

# Modicon M172 Logic Controller

## Hardware Guide

Original instructions

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09/2024



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The information provided in this document contains general descriptions, technical characteristics and/or recommendations related to products/solutions.

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# Safety Information

## Important Information

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





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



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

 <b>DANGER</b>
<b>DANGER</b> indicates a hazardous situation which, if not avoided, <b>will result in</b> death or serious injury.

 <b>WARNING</b>
<b>WARNING</b> indicates a hazardous situation which, if not avoided, <b>could result in</b> death or serious injury.

 <b>CAUTION</b>
<b>CAUTION</b> indicates a hazardous situation which, if not avoided, <b>could result in</b> minor or moderate injury.

<b>NOTICE</b>
<b>NOTICE</b> 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.

## Qualification of Personnel

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product.

The qualified person must be able to detect possible hazards that may arise from parameterization, modifying parameter values and generally from mechanical, electrical, or electronic equipment. The qualified person must be familiar with the

standards, provisions, and regulations for the prevention of industrial accidents, which they must observe when designing and implementing the system.

## Intended Use

The products described or affected by this document, together with software, accessories, and options, are controllers, intended for commercial HVAC machines according to the instructions, directions, examples, and safety information contained in the present document and other supporting documentation.

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements, and the technical data.

Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety-related measures must be implemented.

Since the product is used as a component in an overall machine or process, you must ensure the safety of persons by means of the design of this overall system.

Operate the product only with the specified cables and accessories. Use only genuine accessories and spare parts.

Any use other than the use explicitly permitted is prohibited and can result in unanticipated hazards.

## Prohibited Use

Any use other than that expressed above under Permitted use is strictly prohibited.

The relay contacts supplied are of an electromechanical type and subject to wear. Functional safety protection devices, specified in international or local standards, must be installed externally to this device.

## Liability and Residual Risks

The liability of Schneider Electric is limited to the proper and professional use of this product under the guidelines contained in the present and other supporting documents, and does not extend to damages caused by (but not limited to):

- Unspecified installation/use and, in particular, in contravention of the safety requirements of established legislation or specified in this document;
- Use on equipment which does not provide adequate protection against electrocution, water and dust in the actual installation conditions;
- Use on equipment in which dangerous components can be accessed without the use of specific tools;
- Installation/use on equipment which does not comply with established legislation and standards.

## Disposal

The appliance (or the product) must be disposed of separately in compliance with the local standards in force on waste disposal.

# About the Book

## Document Scope

This document describes the Modicon M172 Logic controllers, expansion modules, remote displays, and accessories, including installation and wiring information.

**NOTE:** Read and understand this document and all related documents, page 9 before installing, operating, or maintaining your device.

## Validity Note

This document has been updated for the release of EcoStruxure Machine Expert - HVAC V1.5.0.

For product compliance and environmental information (RoHS, REACH, PEP, EOL, etc.), go to [www.se.com/ww/en/work/support/green-premium/](http://www.se.com/ww/en/work/support/green-premium/).

## Related Documents

Title of documentation	Reference number
EcoStruxure Machine Expert - HVAC - Operating Guide	EIO0000003412 (ENG)
TM172 Optimized & Performance 7/18 IO - Instruction Sheet	QGH90428
TM172 Performance 28/42 IO - Instruction Sheet	NHA87740
TM172 Optimized & Performance Isolated 28/42 IO - Instruction Sheet	PHA83703
TM172 Optimized & Performance Expansion 12/28 IO - Instruction Sheet	QGH26895
TM172DCLW*** Display Color Touchscreen - Instruction Sheet	QGH26896
TM172DCLF• Display Color Touchscreen Flush Mounting - Instruction Sheet	PHA38669
TM172DGRP Monochrome Display - Instruction Sheet	JYT15912
Modicon M171A Communication Modules – Instruction Sheet	EAV96007

To find documents online, visit the Schneider Electric download center ([www.se.com/ww/en/download/](http://www.se.com/ww/en/download/)).

## Product Related Information

### DANGER

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

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

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

This equipment has been designed to operate outside of any hazardous location, and exclusive of applications that generate, or have the potential to generate, hazardous atmospheres. Only install this equipment in zones known to be free, at all times, of hazardous atmospheres.

### DANGER

#### POTENTIAL FOR EXPLOSION

- Install and use this equipment in non-hazardous locations only.
- Do not install and use this equipment in applications capable of generating hazardous atmospheres, such as those applications employing flammable refrigerants.

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

For information concerning the use of control equipment in applications capable of generating hazardous materials, consult your local, regional, or national standards bureau or certification agency.

<b>▲ WARNING</b>
<p><b>LOSS OF CONTROL</b></p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• Separate or redundant control paths must be provided for critical control functions.</li> <li>• System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.</li> <li>• Observe all accident prevention regulations and local safety guidelines.<sup>1</sup></li> <li>• Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

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

<b>▲ WARNING</b>
<p><b>UNINTENDED EQUIPMENT OPERATION</b></p> <ul style="list-style-type: none"> <li>• Only use software approved by Schneider Electric for use with this equipment.</li> <li>• Update your application program every time you change the physical hardware configuration.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

## Terminology Derived from Standards

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

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

Among others, these standards include:

Standard	Description
IEC 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2023	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2013	Safety of machinery: Electro-sensitive protective equipment. Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery — General principles for design — Risk assessment and risk reduction.

EN 60204–1:2006	Safety of machinery — Electrical equipment of machines — Part 1: General requirements.
ISO 14119:2013	Safety of machinery — Interlocking devices associated with guards — Principles for design and selection.
ISO 13850:2015	Safety of machinery — Emergency stop — Principles for design.
IEC 62061:2021	Safety of machinery — Functional safety of safety-related electrical, electronic, and electronic programmable control systems.
IEC 61508–1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements.
IEC 61508–2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508–3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784–3:2021	Industrial communication networks — Profiles — Part 3: Functional safety fieldbuses — General rules and profile definitions.
2006/42/EC	Machine Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

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

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

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

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

## Information on Non-Inclusive Terminology

As part of a group of responsible, inclusive companies, we are updating our communications and products that contain non-inclusive terminology. Until we complete this process, however, our content may still contain standardized industry terms that may be deemed inappropriate by our customers.



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# Overview

## What's in This Part

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# M172 Range Overview

## What's in This Chapter

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Expansion Modules Range Overview .....	16
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Accessories .....	20

## Modicon M172 Logic Controller Offer Overview

### General Description

Modicon M172 Logic Controller are suitable for customized applications designed to control simple or complex machines:

- Air/water-cooled chiller
- Rooftop unit
- Heat pump
- Compressor rack
- Ventilation unit

The M172 offer is made of:

- Controllers, page 15
- Expansion modules, page 16
- Communication modules, page 17
- Remote displays, page 18
- Accessories, page 20

### Programming Software

In association with the controllers hardware, the EcoStruxure Machine Expert - HVAC development tool is available to program and customize applications.

You can download EcoStruxure Machine Expert - HVAC - Programming software for Modicon M172 Logic Controller from Schneider-electric web site download center Eliwell web site download center.

The use of several programming languages in accordance with IEC 61131-3 regulations (programming standard for industrial control), makes it possible to develop new algorithms or entire programs easily, which can then be uploaded to the M172 controllers via a PC and a Programming cable, helping to provide confidentiality with appropriate security.

For more information, refer to Connection Types, page 163.

# Controller Range Overview

## Type Code

Controller type code:

Type code description							
TM172PDG42R	TM172	P	D	G	42	R	I
Product family	TM172						
Complementary product family	P = Performance O = Optimized						
Physical feature	B = Blind D = Built-in Display						
Embedded Communication	G = RS-485 and Ethernet based communication protocols M = RS-485 based communication protocols						
Number of I/O	7 18 28 42						
Digital output type	R = Relays S = Solid State Relays (SSR) and Relays						
Power supply isolation <sup>(1)</sup>	I = Power Supply Isolated						
<b>(1)</b> Only for 28 and 42 I/O							

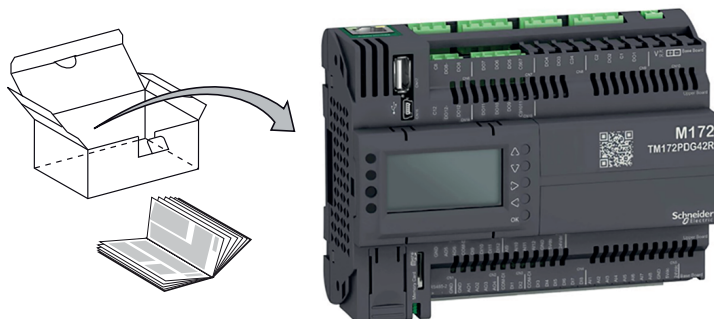
## Controllers References

Reference	Complementary product family	Display	Inputs/Outputs				Micro SD card	USB		Communication		
			DI	DO	AI	AO		USB A	USB Mini-B	2 RS-485	1 Ethernet	1 CAN Exp. bus
<b>7 Inputs/Outputs, page 51</b>												
TM172PBG07R	Performance	-	2	3	2	0	✓	✓	✓	✓	✓	✓
TM172PDG07R		✓										
<b>18 Inputs/Outputs, page 53</b>												
TM172PBG18R	Performance	-	2	6	8	2	✓	✓	✓	✓	✓	✓
TM172PDG18R		✓										
TM172PDG18S				4 + 2 SSR								
TM172OBM18R	Optimized	-	2	6	8	2	-	-	✓	✓	-	✓
TM172ODM18R		✓										
<b>28 Inputs/Outputs, page 55</b>												
TM172PBG28R	Performance	-	8	8	8	4	✓	✓	✓	✓	✓	✓
TM172PBG28RI												
TM172PDG28R		✓										

Reference	Complementary product family	Display	Inputs/Outputs				Micro SD card	USB		Communication		
			DI	DO	AI	AO		USB A	USB Mini-B	2 RS-485	1 Ethernet	1 CAN Exp. bus
TM172PDG28RI												
TM172PDG28S				6 + 2 SSR								
TM172PDG28SI												
TM172OBM28R	Optimized	-	8	8	8	4	-	-	✓	✓	-	✓
TM172ODM28R		✓										
42 Inputs/Outputs, page 58												
TM172PBG42R	Performance	-	12	12	12	6	✓	✓	✓	✓	✓	✓
TM172PBG42RI												
TM172PDG42R		✓										
TM172PDG42RI												
TM172PDG42S					10 + 2 SSR							
TM172PDG42SI												
TM172OBM42R	Optimized	-	12	12	12	6	-	-	✓	✓	-	✓
TM172ODM42R		✓										

The controller runs on 24 Vac/dc power supply.

## TM172P..... / TM172O..... Delivery Content



**NOTE:** Terminal blocks are not provided with the logic controllers and must be ordered separately, page 20

## Expansion Modules Range Overview

### Type Code

Expansion module type code:

Type code description			
TM172E28R	TM172E	28	R
Product family	TM172E		

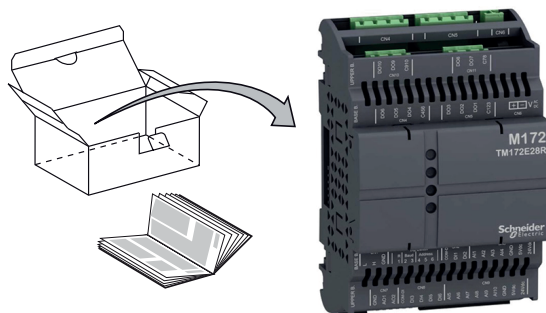
Type code description		
Number of I/O		12 28
Digital output type		R = Relays

## Expansion Modules References

Reference	Inputs/Outputs				1 CAN Exp. bus	1 TTL <sup>(1)</sup>	Compatible controllers
	DI	DO	AI	AO			
12 Inputs/Outputs, page 62							
TM172E12R	2	6	4	-	✓	✓	TM172P..... <sup>(2)</sup> TM172O..... <sup>(2)</sup>
28 Inputs/Outputs, page 64							
TM172E28R	6	10	10	2	✓	✓	TM172P..... <sup>(2)</sup> TM172O..... <sup>(2)</sup>
(1) For service only.							
(2) Also compatible with TM171P controller range.							

The expansion modules run on 24 Vac/dc power supply.

## TM172E•R Delivery Content



**NOTE:** Terminal blocks are not provided with the expansion modules and must be ordered separately, page 20

## Communication Modules Range Overview

### Overview

This section presents communication modules.

## Communication Modules References

Reference	Description	Terminal type	Compatible controllers
TM171ACAN	CAN	2 screw terminal blocks	TM172P..... TM172O..... <sup>(1)</sup>
TM171ALON	LonWorks	1 screw terminal block	
TM171AMB	Modbus SL (RS-485)	2 screw terminal blocks	
TM171ARS232	RS-232 serial link, Relay output	1 SUB-D 9 1 screw terminal block	
TM171ARS485	Modbus SL, and BACnet MS/TP	2 screw terminal blocks	
TM171AETH	Ethernet, Modbus TCP, and BACnet/IP	1 RJ45	TM172O..... <sup>(1)</sup>
TM171AETHRS485	Ethernet, Modbus TCP, BACnet/IP, Modbus SL, and BACnet MS/TP	1 RJ45 2 screw terminal blocks	

(1) Also compatible with TM171P controller range.

For further information about communication modules, refer to the Modicon M171A Communication Modules Instruction Sheet EAV96007.

## Remote Display Range Overview

### Type Code

Remote display with touch interface type code:

Type code description					
TM172DCLWTHP	TM172DCL	W	T	H	P
Product family	TM172DCL				
Mounting type	F = Flush mounting				
Characteristics	G = Gray color W = White color				
Mounting type	W = Vertical mounting				
Characteristics	T = Temperature sensor				
	None H = Relative humidity sensor				
	None P = Presence sensor (PIR)				

Remote display with keys type code:

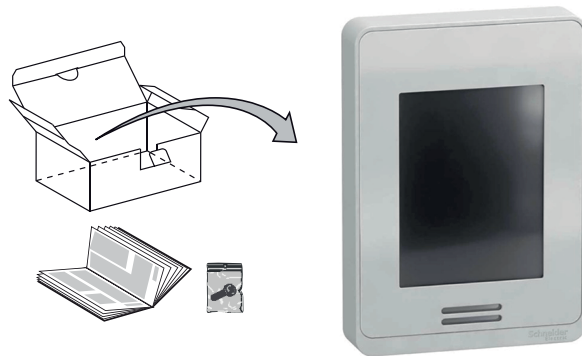
Type code description		
TM172DGRP	TM172	DGRP
Product family	TM172	
Mounting type	DGRP = Display with keys, Panel mounting, 1 CAN serial connection	

## Remote Displays References

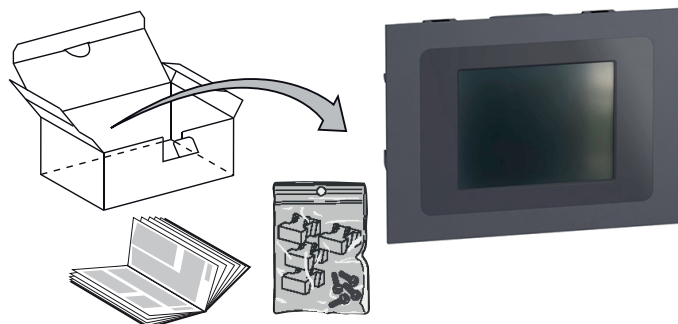
Reference	Embedded sensors			1 RS-485	1 USB Micro-B	1 CAN	Compatible controllers
	Temperature	Humidity	Presence				
TM172DCLWT, page 109	✓	-	-	✓	✓	-	TM172P•••••
TM172DCLWTH, page 109	✓	✓	-	✓	✓	-	TM172O•••••
TM172DCLWTHP, page 109	✓	✓	✓	✓	✓	-	TM171P•••••
TM172DCLFG, page 110	-	-	-	✓	✓	-	TM171O•••••
TM172DCLFW, page 110	-	-	-	✓	✓	-	Third-party Modbus SL devices
TM172DGRP, page 111	-	-	-	-	-	✓	TM172P••••• TM172O•••••

The remote displays run on 24 Vac/dc power supply.

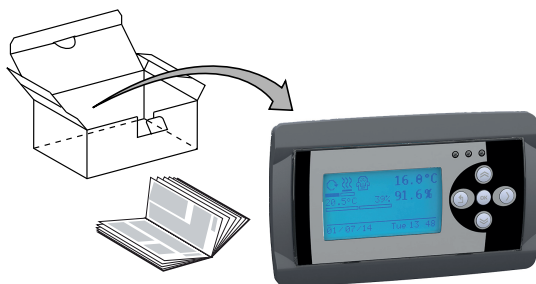
### TM172DCLWT•• Delivery Content



### TM172DCLF• Delivery Content



## TM172DGRP Delivery Content



## Accessories

### Overview

This section describes the accessories and sensors.

### Mounting and Wiring Accessories References

Description		Use	Reference
Vertical surface support for display	White	To install a TM172DCLF* on a vertical surface	TM172ABKPW
	Gray		TM172ABKPG
	White	To install a TM172DGRP on a vertical surface	TM171ABKPB
	Gray		TM171ABKPG
12 clips-on lock		To install the TM172***** controllers and the expansion modules on a panel surface, page 39	TM172AP12PM
Screw terminal blocks for wiring of controllers and expansion modules, page 27		For TM172P*G07R, page 51	TM172ASCTB07
		For TM172***18*, page 53	TM172ASCTB18
		For TM172***28**, page 55	TM172ASCTB28
		For TM172***42**, page 58	TM172ASCTB42
		For TM172E12R, page 62	TM172ASCTB12E
		For TM172E28R, page 64	TM172ASCTB28E
USB cable type A / Mini-B	1.8 m (5.9 ft)	To connect a PC to a TM172***** controller, page 165	BMXXCAUSBH018
	3 m (9.84 ft)		TCSXCNAMUM3P
DIN adapter for current transducer	3240202000	To install the current transducer on a DIN Rail Top Hat	3240301000

### Sensors References

Description		Cable length	Reference
NTC IP68 5x20 mm (0.79 in.) -50+110°C (-122...+230°F) Gray	8 pieces	1.5 m (4.9 ft)	TM1STNTCRN52015
	100 pieces		TM1STNTCRN5201P
	5 pieces	3 m (9.8 ft)	TM1STNTCRN52030



Description		Cable length	Reference
	50 pieces		TM1STNTCRN5203P
	4 pieces	5 m (16.4 ft)	TM1STNTCRN52050
	25 pieces		TM1STNTCRN5205P
NTC IP67 6x15 mm (0.591 in.) -50...+110°C (-122...+230°F) Gray		1.5 m (4.9 ft)	TM1STNTCRN61515
		3 m (9.8 ft)	TM1STNTCRN61530
		5 m (16.4 ft)	TM1STNTCRN61550
NTC FAST IP67 4x40 mm (1.57 in.) -50+110°C (-122...+230°F) Gray		1.5 m (4.9 ft)	TM1STNTCSF44015
		3 m (9.8 ft)	TM1STNTCSF44030
NTC IP68 6x20 mm (0.79 in.) -50+110°C (-122...+230°F) Gray		1.5 m (4.9 ft)	TM1STNTCSN62015
		3 m (9.8 ft)	TM1STNTCSN62030
		5 m (16.4 ft)	TM1STNTCSN62050
NTC IP68 6x20 mm (0.79 in.) TPE with strap Gray		1.5 m (4.9 ft)	TM1STNTCTN62015
		3 m (9.8 ft)	TM1STNTCTN62030
NTC for inside air -40...+60°C (-40...+140°F)	Wall mounting	-	TM1STNTCWN75750
Pt1000 IP68 6x20 mm (0.79 in.) -50...+110°C (-122...+230°F) Green		1.5 m (4.9 ft)	TM1STPTTSN52015
		3 m (9.8 ft)	TM1STPTTSN52030
		5 m (16.4 ft)	TM1STPTTSN52050
Pt1000 IP68 5x20 mm (0.79 in.) -50...+110°C (-122...+230°F) Green		1.5 m (4.9 ft)	TM1STPTTSN62015
		3 m (9.8 ft)	TM1STPTTSN62030
Humidity Probe Outdoor Wall mounting 4...20 mA (%RH)		-	TM1SHC4
Humidity and Temperature Probe Outdoor Wall mounting 4...20 mA (%RH) + NTC (Temp)		-	TM1SHTCN4
Humidity and Temperature Probe Outdoor Wall mounting 4...20 mA (%RH) + 4...20 mA (Temp)		-	TM1SHTCC4
Humidity and Temperature Probe Outdoor Wall mounting, Dewpoint Calculation Modbus SL RS-485			TM1SHTM4
NTC Temperature Probe Outdoor Wall mounting		-	TM1STNTCW69755

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# Global Features

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# Before Starting

## What's in This Chapter

Before Starting .....23

# Before Starting

# Before Starting

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

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

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

### **⚠ WARNING**

#### **REGULATORY INCOMPATIBILITY**

Ensure that all equipment applied and systems designed comply with all applicable local, regional, and national regulations and standards.

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

# Disconnecting Power

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

### **⚡⚠ DANGER**

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

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

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

## Programming Considerations

The products described in this manual have been designed and tested using Schneider Electric programming, configuration, and maintenance software products.

### **⚠ WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

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

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

## Operating Environment

This equipment has been designed to operate outside of any hazardous location, and exclusive of applications that generate, or have the potential to generate, hazardous atmospheres. Only install this equipment in zones known to be free, at all times, of hazardous atmospheres.

### **⚠ DANGER**

#### **POTENTIAL FOR EXPLOSION**

- Install and use this equipment in non-hazardous locations only.
- Do not install and use this equipment in applications capable of generating hazardous atmospheres, such as those applications employing flammable refrigerants.

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

For information concerning the use of control equipment in applications capable of generating hazardous materials, consult your local, regional, or national standards bureau or certification agency.

### **⚠ WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

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

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

## Installation Considerations

### ▲ WARNING

#### UNINTENDED EQUIPMENT OPERATION

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

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

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

The M172 controllers are intended for Top Hat Section Rail (DIN rail) mounting, panel mounting, or wall mounting.

Care must be taken to avoid damage from electrostatic sources when handling this equipment. In particular exposed connectors and, in some cases, exposed printed circuit boards are exceptionally vulnerable to electrostatic discharge.

### ▲ WARNING

#### UNINTENDED EQUIPMENT OPERATION DUE TO ELECTROSTATIC DISCHARGE DAMAGE

- Keep equipment in the protective conductive packaging until you are ready to install the equipment.
- Only install equipment in approved enclosures and / or locations that prevent casual access and provide electrostatic discharge protection.
- Use a conductive wrist strap or equivalent field force protective device attached to an earth ground when handling sensitive equipment.
- Always discharge yourself by touching a grounded surface or approved antistatic mat before handling the equipment.

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

For more information about enclosures, refer to the definition found in IEC 1000-4-2.

# Wiring Best Practices

## What's in This Chapter

Wiring Best Practices.....26

## Wiring Best Practices

## Wiring Best Practices

The following information describes the wiring guidelines and associated best practices to be respected when using a Modicon M172 Logic Controller.

### **DANGER**

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

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

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

### **WARNING**

#### **LOSS OF CONTROL**

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

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

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

## Wiring Guidelines

The following rules must be applied when wiring M172 offer product range:

- I/O and communication wiring must be kept separate from the power wiring. Route these two 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 (required).
- Use twisted pair, shielded cables for analog, and/or fast I/O.
- Use twisted pair, shielded cables for networks, and fieldbus.

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.

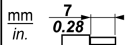







<b>▲ WARNING</b>
<p><b>UNINTENDED EQUIPMENT OPERATION</b></p> <ul style="list-style-type: none"> <li>• Use shielded cables for all fast I/O, analog I/O and communication signals.</li> <li>• Ground cable shields for all analog I/O, fast I/O and communication signals at a single point<sup>1</sup>.</li> <li>• Route communication and I/O cables separately from power cables.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

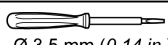

<sup>1</sup> Multipoint grounding is permissible if connections are made to an equipotential ground plane dimensioned to help avoid cable shield damage in the event of power system short-circuit currents.

**NOTE:** Surface temperatures may exceed 60 °C (140 °F). Route primary wiring (wires connected to power mains) separately and apart from secondary wiring (extra low voltage wiring coming from intervening power sources). If that is not possible, double insulation is required such as conduit or cable gains.

## Rules for Screw Terminal Block

The following table presents the cable types and wire sizes for a 5.08 mm (0.20 in.) or 5.00 mm (0.197 in.) pitch screw terminal block:

$\frac{\text{mm}}{\text{in.}}$								
mm <sup>2</sup>	0.2...2.5	0.2...2.5	0.25...2.5	0.25...2.5	2 x 0.2...1	2 x 0.2...1.5	2 x 0.25...1	2 x 0.5...1.5
AWG	24...14	24...14	22...14	22...14	2 x 24...18	2 x 24...16	2 x 22...18	2 x 20...16

	
Ø 3,5 mm (0.14 in.)	
N•m	0.5...0.6
lb-in	4.42...5.31

The following table presents the cable types and wire sizes for a 3.81 mm (0.15 in.) or 3.50 mm (0.14 in.) pitch screw terminal block:

mm <sup>2</sup>	0.14...1.5	0.14...1.5	0.25...1.5	0.25...0.5	2 x 0.08...0.5	2 x 0.08...0.75	2 x 0.25...0.34	2 x 0.5
AWG	26...16	26...16	22...16	22...20	2 x 28...20	2 x 28...20	2 x 24...22	2 x 20

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

The use of copper conductors is required.

**⚠️⚠️ DANGER**

**LOOSE WIRING CAUSES ELECTRIC SHOCK**

- Tighten connections in conformance with the torque specifications.
- Do not insert more than one wire per connector of the terminal block unless using the cable ends (ferrules) specified above.

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

**⚠️ WARNING**

**FIRE HAZARD**

- Use only the recommended wire sizes for the current capacity of the I/O channels and power supplies.
- For relay output wiring up to 2 A, use conductors of at least 0.5 mm<sup>2</sup> (AWG 20) with a temperature rating of at least 80 °C (176 °F).
- For relay output wiring of 3 A, use conductors of at least 1.5 mm<sup>2</sup> (AWG 16) with a temperature rating of at least 80 °C (176 °F).
- For common conductors of relay output wiring of 9 A, or relay output wiring greater than 3 A, use conductors of at least 2.0 mm<sup>2</sup> (AWG 12) with a temperature rating of at least 80 °C (176 °F).

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

## Protecting Outputs from Inductive Load Damage

Depending on the load, a protection circuit may be needed for the relay outputs. 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.**

Choose a protection circuit from the following diagrams according to the power supply used. Connect the protection circuit to the outside of the controller or relay output module.

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 include a protection



device such as a peak limiter, RC circuit or flyback diode. Capacitive loads are not supported by these relays.

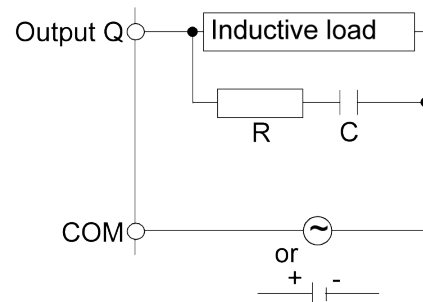
## ⚠ WARNING

### 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.**

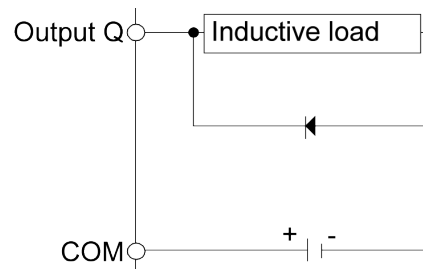
Protective circuit A: this protection circuit can be used for both AC and DC load power circuits.



C Value from 0.1 to 1  $\mu\text{F}$

R Resistor of approximately the same resistance value as the load

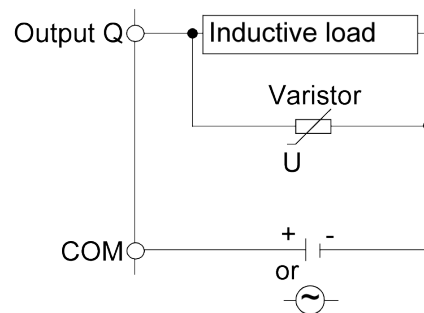
Protective circuit B: this protection circuit can be used for DC load power circuits.



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.



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

**NOTE:** Place protection devices as close to the load as possible.

## Special Handling Considerations

Care must be taken to avoid damage from electrostatic sources when handling this equipment. In particular exposed connectors and, in some cases, exposed printed circuit boards are exceptionally vulnerable to electrostatic discharge.

### ⚠ WARNING

#### UNINTENDED EQUIPMENT OPERATION DUE TO ELECTROSTATIC DISCHARGE DAMAGE

- Keep equipment in the protective conductive packaging until you are ready to install the equipment.
- Only install equipment in approved enclosures and / or locations that prevent casual access and provide electrostatic discharge protection.
- Use a conductive wrist strap or equivalent field force protective device attached to an earth ground when handling sensitive equipment.
- Always discharge yourself by touching a grounded surface or approved antistatic mat before handling the equipment.

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

## Analog Inputs-Probes

Temperature probes have no connection polarity and can be extended using a normal bipolar cable.

The extension of the probes wiring influences the electromagnetic compatibility (EMC) of the instrument

Verify the polarity for probes which have a specific connection polarity.

### NOTICE

#### INOPERABLE EQUIPMENT

Verify all wiring connections before applying power.

**Failure to follow these instructions can result in equipment damage.**

Do not power any connected devices that are externally powered without also applying power to the M172.

## ***NOTICE***

### **INOPERABLE EQUIPMENT**

Ensure that the controller has power applied when applying power to other connected and externally powered devices.

**Failure to follow these instructions can result in equipment damage.**

Signal leads (probes, digital inputs, communication, and the electronic supply) must be routed separately from power cables.

# Installation

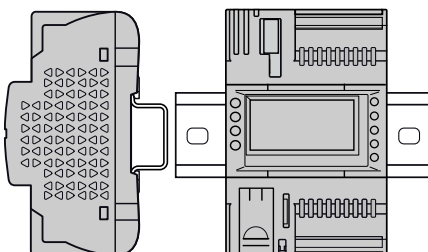
## What's in This Chapter

TM172•••07• / TM172•••18• Controllers Mounting Positions .....	32
TM172•••28•• / TM172•••42•• Controllers Mounting Positions .....	33
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## TM172•••07• / TM172•••18• Controllers Mounting Positions

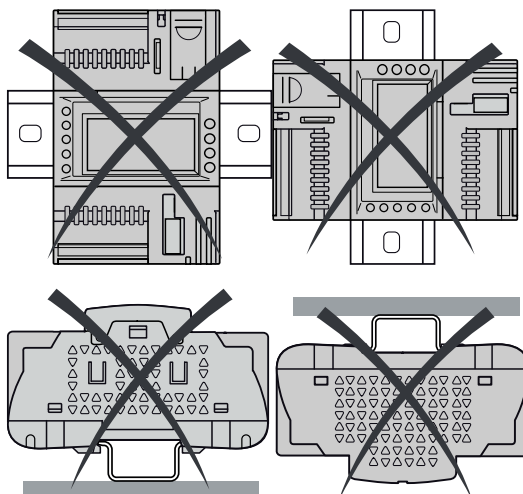
### Correct Mounting Position

TM172•••07• / TM172•••18• controllers must be mounted horizontally on a vertical plane as shown in the figure below:



### Incorrect Mounting Position

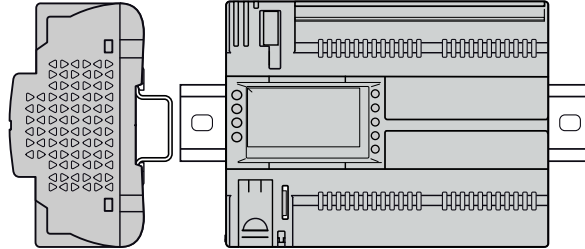
TM172•••07• / TM172•••18• controllers cannot be mounted neither vertically, nor horizontally backward:



# TM172...28... / TM172...42... Controllers Mounting Positions

## Correct Mounting Position

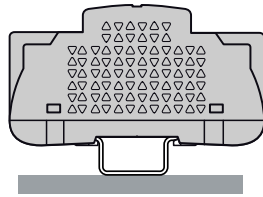
TM172...28... / TM172...42... controllers should be mounted horizontally on a vertical plane as shown in the figure below:



## Acceptable Mounting Position

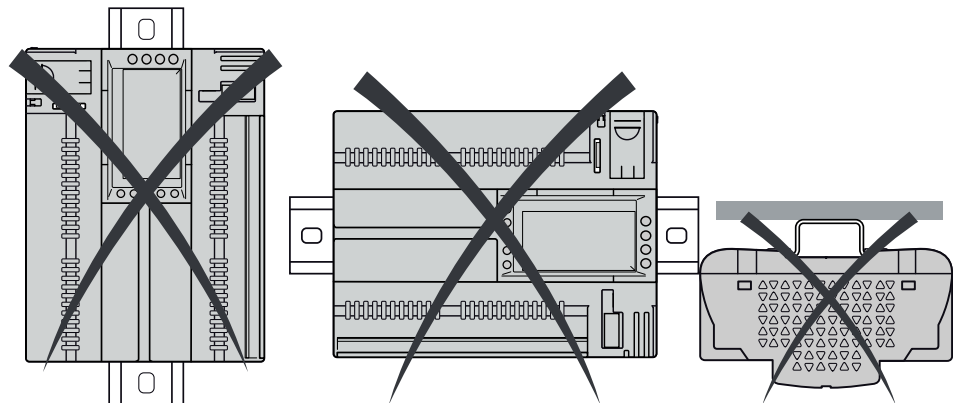
TM172...28R... / TM172...42R... controllers can be mounted horizontally upward with a temperature derating (maximum ambient temperature: 60 °C (140 °F)).

TM172PDG28SI / TM172PDG42SI controllers can be mounted horizontally upward with a temperature derating (maximum ambient temperature: 55 °C (131 °F)).

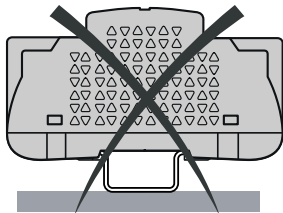


## Incorrect Mounting Position

TM172...28... / TM172...42... controllers cannot be mounted neither vertically, nor horizontally backward:



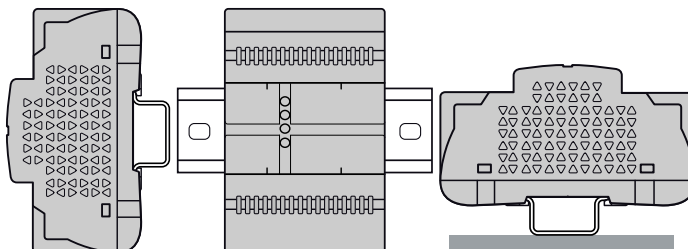
TM172PDG28S / TM172PDG42S controllers cannot be mounted horizontally upward:



## TM172E••R Expansion Modules Mounting Positions

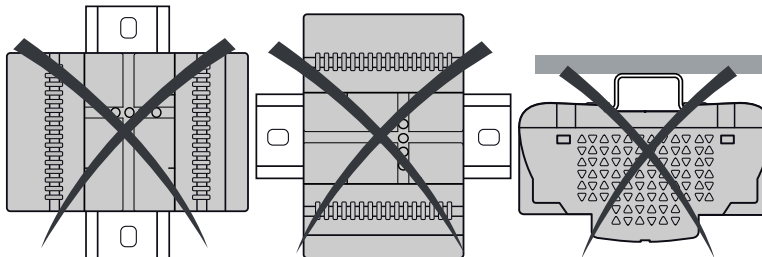
### Correct Mounting Position

TM172E••R expansion modules must be mounted horizontally on a vertical plane or horizontally upward as shown in the figure below:



### Incorrect Mounting Position

TM172E••R expansion modules cannot be mounted neither vertically, nor horizontally backward:



# Controllers and Expansion Modules Clearances

## Minimum Clearances

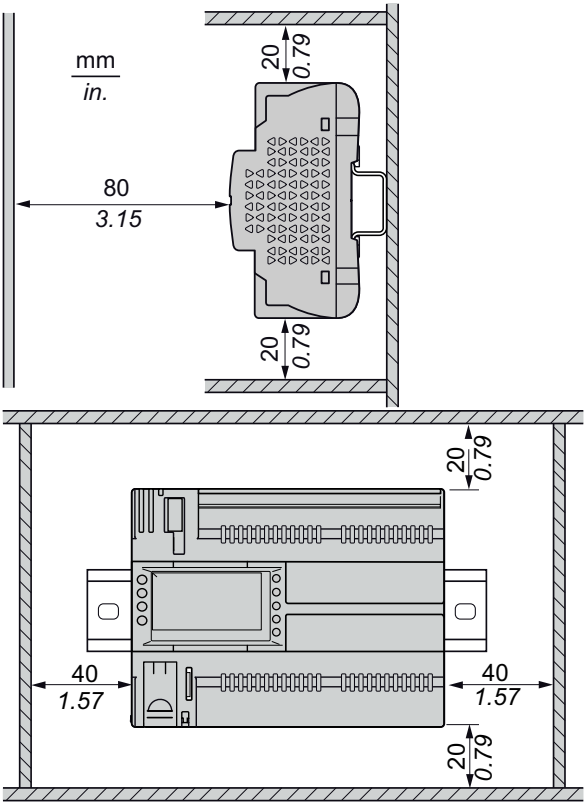
<b>▲ WARNING</b>
<p><b>UNINTENDED EQUIPMENT OPERATION</b></p> <ul style="list-style-type: none"> <li>Place devices dissipating the most heat at the top of the cabinet and ensure adequate ventilation.</li> <li>Avoid placing this equipment next to or above devices that might cause overheating.</li> <li>Install the equipment in a location providing the minimum clearances from all adjacent structures and equipment as directed in this document.</li> <li>Install all equipment in accordance with the specifications in the related documentation.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

TM172..... controllers and expansion modules have been designed as IP20 products and must be installed in an enclosure appropriately rated for its intended environment and secured by a keyed or tooled locking mechanism.

There are 3 types of clearances between:

- The M172 device and the sides of the cabinet (including the panel door).
- The M172 device terminal blocks and the wiring ducts. This distance reduces electromagnetic interference between the controller and the wiring ducts.
- The M172 device and other heat generating devices installed in the same cabinet.

The following figure shows the minimum clearances that apply to TM172..... references:



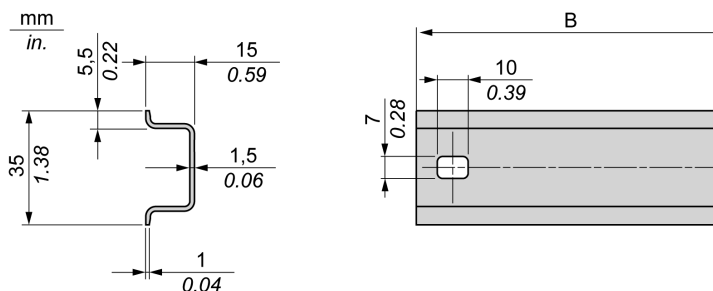
# Top Hat Section Rail (DIN Rail)

## Dimensions of Top Hat Section Rail (DIN Rail)

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

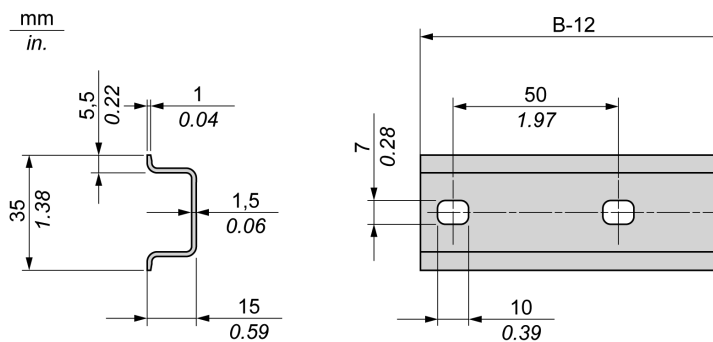
## Symmetric Top Hat Section Rails (DIN Rail)

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



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

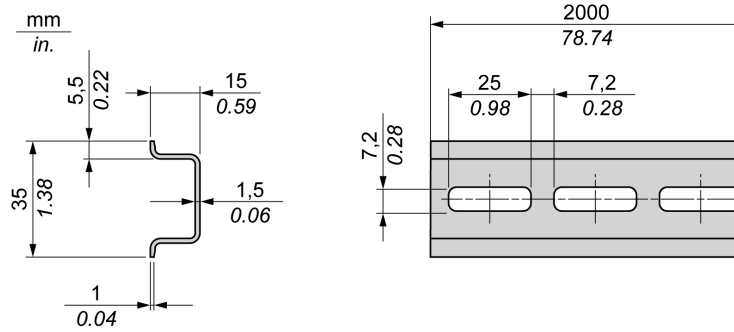
The following illustration and table show the references of the symmetric top hat section rails (DIN rail) for the metal enclosure range:



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



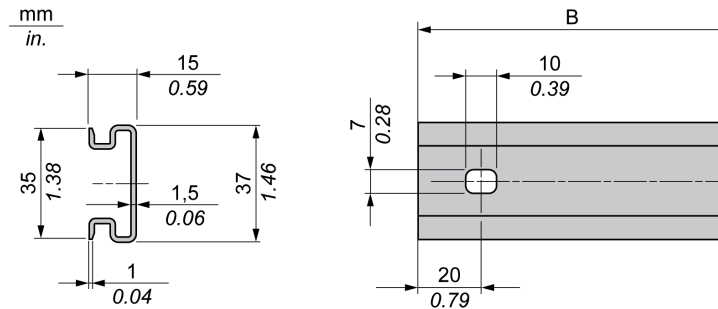
The following illustration and table shows the references of the symmetric top hat section rails (DIN rail) of 2000 mm (78.74 in.):



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

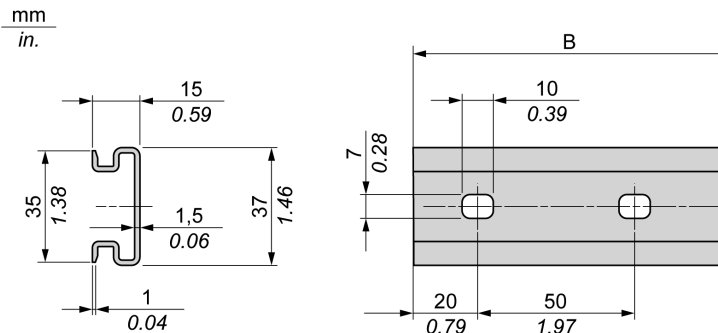
## Double-Profile Top Hat Section Rails (DIN Rail)

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



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

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



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

## Controllers and Expansion Modules Installation

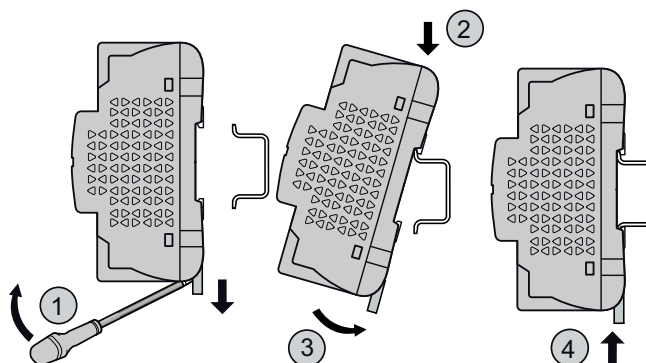
### Overview

This section describes how to install and remove a TM172..... controller or expansion module from a top hat section rail (DIN rail).

### Installing on a Top Hat Section Rail (DIN Rail)

The following procedure describes how to install a controller or an expansion module on a top hat section rail (DIN rail):

Step	Action
1	Move the two spring docking devices to their standby position (use a screwdriver to press against the relative compartments).
2	Position the top groove of the controller or the expansion modules on the top edge of the Top Hat Section Rail (DIN rail).
3	Press the assembly against the Top Hat Section Rail (DIN rail).
4	Press the spring docking devices to put them into the locked position.



## Removing from a Top Hat Section Rail (DIN Rail)

The following procedure describes how to remove a controller or an expansion module from a top hat section rail (DIN rail):

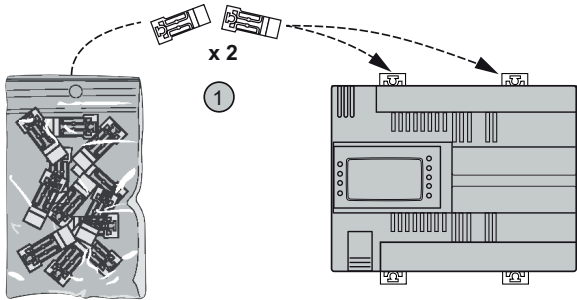
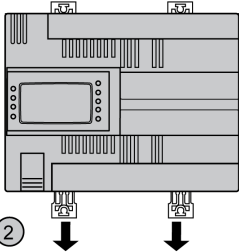
Step	Action
1	Remove the power from the controller or the expansion module.
2	Insert a flat screwdriver into the spring docking devices.
3	Pull down the spring docking device to move it to its standby position.
4	Pull the controller or the expansion module from the top hat section rail (DIN rail) from the bottom.

## Panel Installation

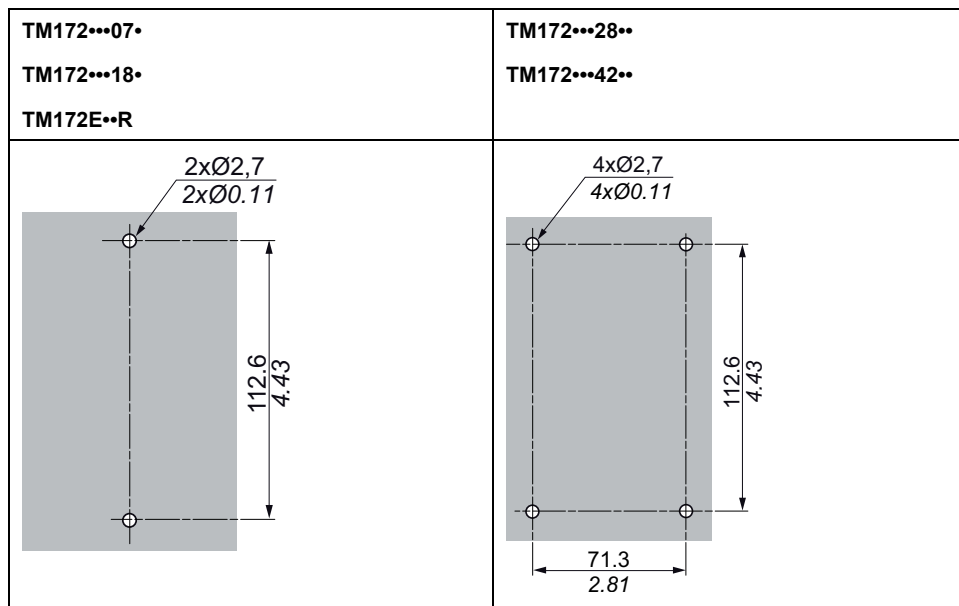
To install the controllers and expansion modules on a panel you must use clip-on locks.

**NOTE:** Upper clip-on locks are not provided with the logic controllers and must be ordered separately, page 20. Only one additional upper clip-on lock is necessary for TM172P•G07R, TM172•••18•, and TM172E••R.

The following procedure shows how to install a TM172•••28•• or a TM172•••42•• controller on a panel using the clip-on locks. The same procedure shall be followed for the TM172P•••••• / TM172O•••••• / TM172E••R:

Step	Action
1	Install the 2 upper clip-on locks 
2	Move the 2 lower clip-on locks to their standby position 
3	Secure the device in position with 4 screws. Refer to the mounting holes layout, page 40.

## Mounting Holes Layout



## TM172DCLWT•• Remote Display Installation

### TM172DCLWT•• Panel installation

The TM172DCLWT•• remote display can be mounted horizontally or vertically on a vertical wall.

TM172DCLWT•• display incorporates a temperature sensor. To function correctly, air must circulate through the product to accurately determine the temperature.

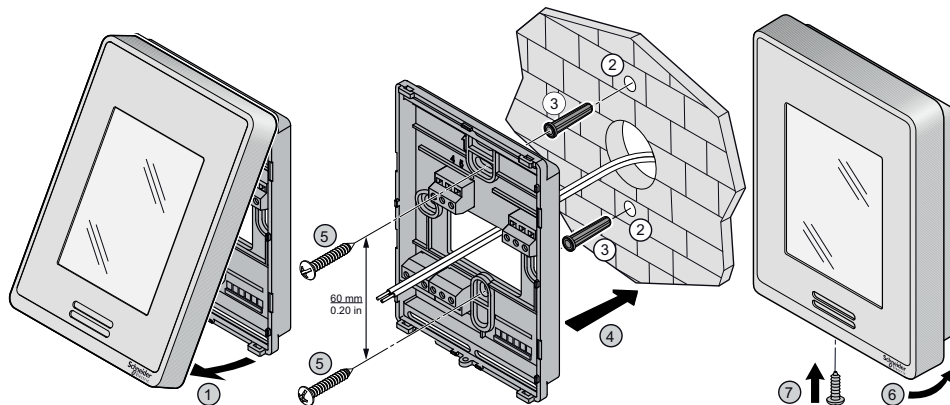
### NOTICE

#### INACCURATE TEMPERATURE MEASUREMENT

Mount the TM172DCLWT•• in an upright, vertical (portrait) position when using the temperature sensor.

**Failure to follow these instructions can result in equipment damage.**

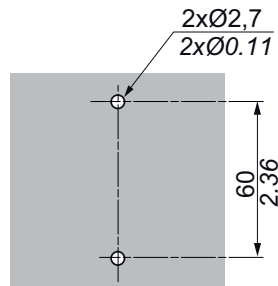
The following graphic and procedure explain how to install TM172DCLWT•• remote display on a wall:



Step	Action
1	Open unit by pulling on bottom side of the display(1)
2	Ensure correct side of base faces up
3	Pull cables 150 mm (5.90 in.) out from wall
4	Align base and mark location of two mounting holes on wall or panel (2)
5	Install anchors in wall (3)
6	Insert cable in central hole of base
7	Place rear cover on the wall and align it with mounting holes (4)
8	Insert screws in mounting holes on each side of base (5)
9	Strip each wire 6 mm (0.24 in.) from end
10	Insert each wire according to wiring chart, page 26
11	Gently push excess wiring back into hole
12	Gently align cover to top of base and snap in place from bottom (6)
13	Install the isolated screw connection for securing the plastic housing (7)

## Mounting Holes Layout

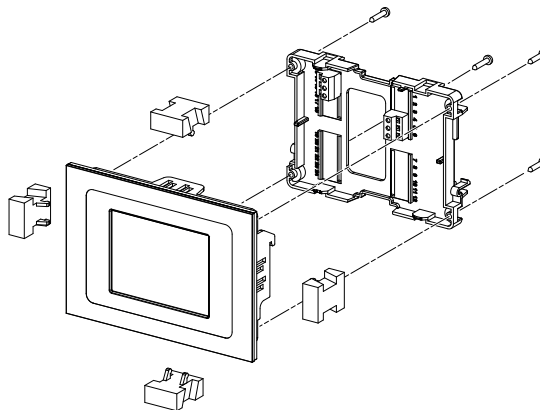
Mounting holes layout for TM172DCLWT••:



## TM172DCLF• Remote Display Installation

### TM172DCLF• Wiring

The TM172DCLF• remote display must be wired prior to the mounting phase.

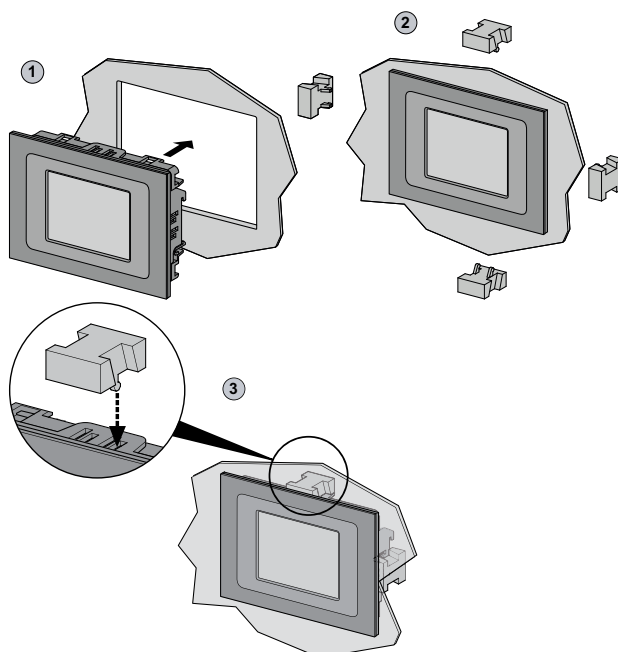


The following procedure explain how to wire a TM172DCLF• remote display:

Step	Action
1	Open unit by pulling on bottom side of the display
2	Insert cable in central hole of base
3	Strip each wire 6 mm (0.24 in.) from end
4	Insert each wire according to wiring chart, page 26
5	Gently align cover to top of base and snap in place.
6	Install the 4 isolated screws connection for securing the plastic housing

## TM172DCLF• Panel Installation

The TM172DCLF• remote display can be mounted horizontally or vertically on a vertical panel.

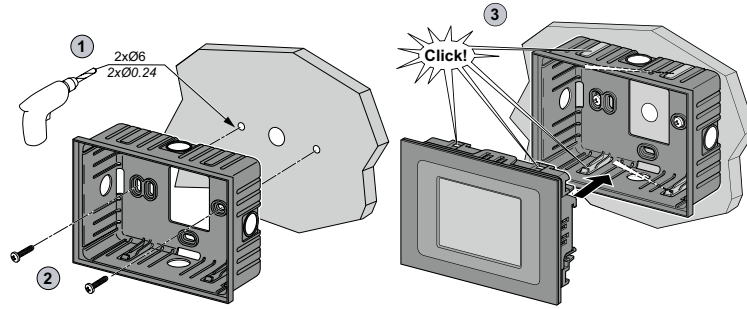


The following procedure explain how to install a TM172DCLF• remote display on a panel:

Step	Action
1	Make a hole using the mounting hole layout.
2	Pull cables 150 mm (5.90 in.) out from hole.
3	Wire the unit according to the wiring procedure.
4	Insert the unit in the hole (1).
5	Secure it with 4 panel mounting locks provided (2)(3).

## TM172DCLF• Vertical Surface Installation

The TM172DCLF• remote display can be mounted horizontally or vertically on a vertical surface using TM172ABKPG or TM172ABKPW accessory.

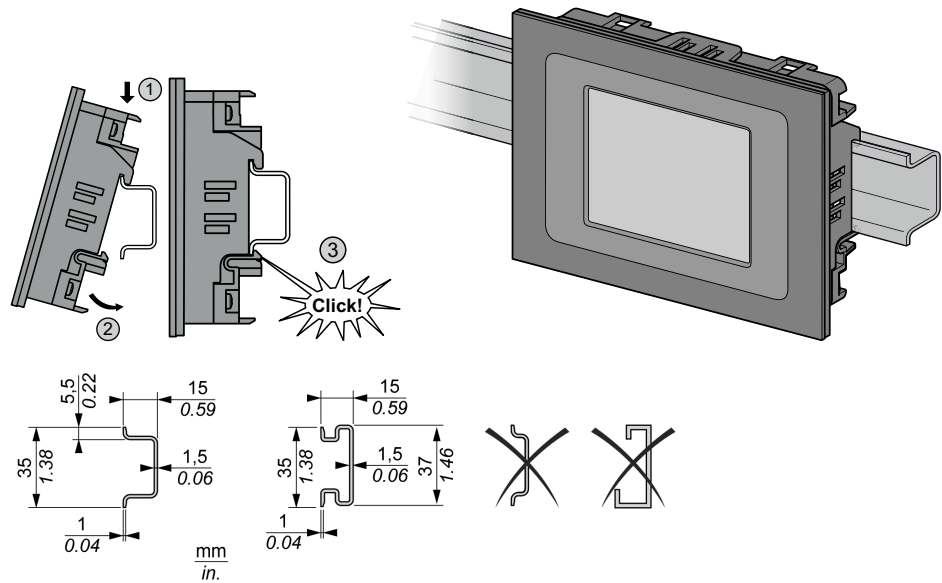


The following procedure explain how to install TM172DCLF• remote display on a vertical surface:

Step	Action
1	Place the TM172ABKP• accessory.
2	Ensure correct side of TM172ABKP• faces up.
3	Pull cables 150 mm (5.90 in.) out from vertical surface if necessary.
4	Align TM172ABKP• and mark location of two mounting holes on the vertical surface.
5	Drill holes in the vertical surface (1).
6	Pull cables 150 mm (5.90 in.) out from a hole of TM172ABKP•.
7	Place TM172ABKP• on the vertical surface and align it with mounting holes.
8	Insert screws in mounting holes on each side of TM172ABKP• (2).
9	Wire the unit according to the wiring procedure.
10	Gently push excess wiring back into hole.
11	Gently snap in place TM172DCLF• into TM172ABKP• (3).

## TM172DCLF• Top Hat Section Rail (DIN Rail) Installation

The TM172DCLF• remote display can be mounted horizontally on a top hat section rail (DIN rail).

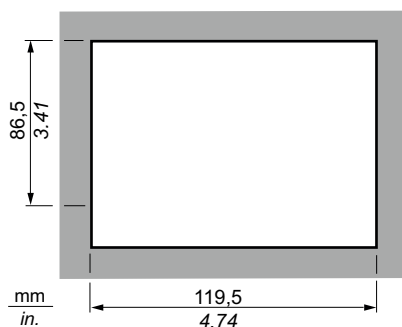


The following procedure describes how to install a TM172DCLF• remote display on a top hat section rail (DIN rail):

Step	Action
1	Wire the unit according to the wiring procedure.
2	Position the top groove of the remote display on the top edge of the Top Hat Section Rail (DIN rail) (1).
3	Press the assembly against the Top Hat Section Rail (DIN rail) (2) up to the locked position (3).

## Mounting Holes Layout

Mounting hole layout for TM172DCLF•:



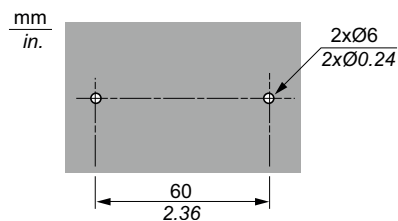
with seals:



without seals:



Mounting holes layout for TM172ABKPG or TM172ABKPW:

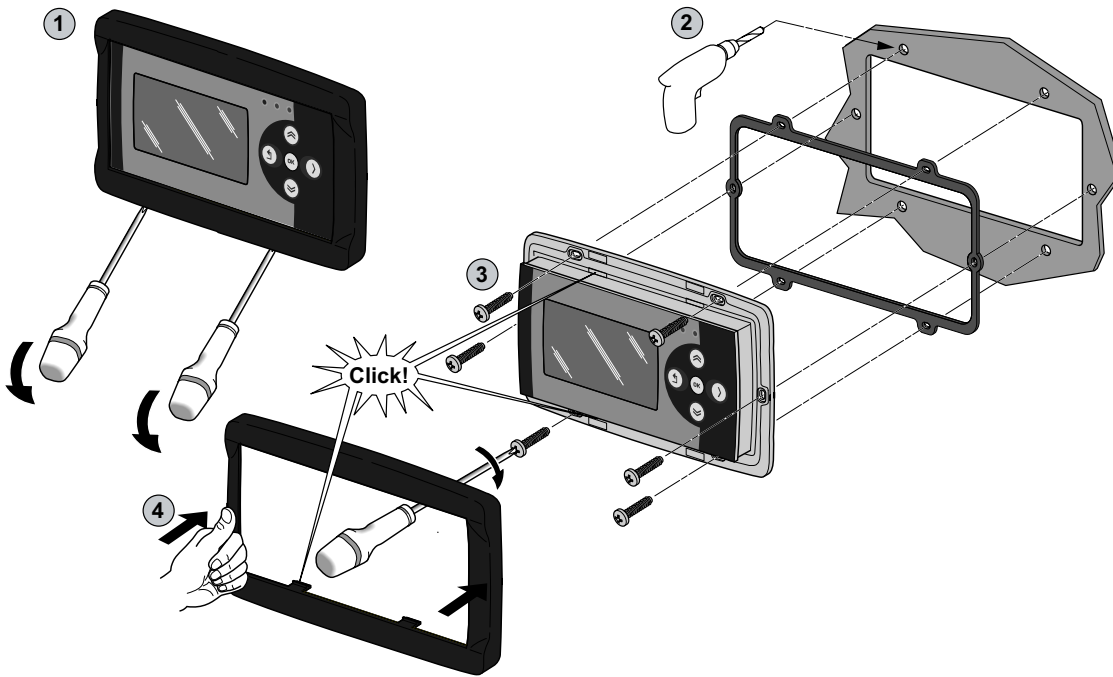


## TM172DGRP Remote Display Installation

### TM172DGRP Panel Installation

The TM172DGRP remote display can be mounted horizontally on a vertical panel.



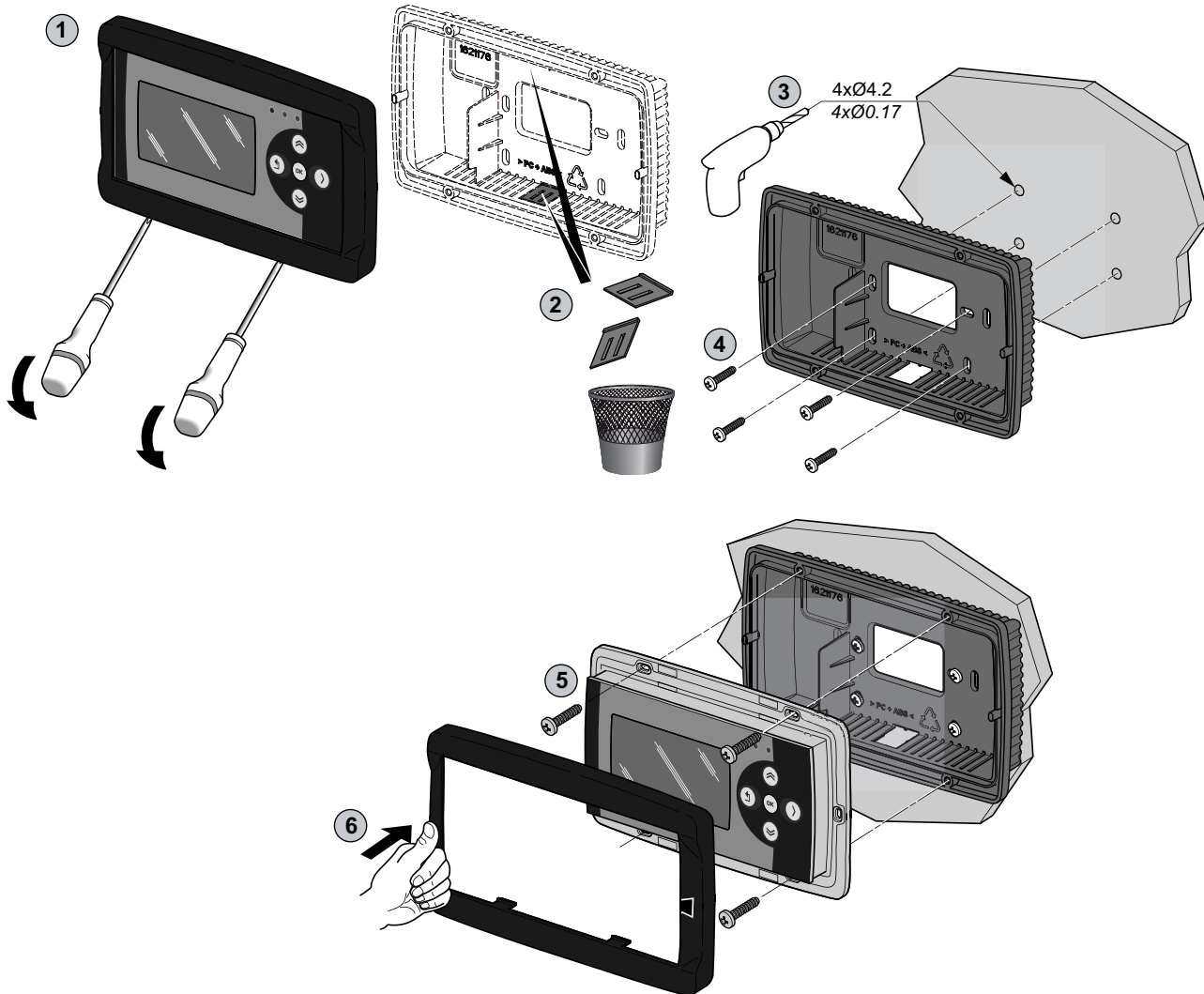


The following procedure explain how to install a TM172DGRP remote display on a panel:

Step	Action
1	Open unit by pulling on bottom side of the display
2	Make a hole using the mounting hole layout. Drill, at the specified spacing, 6 holes using the mounting hole layout, page 47. Insert cable in central hole of the panel. Strip each wire 6 mm (0.24 in.) from end. Connect each wire according to wiring chart, page 26
3	Place the seal, insert the unit in the hole, and fix it with the 6 screws.
4	Gently align cover to top of base and snap in place.

## TM172DGRP Vertical Surface Installation

The TM172DGRP remote display can be mounted horizontally on a vertical surface using TM171ABKPB or TM171ABKPG accessory.

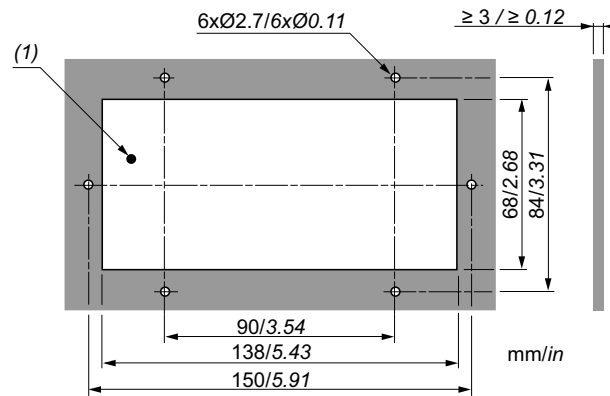


The following procedure explain how to install TM172DGRP remote display on a vertical surface:

Step	Action
1	Open unit by pulling on bottom side of the display
2	On the TM171ABKP• accessory, use the two side slots, one at the bottom and one at the top, under the pre-formatted removable doors, preventing the opening of holes in the wall.
3	Drill, at the specified spacing, 4 holes using the mounting hole layout, page 47.
4	Place the TM171ABKP• accessory and fix it with the 4 screws Pull cables 150 mm (5.90 in.) out from TM171ABKP• side slots. Strip each wire 6 mm (0.24 in.) from end. Connect each wire according to wiring chart, page 26
5	Insert the TM172DGRP remote display in the TM171ABKP• accessory, and fix it with the 4 screws.
6	Gently align cover to top of base and snap in place.

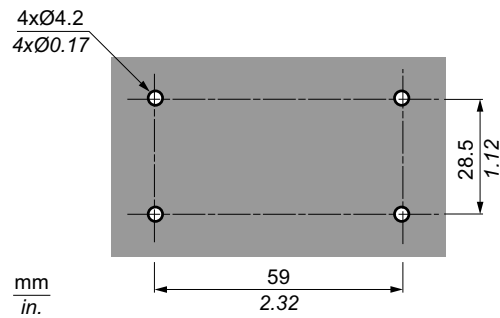
## Mounting Holes Layout

Mounting hole layout for TM172DGRP Panel Installation:



1: Panel cut out

Mounting hole layout for TM172DGRP Vertical Surface Installation with TM171ABKP• accessory:



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# Controllers and Expansion Modules

## What's in This Part

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# Environmental Characteristics

## What's in This Chapter

Environmental Characteristics ..... 49

# Environmental Characteristics

## Technical Data

The Modicon M172 Logic Controller offer components meet European Community (CE) requirements for open equipment. You must install them in an enclosure or other location designed for the specific environmental conditions and to minimize the possibility of unintended contact with hazardous voltages. Use metal enclosures to improve the electromagnetic immunity of your M172 system. This equipment meets CE requirements as indicated in the following tables.

**▲ WARNING**

**UNINTENDED EQUIPMENT OPERATION**

Do not exceed any of the rated values specified within this chapter.

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

## Controller and Expansion Modules Specifications

Characteristics	Specification	TM172P•G07R	TM172P•G18R / TM172O•M18R	TM172PDG18S	TM172O•*28R	TM172PBG28RI / TM172PDG28RI	TM172PDG28SI	TM172O•*42R	TM172PBG42RI / TM172PDG42RI	TM172PDG42SI	TM172P•G28R / TM172P•G42R	TM172PDG28S / TM172PDG42S	TM172E12R	TM172E28R
		The product complies with the following harmonized Standards	EN 60730-1 / EN 60730-2-9	✓										
Construction of control	Electronic automatic Incorporated Control	✓												
Purpose of control	Operating control (non-safety-related)	✓												
Mounting	Top Hat Section Rail (DIN rail)	✓												
	Optional panel mounting (with accessories)	✓												
Type of action	1.B	✓												
	1.Y	-	✓	-	✓	-	✓	-	✓	-	✓	-	-	
Type of disconnection or suspension for each circuit	Micro disconnection	✓												
Pollution degree	2 (normal)	✓												
Over-voltage category	II	✓												
Rated impulse voltage	2500 V	✓												

Characteristics	Specification	TM172P-G07R	TM172P-G18R / TM172O-M18R	TM172PDG18S	TM172O-M28R	TM172PBG28RI / TM172PDG28RI	TM172PDG28SI	TM172O-M42R	TM172PBG42RI / TM172PDG42RI	TM172PDG42SI	TM172P-G28R / TM172P-G42R	TM172PDG28S / TM172PDG42S	TM172E12R	TM172E28R
Period of electric stress on the insulating parts	Long period, EN 60730	✓												
Power supply	24 Vac (+/- 10 %) 50 Hz / 60 Hz 20...38 Vdc (non-isolated)	-						✓						
	24 Vac (+/- 10 %) 50 Hz / 60 Hz 20...38 Vdc (isolated)	✓						-						
Power Consumption	20 VA / 10 W	✓	-						✓	-				
	21 VA / 11 W	-	✓	-						-				
	23 VA / 12 W	-		✓	-						-			
	24 VA / 15 W	-						-		✓	-			
	25 VA / 14 W	-						✓	-		-			
	35 VA / 15 W	-						-		✓	-			
Insulation class	II	✓												
Ambient operating temperature	-20...55 °C (-4...131 °F)	-	✓	-						✓	-			
	-20...60 °C (-4...140 °F)	✓	-		✓ <sup>(1)</sup>	-		✓ <sup>(1)</sup>	-		-			
	-20...65 °C (-4...149 °F)	-	✓ <sup>(2)</sup>	-	✓ <sup>(2)</sup>	-	✓ <sup>(3)</sup>	-	✓	-				
Ambient operating humidity (non-condensing)	5...95 %	✓												
Ambient storage temperature	-30...70 °C (-22...158 °F)	✓												
Ambient storage humidity (non-condensing)	5...95 %	✓												
Temperature for ball pressure test	125 °C (257 °F)	✓						-		✓				
Insulation material group	IIIa	✓												
Fire-resistance category	D	✓												
Software class and structure	A	✓												
Operating altitude	0...2000 m (0...6560 ft)	✓												
Digital outputs	Refer to the label on the device	✓												
Degree of protection by enclosure	IP20	✓												
<p>(1) Limited to 55°C (131°F), if mounted other than horizontally on vertical plane.</p> <p>(2) Limited to 60°C (140°F), if mounted other than horizontally on vertical plane.</p> <p>(3) Limited to 60°C (140°F), if DO8 is active or if mounted other than horizontally on vertical plane.</p>														

# TM172P..... / TM172O..... Controllers Description

## What's in This Chapter

TM172P•G07R.....	51
TM172P••18• / TM172O••18• .....	53
TM172P••28•• / TM172O••28R .....	55
TM172P••42•• / TM172O••42R .....	58

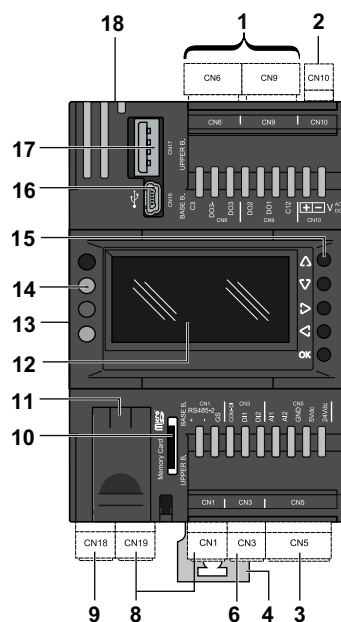
## TM172P•G07R

### Overview

Reference	Description
TM172PBG07R	M172 Performance Blind 7 I/Os Isolated
TM172PDG07R	M172 Performance Display 7 I/Os Isolated

### Physical Description

The following illustration presents the TM172P•G07R controller:



Number	Name	Description
1	CN6	DO3 High voltage relay digital output 250 Vac 3 A SPDT, page 76
	CN9	DO1...DO2 High voltage relay digital output 250 Vac 3 A SPST, page 73
2	CN10	24 Vac/dc isolated power supply, page 67
3	CN5	Power out +24 Vdc power out for analog inputs, max current 100 mA +5 Vdc power out for ratiometric analog inputs, max current 40 mA (2)
		AI1...AI2 Analog inputs are configurable as, page 78: <ul style="list-style-type: none"> <li>• NTC resistive input or digital input</li> <li>• Current analog input</li> <li>• Voltage analog input</li> <li>• PTC resistive input</li> </ul>
4	-	Clip-on lock, page 32

Number	Name	Description
6	CN3	DI1...DI2 Fast digital input, pulse/frequency counter up 2 kHz, opto-isolated, page 70
8	CN1	RS-485 serial port-2, page 94
	CN19	RS-485 serial port-1, page 94
9	CN18	CAN expansion bus master, page 91
10	-	Micro SD memory card slot, page 101
11	-	Service battery door, page 103
12	-	User interface - Display, page 104 (1)
13	-	Communication module connector, page 17
14	-	User interface - LEDs, page 104 (1)
15	-	User interface - Keys, page 104 (1)
16	CN16	USB type Mini-B female for PC connection, page 97
17	CN17	USB type A female for a mass storage device (FAT32), page 97
18	CN20	Ethernet Modbus TCP/IP or BACnet IP, page 98

(1) Only for TM172•D......

(2) 0-5 V Ratiometric: ratiometric range is 0.5 V to 4.5 V. Maximum current at +5 Vdc is 40 mA.

**NOTE:** The controller is delivered without removable screw terminal blocks, page 20.

## NOTICE

### INOPERABLE EQUIPMENT

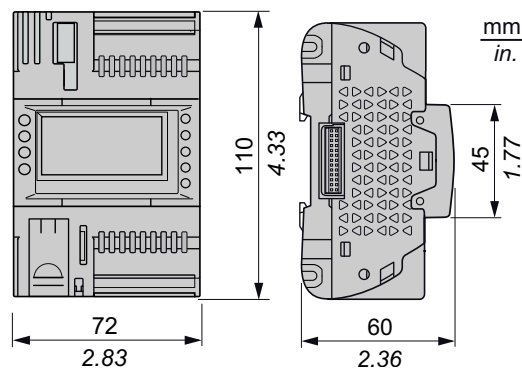
Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected.

**Failure to follow these instructions can result in equipment damage.**

For more details, refer to analog inputs configuration, page 78 and analog outputs configuration, page 87.

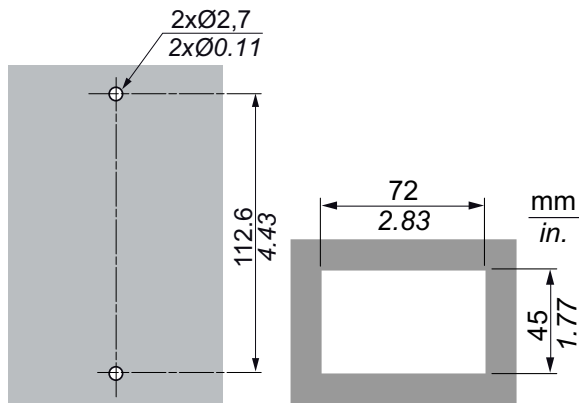
For more information about the wiring, refer to wiring best practices, page 26.

## Dimensions





## Mounting Holes Layout



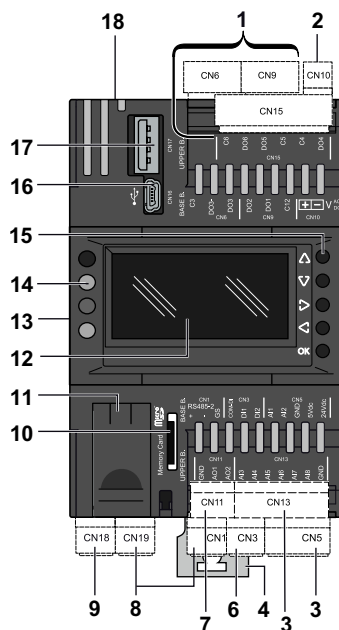
## TM172P••18• / TM172O••18•

### Overview

Reference	Description
TM172PBG18R	M172 Performance Blind 18 I/Os Isolated
TM172PDG18R	M172 Performance Display 18 I/Os Isolated
TM172PDG18S	M172 Performance Display 18 I/Os 2 SSR Isolated
TM172OBM18R	M172 Optimized Blind 18 I/Os Isolated
TM172ODM18R	M172 Optimized Display 18 I/Os Isolated

### Physical Description

The following illustration presents the TM172••18• controller:



Number	Name	Description
1	CN6	DO3 High voltage relay digital output 250 Vac 3 A SPDT, page 76

Number	Name	Description	
	CN9	DO1...DO2	High voltage relay digital output 250 Vac 3 A SPST, page 73
	CN15	DO5...DO6	<ul style="list-style-type: none"> <li>TM172.....R: High voltage relay digital output 250 Vac 3 A SPST, page 73</li> <li>TM172PDG18S: High voltage SSR digital output 240 Vac 0.2 A, page 75</li> </ul>
		DO4	High voltage relay digital output 250 Vac 3 A SPST, page 73
2	CN10	24 Vac/dc isolated power supply, page 67	
3	CN5	Power out	+24 Vdc power out for analog inputs, max current 100 mA +5 Vdc power out for ratiometric analog inputs, max current 40 mA <sup>(2)</sup>
		AI1...AI2	Analog inputs are configurable as, page 78: <ul style="list-style-type: none"> <li>NTC resistive input or digital input</li> <li>Current analog input</li> <li>Voltage analog input</li> <li>PTC resistive input</li> </ul>
	CN13	AI3...AI8	<ul style="list-style-type: none"> <li>NTC resistive input or digital input</li> <li>Current analog input</li> <li>Voltage analog input</li> <li>PTC resistive input</li> </ul>
4	-	Clip-on lock, page 32	
6	CN3	DI1...DI2	Fast digital input, pulse/frequency counter up 2 kHz, opto-isolated, page 70
7	CN11	AO1...AO2	Low voltage SELV analog outputs, configurable as, page 87: <ul style="list-style-type: none"> <li>Current modulation analog output</li> <li>Current ON/OFF analog output</li> <li>Voltage modulation analog output</li> <li>PWM open collector</li> </ul>
8	CN1	RS-485 serial port-2, page 94	
	CN19	RS-485 serial port-1, page 94	
9	CN18	CAN expansion bus master, page 91	
10	-	Micro SD memory card slot, page 101 <sup>(3)</sup>	
11	-	Service battery door, page 103	
12	-	User interface - Display, page 104 <sup>(1)</sup>	
13	-	Communication module connector, page 17	
14	-	User interface - LEDs, page 104 <sup>(1)</sup>	
15	-	User interface - Keys, page 104 <sup>(1)</sup>	
16	CN16	USB type Mini-B female for PC connection, page 97	
17	CN17	USB type A female for a mass storage device (FAT32), page 97 <sup>(3)</sup>	
18	CN20	Ethernet Modbus TCP/IP or BACnet IP, page 98 <sup>(3)</sup>	

(1) Only for TM172-D.....

(2) 0-5 V Ratiometric: ratiometric range is 0.5 V to 4.5 V. Maximum current at +5 Vdc is 40 mA.

(3) Only for TM172P.....

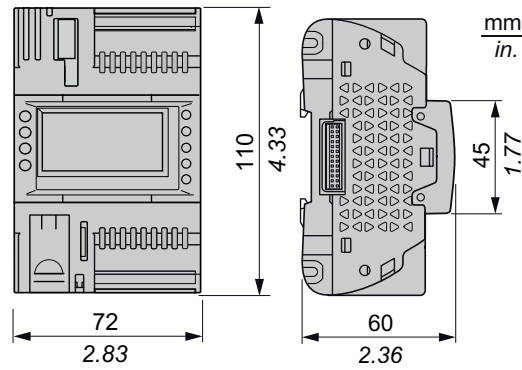
**NOTE:** The controller is delivered without removable screw terminal blocks, page 20.

<b>NOTICE</b>
<b>INOPERABLE EQUIPMENT</b>
Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected.
<b>Failure to follow these instructions can result in equipment damage.</b>

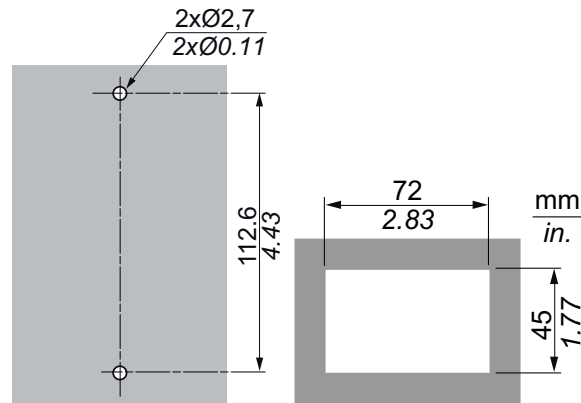
For more details, refer to analog inputs configuration, page 78 and analog outputs configuration, page 87.

For more information about the wiring, refer to wiring best practices, page 26.

## Dimensions



## Mounting Holes Layout



## TM172P..28.. / TM172O..28R

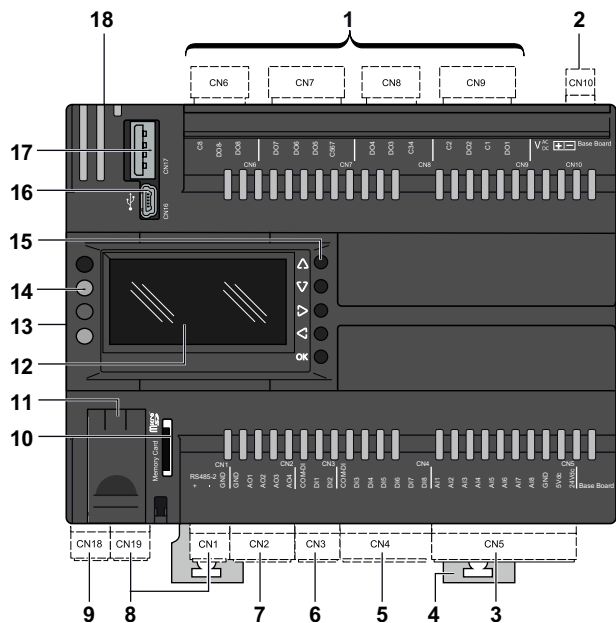
### Overview

Reference	Description
TM172PBG28R	M172 Performance Blind 28 I/Os
TM172PBG28RI	M172 Performance Blind 28 I/Os Isolated
TM172PDG28R	M172 Performance Display 28 I/Os
TM172PDG28RI	M172 Performance Display 28 I/Os Isolated
TM172PDG28S	M172 Performance Display 28 I/Os 2 SSR
TM172PDG28SI	M172 Performance Display 28 I/Os 2 SSR Isolated
TM172OBM28R	M172 Optimized Blind 28 I/Os Isolated
TM172ODM28R	M172 Optimized Display 28 I/Os Isolated

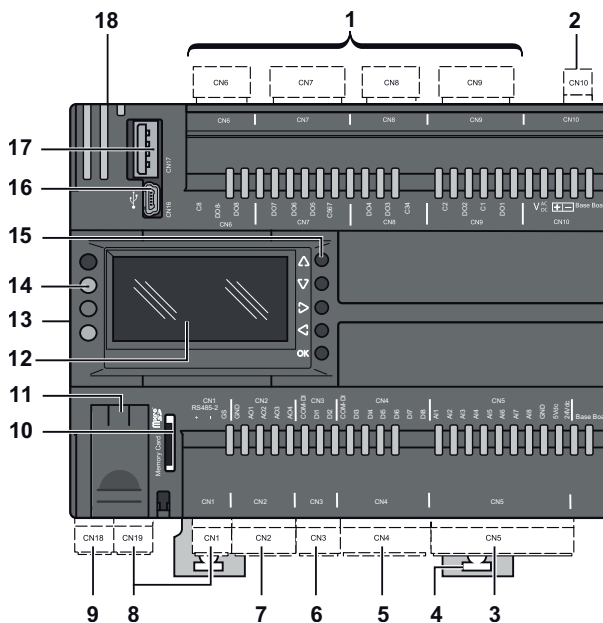
# Physical Description

The following illustration presents the TM172P••28•• controller:

TM172P••28•• controller:



TM172P••28••I / TM172O••28R controller:



Number	Name	Description	
1	CN6	DO8 <ul style="list-style-type: none"> <li>TM172P••28••: High voltage relay digital output 250 Vac 1 A SPDT, page 76</li> <li>TM172P••28••I / TM172O••28R: High voltage relay digital output 250 Vac 3 A SPDT, page 76</li> </ul>	
	CN7	DO5...DO7	High voltage relay digital output 250 Vac 3 A SPST, page 73
	CN8	DO3...DO4	
	CN9	DO1...DO2 <ul style="list-style-type: none"> <li>TM172••••R•: High voltage relay digital output 250 Vac 3 A SPST, page 73</li> <li>TM172••••S•: High voltage SSR digital output 240 Vac 0.5 A, page 75</li> </ul>	
2	CN10	24 Vac/dc power supply, page 67	
3	CN5	Power out <ul style="list-style-type: none"> <li>+24 Vdc power out for analog inputs, max current 150 mA</li> <li>+5 Vdc power out for ratiometric analog inputs, max current 50 mA <sup>(2)</sup></li> </ul>	
		AI1...AI8 <ul style="list-style-type: none"> <li>Analog inputs are configurable as, page 78:                             <ul style="list-style-type: none"> <li>NTC resistive input or digital input</li> <li>Current analog input</li> <li>Voltage analog input</li> <li>PTC resistive input</li> </ul> </li> </ul>	
4	-	Clip-on lock, page 32	
5	CN4	DI3...DI8	Regular digital input opto-isolated, page 71
6	CN3	DI1...DI2	Fast digital input, pulse/frequency counter up 2 kHz, opto-isolated, page 70
7	CN2	AO1...AO2	Low voltage (SELV) analog outputs 0...10 Vdc, page 89
		AO3...AO4 <ul style="list-style-type: none"> <li>Low voltage SELV analog outputs, configurable as, page 87:                             <ul style="list-style-type: none"> <li>Current modulation analog output</li> <li>Current ON/OFF analog output</li> <li>Voltage modulation analog output</li> <li>PWM open collector</li> </ul> </li> </ul>	
8	CN1	RS-485 serial port-2, page 94	
	CN19	RS-485 serial port-1, page 94	
9	CN18	CAN expansion bus master, page 91	

Number	Name	Description
10	-	Micro SD memory card slot, page 101 (3)
11	-	Service battery door, page 103
12	-	User interface - Display, page 104 (1)
13	-	Communication module connector, page 17
14	-	User interface - LEDs, page 104 (1)
15	-	User interface - Keys, page 104 (1)
16	CN16	USB type Mini-B female for PC connection, page 97
17	CN17	USB type A female for a mass storage device (FAT32), page 97 (3)
18	CN20	Ethernet Modbus TCP/IP or BACnet IP, page 98 (3)

(1) Only for TM172•D.....

(2) 0-5 V Ratiometric: ratiometric range is 0.5 V to 4.5 V. Maximum current at +5 Vdc is 50 mA.

(3) Only for TM172P.....

**NOTE:** The controller is delivered without removable screw terminal blocks, page 20.

## NOTICE

**INOPERABLE EQUIPMENT**

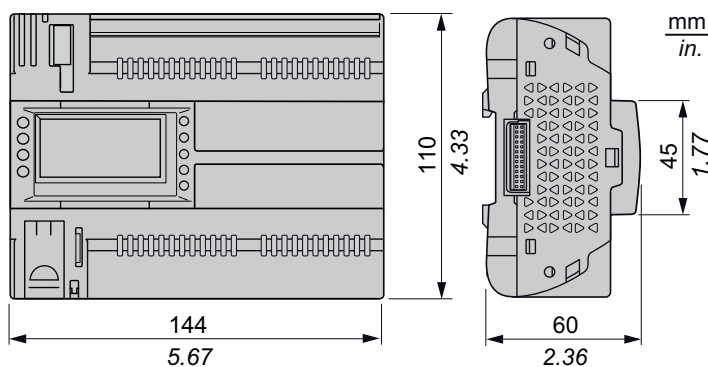
Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected.

**Failure to follow these instructions can result in equipment damage.**

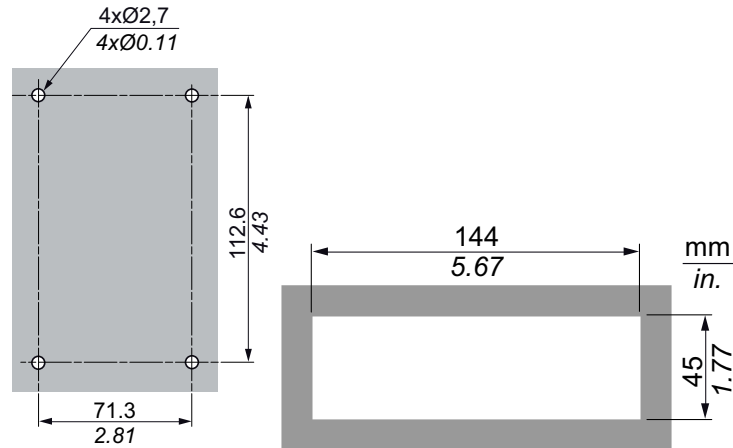
For more details, refer to analog inputs configuration, page 78 and analog outputs configuration, page 87.

For more information about the wiring, refer to wiring best practices, page 26.

## Dimensions



## Mounting Holes Layout



## TM172P..42.. / TM172O..42R

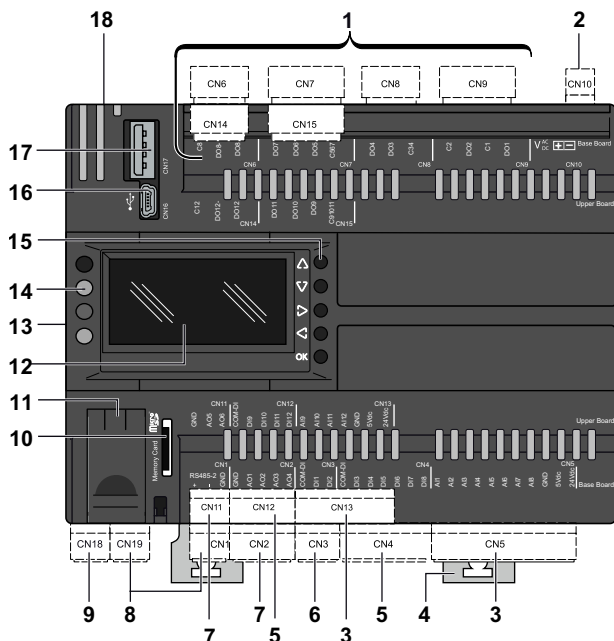
### Overview

Reference	Description
TM172PBG42R	M172 Performance Blind 42 I/Os
TM172PBG42RI	M172 Performance Blind 42 I/Os Isolated
TM172PDG42R	M172 Performance Display 42 I/Os
TM172PDG42RI	M172 Performance Display 42 I/Os Isolated
TM172PDG42S	M172 Performance Display 42 I/Os 2 SSR
TM172PDG42SI	M172 Performance Display 42 I/Os 2 SSR Isolated
TM172OBM42R	M172 Optimized Blind 42 I/Os Isolated
TM172ODM42R	M172 Optimized Display 42 I/Os Isolated

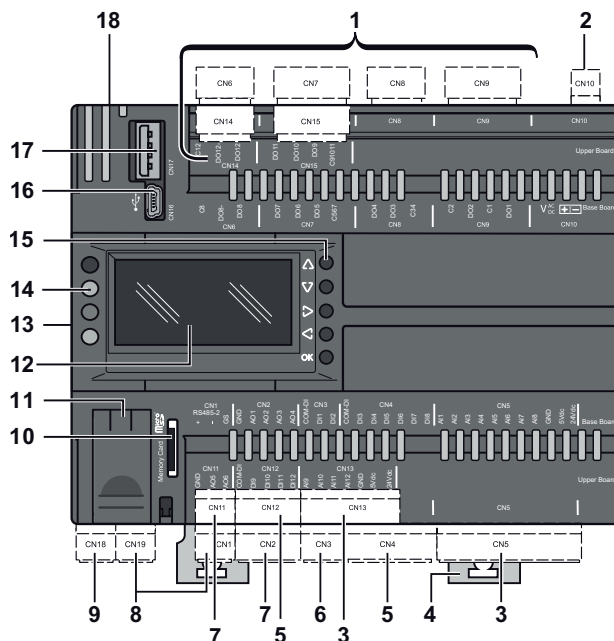
# Physical Description

The following illustration presents the TM172...42... controller:

TM172P...42... controller:



TM172P...42...I / TM172O...42R controller:



Number	Name	Description
1	CN6	DO8 <ul style="list-style-type: none"> <li>TM172P...42...: High voltage relay digital output 250 Vac 1 A SPDT, page 76</li> <li>TM172P...42...I / TM172O...42R: High voltage relay digital output 250 Vac 3 A SPDT, page 76</li> </ul>
	CN7	DO5...DO7
	CN8	DO3...DO4
	CN9	DO1...DO2 <ul style="list-style-type: none"> <li>TM172...R: High voltage relay digital output 250 Vac 3 A SPST, page 73</li> <li>TM172...S: High voltage SSR digital output 240 Vac 0.5 A, page 75</li> </ul>
	CN14	DO12 <ul style="list-style-type: none"> <li>TM172P...42...: High voltage relay digital output 250 Vac 1 A SPDT, page 76</li> <li>TM172P...42...I / TM172O...42R: High voltage relay digital output 250 Vac 3 A SPDT, page 76</li> </ul>
	CN15	DO9...DO11
2	CN10	24 Vac/dc power supply, page 67
3	CN5	Power out <ul style="list-style-type: none"> <li>+24 Vdc power out for analog inputs, max current 150 mA <sup>(3)</sup></li> <li>+5 Vdc power out for ratiometric analog inputs, max current 50 mA <sup>(2)(3)</sup></li> </ul>
		AI1...AI8 <ul style="list-style-type: none"> <li>Analog inputs are configurable as, page 78:                             <ul style="list-style-type: none"> <li>NTC resistive input or digital input</li> <li>Current analog input</li> <li>Voltage analog input</li> <li>PTC resistive input</li> </ul> </li> </ul>
	CN13	AI9...AI12
4	-	Clip-on lock, page 32
5	CN4	DI3...DI8
	CN12	DI9...DI12
6	CN3	DI1...DI2
7	CN2	AO1...AO2

Number	Name	Description
		AO3...AO4 Low voltage SELV analog outputs, configurable as, page 87: <ul style="list-style-type: none"> <li>• Current modulation analog output</li> <li>• Current ON/OFF analog output</li> <li>• Voltage modulation analog output</li> <li>• PWM open collector</li> </ul>
	CN11	AO5...AO6 Low voltage (SELV) analog outputs 0...10 Vdc, page 89
8	CN1	RS-485 serial port-2, page 94
	CN19	RS-485 serial port-1, page 94
9	CN18	CAN expansion bus master, page 91
10	-	Micro SD memory card slot, page 101 (4)
11	-	Service battery door, page 103
12	-	User interface - Display, page 104 (1)
13	-	Communication module connector, page 17
14	-	User interface - LEDs, page 104 (1)
15	-	User interface - Keys, page 104 (1)
16	CN16	USB type Mini-B female for PC connection, page 97
17	CN17	USB type A female for a mass storage device (FAT32), page 97 (4)
18	CN20	Ethernet Modbus TCP/IP or BACnet IP, page 98 (4)
<p>(1) Only for TM172-D.....</p> <p>(2) 0-5 V Ratiometric: ratiometric range is 0.5 V to 4.5 V. Maximum current at +5 Vdc is 50 mA.</p> <p>(3) The maximum current value is the sum between the maximum currents supplied by the corresponding terminals in the CN5 connector and in the CN13 connector.</p> <p>(4) Only for TM172P.....</p>		

**NOTE:** The controller is delivered without removable screw terminal blocks, page 20.

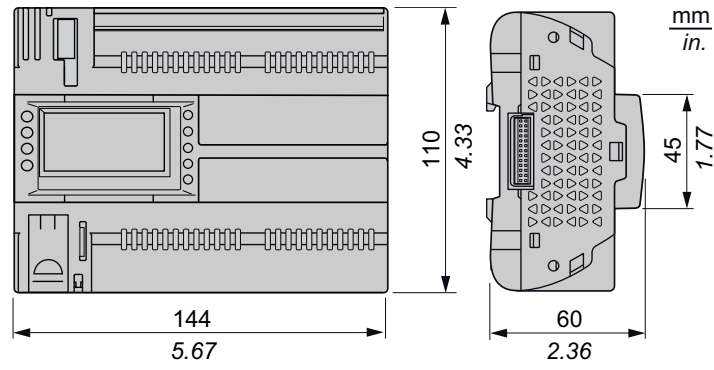
<b>NOTICE</b>
<p><b>INOPERABLE EQUIPMENT</b></p> <p>Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected.</p> <p><b>Failure to follow these instructions can result in equipment damage.</b></p>

For more details, refer to analog inputs configuration, page 78 and analog outputs configuration, page 87.

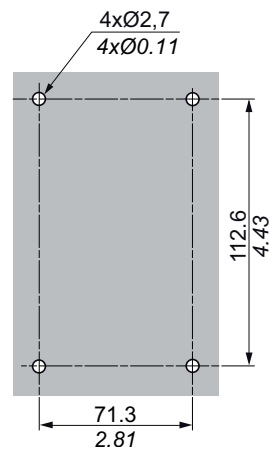
For more information about the wiring, refer to wiring best practices, page 26.



## Dimensions



## Mounting Holes Layout



# TM172E••R Expansion Modules Description

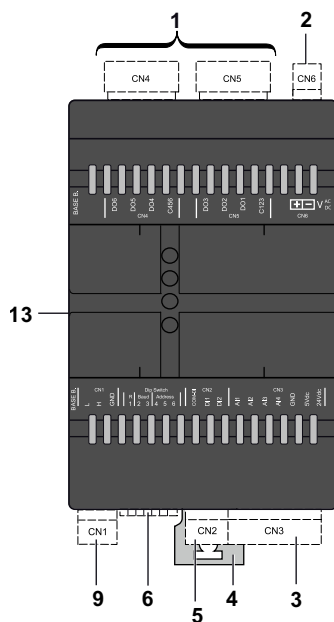
## What's in This Chapter

TM172E12R ..... 62  
 TM172E28R ..... 64

## TM172E12R

### Physical Description

The following illustration presents the TM172E12R expansion module:



Number	Name	Description
1	CN4	DO4...DO6
	CN5	DO1...DO3
2	CN6	24 Vac/dc non-isolated power supply, page 67
3	CN3	Power out
		AI1...AI4
4	-	Clip-on lock, page 32
5	CN2	DI1...DI2
6	-	CAN configuration 6-position DIP switches, page 92
9	CN1	CAN expansion bus slave, page 91
13	-	TTL Port (Service only)

(1) 0...5 V Ratiometric: ratiometric range is 0.5 V to 4.5 V. Maximum current at +5 Vdc is 50 mA.

**NOTE:** The expansion module is delivered without removable screw terminal blocks, page 20.

## NOTICE

### INOPERABLE EQUIPMENT

Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected.

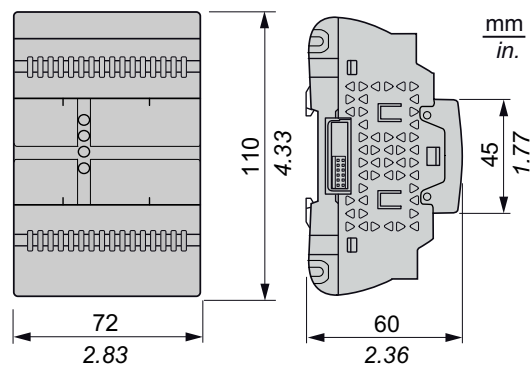
**Failure to follow these instructions can result in equipment damage.**

For more details, refer to analog inputs configuration, page 78 and analog outputs configuration, page 87.

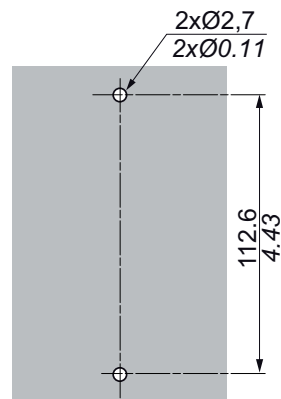
For more information about the wiring, refer to wiring best practices, page 26.

For details about Expansion module troubleshooting, refer to the section TM172E••R Expansion Modules User Interface, page 105.

## Dimensions



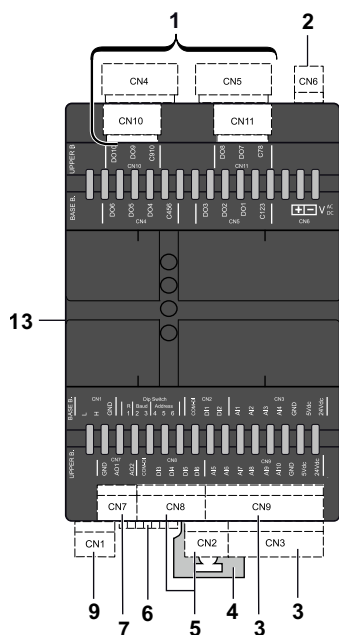
## Mounting Holes Layout



# TM172E28R

## Physical Description

The following illustration presents the TM172E28R expansion module:



Number	Name	Description	
1	CN4	DO4...DO6	High voltage relay digital output 250 Vac 3 A SPST, page 73
	CN5	DO1...DO3	
	CN10	DO9...DO10	
	CN11	DO7...DO8	
2	CN6	24 Vac/dc non-isolated power supply, page 67	
3	CN3	Power out	+24 Vdc power out for analog inputs, max current 125 mA <sup>(2)</sup> +5 Vdc power out for ratiometric analog inputs, max current 50 mA <sup>(1)(2)</sup>
		AI1...AI4	Analog inputs are configurable as, page 78: <ul style="list-style-type: none"> <li>• NTC resistive input or digital input</li> <li>• Current analog input</li> <li>• Voltage analog input</li> <li>• PTC resistive input</li> </ul>
	CN9	AI5...AI10	Identical to CN3.
		Power out	
4	-	Clip-on lock, page 32	
5	CN2	DI1...DI2	Fast digital input, pulse/frequency counter up 2 kHz, page 70, opto-isolated
	CN8	DI3...DI6	Regular digital input opto-isolated, page 71
6	-	CAN configuration 6-position DIP switches, page 92	
7	CN7	AO1...AO2	Low voltage SELV analog outputs, configurable as, page 87: <ul style="list-style-type: none"> <li>• Current modulation analog output</li> <li>• Current ON/OFF analog output</li> <li>• Voltage modulation analog output</li> <li>• PWM open collector</li> </ul>
9	CN1	CAN expansion bus slave, page 91	

Number	Name	Description
13	-	TTL Port (Service only)

(1) 0...5 V Ratiometric: ratiometric range is 0.5 V to 4.5 V. Maximum current at +5 Vdc is 50 mA.

(2) The maximum current value is the sum between the maximum currents supplied by the corresponding terminals in the CN3 connector and in the CN9 connector.

**NOTE:** The expansion module is delivered without removable screw terminal blocks, page 20.

NOTICE

**INOPERABLE EQUIPMENT**

Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected.

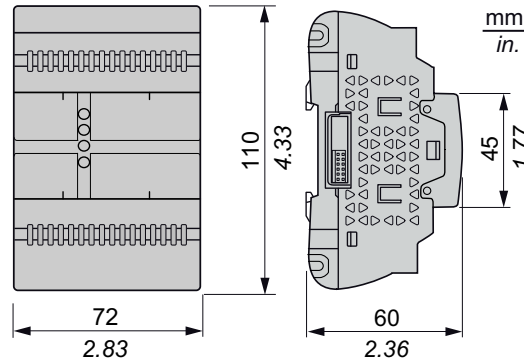
**Failure to follow these instructions can result in equipment damage.**

For more details, refer to analog inputs configuration, page 78 and analog outputs configuration, page 87.

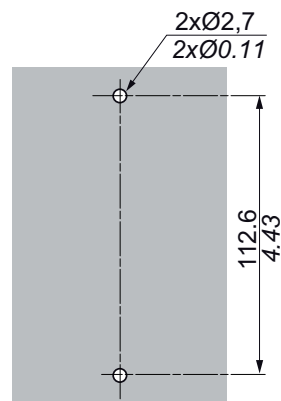
For more information about the wiring, refer to wiring best practices, page 26.

For details about Expansion module troubleshooting, refer to the section TM172E••R Expansion Modules User Interface, page 105.

## Dimensions



## Mounting Holes Layout



# Electrical Characteristics and Wiring Diagrams

## What's in This Chapter

Power Supply.....	67
Digital Input.....	69
Digital Output.....	72
Analog Inputs.....	77
Analog Outputs.....	86
Communication.....	91
Memory.....	101
RTC (Real-Time Clock).....	103

From time to time, new input modules, output modules, or other devices are made available that are not documented in the present documentation. For information on new devices, contact your local Schneider Electric representative.

### **NOTICE**

#### **INOPERABLE EQUIPMENT**

Update the controller firmware to the latest version every time you install a newly released Input/Output expansion module or other device to this equipment.

**Failure to follow these instructions can result in equipment damage.**

**NOTE:** For more information on how to update the controller firmware, contact your local Schneider Electric representative.

Applying incorrect current or voltage levels on TM172P••07• / TM172P••18• / TM172O••18• / TM172P••28•I / TM172O••28R / TM172P••42•I / TM172O••42R controllers and TM172E••R expansion modules inputs and outputs could damage the electronic circuitry. Further, connecting a current input device to an analog input configured for voltage, and vice versa, could damage the electronic circuitry.

### **NOTICE**

#### **INOPERABLE EQUIPMENT**

- Do not apply current above 30 mA to the analog inputs of the expansion module.
- Do not apply voltages above 24 Vdc and less than -7 Vdc to the analog inputs of the expansion module.
- Do not mismatch the applied signal with the analog input configuration.

**Failure to follow these instructions can result in equipment damage.**

Applying incorrect current or voltage levels on TM172P••28•• / TM172P••42•• controllers analog inputs and outputs could damage the electronic circuitry. Further, connecting a current input device to an analog input configured for voltage, and vice versa, could damage the electronic circuitry.

## NOTICE

### INOPERABLE EQUIPMENT

- Do not apply voltages above 11 Vdc to the analog inputs of the controller or Input/Output expansion module when analog input is configured as 0-10V input.
- Do not apply current above 25 mA to the analog inputs of the controller or Input/Output expansion module when analog input is configured as 0-20 mA or 4-20 mA input.
- Do not mismatch applied signal with analog input configuration.

**Failure to follow these instructions can result in equipment damage.**

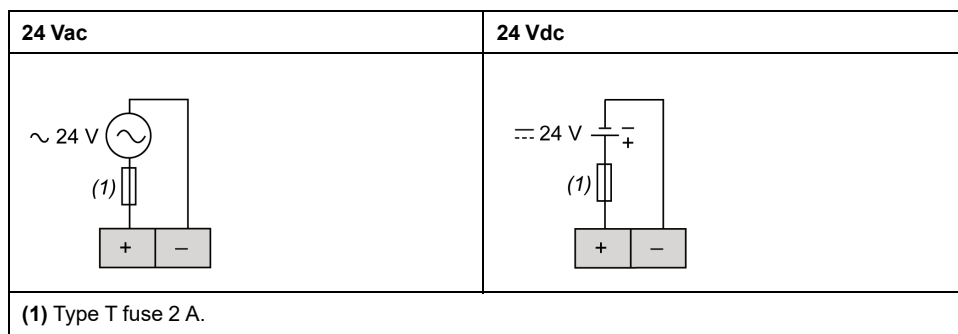
## Power Supply

## Power Supply

## Controllers and Expansion Modules Power Supply

References	Power supply characteristics		Maximum power consumption
TM172P•G07R controller	Isolated	24 Vac (+/- 10 %) - 50/60 Hz	20 VA
		20...38 Vdc	10 W
TM172P•G18• / TM172O•M18R controllers		24 Vac (+/- 10 %) - 50/60 Hz	21 VA
		20...38 Vdc	11 W
TM172P••28•I / TM172O••28R controllers		24 Vac (+/- 10 %) - 50/60 Hz	23 VA
		20...38 Vdc	12 W
TM172P••42•I / TM172O••42R controllers		24 Vac (+/- 10 %) - 50/60 Hz	25 VA
		20...38 Vdc	14 W
TM172P••28• / TM172P••42• controllers	Non-isolated	24 Vac (+/- 10 %) - 50/60 Hz	35 VA
		20...38 Vdc	15 W
TM172E12R expansion module		24 Vac (+/- 10 %) - 50/60 Hz	20 VA
		20...38 Vdc	10 W
TM172E28R expansion module		24 Vac (+/- 10 %) - 50/60 Hz	24 VA
		20...38 Vdc	15 W

Power supply wiring diagram:



<b>Pitch of the terminal block</b>	<b>Cabling length</b>
3.50 mm (0.14 in.)	10 m (32.8 ft)

**NOTICE****INOPERABLE EQUIPMENT**

Do not connect a power cable longer than 10 m (32.8 ft).

**Failure to follow these instructions can result in equipment damage.**

For more information about the wiring, refer to *Best wiring practices*, page 26.

The power supplies for the TM172P•••••, TM172O•••••, and TM172E••R must be rated Safety Extra Low Voltage (SELV) according to IEC 61140. These sources of power are isolated between the electrical input and output circuits of the power supply as well as simple separation from ground (earth), PELV, and other SELV systems.

**⚠ DANGER****GROUND LOOP CAUSING ELECTRIC SHOCK AND/OR INOPERABLE EQUIPMENT**

- Do not connect the 0 V power supply/transformer connection supplying this equipment to any external ground (earth) connection.
- Do not connect any 0 V or ground (earth) of the sensors and actuators connected to this equipment to any external ground connection.
- If necessary, use separate power supplies/transformers to power sensors or actuators isolated from this equipment.

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

In all cases, if the specified voltage range is not maintained, the products may not function as intended. Use appropriate safety interlocks and voltage monitoring circuits.

**⚠ WARNING****POTENTIAL OF OVERHEATING AND FIRE**

- Do not connect the equipment directly to line voltage.
- Use only isolating SELV, Class 2 power supplies / transformers to supply power to this equipment.

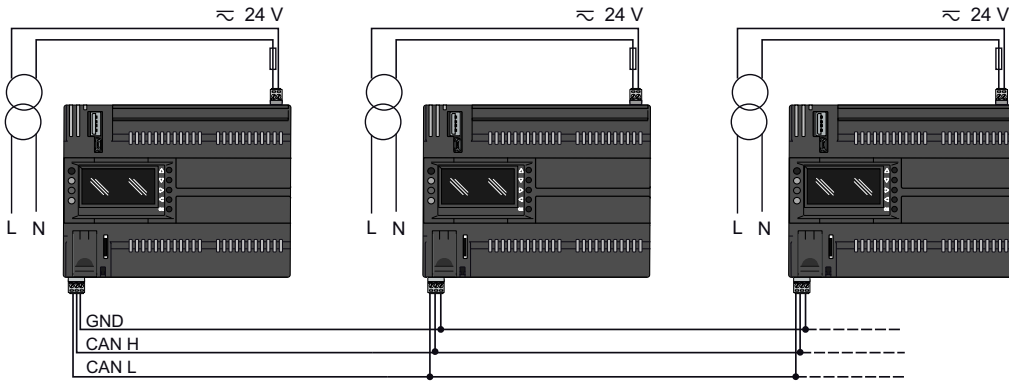
**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

## Power Supply and Field bus Wiring Restriction For Non Isolated Controllers and Expansion Modules

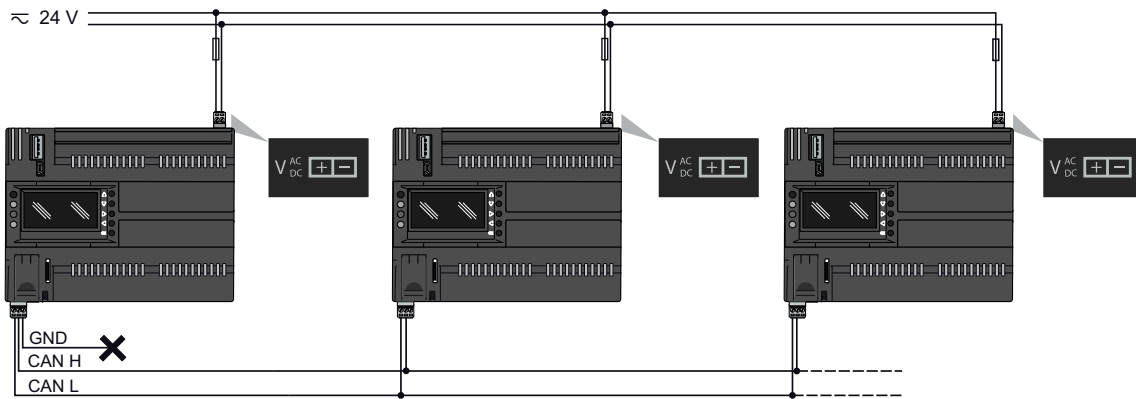
TM172P••28• / TM172P••42• / TM172E••R power supply inputs are not isolated. If you connect the GND connection of the RS-485 network or the CAN expansion bus across multiple controllers, you must use separate, isolated power supplies. Alternatively, if you are interconnecting the equipment to a single power supply, do not connect the RS-485 or CAN GND signal. Pay special attention when connecting serial lines. Miswiring may lead to inoperable equipment.



CAN network example with separate power lines:



CAN network example with common power line and GND signal not connected:



**NOTE:** TM172P•G07R / TM172•••18• / TM172O••28R / TM172O••42R / TM172P••28•I / TM172P••42•I power supply inputs are isolated. GS connection of the RS-485 network or the GND connection of the CAN expansion bus across multiple controllers must be connected regardless of the power supply type and wiring.

## Digital Input

### Digital Inputs

This table presents the digital inputs of controllers and expansion modules:

Description	TM172P•G07R	TM172•••18R	TM172•••18S	TM172•••28R•	TM172•••28S•	TM172•••42R•	TM172•••42S•	TM172E12R	TM172E28R
Fast digital inputs, page 70	2	2	2	2	2	2	2	2	2
Regular digital inputs, page 71	-	-	-	6	6	10	10	-	4

These devices have analog inputs that can be configured as dry contact digital inputs. For more details, refer to the configuration of analog inputs, page 78.

**NOTE:** The commons COM\_DI are not internally connected together.

## Fast Digital Inputs

### Overview

If fast digital inputs are used as regular digital inputs, refer to regular digital inputs wiring diagram, page 72.

### Characteristics

The table indicates the digital inputs characteristics:

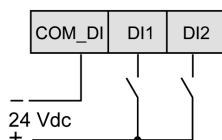
Characteristic	Value	
	Used as fast input	Used as regular input
Type	Digital input	
Power draw (maximum)	5 mA	
Working voltage	+0...38 Vdc	+0...38 Vdc 0...24 Vac +/-10 % 50/60 Hz
Pulse detection minimum length	Positive pulse 0.15 ms	Positive or negative pulse: <ul style="list-style-type: none"> <li>TM172P••07• / TM172•••18•: 40 ms</li> <li>TM172•••28•• / TM172•••42••: 20 ms</li> <li>TM172E28R: 40 ms</li> </ul>
Maximum frequency measurement	2 kHz	-
Logic type	Digital inputs work in positive logic	Digital inputs work in positive or negative logic
Level 1	+20...38 Vdc	+20...38 Vdc 24 Vac +/-10 % 50/60 Hz
Level 0	+0...4 Vdc	+0...4 Vdc 0...3 Vac 50/60 Hz

#### Logic type description

Logic type	Active state
Positive logic	Output supplies current (source output) Current flows to the input (sink input)
Negative logic	Output draws current (sink output) Current flows from the input (source input)

### Wiring Diagram Example

TM172•••07• / TM172•••18• / TM172•••28•• / TM172•••42•• (CN3) fast digital input:



Pitch of the terminal block	Cabling length
3.50 mm (0.14 in)	10 m (32.808 ft)

For more information about the wiring, refer to Best wiring practices, page 26.

## Related Devices and Connectors

The table indicates the related devices and connectors:

Related Device	Connector	Label	Description				
TM172...07•	CN3	<table border="1"> <tr> <td>COM_DI</td> <td>DI1</td> <td>DI2</td> </tr> </table>	COM_DI	DI1	DI2	COM-DI	Common for digital inputs 1...2
COM_DI			DI1	DI2			
TM172...18•			DI1...DI2	Regular digital inputs 1...2			
TM172...28••							
TM172...42••							
TM172E••R	CN2						

## Regular Digital Inputs

### Characteristics

The table indicates the digital inputs characteristics:

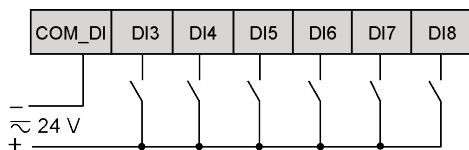
Characteristic	Value
Type	Digital input
Power draw (maximum)	5 mA
Working voltage	+0...38 Vdc 0...24 Vac +/-10 % 50/60 Hz
Pulse detection minimum length	<ul style="list-style-type: none"> <li>• TM172...28••/TM172...42•• positive or negative pulse               <ul style="list-style-type: none"> <li>◦ DI3...DI4: 20 ms</li> <li>◦ DI5...DI8: 40 ms</li> </ul> </li> <li>• TM172...42•• positive or negative pulse               <ul style="list-style-type: none"> <li>◦ DI9...DI12: 40 ms</li> </ul> </li> <li>• TM172E28R positive pulse               <ul style="list-style-type: none"> <li>◦ DI3...DI6: 40 ms</li> </ul> </li> </ul>
Logic type	Digital inputs work in positive logic <ul style="list-style-type: none"> <li>• TM172...28••/TM172...42••: Digital inputs work in positive or negative logic</li> <li>• TM172E28R: Digital inputs work in positive logic</li> </ul>
Level 1	+20...38 Vdc 24 Vac +/-10 % 50/60 Hz
Level 0	+0...4 Vdc 0...3 Vac 50/60 Hz

Logic type description:

Logic type	Active state
Positive logic	Output supplies current (source output) Current flows to the input (sink input)
Negative logic	Output draws current (sink output) Current flows from the input (source input)

## Wiring Diagram Example

TM172...28... / TM172...42... (CN4) regular digital input:



<b>Pitch of the terminal block</b>	<b>Cabling length</b>
3.50 mm (0.14 in)	10 m (32.808 ft)

For more information about the wiring, refer to Best wiring practices, page 26.

## Related Devices and Connectors

The table indicates the related devices and connectors:

Related Device	Connector	Label	Description							
TM172...28...	<table border="1"> <tr> <td>COM_DI</td> <td>DI3</td> <td>DI4</td> <td>DI5</td> <td>DI6</td> <td>DI7</td> <td>DI8</td> </tr> </table>	COM_DI	DI3	DI4	DI5	DI6	DI7	DI8	COM-DI	Common for digital inputs 3...8
COM_DI		DI3	DI4	DI5	DI6	DI7	DI8			
TM172...42...	DI3...DI8	Regular digital inputs 3...8								
TM172...42...	<table border="1"> <tr> <td>COM_DI</td> <td>DI9</td> <td>DI10</td> <td>DI11</td> <td>DI12</td> </tr> </table>	COM_DI	DI9	DI10	DI11	DI12	COM-DI	Common for digital inputs 9...12		
COM_DI		DI9	DI10	DI11	DI12					
	DI9...DI12	Regular digital inputs 9...12								
TM172E28R	<table border="1"> <tr> <td>COM_DI</td> <td>DI3</td> <td>DI4</td> <td>DI5</td> <td>DI6</td> </tr> </table>	COM_DI	DI3	DI4	DI5	DI6	COM-DI	Common for digital inputs 3...6		
COM_DI		DI3	DI4	DI5	DI6					
	DI3...DI6	Regular digital inputs 3...6								

## Digital Output

## Digital Output

This table presents the digital outputs of controllers and expansion modules:

Description	TM172P-G07R	TM172...18R	TM172...18S	TM172...28R	TM172...28S	TM172...42R	TM172...42S	TM172E12R	TM172E28R
High voltage relay SPST digital output, page 73	2	5	3	7	5	10	8	6	10
High voltage Solid-state relay digital output, page 75	-	-	2	-	2	-	2	-	-
High voltage relay SPDT digital output, page 76	1	1	1	1	1	2	2	-	-

These devices have analog outputs that can be configured as low voltage (SELV), open collector outputs. For more details, refer to the configuration of analog outputs, page 78.

**NOTE:** The commons Cx are not internally connected together.

## High voltage Relay SPST Digital Output

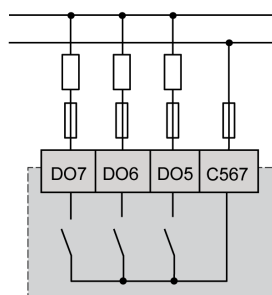
### Characteristics

The table indicates the digital outputs characteristics:

Characteristic	Value
Maximum voltage	250 Vac
Maximum current	3 A resistive load, 2 FLA / 12 LRA
Minimum switching capacity	100 mA / 5 Vdc
Electrical durability conforming to UL60730	100 000 cycles, 3 A at 250 Vac

### Wiring Diagram Example

TM172...28... (CN7) SPST relay output:



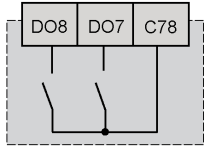
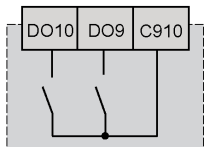
Pitch of the terminal block
5.00 mm (0.197 in)

For more information about the wiring, refer to Best wiring practices, page 26.

## Related Devices and Connectors

The table indicates the related devices and connectors:

Related Device	Connector		Label	Description
TM172***07• TM172***18•	CN9		C12	Common for output relays 1...2 Maximum current: 6 A
			DO1...DO2	Output relays 1...2
TM172***18R	CN15		C4	Common for output relay 4 Maximum current: 3 A
			C5	Common for output relay 5 Maximum current: 3 A
			C6	Common for output relay 6 Maximum current: 3 A
			DO4...DO6	Output relays 4...6
TM172***18S	CN15		C4	Common for output relay 4 Maximum current: 3 A
			DO4	Output relay 4 <b>NOTE:</b> DO5 and DO6 are SSR outputs, page 76.
TM172***28•• TM172***42••	CN7		C567	Common for output relays 5...7 Maximum current: 9 A
			DO5...DO7	Output relays 5...7
	CN8		C34	Common for output relays 3...4 Maximum current: 6 A
			DO3...DO4	Output relays 3...4
TM172***28R• TM172***42R•	CN9		C1	Common for output relay 1 Maximum current: 3 A
			C2	Common for output relay 2 Maximum current: 3 A
			DO1...DO2	Output relays 1...2
TM172***42••	CN15		C91011	Common for output relays 9...11 Maximum current: 9 A
			DO9...DO11	Output relays 9...11
TM172E••R	CN5		C123	Common for output relays 1...3 Maximum current: 9 A
			DO1...DO3	Output relays 1...3
	CN4		C456	Common for output relays 4...6 Maximum current: 9 A
			DO4...DO6	Output relays 4...6

Related Device	Connector	Label	Description	
TM172E28R	CN11		C78	Common for output relays 7...8 Maximum current: 6 A
			DO7...DO8	Output relays 7...8
	CN10		C910	Common for output relays 9...10 Maximum current: 6 A
			DO9...DO10	Output relays 9...10

## High Voltage Solid-State Relay Digital Output

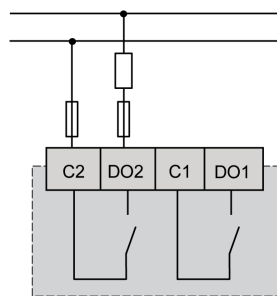
### Characteristics

The table indicates the SSR output characteristics:

Characteristic	Value	
	TM172...18S	TM172...28S• TM172...42S•
Nominal voltage	75...240 Vac	
Maximum current	0.2 A	0.5 A
Switching rate range	45...65 Hz	
Minimum switching capacity	20 mA	

### Wiring Diagram Example

TM172...28S• (CN9) SSR output:



Pitch of the terminal block
5.00 mm (0.197 in)

For more information about the wiring, refer to [Best wiring practices](#), page 26.

## Related Devices and Connectors

The table indicates the related devices and connectors:

Related Device	Connector		Label	Description
TM172...18S	CN15		C5	Common for SSR output 5 Maximum current: 0.2 A
			C6	Common for SSR output 6 Maximum current: 0.2 A
			DO5...DO6	SSR Outputs 5...6 <b>NOTE:</b> DO4 is not an SSR output., page 74
TM172...28S TM172...42S	CN9		C1	Common for SSR output 1 Maximum current: 0.5 A
C2			Common for SSR output 2 Maximum current: 0.5 A	
DO1...DO2			SSR Outputs 1...2	

## High voltage Relay SPDT Digital Output

### Characteristics

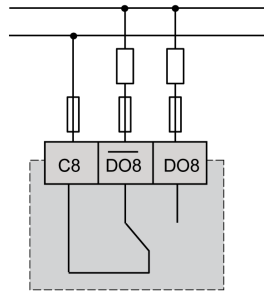
The table indicates the digital outputs characteristics:

Characteristic	Value	
	TM172...07 TM172...18 TM172P...28-I TM172P...42-I TM172O...28R TM172O...42R	TM172P...28 TM172P...42
Maximum voltage	250 Vac	240 Vac
Maximum current	3 A resistive load, NO contact: 2.2 FLA / 13.2 LRA	-20...55 °C (-4...131 °F): 3 A resistive load -20...60 °C (-4...140 °F): 1 A resistive load -20...65 °C (-4...149 °F): 1 A resistive load if DO8 is inactive
Minimum switching capacity	300 mA, resistive load	300 mA, resistive load
Electrical durability conforming to UL60730	100 000 cycles	100 000 cycles



## Wiring Diagram Example

TM172...28... / TM172...42... (CN6) SPDT relay output:



<b>Pitch of the terminal block</b>
5.00 mm (0.197 in)

For more information about the wiring, refer to Best wiring practices, page 26.

## Related Devices and Connectors

The table indicates the related devices and connectors:

Related Device	Connector		Label	Description
TM172...07... TM172...18...	CN6		C3	Common for output relay 3 Maximum current: 3 A
			DO3	Output relay3 - Normally open
			DO3-	Output relay 3 - Normally closed
TM172...28... TM172...42...	CN6		C8	Common for output relay 8 Maximum current: 3 A <sup>(1)(2)</sup>
			DO8	Output relay 8 - Normally open
			DO8-	Output relay 8 - Normally closed
TM172...42...	CN14		C12	Common for output relay 12 Maximum current: 3 A <sup>(1)</sup>
			DO12	Output relay 12 - Normally open
			DO12-	Output relay 12 - Normally closed

(1) TM172P...28... / TM172P...42...: The maximum current is limited to 1 A if the ambient temperature exceeds 55 °C (131 °F).  
 (2) TM172P...28... / TM172P...42...: The ambient temperature must not exceed 60 °C (140 °F) if DO8 is active.

## Analog Inputs

## Analog Inputs

This table presents the analog inputs of controllers and expansion modules:

Description	TM172P•G07R	TM172•••18R	TM172•••18S	TM172•••28R•	TM172•••28S•	TM172•••42R•	TM172•••42S•	TM172E12R	TM172E28R
Configurable analog inputs or digital input.	2	8	8	8	8	12	12	4	10

## Analog Inputs

### Overview

Controllers analog inputs are identified as AI1...AIx.

The inputs are configurable in pairs, AI1- AI2 is the first pair, AI3-AI4 is the second pair, and so on, up to the last pair. Both AIs of a pair must be configured in order to belong to the same type group.

Using the parameter *Cfg\_Aix*, an analog input AIx can be configured to acquire a signal by a physical resource (probe, digital input, voltage/current signal) as specified in the following table:

Type group	Cfg_Aix	Description
NTC resistive input, page 81 or Digital input, page 86	0	NTC (NK103), 10 kΩ at 25 °C, BETA value 3977
	1	Digital input
	2	NTC (103AT-2), 10 kΩ at 25 °C, BETA value 3435
	7	hΩ (NTC) <sup>(1)</sup>
Current input, page 84	3	4...20 mA
	11	0...20 mA
Voltage input 0...10 Vdc, page 85	4	0...10 Vdc
Voltage input 0...5 Vdc, page 85	5	0...5 Vdc Ratiometric
	10	0...5 Vdc
Resistive input, page 82	6	Pt1000
	8	daΩ (Pt1000) <sup>(2)</sup>
	9	PTC (KTY81-121)
<p><b>(1)</b> Resistance value read, expressed in 0.1 kΩ, for a resistance applied to the input using the controller in NTC configuration, for example creating a divider with pull-up resistance of 10 kΩ. The resistance range for the hΩ(NTC) configuration is up to 150 kΩ.</p> <p><b>(2)</b> Resistance value read, expressed in 0.01 kΩ, for a resistance applied to the input using the controller in Pt1000 configuration, that is, creating a divider with pull-up resistance (1.5 kΩ for TM172P•G07R / TM172•••18•, 2 kΩ for other device references). The resistance range for the daΩ (Pt1000) configuration is up to 3 kΩ.</p>		

The analog inputs configured as digital inputs are not isolated.

### NOTICE

#### INOPERABLE EQUIPMENT

Only use voltage free type inputs on analog inputs configured as digital inputs.

**Failure to follow these instructions can result in equipment damage.**

## Compatibility in Pairs

Parameters by pair:

Pairs	Parameter Set	
Pair #1	Cfg_Ai1	Cfg_Ai2
Pair #2	Cfg_Ai3	Cfg_Ai4
Pair #3	Cfg_Ai5	Cfg_Ai6
Pair #4	Cfg_Ai7	Cfg_Ai8
Pair #5	Cfg_Ai9	Cfg_Ai10
Pair #6	Cfg_Ai11	Cfg_Ai12

**NOTE:** The all pairs are available for TM172•••42••. Depending on the analog inputs of the device, not all pairs are available, refer to the Related Devices and Connectors, page 80.

Compatibility table for a pair of AIs:

Example for pair #1			Cfg_Ai1											
			0	1	2	3	4	5	6	7	8	9	10	11
			NTC (NK103)	Digital input	NTC (103AT-2)	4...20 mA	0...10 Vdc	0...5 Vdc Ratiometric	Pt1000	hΩ (NTC)	daΩ (Pt1000)	PTC (KTY81-121)	0...5 Vdc	0...20 mA
Cfg_Ai2	0	NTC (NK103)	✓	✓	✓	-	-	-	-	✓	-	-	-	-
	1	Digital input	✓	✓	✓	-	-	-	-	✓	-	-	-	-
	2	NTC (103AT-2)	✓	✓	✓	-	-	-	-	✓	-	-	-	-
	3	4...20 mA	-	-	-	✓	-	-	-	-	-	-	-	✓
	4	0...10 Vdc	-	-	-	-	✓	-	-	-	-	-	-	-
	5	0...5 Vdc Ratiometric	-	-	-	-	-	✓	-	-	-	-	✓	-
	6	Pt1000	-	-	-	-	-	-	✓	-	✓	✓	-	-
	7	hΩ (NTC)	✓	✓	✓	-	-	-	-	✓	-	-	-	-
	8	daΩ (Pt1000)	-	-	-	-	-	-	✓	-	✓	✓	-	-
	9	PTC (KTY81-121)	-	-	-	-	-	-	✓	-	✓	✓	-	-
	10	0...5 Vdc	-	-	-	-	-	✓	-	-	-	-	✓	-
	11	0...20 mA	-	-	-	✓	-	-	-	-	-	-	-	✓

Applying not allowed configuration produces the error number 8003<sub>h</sub> on the field value of both probes (unsigned decimal: 32771 / signed decimal: -32765).

## Voltage Analog Inputs or Current Analog Inputs Configuration

According to the physical resources wired (voltage signal or current signal), inputs must be configured using the related parameters.

Analog inputs type can be configured as specified in the following table:

Parameter	Description	Range	Default value
<i>FullScaleMin_Alx</i>	Analog input Alx start of scale value	-9999...+9999	0
<i>FullScaleMax_Alx</i>	Analog input Alx full scale value	-9999...+9999	1000
<i>Calibration_Alx</i>	Analog input Alx differential	-1000...+1000	0

Note:

Type of probe configured	Minimum full scale Alx	Maximum full scale Alx
0/4...20 mA current probe	0/4 mA	20 mA
0...10 Vdc voltage probe	0 Vdc	10 Vdc
0...5 Vdc ratiometric probe	10 % (0.5 Vdc)	90 % (4.5 Vdc)
0...5 Vdc probe	0 Vdc	5 Vdc

For details on the values and characteristics of parameters, refer to the Parameters, page 125.

## Related Devices and Connectors

The table indicates the related devices and connectors:

Related Device	Connector	Label	Description																			
TM172...07• TM172...18•	CN5	<table border="1"> <tr> <td>AI1</td> <td>AI2</td> <td>GND</td> <td>5 V out</td> <td>24 V out</td> </tr> </table>	AI1	AI2	GND	5 V out	24 V out	<table border="1"> <tr> <td>24 Vdc</td> <td>+24 Vdc power out for analog inputs, max current 100 mA</td> </tr> <tr> <td>5 Vdc</td> <td>+5 Vdc power out for ratiometric analog inputs, max current 40 mA</td> </tr> <tr> <td>GND</td> <td>0 V signal ground</td> </tr> <tr> <td>AI1...AI2</td> <td>Analog inputs 1... 2 or dry contact digital inputs</td> </tr> </table>	24 Vdc	+24 Vdc power out for analog inputs, max current 100 mA	5 Vdc	+5 Vdc power out for ratiometric analog inputs, max current 40 mA	GND	0 V signal ground	AI1...AI2	Analog inputs 1... 2 or dry contact digital inputs						
AI1	AI2	GND	5 V out	24 V out																		
24 Vdc	+24 Vdc power out for analog inputs, max current 100 mA																					
5 Vdc	+5 Vdc power out for ratiometric analog inputs, max current 40 mA																					
GND	0 V signal ground																					
AI1...AI2	Analog inputs 1... 2 or dry contact digital inputs																					
TM172...18•	CN13	<table border="1"> <tr> <td>AI3</td> <td>AI4</td> <td>AI5</td> <td>AI6</td> <td>AI7</td> <td>AI8</td> <td>GND</td> </tr> </table>	AI3	AI4	AI5	AI6	AI7	AI8	GND	<table border="1"> <tr> <td>GND</td> <td>0 V signal ground</td> </tr> <tr> <td>AI3...AI8</td> <td>Analog inputs 3... 8 or dry contact digital inputs</td> </tr> </table>	GND	0 V signal ground	AI3...AI8	Analog inputs 3... 8 or dry contact digital inputs								
AI3	AI4	AI5	AI6	AI7	AI8	GND																
GND	0 V signal ground																					
AI3...AI8	Analog inputs 3... 8 or dry contact digital inputs																					
TM172...28•• TM172...42••	CN5	<table border="1"> <tr> <td>AI1</td> <td>AI2</td> <td>AI3</td> <td>AI4</td> <td>AI5</td> <td>AI6</td> <td>AI7</td> <td>AI8</td> <td>GND</td> <td>5 V out</td> <td>24 V out</td> </tr> </table>	AI1	AI2	AI3	AI4	AI5	AI6	AI7	AI8	GND	5 V out	24 V out	<table border="1"> <tr> <td>24 Vdc</td> <td>+24 Vdc power out for analog inputs, max current 150 mA <sup>(1)</sup></td> </tr> <tr> <td>5 Vdc</td> <td>+5 Vdc power out for ratiometric analog inputs, max current 50 mA <sup>(1)</sup></td> </tr> <tr> <td>GND</td> <td>0 V signal ground</td> </tr> <tr> <td>AI1...AI8</td> <td>Analog inputs 1... 8 or dry contact digital inputs</td> </tr> </table>	24 Vdc	+24 Vdc power out for analog inputs, max current 150 mA <sup>(1)</sup>	5 Vdc	+5 Vdc power out for ratiometric analog inputs, max current 50 mA <sup>(1)</sup>	GND	0 V signal ground	AI1...AI8	Analog inputs 1... 8 or dry contact digital inputs
AI1	AI2	AI3	AI4	AI5	AI6	AI7	AI8	GND	5 V out	24 V out												
24 Vdc	+24 Vdc power out for analog inputs, max current 150 mA <sup>(1)</sup>																					
5 Vdc	+5 Vdc power out for ratiometric analog inputs, max current 50 mA <sup>(1)</sup>																					
GND	0 V signal ground																					
AI1...AI8	Analog inputs 1... 8 or dry contact digital inputs																					
TM172...42••	CN13	<table border="1"> <tr> <td>AI9</td> <td>AI10</td> <td>AI11</td> <td>AI12</td> <td>GND</td> <td>5 V out</td> <td>24 V out</td> </tr> </table>	AI9	AI10	AI11	AI12	GND	5 V out	24 V out	<table border="1"> <tr> <td>24 Vdc</td> <td>+24 Vdc power out for analog inputs, max current 150 mA <sup>(1)</sup></td> </tr> <tr> <td>5 Vdc</td> <td>+5 Vdc power out for ratiometric analog inputs, max current 50 mA <sup>(1)</sup></td> </tr> <tr> <td>GND</td> <td>0 V signal ground</td> </tr> <tr> <td>AI9...AI12</td> <td>Analog inputs 9...12 for dry contact digital inputs</td> </tr> </table>	24 Vdc	+24 Vdc power out for analog inputs, max current 150 mA <sup>(1)</sup>	5 Vdc	+5 Vdc power out for ratiometric analog inputs, max current 50 mA <sup>(1)</sup>	GND	0 V signal ground	AI9...AI12	Analog inputs 9...12 for dry contact digital inputs				
AI9	AI10	AI11	AI12	GND	5 V out	24 V out																
24 Vdc	+24 Vdc power out for analog inputs, max current 150 mA <sup>(1)</sup>																					
5 Vdc	+5 Vdc power out for ratiometric analog inputs, max current 50 mA <sup>(1)</sup>																					
GND	0 V signal ground																					
AI9...AI12	Analog inputs 9...12 for dry contact digital inputs																					
TM172E••R	CN3	<table border="1"> <tr> <td>AI1</td> <td>AI2</td> <td>AI3</td> <td>AI4</td> <td>GND</td> <td>5 V out</td> <td>24 V out</td> </tr> </table>	AI1	AI2	AI3	AI4	GND	5 V out	24 V out													
AI1	AI2	AI3	AI4	GND	5 V out	24 V out																

Related Device	Connector	Label	Description									
		24 Vdc	+24 Vdc power out for analog inputs, max current 125 mA <sup>(1)</sup>									
		5 Vdc	+5 Vdc power out for ratiometric analog inputs, max current 50 mA <sup>(1)</sup>									
		GND	0 V signal ground									
		AI1...AI4	Analog inputs 1...4 or dry contact digital inputs									
TM172E28R	CN9	<table border="1" style="width: 100%; text-align: center;"> <tr> <td>AI5</td><td>AI6</td><td>AI7</td><td>AI8</td><td>AI9</td><td>AI10</td><td>GND</td><td>5 V out</td><td>24 V out</td> </tr> </table>		AI5	AI6	AI7	AI8	AI9	AI10	GND	5 V out	24 V out
AI5	AI6	AI7	AI8	AI9	AI10	GND	5 V out	24 V out				
		24 Vdc	+24 Vdc power out for analog inputs, max current 125mA <sup>(1)</sup>									
		5 Vdc	+5 Vdc power out for ratiometric analog inputs, max current 50 mA <sup>(1)</sup>									
		GND	0 V signal ground									
		AI5...AI10	Analog inputs 5...10 or dry contact digital inputs									
<p><b>(1)</b> The maximum current value is the sum between the maximum currents supplied by the corresponding terminals in the base board connector and in the upper board connector.</p>												

## TM172DCLWT•• Display Embedded Analog Inputs Parameters

The temperature and humidity sensors analog input are embedded in the display.

The parameters related to the analog inputs are listed in the following table:

Parameter	Description	Range
<i>Temp_UM</i>	Unit of temperature measurement	Value 0: °C Value 1: °F
<i>Calibration_NTC</i>	NTC differential	-18.0...+18.0 Unit: 0.1 °C or °F
<i>Calibration_RH</i>	RH percentage differential	-1000...+1000 Unit: 0.1 %RH

For details on the values and characteristics of parameters, refer to the Parameters, page 153.

## NTC Analog Input

### Characteristics

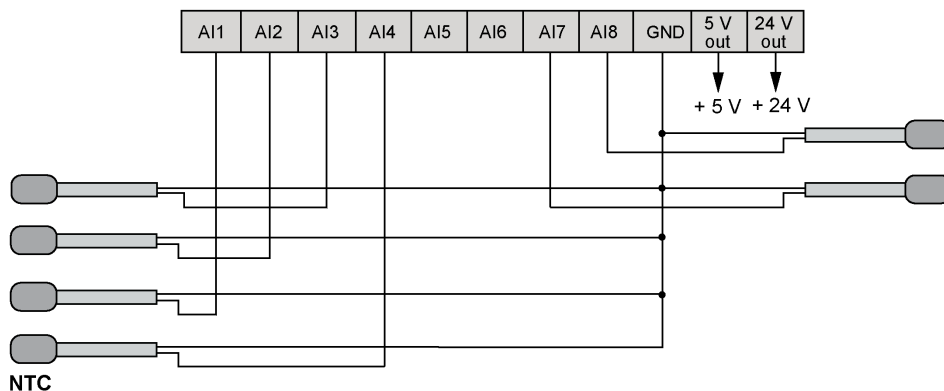
Using the parameter *Cfg\_Aix*, an analog input AIx can be configured to acquire a signal by a physical resource (probe, digital input, voltage/current signal) as specified in the following table:

<i>Cfg_Aix</i>	Description	Accuracy Range	Accuracy	Resolution	Input Impedance
0	NTC (NK103) 10 kΩ at 25 °C BETA value 3977	-40...+137 °C (-40...+278.6 °F)			
		-40...+110 °C (-40...+230 °F)	+/-1 °C (+/-1.8 °F)	0.1 °C (0.18 °F)	10 kΩ
		+110...+137 °C (+230...+278.6 °F)	+/-1.9 °C (+/-3.42 °F)		
2	NTC (103AT-2) 10 kΩ at 25 °C	-50...+110 °C (-58...+230 °F)	+/-1 °C (+/-1.8 °F)	0.1 °C (0.18 °F)	10 kΩ

Cfg_Aix	Description	Accuracy Range	Accuracy	Resolution	Input Impedance	
	BETA value 3435					
7	hΩ (NTC)	0...150 kΩ				
	TM172P•07•	0...75 kΩ	+/-0.85 kΩ	0.1 kΩ	10 kΩ	
	TM172•••18•	75...150 kΩ	+/-2.4 kΩ			
	TM172•••28••	0...150 kΩ	+/-0.85 kΩ			
	TM172•••42••					
	TM172E••R	0...70 kΩ	+/-1 kΩ			
		70...120 kΩ	+/-2.5 kΩ			
120...150 kΩ		+/-6 kΩ				

## Wiring Diagram Example

TM172•••28•• / TM172•••42•• CN5 NTC input connection:



Pitch of the terminal block	Cabling length
3.50 mm (0.14 in)	10 m (32.808 ft)

For more information about the wiring, refer to wiring best practices, page 26.

## Resistive Analog Input

### Characteristics

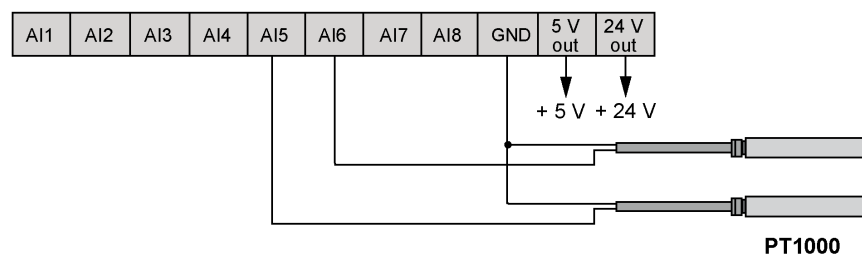
Using the parameter *Cfg\_Aix*, an analog input *Alx* can be configured to acquire a signal by a physical resource (probe, digital input, voltage/current signal) as specified in the following table:

Cfg_Aix	Description	Accuracy Range	Accuracy	Resolution	Input Impedance	
6	Pt1000	-200...+850 °C (-328...+1562 °F)				
	TM172P•07•	-200...0 °C	+/-2.61 °C	0.1 °C (+/-0.18 °F)	1.5 kΩ	
	TM172•••18•	(-328...+32 °F)	(+/-4.70 °F)			
	TM172•••28••	0...+80 °C	+/-3.3 °C			
	TM172•••42••	(+32...+176 °F)	(+/-5.94 °F)			
		+80...+150 °C	+/-3.9 °C		2 kΩ	
	(+176...+302 °F)	(+/-7.02 °F)				

Cfg_Aix	Description	Accuracy Range	Accuracy	Resolution	Input Impedance
		+150...+400 °C (+302...+752 °F)	+/-7.6 °C (+/-13.68 °F)		TM172...28... TM172...42...
		+400...+850 °C (+752...+1562 °F)	+/-17.8 °C (+/-32.04 °F)		
	TM172E...R	-200...-100 °C (-328...-148 °F)	+/-5 °C (+/-9 °F)	0.1 °C (+/-0.18 °F)	2 kΩ
		-100...-50 °C (-148...-58 °F)	+/-3 °C (+/-5.4 °F)		
		-50...+200 °C (-58...+392 °F)	+/-1.5 °C (+/-2.7 °F)		
		+200...+600 °C (+392...+1112 °F)	+/-15 °C (+/-27 °F)		
+600...+850 °C (+1112...+1562 °F)	+/-30 °C (+/-54 °F)				
8	daΩ (Pt1000)	0...3 kΩ	+/-25 Ω	10 Ω	1.5 kΩ
					TM172P...07... TM172...18...
					2 kΩ
					TM172...28... TM172...42... TM172E...R
9	PTC (KTY81-121)	-55...+150 °C (-67...+302 °F)			
		TM172P...07... TM172...18... TM172...28... TM172...42...	-55...+150 °C (-67...+302 °F)	+/-1.1 °C (+/-1.98 °F)	0.1 °C (0.18 °F)
	TM172P...07... TM172...18...				
	2 kΩ				
	TM172...28... TM172...42...				
	TM172E...R	-55...+135 °C (-67...+275 °F)	+/-1.1 °C (+/-1.98 °F)	0.1 °C (0.18 °F)	2 kΩ
+135...+150 °C (+275...+302 °F)		+/-3.1 °C (+/-5.58 °F)			

### Wiring Diagram Example

TM172...28... / TM172...42... CN5 Pt1000 (AI5 and AI6) inputs connection:



<b>Pitch of the terminal block</b>	<b>Cabling length</b>
3.50 mm (0.14 in)	10 m (32.808 ft)

For more information about the wiring, refer to [wiring best practices](#), page 26.

## Current Analog Input

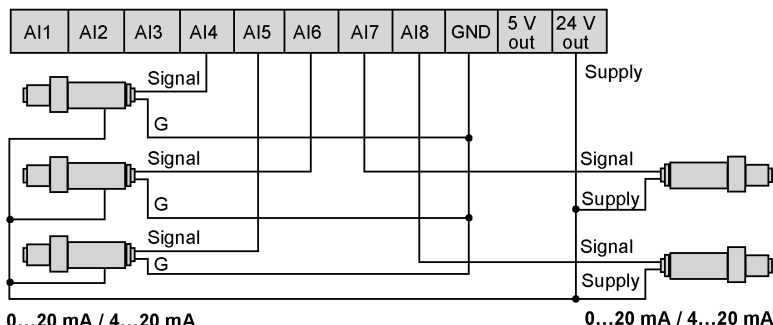
### Characteristics

Using the parameter *Cfg\_Aix*, an analog input *Aix* can be configured to acquire a signal by a physical resource (probe, digital input, voltage/current signal) as specified in the following table:

<i>Cfg_Aix</i>	Description	Range	Accuracy Range	Resolution	Input Impedance
3	4...20 mA	-9999...9999 Default: 0...1000	4...20 mA +/-1 % full range + 1 digit	1 digit	<150 Ω
11	0...20 mA		0...4 mA +/-2 % full range + 1 digit		
			4...20 mA +/-1 % full range + 1 digit		

### Wiring Diagram Example

TM172...28... / TM172...42... (CN5) current input connection:



You can power the transducer from the M172 (5 Vdc or 24 Vdc) or with an external supply.

For more information, refer to [transducer technical data sheet](#).

<b>Pitch of the terminal block</b>	<b>Cabling length</b>
3.50 mm (0.14 in)	10 m (32.808 ft)

For more information about the wiring, refer to [wiring best practices](#), page 26.



# Voltage Analog Input

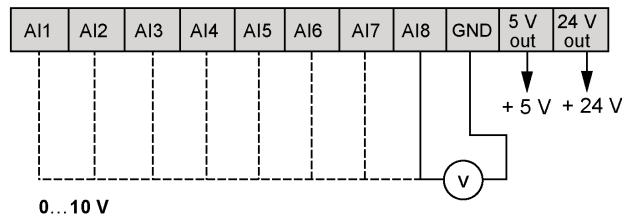
## Characteristics

Using the parameter *Cfg\_Aix*, an analog input *Aix* can be configured to acquire a signal by a physical resource (probe, digital input, voltage/current signal) as specified in the following table:

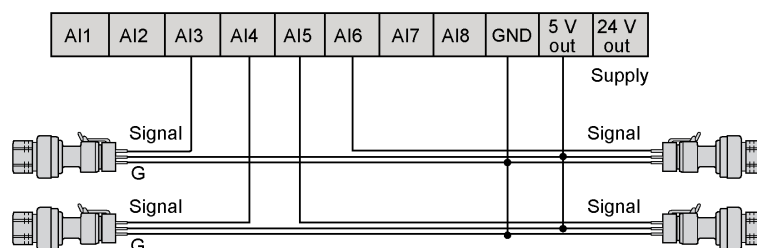
<i>Cfg_Aix</i>	Description	Range	Accuracy Range	Resolution	Input Impedance
4	0...10 Vdc	-9999...9999 Default: 0...1000	0...10 Vdc +/-1 % full range + 1 digit	1 digit	>10 kΩ
					TM172...07• TM172...18• TM172...28•• TM172...42••
					>20 kΩ
					TM172E••R
10	0...5 Vdc	-9999...9999 Default: 0...1000	0...5 Vdc +/-1 % full range + 1 digit	1 digit	>20 kΩ
					TM172...07• TM172...18• TM172...28•• TM172...42••
					>60 kΩ
					TM172E••R
5	0...5 Vdc Ratiometric	-9999...9999 Default: 0...1000	10 % 5 Vdc...90 % 5 Vdc +/-1 % full range + 1 digit	1 digit	>20 kΩ
					TM172...07• TM172...18• TM172...28•• TM172...42••
					>60 kΩ
					TM172E••R

## Wiring Diagram Example

TM172...28•• / TM172...42•• (CN5) voltage input connection:



TM172...28•• / TM172...42•• (CN5) 0-5V ratiometric voltage input connection:



<b>Pitch of the terminal block</b>	<b>Cabling length</b>
3.50 mm (0.14 in)	10 m (32.808 ft)

For more information about the wiring, refer to [wiring best practices](#), page 26.

## Analog Input Used as Digital Input

### Characteristics

Using the parameter *Cfg\_Aix*, an analog input A<sub>x</sub> can be configured to acquire a signal by a physical resource (probe, digital input, voltage/current signal) as specified in the following table:

<i>Cfg_Aix</i>	Description	Range	Accuracy Range	Accuracy	Resolution	Input Impedance
1	Digital input <sup>(1)</sup>	-	-	-	-	10 kΩ

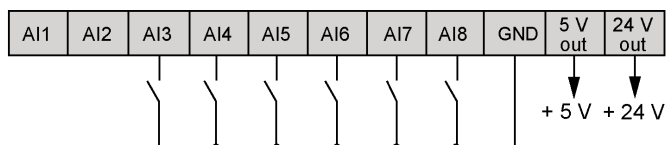
(1) The analog inputs configured as digital inputs are not isolated.

The use of an external power supply with the dry contact digital inputs can result in equipment damage.

<b>NOTICE</b>
<b>INOPERABLE EQUIPMENT</b>
Do not apply external power supply to the dry contact digital inputs of the device.
<b>Failure to follow these instructions can result in equipment damage.</b>

### Wiring Diagram Example

TM172•••28•• / TM172•••42•• (CN5) analog input used as digital input connection:



<b>Pitch of the terminal block</b>	<b>Cabling length</b>
3.50 mm (0.14 in)	10 m (32.808 ft)

For more information about the wiring, refer to [wiring best practices](#), page 26.

## Analog Outputs

### Analog Outputs

This table presents the analog outputs of controllers and expansion modules:

Description	TM172P-G07R	TM172...18R	TM172...18S	TM172...28R•	TM172...28S•	TM172...42R•	TM172...42S•	TM172E12R	TM172E28R
Low voltage (SELV) analog outputs, or Open Collector PWM outputs	-	2	2	2	2	2	2	-	2
Low voltage (SELV) analog outputs	-	-	-	2	2	4	4	-	-

## Analog Outputs

### Overview

Analog outputs are identified as AO1...AOx.

Analog outputs by device reference:

Device references	Non-configurable analog outputs	Configurable analog outputs
TM172...18•	-	AO1, AO2
TM172...28••	AO1, AO2	AO3, AO4
TM172...42••	AO1, AO2, AO5, and AO6	
TM172E28R	-	AO1, AO2

Devices are equipped with low voltage analog output (SELV) 0...10 Vdc, page 89

Using the parameter *Cfg\_AOx*, configurable analog outputs AOx can be configured to provide a signal to a physical resource as specified in the following table:

Cfg_AOx	Description
0	Current modulation 4...20 mA, page 90
1	Current ON/OFF, page 90
2	Voltage modulation 0...10 Vdc, page 89
3	PWM open collector, page 88

## Related Devices and Connectors

The table indicates the related devices and connectors:

Related Device	Connector	Label	Description
TM172...18•	CN11	GND AO1 AO2	0 V signal ground
		AO1...AO2	Analog outputs 1...2
TM172...28•• TM172...42••	CN2	GND AO1 AO2 AO3 AO4	0 V signal ground
		AO1...AO4	Analog outputs 1...4
TM172...42••	CN11	GND AO5 AO6	0 V signal ground
		AO5...AO6	Analog outputs 5...6
TM172E28R	CN7	GND AO1 AO2	0 V signal ground
		AO1...AO2	Analog outputs 1...2

## PWM Open Collector Outputs

### Characteristics

PWM open collector (configurable polarity) configurable analog output characteristics:

Analog output	<ul style="list-style-type: none"> <li>Frequency</li> <li>Duty cycle</li> </ul>			Maximum Sink Current	Maximum Supplies Voltage
	Range	Accuracy	Resolution		
AO1, AO2	<ul style="list-style-type: none"> <li>0...2000 Hz</li> <li>0.0...100.0 %</li> </ul>	<ul style="list-style-type: none"> <li>1 Hz</li> <li>0.1 %</li> </ul>	<ul style="list-style-type: none"> <li>1 Hz</li> <li>0.1 %</li> </ul>	50 mA	24 Vdc
TM172...18 TM172E28R					
AO3, AO4					
TM172P...28 TM172P...42 TM172O...28R TM172O...42R					
AO3, AO4				30 mA	
TM172P...28 TM172P...42					

Analog outputs in PWM mode can be configured as specified in the following table:

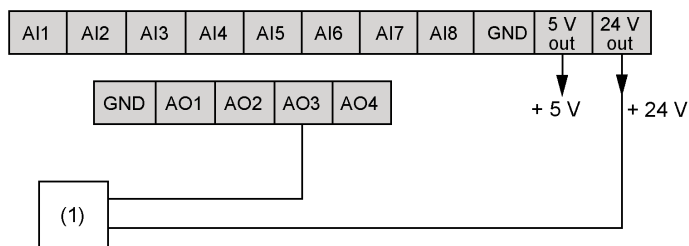
Parameter	Description	Range
<i>PWM_frequency_AO1_AO2</i>	PWM Frequency	0...2000 Hz
<i>PWM_frequency_AO3_AO4</i>		
<i>PWM_polarity_AO1_AO2</i>	PWM Polarity	0, 1
<i>PWM_polarity_AO3_AO4</i>		

**NOTE:** The polarity and the frequency are common for the 2 configurable analog outputs of each device.

For details on the values and characteristics of the parameters, refer to Parameters, page 125.

### Wiring Diagram Example

TM172...28 / TM172...42 (CN2) open collector PWM analog output (AO3) connection:



(1) Third-party actuator (for example: fan module) or external relay

Pitch of the terminal block	Cabling length
3.50 mm (0.14 in)	10 m (32.808 ft)

For more information about the wiring, refer to wiring best practices, page 26.

## Low Voltage (SELV) Analog Outputs

### Characteristics

Voltage modulation 0...10 Vdc non-configurable analog output characteristics:

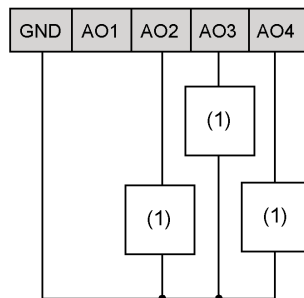
Analog output	Range	Accuracy	Resolution	Load Impedance
AO1, AO2	0...1000	+/-2 % full scale	1 digit	> 700 Ω
TM172...28..				
AO1, AO2, AO5, and AO6				
TM172...42..				

Voltage modulation 0...10 Vdc configurable analog output characteristics:

Analog output	Range	Accuracy	Resolution	Load Impedance
AO1, AO2	0...1000	+/-2 % full scale	1 digit	≥700 Ω
TM172...18·				
TM172E28R				
AO3, AO4				
TM172...28..				
TM172...42..				

### Wiring Diagram Example

TM172...28.. / TM172...42.. (CN2) Low voltage (SELV) analog outputs (AO2, AO3, and AO4) connection:



(1) Third-party actuator (for example: fan module)

Pitch of the terminal block	Cabling length
3.50 mm (0.14 in)	10 m (32.808 ft)

For more information about the wiring, refer to wiring best practices, page 26.

## Analog Current Output

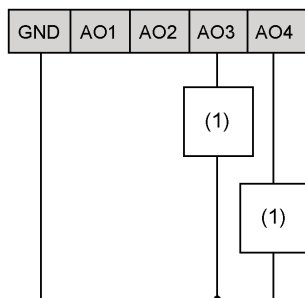
### Characteristics

Current modulation 4...20 mA, page 90 configurable analog output characteristics:

Analog output	Range	Accuracy	Resolution	Load Impedance
AO1, AO2	0...1000	+/-2 % full scale	1 digit	≤450 Ω
TM172...18• TM172E28R				
AO3, AO4				
TM172...28•• TM172...42••				

### Wiring Diagram Example

TM172...28•• / TM172...42•• (CN2) low voltage (SELV) analog outputs (AO3, and AO4) connection:



(1) Third-party actuator (for example: fan module)

Pitch of the terminal block	Cabling length
3.50 mm (0.14 in)	10 m (32.808 ft)

For more information about the wiring, refer to wiring best practices, page 26.

## Current ON/OFF Current Output

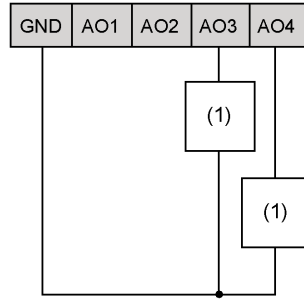
### Characteristics

Current ON-OFF configurable analog output characteristics:

Analog output	Current ON	Current OFF
AO1, AO2		
TM172...18•	23 mA	0 mA
TM172E28R	20 mA	
AO3, AO4		
TM172...28••	23 mA	0 mA
TM172...42••		

## Wiring Diagram Example

TM172...28... / TM172...42... (CN2) current ON/OFF analog output (AO3, and AO4) connection:



(1) Third-party actuator (for example: fan module)

Pitch of the terminal block	Cabling length
3.50 mm (0.14 in)	10 m (32.808 ft)

For more information about the wiring, refer to wiring best practices, page 26.

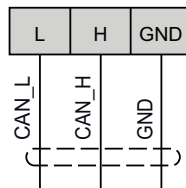
## Communication

### CAN Expansion Bus Port

#### Overview

The TM172P... / TM172O... controllers and TM172E...R expansion modules can be connected through the CAN expansion bus.

#### Connector



Pitch of the terminal block
3.50 mm (0.14 in)

#### Wiring

Use a twisted pair shielded cable with two conductors with section 0.5 mm<sup>2</sup> (AWG 20), plus a sheath (characteristic impedance 120 Ω) with PVC sleeve, nominal capacity between conductors 36 pF/m, nominal capacity between conductor and shield 68 pF/m.

For laying wires, comply with the indications given in standard EN 50174 on information technology wiring. Extra care must be taken in separating data transmission circuits from power lines.

The network must have a bus daisy chain topology and must have 120 Ω 1/4 W termination resistances between the CAN\_H and CAN\_L terminals on each of the two ends of the bus or enable those embedded on the expansion modules.

The maximum cable length depends on the communication speed set in baud:

Baud rate	Maximum network length using:	
	Embedded CAN	TM171ACAN module
50 kBd	1000 m (3280.83 ft)	1000 m (3280.83 ft)
125 kBd	500 m (1640.41 ft)	500 m (1640.41 ft)
250 kBd	200 m (656.17 ft)	250 m (820.21 ft)
500 kBd	30 m (98.42 ft)	60 m (196.85 ft)

## NOTICE

**INOPERABLE EQUIPMENT**

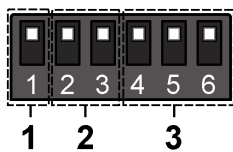
- Do not connect equipment that communicate using RS-485 serial to CAN Expansion Bus terminals.
- Do not connect equipment that communicate using CAN Expansion Bus to RS-485 terminals.

**Failure to follow these instructions can result in equipment damage.**

## TM172E•R Port Configuration Using DIP Switch

The 6-position DIP switches on expansion modules is used to:

- Assert the 120 Ω termination (1)
- Set the CAN baud rate (2)
- Set the CAN address (3)



**NOTE:** The addressing comprises the sum of parameter *Addr\_CAN\_OB* (Default value: 1) plus the composite value of the 6-position DIP switches DIP4...DIP6 (8 addresses).

DIP number	1	2	3	4	5	6	
	120 Ω	Baud		Address			
Disabled Default value							
Enabled							
500 kBd Default value	-						
250 kBd	-						
125 kBd	-						
50 kBd	-						
Address <i>Addr_CAN_OB</i> Default value	-						
Address <i>Addr_CAN_OB</i> + 1							



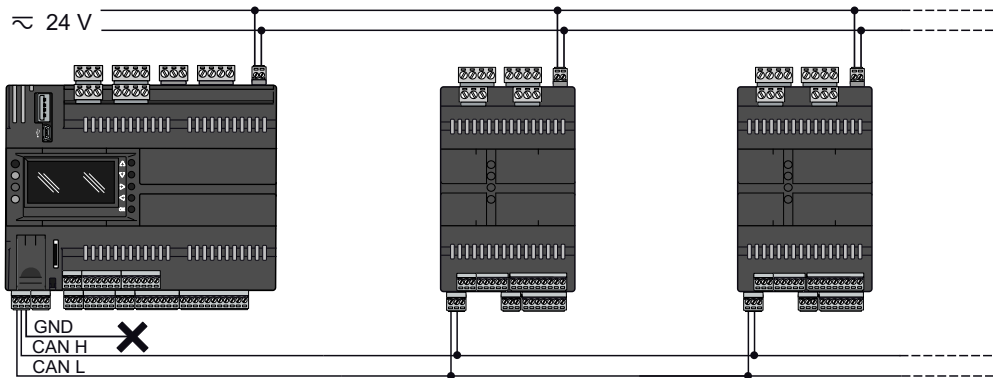
DIP number	1	2	3	4	5	6
	120 Ω	Baud			Address	
Address $Addr\_CAN\_OB + 2$						
Address $Addr\_CAN\_OB + 3$						
Address $Addr\_CAN\_OB + 4$						
Address $Addr\_CAN\_OB + 5$						
Address $Addr\_CAN\_OB + 6$						
Address $Addr\_CAN\_OB + 7$						

### CAN Expansion Bus (Field) Network Connection Example

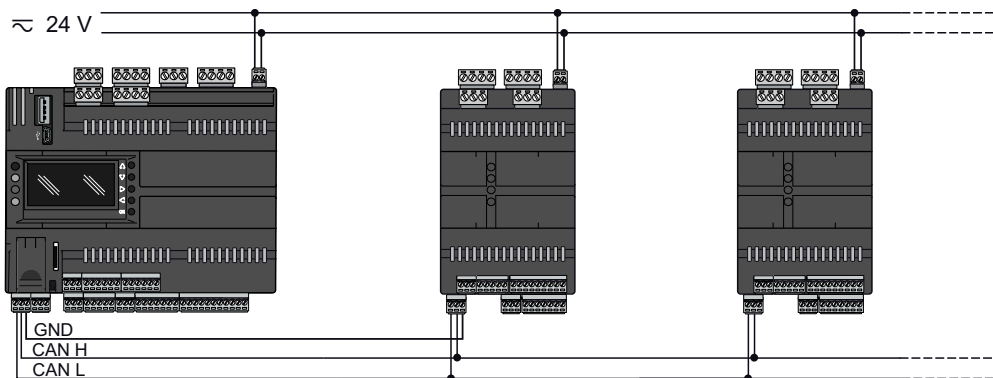
A CAN Expansion Bus (Field) network connection can be constituted by:

- Maximum 1 TM172P..... / TM172O..... functioning as master
- Maximum 12 TM172E••R functioning as slaves. This number can be reduced, depending on the number of inputs and outputs that the master can control.

Non isolated power supply connection example using a TM172PDG42R:



Isolated power supply connection example using a TM172PDG42RI:

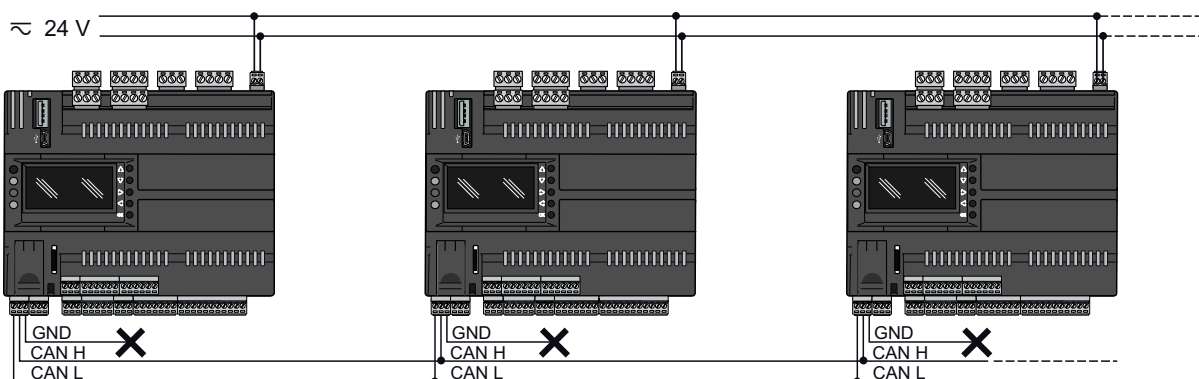


### CAN Expansion Bus Connection (Network) Example

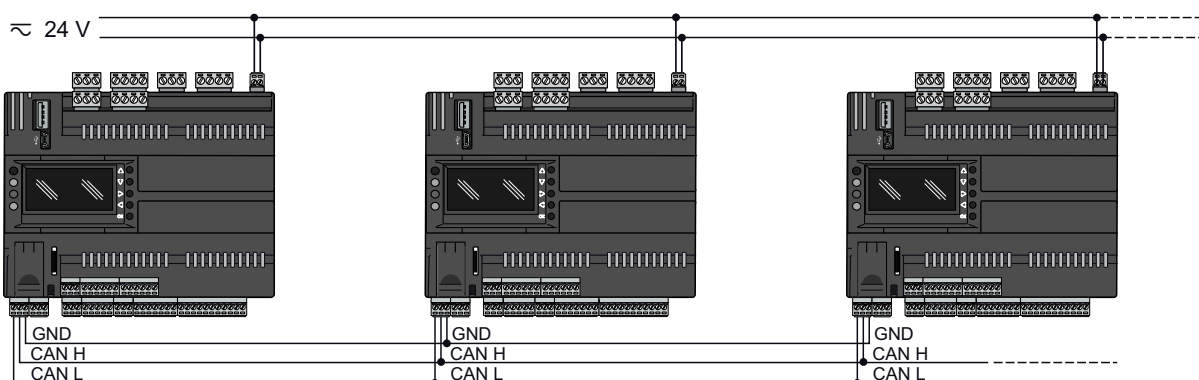
A CAN Expansion Bus (network) connection can be constituted by:

- Maximum 10 TM172P..... / TM172O..... connected in CAN binding. For more details on binding functionalities, refer to EcoStruxure Machine Expert - HVAC - Operating Guide, page 9.

Non isolated power supply connection example using TM172PDG42R:



Isolated power supply connection example using TM172PDG42RI:



## Power Supply Restriction

If you connect the GND connection of the network across multiple devices with power supply inputs that are non-isolated (TM172P••28•, TM172P••42•, or TM172E••R), use separate, isolated power supplies. Alternatively, if you are interconnecting the equipment to a single power supply, do not connect the GND signal. Pay special attention when connecting serial lines. Miswiring may lead to inoperable equipment.

For more details, refer to Power Supply description, page 68.

## RS-485 Serial Ports

### Overview

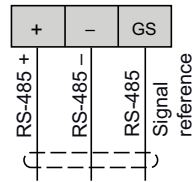
Each TM172P••••• / TM172O••••• controller is equipped with 2 RS-485 serial ports.

These ports permit user to communicate between the controller and a device via:

- A Modbus RTU connection when using **RS485-1**(slave) or **RS485-2** (master or slave) communication port
- A BACnet MS/TP (B-AAC profile certified BTL) connection

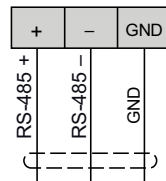
## Connector of TM172P..... / TM172O..... Controllers

The TM172...07• / TM172...18• / TM172O...28R / TM172O...42R / TM172P...28•I / TM172P...42•I controllers are equipped with 2 RS-485 terminals:



**NOTE:** GS of the **RS485-1** and **RS485-2** terminals are internally connected and are isolated from the GND of the device.

The TM172P...28• / TM172P...42• controllers are equipped with 2 RS-485 terminals:



**NOTE:** GND of the **RS485-1** and **RS485-2** terminals are internally connected to the GND of the device.

## Cables

Use a shielded and "twisted pair" cable with two 0.5 mm<sup>2</sup> section conductors (AWG 20), plus braid (characteristic impedance 120 Ω) with PVC sleeve, nominal capacity between conductors 36 pF/m, nominal capacity between conductor and shielding 68 pF/m.

Alternatively use a shielded and "twisted pair" cable with two 0.5 mm<sup>2</sup> section conductors (AWG 20), plus braid with PVC sleeve, nominal capacity between conductors 89 pF/m, nominal capacity between conductor and shielding 161 pF/m. See EN 50174 standard on IT cabling for indications on how cables must be routed.

Always follow regulations applicable to the routing and connection of cables. Separate data transmission circuits from power lines.

RS-485 network up to 1200 m in length with a maximum of 32 devices can be connected directly to the controller. This length can be extended and the number of devices for each channel increased using appropriate repeater modules.

Single terminal strip with 3 conductors: use the 3 conductors ("+", "-" for the signal and "GND" for the braid).

Attach the 120 Ω 1/4 W resistors between the "+" and "-" terminals of the interface and the last controller in each branch of the network.

Maximum settable speed 115200 baud.

RS-485 physical layer can be used for Modbus SL, as well as for BACnet MS/TP communication. Concurrent communication of different protocols on the same serial port is not allowed.

### NOTICE

#### INOPERABLE EQUIPMENT

Do not communicate through Modbus SL and BACnet MS/TP concurrently on the same serial port.

**Failure to follow these instructions can result in equipment damage.**

## NOTICE

### INOPERABLE EQUIPMENT

- Do not connect equipment that communicate using RS-485 serial to CAN Expansion Bus terminals.
- Do not connect equipment that communicate using CAN Expansion Bus to RS-485 terminals.

**Failure to follow these instructions can result in equipment damage.**

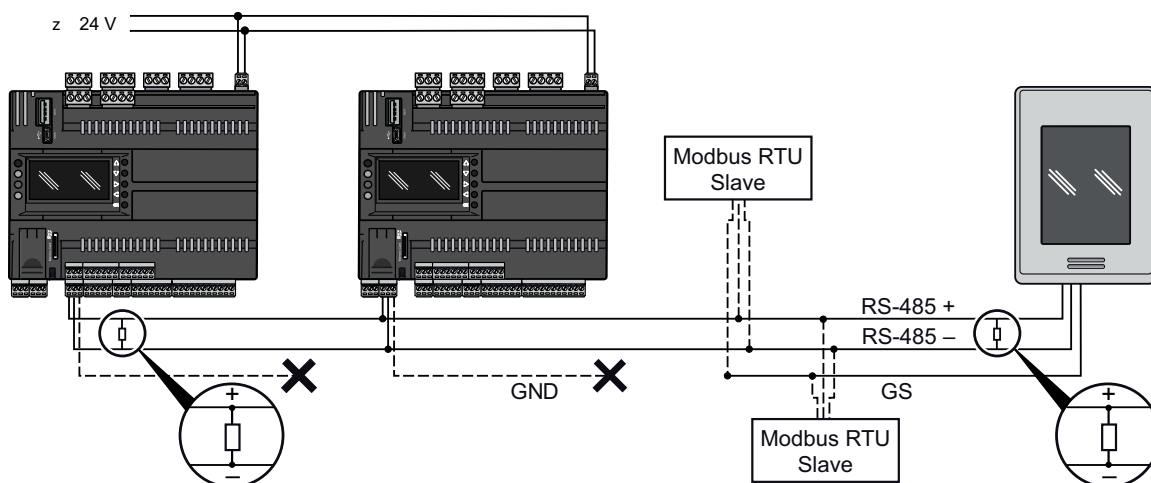
## Power Supply Restriction

If you connect the GND connection of the RS-485 network across multiple devices with power supply inputs that are non-isolated (TM172P••28•, or TM172P••42•), use separate, isolated power supplies. Alternatively, if you are interconnecting the equipment to a single power supply, do not connect the RS-485 GND signal. Pay special attention when connecting serial lines. Miswiring may lead to inoperable equipment.

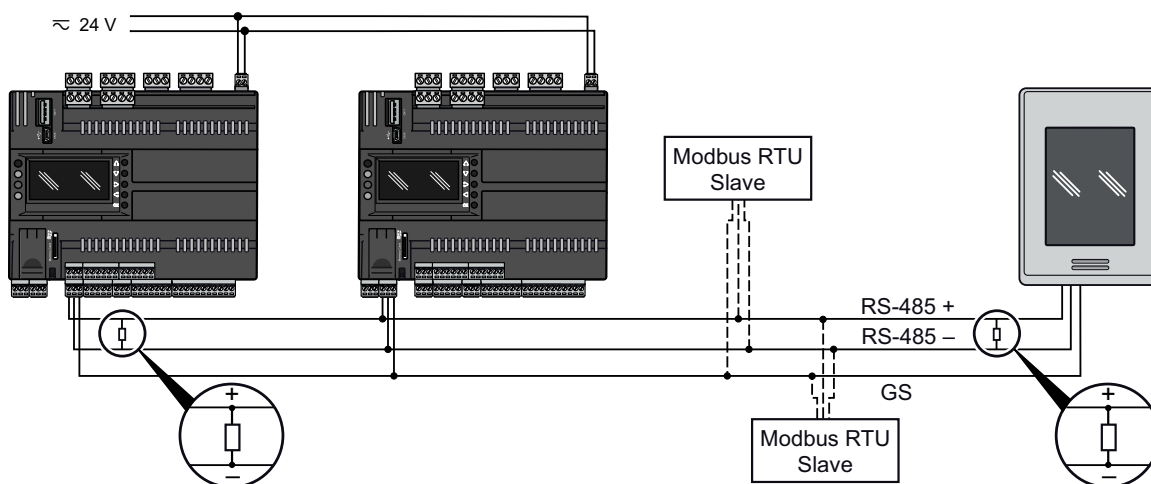
For more details, refer to Power Supply description, page 68.

## Wiring Examples

The following diagram shows an RS-485 (field) architecture wiring example with non isolated controllers:



The following diagram shows an RS-485 (field) architecture wiring example with isolated controllers:



Characteristic	Definition
Type of trunk cable	Shielded cable with one twisted pair and at least a third conductor
Maximum length of bus	1000 m (3280.83 ft) at 19200 bps with a shielded and twisted cable (for example: TSXCSA***)
Maximum number of devices (without repeater)	32 devices that are 31 slaves
Line terminators	120 Ω 1/4 W resistors

Pitch of the terminal block	Cabling length
3.50 mm (0.14 in)	1000 m (3280.83 ft)

## USB Serial Ports

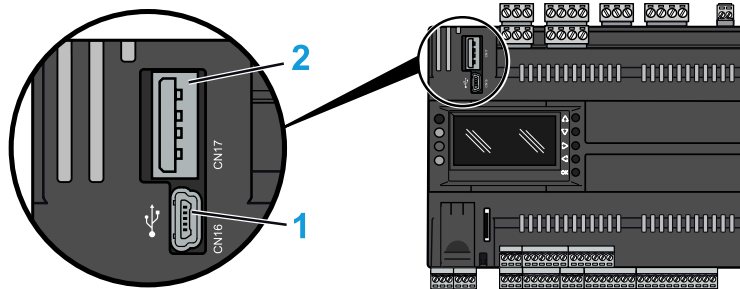
### Overview

An USB type Mini-B (DEVICE) connector placed on the top-left side of the front view of the controller is used to connect the controller to a PC via Mini-B/A USB cable for debugging, commissioning, downloading, uploading with EcoStruxure Machine Expert - HVAC.

For TM172P\*\*\*\*\*, an additional USB type A (HOST) connector is used to connect a USB memory key when downloading the application.

For further information, refer to the commissioning part, page 161.

### Connector of TM172\*\*\*\*\* Controllers



- 1 USB type Mini-B
- 2 USB type A (TM172P\*\*\*\*\* only)

Cabling length
30 cm (11.8 in)

### Connection

The cables required for TM172P\*\*\*\*\* / TM172O\*\*\*\*\* controllers USB Mini-B are TCSXCNAMUM3P or BMXXCAUSBH018.

The TM172P\*\*\*\*\* / TM172O\*\*\*\*\* controllers can also be supplied through the Mini-B USB cable with limited functionalities related to debugging, commissioning, downloading and uploading with EcoStruxure Machine Expert - HVAC. For more information, see the EcoStruxure Machine Expert - HVAC, Programming Guide.

**NOTE:** Do not apply voltage via 24 Vac/dc while the equipment is already connected to a PC via Mini-B USB cable.

Before applying power via 24 Vac/dc power supply connection:

Step	Action
1	Disconnect the Mini-B USB cable.
2	Supply the M172 controller via its 24 Vac/dc supply.
3	Reconnect the Mini-B USB cable.

## Compatibility

TM172P..... / TM172O..... controller is seen as a virtual COM. Serial communication is performed with a CDC profile (USB standard).

Following operating systems are compatible:

- Windows 8 / 8.1 64 bit
- Windows 10 64 bit

The driver is supplied with the EcoStruxure Machine Expert - HVAC.

## Ethernet Port

### Overview

Each TM172P..... controller is equipped by an RJ45 Ethernet port.

The RJ45 Ethernet port is available as an option for TM172O..... controller, by adding a Ethernet, Modbus TCP, and BACnet/IP or a Ethernet, Modbus TCP, BACnet/IP, Modbus SL, and BACnet MS/TP communication module, page 17

### Description

The Ethernet port permits user to connect the device to:

- Different controllers and/or applications exchanging variables and/or parameters (network).
- A supervision system using Modbus TCP/IP protocol.
- An IEC 61131-3 EcoStruxure Machine Expert - HVAC development system.
- A BACnet/IP network, with B-AAC profile.

Concurrent communication of different protocols using the same Ethernet port is allowed (use of a web browser in addition to another Ethernet Fieldbus connection for example).

### Web Functionalities

The M172P also features Web functionalities, offering makers of machinery and systems integrators remote access. Having a web-based connection in machines reduces support and maintenance by minimizing call-out charges. End users also benefit, as they can monitor their own systems both locally and from distance, using the graphics interface of any browser.

Main Web functionalities:

- Web-based access.
- Remote reading and support.
- Local and remote system control, including alarms management.
- Preventive and predictive maintenance.
- Email alarm alerts.

Care must be taken and provisions made for use of this product as a control device to avoid inadvertent consequences of commanded machine operation,

controller state changes, or alteration of data memory or machine operating parameters.

<b>⚠ WARNING</b>
<p><b>UNINTENDED EQUIPMENT OPERATION</b></p> <ul style="list-style-type: none"> <li>• Configure and install the mechanism that enables the remote HMI local to the machine so that local control over the machine can be maintained regardless of the remote commands sent to the application.</li> <li>• You must have a complete understanding of the application and the machine before attempting to control the application remotely.</li> <li>• Take the precautions necessary to assure that you are operating remotely on the intended machine by having clear, identifying documentation within the application and its remote connection.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

## Bridge

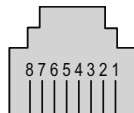
EcoStruxure Machine Expert - HVAC allows monitoring of Modbus/RTU slaves, where M172P controller is the master Modbus/RTU.

In a EcoStruxure Machine Expert - HVAC project, M172P controller is used as a Modbus TCP to Modbus/RTU protocol conversion element for Modbus 03<sub>h</sub> and 10<sub>h</sub> commands.

From EcoStruxure Machine Expert - HVAC, set the connection with the device as Modbus TCP, inserting the M172P controller IP address and the Modbus/RTU address of the device slave.

## Connector

RJ45 Ethernet pin assignment



Pin number	Signal
1	TD+
2	TD-
3	RD+
4	-
5	-
6	RD-
7	-
8	-

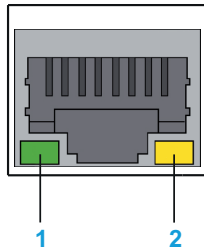
**NOTE:** The controller supports the MDI/MDIX auto-crossover cable function. It is not necessary to use special Ethernet crossover cables to connect devices directly to this port (connections without an Ethernet hub or switch).

<b>Cabling length</b>
100 m (328 ft)

## Status LED

### RJ45 Ethernet status LED

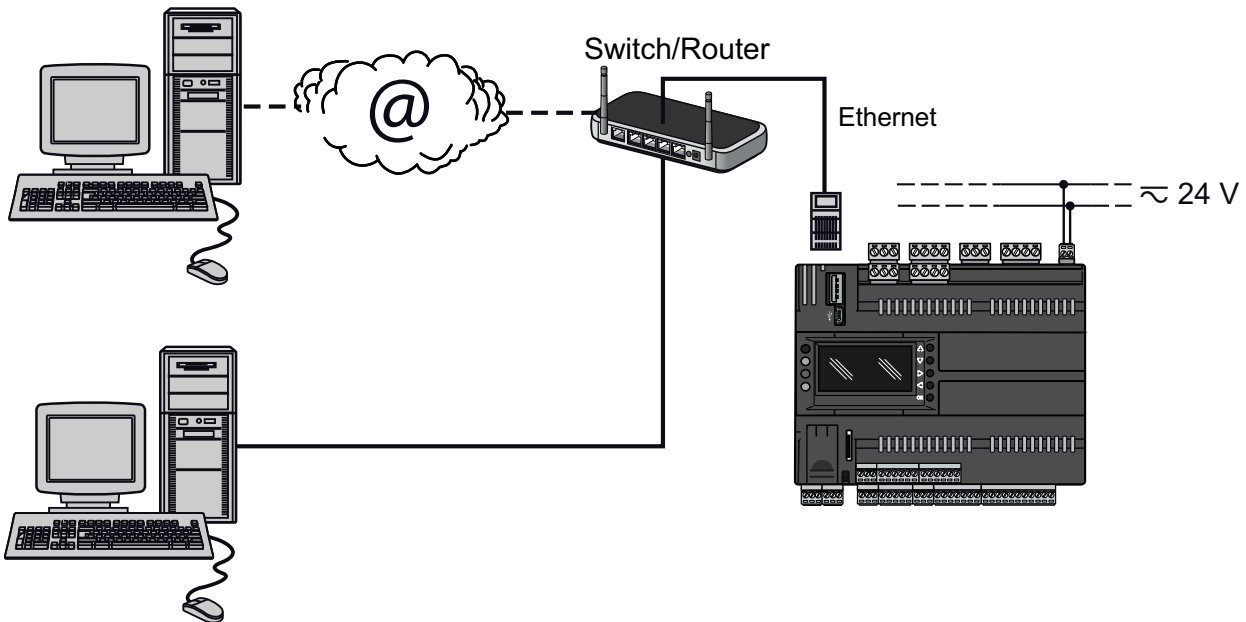
Ethernet control



Label	Signal	LED		
		Color	Status	Description
1	Ethernet link	Green/Yellow	Off	No link
			Yellow On	Link at 10 Mb
			Green On	Link at 100 Mb
2	Ethernet activity	Green	Off	No activity
			Flashing	Activity

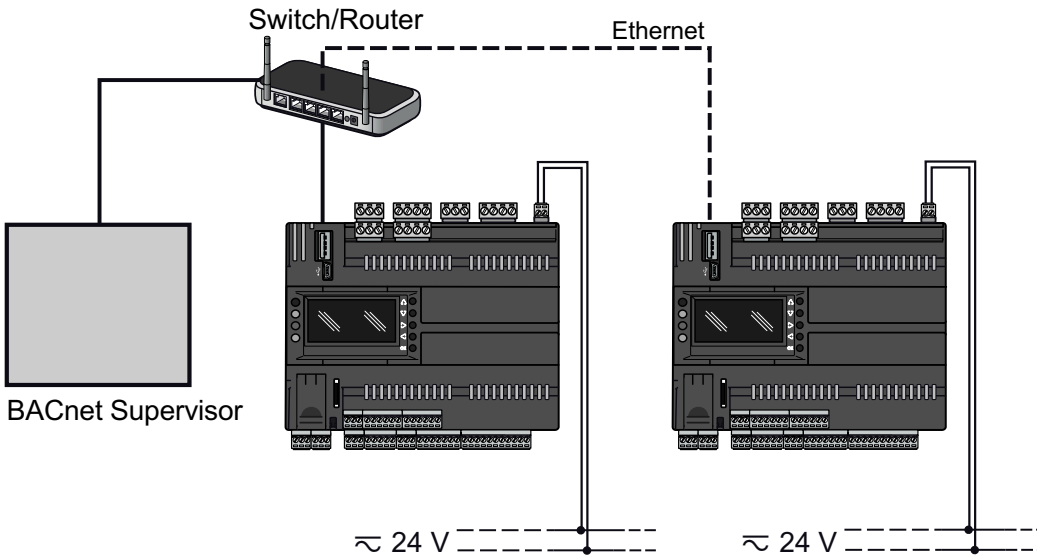
## Architecture Wiring Examples

The following diagram shows an Ethernet architecture wiring example:





The following diagram shows a BACnet/IP architecture wiring example:



## Memory

## Memory

## Overview

The Modicon M172 Logic Controller has two different ways for data storing:

- Internal memory
- External memory (through a slot to insert external memory card, TM172P••••• only)

## Internal Memory

The Modicon M172 Logic Controller has the following memory capacities:

Capacity	Type	Description
512 Kb	Flash	BIOS
96 Kb	RAM	BIOS and retain variables
8 Mb	NOR Flash	File System and BIOS
TM172P••07• / TM172P••18•: 16 Mb TM172P••28•• / TM172P••28••: 32 Mb	SDRAM	Application, HMI, and BIOS

**NOTE:** A RAM datablock (32 bit DWORD), referred to as retain memory can be addressed through EcoStruxure Machine Expert - HVAC at address % MD102.0, and allows data to be permanently stored, as it is with the Flash memory, as long as the RTC battery is active, page 103. There is no limitation in the amount of read and write operations on this block.

## External Memory

The Modicon M172 Logic Controller (TM172P•••••) has a Memory Card slot for micro SD cards to, in certain cases, extend internal memory for the File System, page 142.

- Ultra High-Speed Class 1 (UHS-I) compatibility has been tested and validated with a 16 GB memory card.
- Ultra High-Speed Class 2 (UHS-II) memory cards are not supported.

Micro SD card slot characteristics:

Topic	Characteristics	Description
Supported type	Standard Capacity	Micro SD
	High Capacity	Micro SDHC
Global memory	Maximum capacity	32 GB
Speed	Supported classes	4, 6, and 10
		Ultra high-speed class 1
Memory organization	Maximum size for files	4 GB
	Maximum number of files	512

When handling the micro SD card, follow the instructions below to help prevent internal data on the micro SD card from being corrupted or lost or a micro SD card malfunction from occurring:

## **NOTICE**

### **INOPERABLE EQUIPMENT**

- Do not store the micro SD card where there is static electricity or probable electromagnetic fields.
- Do not store the micro SD card in direct sunlight, near a heater, or other locations where high temperatures can occur.
- Do not bend the micro SD card.
- Do not drop or strike the micro SD card against another object.
- Keep the micro SD card dry.
- Do not touch the micro SD card connectors.
- Do not disassemble or modify the micro SD card.
- Use only micro SD card formatted using FAT32.

**Failure to follow these instructions can result in equipment damage.**

The TM172P\*\*\*\*\* controller does not recognize NTFS formatted micro SD cards. Format the micro SD card on your computer using FAT32.

When using the TM172P\*\*\*\*\* controller and a micro SD card, observe the following to avoid losing valuable data:

- Accidental data loss can occur at any time. Once data is lost, it cannot be recovered.
- If you forcibly extract the micro SD card, data on the micro SD card may become corrupted.
- Removing a micro SD card that is being accessed could damage the micro SD card, or corrupt its data.
- If the micro SD card is not positioned correctly when inserted into the controller, the data on the card and the controller could become damaged.

**NOTICE****LOSS OF APPLICATION DATA**

- Backup micro SD card data regularly.
- Do not remove power or reset the controller, and do not insert or remove the micro SD card while it is being accessed.
- Become familiar with the proper orientation of the micro SD card when inserting it into the controller.

**Failure to follow these instructions can result in equipment damage.**

## RTC (Real-Time Clock)

## RTC (Real-Time Clock)

### RTC Description

The table indicates the functions of the RTC:

Function	Description
RTC data retention time in the event of a power outage	10 years
Drift value	≤ 30 s/month at 25 °C

## Battery

The Modicon M172 Logic Controller has a removable flap placed in the lower-left side of the front view. Behind the service door, there is a battery compartment and a 5-pole male connector (reserved). However, to replace the internal battery, contact your local Schneider Electric representative.

**▲ WARNING****NON USER SERVICABLE COMPONENT**

Do not attempt to replace the battery.

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

# User Interface

## What's in This Chapter

TM172PD..... / TM172OD.... User Interface ..... 104  
 TM172E..R Expansion Modules User Interface ..... 105

# TM172PD..... / TM172OD.... User Interface

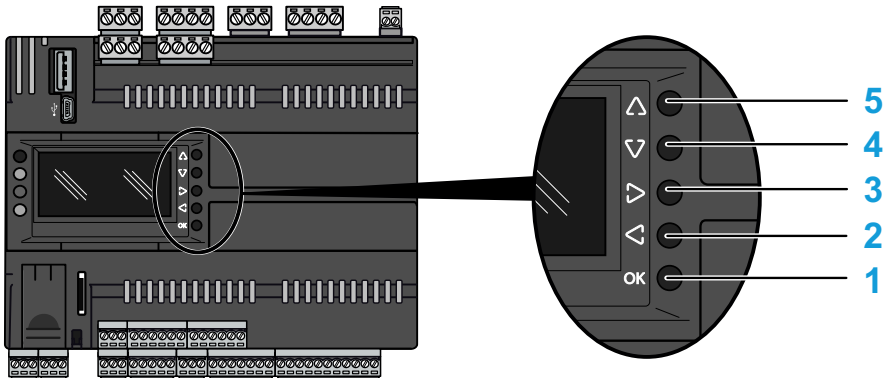
## Overview

The user interface of the TM172PD..... / TM172OD.... controllers has 5 keys and 4 LEDs.

The TM172PB..... / TM172OB.... logic controllers have no display. A TM172DCL.... remote display can be used.

## Keys

The following indications refer to the TM172PD..... / TM172OD.... user interface.

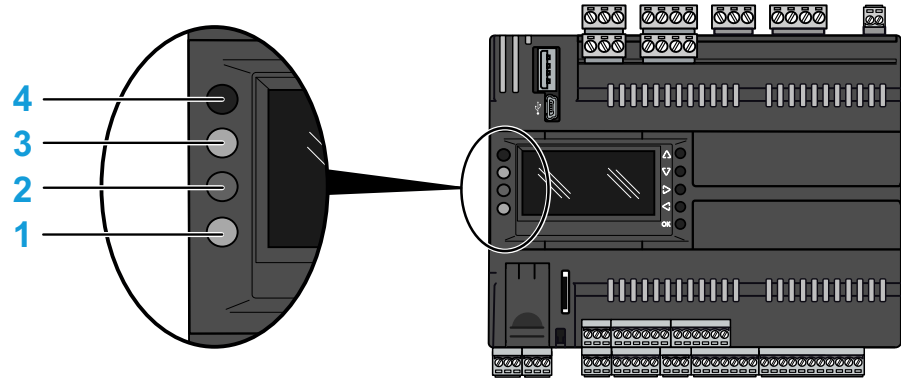


The keys can be programmed from the controller application. The following table describes the keys default setting in Edit Mode (keys are programmable from the controller application).

Description of keys actions:

Number	Key	Press once (press and release)	Press and hold
1	OK	<ul style="list-style-type: none"> <li>Enter/exit Edit mode</li> <li>Confirm operation in Edit Mode</li> </ul>	-
2	LEFT	<ul style="list-style-type: none"> <li>Move cursor to left in Edit Mode</li> </ul>	<ul style="list-style-type: none"> <li>Exit Edit Mode without saving</li> </ul>
3	RIGHT	<ul style="list-style-type: none"> <li>Move cursor to right in Edit Mode</li> </ul>	-
4	DOWN	<ul style="list-style-type: none"> <li>Decrease a value in Edit Mode</li> </ul>	-
5	UP	<ul style="list-style-type: none"> <li>Increase a value in Edit Mode</li> </ul>	-

## LEDs and Display



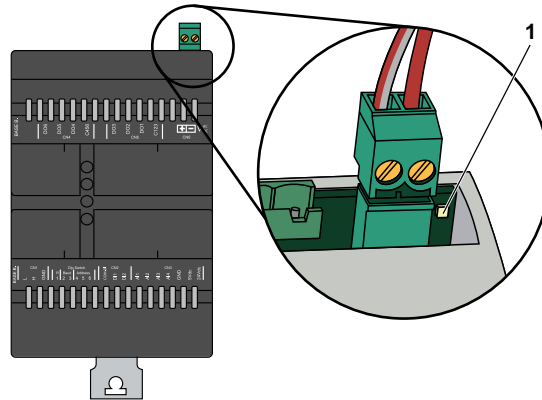
Number	LED	Color	Function
1	C	Green	Programmable from the controller application
2	B	Yellow	
3	A	Red	
4	P	Green	ON when the controller is powered

**NOTE:** By default, A, B, C LEDs are used for USB management.

## TM172E••R Expansion Modules User Interface

### User Interface

The TM172E••R expansion modules have an advanced LED:



1: TM172E••R Expansion Module status LED.

LED State	Description
OFF	There is no power or the device CPU is not working
ON	The TM172E••R Expansion Module is powered and device CPU is running.
Flashing	The TM172E••R Expansion Module is powered and Operational. In this state, the transmission of process data via process data objects (PDOs) is possible.
Fast flashing	During a firmware upgrade. <b>NOTE:</b> At power-on/reset, the LED first flashing for a while and then stay ON.

---

# Remote Display

## What's in This Part

Environmental Characteristics .....	107
Remote Display Description .....	109
Electrical Characteristics and Wiring Diagrams .....	113
Display User Interface .....	118

# Environmental Characteristics

## What's in This Chapter

Environmental Characteristics ..... 107

## Environmental Characteristics

### Environmental Characteristics

Characteristics	Specification	TM172DCLWT**	TM172DCLF*	TM172DGRP
The product complies with the following harmonized regulations	EN60950-1:2006+A2:2013	✓	-	-
	EN55024:2010			
	EN55022:2010/AC2011			
	EN60730-1	-	✓	✓
	EN60730-2-9			
Temperature for ball pressure test	125 °C (257 °F)	-	✓	-
Product certifications	CAN/CSA C22.2 No. 24-1993-06 UL 873:2007-11	✓	-	-
Environmental front panel rating	Type 1 enclosure	-	✓	✓
Degree of protection by enclosure	IP20	✓	✓	✓
	IP65 on front panel	-	✓	✓
Construction of control	Electronic automatic Incorporated Control	-	✓	✓
Purpose of control	Operating control (not safety)	✓	✓	✓
Mounting	Vertical surface	✓	✓	✓
	Flush	-	✓	✓
	Top Hat (DIN rail)	-	✓	-
Type of action	1	-	✓	✓
Pollution degree	2 (normal)	-	✓	✓
Insulation material group	IIIa	-	✓	✓
Over-voltage category	I	-	-	✓
	II	-	✓	-
Rated impulse voltage	330 V	-	✓	✓
Period of electric stress on the insulating parts	N/A	-	-	-
Ambient operating temperature	0...50 °C (32...122 °F)	✓	-	-
	-20...60 °C (-4...140 °F)	-	✓	-
	-20...55 °C (-4...131 °F)	-	-	✓
Ambient operating humidity (non-condensing)	0...75 %	✓	✓	-
	5...95 %	-	-	✓
Ambient storage temperature	-30...50 °C (-22...122 °F)	✓	-	-
	-30...60 °C (-22...140 °F)	-	✓	-
	-30...70 °C (-22...158 °F)	-	-	✓

Characteristics	Specification	TM172DCLWT**	TM172DCLF•	TM172DGRP
Ambient storage humidity (non-condensing)	0...75 %	✓	✓	-
	5...95 %	-	-	✓
Power supply	24 Vac +/-15 % 50/60 Hz	✓	✓	✓
	24 Vdc +/-10 %			
Power consumption	3.2 VA 1.3 W max	✓	✓	-
	3 VA 2 W	-	-	✓
Insulation class	III	-	✓	✓
Fire-resistance category	D	-	✓	-
Software class and structure	A	-	✓	✓
Type of disconnection or suspension for each circuit	N/A	-	-	-



# Remote Display Description

## What's in This Chapter

TM172DCLWT••.....	109
TM172DCLF•.....	110
TM172DGRP.....	111

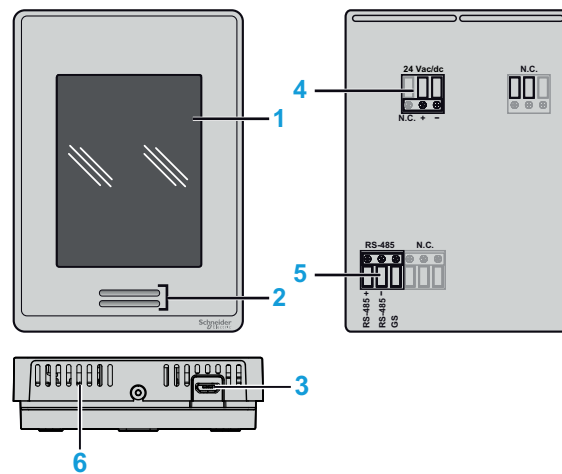
## TM172DCLWT••

### Overview

Reference	Description
TM172DCLWT	M172 Color Touchscreen remote display vertical mounting with built-in temperature sensor
TM172DCLWTH	M172 Color Touchscreen remote display vertical mounting with built-in temperature and humidity sensors
TM172DCLWTHP	M172 Color Touchscreen remote display vertical mounting with built-in temperature, humidity, and presence (PIR) sensors

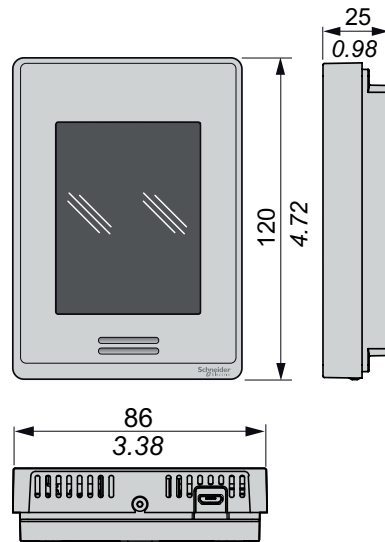
### Physical Description

The following illustrations present a TM172DCLWT•• remote display:



Number	Description
1	Touchscreen
2	Holes for PIR detection
3	USB Micro-B port
4	Power supply connector
5	RS-485 Modbus SL connector
6	Holes for temperature measurement

## Dimensions



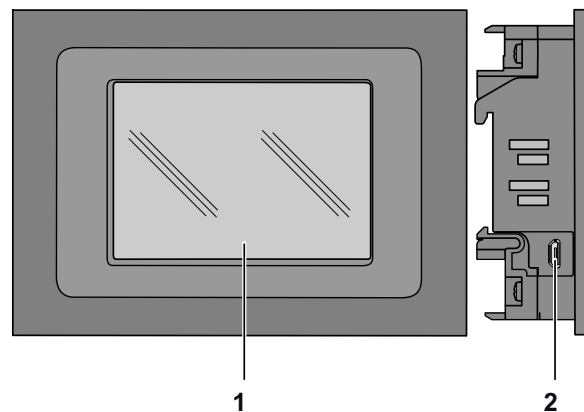
## TM172DCLF•

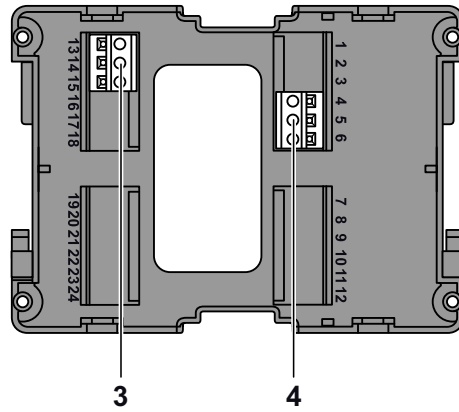
### Overview

Reference	Description
TM172DCLFW	M172 Color Touchscreen remote display flush mounting gray
TM172DCLFG	M172 Color Touchscreen remote display flush mounting white

## Physical Description

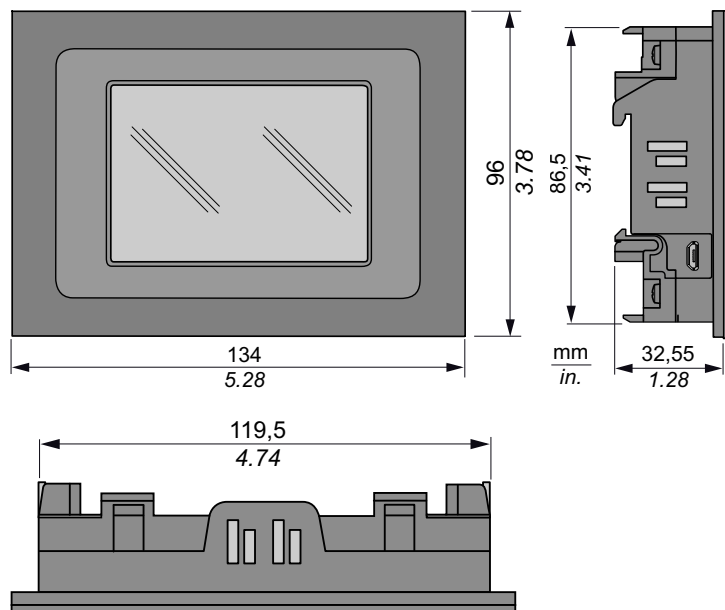
The following illustrations present a TM172DCLF• remote display:





Number	Description
1	Touchscreen
2	USB Micro-B port
3	RS-485 Modbus SL connector
4	Power supply connector

## Dimensions



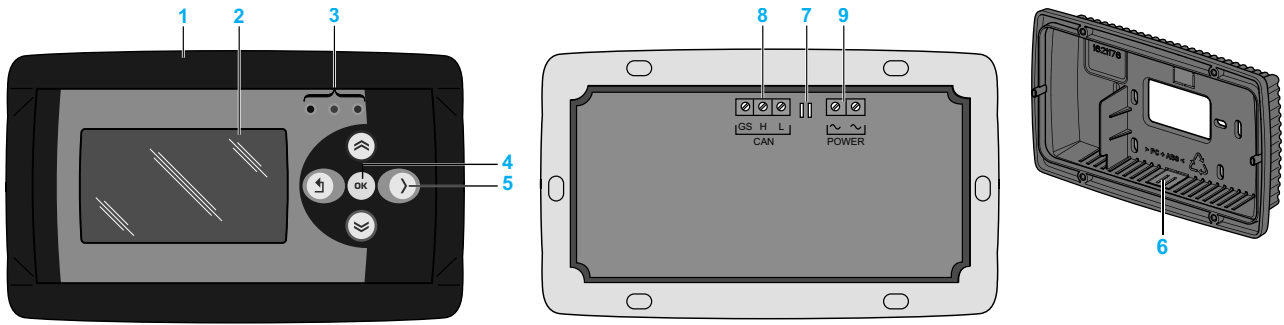
## TM172DGRP

### Overview

Reference	Description
TM172DGRP	M172 monochrome display graphic

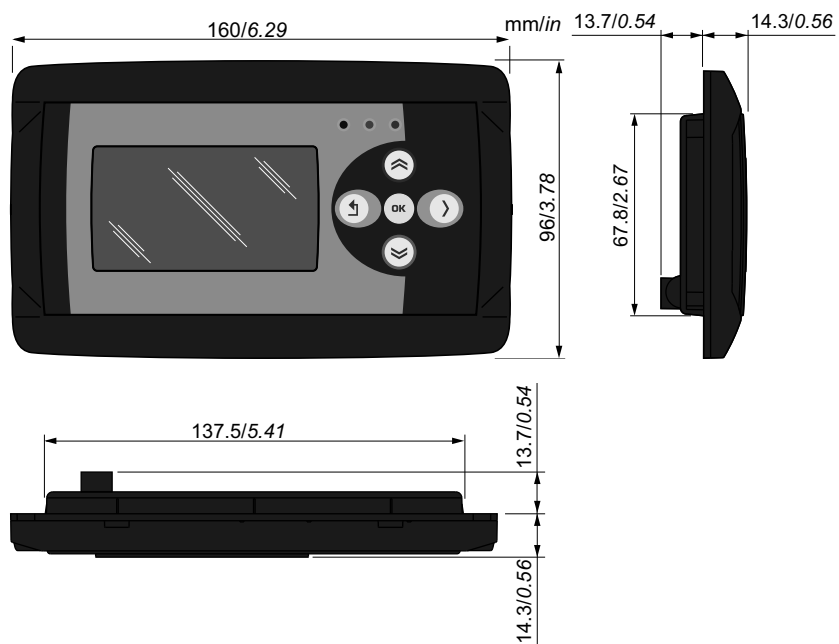
## Physical Description

The following illustrations present a TM172DGRP remote display:



Number	Description
1	Front frame
2	Display
3	Status LEDs
4	Enter key
5	4 navigation keys
6	Cables access of TM171ABKP•
7	CAN termination resistors
8	CAN Expansion bus port
9	Power supply

## Dimensions



# Electrical Characteristics and Wiring Diagrams

## What's in This Chapter

Power Supply.....	113
Embedded Sensors.....	115
TM172DCL•••• RS-485 Modbus Serial Port.....	116
TM172DGRP CAN port.....	116

## Power Supply

### TM172DCL•••• Power Supply

References	Power supply characteristics
TM172DCLWT	24 Vac (+/- 15 %) non-isolated - 50/60 Hz
TM172DCLWTH	24 Vdc (+/- 10 %) non-isolated
TM172DCLWTHP	3.2 VA / 1.3 W maximum power consumption
TM172DCLFW	
TM172DCLFG	

Power supply wiring diagram:

<b>24 Vac/dc</b>	
(1) Type T fuse 500 mA UL recognized	(1) Type T fuse 630 mA
TM172DCLFW TM172DCLFG	TM172DCLWT TM172DCLWTH TM172DCLWTHP
<b>Pitch of the terminal block</b>	<b>Cabling length</b>
5.00 mm (0.197 in.)	10 m (32.808 ft)

## NOTICE

### INOPERABLE EQUIPMENT

Do not connect a power cable longer than 10 m (32.8 ft).

**Failure to follow these instructions can result in equipment damage.**

For more information about the wiring, refer to *Best wiring practices*, page 26.

The power supplies for the TM172DCL•••• must be rated Safety Extra Low Voltage (SELV) according to IEC 61140. These sources of power are isolated between the electrical input and output circuits of the power supply as well as simple separation from ground (earth), PELV, and other SELV systems.

**⚠ DANGER**

**GROUND LOOP CAUSING ELECTRIC SHOCK AND/OR INOPERABLE EQUIPMENT**

Do not connect the 0 V power supply/transformer connection supplying this equipment to any external ground (earth) connection.

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

In all cases, if the specified voltage range is not maintained, the products may not function as intended. Use appropriate safety interlocks and voltage monitoring circuits.

**⚠ WARNING**

**POTENTIAL OF OVERHEATING AND FIRE**

- Do not connect the equipment directly to line voltage.
- Use only isolating SELV, Class 2 power supplies / transformers to supply power to this equipment.

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

## TM172DGRP Power Supply

References	Power supply characteristics
TM172DGRP	24 Vac (+/- 15 %) - 50/60 Hz 24 Vdc (+/- 10 %) 3 VA / 2 W maximum power consumption

Power supply wiring diagram:

**24 Vac/dc**

(1) Type T fuse 200 mA

Pitch of the terminal block	Cabling length
3.81 mm (0.15 in.)	10 m (32.808 ft)

**NOTICE**

**INOPERABLE EQUIPMENT**

Do not connect a power cable longer than 10 m (32.8 ft).

**Failure to follow these instructions can result in equipment damage.**

For more information about the wiring, refer to Best wiring practices, page 26.

**⚠ DANGER**

**GROUND LOOP CAUSING ELECTRIC SHOCK AND/OR INOPERABLE EQUIPMENT**

Do not connect the 0 V power supply/transformer connection supplying this equipment to any external ground (earth) connection.

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

In all cases, if the specified voltage range is not maintained, the products may not function as intended. Use appropriate safety interlocks and voltage monitoring circuits.

**⚠ WARNING**

**POTENTIAL OF OVERHEATING AND FIRE**

- Do not connect the equipment directly to line voltage.
- Use only isolating SELV, Class 2 power supplies / transformers to supply power to this equipment.

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

## Embedded Sensors

### TM172DCLWT•• Embedded Temperature Sensor Characteristics

Characteristic	Value
Type	10 k NTC type 2 thermistor
Resolution	+/- 0.1 °C (+/- 0.2 °F)
Measurement range	-40...+50 °C (-40...+122 °F)
Accuracy	+/- 0.5 °C (+/- 0.9 °F) at 21 °C (70 °F) typical calibration

### TM172DCLWTH• Embedded Humidity Sensors Characteristics

Characteristic	Value
Type and calibration	Single point calibrated bulk polymer
Precision	Reading range from 10...90 % R.H. non-condensing 10...20 % precision: 10 % 20...80 % precision: 5 % 80...90 % precision: 10 %
Stability	Less than 1.0 % yearly (typical drift)

## TM172DCL... RS-485 Modbus Serial Port

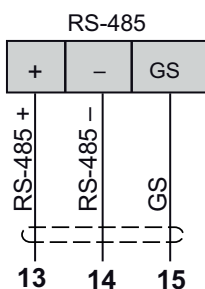
### Overview

The TM172DCL... can be connected to the controller through the RS-485 Modbus.

For details, refer to RS-485 Serial port description of the controller, page 94.

### Connector

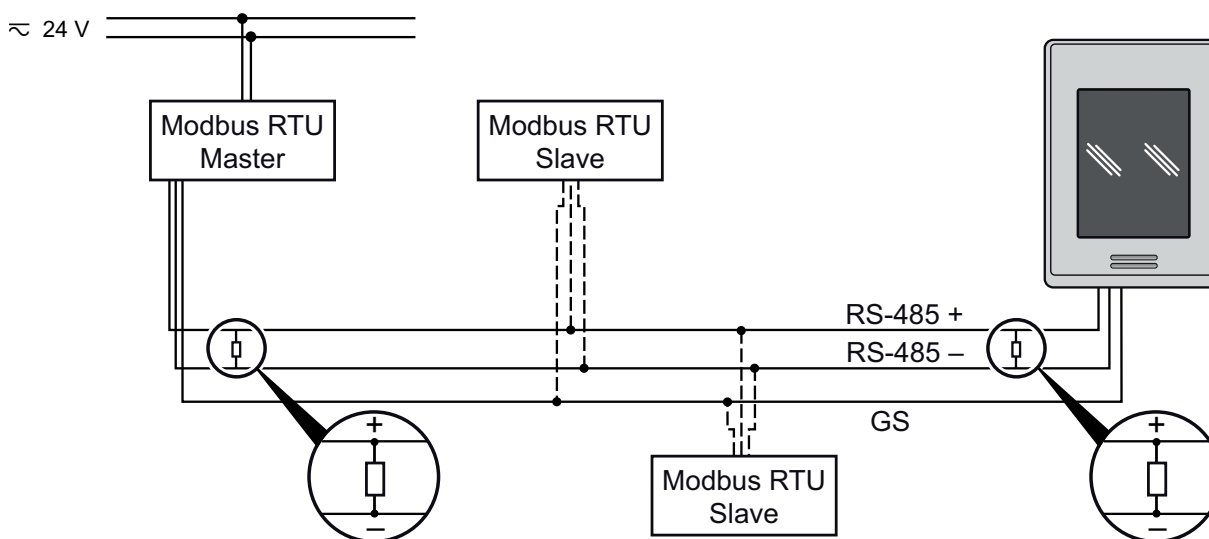
RS-485 connector (CN3):



**NOTE:** GS of the RS-485 terminal is not internally connected to the “-” of the power supply terminal of the device.

### Architecture Wiring Examples

The following diagram shows an RS-485 (field) architecture wiring example:



## TM172DGRP CAN port

### Overview

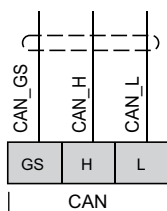
The TM172DGRP can be connected to the controller through the CAN port.

For details, refer to CAN port description of the controller, page 91.



## Connector

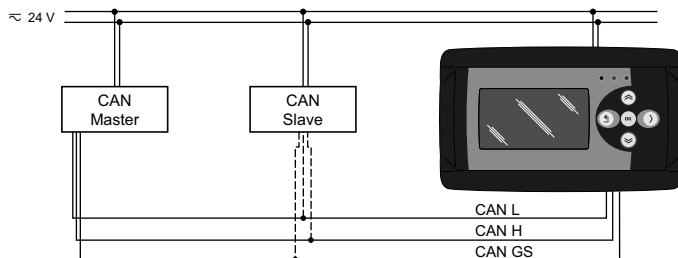
CAN connector :



**NOTE:** The terminals of power supply connection and the signal reference for CAN Expansion Bus (indicated as GS) are not internally connected. FUNCTIONAL isolation between them.

## Architecture Wiring Examples

The following diagram shows a CAN architecture wiring example:



**NOTE:** Both ends of the CAN expansion bus must be terminated. In TM172DGRP, this is possible via its termination jumpers.

# Display User Interface

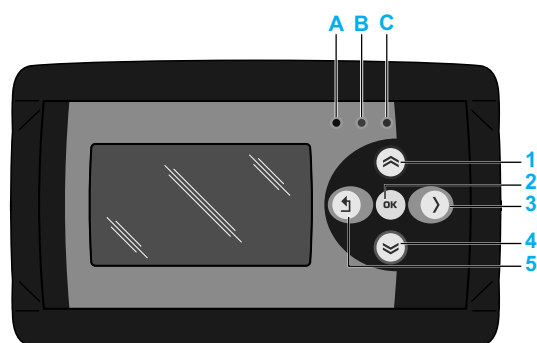
## What's in This Chapter

TM172DGRP User Interface ..... 118  
 Diagnostic Menu ..... 120  
 TM172DGRP Troubleshooting ..... 124

## TM172DGRP User Interface

### Overview

The user interface of the TM172DGRP remote display has 5 keys and 3 LEDs:



TM172DGRP remote display can be used with:

- TM172PD..... / TM172OD..... logic controllers that have an embedded display
- TM172PB..... / TM172OB..... logic controllers that have no embedded display

### Keys

The following table describes the keys default setting in Edit Mode (keys are programmable from the controller application).

Description of keys actions:

Number	Key	Press once (press and release)	Press and hold
1	<b>UP</b>	<ul style="list-style-type: none"> <li>• Scroll up</li> <li>• Return to previous page</li> <li>• Increase / modify a value in Edit Mode</li> <li>• Go to next label</li> </ul>	-
2	<b>OK</b>	<ul style="list-style-type: none"> <li>• Scroll down</li> <li>• Move to next level/menu (open folder, subfolder, parameter, value)</li> <li>• Enter/exit Edit mode</li> <li>• Confirm operation in Edit Mode</li> </ul>	-
3	<b>RIGHT</b>	<ul style="list-style-type: none"> <li>• Move cursor to right in Edit Mode</li> </ul>	-

Number	Key	Press once (press and release)	Press and hold
4	<b>DOWN</b>	<ul style="list-style-type: none"> <li>• Scroll down</li> <li>• Move to the next page</li> <li>• Decrease / modify a value in Edit Mode</li> <li>• Go to previous label</li> </ul>	-
5	<b>LEFT/EXIT</b>	<ul style="list-style-type: none"> <li>• Exit menu page / go back to previous menu</li> <li>• Move cursor to left in Edit Mode</li> </ul>	<ul style="list-style-type: none"> <li>• Exit Edit Mode without saving</li> </ul>

## LEDs and Display

LED	Color	Function
C	Green	Programmable from the controller application
B	Yellow	
A	Red	

## Diagnostic Menu


TM172DGRP is factory-configured with a default Diagnostic menu that appears when the equipment is powered on.

After uploading an HMI menu from TM172P..... controller, the display consist of this menu. This HMI menu was created with the software EcoStruxure Machine Expert - HVAC and stored in the filesystem of the TM172P..... controller .

In this case, to open the Diagnostic menu, proceed as follows:

Number	Key combination	Press and hold for 3 seconds
4 + 5	LEFT+DOWN	Open Diagnostic menu

To return to the HMI menu of the controller application, open the “HMI

Management” page, move the cursor onto the  symbol and press the **OK** key.

## First Power On

When the remote display is powered-on for the first time, SYSTEM INFO pages are displayed showing system status.

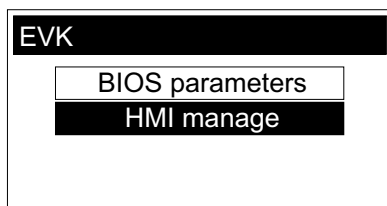
SYSTEM INFO
HW : version 1.0
BIOS : Msk476_18
DATE : 04/08/17
BOOT : Msk450_07

If present, the HMI menu from the controller application is displayed. If not present, the diagnostic menu is displayed.

# Diagnostic Menu

## Overview

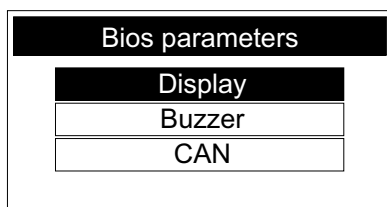
The Diagnostic menu of the TM172DGRP remote display allows you to manage system parameters (BIOS parameters) and the interface (HMI Management).



The Diagnostic menu is composed by 2 sub-menus:

- BIOS parameters, page 120
- HMI Management, page 121

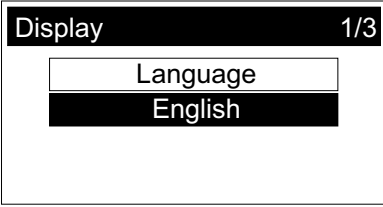
## BIOS Parameters



The BIOS parameters menu permits you to:

- configure the display:
  - the language of the Diagnostic menu (Page 1/3),
  - the LCD contrast (Page 2/3),
  - the backlight time (Page 3/3)
- configure the buzzer activation on key press
- configure the CAN settings of the remote display:
  - CAN address (Page 1/2),
  - CAN baud rate (Page 2/2),

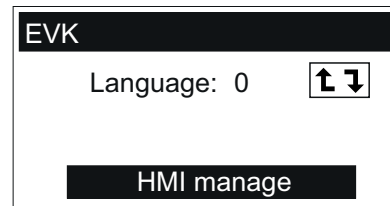
To change the language of the Diagnostic menu:

Step	Action
1	From <b>BIOS parameters</b> page, select <b>Display</b> and press <b>OK</b> key.
2	In <b>Display page (1/3)</b> , press <b>OK</b> key:  Language is in edit mode.
3	Press <b>UP/DOWN</b> keys to select the new language. The Diagnostic menu can be displayed in 5 languages: Italian, English, French, German, and Spanish.
4	Press <b>OK</b> key to validate the new language.
5	Press <b>EXIT</b> key to return to <b>BIOS parameters</b> menu.

See parameter HMI Management/Hmi\_Language, page 158.

## HMI Management


The first HMI Management page shows:



The first HMI Management page permits you to:

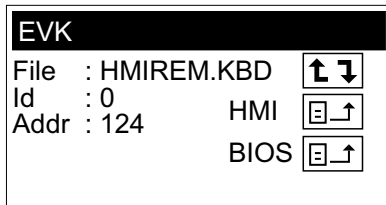
- Change the language of the HMI menu:

Step	Action
1	Select the language number and press <b>OK</b> key.
2	Press <b>UP/DOWN</b> keys to select the new language. The Diagnostic menu can be displayed in 5 languages: 0 = Italian, 1 = English, 2 = French, 3 = German, and 4 = Spanish.
3	Press <b>OK</b> key to validate the new language.

- : Relaunch the HMI menu in the new selected language, page 122.
- **HMI manage**: Go to the Advanced HMI Management page, page 121.

## Advanced HMI Management

The Advanced HMI Management page shows the configuration of the remote display:



The Advanced HMI Management page permits you to:

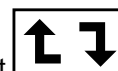
File :	Launch the HMI menu stored in the remote display, if present, page 122.
HMI :	Upload HMI menu from the controller, page 123.
BIOS :	Upload BIOS from the controller, page 123.

**NOTE:** If the symbol

CanOpen

appears at the bottom left of the screen, refer to TM172DGRP Troubleshooting description, page 124.

## How to launch the HMI Menu



To launch the HMI menu stored in the remote display, select and press **OK** in one of the following page:


- First HMI Management, page 121
- Advanced HMI Management, page 121

**Result:** The remote display shows the starting page of the HMI menu (previously uploaded).

**NOTE:** If the controller is not in RUN state, the variable fields only display “???”.


## How to Upload HMI menu from the Controller

To upload HMI menu from the controller:

Step	Action
1	From <b>Advanced HMI Management</b> page, select <b>File</b> and press <b>OK</b> key to toggle between: <ul style="list-style-type: none"> <li>• <b>HMIREM.KBD</b>: different HMI menu in remote display and controller</li> <li>• <b>HMIIEC.COD</b>: same HMI menu in remote display and controller</li> </ul>
2	Select HMI :  icon and press <b>OK</b> key.
3	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p><b>Upload Remote page</b></p> <p>Upload page?</p> <p>The process will not be suspended</p> <p>Cancel                      OK</p> </div> <p>Press <b>UP/DOWN</b> keys to select <b>OK</b> and. press <b>OK</b> key to validate.</p>
4	<p>Wait during the upload.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p><b>Upload Remote page</b></p> <p>In progress...</p> <div style="border: 1px solid black; width: 100px; height: 10px; margin: 5px 0;"> <div style="background-color: black; width: 10%;"></div> </div> <p style="text-align: center;">10%</p> </div>
5	<p>If no error is detected, a confirmation message appears:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p><b>Upload Remote page</b></p> <p>Success...</p> <p>Press OK</p> </div> <p>Press <b>OK</b> key to validate and return to <b>HMI Management</b> page.</p>

## How to Upload BIOS from the controller

To upload BIOS from the controller:

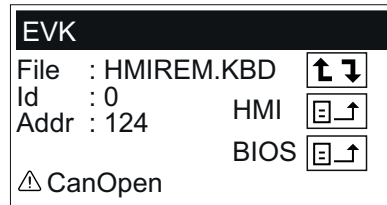
Step	Action
1	From <b>HMI Management</b> page, select <b>BIOS</b> :  icon and press <b>OK</b> key.
2	Press <b>UP/DOWN</b> keys to select <b>OK</b> and press <b>OK</b> key to validate.
3	Wait during the upload.
4	<p>If no error are detected, a confirmation message appears.</p> <p>Press <b>OK</b> key to validate and return to <b>HMI Management</b> page.</p>

# TM172DGRP Troubleshooting

## Troubleshooting

In the Diagnostic menu, the HMI Management page shows the configuration of the TM172DGRP remote display.

If a CAN communication error is detected, a symbol is displayed at the bottom left of the screen:



If occurs, check the communication configuration of the remote display, page 120 and the communication wiring, page 116.



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# Parameters

## What's in This Part

Overview .....	126
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Expansion Module Parameters Table.....	144
Display Color Touchscreen Parameters Table.....	153
TM172DGRP Parameters Table .....	157

# Overview

## Overview

Parameters are used to configure a Modicon M172 Logic Controller.

They can be modified with:

- Keys on:
  - TM172•D••••• front panel
  - TM172DCL•••• remote displays
- PC with EcoStruxure Machine Expert - HVAC
- Modbus SL communication

### ⚠ WARNING

#### UNINTENDED EQUIPMENT OPERATION

After any BIOS parameter modification, power cycle the device.

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

## Modbus Commands and Data Areas

The following commands are implemented:

Modbus command	Description
3 (3 <sub>h</sub> )	Read multiple registers on Client side
6 (6 <sub>h</sub> )	Write single register on Client side
16 (10 <sub>h</sub> )	Write multiple registers on Client side
43 (2B <sub>h</sub> )	Read Device Identification: <ul style="list-style-type: none"> <li>• Vendor name</li> <li>• Product code</li> <li>• Major/minor revision</li> </ul>

## Parameters Tables

The three following tables list all information required to read, write, and decode all accessible resources in the device.

- Controller Parameter table, page 128
- Expansion Module Parameters table, page 144
- Display Parameter table, page 153

## Description of columns:

Column	Description
LABEL	Indicates the label used to display the parameters in the device menu.
ADDRESS	Indicates the address of the Modbus register containing the resource to access.
DATA TYPE	Indicates the size of the data in bits.
CPL	<p>When the field indicates "-1", the value read by the register requires conversion because the value represents a number with a sign. In the other cases, the value is always positive or null.</p> <p>To carry out the conversion, proceed as follows:</p> <ul style="list-style-type: none"> <li>• If the value in the register is from 0 to 32767, the result is the value itself (zero and positive values).</li> <li>• If the value in the register is from 32768 to 65535, the result is the value of the register - 65536 (negative values).</li> </ul>
RESET	<p>Indicates whether the controller must be rebooted after the parameter has been modified.</p> <ul style="list-style-type: none"> <li>• Y = the controller must be rebooted to modify the parameter.</li> <li>• Empty "-" = the controller does not need to be rebooted to modify the parameter.</li> </ul>
DESCRIPTION	Description of the parameter usage.
RANGE	Describes the interval of values that can be assigned to the parameter. It can be correlated with other equipment parameters (indicated in the parameter label).
DEFAULT	Indicates the factory setting for the reference of the device.
U.M.	Indicates the unit of measurement for values converted according to the rules indicated in the CPL column. The unit of measurement shown is for example purposes only, as it may change depending on the application (for example, parameters with a U.M. in °C/bar could also have %RH.)

# Controller Parameter Table

## Folders

**NOTE:** Not all parameters listed are available depending on the accessible resources in the device.

The following tables present the controller parameters, divided into categories (folders):

Folder label
Acknowledgment, page 128
AI Calibration, page 129
AO Calibration, page 128
Analog Inputs - Base Board, page 134
Analog Inputs - Upper Board, page 136
ON Board <b>RS485-1</b> , page 137
ON Board <b>RS485-2</b> , page 138
ON Board CAN Expansion bus, page 139
RS-485 Passive Communication Module, page 139
CAN Expansion bus Passive Communication Module , page 140
RS-232 Passive Communication Module, page 140
Ethernet, page 141
Display, page 142
BACnet, page 142
FileSystem, page 142
Miscellaneous, page 143

## Acknowledgment Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Par_TAB</i>	15716	WORD	-	Y	Map code <b>NOTE:</b> RW parameter	0...65535	0	Num
<i>Par_POLI</i>	15717	WORD	-	Y	Model code <b>NOTE:</b> RW parameter	0...65535	2049	Num
<i>Par_PARMOD</i>	15719	BOOL	-	-	Parameter modified Flag indicating change to default setting: <ul style="list-style-type: none"> <li>0 (false): map not modified</li> <li>1 (true): at least one parameter has been modified with respect to the original configuration</li> </ul>	0, 1	0	Num

## AI Calibration Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Gain_10V_AI1</i>	15527	WORD	-	-	0...10 V Calibration gain AI1	0...65535	32768	Num
<i>Gain_10V_AI10</i>	15590	WORD	-	-	0...10 V Calibration gain AI10	0...65535	32768	Num
<i>Gain_10V_AI11</i>	15597	WORD	-	-	0...10 V Calibration gain AI11	0...65535	32768	Num
<i>Gain_10V_AI12</i>	15604	WORD	-	-	0...10 V Calibration gain AI12	0...65535	32768	Num
<i>Gain_10V_AI2</i>	15534	WORD	-	-	0...10 V Calibration gain AI2	0...65535	32768	Num
<i>Gain_10V_AI3</i>	15541	WORD	-	-	0...10 V Calibration gain AI3	0...65535	32768	Num
<i>Gain_10V_AI4</i>	15548	WORD	-	-	0...10 V Calibration gain AI4	0...65535	32768	Num
<i>Gain_10V_AI5</i>	15555	WORD	-	-	0...10 V Calibration gain AI5	0...65535	32768	Num
<i>Gain_10V_AI6</i>	15562	WORD	-	-	0...10 V Calibration gain AI6	0...65535	32768	Num
<i>Gain_10V_AI7</i>	15569	WORD	-	-	0...10 V Calibration gain AI7	0...65535	32768	Num
<i>Gain_10V_AI8</i>	15576	WORD	-	-	0...10 V Calibration gain AI8	0...65535	32768	Num
<i>Gain_10V_AI9</i>	15583	WORD	-	-	0...10 V Calibration gain AI9	0...65535	32768	Num
<i>Gain_5V_AI1</i>	15526	WORD	-	-	0...5 V Calibration gain AI1	0...65535	32768	Num
<i>Gain_5Vr_AI1</i>	15529	WORD	-	-	0...5 V <sub>ratiometric</sub> Calibration gain AI1	0...65535	32768	Num
<i>Gain_5V_AI10</i>	15589	WORD	-	-	0...5 V Calibration gain AI10	0...65535	32768	Num
<i>Gain_5Vr_AI10</i>	15592	WORD	-	-	0...5 V <sub>ratiometric</sub> Calibration gain AI10	0...65535	32768	Num
<i>Gain_5V_AI11</i>	15596	WORD	-	-	0...5 V Calibration gain AI11	0...65535	32768	Num
<i>Gain_5Vr_AI11</i>	15599	WORD	-	-	0...5 V <sub>ratiometric</sub> Calibration gain AI11	0...65535	32768	Num
<i>Gain_5V_AI12</i>	15603	WORD	-	-	0...5 V Calibration gain AI12	0...65535	32768	Num
<i>Gain_5Vr_AI12</i>	15606	WORD	-	-	0...5 V <sub>ratiometric</sub> Calibration gain AI12	0...65535	32768	Num
<i>Gain_5V_AI2</i>	15533	WORD	-	-	0...5 V Calibration gain AI2	0...65535	32768	Num
<i>Gain_5Vr_AI2</i>	15536	WORD	-	-	0...5 V <sub>ratiometric</sub> Calibration gain AI2	0...65535	32768	Num
<i>Gain_5V_AI3</i>	15540	WORD	-	-	0...5 V Calibration gain AI3	0...65535	32768	Num
<i>Gain_5Vr_AI3</i>	15543	WORD	-	-	0...5 V <sub>ratiometric</sub> Calibration gain AI3	0...65535	32768	Num
<i>Gain_5V_AI4</i>	15547	WORD	-	-	0...5 V Calibration gain AI4	0...65535	32768	Num
<i>Gain_5Vr_AI4</i>	15550	WORD	-	-	0...5 V <sub>ratiometric</sub> Calibration gain AI4	0...65535	32768	Num
<i>Gain_5V_AI5</i>	15554	WORD	-	-	0...5 V Calibration gain AI5	0...65535	32768	Num
<i>Gain_5Vr_AI5</i>	15557	WORD	-	-	0...5 V <sub>ratiometric</sub> Calibration gain AI5	0...65535	32768	Num
<i>Gain_5V_AI6</i>	15561	WORD	-	-	0...5 V Calibration gain AI6	0...65535	32768	Num
<i>Gain_5Vr_AI6</i>	15564	WORD	-	-	0...5 V <sub>ratiometric</sub> Calibration gain AI6	0...65535	32768	Num
<i>Gain_5V_AI7</i>	15568	WORD	-	-	0...5 V Calibration gain AI7	0...65535	32768	Num
<i>Gain_5Vr_AI7</i>	15571	WORD	-	-	0...5 V <sub>ratiometric</sub> Calibration gain AI7	0...65535	32768	Num
<i>Gain_5V_AI8</i>	15575	WORD	-	-	0...5 V Calibration gain AI8	0...65535	32768	Num
<i>Gain_5Vr_AI8</i>	15578	WORD	-	-	0...5 V <sub>ratiometric</sub> Calibration gain AI8	0...65535	32768	Num
<i>Gain_5V_AI9</i>	15582	WORD	-	-	0...5 V Calibration gain AI9	0...65535	32768	Num
<i>Gain_5Vr_AI9</i>	15585	WORD	-	-	0...5 V <sub>ratiometric</sub> Calibration gain AI9	0...65535	32768	Num
<i>Gain_mA_AI1</i>	15528	WORD	-	-	0/4...20 mA Calibration gain AI1	0...65535	32768	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
Gain_mA_AI10	15591	WORD	-	-	0/4...20 mA Calibration gain AI10	0...65535	32768	Num
Gain_mA_AI11	15598	WORD	-	-	0/4...20 mA Calibration gain AI11	0...65535	32768	Num
Gain_mA_AI12	15605	WORD	-	-	0/4...20 mA Calibration gain AI12	0...65535	32768	Num
Gain_mA_AI2	15535	WORD	-	-	0/4...20 mA Calibration gain AI2	0...65535	32768	Num
Gain_mA_AI3	15542	WORD	-	-	0/4...20 mA Calibration gain AI3	0...65535	32768	Num
Gain_mA_AI4	15549	WORD	-	-	0/4...20 mA Calibration gain AI4	0...65535	32768	Num
Gain_mA_AI5	15556	WORD	-	-	0/4...20 mA Calibration gain AI5	0...65535	32768	Num
Gain_mA_AI6	15563	WORD	-	-	0/4...20 mA Calibration gain AI6	0...65535	32768	Num
Gain_mA_AI7	15570	WORD	-	-	0/4...20 mA Calibration gain AI7	0...65535	32768	Num
Gain_mA_AI8	15577	WORD	-	-	0/4...20 mA Calibration gain AI8	0...65535	32768	Num
Gain_mA_AI9	15584	WORD	-	-	0/4...20 mA Calibration gain AI9	0...65535	32768	Num
Gain_Ntc_AI1	15524	WORD	-	-	NTC Calibration gain AI1	0...65535	32768	Num
Gain_Ntc_AI10	15587	WORD	-	-	NTC Calibration gain AI10	0...65535	32768	Num
Gain_Ntc_AI11	15594	WORD	-	-	NTC Calibration gain AI11	0...65535	32768	Num
Gain_Ntc_AI12	15601	WORD	-	-	NTC Calibration gain AI12	0...65535	32768	Num
Gain_Ntc_AI2	15531	WORD	-	-	NTC Calibration gain AI2	0...65535	32768	Num
Gain_Ntc_AI3	15538	WORD	-	-	NTC Calibration gain AI3	0...65535	32768	Num
Gain_Ntc_AI4	15545	WORD	-	-	NTC Calibration gain AI4	0...65535	32768	Num
Gain_Ntc_AI5	15552	WORD	-	-	NTC Calibration gain AI5	0...65535	32768	Num
Gain_Ntc_AI6	15559	WORD	-	-	NTC Calibration gain AI6	0...65535	32768	Num
Gain_Ntc_AI7	15566	WORD	-	-	NTC Calibration gain AI7	0...65535	32768	Num
Gain_Ntc_AI8	15573	WORD	-	-	NTC Calibration gain AI8	0...65535	32768	Num
Gain_Ntc_AI9	15580	WORD	-	-	NTC Calibration gain AI9	0...65535	32768	Num
Gain_Pt1000_AI1	15525	WORD	-	-	Pt1000 Calibration gain AI1	0...65535	32768	Num
Gain_Pt1000_AI10	15588	WORD	-	-	Pt1000 Calibration gain AI10	0...65535	32768	Num
Gain_Pt1000_AI11	15595	WORD	-	-	Pt1000 Calibration gain AI11	0...65535	32768	Num
Gain_Pt1000_AI12	15602	WORD	-	-	Pt1000 Calibration gain AI12	0...65535	32768	Num
Gain_Pt1000_AI2	15532	WORD	-	-	Pt1000 Calibration gain AI2	0...65535	32768	Num
Gain_Pt1000_AI3	15539	WORD	-	-	Pt1000 Calibration gain AI3	0...65535	32768	Num
Gain_Pt1000_AI4	15546	WORD	-	-	Pt1000 Calibration gain AI4	0...65535	32768	Num
Gain_Pt1000_AI5	15553	WORD	-	-	Pt1000 Calibration gain AI5	0...65535	32768	Num
Gain_Pt1000_AI6	15560	WORD	-	-	Pt1000 Calibration gain AI6	0...65535	32768	Num
Gain_Pt1000_AI7	15567	WORD	-	-	Pt1000 Calibration gain AI7	0...65535	32768	Num
Gain_Pt1000_AI8	15574	WORD	-	-	Pt1000 Calibration gain AI8	0...65535	32768	Num
Gain_Pt1000_AI9	15581	WORD	-	-	Pt1000 Calibration gain AI9	0...65535	32768	Num
Gain_PTC_AI1	15530	WORD	-	-	PTC Calibration gain AI1	0...65535	32768	Num
Gain_PTC_AI10	15593	WORD	-	-	PTC Calibration gain AI10	0...65535	32768	Num
Gain_PTC_AI11	15600	WORD	-	-	PTC Calibration gain AI11	0...65535	32768	Num
Gain_PTC_AI12	15607	WORD	-	-	PTC Calibration gain AI12	0...65535	32768	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Gain_PTC_AI2</i>	15537	WORD	-	-	PTC Calibration gain AI2	0...65535	32768	Num
<i>Gain_PTC_AI3</i>	15544	WORD	-	-	PTC Calibration gain AI3	0...65535	32768	Num
<i>Gain_PTC_AI4</i>	15551	WORD	-	-	PTC Calibration gain AI4	0...65535	32768	Num
<i>Gain_PTC_AI5</i>	15558	WORD	-	-	PTC Calibration gain AI5	0...65535	32768	Num
<i>Gain_PTC_AI6</i>	15565	WORD	-	-	PTC Calibration gain AI6	0...65535	32768	Num
<i>Gain_PTC_AI7</i>	15572	WORD	-	-	PTC Calibration gain AI7	0...65535	32768	Num
<i>Gain_PTC_AI8</i>	15579	WORD	-	-	PTC Calibration gain AI8	0...65535	32768	Num
<i>Gain_PTC_AI9</i>	15586	WORD	-	-	PTC Calibration gain AI9	0...65535	32768	Num
<i>Offs_Ntc_AI1</i>	15608	WORD	-1	-	NTC Calibration offset AI1	-32768...32767	0	Num
<i>Offs_Pt1000_AI1</i>	15609	WORD	-1	-	Pt1000 Calibration offset AI1	-32768...32767	0	Num
<i>Offs_5V_AI1</i>	15610	WORD	-1	-	0...5 V Calibration offset AI1	-32768...32767	0	Num
<i>Offs_10V_AI1</i>	15611	WORD	-1	-	0...10 V Calibration offset AI1	-32768...32767	0	Num
<i>Offs_mA_AI1</i>	15612	WORD	-1	-	0/4...20 mA Calibration offset AI1	-32768...32767	0	Num
<i>Offs_5Vr_AI1</i>	15613	WORD	-1	-	0...5 V <sub>ratiometric</sub> Calibration offset AI1	-32768...32767	0	Num
<i>Offs_PTC_AI1</i>	15614	WORD	-1	-	PTC Calibration offset AI1	-32768...32767	0	Num
<i>Offs_Ntc_AI2</i>	15615	WORD	-1	-	NTC Calibration offset AI2	-32768...32767	0	Num
<i>Offs_Pt1000_AI2</i>	15616	WORD	-1	-	Pt1000 Calibration offset AI2	-32768...32767	0	Num
<i>Offs_5V_AI2</i>	15617	WORD	-1	-	0...5 V Calibration offset AI2	-32768...32767	0	Num
<i>Offs_10V_AI2</i>	15618	WORD	-1	-	0...10 V Calibration offset AI2	-32768...32767	0	Num
<i>Offs_mA_AI2</i>	15619	WORD	-1	-	0/4...20 mA Calibration offset AI2	-32768...32767	0	Num
<i>Offs_5Vr_AI2</i>	15620	WORD	-1	-	0...5 V <sub>ratiometric</sub> Calibration offset AI2	-32768...32767	0	Num
<i>Offs_PTC_AI2</i>	15621	WORD	-1	-	PTC Calibration offset AI2	-32768...32767	0	Num
<i>Offs_Ntc_AI3</i>	15622	WORD	-1	-	NTC Calibration offset AI3	-32768...32767	0	Num
<i>Offs_Pt1000_AI3</i>	15623	WORD	-1	-	Pt1000 Calibration offset AI3	-32768...32767	0	Num
<i>Offs_5V_AI3</i>	15624	WORD	-1	-	0...5 V Calibration offset AI3	-32768...32767	0	Num
<i>Offs_10V_AI3</i>	15625	WORD	-1	-	0...10 V Calibration offset AI3	-32768...32767	0	Num
<i>Offs_mA_AI3</i>	15626	WORD	-1	-	0/4...20 mA Calibration offset AI3	-32768...32767	0	Num
<i>Offs_5Vr_AI3</i>	15627	WORD	-1	-	0...5 V <sub>ratiometric</sub> Calibration offset AI3	-32768...32767	0	Num
<i>Offs_PTC_AI3</i>	15628	WORD	-1	-	PTC Calibration offset AI3	-32768...32767	0	Num
<i>Offs_Ntc_AI4</i>	15629	WORD	-1	-	NTC Calibration offset AI4	-32768...32767	0	Num
<i>Offs_Pt1000_AI4</i>	15630	WORD	-1	-	Pt1000 Calibration offset AI4	-32768...32767	0	Num
<i>Offs_5V_AI4</i>	15631	WORD	-1	-	0...5 V Calibration offset AI4	-32768...32767	0	Num
<i>Offs_10V_AI4</i>	15632	WORD	-1	-	0...10 V Calibration offset AI4	-32768...32767	0	Num
<i>Offs_mA_AI4</i>	15633	WORD	-1	-	0/4...20 mA Calibration offset AI4	-32768...32767	0	Num
<i>Offs_5Vr_AI4</i>	15634	WORD	-1	-	0...5 V <sub>ratiometric</sub> Calibration offset AI4	-32768...32767	0	Num
<i>Offs_PTC_AI4</i>	15635	WORD	-1	-	PTC Calibration offset AI4	-32768...32767	0	Num
<i>Offs_Ntc_AI5</i>	15636	WORD	-1	-	NTC Calibration offset AI5	-32768...32767	0	Num
<i>Offs_Pt1000_AI5</i>	15637	WORD	-1	-	Pt1000 Calibration offset AI5	-32768...32767	0	Num
<i>Offs_5V_AI5</i>	15638	WORD	-1	-	0...5 V Calibration offset AI5	-32768...32767	0	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Offs_10V_AI5</i>	15639	WORD	-1	-	0...10 V Calibration offset AI5	-32768...32767	0	Num
<i>Offs_mA_AI5</i>	15640	WORD	-1	-	0/4...20 mA Calibration offset AI5	-32768...32767	0	Num
<i>Offs_5Vr_AI5</i>	15641	WORD	-1	-	0...5 V <sub>ratiometric</sub> Calibration offset AI5	-32768...32767	0	Num
<i>Offs_PTC_AI5</i>	15642	WORD	-1	-	PTC Calibration offset AI5	-32768...32767	0	Num
<i>Offs_Ntc_AI6</i>	15643	WORD	-1	-	NTC Calibration offset AI6	-32768...32767	0	Num
<i>Offs_Pt1000_AI6</i>	15644	WORD	-1	-	Pt1000 Calibration offset AI6	-32768...32767	0	Num
<i>Offs_5V_AI6</i>	15645	WORD	-1	-	0...5 V Calibration offset AI6	-32768...32767	0	Num
<i>Offs_10V_AI6</i>	15646	WORD	-1	-	0...10 V Calibration offset AI6	-32768...32767	0	Num
<i>Offs_mA_AI6</i>	15647	WORD	-1	-	0/4...20 mA Calibration offset AI6	-32768...32767	0	Num
<i>Offs_5Vr_AI6</i>	15648	WORD	-1	-	0...5 V <sub>ratiometric</sub> Calibration offset AI6	-32768...32767	0	Num
<i>Offs_PTC_AI6</i>	15649	WORD	-1	-	PTC Calibration offset AI6	-32768...32767	0	Num
<i>Offs_Ntc_AI7</i>	15650	WORD	-1	-	NTC Calibration offset AI7	-32768...32767	0	Num
<i>Offs_Pt1000_AI7</i>	15651	WORD	-1	-	Pt1000 Calibration offset AI7	-32768...32767	0	Num
<i>Offs_5V_AI7</i>	15652	WORD	-1	-	0...5 V Calibration offset AI7	-32768...32767	0	Num
<i>Offs_10V_AI7</i>	15653	WORD	-1	-	0...10 V Calibration offset AI7	-32768...32767	0	Num
<i>Offs_mA_AI7</i>	15654	WORD	-1	-	0/4...20 mA Calibration offset AI7	-32768...32767	0	Num
<i>Offs_5Vr_AI7</i>	15655	WORD	-1	-	0...5 V <sub>ratiometric</sub> Calibration offset AI7	-32768...32767	0	Num
<i>Offs_PTC_AI7</i>	15656	WORD	-1	-	PTC Calibration offset AI7	-32768...32767	0	Num
<i>Offs_Ntc_AI8</i>	15657	WORD	-1	-	NTC Calibration offset AI8	-32768...32767	0	Num
<i>Offs_Pt1000_AI8</i>	15658	WORD	-1	-	Pt1000 Calibration offset AI8	-32768...32767	0	Num
<i>Offs_5V_AI8</i>	15659	WORD	-1	-	0...5 V Calibration offset AI8	-32768...32767	0	Num
<i>Offs_10V_AI8</i>	15660	WORD	-1	-	0...10 V Calibration offset AI8	-32768...32767	0	Num
<i>Offs_mA_AI8</i>	15661	WORD	-1	-	0/4...20 mA Calibration offset AI8	-32768...32767	0	Num
<i>Offs_5Vr_AI8</i>	15662	WORD	-1	-	0...5 V <sub>ratiometric</sub> Calibration offset AI8	-32768...32767	0	Num
<i>Offs_PTC_AI8</i>	15663	WORD	-1	-	PTC Calibration offset AI8	-32768...32767	0	Num
<i>Offs_Ntc_AI9</i>	15664	WORD	-1	-	NTC Calibration offset AI9	-32768...32767	0	Num
<i>Offs_Pt1000_AI9</i>	15665	WORD	-1	-	Pt1000 Calibration offset AI9	-32768...32767	0	Num
<i>Offs_5V_AI9</i>	15666	WORD	-1	-	0...5 V Calibration offset AI9	-32768...32767	0	Num
<i>Offs_10V_AI9</i>	15667	WORD	-1	-	0...10 V Calibration offset AI9	-32768...32767	0	Num
<i>Offs_mA_AI9</i>	15668	WORD	-1	-	0/4...20 mA Calibration offset AI9	-32768...32767	0	Num
<i>Offs_5Vr_AI9</i>	15669	WORD	-1	-	0...5 V <sub>ratiometric</sub> Calibration offset AI9	-32768...32767	0	Num
<i>Offs_PTC_AI9</i>	15670	WORD	-1	-	PTC Calibration offset AI9	-32768...32767	0	Num
<i>Offs_Ntc_AI10</i>	15671	WORD	-1	-	NTC Calibration offset AI10	-32768...32767	0	Num
<i>Offs_Pt1000_AI10</i>	15672	WORD	-1	-	Pt1000 Calibration offset AI10	-32768...32767	0	Num
<i>Offs_5V_AI10</i>	15673	WORD	-1	-	0...5 V Calibration offset AI10	-32768...32767	0	Num
<i>Offs_10V_AI10</i>	15674	WORD	-1	-	0...10 V Calibration offset AI10	-32768...32767	0	Num
<i>Offs_mA_AI10</i>	15675	WORD	-1	-	0/4...20 mA Calibration offset AI10	-32768...32767	0	Num
<i>Offs_5Vr_AI10</i>	15676	WORD	-1	-	0...5 V <sub>ratiometric</sub> Calibration offset AI10	-32768...32767	0	Num
<i>Offs_PTC_AI10</i>	15677	WORD	-1	-	PTC Calibration offset AI10	-32768...32767	0	Num



LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Offs_Ntc_AI11</i>	15678	WORD	-1	-	NTC Calibration offset AI11	-32768...32767	0	Num
<i>Offs_Pt1000_AI11</i>	15679	WORD	-1	-	Pt1000 Calibration offset AI11	-32768...32767	0	Num
<i>Offs_5V_AI11</i>	15680	WORD	-1	-	0...5 V Calibration offset AI11	-32768...32767	0	Num
<i>Offs_10V_AI11</i>	15681	WORD	-1	-	0...10 V Calibration offset AI11	-32768...32767	0	Num
<i>Offs_mA_AI11</i>	15682	WORD	-1	-	0/4...20 mA Calibration offset AI11	-32768...32767	0	Num
<i>Offs_5Vr_AI11</i>	15683	WORD	-1	-	0...5 V <sub>ratiometric</sub> Calibration offset AI11	-32768...32767	0	Num
<i>Offs_PTC_AI11</i>	15684	WORD	-1	-	PTC Calibration offset AI11	-32768...32767	0	Num
<i>Offs_Ntc_AI12</i>	15685	WORD	-1	-	NTC Calibration offset AI12	-32768...32767	0	Num
<i>Offs_Pt1000_AI12</i>	15686	WORD	-1	-	Pt1000 Calibration offset AI12	-32768...32767	0	Num
<i>Offs_5V_AI12</i>	15687	WORD	-1	-	0...5 V Calibration offset AI12	-32768...32767	0	Num
<i>Offs_10V_AI12</i>	15688	WORD	-1	-	0...10 V Calibration offset AI12	-32768...32767	0	Num
<i>Offs_mA_AI12</i>	15689	WORD	-1	-	0/4...20 mA Calibration offset AI12	-32768...32767	0	Num
<i>Offs_5Vr_AI12</i>	15690	WORD	-1	-	0...5 V <sub>ratiometric</sub> Calibration offset AI12	-32768...32767	0	Num
<i>Offs_PTC_AI12</i>	15691	WORD	-1	-	PTC Calibration offset AI12	-32768...32767	0	Num

## AO Calibration Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Gain_10V_AO1</i>	15692	WORD	-	-	0...10 V Calibration gain AO1	0...65535	3276-8	Num
<i>Gain_10V_AO2</i>	15694	WORD	-	-	0...10 V Calibration gain AO2	0...65535	3276-8	Num
<i>Gain_10V_AO3</i>	15696	WORD	-	-	0...10 V Calibration gain AO3	0...65535	3276-8	Num
<i>Gain_10V_AO4</i>	15698	WORD	-	-	0...10 V Calibration gain AO4	0...65535	3276-8	Num
<i>Gain_10V_AO5</i>	15700	WORD	-	-	0...10 V Calibration gain AO5	0...65535	3276-8	Num
<i>Gain_10V_AO6</i>	15702	WORD	-	-	0...10 V Calibration gain AO6	0...65535	3276-8	Num
<i>Gain_mA_AO1</i>	-	-	-	-	Not used	-	-	-
<i>Gain_mA_AO2</i>	-	-	-	-	Not used	-	-	-
<i>Gain_mA_AO3</i>	15697	WORD	-	-	0/4...20 mA Calibration gain AO3	0...65535	3276-8	Num
<i>Gain_mA_AO4</i>	15699	WORD	-	-	0/4...20 mA Calibration gain AO4	0...65535	3276-8	Num
<i>Gain_mA_AO5</i>	-	-	-	-	Not used	-	-	-
<i>Gain_mA_AO6</i>	-	-	-	-	Not used	-	-	-
<i>Offs_10V_AO1</i>	15704	WORD	-1	-	0...10 V Calibration offset AO1	-32768...32767	0	Num
<i>Offs_mA_AO1</i>	15705	WORD	-1	-	0/4...20 mA Calibration offset AO1	-32768...32767	0	Num
<i>Offs_10V_AO2</i>	15706	WORD	-1	-	0...10 V Calibration offset AO2	-32768...32767	0	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Offs_mA_AO2</i>	15707	WORD	-1	-	0/4...20 mA Calibration offset AO2	-32768...32767	0	Num
<i>Offs_10V_AO3</i>	15708	WORD	-1	-	0...10 V Calibration offset AO3	-32768...32767	0	Num
<i>Offs_mA_AO3</i>	15709	WORD	-1	-	0/4...20 mA Calibration offset AO3	-32768...32767	0	Num
<i>Offs_10V_AO4</i>	15710	WORD	-1	-	0...10 V Calibration offset AO4	-32768...32767	0	Num
<i>Offs_mA_AO4</i>	15711	WORD	-1	-	0/4...20 mA Calibration offset AO4	-32768...32767	0	Num
<i>Offs_10V_AO5</i>	15712	WORD	-1	-	0...10 V Calibration offset AO5	-32768...32767	0	Num
<i>Offs_mA_AO5</i>	15713	WORD	-1	-	0/4...20mA Calibration offset AO5	-32768...32767	0	Num
<i>Offs_10V_AO6</i>	15714	WORD	-1	-	0...10V Calibration offset AO6	-32768...32767	0	Num
<i>Offs_mA_AO6</i>	15715	WORD	-1	-	0/4...20mA Calibration offset AO6	-32768...32767	0	Num

## Analog Inputs - Base Board Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Temp_UM</i>	15725	WORD	-	-	Temperature unit of measurement <ul style="list-style-type: none"> <li>0 = °C</li> <li>1 = °F</li> </ul>	0, 1	0	Num
<i>Cfg_Ai1</i>	15726	UINT	-	-	Type of analog input Ai1 <ul style="list-style-type: none"> <li>0 = NTC (NK103)</li> <li>1 = DI Input</li> <li>2 = NTC (103AT)</li> <li>3 = 4...20 mA</li> <li>4 = 0...10 V</li> <li>5 = 0...5 V (Ratiometric)</li> <li>6 = Pt1000</li> <li>7 = hΩ (NTC)</li> <li>8 = daΩ (Pt1000)</li> <li>9 = PTC</li> <li>10 = 0...5 V</li> <li>11 = 0...20 mA</li> </ul>	0...11	2	Num
<i>Cfg_Ai2</i>	15727	UINT	-	-	Type of analog input Ai2 See <i>Cfg_Ai1</i>	0...11	2	Num
<i>Cfg_Ai3</i>	15728	UINT	-	-	Type of analog input Ai3 See <i>Cfg_Ai1</i>	0...11	2	Num
<i>Cfg_Ai4</i>	15729	UINT	-	-	Type of analog input Ai4 See <i>Cfg_Ai1</i>	0...11	2	Num
<i>Cfg_Ai5</i>	15730	UINT	-	-	Type of analog input Ai5 See <i>Cfg_Ai1</i>	0...11	2	Num
<i>Cfg_Ai6</i>	15731	UINT	-	-	Type of analog input Ai6 See <i>Cfg_Ai1</i>	0...11	2	Num
<i>Cfg_Ai7</i>	16100	UINT	-	-	Type of analog input Ai7	0...11	2	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
					See <i>Cfg_Ai1</i>			
<i>Cfg_Ai8</i>	16101	UINT	-	-	Type of analog input Ai8 See <i>Cfg_Ai1</i>	0...11	2	Num
<i>FullScaleMin_Ai1</i>	15736	WORD	-1	-	Analog input Ai1 start of scale value <b>NOTE:</b> Minimum full scale: for current probes, value at 4 mA, for 0...10 V voltage probes, value at 0 V, for ratiometric probes (0...5 V), value at 10% (corresponding to 0.5 V).	-9999...+9999	0	Num
<i>FullScaleMax_Ai1</i>	15737	WORD	-1	-	Analog input Ai1 full scale value <b>NOTE:</b> Maximum full scale for current probes, value at 20 mA, for 0...10 V voltage probes, value at 10 V, for ratiometric probes (0...5 V), value at 90% (corresponding to 4.5 V).	-9999...+9999	1000	Num
<i>FullScaleMin_Ai2</i>	15738	WORD	-1	-	Analog input Ai2 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Num
<i>FullScaleMax_Ai2</i>	15739	WORD	-1	-	Analog input Ai2 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Num
<i>FullScaleMin_Ai3</i>	15740	WORD	-1	-	Analog input Ai3 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Num
<i>FullScaleMax_Ai3</i>	15741	WORD	-1	-	Analog input Ai3 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Num
<i>FullScaleMin_Ai4</i>	15742	WORD	-1	-	Analog input Ai4 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Num
<i>FullScaleMax_Ai4</i>	15743	WORD	-1	-	Analog input Ai4 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Num
<i>FullScaleMin_Ai5</i>	15744	WORD	-1	-	Analog input Ai5 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Num
<i>FullScaleMax_Ai5</i>	15745	WORD	-1	-	Analog input Ai5 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Num
<i>FullScaleMin_Ai6</i>	15746	WORD	-1	-	Analog input Ai6 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Num
<i>FullScaleMaxAi6</i>	15747	WORD	-1	-	Analog input Ai6 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Num
<i>FullScaleMin_Ai7</i>	16106	WORD	-1	-	Analog input Ai7 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Num
<i>FullScaleMax_Ai7</i>	16107	WORD	-1	-	Analog input Ai7 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Num
<i>FullScaleMin_Ai8</i>	16108	WORD	-1	-	Analog input Ai8 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Num
<i>FullScaleMaxAi8</i>	16109	WORD	-1	-	Analog input Ai8 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Calibration_Ai1</i>	15748	WORD	-1	-	Analog input Ai1 differential	-1000...1000	0	Digit
<i>Calibration_Ai2</i>	15749	WORD	-1	-	Analog input Ai2 differential	-1000...1000	0	Digit
<i>Calibration_Ai3</i>	15750	WORD	-1	-	Analog input Ai3 differential	-1000...1000	0	Digit
<i>Calibration_Ai4</i>	15751	WORD	-1	-	Analog input Ai4 differential	-1000...1000	0	Digit
<i>Calibration_Ai5</i>	15752	WORD	-1	-	Analog input Ai5 differential	-1000...1000	0	Digit
<i>Calibration_Ai6</i>	15753	WORD	-1	-	Analog input Ai6 differential	-1000...1000	0	Digit
<i>Calibration_Ai7</i>	16118	WORD	-1	-	Analog input Ai7 differential	-1000...1000	0	Digit
<i>Calibration_Ai8</i>	16119	WORD	-1	-	Analog input Ai8 differential	-1000...1000	0	Digit
<i>Cfg_AO3</i>	15758	WORD	-	-	Type of analog output AO3 <ul style="list-style-type: none"> <li>0 = current modulation</li> <li>1 = current ON/OFF</li> <li>2 = voltage modulation</li> <li>3 = PWM mode</li> </ul>	0...3	0	Num
<i>Cfg_AO4</i>	15759	WORD	-	-	Type of analog output AO4 See <i>Cfg_AO3</i>	0...3	0	Num
<i>PWM_frequency_AO3_AO4</i>	15769	WORD	-	Y	PWM Frequency for AO3 and AO4 in PWM mode	0...2000	1000	Hz
<i>PWM_polarity_AO3_AO4</i>	15770	WORD	-	-	PWM Polarity for AO3 and AO4 in PWM mode: 1 = direct, 0 = reversed	0, 1	1	Num

## Analog Inputs - Upper Board Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Cfg_Ai9</i>	16102	UINT	-	-	Type of analog input Ai9 <ul style="list-style-type: none"> <li>0 = NTC (NK103)</li> <li>1 = DI Input</li> <li>2 = NTC (103AT)</li> <li>3 = 4...20 mA</li> <li>4 = 0...10 V</li> <li>5 = 0...5 V (Ratiometric)</li> <li>6 = Pt1000</li> <li>7 = hΩ (NTC)</li> <li>8 = daΩ (Pt1000)</li> <li>9 = PTC</li> <li>10 = 0...5 V</li> <li>11 = 0...20 mA</li> </ul>	0...11	3	Num
<i>Cfg_Ai10</i>	16103	UINT	-	-	Type of analog input Ai10 See <i>Cfg_Ai1</i>	0...11	3	Num
<i>Cfg_Ai11</i>	16104	UINT	-	-	Type of analog input Ai11 See <i>Cfg_Ai1</i>	0...11	3	Num
<i>Cfg_Ai12</i>	16105	UINT	-	-	Type of analog input Ai12	0...11	3	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
					See <i>Cfg_Ai1</i>			
<i>FullScaleMin_Ai9</i>	16110	WORD	-1	-	Analog input Ai9 start of scale value <b>NOTE:</b> Minimum full scale: for current probes, value at 4 mA, for 0...10 V voltage probes, value at 0 V, for ratiometric probes (0...5 V), value at 10% (corresponding to 0.5 V).	-9999...+9999	0	Num
<i>FullScaleMax_Ai9</i>	16111	WORD	-1	-	Analog input Ai9 full scale value <b>NOTE:</b> Maximum full scale for current probes, value at 20 mA, for 0...10 V voltage probes, value at 10 V, for ratiometric probes (0...5 V), value at 90% (corresponding to 4.5 V).	-9999...+9999	1000	Num
<i>FullScaleMin_Ai10</i>	16112	WORD	-1	-	Analog input Ai10 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Num
<i>FullScaleMax_Ai10</i>	16113	WORD	-1	-	Analog input Ai10 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Num
<i>FullScaleMin_Ai11</i>	16114	WORD	-1	-	Analog input Ai11 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Num
<i>FullScaleMax_Ai11</i>	16115	WORD	-1	-	Analog input Ai11 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Num
<i>FullScaleMin_Ai12</i>	16116	WORD	-1	-	Analog input Ai12 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Num
<i>FullScaleMax_Ai12</i>	16117	WORD	-1	-	Analog input Ai12 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Num
<i>Calibration_Ai9</i>	16120	WORD	-1	-	Analog input Ai9 differential	-1000...1000	0	Digit
<i>Calibration_Ai10</i>	16121	WORD	-1	-	Analog input Ai10 differential	-1000...1000	0	Digit
<i>Calibration_Ai11</i>	16122	WORD	-1	-	Analog input Ai11 differential	-1000...1000	0	Digit
<i>Calibration_Ai12</i>	16123	WORD	-1	-	Analog input Ai12 differential	-1000...1000	0	Digit

## ON Board RS485-1 Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Addr_RS485_OB1</i>	16124	WORD	-	Y	On-board RS-485 serial address	0... 255	1	Num
<i>Proto_RS485_OB1</i>	16125	WORD	-	Y	On-board RS-485 protocol selection <ul style="list-style-type: none"> <li>• 2 = uNET</li> <li>• 3 = Modbus/RTU</li> </ul>	2, 3	3	Num
<i>Databit_RS485_OB1</i>	16126	WORD	-	Y	On-board RS-485 data bit number Fixed setting 8	8	8	Num
<i>Stopbit_RS485_OB1</i>	16127	WORD	-	Y	On-board RS-485 stop bit number	1, 2	1	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
					<ul style="list-style-type: none"> <li>• 1 = 1 stop bit</li> <li>• 2 = 2 stop bit</li> </ul>			
<i>Parity_RS485_OB1</i>	16128	WORD	-	Y	On-board RS-485 protocol parity <ul style="list-style-type: none"> <li>• 0 = NULL</li> <li>• 1 = ODD</li> <li>• 2 = EVEN</li> </ul>	0...2	2	Num
<i>Baud_RS485_OB1</i>	16129	WORD	-	Y	On-board RS-485 protocol baudrate <ul style="list-style-type: none"> <li>• 0 = 9600 baud</li> <li>• 1 = 19200 baud</li> <li>• 2 = 38400 baud</li> <li>• 3 = 57600 baud</li> <li>• 4 = 76800 baud</li> <li>• 5 = 115200 baud</li> </ul>	0...5	2	Num

## ON Board RS485-2 Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Addr_RS485_OB</i>	15774	WORD	-	Y	On-board RS-485 serial address	0...255	1	Num
<i>Proto_RS485_OB</i>	15775	WORD	-	Y	On-board RS-485 protocol selection <ul style="list-style-type: none"> <li>• 2 = uNET</li> <li>• 3 = Modbus/RTU</li> </ul>	2, 3	3	Num
<i>Databit_RS485_OB</i>	15776	WORD	-	Y	On-board RS-485 data bit number Fixed setting 8	8	8	Num
<i>Stopbit_RS485_OB</i>	15777	WORD	-	Y	On-board RS-485 stop bit number <ul style="list-style-type: none"> <li>• 1 = 1 stop bit</li> <li>• 2 = 2 stop bit</li> </ul>	1, 2	1	Num
<i>Parity_RS485_OB</i>	15778	WORD	-	Y	On-board RS-485 protocol parity <ul style="list-style-type: none"> <li>• 0 = NULL</li> <li>• 1 = ODD</li> <li>• 2 = EVEN</li> </ul>	0...2	2	Num
<i>Baud_RS485_OB</i>	15779	WORD	-	Y	On-board RS-485 protocol baudrate <ul style="list-style-type: none"> <li>• 0 = 9600 baud</li> <li>• 1 = 19200 baud</li> <li>• 2 = 38400 baud</li> <li>• 3 = 57600 baud</li> <li>• 4 = 76800 baud</li> <li>• 5 = 115200 baud</li> </ul>			

## ON Board CAN Expansion Bus Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Addr_CAN_OB</i>	15780	WORD	-	Y	On-board CAN Expansion bus serial address	1...127	1	Num
<i>Baud_CAN_OB</i>	15781	WORD	-	Y	On-board CAN Expansion protocol baudrate <ul style="list-style-type: none"> <li>• 2 = 500 kBd</li> <li>• 3 = 250 kBd</li> <li>• 4 = 125 kBd</li> <li>• 5 = 125 kBd</li> <li>• 6 = 50 kBd</li> </ul>	2...6	2	Num

## RS-485 Passive Communication Module Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Addr_RS485_PI</i>	15782	WORD	-	Y	RS-485 Passive Communication Module serial address	0...255	1	Num
<i>Proto_RS485_PI</i>	15783	WORD	-	Y	RS-485 Passive Communication Module protocol selection <ul style="list-style-type: none"> <li>• 2 = uNET</li> <li>• 3 = Modbus/RTU</li> </ul>	2, 3	3	Num
<i>Databit_RS485_PI</i>	15784	WORD	-	Y	RS-485 Passive Communication Module data bit number  Fixed setting 8	8	8	Num
<i>Stopbit_RS485_PI</i>	15785	WORD	-	Y	RS-485 Passive Communication Module stop bit number <ul style="list-style-type: none"> <li>• 1 = 1 stop bit</li> <li>• 2 = 2 stop bit</li> </ul>	1, 2	1	Num
<i>Parity_RS485_PI</i>	15786	WORD	-	Y	RS-485 Passive Communication Module protocol parity <ul style="list-style-type: none"> <li>• 0 = NULL</li> <li>• 1 = ODD</li> <li>• 2 = EVEN</li> </ul>	0...2	2	Num
<i>Baud_RS485_PI</i>	15787	WORD	-	Y	RS-485 Passive Communication Module protocol baudrate <ul style="list-style-type: none"> <li>• 0 = 9600 baud</li> <li>• 1 = 19200 baud</li> <li>• 2 = 38400 baud</li> <li>• 3 = 57600 baud</li> <li>• 4 = 76800 baud</li> <li>• 5 = 115200 baud</li> </ul>	0...5	2	Num

## CAN Expansion Bus Passive Communication Module Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Addr_CAN_Pi</i>	15788	WORD	-	Y	CAN Expansion bus Passive Communication Module serial address	1...127	1	Num
<i>Baud_CAN_Pi</i>	15789	WORD	-	Y	CAN Expansion bus Passive Communication Module protocol baudrate <ul style="list-style-type: none"> <li>• 2 = 500 kBd</li> <li>• 3 = 250 kBd</li> <li>• 4 = 125 kBd</li> <li>• 5 = 125 kBd</li> <li>• 6 = 50 kBd</li> </ul>	2...6	2	Num

## RS-232 Passive Communication Module Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Addr_RS232_Pi</i>	15790	WORD	-	Y	RS-232 passive Communication Module serial address	0...255	1	Num
<i>Proto_RS232_Pi</i>	15791	WORD	-	Y	RS-232 Passive Communication Module protocol selection <ul style="list-style-type: none"> <li>• 2 = uNET</li> <li>• 3 = Modbus/RTU</li> </ul>	2...3	3	Num
<i>Databit_RS232_Pi</i>	15792	WORD	-	Y	RS-232 Passive Communication Module data bit number <ul style="list-style-type: none"> <li>• 7 = 7 bit</li> <li>• 8 = 8 bit</li> </ul>	7...8	8	Num
<i>Stopbit_RS232_Pi</i>	15793	WORD	-	Y	RS-232 Passive Communication Module stop bit number <ul style="list-style-type: none"> <li>• 1 = 1 stop bit</li> <li>• 2 = 2 stop bit</li> </ul>	1...2	1	Num
<i>Parity_RS232_Pi</i>	15784	WORD	-	Y	RS-232 Passive Communication Module protocol parity <ul style="list-style-type: none"> <li>• 0 = NULL</li> <li>• 1 = ODD</li> <li>• 2 = EVEN</li> </ul>	0...2	2	Num
<i>Baud_RS232_Pi</i>	15795	WORD	-	Y	RS-232 Passive Communication Module protocol baudrate <ul style="list-style-type: none"> <li>• 0 = 9600 baud</li> <li>• 1 = 19200 baud</li> <li>• 2 = 38400 baud</li> <li>• 3 = 57600 baud</li> <li>• 4 = 76800 baud</li> <li>• 5 = 115200 baud</li> </ul>	0...5	2	Num



## Ethernet Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Port_FTP_PI</i>	15772	WORD	-	Y	FTP Port number Value 0 corresponds to port 21	0...65535	65535	Num
<i>Port_HTTP_PI</i>	15796	WORD	-	Y	HTTP port HTTP communication Port number Default 0 corresponds to port 80	0...65535	0	Num
<i>Port_ETH_PI</i>	15797	WORD	-	Y	Port TCP/IP Modbus communication port.	0...65535	65535	Num
<i>Ip_1_ETH_PI</i>	15798	WORD	-	-	Ethernet passive Plug-in IP address (part 1)	0...255	10	Num
<i>Ip_2_ETH_PI</i>	15799	WORD	-	-	Ethernet passive Plug-in IP address (part 2)	0...255	0	Num
<i>Ip_3_ETH_PI</i>	15800	WORD	-	-	Ethernet passive Plug-in IP address (part 3)	0...255	0	Num
<i>Ip_4_ETH_PI</i>	15801	WORD	-	-	Ethernet passive Plug-in IP address (part 4)	0...255	100	Num
<i>DefGtwy_1_ETH_PI</i>	15802	WORD	-	Y	Default gateway (part 1)	0...255	10	Num
<i>DefGtwy_2_ETH_PI</i>	15803	WORD	-	Y	Default gateway (part 2)	0...255	0	Num
<i>DefGtwy_3_ETH_PI</i>	15804	WORD	-	Y	Default gateway (part 3)	0...255	0	Num
<i>DefGtwy_4_ETH_PI</i>	15805	WORD	-	Y	Default gateway (part 4)	0...255	1	Num
<i>NetMsk_1_ETH_PI</i>	15806	WORD	-	Y	Net mask (part 1)	0...255	255	Num
<i>NetMsk_2_ETH_PI</i>	15807	WORD	-	Y	Net mask (part 2)	0...255	255	Num
<i>NetMsk_3_ETH_PI</i>	15808	WORD	-	Y	Net mask (part 3)	0...255	255	Num
<i>NetMsk_4_ETH_PI</i>	15809	WORD	-	Y	Net mask (part 4)	0...255	0	Num
<i>PriDNS_1_ETH_PI</i>	15810	WORD	-	Y	Primary DNS server (part 1)	0...255	8	Num
<i>PriDNS_2_ETH_PI</i>	15811	WORD	-	Y	Primary DNS server (part 2)	0...255	8	Num
<i>PriDNS_3_ETH_PI</i>	15812	WORD	-	Y	Primary DNS server (part 3)	0...255	8	Num
<i>PriDNS_4_ETH_PI</i>	15813	WORD	-	Y	Primary DNS server (part 4)	0...255	8	Num
<i>SecDNS_1_ETH_PI</i>	15814	WORD	-	Y	Secondary DNS server (part 1)	0...255	8	Num
<i>SecDNS_2_ETH_PI</i>	15815	WORD	-	Y	Secondary DNS server (part 2)	0...255	8	Num
<i>SecDNS_3_ETH_PI</i>	15816	WORD	-	Y	Secondary DNS server (part 3)	0...255	4	Num
<i>SecDNS_4_ETH_PI</i>	15817	WORD	-	Y	Secondary DNS server (part 4)	0...255	4	Num
<i>EnableDHCP_ETH_PI</i>	15818	WORD	-	Y	Enable DHCP 0 = False, 1 = True	0, 1	0	Flag
<i>MAC_1_ETH_PI</i>	16130	WORD	-	Y	MAC address (first part)	0	0	Num
<i>MAC_2_ETH_PI</i>	16131	WORD	-	Y	MAC address (second part)	0...24	24	Num
<i>MAC_3_ETH_PI</i>	16132	WORD	-	Y	MAC address (third part)	0...187	187	Num
<i>MAC_4_ETH_PI</i>	16133	WORD	-	Y	MAC address (fourth part)	0...255	255	Num
<i>MAC_5_ETH_PI</i>	16134	WORD	-	Y	MAC address (fifth part)	0...255	255	Num

## Display Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Hmi_Language</i>	15819	WORD	-	Y	Language	0...65535	0	Num
<i>Par_ContrLCD</i>	15723	WORD	-	Y	LCD contrast	0...63	30	Num
<i>Par_BackLightTime</i>	15724	WORD	-	Y	Backlight time	0...3600	10	Sec

## BACnet Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Load_BACnet_E2_Defaults</i>	15766	WORD	-	Y	Load default values for BACnet parameters in EEPROM at next boot	0, 1	1	Flag
<i>Port_BACnet_IP</i>	15768	WORD	-	Y	BACnet/IP Port number. 0 = port 47808  65535 = BACnet stack running only on PLC side	0...65535	65535	Num

## FileSystem Volumes

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>HTTP_volume</i>	16136	WORD	-	Y	Volume of HTTP files 0 = NOR Flash 1 = micro SD card	0, 1	0	Num
<i>DAT_volume</i>	16137	WORD	-	Y	Volume of *.DAT and *.RAW files 0 = NOR Flash 1 = micro SD card	0, 1	0	Num
<i>PLC_volume</i>	16139	WORD	-	Y	Volume of PLC file 0 = NOR Flash 1 = micro SD card	0, 1	0	Num
<i>HMI_volume</i>	16140	WORD	-	Y	Volume of HMI file 0 = NOR Flash 1 = micro SD card	0, 1	0	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>REM_volume</i>	16141	WORD	-	Y	Volume of HMI Remote file 0 = NOR Flash 1 = micro SD card	0, 1	0	Num
<i>PAR_volume</i>	16142	WORD	-	Y	Volume of CONNEC.PAR file 0 = NOR Flash 1 = micro SD card	0, 1	0	Num

## Miscellaneous

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>virtualDipSwitch</i>	16143	WORD	-	Y	Numeric prefix for system files name	0...7	0	Num

# Expansion Module Parameters Table

## Folders

**NOTE:** Not all parameters listed are available depending on the accessible resources in the device.

The following tables present the Expansion module parameters, divided into categories (folders):

Folder label
Acknowledgment, page 144
AI Calibration, page 144
AO Calibration, page 148
Analog Inputs - Base Board, page 148
Analog Inputs - Upper Board, page 150
Analog Outputs Upper Board Folder, page 152
ON Board CAN Expansion bus, page 152

## Acknowledgment Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Par_TAB</i>	15716	WORD	-	Y	Map code <b>NOTE:</b> read/write parameter	0...65535	0	Num
<i>Par_POLI</i>	15717	WORD	-	Y	Model Code <b>NOTE:</b> read/write parameter	0...65535	2049	Num
<i>Par_PCH</i>	15719	BOOL	-	-	Device model <b>NOTE:</b> read/write parameter	0...65535	324	Num

## AI Calibration Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Gain_10V_AI1</i>	15527	WORD	-	-	0...10 V calibration gain AI1	0...65535	32768	Num
<i>Gain_10V_AI10</i>	15590	WORD	-	-	0...10 V calibration gain AI10	0...65535	32768	Num
<i>Gain_10V_AI2</i>	15534	WORD	-	-	0...10 V calibration gain AI2	0...65535	32768	Num
<i>Gain_10V_AI3</i>	15541	WORD	-	-	0...10 V calibration gain AI3	0...65535	32768	Num
<i>Gain_10V_AI4</i>	15548	WORD	-	-	0...10 V calibration gain AI4	0...65535	32768	Num
<i>Gain_10V_AI5</i>	15555	WORD	-	-	0...10 V calibration gain AI5	0...65535	32768	Num
<i>Gain_10V_AI6</i>	15562	WORD	-	-	0...10 V calibration gain AI6	0...65535	32768	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Gain_10V_AI7</i>	15569	WORD	-	-	0...10 V calibration gain AI7	0...65535	32768	Num
<i>Gain_10V_AI8</i>	15576	WORD	-	-	0...10 V calibration gain AI8	0...65535	32768	Num
<i>Gain_10V_AI9</i>	15583	WORD	-	-	0...10 V calibration gain AI9	0...65535	32768	Num
<i>Gain_5Vr_AI1</i>	15526	WORD	-	-	0...5 V <sub>ratiometric</sub> calibration gain AI1	0...65535	32768	Num
<i>Gain_5V_AI1</i>	15529	WORD	-	-	0...5 V calibration gain AI1	0...65535	32768	Num
<i>Gain_5Vr_AI10</i>	15589	WORD	-	-	0...5 V <sub>ratiometric</sub> calibration gain AI10	0...65535	32768	Num
<i>Gain_5V_AI10</i>	15592	WORD	-	-	0...5 V calibration gain AI10	0...65535	32768	Num
<i>Gain_5Vr_AI2</i>	15533	WORD	-	-	0...5 V <sub>ratiometric</sub> calibration gain AI2	0...65535	32768	Num
<i>Gain_5V_AI2</i>	15536	WORD	-	-	0...5 V calibration gain AI2	0...65535	32768	Num
<i>Gain_5Vr_AI3</i>	15540	WORD	-	-	0...5 V <sub>ratiometric</sub> calibration gain AI3	0...65535	32768	Num
<i>Gain_5V_AI3</i>	15543	WORD	-	-	0...5 V calibration gain AI3	0...65535	32768	Num
<i>Gain_5Vr_AI4</i>	15547	WORD	-	-	0...5 V <sub>ratiometric</sub> calibration gain AI4	0...65535	32768	Num
<i>Gain_5V_AI4</i>	15550	WORD	-	-	0...5 V calibration gain AI4	0...65535	32768	Num
<i>Gain_5Vr_AI5</i>	15554	WORD	-	-	0...5 V <sub>ratiometric</sub> calibration gain AI5	0...65535	32768	Num
<i>Gain_5V_AI5</i>	15557	WORD	-	-	0...5 V calibration gain AI5	0...65535	32768	Num
<i>Gain_5Vr_AI6</i>	15561	WORD	-	-	0...5 V <sub>ratiometric</sub> calibration gain AI6	0...65535	32768	Num
<i>Gain_5V_AI6</i>	15564	WORD	-	-	0...5 V calibration gain AI6	0...65535	32768	Num
<i>Gain_5Vr_AI7</i>	15568	WORD	-	-	0...5 V <sub>ratiometric</sub> calibration gain AI7	0...65535	32768	Num
<i>Gain_5V_AI7</i>	15571	WORD	-	-	0...5 V calibration gain AI7	0...65535	32768	Num
<i>Gain_5Vr_AI8</i>	15575	WORD	-	-	0...5 V <sub>ratiometric</sub> calibration gain AI8	0...65535	32768	Num
<i>Gain_5V_AI8</i>	15578	WORD	-	-	0...5 V calibration gain AI8	0...65535	32768	Num
<i>Gain_5Vr_AI9</i>	15582	WORD	-	-	0...5 V <sub>ratiometric</sub> calibration gain AI9	0...65535	32768	Num
<i>Gain_5V_AI9</i>	15585	WORD	-	-	0...5 V calibration gain AI9	0...65535	32768	Num
<i>Gain_mA_AI1</i>	15528	WORD	-	-	0/4...20 mA calibration gain AI1	0...65535	32768	Num
<i>Gain_mA_AI10</i>	15591	WORD	-	-	0/4...20 mA calibration gain AI10	0...65535	32768	Num
<i>Gain_mA_AI2</i>	15535	WORD	-	-	0/4...20 mA calibration gain AI2	0...65535	32768	Num
<i>Gain_mA_AI3</i>	15542	WORD	-	-	0/4...20 mA calibration gain AI3	0...65535	32768	Num
<i>Gain_mA_AI4</i>	15549	WORD	-	-	0/4...20 mA calibration gain AI4	0...65535	32768	Num
<i>Gain_mA_AI5</i>	15556	WORD	-	-	0/4...20 mA calibration gain AI5	0...65535	32768	Num
<i>Gain_mA_AI6</i>	15563	WORD	-	-	0/4...20 mA calibration gain AI6	0...65535	32768	Num
<i>Gain_mA_AI7</i>	15570	WORD	-	-	0/4...20 mA calibration gain AI7	0...65535	32768	Num
<i>Gain_mA_AI8</i>	15577	WORD	-	-	0/4...20 mA calibration gain AI8	0...65535	32768	Num
<i>Gain_mA_AI9</i>	15584	WORD	-	-	0/4...20 mA calibration gain AI9	0...65535	32768	Num
<i>Gain_Ntc_AI1</i>	15524	WORD	-	-	NTC calibration gain AI1	0...65535	32768	Num
<i>Gain_Ntc_AI10</i>	15587	WORD	-	-	NTC calibration gain AI10	0...65535	32768	Num
<i>Gain_Ntc_AI2</i>	15531	WORD	-	-	NTC calibration gain AI2	0...65535	32768	Num
<i>Gain_Ntc_AI3</i>	15538	WORD	-	-	NTC calibration gain AI3	0...65535	32768	Num
<i>Gain_Ntc_AI4</i>	15545	WORD	-	-	NTC calibration gain AI4	0...65535	32768	Num
<i>Gain_Ntc_AI5</i>	15552	WORD	-	-	NTC calibration gain AI5	0...65535	32768	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
Gain_Ntc_AI6	15559	WORD	-	-	NTC calibration gain AI6	0...65535	32768	Num
Gain_Ntc_AI7	15566	WORD	-	-	NTC calibration gain AI7	0...65535	32768	Num
Gain_Ntc_AI8	15573	WORD	-	-	NTC calibration gain AI8	0...65535	32768	Num
Gain_Ntc_AI9	15580	WORD	-	-	NTC calibration gain AI9	0...65535	32768	Num
Gain_Pt1000_AI1	15525	WORD	-	-	Pt1000 calibration gain AI1	0...65535	32768	Num
Gain_Pt1000_AI10	15588	WORD	-	-	Pt1000 calibration gain AI10	0...65535	32768	Num
Gain_Pt1000_AI2	15532	WORD	-	-	Pt1000 calibration gain AI2	0...65535	32768	Num
Gain_Pt1000_AI3	15539	WORD	-	-	Pt1000 calibration gain AI3	0...65535	32768	Num
Gain_Pt1000_AI4	15546	WORD	-	-	Pt1000 calibration gain AI4	0...65535	32768	Num
Gain_Pt1000_AI5	15553	WORD	-	-	Pt1000 calibration gain AI5	0...65535	32768	Num
Gain_Pt1000_AI6	15560	WORD	-	-	Pt1000 calibration gain AI6	0...65535	32768	Num
Gain_Pt1000_AI7	15567	WORD	-	-	Pt1000 calibration gain AI7	0...65535	32768	Num
Gain_Pt1000_AI8	15574	WORD	-	-	Pt1000 calibration gain AI8	0...65535	32768	Num
Gain_Pt1000_AI9	15581	WORD	-	-	Pt1000 calibration gain AI9	0...65535	32768	Num
Gain_PTC_AI1	15530	WORD	-	-	PTC calibration gain AI1	0...65535	32768	Num
Gain_PTC_AI10	15593	WORD	-	-	PTC calibration gain AI10	0...65535	32768	Num
Gain_PTC_AI2	15537	WORD	-	-	PTC calibration gain AI2	0...65535	32768	Num
Gain_PTC_AI3	15544	WORD	-	-	PTC calibration gain AI3	0...65535	32768	Num
Gain_PTC_AI4	15551	WORD	-	-	PTC calibration gain AI4	0...65535	32768	Num
Gain_PTC_AI5	15558	WORD	-	-	PTC calibration gain AI5	0...65535	32768	Num
Gain_PTC_AI6	15565	WORD	-	-	PTC calibration gain AI6	0...65535	32768	Num
Gain_PTC_AI7	15572	WORD	-	-	PTC calibration gain AI7	0...65535	32768	Num
Gain_PTC_AI8	15579	WORD	-	-	PTC calibration gain AI8	0...65535	32768	Num
Gain_PTC_AI9	15586	WORD	-	-	PTC calibration gain AI9	0...65535	32768	Num
Offs_Ntc_AI1	15608	WORD	-1	-	NTC calibration offset AI1	-32768...32767	0	Num
Offs_Pt1000_AI1	15609	WORD	-1	-	Pt1000 calibration offset AI1	-32768...32767	0	Num
Offs_5V_AI1	15610	WORD	-1	-	0...5 V calibration offset AI1	-32768...32767	0	Num
Offs_10V_AI1	15611	WORD	-1	-	0...10 V calibration offset AI1	-32768...32767	0	Num
Offs_mA_AI1	15612	WORD	-1	-	0/4...20 mA calibration offset AI1	-32768...32767	0	Num
Offs_5V_AI1	15613	WORD	-1	-	0...5 V calibration offset AI1	-32768...32767	0	Num
Offs_PTC_AI1	15614	WORD	-1	-	PTC calibration offset AI1	-32768...32767	0	Num
Offs_Ntc_AI2	15615	WORD	-1	-	NTC calibration offset AI2	-32768...32767	0	Num
Offs_Pt1000_AI2	15616	WORD	-1	-	Pt1000 calibration offset AI2	-32768...32767	0	Num
Offs_5V_AI2	15617	WORD	-1	-	0...5 V calibration offset AI2	-32768...32767	0	Num
Offs_10V_AI2	15618	WORD	-1	-	0...10 V calibration offset AI2	-32768...32767	0	Num
Offs_mA_AI2	15619	WORD	-1	-	0/4...20 mA calibration offset AI2	-32768...32767	0	Num
Offs_5V_AI2	15620	WORD	-1	-	0...5 V calibration offset AI2	-32768...32767	0	Num
Offs_PTC_AI2	15621	WORD	-1	-	PTC calibration offset AI2	-32768...32767	0	Num
Offs_Ntc_AI3	15622	WORD	-1	-	NTC calibration offset AI3	-32768...32767	0	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Offs_5V_AI3</i>	15624	WORD	-1	-	0...5 V calibration offset AI3	-32768...32767	0	Num
<i>Offs_10V_AI3</i>	15625	WORD	-1	-	0...10 V calibration offset AI3	-32768...32767	0	Num
<i>Offs_mA_AI3</i>	15626	WORD	-1	-	0/4...20 mA calibration offset AI3	-32768...32767	0	Num
<i>Offs_5V_AI3</i>	15627	WORD	-1	-	0...5 V calibration offset AI3	-32768...32767	0	Num
<i>Offs_PTC_AI3</i>	15628	WORD	-1	-	PTC calibration offset AI3	-32768...32767	0	Num
<i>Offs_Ntc_AI4</i>	15629	WORD	-1	-	NTC calibration offset AI4	-32768...32767	0	Num
<i>Offs_Pt1000_AI4</i>	15630	WORD	-1	-	Pt1000 calibration offset AI4	-32768...32767	0	Num
<i>Offs_5V_AI4</i>	15631	WORD	-1	-	0...5 V calibration offset AI4	-32768...32767	0	Num
<i>Offs_10V_AI4</i>	15632	WORD	-1	-	0...10 V calibration offset AI4	-32768...32767	0	Num
<i>Offs_5V_AI4</i>	15634	WORD	-1	-	0...5 V calibration offset AI4	-32768...32767	0	Num
<i>Offs_PTC_AI4</i>	15635	WORD	-1	-	PTC calibration offset AI4	-32768...32767	0	Num
<i>Offs_Ntc_AI5</i>	15636	WORD	-1	-	NTC calibration offset AI5	-32768...32767	0	Num
<i>Offs_Pt1000_AI5</i>	15637	WORD	-1	-	Pt1000 calibration offset AI5	-32768...32767	0	Num
<i>Offs_5V_AI5</i>	15638	WORD	-1	-	0...5 V calibration offset AI5	-32768...32767	0	Num
<i>Offs_10V_AI5</i>	15639	WORD	-1	-	0...10 V calibration offset AI5	-32768...32767	0	Num
<i>Offs_mA_AI5</i>	15640	WORD	-1	-	0/4...20 mA calibration offset AI5	-32768...32767	0	Num
<i>Offs_5V_AI5</i>	15641	WORD	-1	-	0...5 V calibration offset AI5	-32768...32767	0	Num
<i>Offs_PTC_AI5</i>	15642	WORD	-1	-	PTC calibration offset AI5	-32768...32767	0	Num
<i>Offs_Ntc_AI6</i>	15643	WORD	-1	-	NTC calibration offset AI6	-32768...32767	0	Num
<i>Offs_5V_AI6</i>	15645	WORD	-1	-	0...5 V calibration offset AI6	-32768...32767	0	Num
<i>Offs_10V_AI6</i>	15646	WORD	-1	-	0...10 V calibration offset AI6	-32768...32767	0	Num
<i>Offs_mA_AI6</i>	15647	WORD	-1	-	0/4...20 mA calibration offset AI6	-32768...32767	0	Num
<i>Offs_5V_AI6</i>	15648	WORD	-1	-	0...5 V calibration offset AI6	-32768...32767	0	Num
<i>Offs_PTC_AI6</i>	15649	WORD	-1	-	PTC calibration offset AI6	-32768...32767	0	Num
<i>Offs_Ntc_AI7</i>	15650	WORD	-1	-	NTC calibration offset AI7	-32768...32767	0	Num
<i>Offs_Pt1000_AI7</i>	15651	WORD	-1	-	Pt1000 calibration offset AI7	-32768...32767	0	Num
<i>Offs_5V_AI7</i>	15652	WORD	-1	-	0...5 V calibration offset AI7	-32768...32767	0	Num
<i>Offs_10V_AI7</i>	15653	WORD	-1	-	0...10 V calibration offset AI7	-32768...32767	0	Num
<i>Offs_mA_AI7</i>	15654	WORD	-1	-	0/4...20 mA calibration offset AI7	-32768...32767	0	Num
<i>Offs_5V_AI7</i>	15655	WORD	-1	-	0...5 V calibration offset AI7	-32768...32767	0	Num
<i>Offs_PTC_AI7</i>	15656	WORD	-1	-	PTC calibration offset AI7	-32768...32767	0	Num
<i>Offs_Ntc_AI8</i>	15657	WORD	-1	-	NTC calibration offset AI8	-32768...32767	0	Num
<i>Offs_Pt1000_AI8</i>	15658	WORD	-1	-	Pt1000 calibration offset AI8	-32768...32767	0	Num
<i>Offs_5V_AI8</i>	15659	WORD	-1	-	0...5 V calibration offset AI8	-32768...32767	0	Num
<i>Offs_10V_AI8</i>	15660	WORD	-1	-	0...10 V calibration offset AI8	-32768...32767	0	Num
<i>Offs_mA_AI8</i>	15661	WORD	-1	-	0/4...20 mA calibration offset AI8	-32768...32767	0	Num
<i>Offs_5V_AI8</i>	15662	WORD	-1	-	0...5 V calibration offset AI8	-32768...32767	0	Num
<i>Offs_Ntc_AI9</i>	15664	WORD	-1	-	NTC calibration offset AI9	-32768...32767	0	Num
<i>Offs_Pt1000_AI9</i>	15665	WORD	-1	-	Pt1000 calibration offset AI9	-32768...32767	0	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Offs_5V_AI9</i>	15666	WORD	-1	-	0...5 V calibration offset AI9	-32768...32767	0	Num
<i>Offs_10V_AI9</i>	15667	WORD	-1	-	0...10 V calibration offset AI9	-32768...32767	0	Num
<i>Offs_mA_AI9</i>	15668	WORD	-1	-	0/4...20 mA calibration offset AI9	-32768...32767	0	Num
<i>Offs_5V_AI9</i>	15669	WORD	-1	-	0...5 V calibration offset AI9	-32768...32767	0	Num
<i>Offs_PTC_AI9</i>	15670	WORD	-1	-	PTC calibration offset AI9	-32768...32767	0	Num
<i>Offs_Ntc_AI10</i>	15671	WORD	-1	-	NTC calibration offset AI10	-32768...32767	0	Num
<i>Offs_Pt1000_AI10</i>	15672	WORD	-1	-	Pt1000 calibration offset AI10	-32768...32767	0	Num
<i>Offs_5V_AI10</i>	15673	WORD	-1	-	0...5 V calibration offset AI10	-32768...32767	0	Num
<i>Offs_10V_AI10</i>	15674	WORD	-1	-	0...10 V calibration offset AI10	-32768...32767	0	Num
<i>Offs_mA_AI10</i>	15675	WORD	-1	-	0/4...20 mA calibration offset AI10	-32768...32767	0	Num
<i>Offs_5V_AI10</i>	15676	WORD	-1	-	0...5 V calibration offset AI10	-32768...32767	0	Num
<i>Offs_PTC_AI10</i>	15677	WORD	-1	-	PTC calibration offset AI10	-32768...32767	0	Num

## AO Calibration Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Gain_10V_AO1</i>	15692	WORD	-	-	0...10 V calibration gain AO1	0...65535	32768	Num
<i>Gain_10V_AO2</i>	15694	WORD	-	-	0...10 V calibration gain AO2	0...65535	32768	Num
<i>Gain_mA_AO1</i>	15693	WORD	-	-	0/4...20 mA calibration gain AO1	0...65535	32768	Num
<i>Gain_mA_AO2</i>	15695	WORD	-	-	0/4...20 mA calibration gain AO2	0...65535	32768	Num
<i>Offs_mA_AO1</i>	15705	WORD	-1	-	0/4...20 mA calibration offset AO1	-32768...32767	0	Num
<i>Offs_10V_AO2</i>	15706	WORD	-1	-	0...10 V calibration offset AO2	-32768...32767	0	Num
<i>Offs_mA_AO2</i>	15707	WORD	-1	-	0/4...20 mA calibration offset AO2	-32768...32767	0	Num

## Analog Inputs - Base Board Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Temp_UM</i>	15725	WORD	-	-	Temperature unit of measurement <ul style="list-style-type: none"> <li>• 0 = °C</li> <li>• 1 = °F</li> </ul>	0, 1	0	Num
<i>Cfg_Ai1</i>	15726	WORD	-	-	Type of analog input Ai1 <ul style="list-style-type: none"> <li>• 0= NTC (NK103)</li> <li>• 1 = DI Input</li> <li>• 2 = NTC (103AT)</li> </ul>	0...11	2	Num



LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
					<ul style="list-style-type: none"> <li>3 = 4...20 mA</li> <li>4 = 0...10 V</li> <li>5 = 0...5 V (Ratiometric)</li> <li>6 = Pt1000</li> <li>7 = hΩ (NTC)</li> <li>8 = daΩ (Pt1000)</li> <li>9 = PTC</li> <li>10 = 0...5 V</li> <li>11 = 0...20 mA</li> </ul>			
<i>Cfg_Ai2</i>	15727	WORD	-	-	Type of analog input Ai2 See <i>Cfg_Ai1</i>	0...11	2	Num
<i>Cfg_Ai3</i>	15728	WORD	-	-	Type of analog input Ai3 See <i>Cfg_Ai1</i>	0...11	2	Num
<i>Cfg_Ai4</i>	15729	WORD	-	-	Type of analog input Ai4 See <i>Cfg_Ai1</i>	0...11	2	Num
<i>FullScaleMin_Ai1</i>	15736	WORD	-	-	Analog input Ai1 start of scale value <b>NOTE:</b> Minimum full scale: for current probes, value at 4 mA, for 0...10 V voltage probes, value at 0 V, for ratiometric probes (0...5 V), value at 10% (corresponding to 0.5 V).	-9999...+9999	0	Digit
<i>FullScaleMax_Ai1</i>	15737	WORD	-1	-	Analog input Ai1 full scale value <b>NOTE:</b> Maximum full scale for current probes, value at 20 mA, for 0...10 V voltage probes, value at 10 V, for ratiometric probes (0...5 V), value at 90% (corresponding to 4.5 V).	-9999...+9999	1000	Digit
<i>FullScaleMin_Ai2</i>	15738	WORD	-1	-	Analog input Ai2 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Digit
<i>FullScaleMax_Ai2</i>	15739	WORD	-1	-	Analog input Ai2 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Digit
<i>FullScaleMin_Ai3</i>	15740	WORD	-1	-	Analog input Ai3 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Digit
<i>FullScaleMax_Ai3</i>	15741	WORD	-1	-	Analog input Ai3 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Digit
<i>FullScaleMin_Ai4</i>	15742	WORD	-1	-	Analog input Ai4 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Digit
<i>FullScaleMax_Ai4</i>	15743	WORD	-1	-	Analog input Ai4 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Digit
<i>Calibration_Ai1</i>	15748	WORD	-1	-	Analog input Ai1 differential	-1000...1000	0	Digit
<i>Calibration_Ai2</i>	15749	WORD	-1	-	Analog input Ai2 differential	-1000...1000	0	Digit
<i>Calibration_Ai3</i>	15750	WORD	-1	-	Analog input Ai3 differential	-1000...1000	0	Digit
<i>Calibration_Ai4</i>	15751	WORD	-1	-	Analog input Ai4 differential	-1000...1000	0	Digit
<i>SubCfg_AI1</i>	16010	WORD	-	-	Sub configuration of analog input AI1 <ul style="list-style-type: none"> <li>0= Low Pass filter disabled, analog value in raw points;</li> </ul>	0...3	3	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
					<ul style="list-style-type: none"> <li>1= Low Pass filter disabled, analog value converted;</li> <li>2= Low Pass filter enabled, analog value in raw points;</li> <li>3 = Low Pass filter enabled, analog value converted.</li> </ul>			
<i>SubCfg_AI2</i>	16011	WORD	-	-	Sub configuration of analog input AI2 See <i>SubCfg_AI1</i>	0...3	3	Num
<i>SubCfg_AI3</i>	16012	WORD	-	-	Sub configuration of analog input AI3 See <i>SubCfg_AI1</i>	0...3	3	Num
<i>SubCfg_AI4</i>	16013	WORD	-	-	Sub configuration of analog input AI4 See <i>SubCfg_AI1</i>	0...3	3	Num

## Analog Inputs - Upper Board Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Cfg_AI5</i>	15730	WORD	-	-	Type of analog input Ai5 See <i>Cfg_AI1</i>	0...11	2	Num
<i>Cfg_AI6</i>	15731	WORD	-	-	Type of analog input Ai6 See <i>Cfg_AI1</i>	0...11	2	Num
<i>Cfg_AI7</i>	16100	WORD	-	-	Type of analog input Ai7 See <i>Cfg_AI1</i>	0...11	2	Num
<i>Cfg_AI8</i>	16101	WORD	-	-	Type of analog input Ai8 See <i>Cfg_AI1</i>	0...11	2	Num
<i>Cfg_AI9</i>	16102	WORD	-	-	Type of analog input Ai9 See <i>Cfg_AI1</i>	0...11	3	Num
<i>Cfg_AI10</i>	16103	WORD	-	-	Type of analog input Ai10 See <i>Cfg_AI1</i>	0...11	3	Num
<i>FullScaleMin_AI5</i>	15744	WORD	-1	-	Analog input Ai5 start of scale value See <i>FullScaleMin_AI1</i>	-9999...+9999	0	Digit
<i>FullScaleMax_AI5</i>	15745	WORD	-1	-	Analog input Ai5 full scale value See <i>FullScaleMax_AI1</i>	-9999...+9999	1000	Digit
<i>FullScaleMin_AI6</i>	15746	WORD	-1	-	Analog input Ai6 start of scale value See <i>FullScaleMin_AI1</i>	-9999...+9999	0	Digit
<i>FullScaleMaxAI6</i>	15747	WORD	-1	-	Analog input Ai6 full scale value See <i>FullScaleMax_AI1</i>	-9999...+9999	1000	Digit
<i>FullScaleMin_AI7</i>	16106	WORD	-1	-	Analog input Ai7 start of scale value See <i>FullScaleMin_AI1</i>	-9999...+9999	0	Digit

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>FullScaleMax_Ai7</i>	16107		-1	-	Analog input Ai7 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Digit
<i>FullScaleMin_Ai8</i>	16108		-1	-	Analog input Ai8 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Digit
<i>FullScaleMaxAi8</i>	16109		-1	-	Analog input Ai8 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Digit
<i>FullScaleMin_Ai9</i>	16110		-1	-	Analog input Ai9 start of scale value <b>NOTE:</b> Minimum full scale: current probes, value at 4 mA, for 0...10 V voltage probes, value at 0 V, for ratiometric probes (0...5 V), value at 10% (corresponding to 0.5 V).	-9999...+9999	0	Digit
<i>FullScaleMax_Ai9</i>	16111		-1	-	Analog input Ai9 full scale value <b>NOTE:</b> Maximum full scale current probes, value at 20 mA, for 0...10 V voltage probes, value at 10 V, for ratiometric probes (0...5 V), value at 90% (corresponding to 4.5 V).	-9999...+9999	1000	Digit
<i>FullScaleMin_Ai10</i>	16112		-1	-	Analog input Ai10 start of scale value See <i>FullScaleMin_Ai1</i>	-9999...+9999	0	Digit
<i>FullScaleMax_Ai10</i>	16113		-1	-	Analog input Ai10 full scale value See <i>FullScaleMax_Ai1</i>	-9999...+9999	1000	Digit
<i>Calibration_AI5</i>	15752		-1	-	Analog input Ai5 differential	-1000...1000	0	Digit
<i>Calibration_AI6</i>	15753		-1	-	Analog input Ai6 differential	-1000...1000	0	Digit
<i>Calibration_AI7</i>	16118		-1	-	Analog input Ai7 differential	-1000...1000	0	Digit
<i>Calibration_AI8</i>	16119		-1	-	Analog input Ai8 differential	-1000...1000	0	Digit
<i>Calibration_AI9</i>	16120		-1	-	Analog input Ai9 differential	-1000...1000	0	Digit
<i>Calibration_AI10</i>	16121		-1	-	Analog input Ai10 differential	-1000...1000	0	Digit
<i>SubCfg_AI5</i>	16014		-	-	Sub configuration of analog input AI5 See <i>SubCfg_AI1</i>	0...3	3	Num
<i>SubCfg_AI6</i>	16015		-	-	Sub configuration of analog input AI6 See <i>SubCfg_AI1</i>	0...3	3	Num
<i>SubCfg_AI7</i>	16016		-	-	Sub configuration of analog input AI7 See <i>SubCfg_AI1</i>	0...3	3	Num
<i>SubCfg_AI8</i>	16017		-	-	Sub configuration of analog input AI8 See <i>SubCfg_AI1</i>	0...3	3	Num
<i>SubCfg_AI9</i>	16018		-	-	Sub configuration of analog input AI9 See <i>SubCfg_AI1</i>	0...3	3	Num
<i>SubCfg_AI10</i>	16019		-	-	Sub configuration of analog input AI10 See <i>SubCfg_AI1</i>	0...3	3	Num

## Analog Outputs Upper Board Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Cfg_AO1</i>	15758		-	-	Type of analog output AO1 <ul style="list-style-type: none"> <li>0= Current modulation</li> <li>1 = Current ON/OFF</li> <li>2 = Voltage modulation</li> <li>3 = PWM mode</li> </ul>	0...3	0	Num
<i>Cfg_AO2</i>	15759		-	-	Type of analog output AO2 See <i>Cfg_AO1</i>	0...3	0	Num
<i>PWM_frequency_AO1_AO2</i>	15769		-	Y	PWM Frequency for AO1 and AO2 in PWM mode	0...2000	1000	Hz
<i>PWM_polarity_AO1_AO2</i>	15770		-	-	PWM Polarity for AO1 and AO2 in PWM mode <ul style="list-style-type: none"> <li>0= Reversed</li> <li>1 = Direct</li> </ul>	0, 1	1	Num

## ON Board CAN Expansion Bus Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Addr_CAN_OB</i>	15780		-	Y	On-board CAN Expansion Bus serial address	1...127	1	Num
<i>SendPeriodFDI1</i>	17000		-	-	Min period of FDI1 transmission: 0 = max frequency	0...65535	65535	ms
<i>SendPeriodFDI2</i>	17001		-	-	Min period of FDI2 transmission: 0 = max frequency	0...65535	65535	ms

# Display Color Touchscreen Parameters Table

## Folders

**NOTE:** Not all parameters listed are available depending on the accessible resources in the device.

The following tables present the Display Color Touchscreen parameters, divided into categories (folders):

Folder label
Acknowledgment, page 153
AI Calibration, page 153
Analog Inputs, page 154
ON Board RS-485, page 154
Display, page 155
Remote Slave, page 154

## Acknowledgment Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Par_TAB</i>	8192	WORD	-	Y	Map code <b>NOTE:</b> read/write parameter	0...65535	0	Num
<i>Par_POLI</i>	8193	WORD	-	Y	Model Code <b>NOTE:</b> read/write parameter	0...65535	0	Num
<i>Par_PARMOD</i>	8194	WORD	-	-	Parameter modified <ul style="list-style-type: none"> <li>• 0 = False</li> <li>• 1 = True</li> </ul>	0, 1	0	Flag

## AI Calibration Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>CAL_RH_interne</i>	8195		-	-	Calibration value for RH	-	-	-

## Analog Inputs Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Temp_UM</i>	8196	WORD	-	-	Unit of temperature measurement <ul style="list-style-type: none"> <li>• 0 = °C</li> <li>• 1 = °F</li> </ul>	0, 1	0	Num
<i>Calibration_NTC</i>	8197	WORD	-	-	NTC differential	-180...180	0	°C/10 (°F/10)
<i>Calibration_RH</i>	8206	WORD	-	-	RH percentage differential	-1000...1000	0	%/10

## ON Board RS-485 Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Addr_RS485_OB</i>	8198	WORD	-	Y	RS-485 On-board address	0...247	1	Num
<i>Proto_RS485_OB</i>	8199	WORD	-	-	Modbus working mode <ul style="list-style-type: none"> <li>• 0 = Slave</li> <li>• 1 = Master</li> </ul>	0, 1	(1)	Num
<i>DataBit_RS485_OB</i>	8200	WORD	-	Y	RS-485 On-board Data bit number	8	8	Num
<i>StopBit_RS485_OB</i>	8201	WORD	-	Y	RS-485 On-board stop bit number	1, 2	1	Num
<i>Parity_RS485_OB</i>	8202	WORD	-	Y	RS-485 On-board parity protocol <ul style="list-style-type: none"> <li>• 0 = Null</li> <li>• 1 = Odd</li> <li>• 2 = Even</li> </ul>	0...2	2	Num
<i>Baud_RS485_OB</i>	8203	WORD	-	Y	RS-485 On-board baud rate protocol <ul style="list-style-type: none"> <li>• 0 = 9600</li> <li>• 1 = 19200</li> <li>• 2 = 38400</li> <li>• 3 = 57600</li> <li>• 4 = 115200</li> </ul>	0...4	2	Num

(1) TM172DCLWT\*: 0, TM172DCLF\*: 1

## Remote Slave Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>RemoteSlave1_addr</i>	8254	WORD	-	Y	Remote slave 1 address	0...247	0	Num
<i>RemoteSlave1_32bit_order</i>	8262	WORD	-	Y	Remote slave 1 MSB and LSB order	0...3	0(1)	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
					<ul style="list-style-type: none"> <li>0 = DWORD register not swapped and REAL register not swapped</li> <li>1 = DWORD register swapped and REAL register not swapped</li> <li>2 = DWORD register not swapped and REAL register swapped</li> <li>3 = DWORD register swapped and REAL register swapped</li> </ul>			
<i>RemoteSlave2_addr</i>	8255	WORD	-	Y	Remote slave 2 address	0...247	0	Num
<i>RemoteSlave2_32bit_order</i>	8263	WORD	-	Y	Remote slave 2 MSB and LSB order <i>See RemoteSlave1_32bit_order</i>	0...3	0 <sup>(1)</sup>	Num
<i>RemoteSlave3_addr</i>	8256	WORD	-	Y	Remote slave 3 address	0...247	0	Num
<i>RemoteSlave3_32bit_order</i>	8264	WORD	-	Y	Remote slave 3 MSB and LSB order <i>See RemoteSlave1_32bit_order</i>	0...3	0 <sup>(1)</sup>	Num
<i>RemoteSlave4_addr</i>	8257	WORD	-	Y	Remote slave 4 address	0...247	0	Num
<i>RemoteSlave4_32bit_order</i>	8265	WORD	-	Y	Remote slave 4 MSB and LSB order <i>See RemoteSlave1_32bit_order</i>	0...3	0 <sup>(1)</sup>	Num
<i>RemoteSlave5_addr</i>	8258	WORD	-	Y	Remote slave 5 address	0...247	0	Num
<i>RemoteSlave5_32bit_order</i>	8266	WORD	-	Y	Remote slave 5 MSB and LSB order <i>See RemoteSlave1_32bit_order</i>	0...3	0 <sup>(1)</sup>	Num
<i>RemoteSlave6_addr</i>	8259	WORD	-	Y	Remote slave 6 address	0...247	0	Num
<i>RemoteSlave6_32bit_order</i>	8267	WORD	-	Y	Remote slave 6 MSB and LSB order <i>See RemoteSlave1_32bit_order</i>	0...3	0 <sup>(1)</sup>	Num
<i>RemoteSlave7_addr</i>	8260	WORD	-	Y	Remote slave 7 address	0...247	0	Num
<i>RemoteSlave7_32bit_order</i>	8268	WORD	-	Y	Remote slave 7 MSB and LSB order <i>See RemoteSlave1_32bit_order</i>	0...3	0 <sup>(1)</sup>	Num
<i>RemoteSlave8_addr</i>	8261	WORD	-	Y	Remote slave 8 address	0...247	0	Num
<i>RemoteSlave8_32bit_order</i>	8269	WORD	-	Y	Remote slave 8 MSB and LSB order <i>See RemoteSlave1_32bit_order</i>	0...3	0 <sup>(1)</sup>	Num
<b>(1)</b> 0=Word NOT swapped, 1= Word swapped for WORD, 2= Word swapped for REAL, 3= Word swapped								

## Display Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Par_Orientation</i>	8204	WORD	-	Y	Display orientation <ul style="list-style-type: none"> <li>0 = Landscape</li> <li>1 = Portrait</li> </ul>	0, 1	0	-
<i>Par_Language</i>	8205	WORD	-	-	System Language	0...65535	1	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Par_BackLightTime</i>	8207	WORD	-	-	Backlight time	0...3600	10	Sec
<i>Par_BackLightMinValue</i>	8250	WORD	-	-	Backlight minimum value	0...100	5%	%



# TM172DGRP Parameters Table

## Folders

The following tables present the parameters, divided into categories (folders):

Folder label
Acknowledgment, page 157
HMI Management, page 157
Display, page 158
Buzzer, page 158
CAN, page 159

## Acknowledgment Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Par_TAB</i>	15716	WORD	-	Y	Map code <b>NOTE:</b> read/write parameter	0...65535	0	Num
<i>Par_POLI</i>	15717	WORD	-	Y	Model Code <b>NOTE:</b> read/write parameter	0...65535	2049	Num
<i>Par_PARMOD</i>	15719	BOOL	-	-	Parameter modified <ul style="list-style-type: none"> <li>0 = False</li> <li>1 = True</li> </ul> At least one parameter has been modified from the original configuration	0, 1	0	Flag

## HMI Management Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Hmi_Language</i>	15989	WORD	-	-	-	0...65535	0	Num
<i>HmiList_Current</i>	15820	WORD	-	-	Current HMI <ul style="list-style-type: none"> <li>0 = HMI remote 1</li> </ul>	0...11	0	Num
<i>HmiList_ID</i>	15821	WORD	-	-	HMI remote navigation ID list	0...254	0	Num
<i>HmiList_Res</i>	15833	WORD	-	-	HMI remote navigation resource type <ul style="list-style-type: none"> <li>3 = CAN</li> </ul>	1...3	3	Num
<i>HmiList_Addr</i>	15845	WORD	-	-	HMI remote navigation resource address for CAN	0...255	124	Num

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>HmiList_File</i>	15893	15 byte	-	-	HMI remote navigation file (DOS 8.3 uppercase format)	*****	(1)	String
(1) Default file name: <i>HMIREM.KBD</i>								

## Display Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Par_Language</i>	15819	WORD	-	-	Display language: <ul style="list-style-type: none"> <li>• 0 = Italian</li> <li>• 1 = English</li> <li>• 2 = French</li> <li>• 3 = German</li> <li>• 4 = Spanish</li> </ul>	0...65535	1	Num
<i>Par_ContrLCD</i>	15723	WORD	-	Y	LCD Contrast Allows adjustment of the LCD display contrast	0...64	40	Num
<i>Par_BackLightTime</i>	15724	WORD	-	-	Backlight time Allows adjustment of LCD display switch-on time.	0...3600	10	Sec

## Buzzer Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Buzzer_Mode</i>	15990	WORD	-	-	Buzzer Mode: <ul style="list-style-type: none"> <li>• 0 = always off</li> <li>• 1 = beep per key</li> <li>• 2 = active on Red LED</li> </ul>	0...2	0	Num

## CAN Folder

LABEL	ADDRESS	DATA TYPE	CPL	RESET	DESCRIPTION	RANGE	DEFAULT	U.M.
<i>Addr_CAN_OB</i>	15780	WORD	-	Y	On-board CAN serial address.	1...127	127	Num
<i>Baud_CAN_OB</i>	15781	WORD	-	Y	On-board CAN protocol baudrate: <ul style="list-style-type: none"><li>• 2 = 500 kBd</li><li>• 3 = 250 kBd</li><li>• 4 = 125 kBd</li><li>• 5 = 125 kBd</li><li>• 6 = 50 kBd</li></ul>	2...6	2	Num

---

# Commissioning

## What's in This Part

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# EcoStruxure Machine Expert - HVAC

## What's in This Chapter

General Description..... 161

## Overview

Components and accessories are described below.

## General Description

### Overview

The EcoStruxure Machine Expert - HVAC development tool makes it possible to create and customize IEC 61131-3 programs for various types of application. You can download EcoStruxure Machine Expert - HVAC from Schneider-electric web site download center. It is intended for applications in HVAC&R.

## EcoStruxure Machine Expert - HVAC Component

EcoStruxure Machine Expert - HVAC permits to:

- Create and manage libraries, applications, and diagnostics.
- Manage previously developed applications, upload/download applications, and modify device parameters from a serial port.

## PC Connection

M172 can be connected to a PC through the USB port and a USB cable:

- Type A USB (HOST). Used to connect a USB memory key drive when downloading the application.
- Type Mini-B USB (DEVICE). Used to connect TM172P..... / TM172O..... to a PC via Mini-B/A USB cable for debugging, commissioning, downloading, and uploading with EcoStruxure Machine Expert - HVAC.
- Type micro-B USB (DEVICE). Used to connect TM172DCL.... to a PC via micro-B/A USB cable for debugging, commissioning, downloading, and uploading with EcoStruxure Machine Expert - HVAC.

The TM172P..... / TM172O..... can also be supplied through the USB cable with limited functionalities related to debugging, commissioning, downloading and uploading with EcoStruxure Machine Expert - HVAC. For more information, refer to the EcoStruxure Machine Expert - HVAC Operating Guide.

**NOTE:** Do not apply voltage via 24 Vac/dc while the equipment is already connected to a PC via Mini-B USB cable (TM172P..... only).

Before applying power via 24 Vac/dc power supply connection:

- Disconnect the Mini-B USB cable.
- Supply the M172 controller via its 24 Vac/dc power supply connector.
- Reconnect the Mini-B USB cable.

**NOTE:** Inactive connections are not closed automatically. If all connections are open and the cable is disconnected, a reconnect is not possible and the controller must be power cycled.

**NOTICE****LOSS OF COMMUNICATION**

- Close all open TCP connections between PC and the controller before disconnecting the Ethernet cable.
- Close all open TCP connections before replacing an Ethernet cable.

**Failure to follow these instructions can result in equipment damage.**

# Controller Connection Types

## What's in This Chapter

First Commissioning ..... 163  
 Connection with a PC through Modbus SL/USB ..... 165  
 Connection with a USB Memory Key ..... 166  
 Connection with a PC through Ethernet ..... 168

## First Commissioning

### Overview

There are several processes to connect the PC to the M172 controller:

Protocol	Factory status	Connection with	Connector
Modbus SL	Enabled	USB/RS-485 adapter TSXCUSB485 with cable VW3A8306D3O.	CN1 / CN19
USB		Mini-B/A USB cable	CN16 / CN17
HTTP		Ethernet cable	CN20
Modbus TCP	Disabled	Ethernet cable	CN20
BACnet IP			CN20
FTP			CN20

For reasons of Internet security, Modbus TCP / BACnet IP / FTP are disabled by default. Therefore you can manually enable Modbus TCP / BACnet IP / FTP.

However, doing so may expose your network to possible cyberattacks if you do not take additional measures to protect your enterprise. In addition, you may be subject to laws and regulations concerning cybersecurity.

▲ WARNING
UNAUTHENTICATED ACCESS AND SUBSEQUENT NETWORK INTRUSION
<ul style="list-style-type: none"> <li>• Observe and respect any and all pertinent national, regional and local cybersecurity and/or personal data laws and regulations when enabling Modbus TCP / BACnet IP / FTP if you wish to communicate to third party devices on an industrial network.</li> <li>• Isolate your industrial network from other networks inside your company.</li> <li>• Protect any network against unintended access by using firewalls, VPN, or other, proven security measures</li> </ul>
Failure to follow these instructions can result in death, serious injury, or equipment damage.

## First Connection

Once the first connection between PC and M172 controller starts, EcoStruxure Machine Expert - HVAC asks you to enter the default password of the web-server and to replace it by a new different one.

Lets consider that the M172 controller has 3 scenarios:

Scenario	Description	Firmware Version	
		TM172P**07*	TM172P**28**
		TM172P**18*	TM172P**42**
		TM172O**18*	TM172O**28R
			TM172O**42R
<b>BRAND NEW</b>	Represents a controller just manufactured with default password of the web-server.	668.10 or greater	596.10 or greater
<b>NOT BRAND NEW</b>	Represents a controller already accessed by a user and which default password of the web-server has changed.		
<b>OBSOLETE</b>	Represents a controller already available on the market without default password settings/ restrictions	Lower than 668.10	Lower than 596.10

## CyberSecurity Defense-in-Depth

Schneider Electric adheres to industry best practices in the development and implementation of control systems. This 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.

<b>▲ WARNING</b>
<p><b>UNAUTHENTICATED ACCESS AND SUBSEQUENT UNAUTHORIZED MACHINE OPERATION</b></p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• Limit the number of devices connected to a network to the minimum necessary.</li> <li>• Isolate your industrial network from other networks inside your company.</li> <li>• Protect any network against unintended access by using firewalls, VPN, or other, proven security measures.</li> <li>• Monitor activities within your systems.</li> <li>• Prevent subject devices from direct access or direct link by unauthorized parties or unauthenticated actions.</li> <li>• Prepare a recovery plan including backup of your system and process information.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

## Replace the Default Password

Change the default password upon first use. In addition, consider carefully the implications for giving any access to other people.



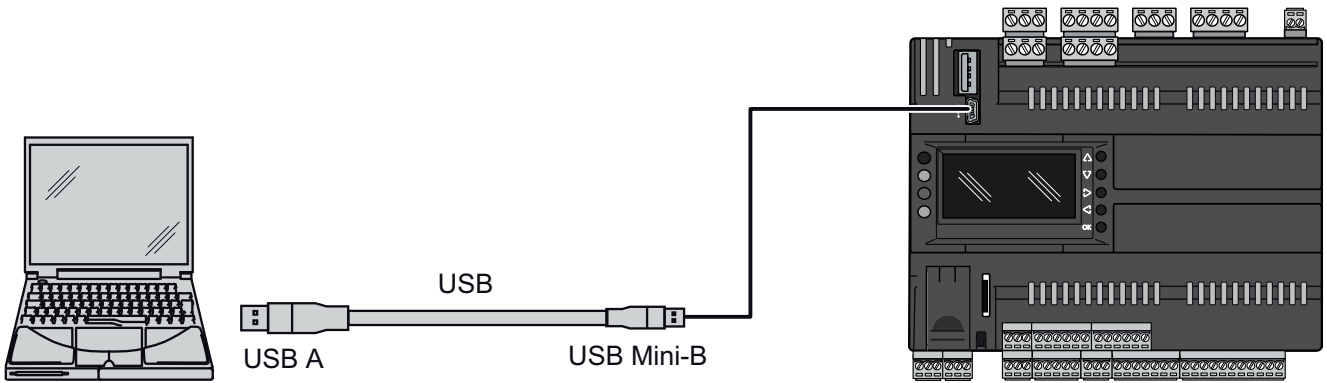
<b>⚠ WARNING</b>
<p><b>UNAUTHORIZED DATA ACCESS</b></p> <ul style="list-style-type: none"> <li>• Immediately change any and all default passwords to new, secure passwords.</li> <li>• Do not distribute passwords to unauthorized or otherwise unqualified personnel.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

**NOTE:** A secure password is one that has not been shared or distributed to any unauthorized personnel and does not contain any personal or otherwise obvious information. Further, a mix of upper and lower case letters and numbers offer greater security. You should choose a password length of at least seven characters.

## Connection with a PC through Modbus SL/USB

### Connecting the PC to the Controller

Direct connection between the PC and the controller:



To connect the PC to the controller, use a type A / type Mini-B USB cable.

Following operations are possible between the PC and the controller in direct USB connection:

Data type	PC → Controller	Controller → PC
Parameters	✓	✓
Controller application	✓	✓
HMI application	✓	✓
Data file	✓	✓
BIOS	✓	-

## First Commissioning

M172 first connection via Modbus Serial Line (USB device / RS-485):

Step	Action
1	Connect the PC to a <b>BRAND NEW</b> controller.
2	Launch EcoStruxure Machine Expert - HVAC.

Step	Action
3	In the <b>Configuration</b> tab, click <b>On-line &gt; Setup Communication</b> to configure the communication port.
4	In the <b>Configuration</b> tab, click <b>On-line &gt; Connect</b> to connect to the controller. <b>NOTE:</b> EcoStruxure Machine Expert - HVAC verifies if it is a <b>BRAND NEW</b> controller. If it is a <b>NOT BRAND NEW</b> or a <b>OBSOLETE</b> controller, the connection can be directly established.
5	Enter the default login: "administrator"
6	Enter the default password: "password".
7	Enter the new password.
8	Click <b>OK</b> to validate. <b>Result:</b> If the new password is different from the default one, the connection can be directly established.  You can now configure the controller and activate the communication port with the dedicated parameters, page 128.

## Cybersecurity

After the first connection, you can manually enable Modbus TCP / BACnet IP / FTP.

However, doing so may expose your network to possible cyberattacks if you do not take additional measures to protect your enterprise. In addition, you may be subject to laws and regulations concerning cybersecurity.

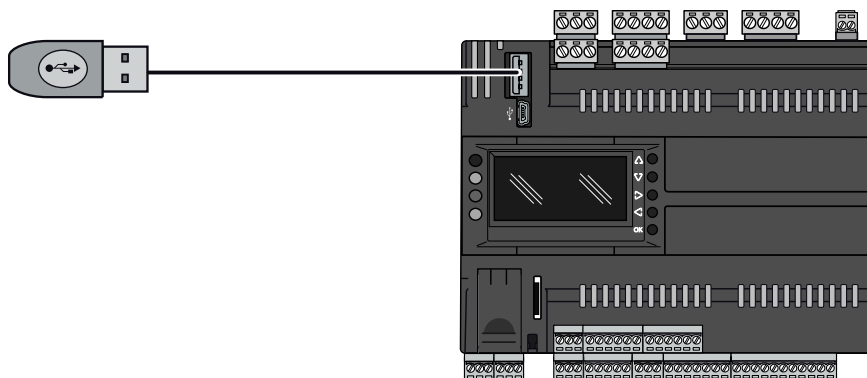
For cybersecurity details, refer to:

- CyberSecurity Defense-in-Depth, page 164.
- Replace the default password, page 164.

## Connection with a USB Memory Key

### Connecting a USB Memory Key to the Controller

Connection of the USB memory key to the TM172P\*\*\*\*\* controller:



The USB memory key is connected on the type A USB port of the controller.

Following operations are possible between the USB memory key and the controller in direct USB connection:

Data type	Memory key → Controller	Controller → Memory key
Parameters	✓	✓
Controller application	✓	✓
HMI application	✓	✓
Data file	✓	✓
BIOS	-	-

## First Programming: USB Memory Key → Controller

In EcoStruxure Machine Expert - HVAC, at each time you select **Create USB programming files**, you must enter a new password for **BRAND NEW** controller only (new password different of the default password of the web-server).

M172 first programming via USB memory key:

Step	Action
1	Connect the USB memory key to a <b>BRAND NEW</b> controller.
2	<ul style="list-style-type: none"> <li>• USB content is downloaded into the controller: yellow LED flashes during download.</li> <li>• When the download is completed, green LED flashes twice and switch ON to confirm successful download.</li> </ul> <p><b>NOTE:</b></p> <ul style="list-style-type: none"> <li>• If the password file does not exist in the USB memory key, the download is not executed into a <b>BRAND NEW</b> controller.</li> <li>• If it is a <b>NOT BRAND NEW</b> or a <b>OBSOLETE</b> controller, USB content can be directly downloaded into the controller.</li> <li>• If it is a <b>OBSOLETE</b> controller, the file related to the password changed must be removed.</li> </ul>
3	Remove USB memory key.

**NOTE:** The USB memory key contains the default login and default password in clear text, you must pay particular attention to protect these informations.

## Cybersecurity

After the first connection, you can manually enable Modbus TCP / BACnet IP / FTP.

However, doing so may expose your network to possible cyberattacks if you do not take additional measures to protect your enterprise. In addition, you may be subject to laws and regulations concerning cybersecurity.

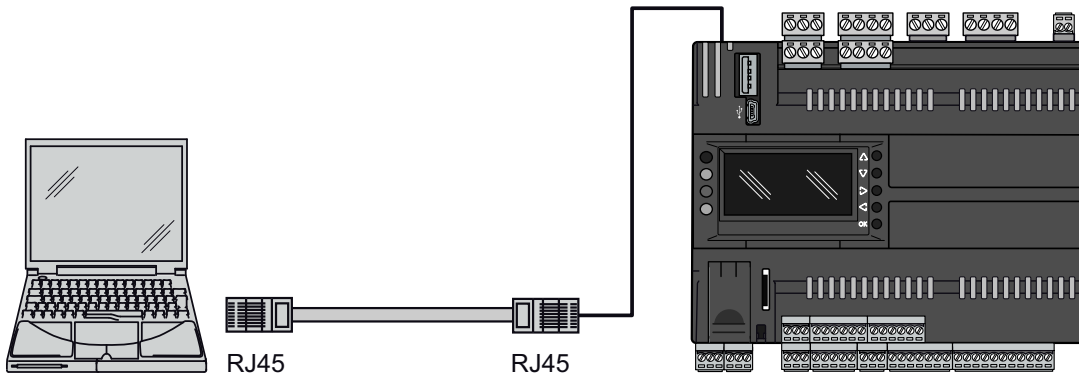
For cybersecurity details, refer to:

- CyberSecurity Defense-in-Depth, page 164.
- Replace the default password, page 164.

# Connection with a PC through Ethernet

## Connecting the PC to the Controller

Direct connection between the PC and the TM172P..... controller:



To connect the PC to the controller, use a RJ45 Ethernet cable.

Following operations are possible between the PC and the controller in direct Ethernet connection:

Data type	PC → Controller	Controller → PC
Parameters	✓	✓
Controller application	✓	✓
HMI application	✓	✓
Data file	✓	✓
BIOS	✓	-

## First Commissioning

M172 first connection via RJ45 Ethernet cable:

Step	Action
1	Connect the PC to a <b>BRAND NEW</b> controller.
2	Launch EcoStruxure Machine Expert - HVAC.
3	In the <b>Configuration</b> tab, click <b>On-line &gt; Setup Communication</b> to configure the communication port. The Modbus TCP protocol must be selected.  The default IP address for a <b>BRAND NEW</b> controller is: 10.0.0.100
4	In the <b>Configuration</b> tab, click <b>On-line &gt; Connect</b> to connect to the controller. <b>NOTE:</b> EcoStruxure Machine Expert - HVAC verifies if it is a <b>BRAND NEW</b> controller.  If it is a <b>NOT BRAND NEW</b> or <b>OBSOLETE</b> controller: <ul style="list-style-type: none"> <li>• If Modbus TCP enabled, the connection can be directly established.</li> <li>• If Modbus TCP disabled and HTTP disabled, the connection is not established.</li> <li>• If Modbus TCP disabled and HTTP enabled, EcoStruxure Machine Expert - HVAC redirects to the webpage.</li> </ul>
5	Enter the default login: "administrator"
6	Enter the default password: "password".
7	Enter the new password.
8	Click <b>OK</b> to validate.  <b>Result:</b> If the new password is different from the default one, the connection can be directly established.  You can now configure the controller and activate the communication port with the dedicated parameters, page 128.

## Cybersecurity

After the first connection, you can manually enable Modbus TCP / BACnet IP / FTP.

However, doing so may expose your network to possible cyberattacks if you do not take additional measures to protect your enterprise. In addition, you may be subject to laws and regulations concerning cybersecurity.

For cybersecurity details, refer to:

- CyberSecurity Defense-in-Depth, page 164.
- Replace the default password, page 164.

# Expansion and Remote Display Connection Types

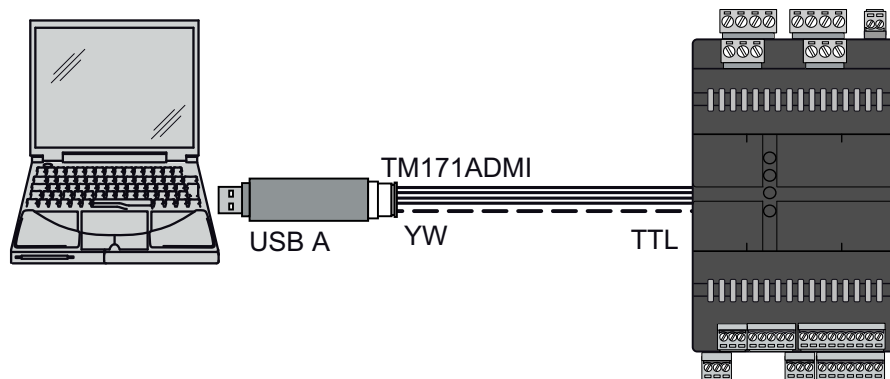
## What's in This Chapter

Connection for Expansion Module and Remote display ..... 170

## Connection for Expansion Module and Remote display

### Connecting The PC to an Expansion Module

Direct connection between the PC and an expansion module:



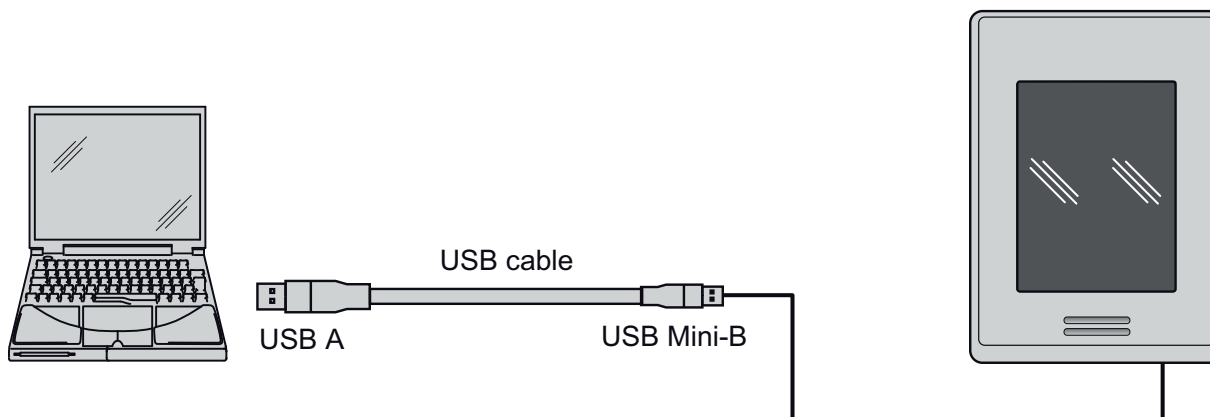
To connect the PC to the expansion module, use a TM171ADMI programming cable (Yellow) on the TTL port of the device.

Following operations are possible between the PC and the Expansion Module:

Data type	PC → Expansion module	Expansion module → PC
Parameters	✓	✓
Controller application	-	-
HMI application	-	-
Data file	-	-
BIOS	✓	-

### Connecting the PC to the TM172DCL••• Remote Display

Direct connection between the PC and the TM172DCL••• remote display:



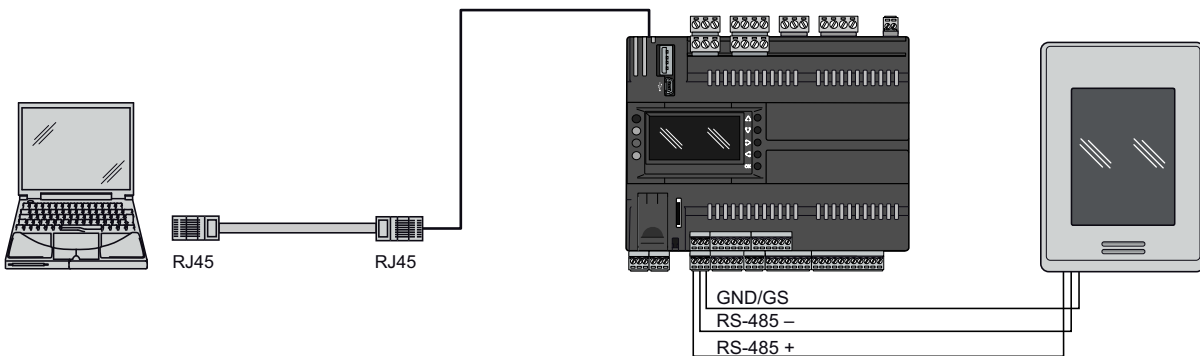
To connect the PC to the remote display, use a type A / type micro-B USB cable.

Following operations are possible between the PC and the controller in direct USB connection:

Data type	PC → Remote display	Remote display →PC
Parameters	✓	✓
Controller application	✓	-
HMI application	✓	-
Data file	-	-
BIOS	✓	-

## Connecting the PC to TM172DCL•••• the Remote Display through a Controller

Connection between the PC and the TM172DCL•••• remote display through a controller:



To connect the PC to the TM172DCL•••• remote display trough a controller, use:

- A RJ45 Ethernet cable between the PC and the controller.
- An RS-485 connection between the controller and the remote display

NOTE: Bridge function must be enabled in the TM172P••••• / TM172O••••• controller, TM172DCL•••• run as Slave Modbus/RTU.

Following operations are possible between the PC and the remote display connected through the controller:

Data type	PC → Remote display	Remote display →PC
Parameters	✓	✓
Controller application	✓	-
HMI application	✓	-
Data file	-	-
BIOS	✓	-

## Connecting the TM172DGRP Remote Display

For commissioning, the TM172DGRP remote display can only be connected to a controller. You can upload HMI pages and upload BIOS.

Following operations are possible between the controller and the TM172DGRP remote display:

Data type	Controller → Remote display	Remote display → Controller
Parameters	-	-
Controller application	-	-
HMI pages	✓	-
Data file	-	-
BIOS	✓	-

For more details, refer to Diagnostic Menu, page 120.



# BIOS Update

## What's in This Chapter

BIOS Update ..... 173

# BIOS Update

## Overview

There are several ways to update the M172 controller, M172 Expansion and M172 Display Color Touchscreen BIOS:

- Downloading into the Modicon M172 Logic Controller from USB memory key
- Downloading into the Modicon M172 Logic Controller from PC with EcoStruxure Machine Expert - HVAC
- Downloading into the Modicon M172 Expansion Module from PC with EcoStruxure Machine Expert - HVAC
- Downloading into the Modicon M172 Display Color Touchscreen from PC with EcoStruxure Machine Expert - HVAC

If you remove power to the device, or there is a power outage or communication interruption during the transfer of the application, your device may become inoperative. If a communication interruption or a power outage occurs, reattempt the transfer. If there is a power outage or communication interruption during a firmware update, or if an invalid firmware is used, your device will become inoperative. In this case, use a valid firmware and reattempt the firmware update.

### **NOTICE**

#### **INOPERABLE EQUIPMENT**

- Do not interrupt the transfer of the application program or a firmware change once the transfer has begun.
- Re-initiate the transfer if the transfer is interrupted for any reason.
- Do not attempt to place the device into service until the file transfer has completed successfully.

**Failure to follow these instructions can result in equipment damage.**

## Download Controller BIOS from USB Memory Key

Steps to download controller BIOS from USB memory key:

Step	Action
1	Trace the BIOS file (it has the file extension .bin) in one of the following ways: <ul style="list-style-type: none"> <li>If you have EcoStruxure Machine Expert - HVAC installed on your PC, BIOS is available in the following:  <code>&lt;C:\Programs&gt;\Schneider Electric\EcoStruxureMachineExpertHVAC\Catalog\FreeAdvance\Firmware_XXX</code></li> <li>Download .bin file from website - Firmware Update section.</li> </ul>
2	Copy this file into a USB memory key (for example, mskxxx_yy.bin)
3	Connect USB memory key to Modicon M172 Logic Controller, page 166. <ul style="list-style-type: none"> <li>BIOS is downloaded into Modicon M172 Logic Controller: yellow LED flashes during download.</li> <li>When the download is completed, green LED flashes twice and switch ON to confirm successful download.</li> </ul>
4	Remove USB memory key. <ul style="list-style-type: none"> <li>Modicon M172 Logic Controller automatically resets and restarts.</li> <li>If a SYSTEM FAULT message appears, it is related to a watchdog time-out that occurred while updating the BIOS and, in this case, can be ignored.</li> </ul> BIOS update has been completed successfully.

Modicon M172 Logic Controller does not download a non-compliant BIOS (for example you cannot download BIOS for Modicon M171 Optimized Logic Controller into an Modicon M172 Logic Controller and vice versa).

## Download Controller BIOS from PC with EcoStruxure Machine Expert - HVAC software

Steps to download Controller BIOS from PC:

Step	Action
1	Connect the Modicon M172 Logic Controller via USB, page 165, RS-485, or Ethernet, page 168 to the PC.
2	Open EcoStruxure Machine Expert - HVAC software.
3	Open a existing project or create a new one.
4	Select the <b>Commissioning</b> tab.
5	In the menu, select <b>Target &gt; Setup communication</b> .
6	Click <b>Connect</b> .
7	Click on the controller name in the <b>Commissioning</b> window.
8	Click <b>BIOS download</b> .
9	Select the .bin file you want to download, located in: <ul style="list-style-type: none"> <li><code>&lt;C:\Programs&gt;\Schneider Electric\EcoStruxureMachineExpertHVAC\Catalog\FreeAdvance\Firmware_XXX</code></li> </ul>
10	Click <b>Download</b> button.  The operation may take a few minutes.  If the download terminates successfully, a confirmation is displayed.
11	Disconnect the device from the PC.

## Download BIOS of Controller, Expansion Module, or Touchscreen Remote Display from PC with EcoStruxure Machine Expert - HVAC Installer software

Steps to download BIOS from PC:

Step	Action
1	Connect the Modicon M172 Logic Controller, the Modicon M172 Expansion Module or the Modicon M172 Display Color Touchscreen to the PC.
2	Open EcoStruxure Machine Expert - HVAC Installer software.
3	Use the <b>Network Scan</b> or add the device you want to update from the <b>Catalog</b> to the <b>Tree</b> .
4	Click <b>Connect</b> .
5	Right-click on the device name in the <b>Tree</b> .
6	Select <b>BIOS download</b> .
7	<p>Select the .bin file you want to download:</p> <ul style="list-style-type: none"> <li>For Modicon M172 Logic Controller, the BIOS files are located in:  <code>&lt;C:\Programs&gt;\Schneider Electric                      \EcoStruxureMachineExpertHVAC\Catalog\FreeAdvance\Firmware_XXX</code> </li> <li>For Modicon M172 Expansion Module, the BIOS files are located in:  <code>&lt;C:\Programs&gt;\Schneider Electric                      \EcoStruxureMachineExpertHVAC\Catalog\FreeAdvance\TM172E                      \Firmware_XXX</code> </li> <li>For Modicon M172 Display Color Touchscreen, the BIOS files are located in:  <code>&lt;C:\Programs&gt;\Schneider Electric                      \EcoStruxureMachineExpertHVAC\Catalog\FreeAdvance\TM172DC                      \Firmware_XXX</code> </li> </ul>
8	<p>Click <b>Download</b>.</p> <p>The operation may take a few minutes.</p> <p>If the download terminates successfully, a confirmation is displayed.</p>
9	Disconnect the device from the PC.

## Download BIOS of TM172DGRP

To download BIOS, connect the remote display to the controller, page 172 and download the BIOS via the DIAGNOSTIC Menu, page 120.

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# Appendices

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# Appendices

## What's in This Chapter

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 NTC 10k-2 beta (25/50) 3977 Resistance Temperature Table ..... 178  
 Pt1000 Resistance Temperature Table..... 179  
 PTC Resistance Temperature Table..... 182

## NTC 10k beta 3435 Resistance Temperature Table

### Celsius

T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)
-40	187 400	-13	48 590	14	15 270	41	5 630	68	2 366	95	1 108
-39	177 500	-12	46 410	15	14 680	42	5 440	69	2 296	96	1 080
-38	168 200	-11	44 350	16	14 110	43	5 257	70	2 229	97	1 052
-37	159 400	-10	42 390	17	13 570	44	5 081	71	2 164	98	1 025
-36	151 100	-9	40 500	18	13 050	45	4 912	72	2 101	99	999.0
-35	143 400	-8	38 700	19	12 560	46	4 750	73	2 040	100	973.7
-34	136 100	-7	37 000	20	12 090	47	4 594	74	1 981	101	949.0
-33	129 200	-6	35 380	21	11 630	48	4 444	75	1 925	102	925.0
-32	122 800	-5	33 850	22	11 200	49	4 300	76	1 870	103	901.8
-31	116 700	-4	32 390	23	10 780	50	4 162	77	1 817	104	879.3
-30	110 900	-3	31 000	24	10 380	51	4 027	78	1 766	105	857.4
-29	105 400	-2	29 690	25	10 000	52	3 897	79	1 716	106	836.3
-28	100 100	-1	28 440	26	9 633	53	3 773	80	1 669	107	815.7
-27	95 220	0	27 250	27	9 281	54	3 653	81	1 622	108	795.8
-26	90 570	1	26 100	28	8 945	55	3 537	82	1 577	109	776.4
-25	86 180	2	25 000	29	8 623	56	3 426	83	1 534	110	757.6
-24	82 040	3	23 960	30	8 314	57	3 319	84	1 492	111	739.2
-23	78 130	4	22 970	31	8 016	58	3 216	85	1 451	112	721.4
-22	74 440	5	22 030	32	7 730	59	3 117	86	1 412	113	704.1
-21	70 940	6	21 130	33	7 456	60	3 022	87	1 374	114	687.3
-20	67 640	7	20 280	34	7 193	61	2 929	88	1 337	115	671.0
-19	64 440	8	19 460	35	6 941	62	2 839	89	1 301	116	655.2
-18	61 420	9	18 690	36	6 700	63	2 753	90	1 266	117	639.8
-17	58 570	10	17 950	37	6 468	64	2 670	91	1 233	118	624.8
-16	55 870	11	17 230	38	6 246	65	2 589	92	1 200	119	610.3
-15	53 310	12	16 550	39	6 033	66	2 512	93	1 169	120	596.1
-14	50 880	13	15 900	40	5 829	67	2 438	94	1 138		

### Fahrenheit

T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)
-40.0	187 400	8.6	48 590	57.2	15 270	105.8	5 630	154.4	2 366	203.0	1 108
-38.2	177 500	10.4	46 410	59.0	14 680	107.6	5 440	156.2	2 296	204.8	1 080

T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)
-36.4	168 200	12.2	44 350	60.8	14 110	109.4	5 257	158.0	2 229	206.6	1 052
-34.6	159 400	14.0	42 390	62.6	13 570	111.2	5 081	159.8	2 164	208.4	1 025
-32.8	151 100	15.8	40 500	64.4	13 050	113.0	4 912	161.6	2 101	210.2	999.0
-31.0	143 400	17.6	38 700	66.2	12 560	114.8	4 750	163.4	2 040	212.0	973.7
-29.2	136 100	19.4	37 000	68.0	12 090	116.6	4 594	165.2	1 981	213.8	949.0
-27.4	129 200	21.2	35 380	69.8	11 630	118.4	4 444	167.0	1 925	215.6	925.0
-25.6	122 800	23.0	33 850	71.6	11 200	120.2	4 300	168.8	1 870	217.4	901.8
-23.8	116 700	24.8	32 390	73.4	10 780	122.0	4 162	170.6	1 817	219.2	879.3
-22.0	110 900	26.6	31 000	75.2	10 380	123.8	4 027	172.4	1 766	221.0	857.4
-20.2	105 400	28.4	29 690	77.0	10 000	125.6	3 897	174.2	1 716	222.8	836.3
-18.4	100 100	30.2	28 440	78.8	9 633	127.4	3 773	176.0	1 669	224.6	815.7
-16.6	95 220	32.0	27 250	80.6	9 281	129.2	3 653	177.8	1 622	226.4	795.8
-14.8	90 570	33.8	26 100	82.4	8 945	131.0	3 537	179.6	1 577	228.2	776.4
-13.0	86 180	35.6	25 000	84.2	8 623	132.8	3 426	181.4	1 534	230.0	757.6
-11.2	82 040	37.4	23 960	86.0	8 314	134.6	3 319	183.2	1 492	231.8	739.2
-9.4	78 130	39.2	22 970	87.8	8 016	136.4	3 216	185.0	1 451	233.6	721.4
-7.6	74 440	41.0	22 030	89.6	7 730	138.2	3 117	186.8	1 412	235.4	704.1
-5.8	70 940	42.8	21 130	91.4	7 456	140.0	3 022	188.6	1 374	237.2	687.3
-4.0	67 640	44.6	20 280	93.2	7 193	141.8	2 929	190.4	1 337	239.0	671.0
-2.2	64 440	46.4	19 460	95.0	6 941	143.6	2 839	192.2	1 301	240.8	655.2
-0.4	61 420	48.2	18 690	96.8	6 700	145.4	2 753	194.0	1 266	242.6	639.8
1.4	58 570	50.0	17 950	98.6	6 468	147.2	2 670	195.8	1 233	244.4	624.8
3.2	55 870	51.8	17 230	100.4	6 246	149.0	2 589	197.6	1 200	246.2	610.3
5.0	53 310	53.6	16 550	102.2	6 033	150.8	2 512	199.4	1 169	248.0	596.1
6.8	50 880	55.4	15 900	104.0	5 829	152.6	2 438	201.2	1 138		

## NTC 10k-2 beta (25/50) 3977 Resistance Temperature Table

### Celsius

T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)
-39.44	323 839	-18.33	88 090	2.78	28 365	23.89	10 501	45.00	4 367	66.11	2 003
-38.33	300 974	-17.22	82 670	3.89	26 834	25.00	10 000	46.11	4 182	67.22	1 927
-37.22	279 880	-16.11	77 620	5.00	25 395	26.11	9 526	47.22	4 006	68.33	1 855
-36.11	260 410	-15.00	72 911	6.11	24 042	27.22	9 078	48.33	3 838	69.44	1 785
-35.00	242 427	13.89	68 518	7.22	22 770	28.33	8 653	49.44	3 679	70.56	1 718
-33.89	225 809	12.78	64 419	8.33	21 573	29.44	8 251	50.56	3 525	71.67	1 655
-32.78	210 443	11.67	60 592	9.44	20 446	30.56	7 866	51.67	3 380	72.78	1 594
-31.67	196 227	10.56	57 017	10.56	19 376	31.67	7 505	52.78	3 242	73.89	1 536
-30.56	183 068	9.44	53 647	11.67	18 378	32.78	7 163	53.89	3 111	75.00	1 480
-29.44	170 775	8.33	50 526	12.78	17 437	33.89	6 838	55.00	2 985	76.11	1 427
-28.33	159 488	7.22	47 606	13.89	16 550	35.00	6 530	56.11	2 865	77.22	1 375
-27.22	149 024	6.11	44 874	15.00	15 714	36.11	6 238	57.22	2 751	78.33	1 326
-26.11	139 316	5.00	42 317	16.11	14 925	37.22	5 960	58.33	2 642	79.44	1 279
-25.00	130 306	3.89	39 921	17.22	14 180	38.33	5 697	59.44	2 538	80.56	1 234

T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)
-23.89	121 939	2.78	37 676	18.33	13 478	39.44	5 447	60.56	2 438	81.67	1 190
-22.78	114 165	1.67	35 573	19.44	12 814	40.56	5 207	61.67	2 343	82.78	1 149
-21.67	106 939	0.56	33 599	20.56	12 182	41.67	4 981	62.78	2 252	83.89	1 109
-20.56	100 218	0.56	31 732	21.67	11 590	42.78	4 766	63.89	2 165	85.00	1 070
-19.44	93 909	1.67	29 996	22.78	11 030	43.89	4 561	65.00	2 082	86.11	1 034

## Fahrenheit

T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)
-39	323 839	-1	88 090	37	28 365	75	10 501	113	4 367	151	2 003
-37	300 974	1	82 670	39	26 834	77	10 000	115	4 182	153	1 927
-35	279 880	3	77 620	41	25 395	79	9 526	117	4 006	155	1 855
-33	260 410	5	72 911	43	24 042	81	9 078	119	3 838	157	1 785
-31	242 427	57	68 518	45	22 770	83	8 653	121	3 679	159	1 718
-29	225 809	55	64 419	47	21 573	85	8 251	123	3 525	161	1 655
-27	210 443	53	60 592	49	20 446	87	7 866	125	3 380	163	1 594
-25	196 227	51	57 017	51	19 376	89	7 505	127	3 242	165	1 536
-23	183 068	49	53 647	53	18 378	91	7 163	129	3 111	167	1 480
-21	170 775	47	50 526	55	17 437	93	6 838	131	2 985	169	1 427
-19	159 488	45	47 606	57	16 550	95	6 530	133	2 865	171	1 375
-17	149 024	43	44 874	59	15 714	97	6 238	135	2 751	173	1 326
-15	139 316	41	42 317	61	14 925	99	5 960	137	2 642	175	1 279
-13	130 306	39	39 921	63	14 180	101	5 697	139	2 538	177	1 234
-11	121 939	37	37 676	65	13 478	103	5 447	141	2 438	179	1 190
-9	114 165	35	35 573	67	12 814	105	5 207	143	2 343	181	1 149
-7	106 939	33	33 599	69	12 182	107	4 981	145	2 252	183	1 109
-5	100 218	33	31 732	71	11 590	109	4 766	147	2 165	185	1 070
-3	93 909	35	29 996	73	11 030	111	4 561	149	2 082	187	1 034

## Pt1000 Resistance Temperature Table

### Celsius

T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)
-100	602.56	-49	807.03	2	1007.81	53	1205.52	104	1400.22	155	1591.91
-99	606.61	-48	811.00	3	1011.72	54	1209.36	105	1404.00	156	1595.64
-98	610.66	-47	814.97	4	1015.62	55	1213.21	106	1407.79	157	1599.37
-97	614.71	-46	818.94	5	1019.53	56	1217.05	107	1411.58	158	1603.09
-96	618.76	-45	822.90	6	1023.43	57	1220.90	108	1415.36	159	1606.82
-95	622.80	-44	826.87	7	1027.33	58	1224.74	109	1419.14	160	1610.54
-94	626.84	-43	830.83	8	1031.23	59	1228.58	110	1422.93	161	1614.27
-93	630.88	-42	834.79	9	1035.13	60	1232.42	111	1426.71	162	1617.99
-92	634.92	-41	838.75	10	1039.03	61	1236.26	112	1430.49	163	1621.71
-91	638.96	-40	842.71	11	1042.92	62	1240.09	113	1434.26	164	1625.43

T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)
-90	643.00	-39	846.66	12	1046.82	63	1243.93	114	1438.04	165	1629.15
-89	647.03	-38	850.62	13	1050.71	64	1247.77	115	1441.82	166	1632.86
-88	651.06	-37	854.57	14	1054.60	65	1251.60	116	1445.59	167	1636.58
-87	655.09	-36	858.53	15	1058.49	66	1255.43	117	1449.37	168	1640.30
-86	659.12	-35	862.48	16	1062.38	67	1259.26	118	1453.14	169	1644.01
-85	663.15	-34	866.43	17	1066.27	68	1263.09	119	1456.91	170	1647.72
-84	667.17	-33	870.38	18	1070.16	69	1266.92	120	1460.68	171	1651.43
-83	671.20	-32	874.32	19	1074.05	70	1270.75	121	1464.45	172	1655.14
-82	675.22	-31	878.27	20	1077.94	71	1274.58	122	1468.22	173	1658.85
-81	679.24	-30	882.22	21	1081.82	72	1278.40	123	1471.98	174	1662.56
-80	683.25	-29	886.16	22	1085.70	73	1282.23	124	1475.75	175	1666.27
-79	687.27	-28	890.10	23	1089.59	74	1286.05	125	1479.51	176	1669.97
-78	691.29	-27	894.04	24	1093.47	75	1289.87	126	1483.28	177	1673.68
-77	695.30	-26	897.98	25	1097.35	76	1293.70	127	1487.04	178	1677.38
-76	699.31	-25	901.92	26	1101.23	77	1297.52	128	1490.80	179	1681.08
-75	703.32	-24	905.86	27	1105.10	78	1301.33	129	1494.56	180	1684.78
-74	707.33	-23	909.80	28	1108.98	79	1305.15	130	1498.32	181	1688.48
-73	711.34	-22	913.73	29	1112.86	80	1308.97	131	1502.08	182	1692.18
-72	715.34	-21	917.67	30	1116.73	81	1312.78	132	1505.83	183	1695.88
-71	719.34	-20	921.60	31	1120.60	82	1316.60	133	1509.59	184	1699.58
-70	723.35	-19	925.53	32	1124.47	83	1320.41	134	1513.34	185	1703.27
-69	727.35	-18	929.46	33	1128.35	84	1324.22	135	1517.10	186	1706.96
-68	731.34	-17	933.39	34	1132.21	85	1328.03	136	1520.85	187	1710.66
-67	735.34	-16	937.32	35	1136.08	86	1331.84	137	1524.60	188	1714.35
-66	739.34	-15	941.24	36	1139.95	87	1335.65	138	1528.35	189	1718.04
-65	743.33	-14	945.17	37	1143.82	88	1339.46	139	1532.10	190	1721.73
-64	747.32	-13	949.09	38	1147.68	89	1343.26	140	1535.84	191	1725.42
-63	751.31	-12	953.02	39	1151.55	90	1347.07	141	1539.59	192	1729.10
-62	755.30	-11	956.94	40	1155.41	91	1350.87	142	1543.33	193	1732.79
-61	759.29	-10	960.86	41	1159.27	92	1354.68	143	1547.08	194	1736.48
-60	763.28	-9	964.78	42	1163.13	93	1358.48	144	1550.82	195	1740.16
-59	767.26	-8	968.70	43	1166.99	94	1362.28	145	1554.56	196	1743.84
-58	771.25	-7	972.61	44	1170.85	95	1366.08	146	1558.30	197	1747.52
-57	775.23	-6	976.53	45	1174.70	96	1369.87	147	1562.04	198	1751.20
-56	779.21	-5	980.44	46	1178.56	97	1373.67	148	1565.78	199	1754.88
-55	783.19	-4	984.36	47	1182.41	98	1377.47	149	1569.52	200	1758.56
-54	787.17	-3	988.27	48	1186.27	99	1381.26	150	1573.25		
-53	791.14	-2	992.18	49	1190.12	100	1385.06	151	1576.99		
-52	795.12	-1	996.09	50	1193.97	101	1388.85	152	1580.72		
-51	799.09	0	1000.00	51	1197.82	102	1392.64	153	1584.45		
-50	803.06	1	1003.91	52	1201.67	103	1396.43	154	1588.18		



## Fahrenheit

T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)
-148.0	602.56	-56.2	807.03	35.6	1007.81	127.4	1205.52	219.2	1400.22	311.0	1591.91
-146.2	606.61	-54.4	811.00	37.4	1011.72	129.2	1209.36	221.0	1404.00	312.8	1595.64
-144.4	610.66	-52.6	814.97	39.2	1015.62	131.0	1213.21	222.8	1407.79	314.6	1599.37
-142.6	614.71	-50.8	818.94	41.0	1019.53	132.8	1217.05	224.6	1411.58	316.4	1603.09
-140.8	618.76	-49.0	822.90	42.8	1023.43	134.6	1220.90	226.4	1415.36	318.2	1606.82
-139.0	622.80	-47.2	826.87	44.6	1027.33	136.4	1224.74	228.2	1419.14	320.0	1610.54
-137.2	626.84	-45.4	830.83	46.4	1031.23	138.2	1228.58	230.0	1422.93	321.8	1614.27
-135.4	630.88	-43.6	834.79	48.2	1035.13	140.0	1232.42	231.8	1426.71	323.6	1617.99
-133.6	634.92	-41.8	838.75	50.0	1039.03	141.8	1236.26	233.6	1430.49	325.4	1621.71
-131.8	638.96	-40.0	842.71	51.8	1042.92	143.6	1240.09	235.4	1434.26	327.2	1625.43
-130.0	643.00	-38.2	846.66	53.6	1046.82	145.4	1243.93	237.2	1438.04	329.0	1629.15
-128.2	647.03	-36.4	850.62	55.4	1050.71	147.2	1247.77	239.0	1441.82	330.8	1632.86
-126.4	651.06	-34.6	854.57	57.2	1054.60	149.0	1251.60	240.8	1445.59	332.6	1636.58
-124.6	655.09	-32.8	858.53	59.0	1058.49	150.8	1255.43	242.6	1449.37	334.4	1640.30
-122.8	659.12	-31.0	862.48	60.8	1062.38	152.6	1259.26	244.4	1453.14	336.2	1644.01
-121.0	663.15	-29.2	866.43	62.6	1066.27	154.4	1263.09	246.2	1456.91	338.0	1647.72
-119.2	667.17	-27.4	870.38	64.4	1070.16	156.2	1266.92	248.0	1460.68	339.8	1651.43
-117.4	671.20	-25.6	874.32	66.2	1074.05	158.0	1270.75	249.8	1464.45	341.6	1655.14
-115.6	675.22	-23.8	878.27	68.0	1077.94	159.8	1274.58	251.6	1468.22	343.4	1658.85
-113.8	679.24	-22.0	882.22	69.8	1081.82	161.6	1278.40	253.4	1471.98	345.2	1662.56
-112.0	683.25	-20.2	886.16	71.6	1085.70	163.4	1282.23	255.2	1475.75	347.0	1666.27
-110.2	687.27	-18.4	890.10	73.4	1089.59	165.2	1286.05	257.0	1479.51	348.8	1669.97
-108.4	691.29	-16.6	894.04	75.2	1093.47	167.0	1289.87	258.8	1483.28	350.6	1673.68
-106.6	695.30	-14.8	897.98	77.0	1097.35	168.8	1293.70	260.6	1487.04	352.4	1677.38
-104.8	699.31	-13.0	901.92	78.8	1101.23	170.6	1297.52	262.4	1490.80	354.2	1681.08
-103.0	703.32	-11.2	905.86	80.6	1105.10	172.4	1301.33	264.2	1494.56	356.0	1684.78
-101.2	707.33	-9.4	909.80	82.4	1108.98	174.2	1305.15	266.0	1498.32	357.8	1688.48
-99.4	711.34	-7.6	913.73	84.2	1112.86	176.0	1308.97	267.8	1502.08	359.6	1692.18
-97.6	715.34	-5.8	917.67	86.0	1116.73	177.8	1312.78	269.6	1505.83	361.4	1695.88
-95.8	719.34	-4.0	921.60	87.8	1120.60	179.6	1316.60	271.4	1509.59	363.2	1699.58
-94.0	723.35	-2.2	925.53	89.6	1124.47	181.4	1320.41	273.2	1513.34	365.0	1703.27
-92.2	727.35	-0.4	929.46	91.4	1128.35	183.2	1324.22	275.0	1517.10	366.8	1706.96
-90.4	731.34	1.4	933.39	93.2	1132.21	185.0	1328.03	276.8	1520.85	368.6	1710.66
-88.6	735.34	3.2	937.32	95.0	1136.08	186.8	1331.84	278.6	1524.60	370.4	1714.35
-86.8	739.34	5.0	941.24	96.8	1139.95	188.6	1335.65	280.4	1528.35	372.2	1718.04
-85.0	743.33	6.8	945.17	98.6	1143.82	190.4	1339.46	282.2	1532.10	374.0	1721.73
-83.2	747.32	8.6	949.09	100.4	1147.68	192.2	1343.26	284.0	1535.84	375.8	1725.42
-81.4	751.31	10.4	953.02	102.2	1151.55	194.0	1347.07	285.8	1539.59	377.6	1729.10
-79.6	755.30	12.2	956.94	104.0	1155.41	195.8	1350.87	287.6	1543.33	379.4	1732.79
-77.8	759.29	14.0	960.86	105.8	1159.27	197.6	1354.68	289.4	1547.08	381.2	1736.48
-76.0	763.28	15.8	964.78	107.6	1163.13	199.4	1358.48	291.2	1550.82	383.0	1740.16
-74.2	767.26	17.6	968.70	109.4	1166.99	201.2	1362.28	293.0	1554.56	384.8	1743.84
-72.4	771.25	19.4	972.61	111.2	1170.85	203.0	1366.08	294.8	1558.30	386.6	1747.52
-70.6	775.23	21.2	976.53	113.0	1174.70	204.8	1369.87	296.6	1562.04	388.4	1751.20
-68.8	779.21	23.0	980.44	114.8	1178.56	206.6	1373.67	298.4	1565.78	390.2	1754.88

T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)
-67.0	783.19	24.8	984.36	116.6	1182.41	208.4	1377.47	300.2	1569.52	392.0	1758.56
-65.2	787.17	26.6	988.27	118.4	1186.27	210.2	1381.26	302.0	1573.25		
-63.4	791.14	28.4	992.18	120.2	1190.12	212.0	1385.06	303.8	1576.99		
-61.6	795.12	30.2	996.09	122.0	1193.97	213.8	1388.85	305.6	1580.72		
-59.8	799.09	32.0	1000.00	123.8	1197.82	215.6	1392.64	307.4	1584.45		
-58.0	803.06	33.8	1003.91	125.6	1201.67	217.4	1396.43	309.2	1588.18		

## PTC Resistance Temperature Table

### Celsius

T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)
-55	490.10	-14	718.2	27	1008.60	68	1361.4	109	1776.3	150	2189.00
-54	494.88	-13	724.48	28	1016.48	69	1370.88	110	1786.98		
-53	499.75	-12	730.85	29	1024.35	70	1380.25	111	1797.95		
-52	504.63	-11	737.33	30	1032.33	71	1389.73	112	1808.93		
-51	509.60	-10	743.70	31	1040.30	72	1399.20	113	1819.90		
-50	514.58	-9	750.28	32	1048.28	73	1408.78	114	1830.88		
-49	519.55	-8	756.35	33	1056.35	74	1418.35	115	1841.85		
-48	524.63	-7	763.33	34	1064.43	75	1427.93	116	1852.83		
-47	529.70	-6	769.9	35	1072.60	76	1437.60	117	1863.80		
-46	534.78	-5	776.58	36	1080.68	77	1447.28	118	1874.78		
-45	539.96	-4	783.26	37	1088.96	78	1456.96	119	1885.76		
-44	545.13	-3	789.93	38	1097.13	79	1466.73	120	1896.73		
-43	550.41	-2	796.71	39	1105.41	80	1476.51	121	1907.51		
-42	555.68	-1	803.48	40	1113.78	81	1486.38	122	1918.28		
-41	560.96	0	810.36	41	1122.06	82	1496.26	123	1929.06		
-40	566.23	1	817.23	42	1130.43	83	1506.13	124	1939.83		
-39	571.61	2	824.11	43	1138.91	84	1516.11	125	1950.61		
-38	577.09	3	830.99	44	1147.39	85	1526.09	126	1961.19		
-37	582.56	4	837.96	45	1155.86	86	1536.06	127	1971.76		
-36	588.04	5	845.04	46	1164.34	87	1546.14	128	1982.34		
-35	593.51	6	852.01	47	1172.91	88	1556.21	129	1992.91		
-34	599.09	7	859.09	48	1181.59	89	1566.29	130	2003.49		
-33	604.66	8	866.26	49	1190.16	90	1576.46	131	2013.46		
-32	610.34	9	873.44	50	1198.84	91	1586.74	132	2023.44		
-31	616.01	10	880.61	51	1207.61	92	1596.91	133	2033.41		
-30	621.69	11	887.89	52	1216.29	93	1607.19	134	2043.39		
-29	627.47	12	895.07	53	1225.17	94	1617.57	135	2053.37		
-28	633.24	13	902.44	54	1233.94	95	1627.84	136	2063.34		
-27	639.12	14	909.72	55	1242.82	96	1638.22	137	2073.32		
-26	644.89	15	917.19	56	1251.69	97	1648.69	138	2083.29		
-25	650.87	16	924.57	57	1260.67	98	1659.17	139	2093.27		
-24	656.74	17	932.04	58	1269.64	99	1669.64	140	2103.24		

T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)
-23	662.72	18	939.52	59	1278.62	100	1680.22	141	2111.82		
-22	668.80	19	947.00	60	1287.70	101	1690.90	142	2120.40		
-21	674.77	20	954.57	61	1296.77	102	1701.57	143	2128.97		
-20	680.85	21	962.25	62	1305.95	103	1712.25	144	2137.55		
-19	687.02	22	969.82	63	1315.12	104	1722.92	145	2146.12		
-18	693.20	23	977.50	64	1324.30	105	1733.60	146	2154.70		
-17	699.37	24	985.27	65	1333.47	106	1744.27	147	2163.27		
-16	705.55	25	993.05	66	1342.75	107	1754.95	148	2171.85		
-15	711.82	26	1000.82	67	1352.12	108	1765.62	149	2180.42		

## Fahrenheit

T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)
-67	490.10	6.8	718.2	80.6	1008.60	154.4	1361.4	228.2	1776.3	302	2189.00
-65.2	494.88	8.6	724.48	82.4	1016.48	156.2	1370.88	230	1786.98		
-63.4	499.75	10.4	730.85	84.2	1024.35	158	1380.25	231.8	1797.95		
-61.6	504.63	12.2	737.33	86	1032.33	159.8	1389.73	233.6	1808.93		
-59.8	509.60	14	743.70	87.8	1040.30	161.6	1399.20	235.4	1819.90		
-58	514.58	15.8	750.28	89.6	1048.28	163.4	1408.78	237.2	1830.88		
-56.2	519.55	17.6	756.35	91.4	1056.35	165.2	1418.35	239	1841.85		
-54.4	524.63	19.4	763.33	93.2	1064.43	167	1427.93	240.8	1852.83		
-52.6	529.70	21.2	769.9	95	1072.60	168.8	1437.60	242.6	1863.80		
-50.8	534.78	23	776.58	96.8	1080.68	170.6	1447.28	244.4	1874.78		
-49	539.96	24.8	783.26	98.6	1088.96	172.4	1456.96	246.2	1885.76		
-47.2	545.13	26.6	789.93	100.4	1097.13	174.2	1466.73	248	1896.73		
-45.4	550.41	28.4	796.71	102.2	1105.41	176	1476.51	249.8	1907.51		
-43.6	555.68	30.2	803.48	104	1113.78	177.8	1486.38	251.6	1918.28		
-41.8	560.96	32	810.36	105.8	1122.06	179.6	1496.26	253.4	1929.06		
-40	566.23	33.8	817.23	107.6	1130.43	181.4	1506.13	255.2	1939.83		
-38.2	571.61	35.6	824.11	109.4	1138.91	183.2	1516.11	257	1950.61		
-36.4	577.09	37.4	830.99	111.2	1147.39	185	1526.09	258.8	1961.19		
-34.6	582.56	39.2	837.96	113	1155.86	186.8	1536.06	260.6	1971.76		
-32.8	588.04	41	845.04	114.8	1164.34	188.6	1546.14	262.4	1982.34		
-31	593.51	42.8	852.01	116.6	1172.91	190.4	1556.21	264.2	1992.91		
-29.2	599.09	44.6	859.09	118.4	1181.59	192.2	1566.29	266	2003.49		
-27.4	604.66	46.4	866.26	120.2	1190.16	194	1576.46	267.8	2013.46		
-25.6	610.34	48.2	873.44	122	1198.84	195.8	1586.74	269.6	2023.44		
-23.8	616.01	50	880.61	123.8	1207.61	197.6	1596.91	271.4	2033.41		
-22	621.69	51.8	887.89	125.6	1216.29	199.4	1607.19	273.2	2043.39		
-20.2	627.47	53.6	895.07	127.4	1225.17	201.2	1617.57	275	2053.37		
-18.4	633.24	55.4	902.44	129.2	1233.94	203	1627.84	276.8	2063.34		
-16.6	639.12	57.2	909.72	131	1242.82	204.8	1638.22	278.6	2073.32		
-14.8	644.89	59	917.19	132.8	1251.69	206.6	1648.69	280.4	2083.29		
-13	650.87	60.8	924.57	134.6	1260.67	208.4	1659.17	282.2	2093.27		
-11.2	656.74	62.6	932.04	136.4	1269.64	210.2	1669.64	284	2103.24		

T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)	T (°F)	R (Ω)
-9.4	662.72	64.4	939.52	138.2	1278.62	212	1680.22	285.8	2111.82		
-7.6	668.80	66.2	947.00	140	1287.70	213.8	1690.90	287.6	2120.40		
-5.8	674.77	68	954.57	141.8	1296.77	215.6	1701.57	289.4	2128.97		
-4	680.85	69.8	962.25	143.6	1305.95	217.4	1712.25	291.2	2137.55		
-2.2	687.02	71.6	969.82	145.4	1315.12	219.2	1722.92	293	2146.12		
-0.6	693.20	73.4	977.50	147.2	1324.30	221	1733.60	294.8	2154.70		
1.4	699.37	75.2	985.27	149	1333.47	222.8	1744.27	296.6	2163.27		
3.2	705.55	77	993.05	150.8	1342.75	224.6	1754.95	298.4	2171.85		
5	711.82	78.8	1000.82	152.6	1352.12	226.6	1765.62	300.2	2180.42		

---

# 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

### **BIOS:**

(*basic input output system*) Part of the firmware used during the booting process.

### **BOOL:**

(*boolean*) A basic data type in computing. A `BOOL` variable can have one of these values: 0 (`FALSE`), 1 (`TRUE`). A bit that is extracted from a word is of type `BOOL`.

## C

### **controller:**

Automates industrial processes (also known as programmable logic controller or programmable controller).

### **COP:**

(*Coefficient Of Performance*) It is a ratio of cooling provided to work required.

## D

### **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.

## E

### **EEPROM:**

(*electrically erasable programmable read-only memory*) A type of non-volatile memory to store required data even when power is removed.

### **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.

### **EMC:**

(*electromagnetic compatibility*)

---

**EN:**

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

**expansion bus:**

An electronic communication bus between expansion I/O modules and a controller.

**F****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.

**FLA:**

*(Full-Load Amperes)* Amount of current drawn by the motor at rated load and rated voltage.

**flash memory:**

A non-volatile memory that can be overwritten. It is stored on a special EEPROM that can be erased and reprogrammed.

**H****HVAC&R:**

*(heating, ventilation, and air conditioning and refrigeration)*

**I****I/O:**

*(input/output)*

**ID:**

*(identifier/identification)*

**IEC 61131-3:**

Part 3 of a 3-part IEC standard for industrial automation equipment. IEC 61131-3 is concerned with controller programming languages and defines 2 graphical and 2 textual programming language standards. The graphical programming languages are ladder diagram and function block diagram. The textual programming languages include structured text and instruction list.

**IP20:**

*(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. IP20 devices help protect against electric contact of objects larger than 12.5 mm, but not against water.

**L****LAN:**

*(local area network)* A short-distance communications network that is implemented in a home, office, or institutional environment.

---

**LCD:**

*(liquid crystal display)* Used in many HMI devices to display menus and messages to machine operators.

**LED:**

*(light emitting diode)* An indicator that illuminates under a low-level electrical charge.

**LRA:**

*(Locked-Rotor Amperes)* Amount of current drawn by the motor at rated voltage while its rotor is locked. This provides an indication of the inrush current during start-up.

**M****Modbus SL:**

*(Modbus serial line)* Implementation of the protocol over a RS-232 or RS-485 serial connection.

**Modbus:**

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

**ms:**

*(millisecond)*

**N****NC:**

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

**NEMA:**

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

**network:**

A system of interconnected devices that share a common data path and protocol for communications.

**NO:**

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

**NTC:**

*(Negative Temperature Coefficient)*

**P****PLC:**

*(programmable logic controller)* An industrial computer used to automate manufacturing, industrial, and other electromechanical processes. PLCs are different from common computers in that they are designed to have multiple input and output arrays and adhere to more robust specifications for shock, vibration, temperature, and electrical interference among other things.

---

**power supply terminals:**

The power supply is connected to these terminals to provide power to the controller.

**protocol:**

A convention or standard definition that controls or enables the connection, communication, and data transfer between 2 computing system and devices.

**Pt1000:**

(*platinum 1000*) Resistance thermometers, also referred to as resistance temperature detectors, are sensors used to measure temperature by correlating electrical resistance with temperature. As the temperature changes, the resistance to an electrical current passing through them predictably changes likewise. They are characterized by their nominal resistance  $R_0$  at a temperature of 0 °C.

- Pt1000 ( $R_0 = 1 \text{ k}\Omega$ )

**PTC:**

(*Positive Temperature Coefficient*)

**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 PWM 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-485:**

A standard type of serial communication bus, based on 2 wires (also known as EIA RS-485).

**RTC:**

(*real-time clock*) A battery-backed time-of-day and calendar clock that operates continuously, even when the controller is not powered for the life of the battery.

**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.

**sink input:**

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

**SL:**

(*serial line*)

**SPDT:**

(*single-pole, double-throw*)

**SPST:**

(*single-pole, single-throw*)



---

**SSR:**

*(solid-state relay)*

**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.

**W**

**WORD:**

A type encoded in a 16-bit format.

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