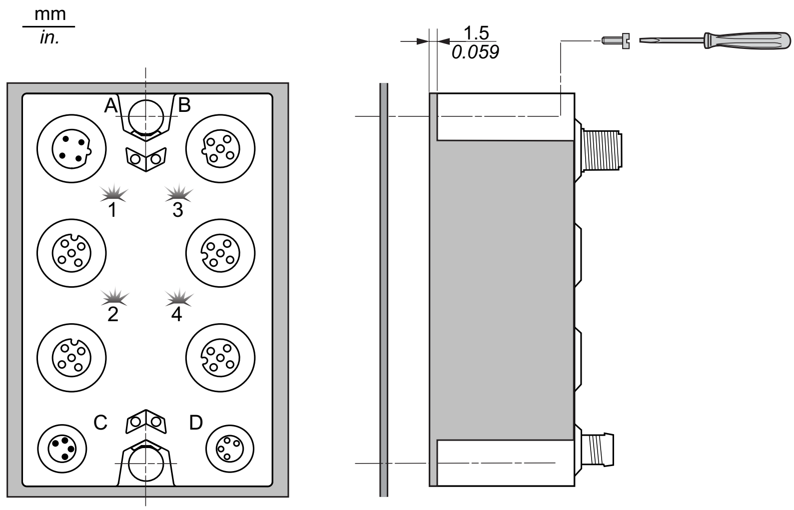
TM7 Block Directly on the Machine

The TM7 block can be mounted to any bare-metal surface of the machine, provided that the surface is properly grounded *(see page 130)*. To mount the block directly on the machine, the following figure gives the drilling template of the blocks:



(1) Size 1
(2) Size 2

The thickness of the base plate should be taken into consideration when defining the screw length.

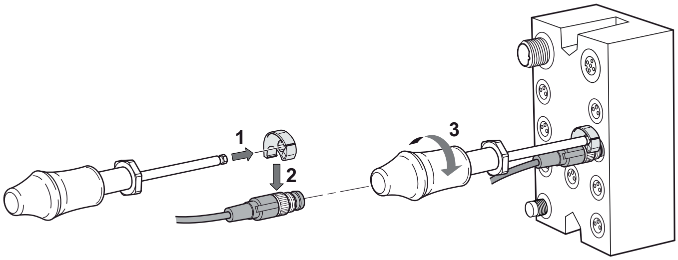


NOTE: Maximum torque to fasten the required M4 screws is 0.6 Nm (5.3 lbf-in).

NOTICE
INOPERABLE EQUIPMENT ● Ensure that the block is securely affixed to its mounting surface. ● Do not tighten screws beyond the specified maximum torque. **Failure to follow these instructions can result in equipment damage.**

TM7 Cable Installation

The plug connector of the TM7 cables *(see page 355)* is mounted by hand and then tightened to a defined force with the aid of the torque wrench *(see page 66)*:



Connector Size	Preset Torque
M8	0.2 Nm (1.8 lbf-in)
M12	0.4 Nm (3.5 lbf-in)

⚠ WARNING

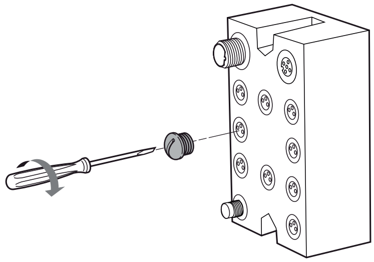
IP67 NON-CONFORMANCE

- Properly fit all connectors with cables or sealing plugs and tighten for IP67 conformance according to the torque values as specified in this document.
- Do not connect or disconnect cables or sealing plugs in the presence of water or moisture.

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

Sealing Plug Installation

Open connectors with no cable attached are capped with suitable sealing plugs *(see page 65)*:



Connector Size	Preset Torque
M8	0.2 Nm (1.8 lbf-in)
M12	0.4 Nm (3.5 lbf-in)

⚠ WARNING

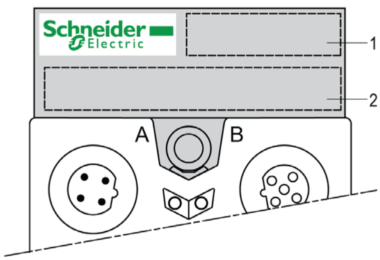
IP67 NON-CONFORMANCE

- Properly fit all connectors with cables or sealing plugs and tighten for IP67 conformance according to the torque values as specified in this document.
- Do not connect or disconnect cables or sealing plugs in the presence of water or moisture.

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

TM7 Block Labeling

The support for block label and its label are inserted in the appropriate opening in the top (the figure below) or in the bottom of the block:



1 Reference of the block
2 Area for customer

Addressing

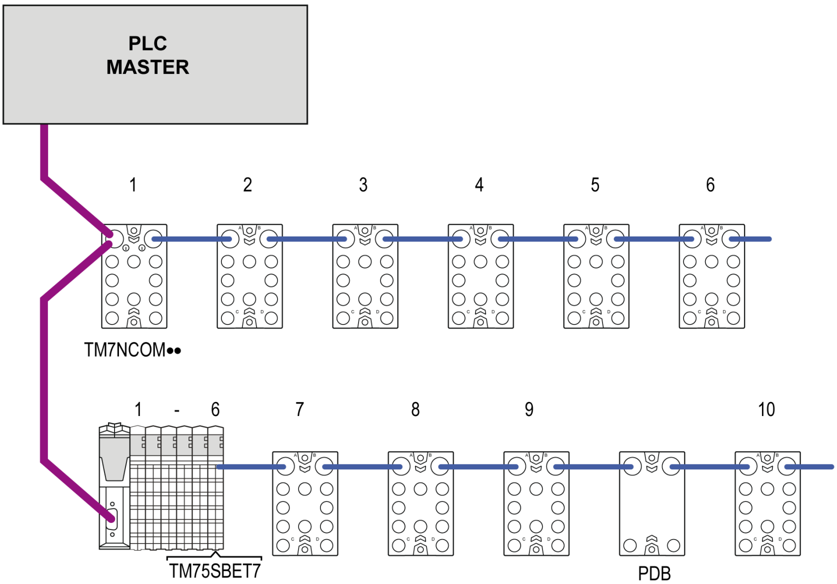
Addressing Principle

The TM7 bus is self-addressing, and automatically increments by 1 starting with the first I/O block after the TM5SBET7 transmitter module. For example, if the address of the transmitter module is 6, the first TM7 I/O block will automatically be assigned an address of 7.

NOTE: The TM7 Power Distribution Block (PDB) does not have a physical address.

An Example of Addressing

The example below illustrates the addressing principle for the TM7 bus. As you can see, the TM7 System automatically addresses the I/O blocks from left to right:



TM7NCOM•• TM7 Field bus interface I/O block
TM5SBET7 Transmitter module
PDB Power Distribution Block

Chapter 9
Commissioning and Maintaining

Diagnostics

Diagnostics

The TM7 System offer several levels of diagnostics depending on master architecture on the block using visual LED displays.

Refer to the hardware guides for the products of the TM7 System for status LEDs descriptions.

Appendices

Overview

These appendices give the association and power consumption tables, the description of the power distribution and common distribution electronic modules, the bus bases and terminal blocks for designing your TM5 System.

What Is in This Appendix?

The appendix contains the following chapters:

Appendix A
Association and Power Consumption Tables

Overview

This chapter gives the association table and power consumption tables that are useful for designing your TM5 System and TM7 System.

What Is in This Chapter?

This chapter contains the following sections:

Section A.1
Association Table

TM5 Association Table

Association Table

One bus base, one electronic module and one terminal block compose a complete slice. During the configuration procedure *(see Modicon TM5, Expansion Modules Configuration, Programming Guide)* of your TM5 System, the SoMachine software notifies you of the bus base and terminal block compatible with your choice of electronic module.

A slice must only be composed of a single color. For example, a gray bus base should only be assembled with a gray electronic module and a gray terminal block. However, color alone is not sufficient for compatibility; always confirm that functionality of slice components matches as well.

DANGER

INCOMPATIBLE COMPONENTS CAUSE ELECTRONIC SHOCK OR ARC FLASH

- Do not associate components of a slice that have different colors.
- Always confirm the compatibility of slice components and modules before installation using the association table in this manual.
- Ensure that a correct terminal block is installed on the appropriate electronic module.

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

The following table provides information on the compatibility of the bus bases, electronic modules, and terminal blocks available in the TM5 System. The last column of the table indicates if the TM5SD000 dummy module is compatible in place of another electronic module:

Reference		**Bus Bases**					**Terminal Blocks**					
		TM5ACBM11	**TM5ACBM15**	**TM5ACBM01R**	**TM5ACBM05R**	**TM5ACBM12**	**TM5ACTB06**	**TM5ACTB12**	**TM5ACTB12PS**	**TM5ACTB16**	**TM5ACTB32**	**TM5SD000**
Compact I/O		Not applicable					–	X	–	–	–	–
Digital Input Modules	TM5SDI2D	X	X	–	–	–	X	X	–	–	–	X
	TM5SDI4D	X	X	–	–	–	–	X	–	–	–	X
	TM5SDI6D	X	X	–	–	–	X	X	–	–	–	X
	TM5SDI12D	X	X	–	–	–	–	X	–	–	–	X
	TM5SDI16D	X	X	–	–	–	–	–	–	X	–	X
	TM5SDI2A	–	–	–	–	X	–	–	–	–	X	–
	TM5SDI4A	–	–	–	–	X	–	–	–	–	X	–
	TM5SDI6U	–	–	–	–	X	–	–	–	–	X	–
Digital Output Modules	TM5SDO2T	X	X	–	–	–	X	X	–	–	–	X
	TM5SDO4T	X	X	–	–	–	–	X	–	–	–	X
	TM5SDO4TA	X	X	–	–	–	–	X	–	–	–	X
	TM5SDO6T	X	X	–	–	–	X	X	–	–	–	X
	TM5SDO8TA	X	X	–	–	–	–	X	–	–	–	X
	TM5SDO12T	X	X	–	–	–	–	X	–	–	–	X
	TM5SDO16T	X	X	–	–	–	–	–	–	X	–	X
	TM5SDO2R	–	–	–	–	X	–	–	–	–	X	–
	TM5SDO4R	–	–	–	–	X	–	–	–	–	X	–
	TM5SDO2S	–	–	–	–	X	–	–	–	–	X	–
Mixed Input/Output Modules	TM5SDM12DT	X	X	–	–	–	–	X	–	–	–	X
	TM5SMM6D2L	X	X	–	–	–	–	X	–	–	–	X
X Compatible **–** Incompatible												

Reference		Bus Bases					Terminal Blocks					
		TM5ACBM11	**TM5ACBM15**	**TM5ACBM01R**	**TM5ACBM05R**	**TM5ACBM12**	**TM5ACTB06**	**TM5ACTB12**	**TM5ACTB12PS**	**TM5ACTB16**	**TM5ACTB32**	**TM5SD000**
Analog Input Modules	TM5SAI2L	X	X	–	–	–	X	X	–	–	–	X
	TM5SAI4L	X	X	–	–	–	–	X	–	–	–	X
	TM5SAI2H	X	X	–	–	–	X	X	–	–	–	X
	TM5SAI4H	X	X	–	–	–	–	X	–	–	–	X
	TM5SAI2PH	X	X	–	–	–	X	X	–	–	–	X
	TM5SAI4PH	X	X	–	–	–	–	X	–	–	–	X
	TM5SAI2TH	X	X	–	–	–	X	X	–	–	–	X
	TM5SAI6TH	X	X	–	–	–	–	X	–	–	–	X
	TM5SEAISG	X	X	–	–	–	–	X	–	–	–	X
Analog Output Modules	TM5SAO2L	X	X	–	–	–	X	X	–	–	–	X
	TM5SAO4L	X	X	–	–	–	–	X	–	–	–	X
	TM5SAO2H	X	X	–	–	–	X	X	–	–	–	X
	TM5SAO4H	X	X	–	–	–	–	X	–	–	–	X
Expert Modules	TM5SE1IC02505	X	X	–	–	–	–	X	–	–	–	X
	TM5SE1IC01024	X	X	–	–	–	–	X	–	–	–	X
	TM5SE2IC01024	X	X	–	–	–	–	X	–	–	–	X
	TM5SE1SC10005	X	X	–	–	–	–	X	–	–	–	X
	TM5SDI2DF	X	X	–	–	–	X	X	–	–	–	X
Transmitter & Receiver Modules	TM5SBET1	X	X	–	–	–	X	X	–	–	–	X
	TM5SBET7	X	X	–	–	–	–	X	–	–	–	X
	TM5SBER2	–	–	X	X	–	–	–	X	–	–	–
Power Distribution Modules (PDM)	TM5SPS1	–	–	X	X	–	–	–	X	–	–	–
	TM5SPS1F	–	–	X	X	–	–	–	X	–	–	–
	TM5SPS2	–	–	X	X	–	–	–	X	–	–	–
	TM5SPS2F	–	–	X	X	–	–	–	X	–	–	–

X Compatible
– Incompatible

Reference		Bus Bases					Terminal Blocks					
		TM5ACBM11	TM5ACBM15	TM5ACBM01R	TM5ACBM05R	TM5ACBM12	TM5ACTB06	TM5ACTB12	TM5ACTB12PS	TM5ACTB16	TM5ACTB32	TM5SD000
Common Distribution Modules (CDM)	TM5SPDG12F	X	X	–	–	–	–	X	–	–	–	X
	TM5SPDD12F	X	X	–	–	–	–	X	–	–	–	X
	TM5SPDG5D4F	X	X	–	–	–	–	X	–	–	–	X
	TM5SPDG6D6F	X	X	–	–	–	–	X	–	–	–	X
Dummy Module	TM5SD000	X	X	–	–	–	X	X	–	–	–	X

X Compatible
– Incompatible

Section A.2
TM5 Power Consumption Tables

Introduction

This section gives the current supplied and consumption tables useful for designing your TM5 System.

What Is in This Section?

This section contains the following topics:

Current Supplied and Consumption Tables on the 24 Vdc I/O Power Segment

Introduction

During configuration procedure of your TM5 System, the TM5 Manager *(see Modicon TM5, Expansion Modules Configuration, Programming Guide)* calculates the probable current consumption of each 24 Vdc power segment according to your design.

The following tables give a synthesis of the current supplied and current consumed on the 24 Vdc I/O power segment by the following TM5 components:
- Controllers
- Compact I/O
- Electronic modules

The bus bases do not draw current from the 24 Vdc I/O power segment.

Controllers

The following table gives the current supplied and consumed by the components of the controllers on the 24 Vdc I/O power segment:

Reference		**On the 24 Vdc I/O Power Segment**			
		Max. Current Supplied (mA)	**Current Consumed by the Electronic Module (mA)**	**Max. Current Consumed by the Loads (mA)**	**Max. Current Consumed by the Sensor/Actuator/External Device (mA)**
Controller Power Distribution Module	(CPDM)	10000	–	–	–
Dummy Module	D000E	–	–	–	–
Embedded Digital Input	DI6DE	–	37	–	–
	DI12DE	–	73	–	–
Embedded Digital Output	DO12TE	–	48	6000	–
	DO6RE	–	–	6000	–
Embedded Analog Input	AI4LE	–	46	–	–

Compact I/O

The following table gives the current supplied and consumed by the compact I/O on the 24 Vdc I/O power segment:

Reference	On the 24 Vdc I/O Power Segment			
	Max. Current Supplied (mA)	Current Consumed by the Electronic Module (mA)	Max. Current Consumed by the Loads (mA)	Max. Current Consumed by the Sensor/Actuator/External Device (mA)
TM5C24D18T	–	140	9000	–
TM5C12D8T	–	80	4000	2500
TM5C24D12R	–	165	–	–
TM5CAI8O8VL	–	205	–	–
TM5CAI8O8CL	–	218	–	–
TM5CAI8O8CVL	–	214	–	–
TM5C12D6T6L	–	290	3000	–

Electronic Modules

The following table gives the current supplied and consumed by the electronic modules on the 24 Vdc I/O power segment:

Reference		On the 24 Vdc I/O Power Segment			
		Max. Current Supplied (mA)	Current Consumed by the Electronic Module (mA)	Max. Current Consumed by the Loads (mA)	Max. Current Consumed by the Sensor/Actuator/External Device (mA)
Digital Input Modules	TM5SDI2D	–	12	–	500
	TM5SDI4D	–	25	–	500
	TM5SDI6D	–	37	–	–
	TM5SDI12D	–	73	–	–
	TM5SDI16D	–	61	–	–
	TM5SDI2A	–	–	–	–
	TM5SDI4A	–	–	–	–
	TM5SDI6U	–	–	–	–

Reference		On the 24 Vdc I/O Power Segment			
		Max. Current Supplied (mA)	**Current Consumed by the Electronic Module (mA)**	**Max. Current Consumed by the Loads (mA)**	**Max. Current Consumed by the Sensor/Actuator/External Device (mA)**
Digital Output Modules	TM5SDO2T	–	14	1000	500
	TM5SDO4T	–	20	2000	500
	TM5SDO4TA	–	21	4000	500
	TM5SDO6T	–	30	3000	–
	TM5SDO8TA	–	0	–	–
	TM5SDO12T	–	48	6000	–
	TM5SDO16T	–	40	8000	–
	TM5SDO2R	–	–	–	–
	TM5SDO4R	–	–	–	–
	TM5SDO2S	–	–	–	–
Mixed Input/output Modules	TM5SDM12DT	–	21	2000	–
	TM5SMM6D2L	–	73	–	–
Analog Input Modules	TM5SAI2L	–	33	–	–
	TM5SAI4L	–	46	–	–
	TM5SAI2H	–	50	–	–
	TM5SAI4H	–	63	–	–
	TM5SAI2PH	–	46	–	–
	TM5SAI4PH	–	46	–	–
	TM5SAI2TH	–	30	–	–
	TM5SAI6TH	–	38	–	–
	TM5SEAISG	–	52	–	–
Analog Output Modules	TM5SAO2L	–	46	–	–
	TM5SAO2H	–	50	–	–
	TM5SAO4L	–	63	–	–
	TM5SAO4H	–	63	–	–
Expert Modules	TM5SE1IC02505	–	63	–	300
	TM5SE1IC01024	–	58	–	300
	TM5SE2IC01024	–	63	–	600
	TM5SE1SC10005	–	63	–	300
	TM5SDI2DF	–	34	–	500

Reference		On the 24 Vdc I/O Power Segment			
		Max. Current Supplied (mA)	**Current Consumed by the Electronic Module (mA)**	**Max. Current Consumed by the Loads (mA)**	**Max. Current Consumed by the Sensor/Actuator/External Device (mA)**
Transmitter & Receiver Modules	TM5SBET1	0	25	–	–
	TM5SBET7	0	30	–	–
	TM5SBER2	10000	25	–	–
Power Distribution Modules (PDM)	TM5SPS1	10000	25	–	–
	TM5SPS1F	6300	34	–	–
	TM5SPS2	10000	25	–	–
	TM5SPS2F	6300	34	–	–
Interface Power Distribution Module (IPDM)	TM5SPS3	10000	25	–	–
Common Distribution Modules (CDM)	TM5SPDG12F	–	–	–	6300
	TM5SPDD12F	–	42	–	6300
	TM5SPDG5D4F	–	–	–	–
	TM5SPDG6D6F	–	–	–	6300
Dummy Module	TM5SD000	–	–	–	–

Current Supplied and Consumption Tables on the TM5 Power Bus

Introduction

During the configuration procedure of your TM5 System, the TM5 Manager *(see Modicon TM5, Expansion Modules Configuration, Programming Guide)* calculates the probable current consumption of the TM5 power bus according to your design.

The following tables give a synthesis of the current supplied and current consumed on the TM5 power bus by the following TM5 components:

- Controllers
- Compact I/O
- Electronic modules
- Bus bases

Controllers

The following table gives the current supplied and consumed by controllers on the TM5 power bus:

Reference		On the TM5 Power Bus	
		Current Supplied (mA)	**Current Consumed (mA)**
Modicon M258 Logic Controller	TM258LD42DT	400	–
	TM258LD42DT4L	400	–
	TM258LF42DT	400	–
	TM258LF42DR	400	–
	TM258LF42DT4L	400	–
	TM258LF66DT4L	400	–
Modicon LMC058 Motion Controller	LMC058LF42	400	–
	LMC058LF424	400	–

Compact I/O Modules

The following table gives the current supplied and consumed by the compact I/O on the TM5 power bus:

Reference	On the TM5 Power Bus	
	Current Supplied (mA)	Current Consumed (mA)
TM5C24D18T	–	70
TM5C12D8T	–	68
TM5C24D12R	–	68
TM5CAI8O8VL	–	52
TM5CAI8O8CL	–	50
TM5CAI8O8CVL	–	50
TM5C12D6T6L	–	69

Electronic Modules

The following table gives the current supplied and consumed by the electronic modules on the TM5 power bus:

Reference		On the TM5 Power Bus	
		Current Supplied (mA)	Current Consumed (mA)
Digital Input Modules	TM5SDI2D	–	24
	TM5SDI4D	–	28
	TM5SDI6D	–	30
	TM5SDI12D	–	36
	TM5SDI16D	–	56
	TM5SDI2A	–	28
	TM5SDI4A	–	34
	TM5SDI6U	–	42
NOTE: The current consumption values of the electronic modules do not take into account the current consumption values of the associated bus bases *(see page 261)*.			

Reference		On the TM5 Power Bus	
		Current Supplied (mA)	Current Consumed (mA)
Digital Output Modules	TM5SDO2T	–	26
	TM5SDO4T	–	32
	TM5SDO4TA	–	32
	TM5SDO6T	–	36
	TM5SDO8TA	–	44
	TM5SDO12T	–	52
	TM5SDO16T	–	61
	TM5SDO2R	–	90
	TM5SDO4R	–	160
	TM5SDO2S	–	70
Mixed Input/Output Modules	TM5SDM12DT	–	42
	TM5SMM6D2L	–	2
Analog Input Modules	TM5SAI2L	–	2
	TM5SAI4L	–	2
	TM5SAI2H	–	2
	TM5SAI4H	–	2
	TM5SAI2PH	–	2
	TM5SAI4PH	–	2
	TM5SAI2TH	–	2
	TM5SAI6TH	–	2
	TM5SEAISG	–	2
Analog Output Modules	TM5SAO2L	–	2
	TM5SAO2H	–	2
	TM5SAO4L	–	2
	TM5SAO4H	–	2
Expert Modules	TM5SE1IC02505	–	2
	TM5SE1IC01024	–	2
	TM5SE2IC01024	–	2
	TM5SE1SC10005	–	2
	TM5SDI2DF	–	30
NOTE: The current consumption values of the electronic modules do not take into account the current consumption values of the associated bus bases *(see page 261)*.			

Reference			On the TM5 Power Bus	
			Current Supplied (mA)	Current Consumed (mA)
Transmitter & Receiver Modules	TM5SBET1		–	100
	TM5SBET7		–	100
	TM5SBER2	–10...55 °C (14...131 °F):	1156	–
		55...60 °C (131...140 °F):	676	–
Power Distribution Modules (PDM)	TM5SPS1		–	40
	TM5SPS1F		–	40
	TM5SPS2	–10...55 °C (14...131 °F):	1136	–
		55...60 °C (131...140 °F):	740	–
	TM5SPS2F	–10...55 °C (14...131 °F):	1136	–
		55...60 °C (131...140 °F):	740	–
Interface Power Distribution Module (IPDM)	TM5SPS3	–10...55 °C (14...131 °F):	750	–
		55...60 °C (131...140 °F):	500	–
Common Distribution Modules (CDM)	TM5SPDG12F		–	24
	TM5SPDD12F		–	24
	TM5SPDG5D4F		–	24
	TM5SPDG6D6F		–	24
Dummy Module	TM5SD000		–	0
NOTE: The current consumption values of the electronic modules do not take into account the current consumption values of the associated bus bases *(see page 261)*.				

Bus Bases

The following table gives the current supplied and consumed by the bus bases on the TM5 power bus:

Reference	On the TM5 Power Bus	
	Current Supplied (mA)	Current Consumed (mA)
TM5ACBM11	–	26
TM5ACBM15	–	26
TM5ACBM01R	–	26
TM5ACBM05R	–	26
TM5ACBM12	–	26

Section A.3
TM7 Power Consumption Tables

Introduction

This section gives the current supplied and consumption tables useful for designing your TM7 System.

What Is in This Section?

This section contains the following topics:

Current Supplied and Consumption Tables on the 24 Vdc I/O Power Segment

Introduction

During the configuration procedure of your TM7 System, the TM5 manager *(see Modicon TM7, Expansion Blocks Configuration, Programming Guide)* checks the current consumption on each 24 Vdc power segment according to your design.

The following tables give a synthesis of the current supplied and current consumed on the 24 Vdc I/O power segment by the TM7 blocks.

NOTE: There is no current supplied or consumed by the TM7 Power Distribution Block (PDB) on the 24 Vdc I/O power segment.

TM7 Field Bus Interface I/O Block

The following table gives the current supplied and consumed by the TM7 field bus interface I/O blocks on the 24 Vdc I/O power segment:

Reference		On the 24 Vdc I/O Power Segment			
		Max. Current Supplied (mA)	Current Consumed by the Electronic (mA)	Max. Current Consumed by the Loads (mA)	Max. Current Consumed by the Sensor/Actuator (mA)
TM7 Field Bus Interface I/O Block	TM7NCOM08B	4000	84	4000	500
	TM7NCOM16B	4000	125	4000	500
	TM7NCOM16A	4000	125	4000	500

TM7 Blocks

The following table gives the current supplied and consumed by the TM7 blocks on the 24 Vdc I/O power segment:

Reference		On the 24 Vdc I/O Power Segment			
		Max. Current Supplied[1] (mA)	Current Consumed by the Electronic (mA)	Max. Current Consumed by the Loads (mA)	Max. Current Consumed by the Sensor/Actuator (mA)
Digital input	TM7BDI8B	8000	42	–	500
	TM7BDI16B	8000	21	–	500
	TM7BDI16A	8000	21	–	500
Digital output	TM7BDO8TAB	8000	84	8000	500
Digital mixed input/output	TM7BDM8B	8000	105	4000	500
	TM7BDM16A	8000	125	8000	500
	TM7BDM16B	8000	125	8000	500
Analog input	TM7BAI4VLA	8000	125	–	500
	TM7BAI4CLA	8000	125	–	500
	TM7BAI4TLA	8000	63	–	–
	TM7BAI4PLA	8000	108	–	–
Analog output	TM7BAO4VLA	8000	167	–	500
	TM7BAO4CLA	8000	188	–	500
Analog mixed input/output	TM7BAM4VLA	8000	125	–	500
	TM7BAM4CLA	8000	125	–	500
(1) When connecting the 24 Vdc I/O power IN connector to an external power supply					

Current Supplied and Consumption Tables on the TM7 Power Bus

Introduction

During the configuration procedure of your TM7 System, the TM5 Manager *(see Modicon TM7, Expansion Blocks Configuration, Programming Guide)* calculates the probable current consumption of the TM7 power bus according to your design.

The following tables give a synthesis of the current supplied and current consumed on the TM7 power bus by the following TM5 / TM7 components:
- TM5SBET7 Transmitter module,
- TM7 expansion blocks (Field bus interface I/O blocks, I/O blocks and Power Distribution Block).

TM5SBET7 Transmitter Module

For information on the current supplied to the TM7 power bus, refer to Supplying the TM7 Power Bus *(see page 205)*.

Expansion Blocks

The following table gives the current supplied and consumed by the expansion blocks on the TM7 power bus:

Reference		**On the TM7 Power Bus**	
		Current Supplied (mA)	**Current Consumed (mA)**
TM7 Field bus interface I/O blocks	TM7NCOM08B	150	–
	TM7NCOM16B	750	–
	TM7NCOM16A	750	–
Digital input	TM7BDI8B	–	38
	TM7BDI16B	–	38
	TM7BDI16A	–	38
Digital output	TM7BDO8TAB	–	38
Digital mixed input/output	TM7BDM8B	–	38
	TM7BDM16A	–	38
	TM7BDM16B	–	38
Analog input	TM7BAI4VLA	–	38
	TM7BAI4CLA	–	38
	TM7BAI4TLA	–	38
	TM7BAI4PLA	–	38

Reference		On the TM7 Power Bus	
		Current Supplied (mA)	Current Consumed (mA)
Analog output	TM7BAO4VLA	–	38
	TM7BAO4CLA	–	38
Analog mixed input/output	TM7BAM4VLA	–	38
	TM7BAM4CLA	–	38
(Power Distribution Block)	TM7SPS1A	750	–

Appendix B
TM5 Power Distribution Modules (PDM)

Overview

This chapter describes the TM5 Power Distribution Modules (PDM).

What Is in This Chapter?

This chapter contains the following sections:

Section B.1
TM5SPS1 PDM Electronic Module 24 Vdc I/O

What Is in This Section?

This section contains the following topics:

TM5SPS1 Presentation

Main Characteristics

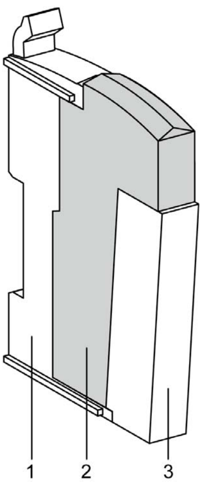
The TM5SPS1 Power Distribution Module supplies the 24 Vdc I/O power segment.

The table below describes the main characteristics of the TM5SPS1 electronic module:

Main Characteristics	
Maximum current provided on 24 Vdc I/O power segment	10000 mA
TM5 power bus current generated	No

Ordering Information

The following figure and table gives the references to create a slice with the TM5SPS1 electronic module:

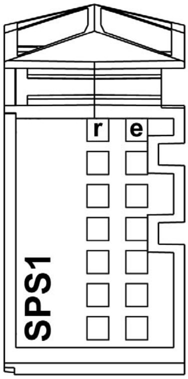


Number	Reference	Description	Color
1	TM5ACBM01R or TM5ACBM05R	Bus base 24 Vdc I/O power segment left isolated Bus base 24 Vdc I/O power segment left isolated with address setting	Gray Gray
2	TM5SPS1	Electronic module	Gray
3	TM5ACTBM12PS	Terminal block, 12-pin	Gray

NOTE: For more information, refer to TM5 Bus Bases and Terminal Blocks *(see page 339)*.

Status LEDs

The following figure shows the TM5SPS1 status LEDs:



The table below describes the TM5SPS1 status LEDs:

LED	Color	Status	Description
r	Green	Off	Power supply not connected
		Single flash	Reset state
		Flashing	Preoperational state
		On	RUN state
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

TM5SPS1 Characteristics

Introduction

This section gives the TM5SPS1 electronic module characteristics.

See also Environmental Characteristics *(see page 70)*.

⚠ 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.

General Characteristics

The following table shows the general characteristics of the TM5SPS1 electronic module:

General Characteristics	
Rated power supply voltage	24 Vdc
24 Vdc I/O power segment current draw	25 mA
TM5 power bus 5 Vdc current draw	40 mA
Power dissipation	0.8 W max.
Weight	30 g (1.1 oz)
ID code	7103 dec

24 Vdc I/O Power Segment Characteristics

The following table shows the 24 Vdc I/O power segment characteristics of the TM5SPS1 electronic module:

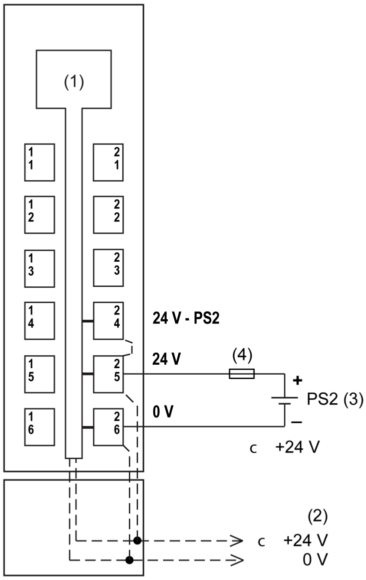
24 Vdc I/O Power Segment Characteristics	
Power supply range	20.4...28.8 Vdc
Rated voltage	24 Vdc
Maximum current provided	10000 mA
Reverse polarity protection	No
Short circuit protection	External fuse type T slow-blow 10 A max. 250 V
Isolation between power segment and TM5 power and data buses	See note [1]

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

TM5SPS1 Wiring Diagram

Wiring Diagram

The following figure shows the wiring diagram for the TM5SPS1:



1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases
3 PS2: External isolated power supply 24 Vdc
4 External fuse type T slow-blow 10 A max. 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.

Section B.2
TM5SPS1F PDM Electronic Module 24 Vdc I/O Fuse 6.3 A

What Is in This Section?

This section contains the following topics:

TM5SPS1F Presentation

Main Characteristics

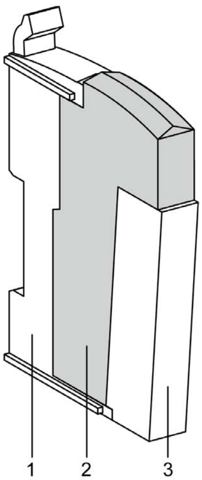
The TM5SPS1F power distribution module feeds the 24 Vdc I/O power segment through an exchangeable fuse.

The table below describes the main characteristics of the TM5SPS1F electronic module:

Main Characteristics	
Maximum current provided on 24 Vdc I/O power segment	6300 mA
TM5 power bus current generated	No

Ordering Information

The following figure and table gives the references to create a slice with the TM5SPS1F electronic module:

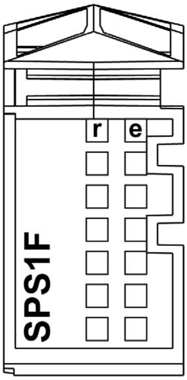


Number	Model Number	Description	Color
1	TM5ACBM01R or TM5ACBM05R	Bus base 24 Vdc I/O power segment left isolated Bus base 24 Vdc I/O power segment left isolated with address setting	Gray Gray
2	TM5SPS1F	Electronic module	Gray
3	TM5ACTBM12PS	Terminal block, 12-pin	Gray

NOTE: For more information, refer to TM5 Bus Bases and Terminal Blocks *(see page 339)*.

Status LEDs

The following figure shows the TM5SPS1F status LEDs:



The table below describes the TM5SPS1F status LEDs:

<table>
<tr><th>LED</th><th>Color</th><th>Status</th><th>Description</th></tr>
<tr><td rowspan="4">r</td><td rowspan="4">Green</td><td>Off</td><td>Power supply not connected</td></tr>
<tr><td>Single flash</td><td>Reset state</td></tr>
<tr><td>Flashing</td><td>Preoperational state</td></tr>
<tr><td>On</td><td>RUN state</td></tr>
<tr><td rowspan="2">e</td><td rowspan="2">Red</td><td>Off</td><td>OK or module not connected</td></tr>
<tr><td>Double flash</td><td>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.</td></tr>
<tr><td>e+r</td><td colspan="2">Steady red/single green flash</td><td>Invalid firmware</td></tr>
</table>

TM5SPS1F Characteristics

Introduction

This section gives the TM5SPS1F electronic module characteristics.

See also Environmental Characteristics *(see page 70)*.

⚠ 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.

General Characteristics

The following table shows the general characteristics of the TM5SPS1F electronic module:

General Characteristics	
Rated power supply voltage	24 Vdc
24 Vdc I/O power segment current draw	35 mA
TM5 power bus 5 Vdc current draw	40 mA
Power dissipation	1.02 W max.
Weight	30 g (1.1 oz)
ID code	8214 dec

24 Vdc I/O Power Segment Characteristics

The following table shows the 24 Vdc I/O power segment characteristics of the TM5SPS1F electronic module:

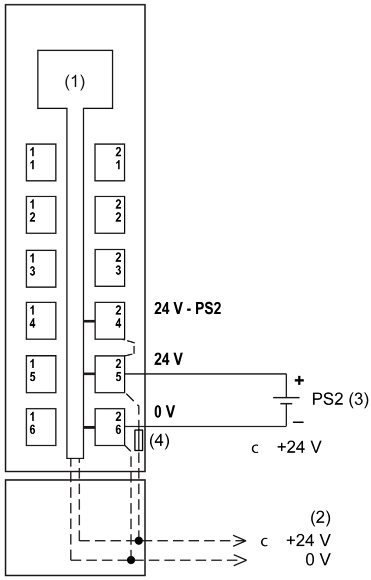
24 Vdc I/O Power Segment Characteristics	
Power supply range	20.4...28.8 Vdc
Rated power supply voltage	24 Vdc
Maximum current provided	6300 mA
Reverse polarity protection	No
Short circuit protection	Integrated fuse type T slow-blow 6.3 A 250 V exchangeable
Isolation between power segment and TM5 power and data buses	See note [1]

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

TM5SPS1F Wiring Diagram

Wiring Diagram

The following figure shows the wiring diagram for TM5SPS1F:



1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases
3 PS2: External isolated power supply 24 Vdc
4 Integrated fuse type T slow-blow 6.3 A 250 V exchangeable

⚠ 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.

Section B.3
TM5SPS2 PDM Electronic Module 24 Vdc I/O and TM5 Power Bus

What Is in This Section?

This section contains the following topics:

TM5SPS2 Presentation

Main Characteristics

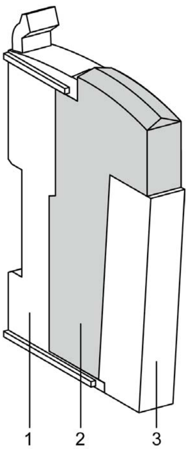
The TM5SPS2 power distribution module feeds the TM5 power bus as well as the 24 Vdc I/O power segment.

The table below describes the main characteristics of the TM5SPS2 electronic module:

Main characteristics	
Maximum current provided on 24 Vdc I/O power segment	10000 mA
TM5 power bus current generated	1136 mA

Ordering Information

The following figure and table gives the references to create a slice with the TM5SPS2 electronic module:

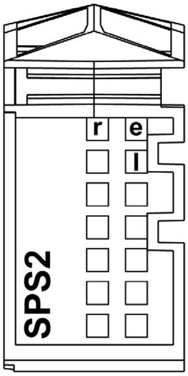


Number	Reference	Description	Color
1	TM5ACBM01R or TM5ACBM05R	Bus base 24 Vdc I/O power segment left isolated Bus base 24 Vdc I/O power segment left isolated with address setting	Gray Gray
2	TM5SPS2	Electronic module	Gray
3	TM5ACTBM12PS	Terminal block, 12-pin	Gray

NOTE: For more information, refer to TM5 Bus Bases and Terminal Blocks *(see page 339)*.

Status LEDs

The following figure shows the TM5SPS2 status LEDs:



The table below describes the TM5SPS2 status LEDs:

LED	Color	Status	Description
r	Green	Off	Power supply not connected
		Single flash	Reset state
		Flashing	Preoperational state
		On	RUN state
e	Red	Off	OK or module not connected
		Double flash	Indicates one of the following conditions: ● TM5 power bus is overloaded. ● 24 Vdc I/O power segment, via the external power supply or supplies, is too low. ● Input voltage for 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	TM5 power bus in the acceptable range
		On	TM5 power bus is overloaded

TM5SPS2 Characteristics

Introduction

This section gives the TM5SPS2 electronic module characteristics.

See also Environmental Characteristics *(see page 70)*.

⚠ 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.

General Characteristics

The following table shows the general characteristics of the TM5SPS2 electronic module:

General Characteristics	
Rated power supply voltage	24 Vdc
24 Vdc I/O power segment current draw	25 mA
Power dissipation	1.91 W max.
Weight	30 g (1.1 oz)
ID code	7104 dec

TM5 Power Bus Characteristics

The following table shows the TM5 power bus characteristics of the TM5SPS2 electronic module:

TM5 Power Bus Characteristics	
Power supply range	20.4...28.8 Vdc
Rated input current	0.7 A max. at 24 Vdc
Reverse polarity protection	Yes
Fuse	Integrated, can not be exchanged
Current generated	1136 mA
Parallel operation	Yes [2]
Electrical isolation	See note [1]

1 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.
2 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.

Temperature De-rating

These electronic modules are subject to temperature restrictions on TM5 power bus current generated

- - 10...55 °C (14...131 °F): 1136 mA
- 55...60 °C (131...140 °F): 740 mA

24 Vdc I/O Power Segment Characteristics

The following table shows the 24 Vdc I/O power segment characteristics of the TM5SPS2 electronic module:

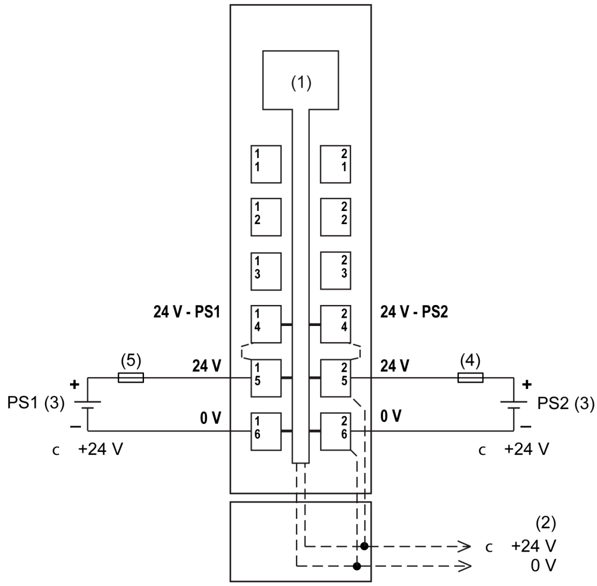
24 Vdc I/O Power Segment Characteristics	
Power supply range	20.4...28.8 Vdc
Rated power supply voltage	24 Vdc
Maximum current provided	10000 mA
Reverse polarity protection	No
Short circuit protection	External fuse type T slow-blow 10 A max. 250 V
Isolation between power segment and TM5 power and data buses	See note [1]

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

TM5SPS2 Wiring Diagram

Wiring Diagram

The following figure shows the wiring diagram for the TM5SPS2:



1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases
3 PS1/PS2: External isolated power supplies 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.**

Section B.4
TM5SPS2F PDM Electronic Module 24 Vdc I/O Fuse 6.3 A and TM5 Power Bus

What Is in This Section?

This section contains the following topics:

TM5SPS2F Presentation

Main Characteristics

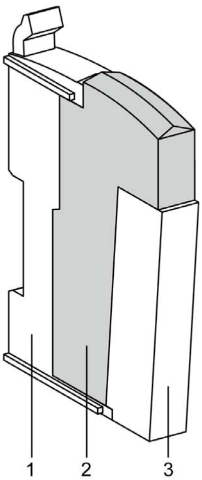
The TM5SPS2F power distribution module feeds the TM5 power bus as well as the 24 Vdc I/O power segment through an integrated exchangeable fuse.

The table below describes the main characteristics of the TM5SPS2F electronic module:

Main Characteristics	
Maximum current provided on 24 Vdc I/O power segment	6300 mA
TM5 power bus current generated	1136 mA

Ordering Information

The following figure and table gives the references to create a slice with the TM5SPS2F electronic module:

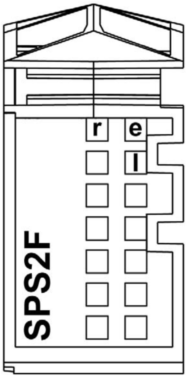


Number	Model Number	Description	Color
1	TM5ACBM01R or TM5ACBM05R	Bus base 24 Vdc I/O power segment left isolated Bus base 24 Vdc I/O power segment left isolated with address setting	Gray Gray
2	TM5SPS2F	Electronic module	Gray
3	TM5ACTBM12PS	Terminal block, 12-pin	Gray

NOTE: For more information, refer to TM5 Bus Bases and Terminal Blocks *(see page 339)*.

Status LEDs

The following figure shows the TM5SPS2F status LEDs:



The table below describes the TM5SPS2F status LEDs:

LED	Color	Status	Description
r	Green	Off	Power supply not connected
		Single flash	Reset state
		Flashing	Preoperational state
		On	RUN state
e	Red	Off	OK or module not connected
		Double flash	Indicates one of the following conditions: ● TM5 power bus is overloaded. ● 24 Vdc I/O power segment, via the external power supply or supplies, is too low. ● Input voltage for TM5 power bus, via the external power supply or supplies, is too low.
e+r	Steady red/single green flash		Invalid firmware
I	Red	Off	TM5 power bus in the acceptable range
		On	TM5 power bus is overloaded

TM5SPS2F Characteristics

Introduction

This section gives the TM5SPS2F electronic module characteristics.

See also Environmental Characteristics *(see page 70)*.

⚠ 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.

General Characteristics

The following table shows the general characteristics of the TM5SPS2F electronic module:

General Characteristics	
Rated power supply voltage	24 Vdc
24 Vdc I/O power segment current draw	35 mA
Power dissipation	2.13 W max.
Weight	30 g (1.1 oz)
ID code	8215 dec

TM5 Power Bus Characteristics

The following table shows the TM5 power bus characteristics of the TM5SPS2F electronic module:

TM5 Power Bus Characteristics	
Power supply range	20.4...28.8 Vdc
Rated input current	0.7 A max. at 24 Vdc
Reverse polarity protection	Yes
Fuse	Integrated, can not be exchanged
Current generated	1136 mA
Parallel operation	Yes [2]
Electrical isolation	See note [1]

1 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.
2 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.

Temperature De-rating

These electronic modules are subject to temperature restrictions on TM5 power bus current generated

- - 10...55 °C (14...131 °F): 1136 mA
- 55...60 °C (131...140 °F): 740 mA

24 Vdc I/O Power Segment Characteristics

The following table shows the 24 Vdc I/O power segment characteristics of the TM5SPS1 electronic module:

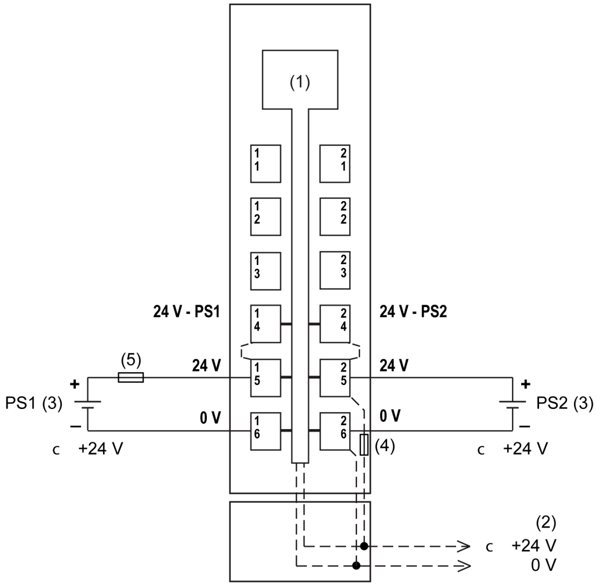
24 Vdc I/O Power Segment Characteristics	
Power supply range	20.4...28.8 Vdc
Rated power supply voltage	24 Vdc
Maximum current provided	6300 mA
Reverse polarity protection	No
Short circuit protection	Integrated fuse type T slow-blow 6.3 A 250 V exchangeable
Isolation between power segment and TM5 power and data buses	See note [1]

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

TM5SPS2F Wiring Diagram

Wiring Diagram

The following figure shows the wiring diagram for the TM5SPS2F:



1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases
3 PS2: External isolated power supply 24 Vdc
4 Integrated fuse type T slow-blow 6.3 A 250 V exchangeable
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.

Appendix C
TM5 Interface Power Distribution Module (IPDM)

What Is in This Chapter?

This chapter contains the following topics:

TM5SPS3 Presentation

Main Characteristics

The TM5SPS3 Interface Power Distribution Module (IPDM) consists of two dedicated electrical circuits:

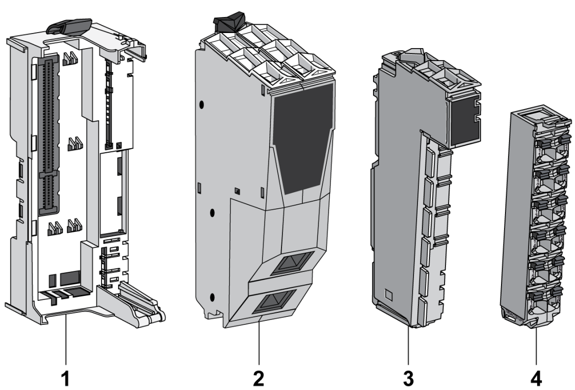
- a 24 Vdc Main power that serves the electronics of the field bus Interface Module and generates independent power for the TM5 power bus that serves the expansion modules.
- a 24 Vdc I/O power segment that serves:
  - the expansion modules,
  - the sensors and actuators connected to the expansion modules,
  - 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	10000 mA
TM5 power bus generated	750 mA

Ordering Information

The following figure and table provide the references to create a TM5 Sercos bus interface with the TM5SPS3 IPDM:



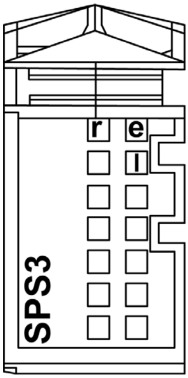
Number	Reference	Description	Color
1	TM5ACBN1	Bus base for Sercos bus interface module and Interface Power Distribution Module (IPDM) (*see page 38*)	White
2	TM5NS31	Sercos bus interface module	White

Number	Reference	Description	Color
3	TM5SPS3	Interface Power Distribution Module (IPDM)) *(see page 47)*	Grey
4	TM5ACTB12PS	Terminal block for PDM, IPDM and receiver electronic module *(see page 40)*	Grey

NOTE: For more information, refer to *TM5 Bus Bases and Terminal Blocks (see page 339)*.

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
I	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 *(see page 70)*.

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
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:

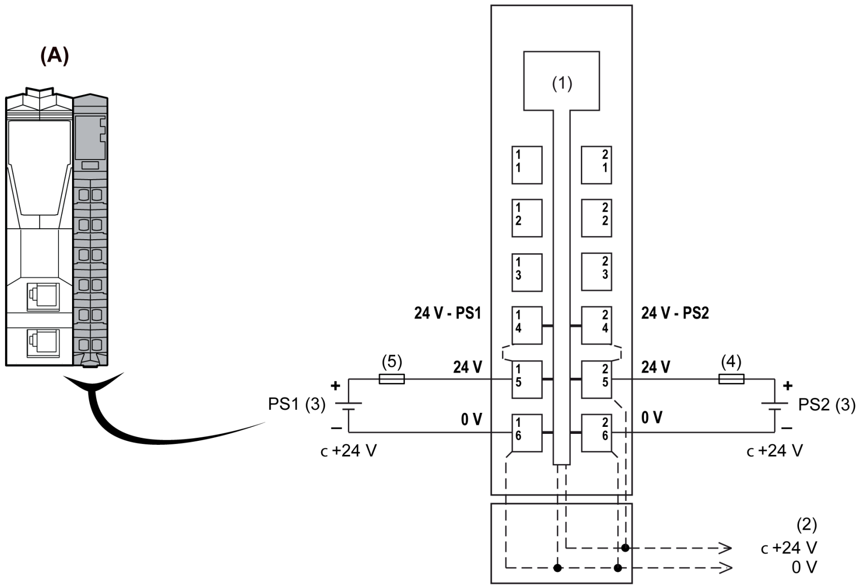
24 Vdc I/O Power Segment Characteristics	
Power supply range	20.4...28.8 Vdc
Rated power supply voltage	24 Vdc
Maximum current provided	10 A
Reverse polarity protection	No
Short circuit protection	External fuse type T slow-blow 10 A max. 250 V
Isolation between power segment and TM5 buses	See note [1]

[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.

Appendix D
TM5 Common Distribution Modules (CDM)

Overview

This chapter describes TM5 Common Distribution Modules (CDM) for designing your TM5 System.

What Is in This Chapter?

This chapter contains the following sections:

Section D.1
TM5SPDG12F Electronic Module 12 x 0 Vdc

What Is in This Section?

This section contains the following topics:

TM5SPDG12F Presentation

Main Characteristics

The TM5SPDG12F CDM provides 12 x 0 Vdc terminal connections from the 24 Vdc I/O power segment, which opens up additional wiring possibilities for sensors and actuators.

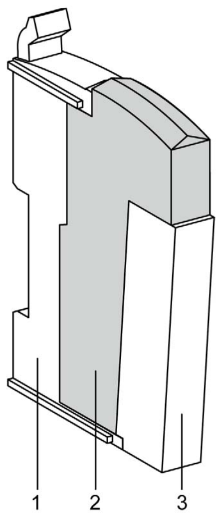
The module is equipped with an exchangeable fuse between the 0 Vdc potential on the terminal block and the 0 Vdc of the 24 Vdc I/O power segment. The status of the fuse is available with the status LEDs and in the I/O mapping tab *(see Modicon TM5, Expansion Modules Configuration, Programming Guide)* of the SoMachine software.

The table below gives you the main characteristics of the TM5SPDG12F electronic module:

Main Characteristics		
Power supply source	24 Vdc I/O power segment	
Type of common connections	0 Vdc	24 Vdc
Number of common connections	12	0

Ordering Information

The following figure and table gives the references to create a slice with the TM5SPDG12F:

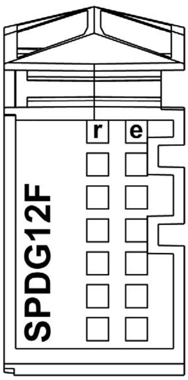


Number	Model Number	Description	Color
1	TM5ACBM11 or TM5ACBM15	Bus base Bus base with address setting	White White
2	TM5SPDG12F	Electronic module	White
3	TM5ACTB12	Terminal block, 12-pin	White

NOTE: For more information, refer to TM5 Bus Bases and Terminal Blocks *(see page 339)*.

Status LEDs

The following figure shows the TM5SPDG12F status LEDs:



The table below describes the TM5SG12F status LEDs:

LEDs	Color	Status	Description
r	Green	Off	Module supply not connected
		Single flash	Reset state
		Flashing	Preoperational state
		On	RUN state
e	Red	Off	Ok or no power supply
		On	Detected error or reset state
		Single Flash	Fuse is blown or missing
e+r	Steady red / single green flash		Invalid firmware

TM5SPDG12F Characteristics

Introduction

This section gives the TM5SPDG12F electronic module characteristics.

See also **Environmental Characteristics** *(see page 70)*.

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.

General Characteristics

The following table shows the general characteristics of the TM5SPDG12F electronic module:

General Characteristics	
Rated power supply voltage Power supply source	0 Vdc Connected to the 0 Vdc of the 24 Vdc I/O power segment.
Status indicators	Operating state, module status
24 Vdc I/O power segment current draw	6300 mA max.
TM5 power bus 5 Vdc current draw	24 mA
Power dissipation	1.12 W max.
Weight	25 g (0.9 oz)
ID code	9853 dec

Common Characteristics

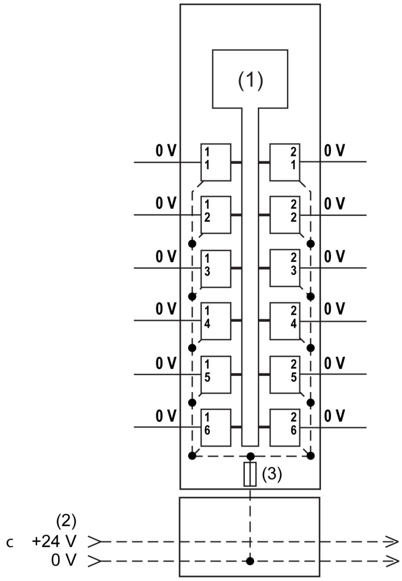
The following table shows the common characteristics of the TM5SPDG12F electronic module:

Common Characteristics	
Rated output voltage	0 Vdc from the 24 Vdc I/O power segment
Protection	Integrated fuse type T slow-blow 6.3 A 250 V exchangeable

TM5SPDG12F Wiring Diagram

Wiring Diagram

The following figure shows the wiring diagram for the TM5SPDG12F:

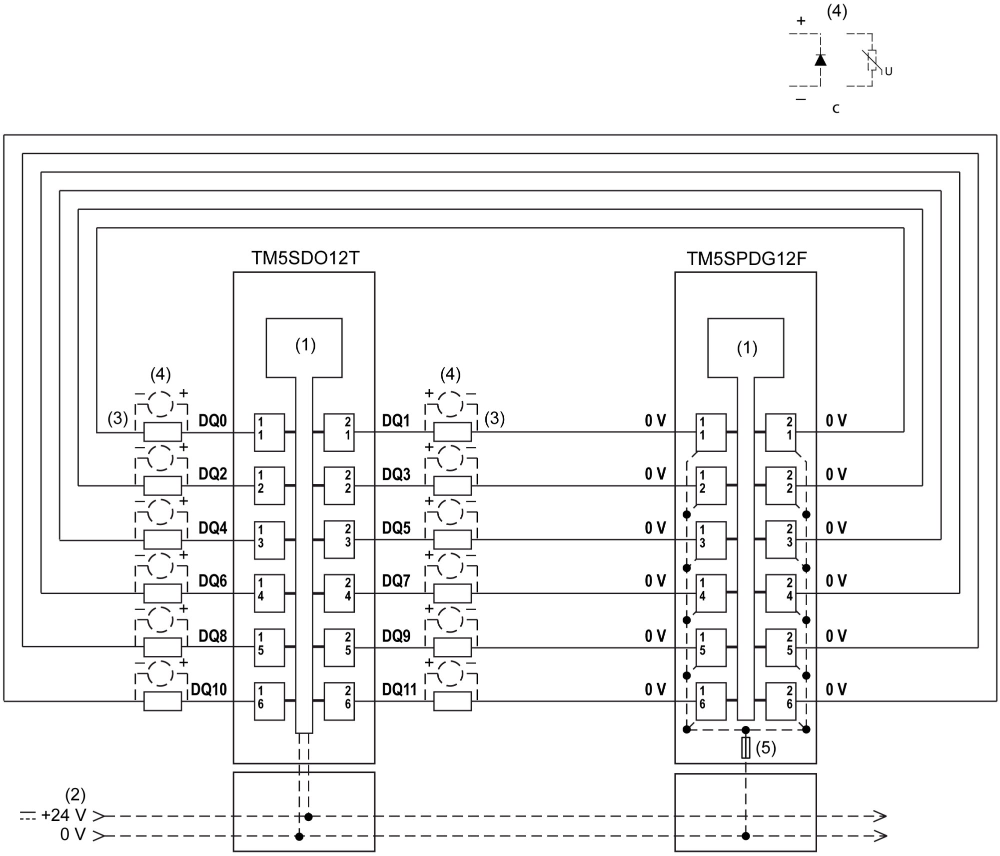


1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases
3 Integrated fuse type T slow-blow 6.3 A 250 V exchangeable

NOTE: Common Distribution Modules (CDMs) and the devices they serve must all share the same external power source. That is to say, I/O electronic modules, the field devices connected to them and the CDM must all reside on the same 24 Vdc I/O power segment. If not, the status LEDs may not function correctly. In addition, there may potentially be more significant consequences such as an explosion and/or fire hazard.

⚠ WARNING
POTENTIAL EXPLOSION OR FIRE You must connect the returns from the devices to the same power source as the 24 Vdc I/O power segment serving the module. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

The following figure shows the wiring diagram for the TM5SPDG12F with a TM5SDO12T:



1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases
3 1-wire load
4 Inductive load protection
5 Integrated fuse type T slow-blow 6.3 A 250 V exchangeable

⚠ 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.

Section D.2
TM5SPDD12F Electronic Module 12 x 24 Vdc

What Is in This Section?

This section contains the following topics:

TM5SPDD12F Presentation

Main Characteristics

The TM5SPDD12F CDM provides 12 x 24 Vdc terminal connections from the 24 Vdc I/O power segment, which opens up additional wiring possibilities for sensors and actuators.

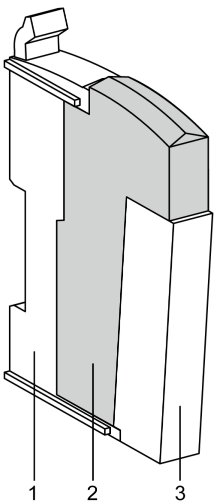
The module is equipped with an exchangeable fuse between the 24 Vdc potential on the terminal block and the 24 Vdc of the 24 Vdc I/O power segment. The status of the fuse is available with the status LEDs and in the I/O mapping tab *(see Modicon TM5, Expansion Modules Configuration, Programming Guide)* of the SoMachine software.

The table below gives you the main characteristics of the TM5SPDD12F electronic module:

Main Characteristics		
Power supply source	24 Vdc I/O power segment	
Type of common connections	0 Vdc	24 Vdc
Number of common connections	0	12

Ordering Information

The following figure shows a slice with the TM5SPDD12F:

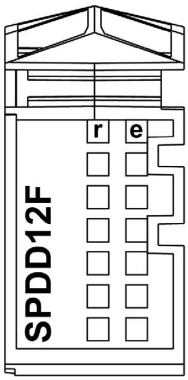


Number	Model Number	Description	Color
1	TM5ACBM11 or TM5ACBM15	Bus base Bus base with address setting	White White
2	TM5SPDD12F	Electronic module	White
3	TM5ACTB12	Terminal block, 12-pin	White

NOTE: For more information, refer to TM5 Bus Bases and Terminal Blocks *(see page 339)*.

Status LEDs

The following figure shows the TM5SPDD12F status LEDs:



The table below describes the TM5SPDD12F status LEDs:

LEDs	Color	Status	Description
r	Green	Off	Module supply not connected
		Single flash	Reset state
		Flashing	Preoperational state
		On	RUN state
e	Red	Off	Ok or no power supply
		On	Detected error or reset state
		Single Flash	Fuse is blown or missing
e+r	Steady red / single green flash		Invalid firmware

TM5SPDD12F Characteristics

Introduction

This section gives the TM5SPDD12F module characteristics.

See also **Environmental Characteristics** *(see page 70)*.

⚠ 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.

General Characteristics

The following table shows the general characteristics of the TM5SPDD12F electronic module:

General Characteristics	
Rated power supply voltage Power supply source	24 Vdc Connected to the 24 Vdc of the 24 Vdc I/O power segment.
Status indicators	Operating state, module status
24 Vdc I/O power segment current draw	6300 mA max.
TM5 power bus 5 Vdc current draw	24 mA
Power dissipation	1.12 W max.
Weight	25 g (0.9 oz)
ID code	9854 dec

Common Characteristics

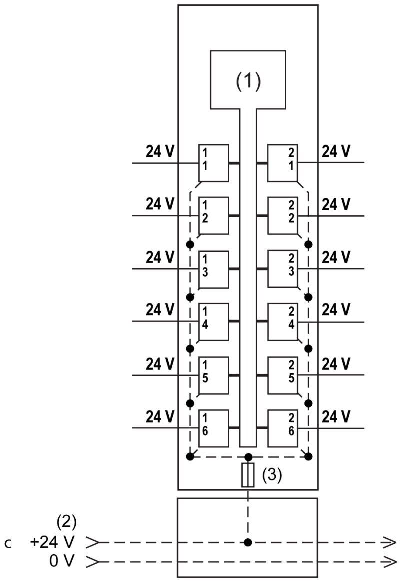
The following table shows the common characteristics of the TM5SPDD12F electronic module:

Common Characteristics	
Rated output voltage	24 Vdc from the 24 Vdc I/O power segment
Protection	Integrated fuse type T slow-blow 6.3 A 250 V exchangeable

TM5SPDD12F Wiring Diagram

Wiring Diagram

The following figure shows the wiring diagram for the TM5SPDD12F:

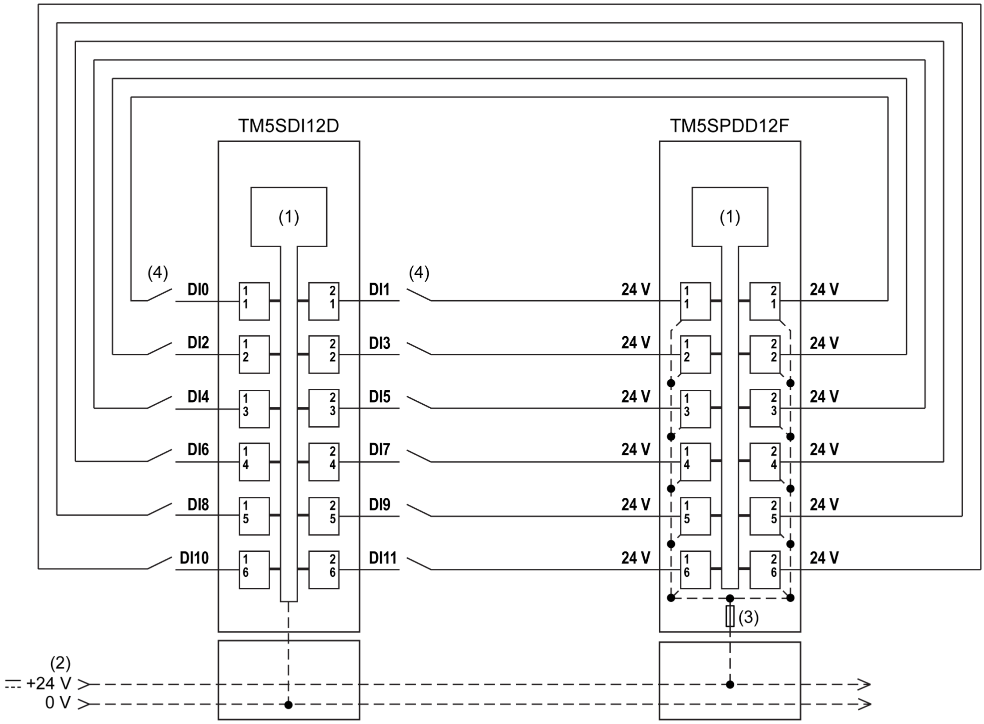


1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases
3 Integrated fuse type T slow-blow 6.3 A 250 V exchangeable

NOTE: Common Distribution Modules (CDMs) and the devices they serve must all share the same external power source. That is to say, I/O electronic modules, the field devices connected to them and the CDM must all reside on the same 24 Vdc I/O power segment. If not, the status LEDs may not function correctly. In addition, there may potentially be more significant consequences such as an explosion and/or fire hazard.

⚠ WARNING
POTENTIAL EXPLOSION OR FIRE You must connect the returns from the devices to the same power source as the 24 Vdc I/O power segment serving the module. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

The following figure shows the wiring diagram for the TM5SPDD12F with a TM5SDI12D:



1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases
3 Integrated fuse type T slow-blow 6.3 A 250 V exchangeable
4 1-wire sensor

⚠ 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.

Section D.3
TM5SPDG5D4F Electronic Module 5 x 0 Vdc and 5 x 24 Vdc

What Is in This Section?

This section contains the following topics:

TM5SPDG5D4F Presentation

Main Characteristics

The TM5SPDG5D4F CDM provides 5 x 0 Vdc and 5 x 24 Vdc terminal connections from an external 24 Vdc power source. There is no connection to the 24 Vdc I/O power segment.

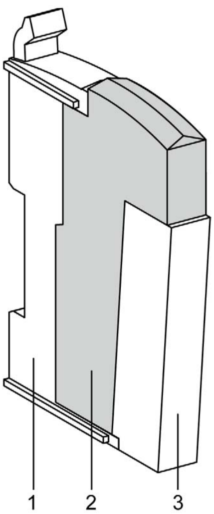
The module is equipped with an exchangeable fuse between the 24 Vdc potential on the terminal block and the external 24 Vdc power source. The status of the fuse is available with the status LEDs and in the I/O mapping tab *(see Modicon TM5, Expansion Modules Configuration, Programming Guide)* of the SoMachine software.

The table below gives you the main characteristics of the TM5SPDG5D4F electronic module:

Main Characteristics		
Power supply source	External 24 Vdc power source	
Type of common connections	0 Vdc	24 Vdc
Number of common connections	5	5

Ordering Information

The following figure shows a slice with the TM5SPDG5D4F electronic module:

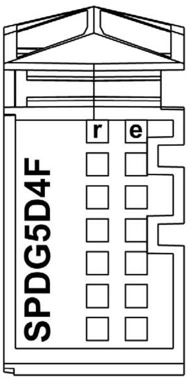


Number	Model Number	Description	Color
1	TM5ACBM11 or TM5ACBM15	Bus base Bus base with address setting	White White
2	TM5SPDG5D4F	Electronic module	White
3	TM5ACTB12	Terminal block, 12-pin	White

NOTE: For more information, refer to TM5 Bus Bases and Terminal Blocks *(see page 339)*.

Status LEDs

The following figure shows the TM5SPDG5D4F status LEDs:



The table below describes the TM5SPDG5D4F status LEDs:

LEDs	Color	Status	Description
r	Green	Off	Module supply not connected
		Single flash	Reset state
		Flashing	Preoperational state
		On	RUN state
e	Red	Off	Ok or no power supply
		On	Detected error or reset state
		Single Flash	Fuse is blown or missing
		Double Flash	Feed voltage too low
e+r	Steady red / single green flash		Invalid firmware

TM5SPDG5D4F Characteristics

Introduction

This section gives the TM5SPDG5D4F module characteristics.

See also **Environmental Characteristics** *(see page 70)*.

⚠ 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.

General Characteristics

The following table shows the general characteristics of the TM5SPDG5D4F electronic module:

General Characteristics	
Rated power supply voltage Power supply source	24 Vdc Connected to an external 24 Vdc power source
Power supply range	20.4...28.8 Vdc
Status indicators	Operating state, module status
24 Vdc I/O power segment current draw	Not connected
TM5 power bus 5 Vdc current draw	24 mA
Power dissipation	1.27 W max.
Weight	25 g (0.9 oz)
ID code	9856 dec

Common Characteristics

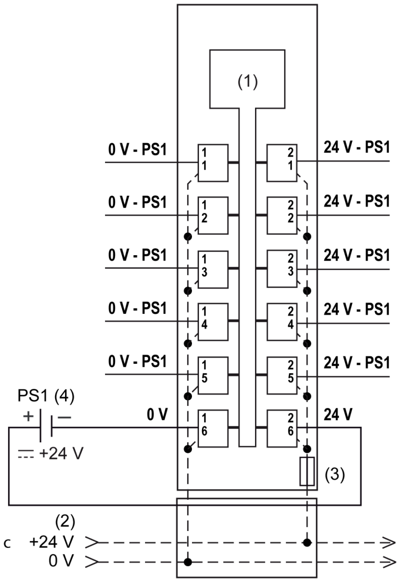
The following table shows the common characteristics of the TM5SPDG5D4F electronic module:

Common Characteristics	
Power supply range	20.4...28.8 Vdc
Rated output voltage	0 Vdc and 24 Vdc from the external 24 Vdc power source
Protection	Integrated fuse type T slow-blow 6.3 A 250 V exchangeable

TM5SPDG5D4F Wiring Diagram

Wiring Diagram

The following figure shows the wiring diagram for the TM5SPDG5D4F:



1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases
3 Integrated fuse type T slow-blow 6.3 A 250 V exchangeable
4 PS1: External isolated power supplies 24 Vdc

⚠ 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.

Section D.4
TM5SPDG6D6F Electronic Module 6 x 0 Vdc and 6 x 24 Vdc

What Is in This Section?

This section contains the following topics:

TM5SPDG6D6F Presentation

Main Characteristics

The TM5SPDG6D6F CDM provides 6 x 0 Vdc and 6 x 24 Vdc terminal connections from the 24 Vdc I/O power segment.

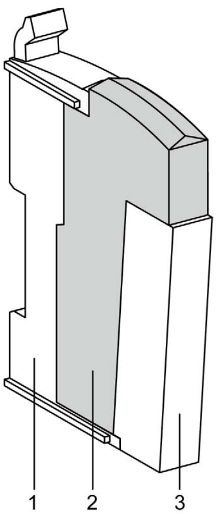
The module is equipped with an exchangeable fuse between the 24 Vdc potential on the terminal block and the 24 Vdc of the 24 Vdc I/O power segment. The status of the fuse is available with both the status LEDs and in the I/O mapping tab *(see Modicon TM5, Expansion Modules Configuration, Programming Guide)* of the SoMachine software.

The table below gives you the main characteristics of the TM5SPDG6D6F electronic module:

Main Characteristics		
Power supply source	24 Vdc I/O power segment	
Type of common connections	0 Vdc	24 Vdc
Number of common connections	6	6

Ordering Information

The following figure shows a slice with the TM5SPDG6D6F electronic module:

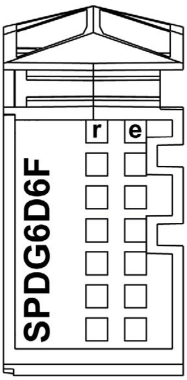


Number	Model Number	Description	Color
1	TM5ACBM11 or TM5ACBM15	Bus base Bus base with address setting	White White
2	TM5SPDG6D6F	Electronic module	White
3	TM5ACTB12	Terminal block, 12-pin	White

NOTE: For more information, refer to TM5 Bus Bases and Terminal Blocks *(see page 339)*.

Status LEDs

The following figure shows the TM5SPDG6D6F status LEDs:



The table below describes the TM5SPDG6D6F status LEDs:

LEDs	Color	Status	Description
r	Green	Off	Module supply not connected
		Single flash	Reset state
		Flashing	Preoperational state
		On	RUN state
e	Red	Off	Ok or no power supply
		On	Detected error or reset state
		Single flash	Fuse is blown or missing
		Double flash	Feed voltage too low
		Triple flash	24 Vdc I/O power segment OK, fuse is blown and feed voltage is too low
e+r	Steady red / single green flash		Invalid firmware

TM5SPDG6D6F Characteristics

Introduction

This section gives the TM5SPDG6D6F module characteristics.

See also **Environmental Characteristics** *(see page 70)*.

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.

General Characteristics

The following table shows the general characteristics of the TM5SPDG6D6F electronic module:

General Characteristics	
Rated power supply voltage Power supply source	0 Vdc and 24 Vdc Connected to the 24 Vdc I/O power segment.
Status indicators	Operating state, module status
24 Vdc I/O power segment current draw	6300 mA max.
TM5 power bus 5 Vdc current draw	24 mA
Power dissipation	1.27 W max.
Weight	25 g (0.9 oz)
ID code	9855 dec

Common Characteristics

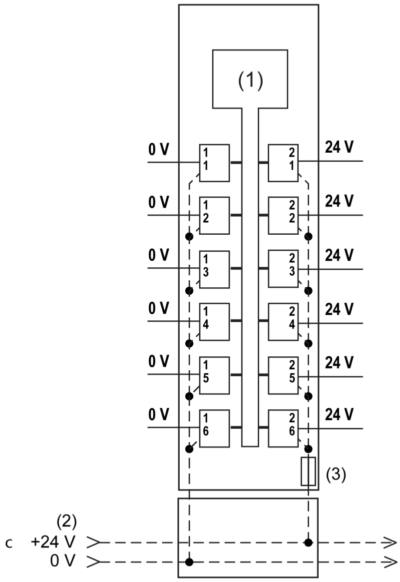
The following table shows the common characteristics of the TM5SPDG6D6F electronic module:

Common Characteristics	
Rated output voltage	0 Vdc and 24 Vdc from the 24 Vdc I/O power segment
Protection	Integrated fuse type T slow-blow 6.3 A 250 V exchangeable

TM5SPDG6D6F Wiring Diagram

Wiring Diagram

The following figure shows the wiring diagram for the TM5SPDG6D6F:

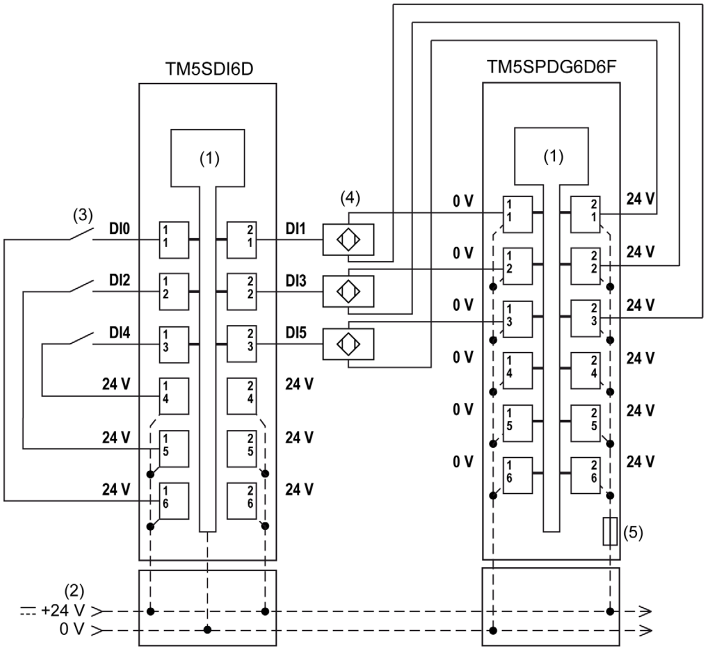


1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases
3 Integrated fuse type T slow-blow 6.3 A 250 V exchangeable

NOTE: Common Distribution Modules (CDMs) and the devices they serve must all share the same external power source. That is to say, I/O electronic modules, the field devices connected to them and the CDM must all reside on the same 24 Vdc I/O power segment. If not, the status LEDs may not function correctly. In addition, there may potentially be more significant consequences such as an explosion and/or fire hazard.

⚠ WARNING
POTENTIAL EXPLOSION OR FIRE You must connect the returns from the devices to the same power source as the 24 Vdc I/O power segment serving the module. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

The following figure shows the wiring diagram for the TM5SPDG6D6F with a TM5SDI6D:



1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases
3 2-wire sensor
4 3-wire sensor
5 Integrated fuse type T slow-blow 6.3 A 250 V exchangeable

⚠ 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.

Appendix E
TM5 Accessories Modules

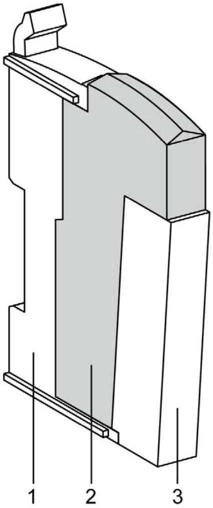
TM5SD000 Dummy Module

General Information

TM5SD000 dummy module is a non-functional module. This module is used as a place holder for later system expansion according to the TM5 association table *(see page 248)*.

Ordering Information

The following figure shows a slice with the TM5SD000 dummy module:

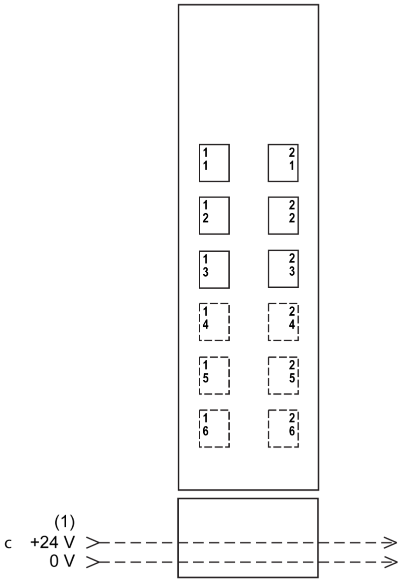


Number	Reference	Description	Color
1	TM5ACBM11 or TM5ACBM15	Bus base Bus base with address setting	White White
2	TM5DSD000	Dummy module	White
3	TM5ACTB06 or TM5ACTB12	Terminal block, 6-pin Terminal block, 12-pin	White White

General Characteristics

The characteristics of the TM5SD000 dummy module are described in environmental characteristics *(see page 70)*.

Wiring Diagram



1 24 Vdc I/O power segment integrated into the bus bases

Appendix F
TM5 Bus Bases and Terminal Blocks

Overview

This chapter describes the bus bases and terminal blocks for designing your TM5 System.

What Is in This Chapter?

This chapter contains the following topics:

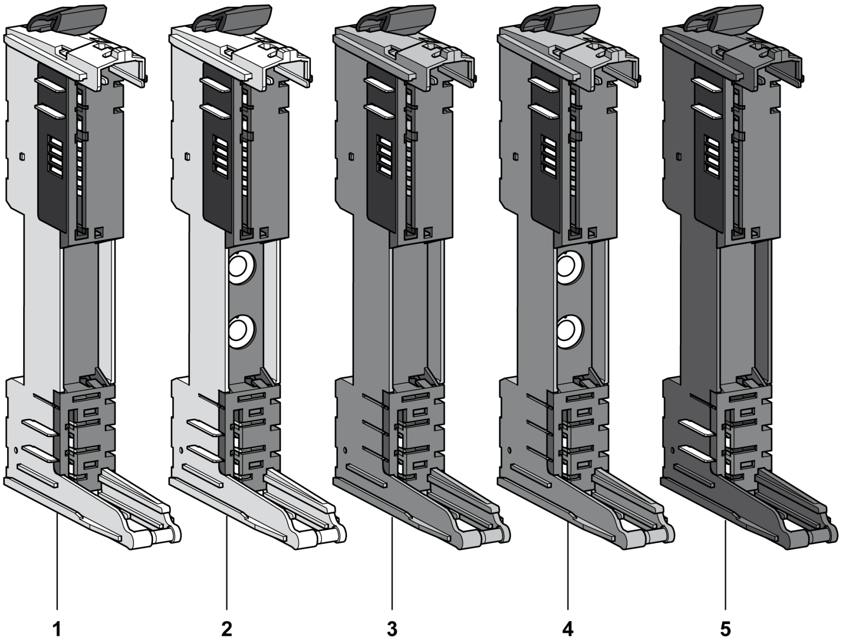
TM5 System Bus Bases

Overview

The TM5 System bus bases are divided into different groups:

- TM5ACBM11 and TM5ACBM15 white bus bases are designed for 24 Vdc electronic modules.
- TM5ACBM01R and TM5ACBM05R gray bus bases are designed for Power Distribution Modules (PDM) and receiver modules.
- The TM5ACBM12 black bus base is designed for input or output Alternative Current (AC) electronic modules.

The following figure shows the TM5 System bus bases:



Number	Reference	Description	Color
1	TM5ACBM11	Bus base 24 Vdc 24 Vdc I/O power segment pass-through	White
2	TM5ACBM15	Bus base 24 Vdc 24 Vdc I/O power segment pass-through with address setting *(see page 163)*	White
3	TM5ACBM01R	Bus base 24 Vdc for PDM and Receiver modules 24 Vdc I/O power segment left isolated	Gray
4	TM5ACBM05R	Bus base 24 Vdc for PDM and Receiver modules 24 Vdc I/O power segment left isolated with address setting *(see page 163)*	Gray
5	TM5ACBM12	Bus base for AC modules 24 Vdc I/O power segment pass through	Black

NOTE: Electronic modules with relays for 30 Vdc / 230 Vac must be associated with TM5ACBM12 bus bases.

A slice must only be composed of a single color. For example, a gray bus base should only be assembled with a gray electronic module and a gray terminal block. However, color alone is not sufficient for compatibility; always confirm that functionality of slice components matches as well.

DANGER

INCOMPATIBLE COMPONENTS CAUSE ELECTRONIC SHOCK OR ARC FLASH

- Do not associate components of a slice that have different colors.
- Always confirm the compatibility of slice components and modules before installation using the association table in this manual.
- Ensure that a correct terminal block is installed on the appropriate electronic module.

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

General Characteristics

This section gives the TM5 System bus bases characteristics. See also environmental characteristics *(see page 70)*.

⚠ 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 following table shows the technical data for TM5 System bus bases:

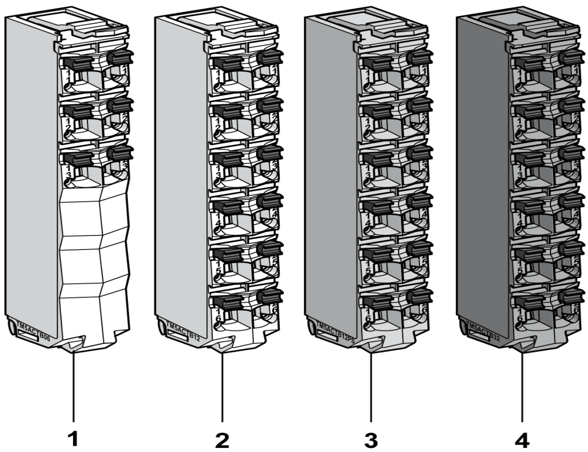
General Characteristics	
TM5 power bus current draw	26 mA
Power dissipation	0.13 W max.

TM5 System Terminal Blocks

Overview

The main features of the terminal blocks are:
- Tool-free wiring *(see page 115)* with spring clamp push-in technology
- Simple push-button wire release
- Ability to label *(see page 174)* each terminal
- Plain text labeling *(see page 181)* also possible
- Test access *(see page 184)* for standard probes
- Can be custom-coded *(see page 167)*

The following figure shows the TM5 System terminal blocks:



Number	Reference	Description	Color
1	TM5ACTB06	6-pin terminal block designed for 24 Vdc I/O modules and TM5SBET1 Transmitter module.	White
2	TM5ACTB12	12-pin terminal block designed for 24 Vdc I/O modules, Common Distribution Modules (CDM) and Transmitter modules.	White
3	TM5ACTB12PS	12-pin terminal block designed for 24 Vdc Power Distribution Modules (PDM), 24 Vdc Interface Power distribution Module (IPDM) and Receiver module.	Gray
4	TM5ACTB32	12-pin terminal block designed for AC and I/O relays modules.	Black
5	TM5ACTB16	16-pin terminal block designed for 24 Vdc I/O modules, Common Distribution Modules (CDM) and Transmitter modules.	White

A slice must only be composed of a single color. For example, a gray bus base should only be assembled with a gray electronic module and a gray terminal block. However, color alone is not sufficient for compatibility; always confirm that functionality of slice components matches as well.

DANGER

INCOMPATIBLE COMPONENTS CAUSE ELECTRONIC SHOCK OR ARC FLASH

- Do not associate components of a slice that have different colors.
- Always confirm the compatibility of slice components and modules before installation using the association table in this manual.
- Ensure that a correct terminal block is installed on the appropriate electronic module.

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

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.

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.

The following table shows the technical data for TM5 System terminal blocks, see also environmental characteristics *(see page 70)*:

General Characteristics		
Type of terminal		Spring-clamp push-in terminal
Contact resistance		≤5 mΩ
Maximum voltage[1]		300 V
Current[1]		10 A max. per connector
Weight	TM5ACTB06	16 g (0.6 oz)
	TM5ACTB12 TM5ACTB12PS TM5ACTB16 TM5ACTB32	20 g (0.7 oz)
Connection cross section:		
Solid wire line		0.08 mm²...2.5 mm² (AWG 28...14) or 0.08 mm²...1.5 mm² (AWG 28...16)[3]
Fine wire line		0.25 mm²...2.5 mm² (AWG 24...14) or 0.25 mm²...1.5 mm² (AWG 24...16)[3]
With wire cable end		0.25 mm²...1.5 mm² (AWG 24...16) or 0.25 mm²...0.75 mm² (AWG 24...20)[3]
With double wire cable end[2]		2 x 0.25...2 x 0.75 mm² (AWG 2 x 24...2 x 18)
Wire		Follow the wiring rules *(see page 115)*.
Note: **1** Connected voltage and current depends on I/O electronics modules associated. **2** Not applicable for TM5ACTB16. **3** Only for TM5ACTB16.		

⚠ 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.

Maximum Insertion/Removal Cycles

The TM5 System bus bases are designed to withstand up to 50 electronic module insertion/removal cycles.

NOTE: If electronic modules are inserted and removed from a bus base more than 50 times, the integrity of the electronic module-to-bus base contacts will be subject to possible degradation. Be sure the history of your electronic modules is known.

Appendix G
TM7 Power Distribution Block (PDB)

Overview

This chapter describes the TM7SPS1A Power Distribution Block (PDB) for designing your TM7 System.

What Is in This Chapter?

This chapter contains the following topics:

TM7SPS1A Presentation

Main Characteristics

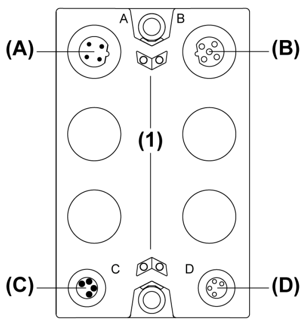
The TM7SPS1A PDB supplies the TM7 power bus.

The following table provides the main characteristics of the TM7SPS1A block:

Main Characteristics	
Rated output power	15 W
Rated input voltage	24 Vdc
Rated output voltage	20 Vdc
Rated output current	750 mA
TM7 bus connection type	M12, B coded, male and female connector types
Power supply connection type	M8, 4-pin, male and female connector types

Description

The following figure illustrates the TM7SPS1A block:

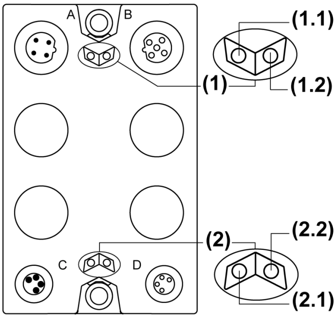


(A) TM7 bus IN connector
(B) TM7 bus OUT connector
(C) 24 Vdc power IN connector
(D) 24 Vdc power OUT connector
(1) Status LEDs

NOTE: Refer also to Status LEDs *(see page 349)*.

Status LEDs

The following figure illustrates the status LEDs of the TM7SPS1A block:



(1) TM7 power bus status LEDs, set of two LEDs: 1.1 (green) and 1.2 (green)
(2) Power status LEDs, set of two LEDs: 2.1 (orange) and 2.2 (orange)

The table below describes the TM7 power bus status LEDs of the TM7SPS1A block:

TM7 power bus status LEDs		Description
LED 1.1	**LED 1.2**	
OFF	OFF	No power supply on TM7 Bus, or detected error on TM7 Power bus
ON	ON	TM7 power supply is in valid range

The table below describes the power status LEDs of the TM7SPS1A block:

Power status LEDs		Description
LED 2.1	**LED 2.2**	
OFF	OFF	No power supply, or power supply below the lower limit value
ON	ON	Power block supply is in valid range

TM7SPS1A Characteristics

General Characteristics

⚠ DANGER

FIRE HAZARD

Use cable sizes that meet the I/O channel and power supply voltage and current ratings.

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 describes the general characteristics of the TM7SPS1A block:

General Characteristics	
Rated power supply voltage	24 Vdc
Power supply range	18...30 Vdc
Rated input current	750 mA
Protection	Internal fuse not replaceable
Power dissipation	3 W max.
Weight	190 g (6.7 oz)

See also Environmental Characteristics *(see page 194)*.

Output Characteristics

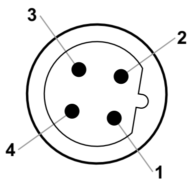
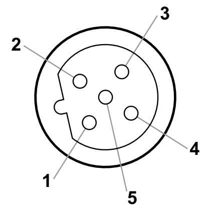
The table below describes the output characteristics of the TM7SPS1A block:

Output Characteristics	
Rated output power	15 W
Rated output voltage	20 Vdc
Output current	750 mA max.
Internal protection	Overload and short circuit
Supply failure holdup time	5 ms min. at 24 Vdc input voltage and Iout max.
Parallel operation	Yes, protection with redundancy during parallel operation of multiple PDBs
Redundant operation	Yes, if connected to the same input power supply

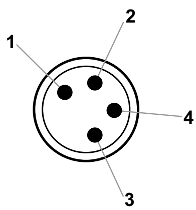
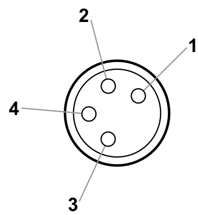
TM7SPS1A Wiring Diagram

Pin Assignments

The following figure shows the pin assignment of the TM7 bus IN (A) and OUT (B) connectors:

Connector (A)	Pin	Designation	Connector (B)
	1	TM7 V+	
	2	TM7 Bus Data	
	3	TM7 0V	
	4	TM7 Bus $\overline{\text{Data}}$	
	5	N.C.	

The following figure shows the pin assignment of the 24 Vdc power IN (C) and OUT (D) connectors:

Connector (C)	Pin	Designation	Connector (D)
	1	24 Vdc Main power	
	2	24 Vdc Main power	
	3	0 Vdc	
	4	0 Vdc	

⚠ DANGER

FIRE HAZARD

Use cable sizes that meet the I/O channel and power supply voltage and current ratings.

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

Use shielded, properly grounded cables for all analog and high-speed inputs or outputs and 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 wherever specified for inputs, outputs and communication connections.
- Properly ground the cable shields as indicated in the related documentation.
- Route communication and I/O cables separately from power cables.

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

⚠ WARNING

ELECTROMAGNETIC INTERFERENCE

- Do not connect cables to connectors that are not properly wired to the sensor or actuator.
- Always use sealing plugs for any unused connectors.

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

⚠ WARNING

IP67 NON-CONFORMANCE

- Properly fit all connectors with cables or sealing plugs and tighten for IP67 conformance according to the torque values as specified in this document.
- Do not connect or disconnect cables or sealing plugs in the presence of water or moisture.

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

Appendix H
TM7 Cables

Overview

This chapter describes the TM7 cables for wiring your TM7 System.

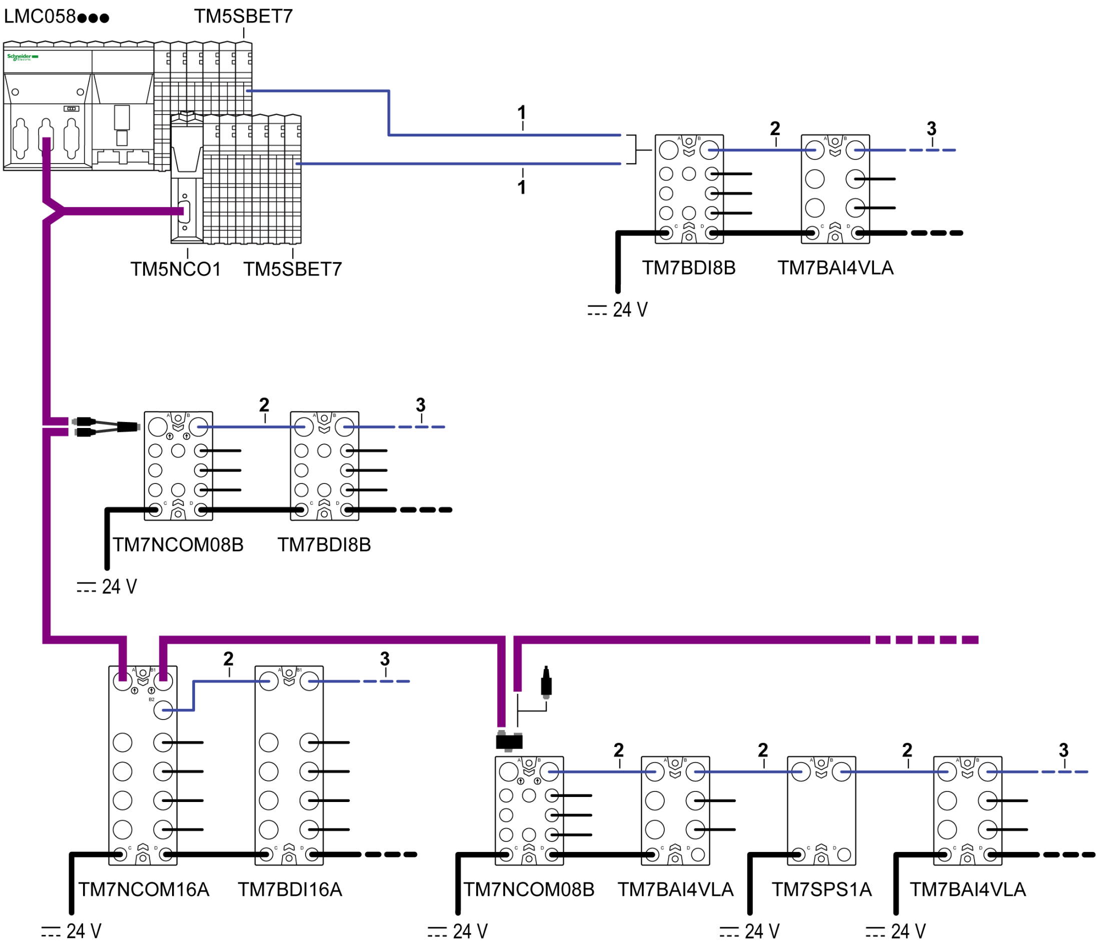
What Is in This Chapter?

This chapter contains the following topics:

Expansion Bus Cables

Overview

The following figure shows expansion bus cables used in TM5/TM7 configurations:



1 Attachment IN cable: to connect a TM7 I/O block after a TM5 configuration using a TM5SBET7 transmitter module.
2 Drop cable: to build TM7 expansion bus between TM7 expansions blocks.
3 Attachment OUT cable: to connect a TM5 remote island after a TM7 I/O block using a TM5SBER2 receiver module.

Ordering Information

Length	Short Description, Reference					
	Drop Cable		**Attachment IN Cable**		**Attachment OUT Cable**	
0.3 m (1 ft)	TCSXCN2M2F03E	TCSXCN1M1F03E	–	–	–	–
1 m (3.3 ft)	TCSXCN2M2F1E	TCSXCN1M1F1E	TCSXCN2FNX1E	TCSXCN1FNX1E	TCSXCN2MNX1E	TCSXCN1MNX1E
2 m (6.6 ft)	TCSXCN2M2F2E	TCSXCN1M1F2E	–	–	–	–
3 m (9.8 ft)	–	–	TCSXCN2FNX3E	TCSXCN1FNX3E	TCSXCN2MNX3E	TCSXCN1MNX3E
5 m (16.4 ft)	TCSXCN2M2F5E	TCSXCN1M1F5E	–	–	–	–
10 m (32.8 ft)	TCSXCN2M2F10E	TCSXCN1M1F10E	TCSXCN2FNX10E	TCSXCN1FNX10E	TCSXCN2MNX10E	TCSXCN1MNX10E
15 m (49.2 ft)	TCSXCN2M2F15E	TCSXCN1M1F15E	–	–	–	–
25 m (82 ft)	–	–	TCSXCN2FNX25E	TCSXCN1FNX25E	TCSXCN2MNX25E	TCSXCN1MNX25E
Dimensions and Pin Assignment	TCSXCN2M2F••E  (*see page 360*)	TCSXCN1M1F••E  (*see page 361*)	TCSXCN2FNX••E  (*see page 362*)	TCSXCN1FNX••E  (*see page 363*)	TCSXCN2MNX••E  (*see page 364*)	TCSXCN1MNX••E  (*see page 365*)

Cable Characteristics

The table below describes the characteristics of the individual wire pairs of the cable:

Wire	Characteristics	Value
Power pair	Conductor cross section (gauge)	0.34 mm^2 (AWG 22)
	Material insulation	Polyolefin
	Core diameter including insulation	1.40 mm (0.05 in.) ± 0.05 mm (0.002 in.)
	Electrical resistance (at 20 °C)	≤ 0.052 Ω/m (0.016 Ω/ft)
	Insulation resistance (at 20 °C)	≥ 100 MΩ*km (328 GΩ*ft)
	Nominal voltage	300 V
	Test voltage conductor	2000 Vdc x 1 s
Data pair	Conductor cross section (gauge)	0.2 mm^2 (AWG 24)
	Material insulation	Foam-skin PE
	Core diameter including insulation	2.05 mm (0.08 in.) ± 0.1 mm (0.004 in.)
	Electrical resistance (at 20 °C)	≤ 0.078 Ω/m (0.024 Ω/ft)
	Insulation resistance (at 20 °C)	≥ 5000 MΩ*km (16.4 TΩ*ft)
	Characteristic impedance (at 5 MHz)	120 Ω
	Nominal voltage	30 V
	Test voltage conductor	1500 Vdc x 1 s

The table below describes the general characteristics of the cable:

Characteristics		Specification
Cable type		Special PUR black shielded
Conductor material		Stranded tinned copper
Shield		Tinned copper foil and drain wire
External cable diameter		6.7 mm (0.26 in.) ± 0.3 mm (0.012 in.)
Minimum curve radius		67 mm (2.63 in.)
Max pulling strength	Static application	50 N/mm^2 (7252 lbf/in^2)
	Dynamic application	20 N/mm^2 (2901 lbf/in^2)
Wire colors	Power pair	Red, black
	Data pair	Blue, white
External sheath, color		Black-gray RAL 7021
Cable weight		54.8 kg/km (0.037 lb/ft)

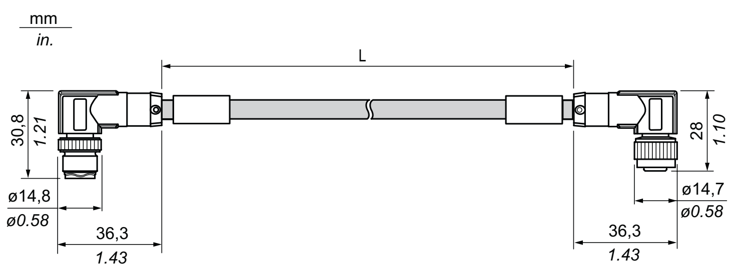
Characteristics	Specification
Number of bending cycles	4 million
Traversing path	10 m (32.8 ft)
Traversing rate	3 m/s (9.8 ft/s)
Acceleration	10 m/s^2 (32.8 ft/s^2)
M12 fastening torque	Max 0.4 Nm (3.5 lbf-in)

The table below describes the environmental characteristics of the cable:

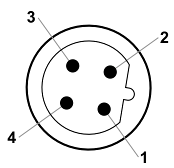
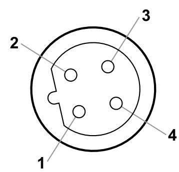
Characteristics	Specification
Operating temperature	–20...75 °C (–4...167 °F)
Storage temperature	–40...80 °C (–40...176 °F)
Special properties	Flexible cable conduit capable
	Silicone-free
Freedom from halogen	As per DIN VDE 0472 part 815
WEEE/RoHS	Compliant

TCSXCN2M2F••E Dimensions and Pin Assignment

Dimensions

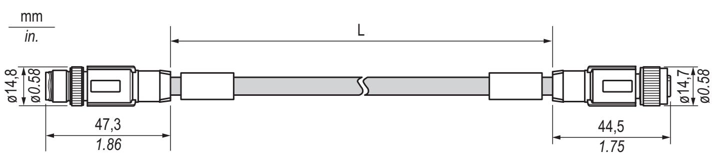


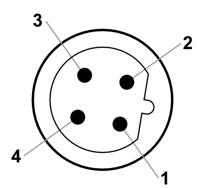
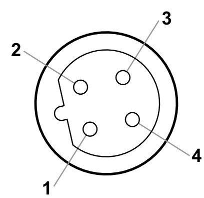
L length as a function of the particular reference

Pin Assignment				
Male Connector	**Pin**	**Designation**	**Wire Color**	**Female Connector**
	1	TM7 V+	Red	
	2	TM7 Bus Data	White	
	3	TM7 OV	Black	
	4	TM7 Bus $\overline{\text{Data}}$	Blue	
	M12[1]	SHLD	Shield	

1 Shielding 360 ° around M12 knurled screw.

TCSXCN1M1F••E Dimensions and Pin Assignment

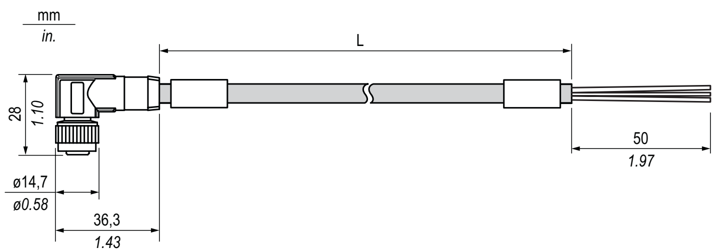
Dimensions	
	
L	length as a function of the particular reference

Pin Assignment				
Male Connector	**Pin**	**Designation**	**Wire Color**	**Female Connector**
	1	TM7 V+	Red	
	2	TM7 Bus Data	White	
	3	TM7 OV	Black	
	4	TM7 Bus $\overline{\text{Data}}$	Blue	
	M12[1]	SHLD	Shield	

1 Shielding 360 ° around M12 knurled screw.

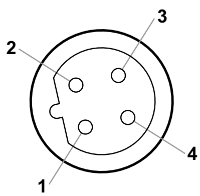
TCSXCN2FNX••E Dimensions and Pin Assignment

Dimensions



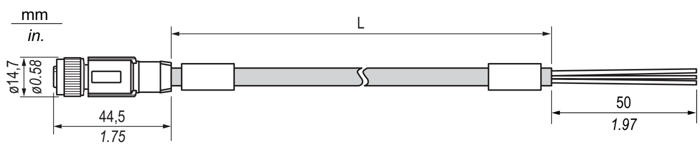
L length as a function of the particular reference

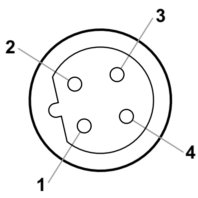
Pin Assignment

Female Connector	Pin	Designation	Wire Color	Open
	1	TM7 V+	Red	For custom wiring
	2	TM7 Bus Data	White	
	3	TM7 OV	Black	
	4	TM7 Bus $\overline{\text{Data}}$	Blue	
	M12[1]	SHLD	Shield	

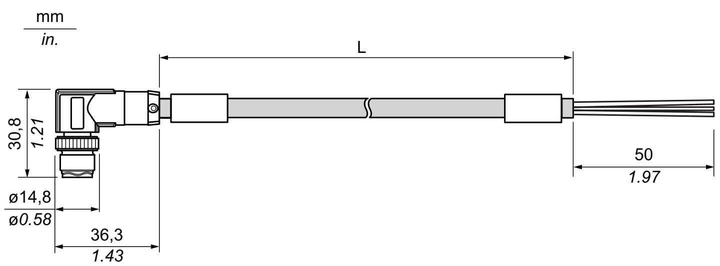
1 Shielding 360 ° around M12 knurled screw.

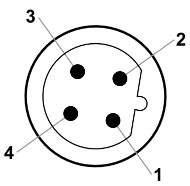
TCSXCN1FNX••E Dimensions and Pin Assignment

Dimensions

L length as a function of the particular reference

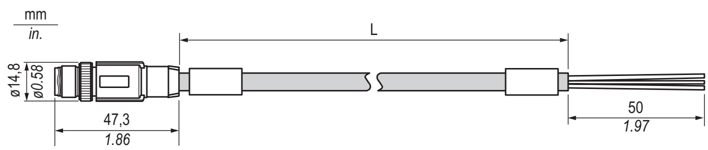
Pin Assignment				
Female Connector	**Pin**	**Designation**	**Wire Color**	**Open**
	1	TM7 V+	Red	For custom wiring
	2	TM7 Bus Data	White	
	3	TM7 OV	Black	
	4	TM7 Bus $\overline{\text{Data}}$	Blue	
	M12[1]	SHLD	Shield	
1 Shielding 360 ° around M12 knurled screw.				

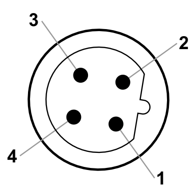
TCSXCN2MNX••E Dimensions and Pin Assignment

Dimensions

L length as a function of the particular reference

Pin Assignment				
Male Connector	**Pin**	**Designation**	**Wire Color**	**Open**
	1	TM7 V+	Red	For custom wiring
	2	TM7 Bus Data	White	
	3	TM7 OV	Black	
	4	TM7 Bus $\overline{\text{Data}}$	Blue	
	M12[1]	SHLD	Shield	
1 Shielding 360 ° around M12 knurled screw.				

TCSXCN1MNX••E Dimensions and Pin Assignment

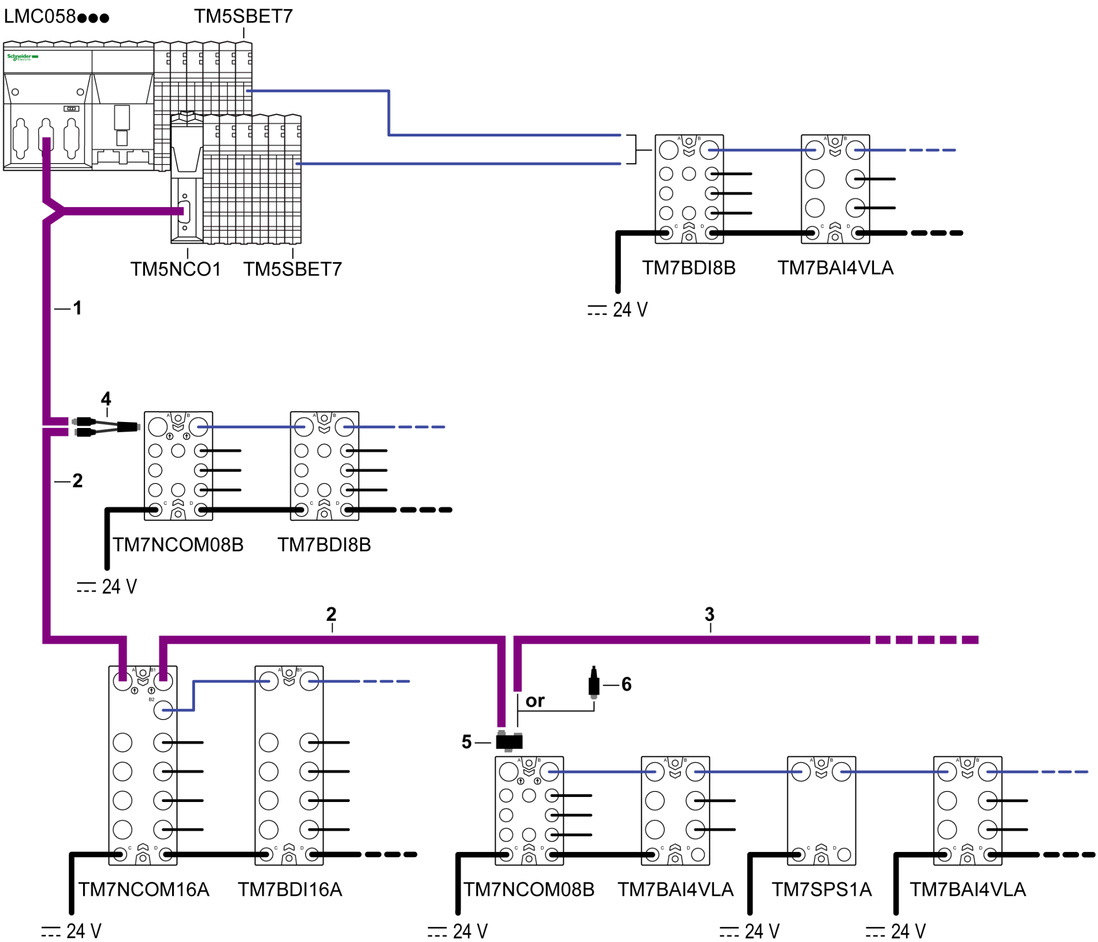
Dimensions	
	
L	length as a function of the particular reference

Pin Assignment				
Male Connector	**Pin**	**Designation**	**Wire Color**	**Open**
	1	TM7 V+	Red	For custom wiring
	2	TM7 Bus Data	White	
	3	TM7 OV	Black	
	4	TM7 Bus $\overline{\text{Data}}$	Blue	
	M12[1]	SHLD	Shield	
1	Shielding 360 ° around M12 knurled screw.			

CANopen Cables

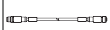
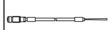
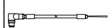
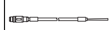
Overview

The following figure shows an example of TM5/TM7 configuration using CANopen cables:



1 Attachment IN cable: to connect a TM7 CANopen interface I/O block to an IP20 configuration (controller, TM5 CANopen island, or other IP20 CANopen devices).
2 Drop cable: to build CAN bus between TM7 CANopen interface I/O blocks.
3 Attachment OUT cable: to connect a TM5 CANopen island or other IP20 CANopen device to a TM7 CANopen interface I/O block.
4 CAN bus Y cable
5 CAN bus Y connector
6 M12 CAN bus terminating resistor

Ordering Information

Length	Short Description, Reference					
	Drop Cable		Attachment IN Cable		Attachment OUT Cable	
0.3 m (1 ft)	TCSCCN2M2F03	TCSCCN1M1F03	–	–	–	–
1 m (3.3 ft)	TCSCCN2M2F1	TCSCCN1M1F1	TCSCCN2FNX1SA	TCSCCN1FNX1SA	TCSCCN2MNX1SA	TCSCCN1MNX1SA
2 m (6.6 ft)	TCSCCN2M2F2	TCSCCN1M1F2	–	–	–	–
3 m (9.8 ft)	–	–	TCSCCN2FNX3SA	TCSCCN1FNX3SA	TCSCCN2MNX3SA	TCSCCN1MNX3SA
5 m (16.4 ft)	TCSCCN2M2F5	TCSCCN1M1F5	–	–	–	–
10 m (32.8 ft)	TCSCCN2M2F10	TCSCCN1M1F10	TCSCCN2FNX10SA	TCSCCN1FNX10SA	TCSCCN2MNX10SA	TCSCCN1MNX10SA
15 m (49.2 ft)	TCSCCN2M2F15	TCSCCN1M1F15	–	–	–	–
25 m (82 ft)	–	–	TCSCCN2FNX25SA	TCSCCN1FNX25SA	TCSCCN2MNX25SA	TCSCCN1MNX25SA
Dimensions and Pin Assignment	TCSCCN2M2F••  (*see page 369*)	TCSCCN1M1F••  (*see page 370*)	TCSCCN2FNX••SA  (*see page 370*)	TCSCCN1FNX••SA  (*see page 371*)	TCSCCN2MNX••SA  (*see page 372*)	TCSCCN1MNX••SA  (*see page 373*)

Cable Characteristics

The following table describes the characteristics of the individual wire pairs of the cable:

Wire	Characteristics	Value
Power pair	Conductor cross section (gauge)	0.34 mm^2 (AWG 22)
	Material insulation	Polyolefin
	Core diameter including insulation	1.40 mm (0.05 in.) ± 0.05 mm (0.002 in.)
	Electrical resistance (at 20 °C (68 °F))	≤ 0.052 Ω/m (0.016 Ω/ft)
	Insulation resistance (at 20 °C (68 °F))	≥ 100 MΩ*km (328 GΩ/ft)
	Nominal voltage	300 V
	Test voltage conductor	2000 Vdc x 1 s
Data pair	Conductor cross section (gauge)	0.2 mm^2 (AWG 24)
	Material insulation	Foam-skin PE
	Core diameter including insulation	2.05 mm (0.08 in.) ± 0.1 mm (0.004 in.)
	Electrical resistance (at 20 °C (68 °F))	≤ 0.078 Ω/m (0.024 Ω/ft)
	Insulation resistance (at 20 °C (68 °F))	≥ 5000 MΩ*km (16.4 TΩ/ft)
	Characteristic impedance (at 5 MHz)	120 Ω
	Nominal voltage	30 V
	Test voltage conductor	1500 Vdc x 1 s

The table below describes the general characteristics of the cable:

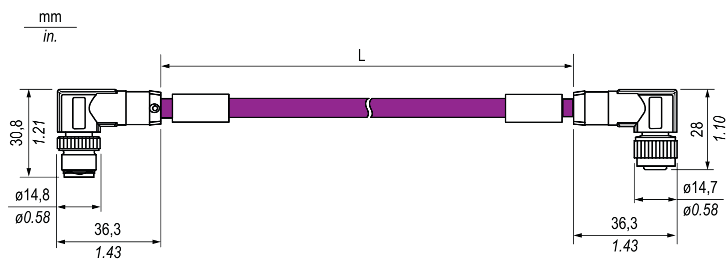
Characteristics		Specification
Cable type		Special PUR black shielded
Conductor material		Stranded tinned copper
Shield		Tinned copper foil and drain wire
External cable diameter		6.7 mm (0.26 in.) ± 0.3 mm (0.012 in.)
Minimum curve radius		67 mm (2.63 in.)
Max pulling strength	Static application	50 N/mm^2 (7252 lbf/in^2)
	Dynamic application	20 N/mm^2 (2901 lbf/in^2)
Wire colors	Power pair	Red, black
	Data pair	Blue, white
External sheath, color		Magenta RAL 4001
Cable weight		54.8 kg/km (0.037 lb/ft)
Number of bending cycles		4 million
Traversing path		10 m (32.8 ft)
Traversing rate		3 m/s (9.8 ft/s)
Acceleration		10 m/s^2 (32.8 ft/s^2)
M12 fastening torque		Max 0.4 Nm (3.5 lbf-in)

The table below describes the environmental characteristics of the cable:

Characteristics	Specification
Operating temperature	–20...75 °C (–4...167 °F)
Storage temperature	–40...80 °C (–40...176 °F)
Special properties	Flexible cable conduit capable
	Silicone-free
Freedom from halogen	As per DIN VDE 0472 part 815
WEEE/RoHS	Compliant

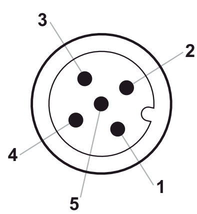
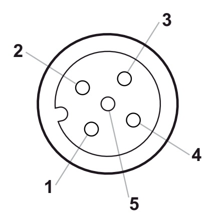
TCSCCN2M2F•• Dimensions and Pin Assignment

Dimensions



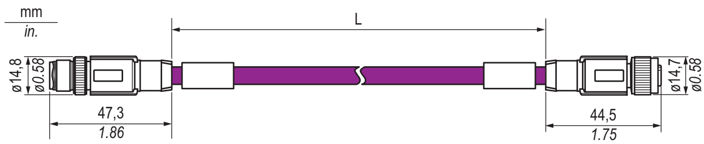
L length as a function of the particular reference

Pin Assignment

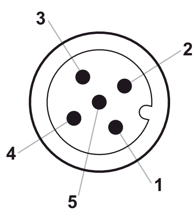
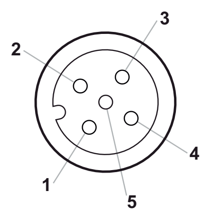
Male Connector	Pin	Designation	Wire Color	Female Connector
	1	(CAN_SHLD)	Shield	
	2	(CAN_V+)	Red	
	3	CAN_GND	Black	
	4	CAN_H	White	
	5	CAN_L	Blue	

TCSCCN1M1F•• Dimensions and Pin Assignment

Dimensions

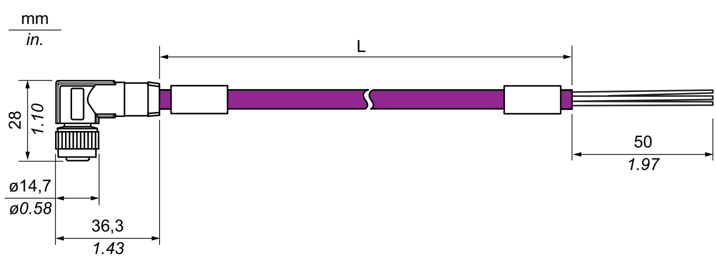


L length as a function of the particular reference

Pin Assignment				
Male Connector	**Pin**	**Designation**	**Wire Color**	**Female Connector**
	1	(CAN_SHLD)	Shield	
	2	(CAN_V+)	Red	
	3	CAN_GND	Black	
	4	CAN_H	White	
	5	CAN_L	Blue	

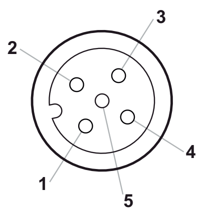
TCSCCN2FNX••SA Dimensions and Pin Assignment

Dimensions



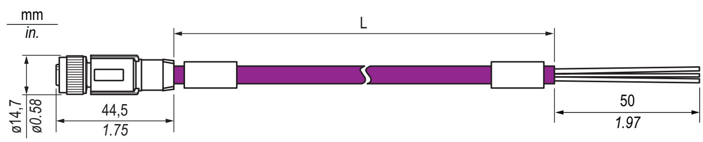
L length as a function of the particular reference

⚠ CAUTION
UNINTENDED CANopen NETWORK OPERATION
Only use the CAN_V+ signal (red wire) for power distribution.
Failure to follow these instructions can result in injury or equipment damage.

Pin Assignment				
Female Connector	**Pin**	**Designation**	**Wire Color**	**Open**
	1	(CAN_SHLD)	Shield	For custom wiring
	2	(CAN_V+)	Red	
	3	CAN_GND	Black	
	4	CAN_H	White	
	5	CAN_L	Blue	

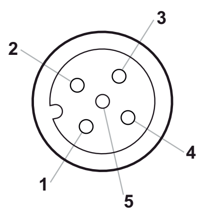
TCSCCN1FNX••SA Dimensions and Pin Assignment

Dimensions



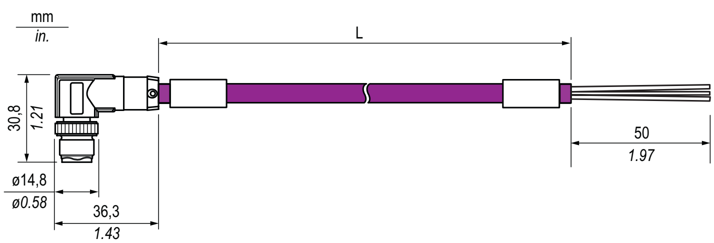
L length as a function of the particular reference

⚠ CAUTION
UNINTENDED CANopen NETWORK OPERATION
Only use the CAN_V+ signal (red wire) for power distribution.
Failure to follow these instructions can result in injury or equipment damage.

Pin Assignment				
Female Connector	**Pin**	**Designation**	**Wire Color**	**Open**
	1	(CAN_SHLD)	Shield	For custom wiring
	2	(CAN_V+)	Red	
	3	CAN_GND	Black	
	4	CAN_H	White	
	5	CAN_L	Blue	

TCSCCN2MNX••SA Dimensions and Pin Assignment

Dimensions



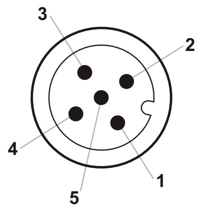
L length as a function of the particular reference

⚠ CAUTION

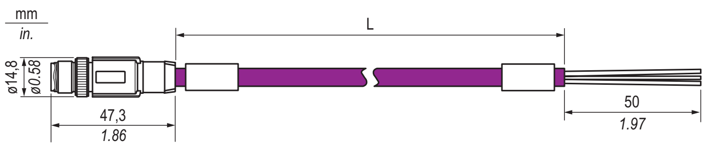
UNINTENDED CANopen NETWORK OPERATION

Only use the CAN_V+ signal (red wire) for power distribution.

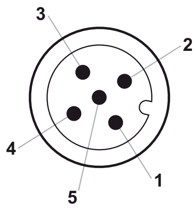
Failure to follow these instructions can result in injury or equipment damage.

Pin Assignment				
Male Connector	**Pin**	**Designation**	**Wire Color**	**Open**
	1	(CAN_SHLD)	Shield	For custom wiring
	2	(CAN_V+)	Red	
	3	CAN_GND	Black	
	4	CAN_H	White	
	5	CAN_L	Blue	

TCSCCN1MNX••SA Dimensions and Pin Assignment

Dimensions

L length as a function of the particular reference

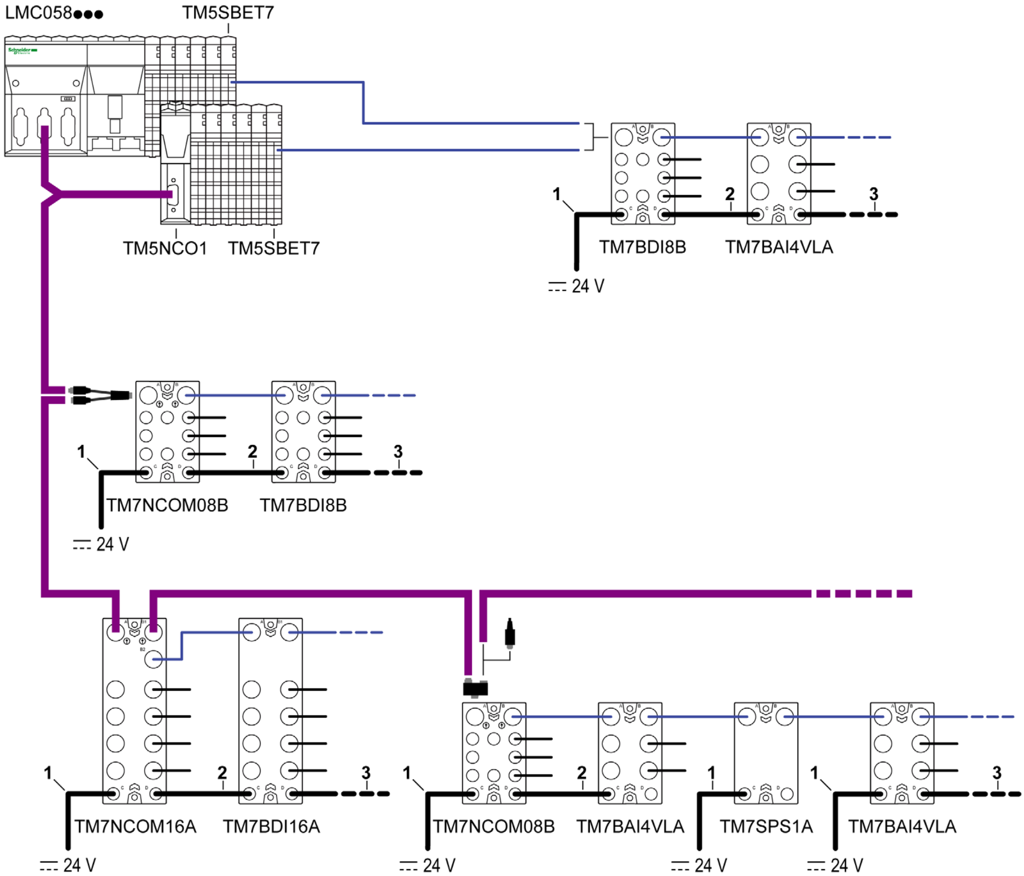
CAUTION
UNINTENDED CANopen NETWORK OPERATION
Only use the CAN_V+ signal (red wire) for power distribution.
Failure to follow these instructions can result in injury or equipment damage.

Pin Assignment				
Male Connector	**Pin**	**Designation**	**Wire Color**	**Open**
	1	(CAN_SHLD)	Shield	For custom wiring
	2	(CAN_V+)	Red	
	3	CAN_GND	Black	
	4	CAN_H	White	
	5	CAN_L	Blue	

Power Cables

Overview

The following figure shows the power cables used in TM5/TM7 configurations:

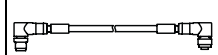
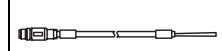


1 Attachment IN cable: to connect an external power supply to a TM7 interface I/O block, a TM7 Power Distribution Block (PDB) or a TM7 I/O block.

2 Drop cable: to route 24 Vdc I/O power segment between two TM7 blocks.

3 Attachment OUT cable: to connect a TM7 block to another device.

Ordering Information

Length	Short Description, Reference					
	Drop Cable		Attachment IN Cable		Attachment OUT Cable	
0.3 m (1 ft)	TCSXCNEMEF03V	TCSXCNDMDF03 V	–	–	–	–
1 m (3.3 ft)	TCSXCNEMEF1V	TCSXCNDMDF1V	TCSXCNEFNX1V	TCSXCNDFNX1V	TCSXCNEXNX1V	TCSXCNDMNX1V
2 m (6.6 ft)	TCSXCNEMEF2V	TCSXCNDMDF2V	–	–	–	–
3 m (9.8 ft)	–	–	TCSXCNEFNX3V	TCSXCNDFNX3V	TCSXCNEXNX3V	TCSXCNDMNX3V
5 m (16.4 ft)	TCSXCNEMEF5V	TCSXCNDMDF5V	–	–	–	–
10 m (32.8 ft)	TCSXCNEMEF10V	TCSXCNDMDF10V	TCSXCNEFNX10V	TCSXCNDFNX10V	TCSXCNEXNX10V	TCSXCNDMNX10V
15 m (49.2 ft)	TCSXCNEMEF15V	TCSXCNDMDF15V	–	–	–	–
25 m (82 ft)	–	–	TCSXCNEFNX25V	TCSXCNDFNX25V	TCSXCNEXNX25V	TCSXCNDMNX25V
Dimensions and Pin Assignment	TCSXCNEMEF••V  (see page 378)	TCSXCNDMDF••V  (see page 379)	TCSXCNEFNX••V  (see page 380)	TCSXCNDFNX••V  (see page 381)	TCSXCNEXNX••V  (see page 382)	TCSXCNDMNX••V  (see page 383)

Cable Characteristics

The table below describes the characteristics of the individual wire of the cable:

Characteristics	Specifications
Conductor cross section (gauge)	0.34 mm^2 (AWG 22)
Material insulation	Polypropylene (PP)
Core diameter including insulation	1.27 mm (0.05 in.) ± 0.02 mm (0.0008 in.)
Electrical resistance (at 20 °C)	≤0.058 Ω/m (0.018 Ω/ft)
Insulation resistance (at 20 °C)	≥ 100 MΩ*km (328 GΩ/ft)
Nominal voltage	300 V
Test voltage conductor	3000 Vdc x 1 s

The table below describes the general characteristics of the cable:

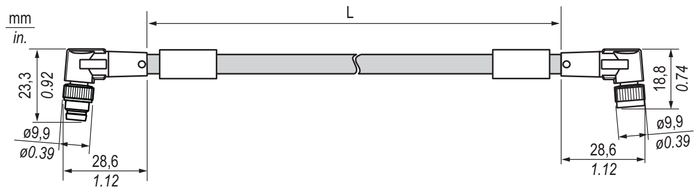
Characteristics	Specification
Cable type	Special PUR black shielded
Conductor material	Bare Cu litz wires
Shield	Braided copper wires
External cable diameter	4.7 mm (0.19 in.)
Minimum curve radius	47 mm (1.85 in.)
Wire colors	Black, brown, blue, white
External sheath, color	Black-gray RAL 7021

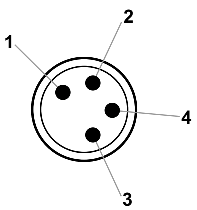
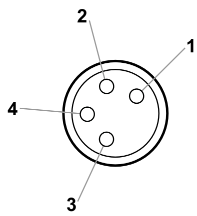
Characteristics	Specification
Cable weight	30 kg/km (0.02 lb/ft)
Number of bending cycles	4 million
Traversing path	10 m (32.8 ft)
Traversing rate	3 m/s (9.8 ft/s)
Acceleration	10 m/s^2 (32.8 ft/s^2)
M8 fastening torque	Max. 0.2 Nm (1.8 lbf-in)

The table below describes the environmental characteristics of the cable:

Characteristics	Specification
Operating temperature	–5...80 °C (23...176 °F)
Storage temperature	–40...80 °C (–40...176 °F)
Special properties	Flexible cable conduit capable
	Silicone-free
	Free of substances which would hinder coating with paint or varnish
Flame resistance	As per UL-Style 20549
Freedom from halogen	As per DIN VDE 0472 part 815
Resistance to oil	Complying with DIN EN 60811-2-1
Other resistance	Highly resistant to acids, alkaline solutions and solvents
	Hydrolysis and microbe resistant
WEEE/RoHS	Compliant

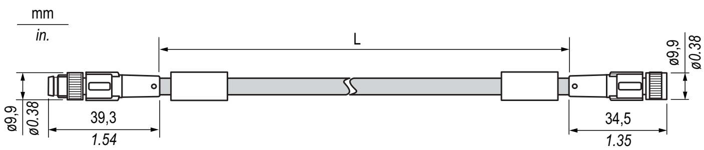
TCSXCNEMEF••V Dimensions and Pin Assignment

Dimensions	
	
L	length as a function of the particular reference

Male Connector	Pin	Designation	Wire Color	Female Connector
	1	24 Vdc	White	
	2	24 Vdc	Brown	
	3	0 Vdc	Blue	
	4	0 Vdc	Black	

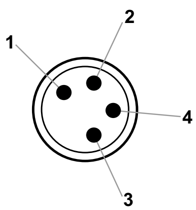
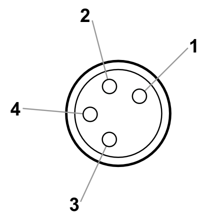
TCSXCNDMDF••V Dimensions and Pin Assignment

Dimensions

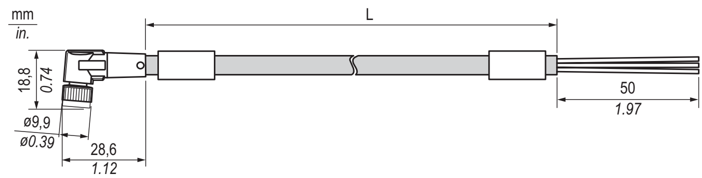


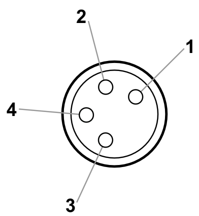
L	length as a function of the particular reference

Pin Assignment

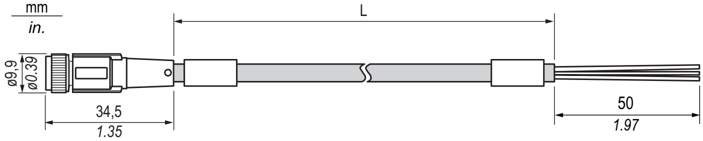
Male Connector	Pin	Designation	Wire Color	Female Connector
	1	24 Vdc	White	
	2	24 Vdc	Brown	
	3	0 Vdc	Blue	
	4	0 Vdc	Black	

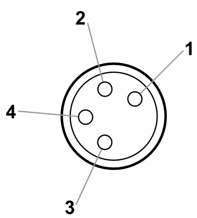
TCSXCNEFNX••V Dimensions and Pin Assignment

Dimensions

L length as a function of the particular reference

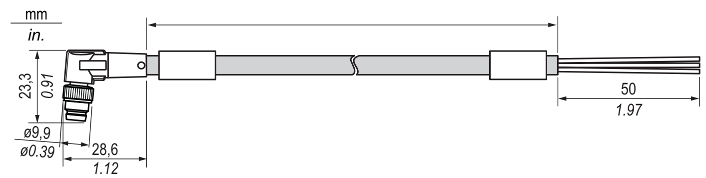
Pin Assignment				
Female Connector	**Pin**	**Designation**	**Wire Color**	**Open**
	1	24 Vdc	White	For custom wiring
	2	24 Vdc	Brown	
	3	0 Vdc	Blue	
	4	0 Vdc	Black	

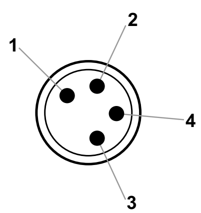
TCSXCNDFNX••V Dimensions and Pin Assignment

Dimensions

L length as a function of the particular reference

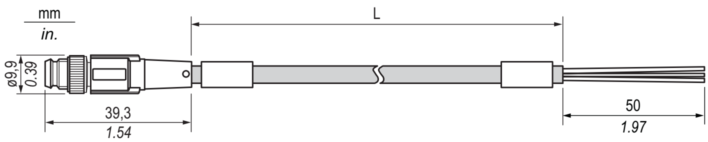
Pin Assignment				
Female Connector	**Pin**	**Designation**	**Wire Color**	**Open**
	1	24 Vdc	White	For custom wiring
	2	24 Vdc	Brown	
	3	0 Vdc	Blue	
	4	0 Vdc	Black	

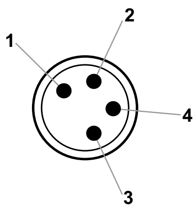
TCSXCNEXNX••V Dimensions and Pin Assignment

Dimensions	
	
L	length as a function of the particular reference

Pin Assignment				
Male Connector	**Pin**	**Designation**	**Wire Color**	**Open**
	1	24 Vdc	White	For custom wiring
	2	24 Vdc	Brown	
	3	0 Vdc	Blue	
	4	0 Vdc	Black	

TCSXCNDMNX••V Dimensions and Pin Assignment

Dimensions

L length as a function of the particular reference

Pin Assignment				
Male Connector	**Pin**	**Designation**	**Wire Color**	**Open**
	1	24 Vdc	White	For custom wiring
	2	24 Vdc	Brown	
	3	0 Vdc	Blue	
	4	0 Vdc	Black	

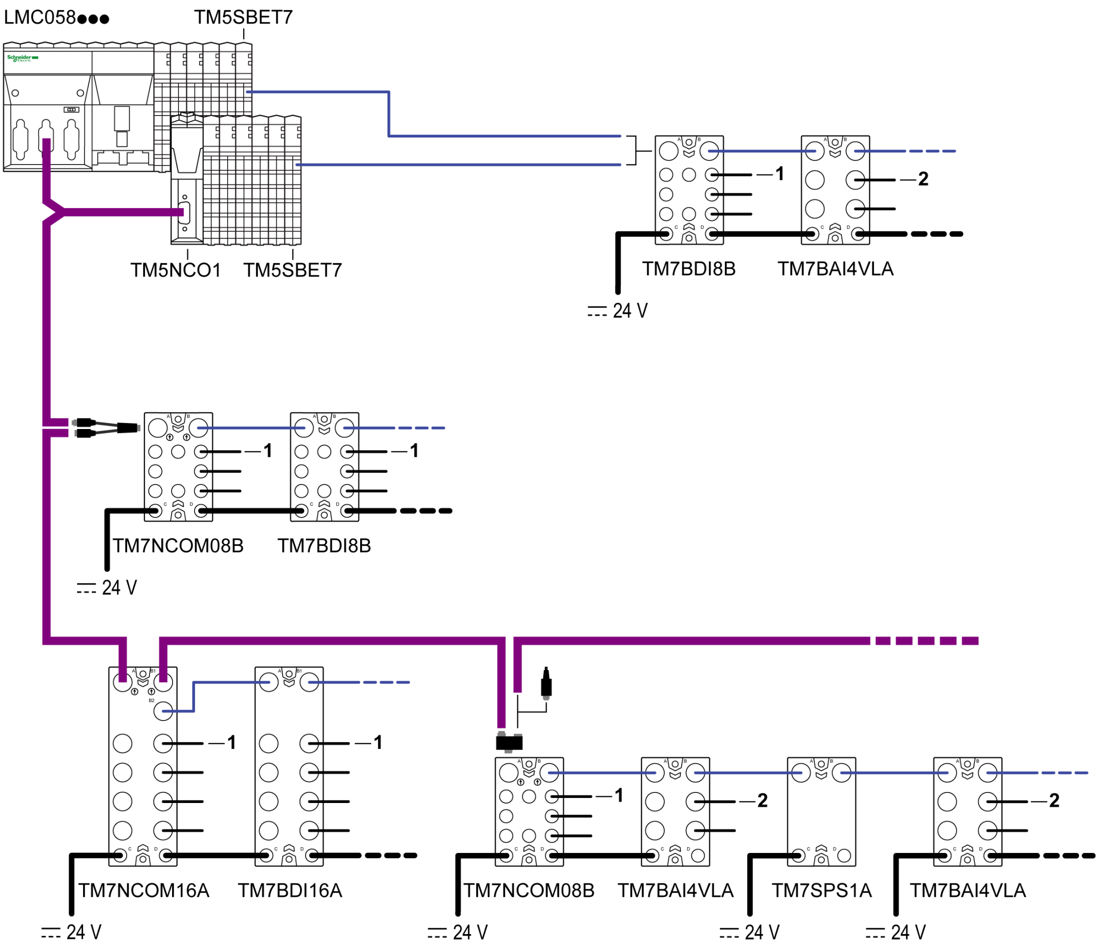
Sensor Cables

Overview

The sensor cables are used to:

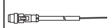
- Connect the sensors to the analog inputs of the TM7 I/O blocks
- Connect the actuators to the analog outputs of the TM7 I/O blocks
- Connect the fast digital signals to the fast inputs or outputs of the TM7 I/O blocks

The following figure shows sensor cables used in TM5/TM7 configurations:



1 Sensor cable for TM7 field bus interface I/O block and TM7 digital I/O block
2 Sensor cable for TM7 analog I/O block

Ordering Information

Length	Short Description, Reference			
	M 12 Cable for Analog I/O		M 12 Cable for Digital I/O	M 8 Cable for Digital I/O
0.5 m (1.6 ft)	–	–	XZ CP1564L05	XZ CP2737L05
1 m (3.3 ft)	–	–	XZ CP1564L1	XZ CP2737L1
2 m (6.6 ft)	TCSXCN2M2SA	TCSXCN1M2SA	XZ CP1564L2	XZ CP2737L2
5 m (16.4 ft)	TCSXCN2M5SA	TCSXCN1M5SA	–	–
15 m (49.2 ft)	TCSXCN2M15SA	TCSXCN1M15SA	–	–
Dimensions and Pin Assignment	TCSXCN2M••SA  (see page 390)	TCSXCN1M••SA  (see page 391)	XZ CP1564L••  (see page 392)	XZ CP2737L••  (see page 393)

TCSXCN2M••SA and TCSXCN1M••SA Cable Characteristics

The table below describes the characteristics of the individual wire of the cable:

Characteristics	Specifications
Conductor cross section (gauge)	0.34 mm^2 (AWG 22)
Material insulation	Polypropylene (PP)
Material filler	Polyethylene (PE)
Core diameter including insulation	1.27 mm (0.05 in.) ± 0.02 mm (0.0008 in.)
Electrical resistance (at 20 °C (68 °F))	≤0.058 Ω/m (0.018 Ω/ft)
Insulation resistance (at 20 °C (68 °F))	≥ 100 GΩ*km (328 TΩ*ft)
Nominal voltage	300 V
Test voltage conductor	3000 Vdc x 1 s

The table below describes the general characteristics of the cable:

Characteristics	Specification
Cable type	Special PUR black shielded
Conductor material	Bare Cu litz wires
Shield	Braided copper wires
External cable diameter	5.9 mm (0.23 in.)
Minimum curve radius	59 mm (2.32 in.)
Wire colors	Brown, white, blue, black, gray
External sheath, color	Black-gray RAL 7021
Cable weight	48 kg/km (1.55 lb/ft)
Number of bending cycles	4 million
Traversing path	10 m (32.8 ft)
Traversing rate	3 m/s (9.8 ft/s)
Acceleration	10 m/s^2 (32.8 ft/s^2)
M12 fastening torque	Max. 0.4 Nm (3.5 lbf-in)

The following table lists the environmental characteristics of the cable:

Characteristics	Specification
Operating temperature	– 5...80 °C (23...176 °F)
Storage temperature	– 40...80 °C (– 40...176 °F)
Special properties	Flexible cable conduit capable
	Silicone-free
	Free of substances which would hinder coating with paint or varnish
Flame resistance	As per UL-Style 20549
Freedom from halogen	As per DIN VDE 0472 part 815
Resistance to oil	Complying with DIN EN 60811-2-1
Other resistance	Highly resistant to acids, alkaline solutions and solvents
	Hydrolysis and microbe resistant
WEEE/RoHS	Compliant

XZ CP1564L•• Cable Characteristics

The following table describes the characteristics of the individual wire of the cable:

Characteristics	Specifications
Conductor cross section (gauge)	4 x 0.34 mm^2 (AWG 22) and 1 x 0.5 mm^2 (AWG 20)
Material insulation	PVC
Insulation resistance (at 20 °C (68 °F))	> 1 GΩ
Nominal current	4 A
Nominal voltage	30 Vac, 36 Vdc
Contact resistance	≤5 mΩ
Insulation voltage	2500 Vdc

The following table lists the general characteristics of the cable:

Characteristics		Specification
Cable type		Special PUR black shielded
External cable diameter		5.2 mm (0.20 in.)
Minimum curve radius		52 mm (2.05 in.)
Wire colors		Brown, black/white, blue, black, yellow/green
External sheath, color		Black
Cable weight	XZ CP1564L05	0.040 kg (0.09 lb)
	XZ CP1564L1	0.065 kg (0.14 lb)
	XZ CP1564L2	0.115 kg (0.25 lb)
Tensile strength		20...45 N/mm^2 (2901...6527 lbf/in^2)
M12 fastening torque		Max. 0.4 Nm (3.5 lbf-in)

The following table lists the environmental characteristics of the cable:

Characteristics	Specification
Operating temperature	–5...90 °C (23...194 °F)
Storage temperature	–35...100 °C (–31...212 °F)
Special properties	Flexible cable conduit capable
	Silicone-free
	Without unmoulding agent
Flame resistance	C2 conforming to NF C 32-070
Freedom from halogen	As per DIN VDE 0472 part 815
Other resistance	Resistant to soluble, mineral or synthetic oil at 90 °C (194 °F)
WEEE/RoHS	Compliant

XZ CP2337L•• Cable Characteristics

The following table describes the characteristics of the individual wire of the cable:

Characteristics	Specifications
Conductor cross section (gauge)	0.34 mm^2 (AWG 22)
Material insulation	PVC
Insulation resistance (at 20 °C (68 °F))	> 1 GΩ
Nominal current	4 A
Nominal voltage	60 Vac, 75 Vdc
Contact resistance	≤5 mΩ
Insulation voltage	2500 Vdc

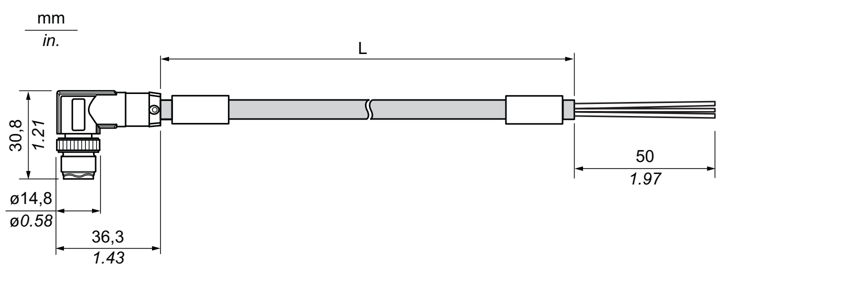
The following table lists the general characteristics of the cable:

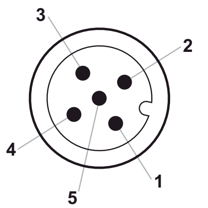
Characteristics		Specification
Cable type		Special PUR black shielded
External cable diameter		5.2 mm (0.20 in.)
Minimum curve radius		52 mm (2.05 in.)
Wire colors		Brown, blue, black
External sheath, color		Black
Cable weight	XZ CP2737L05	0.030 kg (0.07 lb)
	XZ CP2737L1	0.050 kg (0.11 lb)
	XZ CP2737L2	0.080 kg (0.18 lb)
Tensile strength		20...45 N/mm^2 (2901...6527 lbf.in^2)
M8 fastening torque		Max. 0.2 Nm (1.8 lbf-in)

The following table lists the environmental characteristics of the cable:

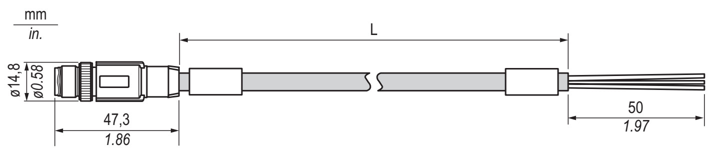
Characteristics	Specification
Operating temperature	–5...90 °C (23...194 °F)
Storage temperature	–35...100 °C (–31...212 °F)
Special properties	Flexible cable conduit capable
	Silicone-free
	Without unmoulding agent
Flame resistance	C2 conforming to NF C 32-070
Freedom from halogen	As per DIN VDE 0472 part 815
Other resistance	Resistant to soluble, mineral or synthetic oil at 90 °C (194 °F)
WEEE/RoHS	Compliant

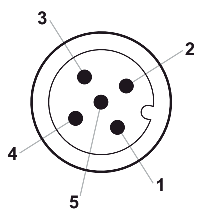
TCSXCN2M••SA Dimensions and Pin Assignment

Dimensions

L length as a function of the particular reference

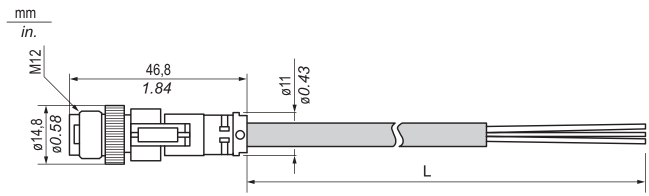
Pin Assignment			
Male Connector	**Pin**	**Designation**	**Wire Color**
	1	For pin assignment, refer to the wiring diagrams of the Modicon TM7 Analog I/O Blocks Hardware Guide.	Brown
	2		White
	3		Blue
	4		Black
	5		Gray
	M12[1]		SHLD
1 Shielding 360 ° around M12 knurled screw			

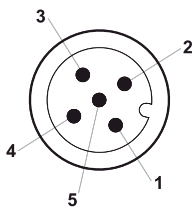
TCSXCN1M••SA Dimensions and Pin Assignment

Dimensions

L length as a function of the particular reference

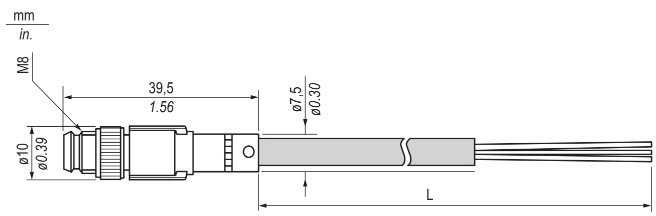
Pin Assignment			
Male Connector	**Pin**	**Designation**	**Wire Color**
	1	For pin assignment, refer to the wiring diagrams of the Modicon TM7 Analog I/O Blocks Hardware Guide.	Brown
	2		White
	3		Blue
	4		Black
	5		Gray
	M12[1]		SHLD
1 Shielding 360 ° around M12 knurled screw			

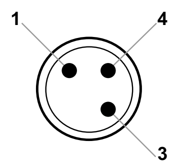
XZ CP1564L•• Dimensions and Pin Assignment

Dimensions	
	
L	length as a function of the particular reference

Pin Assignment			
Male Connector	**Pin**	**Designation**	**Wire Color**
	1	For pin assignment, refer to the wiring diagrams of the Modicon TM7 Digital I/O Blocks Hardware Guide or Modicon TM7 CANopen I/O Blocks Hardware Guide.	Brown
	2		Black / White
	3		Blue
	4		Black
	5		Yellow / Green

XZ CP2737L•• Dimensions and Pin Assignment

Dimensions

L length as a function of the particular reference

Pin Assignment			
Male Connector	**Pin**	**Designation**	**Wire Color**
	1	For pin assignment, refer to the wiring diagrams of the Modicon TM7 Digital I/O Blocks Hardware Guide oror Modicon TM7 CANopen I/O Blocks Hardware Guide.	Brown
	3		Blue
	4		Black

Glossary

A

analog input
Converts received voltage or current levels into numerical values. You can store and process these values within the logic controller.

analog output
Converts numerical values within the logic controller and sends out proportional voltage or current levels.

application
A program including configuration data, symbols, and documentation.

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

B

bus base
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 logic controllers. Each base bus extends the integrated TM5 data and electronic power buses as well as the 24 Vdc I/O power segment. The electronic modules are added to the TM5 system through their insertion on the base bus.

B coded
Connectors that have 1 raised key on the female connector and 1 mating slot on the male connector. These connectors (also called reverse keyed) are used for field bus applications.

C

CAN
(*controller area network*) A protocol (ISO 11898) for serial bus networks, designed for the interconnection of smart devices (from multiple manufacturers) in smart systems and for real-time industrial applications. Originally developed for use in automobiles, CAN is now used in a variety of industrial automation control environments.

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

compact I/O module
An inseparable group of 5 analog and/or digital I/O electronic modules in a single reference.

configuration

The arrangement and interconnection of hardware components within a system and the hardware and software parameters that determine the operating characteristics of the system.

controller

Automates industrial processes (also known as programmable logic controller or programmable controller).

CPDM

(*controller power distribution module*) The connection of the controller to the external 24 Vdc power supplies and the beginning of the power distribution for the local configuration.

CSA

(*Canadian standards association*) The Canadian standard for industrial electronic equipment in hazardous environments.

D

derating

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.

digital I/O

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

DIN

(*Deutsches Institut für Normung*) A German institution that sets engineering and dimensional standards.

drop cable

The unterminated derivation cord used to connect a TAP to a device.

E

EIA

(*electronic industries alliance*) The trade organization for establishing electrical/electronic and data communication standards (including RS-232 and RS-485) in the United States.

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.)

element

The short name of the ARRAY element.

EN

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

encoder

A device for length or angular measurement (linear or rotary encoders).

equipment

A part of a machine including sub-assemblies such as conveyors, turntables, and so on.

Ethernet

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

expansion bus

An electronic communication bus between expansion I/O modules and a controller.

expansion I/O module

(*expansion input/output module*) Either a digital or analog module that adds additional I/O to the base controller.

F

FAST I/O

FAST input/output Specific I/O modules with some electrical features (for example, response time) while the treatment of these channels are done directly by the controller

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.

firmware

Represents the BIOS, data parameters, and programming instructions that constitute the operating system on a controller. The firmware is stored in non-volatile memory within the controller.

function

A programming unit that has 1 input and returns 1 immediate result. However, unlike FBs, it is directly called with its name (as opposed to through an instance), has no persistent state from one call to the next and can be used as an operand in other programming expressions.

Examples: boolean (AND) operators, calculations, conversions (BYTE_TO_INT)

H

hex

(*hexadecimal*)

hot swapping

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

HSC

(*high-speed counter*)

I

I/O

(*input/output*)

ID

(*identifier/identification*)

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.

input/output

The index of the ARRAY.

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.

IP 67

(*ingress protection*) The protection classification according to IEC 60529. IP 67 modules are protected against ingress of dust, contact, and water up to an immersion depth of 1 m.

L

LED

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

M

Modbus

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

ms

(*millisecond*)

N

network

A system of interconnected devices that share a common data path and protocol for communications.

P

PCI

(*peripheral component interconnect*) An industry-standard bus for attaching peripherals.

PDM

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

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).

Profibus DP

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

PWM

(*pulse width modulation*) A fast output that oscillates between off and on in an adjustable duty cycle, producing a rectangular wave form (though you can adjust it to produce a square wave). The PTO is well adapted to simulate or approximate an analog output in that it regulates the voltage of the output over its period making it useful in light dimming or speed control applications, among others.

R

RS-232

A standard type of serial communication bus, based on 3 wires (also known as EIA RS-232C or V.24).

RS-485

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

run

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

S

SELV

(*safety extra low voltage*) A system that follows IEC 61140 guidelines for power supplies 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 inoperable conditions.

sercos

(*serial real-time communications system*) 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.

sink input

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

SoMachine

A comprehensive controller development system software tool for configuring and programming the Modicon logic controller and devices compliant with IEC 61131-3.

source output

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

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

U

UL

(*underwriters laboratories*) A US organization for product testing and safety certification.

Index

D

E

F

H

I

L

M

P

R

S

T

W