

# Modicon TMC4

## Cartridges

### Programming Guide

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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.

### **DANGER**

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

### **WARNING**

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

### **CAUTION**

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

### **NOTICE**

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

## Please Note

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

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

# About the Book

## Document Scope

This document describes the software configuration of the TMC4 cartridges for EcoStruxure Machine Expert. For further information, refer to the separate documents provided in the EcoStruxure Machine Expert online help.

## Validity Note

This document has been updated for the release of EcoStruxure™ Machine Expert V2.2.

The characteristics that are described in the present document, as well as those described in the documents included in the Related Documents section below, can be found online. To access the information online, go to the Schneider Electric home page [www.se.com/ww/en/download/](http://www.se.com/ww/en/download/).

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

## Related Documents

| Title of Documentation                            | Reference Number   |
|---|--|
| EcoStruxure Machine Expert Programming Guide      | EIO0000002854 (ENG)<br>EIO0000002855 (FRE)<br>EIO0000002856 (GER)<br>EIO0000002858 (SPA)<br>EIO0000002857 (ITA)<br>EIO0000002859 (CHS) |
| Modicon M241 Logic Controller - Programming Guide | EIO0000003059 (ENG)<br>EIO0000003060 (FRE)<br>EIO0000003061 (GER)<br>EIO0000003062 (SPA)<br>EIO0000003063 (ITA)<br>EIO0000003064 (CHS) |
| Modicon TMC4 Cartridges - Hardware Guide          | EIO0000003113 (ENG)<br>EIO0000003114 (FRE)<br>EIO0000003115 (GER)<br>EIO0000003116 (SPA)<br>EIO0000003117 (ITA)<br>EIO0000003118 (CHS) |
| Modicon M241 Logic Controller - Hardware Guide    | EIO0000003083 (ENG)<br>EIO0000003084 (FRE)<br>EIO0000003085 (GER)<br>EIO0000003086 (SPA)<br>EIO0000003087 (ITA)<br>EIO0000003088 (CHS) |

## Product Related Information

### ▲ WARNING

#### LOSS OF CONTROL

- Perform a Failure Mode and Effects Analysis (FMEA), or equivalent risk analysis, of your application, and apply preventive and detective controls before implementation.
- Provide a fallback state for undesired control events or sequences.
- Provide separate or redundant control paths wherever required.
- Supply appropriate parameters, particularly for limits.
- Review the implications of transmission delays and take actions to mitigate them.
- Review the implications of communication link interruptions and take actions to mitigate them.
- Provide independent paths for control functions (for example, emergency stop, over-limit conditions, and error conditions) according to your risk assessment, and applicable codes and regulations.
- Apply local accident prevention and safety regulations and guidelines.<sup>1</sup>
- Test each implementation of a system for proper operation before placing it into service.

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

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

### ▲ WARNING

#### UNINTENDED EQUIPMENT OPERATION

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

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

## Terminology Derived from Standards

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

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

Among others, these standards include:

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

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

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

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

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

# TMC4 Cartridges Configuration General Information

## Introduction

This chapter provides general information to help you configure TMC4 cartridges for EcoStruxure Machine Expert.

## I/O Configuration General Practices

### Match Software and Hardware Configuration

The I/O that may be embedded in your controller is independent of the I/O that you may have added in the form of I/O expansion. It is important that the logical I/O configuration within your program matches the physical I/O configuration of your installation. If you add or remove any physical I/O to or from the I/O expansion bus or, depending on the controller reference, to or from the controller (in the form of cartridges), then you must update your application configuration. This is also true for any field bus devices you may have in your installation. Otherwise, there is the potential that the expansion bus or field bus no longer function while the embedded I/O that may be present in your controller continues to operate.

#### **▲ WARNING**

##### **UNINTENDED EQUIPMENT OPERATION**

Update the configuration of your program each time you add or delete any type of I/O expansions on your I/O bus, or you add or delete any devices on your field bus.

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

## General Description

### Introduction

The TMC4 cartridges connect to Modicon M241 Logic Controllers to increase the number of I/Os available on the controller.

### Cartridge Features

The following table describes the TMC4 cartridge features:

| Reference  | Description  |
|------------|--|
| TMC4AI2    | TMC4 cartridge with 2 analog voltage or current inputs (0...10 V, 0...20 mA, 4...20 mA), 12 bits |
| TMC4TI2    | TMC4 cartridge with 2 analog temperature inputs (thermocouple, RTD), 14 bits                     |
| TMC4AQ2    | TMC4 cartridge with 2 analog voltage or current outputs (0...10 V, 4...20 mA), 16 bits           |
| TMC4HOIS01 | TMC4 application cartridge with 2 analog voltage or current inputs for hoisting load cells       |
| TMC4PACK01 | TMC4 application cartridge with 2 analog voltage or current inputs for packaging                 |

## Logic Controller Compatibility

The following table describes the number of TMC4 cartridges that can be installed in a Modicon M241 Logic Controller:

| Reference   | Cartridge Slots |
|-------------|-----------------|
| TM241C24R   | 1               |
| TM241CE24R  | 1               |
| TM241CEC24R | 1               |
| TM241C24T   | 1               |
| TM241CE24T  | 1               |
| TM241CEC24T | 1               |
| TM241C24U   | 1               |
| TM241CE24U  | 1               |
| TM241CEC24U | 1               |
| TM241C40R   | 2               |
| TM241CE40R  | 2               |
| TM241C40T   | 2               |
| TM241CE40T  | 2               |
| TM241C40U   | 2               |
| TM241CE40U  | 2               |

**NOTE:** For more information on cartridge compatibility with specific controllers, refer to your controller-specific hardware guide.

## Adding Cartridges to a Configuration

### Adding a Cartridge

TMC4 cartridges can be connected to Modicon M241 Logic Controllers with 1 or 2 available cartridge slots.

To add a cartridge to your configuration, select the cartridge in the **Hardware Catalog**, drag it to the **Devices tree**, and drop it on one of the highlighted nodes.

For more information on adding a device to your project, refer to:

- Using the Drag-and-drop Method (see EcoStruxure Machine Expert, Programming Guide)
- Using the Contextual Menu or Plus Button (see EcoStruxure Machine Expert, Programming Guide)

## Configuring Cartridges

### I/O Configuration

The configuration of a cartridge is carried out through the **I/O Mapping** and **I/O Configuration** tabs of the cartridge module.

To display the configuration tabs:

| Step | Action  |
|------|---|
| 1    | In the <b>Devices tree</b> , double-click the cartridge. The <b>I/O Mapping</b> tab appears.  |
| 2    | Edit the parameters of the <b>I/O Mapping</b> tab to configure the addresses used by the cartridge module and diagnostic information.                               |
| 3    | Click the <b>I/O Configuration</b> tab to configure the cartridge. For details on the <b>I/O Configuration</b> tab, refer to the description of individual modules. |

## I/O Mapping Tab Description

The **I/O Mapping** tab allows you to:

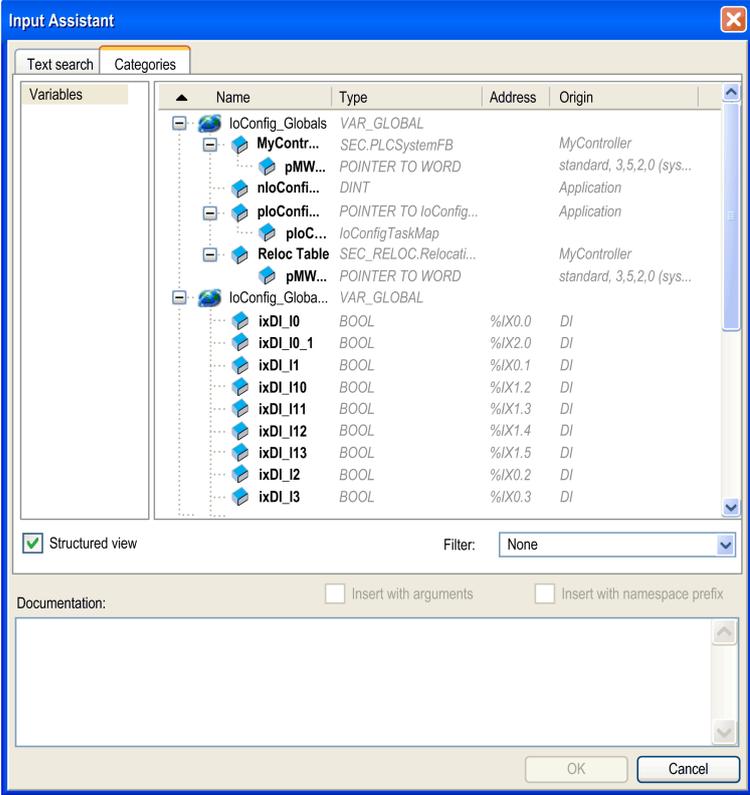
- Map input and output channels onto variables.
- View diagnostic information relating to the status of the cartridge.

This figure shows an example of the **I/O Mapping** tab:

| I/O Mapping   I/O Configuration   Information |         |                 |             |        |               |      |                          |
|---|---------|-----------------|-------------|--------|---------------|------|--------------------------|
| Channels                                      |         |                 |             |        |               |      |                          |
| Variable                                      | Mapping | Channel         | Address     | Type   | Default Value | Unit | Description              |
| Inputs  |         |                 |             |        |               |      |                          |
|   |         | IW0             | %IW2        | INT    |               |      |                          |
|   |         | IW1             | %IW3        | INT    |               |      |                          |
| Diagnostic                                    |         |                 |             |        |               |      |                          |
|   |         | IW2             | %IB8        | BYTE   |               |      |                          |
|   |         | Reserved        | %IX8.0      | BOOL   |               |      | Reserved                 |
|   |         | Reserved        | %IX8.1      | BOOL   |               |      | Reserved                 |
|   |         | ixModule_1_2... | 24VFault    | %IX8.2 | BOOL          |      | +24 V Power disable      |
|   |         | Reserved        | %IX8.3      | BOOL   |               |      | Reserved                 |
|   |         | Reserved        | %IX8.4      | BOOL   |               |      | Reserved                 |
|   |         | ixModule_1_O... | OutOfRan... | %IX8.5 | BOOL          |      | Input out of range (CH0) |
|   |         | ixModule_1_O... | OutOfRan... | %IX8.6 | BOOL          |      | Input out of range (CH1) |
|   |         | Reserved        | %IX8.7      | BOOL   |               |      | Reserved                 |

## I/O Mapping for Inputs/Outputs

This table describes each parameter of the **I/O Mapping** tab for inputs and outputs:

| Parameter            | Description   |
|----------------------|---|
| <b>Variable</b>      | <p>Allows you to map the channel on a variable.</p> <p><b>NOTE:</b> Expand the list of variables from the category <b>Inputs</b> or <b>Outputs</b>.</p> <p>You can map a channel by either creating a new variable or mapping to an existing variable.</p> <p><b>Create new variable:</b></p> <p>Double-click the variable to enter the new variable name. A new variable is created if the variable does not already exist.</p> <p><b>Map to existing variable:</b></p> <p>Double-click the variable and click [...] to open the <b>Input Assistant</b> window. Select the variable from the list and press <b>OK</b>.</p> <p>This figure shows the <b>Input Assistant</b> window:</p>  |
| <b>Mapping</b>       | Indicates whether the channel is mapped on a new variable or an existing variable.  |
| <b>Channel</b>       | Displays the channel name of the device.  |
| <b>Address</b>       | Displays the address of the channel.<br><b>NOTE:</b> If the channel is mapped to an existing variable, the corresponding address appears as strikethrough text in the table.  |
| <b>Type</b>          | Displays the data type of the channel.  |
| <b>Default Value</b> | Indicates the value taken by the output when the controller is in a <b>STOPPED</b> or <b>HALT</b> state.<br><br>Double-click the cell to change the default value.  |
| <b>Unit</b>          | Displays the unit of the channel value.   |
| <b>Description</b>   | Allows you to enter a short description of the channel.   |

# Updating Cartridges Firmware

## Introduction

The TMC4 cartridges have a firmware that you can update. The firmware update can only be done when the cartridge is mounted on the controller.

The firmware version of the cartridge can be seen in the `i_uifirmwareVersion` variable of the `CART_R_STRUCT` (see Modicon M241 Logic Controller, System Functions and Variables, PLCSystem Library Guide) in the M241 PLCSystem Library Guide.

The cartridge firmware is delivered in `.bin` files.

## Description

When the controller starts, it verifies whether there is a file named `cart1.bin` or `cart2.bin` in the `/sys/OS` directory of the internal file system. If such a file is found, and if a cartridge is installed in the controller and configured, the firmware update of the cartridge starts.

**NOTE:** The firmware is only updated if the firmware file is different from the firmware of the cartridge.

The firmware update operation lasts approximately 10 seconds per cartridge.

## Procedure

Follow this procedure to update the cartridge firmware:

| Step | Action   |
|------|--|
| 1    | Copy the <code>.bin</code> file onto the SD card (see Modicon M241 Logic Controller, Programming Guide).   |
| 2    | Generate a script using the SD Card Mass Storage (see Modicon M241 Logic Controller, Programming Guide) editor and the <b>Download</b> command to store the <code>cart1.bin</code> file into the <code>/sys/OS</code> directory of the controller.   |
| 3    | Insert the SD card into the controller and wait until the end of the download: <ul style="list-style-type: none"> <li>• If the download ended successfully, the SD LED (green) is ON, and the ERR LED (red) flashes regularly.</li> <li>• If an error is detected, the SD LED (green) is OFF, and the ERR and I/O LEDs (red) flash regularly.</li> </ul> |
| 4    | Remove the SD card and restart the controller. <p><b>NOTE:</b> The <b>PWR</b> LED of the cartridge is OFF to indicate that the firmware update is in progress.</p>   |
| 5    | Wait until the <b>PWR</b> LED of the cartridge illuminates or flashes, indicating that the firmware update is complete.  |

# TMC4 Standard Cartridges

## TMC4AI2

### Introduction

The TMC4AI2 cartridge features 2 analog voltage or current input channels with 12-bit resolution.

The channel input types are:

- 0...10 V
- 0...20 mA
- 4...20 mA

For further hardware information, refer to TMC4AI2 (see Modicon TMC4, Cartridges, Hardware Guide).

If you have physically wired the analog channel for a voltage signal and you configure the channel for a current signal in EcoStruxure Machine Expert, you may damage the analog circuit.

### **NOTICE**

#### **INOPERABLE EQUIPMENT**

Verify that the physical wiring of the analog circuit is compatible with the software configuration for the analog channel.

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

### I/O Mapping Tab

Refer to [Configuring Cartridges](#), page 10 for a description of how to configure the inputs and outputs of the module.

Variables can be defined and named in the **I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the **I/O Mapping** tab:

| Variable   | Channel       | Type | Description                    |
|------------|---------------|------|--------------------------------|
| Inputs     | iiTMC4AI2_IWO | INT  | Value of the input 0           |
|            | iiTMC4AI2_IW1 | INT  | Value of the input 1           |
| Diagnostic | ibTMC4AI2_IW2 | BYTE | Status of the cartridge        |
|            | Reserved      | BOOL | Reserved                       |
|            | Reserved      | BOOL | Reserved                       |
|            | 24VFault      | BOOL | +24 V power supply disabled    |
|            | Reserved      | BOOL | Reserved                       |
|            | Reserved      | BOOL | Reserved                       |
|            | OutOfRange0   | BOOL | Input out of range (channel 0) |
|            | OutOfRange1   | BOOL | Input out of range (channel 1) |
|            | Reserved      | BOOL | Reserved                       |

For further generic descriptions, refer to [I/O Mapping Tab Description](#), page 11.

## I/O Configuration Tab

For each input, you can define:

| Parameter           |                  | Value  | Default Value    | Description   |
|---------------------|------------------|--|------------------|---|
| <b>Type</b>         |                  | <b>Not used</b><br><b>0 - 10 V</b><br><b>0 - 20 mA</b><br><b>4 - 20 mA</b>       | <b>Not used</b>  | Select the mode of the channel.                                 |
| <b>Min.</b>         | <b>0 - 10 V</b>  | -32768...32767   | 0                | Specifies the lower measurement limit.                          |
|                     | <b>0 - 20 mA</b> |  | 0                |   |
|                     | <b>4 - 20 mA</b> |  | 4000             |   |
| <b>Max.</b>         | <b>0 - 10 V</b>  | -32768...32767   | 10000            | Specifies the upper measurement limit.                          |
|                     | <b>0 - 20 mA</b> |  | 20000            |   |
|                     | <b>4 - 20 mA</b> |  | 20000            |   |
| <b>Filter Level</b> |                  | <b>No Filter</b><br><b>Filter1 (Shortest)</b><br>...<br><b>Filter6 (Longest)</b> | <b>No Filter</b> | Specifies the digital filtering level to apply on this channel. |

## TMC4TI2

### Introduction

The TMC4TI2 cartridge features 2 analog input channels with 14-bit resolution.

The channel input types are:

- K thermocouple
- J thermocouple
- R thermocouple
- S thermocouple
- B thermocouple
- E thermocouple
- T thermocouple
- N thermocouple
- PT100
- PT1000
- NI100
- NI1000

For further hardware information, refer to TMC4TI2 (see Modicon TMC4, Cartridges, Hardware Guide).

### I/O Mapping Tab

Refer to *Configuring Cartridges*, page 10 for a description of how to configure the inputs and outputs of the module.

Variables can be defined and named in the **I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the **I/O Mapping** tab:

| Variable   | Channel             | Type | Description  |
|------------|---------------------|------|--|
| Inputs     | iiTMC4T12_IW0       | INT  | Value of the input 0   |
|            | iiTMC4T12_IW1       | INT  | Value of the input 1   |
|            | iiTMC4T12_IW2       | INT  | Cold-junction (channel 0)                                    |
|            | iiTMC4T12_IW3       | INT  | Cold-junction (channel 1)                                    |
| Diagnostic | ibTMC4T12_IW4       | BYTE | Status of the cartridge                                      |
|            | BrokenWire0         | BOOL | Input broken wire alert (channel 0)                          |
|            | BrokenWire1         | BOOL | Input broken wire alert (channel 1)                          |
|            | 24VFault            | BOOL | +24 V power supply disabled                                  |
|            | ADCreinitialization | BOOL | 0: input values are valid.<br>1: input values are not valid. |
|            | Reserved            | BOOL | Reserved   |
|            | OutOfRange0         | BOOL | Input out of range (channel 0)                               |
|            | OutOfRange1         | BOOL | Input out of range (channel 1)                               |
|            | Reserved            | BOOL | Reserved   |

For further generic descriptions, refer to *I/O Mapping Tab Description*, page 11.

## I/O Configuration Tab

For each input, you can define:

| Parameter                 | Value   | Default Value          | Description   |
|---------------------------|---|------------------------|---|
| <b>Type</b>               | <b>K Thermocouple</b><br><b>J Thermocouple</b><br><b>R Thermocouple</b><br><b>S Thermocouple</b><br><b>B Thermocouple</b><br><b>E Thermocouple</b><br><b>T Thermocouple</b><br><b>N Thermocouple</b><br><b>C Thermocouple</b><br><b>PT100</b><br><b>PT1000</b><br><b>NI100</b><br><b>NI1000</b> | <b>K Thermocouple</b>  | Select the mode of the channel.   |
| <b>Scope</b>              | <b>Customized</b><br><b>Celsius (0.1°C)</b><br><b>Fahrenheit (0.1°F)</b>  | <b>Celsius (0.1°C)</b> | Select the temperature units for a channel.   |
| <b>Minimum</b>            | See the table below   |                        | Specifies the lower measurement limit.  |
| <b>Maximum</b>            | See the table below   |                        | Specifies the upper measurement limit.  |
| <b>WireBrakeDetection</b> | <b>No</b><br><b>Yes</b>   | <b>No</b>              | Activates/deactivates broken wire detection on this channel.  |
| <b>ColdJunctionEnable</b> | <b>No</b><br><b>Yes</b>   | <b>Yes</b>             | For thermocouple inputs, activates/deactivates internal cold junction compensation on this channel.<br><br>Cold junction compensation automatically corrects for temperature variations at the thermocouple reference junction. |
| <b>RTD Wire Mode</b>      | <b>2-wire</b><br><b>3-wire</b><br><b>4-wire</b>   | <b>3-wire</b>          | For PT100, PT100, NI100, and NI1000 input types, select the resistor temperature detector (RTD) wiring mode.  |

| Type                  | Celsius (0.1 °C) |         | Customized |         | Fahrenheit (0.1 °F) |         |
|-----------------------|------------------|---------|------------|---------|---------------------|---------|
|                       | Minimum          | Maximum | Minimum    | Maximum | Minimum             | Maximum |
| <b>K Thermocouple</b> | -2000            | 13000   | -32768     | 32767   | -3280               | 23720   |
| <b>J Thermocouple</b> | -2000            | 10000   | -32768     | 32767   | -3280               | 18320   |
| <b>R Thermocouple</b> | 0                | 17600   | -32768     | 32767   | 320                 | 32000   |
| <b>S Thermocouple</b> | 0                | 17600   | -32768     | 32767   | 320                 | 32000   |
| <b>T Thermocouple</b> | -2000            | 4000    | -32768     | 32767   | -3280               | 7520    |
| <b>B Thermocouple</b> | 0                | 18200   | -32768     | 32767   | 7520                | 32720   |
| <b>E Thermocouple</b> | -2000            | 8000    | -32768     | 32767   | -3280               | 14720   |
| <b>N Thermocouple</b> | -2000            | 13000   | -32768     | 32767   | -3280               | 23720   |
| <b>PT100</b>          | -2000            | 8500    | -32768     | 32767   | -3280               | 15620   |
| <b>PT1000</b>         | -2000            | 8500    | -32768     | 32767   | -3280               | 15620   |
| <b>NI100</b>          | -600             | 1800    | -32768     | 32767   | -760                | 3560    |
| <b>NI1000</b>         | -600             | 1800    | -32768     | 32767   | -760                | 3560    |

## TMC4AQ2

### Introduction

The TMC4AQ2 cartridge features 2 voltage or current analog output channels with 16-bit resolution.

The channel output types are:

- 0...10 V
- 4...20 mA

For further hardware information, refer to TMC4AQ2 (see Modicon TMC4, Cartridges, Hardware Guide).

If you have physically wired the analog channel for a voltage signal and you configure the channel for a current signal in EcoStruxure Machine Expert, you may damage the analog circuit.

### **NOTICE**

#### **INOPERABLE EQUIPMENT**

Verify that the physical wiring of the analog circuit is compatible with the software configuration for the analog channel.

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

### I/O Mapping Tab

Refer to [Configuring Cartridges](#), page 10 for a description of how to configure the inputs and outputs of the module.

Variables can be defined and named in the **I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the **I/O Mapping** tab:

| Variable   | Channel       | Type | Description                          |
|------------|---------------|------|--------------------------------------|
| Outputs    | qiTMC4AQ2_QWO | INT  | Value of the output 0                |
|            | qiTMC4AQ2_QW1 | INT  | Value of the output 1                |
| Diagnostic | ibTMC4AQ2_IWO | BYTE | Status of the cartridge              |
|            | BrokenWire0   | BOOL | Output broken wire alert (channel 0) |
|            | BrokenWire1   | BOOL | Output broken wire alert (channel 1) |
|            | 24VFault      | BOOL | +24 V power supply disabled          |
|            | Reserved      | BOOL | Reserved                             |

For further generic descriptions, refer to *I/O Mapping Tab Description*, page 11.

## I/O Configuration Tab

For each output, you can define:

| Parameter   | Value  | Default Value                    | Description                            |
|-------------|--|----------------------------------|--|
| <b>Type</b> | <b>Not Used</b><br><b>0 - 10 V</b><br><b>4 - 20 mA</b> | <b>Not Used</b>                  | The mode of the channel.               |
| <b>Min.</b> | <b>0 - 10 V</b><br><b>4 - 20 mA</b>                    | -32768...32767<br>0<br>4000      | Specifies the lower measurement limit. |
| <b>Max.</b> | <b>0 - 10 V</b><br><b>4 - 20 mA</b>                    | -32768...32767<br>10000<br>20000 | Specifies the upper measurement limit. |

# TMC4 Application Cartridges

## TMC4HOIS01

### Introduction

The TMC4HOIS01 cartridge features 2 analog voltage or current input channels with 12-bit resolution.

The channel input types are:

- 0...10 V
- 0...20 mA
- 4...20 mA

For further hardware information, refer to TMC4HOIS01 (see Modicon TMC4, Cartridges, Hardware Guide).

If you have physically wired the analog channel for a voltage signal and you configure the channel for a current signal in EcoStruxure Machine Expert, you may damage the analog circuit.

### **NOTICE**

#### **INOPERABLE EQUIPMENT**

Verify that the physical wiring of the analog circuit is compatible with the software configuration for the analog channel.

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

### I/O Mapping Tab

Refer to [Configuring Cartridges](#), page 10 for a description of how to configure the inputs and outputs of the module.

Variables can be defined and named in the **I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the **I/O Mapping** tab:

| Variable   | Channel          | Type | Description                    |
|------------|------------------|------|--------------------------------|
| Inputs     | iiTMC4HOIS01_IW0 | INT  | Value of the input 0           |
|            | iiTMC4HOIS01_IW1 | INT  | Value of the input 1           |
| Diagnostic | ibTMC4HOIS01_IW2 | BYTE | Status of the cartridge        |
|            | Reserved         | BOOL | Reserved                       |
|            | Reserved         | BOOL | Reserved                       |
|            | 24VFault         | BOOL | +24 V power supply disabled    |
|            | Reserved         | BOOL | Reserved                       |
|            | Reserved         | BOOL | Reserved                       |
|            | OutOfRange0      | BOOL | Input out of range (channel 0) |
|            | OutOfRange1      | BOOL | Input out of range (channel 1) |
|            | Reserved         | BOOL | Reserved                       |

For further generic descriptions, refer to [I/O Mapping Tab Description](#), page 11.

## I/O Configuration Tab

For each input, you can define:

| Parameter           |                  | Value  | Default Value    | Description   |
|---------------------|------------------|--|------------------|---|
| <b>Type</b>         |                  | <b>Not used</b><br>0 - 10 V<br>0 - 20 mA<br>4 - 20 mA              | <b>Not used</b>  | Select the mode of the channel.                                 |
| <b>Min.</b>         | <b>0 - 10 V</b>  | -32768...32767   | 0                | Specifies the lower measurement limit.                          |
|                     | <b>0 - 20 mA</b> |  | 0                |   |
|                     | <b>4 - 20 mA</b> |  | 4000             |   |
| <b>Max.</b>         | <b>0 - 10 V</b>  | -32768...32767   | 10000            | Specifies the upper measurement limit.                          |
|                     | <b>0 - 20 mA</b> |  | 20000            |   |
|                     | <b>4 - 20 mA</b> |  | 20000            |   |
| <b>Filter Level</b> |                  | <b>No Filter</b><br>Filter1 (Shortest)<br>...<br>Filter6 (Longest) | <b>No Filter</b> | Specifies the digital filtering level to apply on this channel. |

## TMC4PACK01

### Introduction

The TMC4PACK01 cartridge module features 2 analog voltage or current input channels with 12-bit resolution.

The channel input types are:

- 0...10 V
- 0...20 mA
- 4...20 mA

For further hardware information, refer to TMC4PACK01 (see Modicon TMC4, Cartridges, Hardware Guide).

If you have physically wired the analog channel for a voltage signal and you configure the channel for a current signal in EcoStruxure Machine Expert, you may damage the analog circuit.

|  |
|--|
| <b>NOTICE</b>  |
| <p><b>INOPERABLE EQUIPMENT</b></p> <p>Verify that the physical wiring of the analog circuit is compatible with the software configuration for the analog channel.</p> <p><b>Failure to follow these instructions can result in equipment damage.</b></p> |

## I/O Mapping Tab

Refer to *Configuring Cartridges*, page 10 for a description of how to configure the inputs and outputs of the module.

Variables can be defined and named in the **I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the **I/O Mapping** tab:

| Variable   | Channel          | Type | Description                    |
|------------|------------------|------|--------------------------------|
| Inputs     | iiTMC4PACK01_IW0 | INT  | Value of the input 0           |
|            | iiTMC4PACK01_IW1 | INT  | Value of the input 1           |
| Diagnostic | ibTMC4PACK01_IW2 | BYTE | Status of the cartridge        |
|            | Reserved         | BOOL | Reserved                       |
|            | Reserved         | BOOL | Reserved                       |
|            | 24VFault         | BOOL | +24 V power supply disabled    |
|            | Reserved         | BOOL | Reserved                       |
|            | Reserved         | BOOL | Reserved                       |
|            | OutOfRange0      | BOOL | Input out of range (channel 0) |
|            | OutOfRange1      | BOOL | Input out of range (channel 1) |
|            | Reserved         | BOOL | Reserved                       |

For further generic descriptions, refer to *I/O Mapping Tab Description*, page 11.

## I/O Configuration Tab

For each input, you can define:

| Parameter    | Value   | Default Value  | Description   |
|--------------|---|----------------|---|
| Type         | Not used<br>0 - 10 V<br>0 - 20 mA<br>4 - 20 mA              | Not used       | Select the mode of the channel.                                 |
| Min.         | 0 - 10 V  | -32768...32767 | Specifies the lower measurement limit.                          |
|              | 0 - 20 mA   | 0              |   |
|              | 4 - 20 mA   | 4000           |   |
| Max.         | 0 - 10 V  | -32768...32767 | Specifies the upper measurement limit.                          |
|              | 0 - 20 mA   | 10000          |   |
|              | 4 - 20 mA   | 20000          |   |
| Filter Level | No Filter<br>Filter1 (Shortest)<br>...<br>Filter6 (Longest) | No Filter      | Specifies the digital filtering level to apply on this channel. |

# 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.

## B

### **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`; for example, `%MW10.4` is a fifth bit of memory word number 10.

### **byte:**

A type that is encoded in an 8-bit format, ranging from 00 hex to FF hex.

## C

### **configuration:**

The arrangement and interconnection of hardware components within a system and the hardware and software parameters that determine the operating characteristics of the system.

### **controller:**

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

## E

### **equipment:**

A part of a machine including sub-assemblies such as conveyors, turntables, and so on.

### **expansion bus:**

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

## 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.

## I

### **I/O:**

(*input/output*)

**IEC:**

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

**INT:**

*(integer)* A whole number encoded in 16 bits.

**L**

**LED:**

*(light emitting diode)* An indicator that illuminates under a low-level electrical charge.

**N**

**node:**

An addressable device on a communication network.

**O**

**OS:**

*(operating system)* A collection of software that manages computer hardware resources and provides common services for computer programs.

**P**

**program:**

The component of an application that consists of compiled source code capable of being installed in the memory of a logic controller.

**S**

**symbol:**

A string of a maximum of 32 alphanumeric characters, of which the first character is alphabetic. It allows you to personalize a controller object to facilitate the maintainability of the application.

**V**

**variable:**

A memory unit that is addressed and modified by a program.

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Schneider Electric  
35 rue Joseph Monier  
92500 Rueil Malmaison  
France

+ 33 (0) 1 41 29 70 00

[www.se.com](http://www.se.com)

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