Modicon TMC2
Cartridges
Hardware Guide

12/2018
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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

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

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

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<td>Index</td>
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</table>
Important Information

NOTICE

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

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

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

⚠️ DANGER

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

⚠️ WARNING

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

⚠️ CAUTION

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

⚠️ NOTICE

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

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

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

At a Glance

Document Scope
This guide describes the hardware implementation of TMC2. It provides the parts description, characteristics, wiring diagrams, and installation details for TMC2.

Validity Note
The information in this manual is applicable only for TMC2 products.
This document has been updated for the release of EcoStruxure™ Machine Expert - Basic V1.0.
For product compliance and environmental information (RoHS, REACH, PEP, EOLI, etc.), go to www.schneider-electric.com/green-premium.
The technical characteristics of the devices described in the present document also appear online.
To access the information online:

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

The characteristics that are presented in 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

<table>
<thead>
<tr>
<th>Title of Documentation</th>
<th>Reference Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modicon TMC2 Cartridges - Programming Guide</td>
<td>EIO0000003329 (ENG)</td>
</tr>
<tr>
<td></td>
<td>EIO0000003330 (FRA)</td>
</tr>
<tr>
<td></td>
<td>EIO0000003331 (GER)</td>
</tr>
<tr>
<td></td>
<td>EIO0000003332 (SPA)</td>
</tr>
<tr>
<td></td>
<td>EIO0000003333 (ITA)</td>
</tr>
<tr>
<td></td>
<td>EIO0000003334 (CHS)</td>
</tr>
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<td></td>
<td>EIO0000003335 (POR)</td>
</tr>
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<td></td>
<td>EIO0000003336 (TUR)</td>
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| Modicon M221 Logic Controller - Hardware Guide| EIO0000003313 (ENG) |
|                                               | EIO0000003314 (FRA) |
|                                               | EIO0000003315 (GER) |
|                                               | EIO0000003316 (SPA) |
|                                               | EIO0000003317 (ITA) |
|                                               | EIO0000003318 (CHS) |
|                                               | EIO0000003319 (POR) |
|                                               | EIO0000003320 (TUR) |

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

Product Related Information

**DANGER**

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

**DANGER**

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

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

**WARNING**

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

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


**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:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
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<tr>
<td>EN 61131-2:2007</td>
<td>Programmable controllers, part 2: Equipment requirements and tests.</td>
</tr>
<tr>
<td>ISO 12100:2010</td>
<td>Safety of machinery - General principles for design - Risk assessment and risk reduction</td>
</tr>
<tr>
<td>EN 60204-1:2006</td>
<td>Safety of machinery - Electrical equipment of machines - Part 1: General requirements</td>
</tr>
<tr>
<td>ISO 13850:2006</td>
<td>Safety of machinery - Emergency stop - Principles for design</td>
</tr>
<tr>
<td>2006/42/EC</td>
<td>Machinery Directive</td>
</tr>
<tr>
<td>2014/30/EU</td>
<td>Electromagnetic Compatibility Directive</td>
</tr>
<tr>
<td>2014/35/EU</td>
<td>Low Voltage Directive</td>
</tr>
</tbody>
</table>
In addition, terms used in the present document may tangentially be used as they are derived from other standards such as:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 60034 series</td>
<td>Rotating electrical machines</td>
</tr>
<tr>
<td>IEC 61800 series</td>
<td>Adjustable speed electrical power drive systems</td>
</tr>
<tr>
<td>IEC 61158 series</td>
<td>Digital data communications for measurement and control – Fieldbus for use in industrial control systems</td>
</tr>
</tbody>
</table>

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

**NOTE:** The aforementioned standards may or may not apply to the specific products cited in the present documentation. For more information concerning the individual standards applicable to the products described herein, see the characteristics tables for those product references.
Part I
TMC2 General Overview

What Is in This Part?
This part contains the following chapters:

<table>
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<tr>
<th>Chapter</th>
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<tr>
<td>2</td>
<td>TMC2 Installation</td>
<td>17</td>
</tr>
</tbody>
</table>
Chapter 1
TMC2 Description

General Description

Introduction
The cartridges are designed to be connected to the Modicon TM221C Logic Controller range.

Cartridges Features
The following table describes the TMC2 cartridges features:

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMC2AI2</td>
<td>(see page 39) TMC2 cartridge with 2 analog voltage or current inputs (0…10 V, 0…20 mA, 4…20 mA), 12 bits</td>
</tr>
<tr>
<td>TMC2TI2</td>
<td>(see page 45) TMC2 cartridge with 2 analog temperature inputs (thermocouple, RTD), 14 bits</td>
</tr>
<tr>
<td>TMC2AQ2V</td>
<td>(see page 51) TMC2 cartridge with 2 analog voltage outputs (0…10 V), 12 bits</td>
</tr>
<tr>
<td>TMC2AQ2C</td>
<td>(see page 57) TMC2 cartridge with 2 analog current outputs (4…20 mA), 12 bits</td>
</tr>
<tr>
<td>TMC2SL1</td>
<td>(see page 63) TMC2 cartridge with 1 serial line (RS232 or RS485)</td>
</tr>
<tr>
<td>TMC2HOIS01</td>
<td>(see page 71) TMC2 application cartridge with 2 analog voltage or current inputs for hoisting load cells</td>
</tr>
<tr>
<td>TMC2PACK01</td>
<td>(see page 77) TMC2 application cartridge with 2 analog voltage or current inputs for packaging</td>
</tr>
<tr>
<td>TMC2CONV01</td>
<td>(see page 83) TMC2 application cartridge with 1 serial line for conveying</td>
</tr>
</tbody>
</table>
Logic Controller Compatibility

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

The following table describes the number of TMC2 cartridges that can be installed in a Modicon TM221C Logic Controller:

<table>
<thead>
<tr>
<th>Reference</th>
<th>Cartridge Slots</th>
<th>Compatible Cartridges</th>
<th>Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>TM221C16R</td>
<td>1</td>
<td>TMC2AI2</td>
<td>0</td>
</tr>
<tr>
<td>TM221CE16R</td>
<td>1</td>
<td>TMC2TI2</td>
<td>0</td>
</tr>
<tr>
<td>TM221C16T</td>
<td>1</td>
<td>TMC2AQ2V</td>
<td>0</td>
</tr>
<tr>
<td>TM221CE16T</td>
<td>1</td>
<td>TMC2AQ2C</td>
<td>0</td>
</tr>
<tr>
<td>TM221C4R</td>
<td>2 (1)</td>
<td>TMC2HOIS01</td>
<td>1</td>
</tr>
<tr>
<td>TM221CE4R</td>
<td>2 (1)</td>
<td>TMC2PACK01</td>
<td>1</td>
</tr>
<tr>
<td>TM221C4T</td>
<td>2 (1)</td>
<td>TMC2SL1</td>
<td>0</td>
</tr>
<tr>
<td>TM221CE4T</td>
<td>2 (1)</td>
<td>TMC2CONV01</td>
<td>0</td>
</tr>
</tbody>
</table>

(1) Only one serial line cartridge (TMC2SL1; TMC2CONV01) may be added to a logic controller.

NOTICE

ELECTROSTATIC DISCHARGE

- Verify that empty cartridge slots have their covers in place before applying power to the controller.
- Do not touch the contacts of the cartridge.
- Only handle the cartridge on the housing.
- Take the necessary protective measures against electrostatic discharges.

Failure to follow these instructions can result in equipment damage.
Chapter 2
TMC2 Installation

What Is in This Chapter?
This chapter contains the following sections:

<table>
<thead>
<tr>
<th>Section</th>
<th>Topic</th>
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<td>2.2</td>
<td>TMC2 Installation</td>
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<tr>
<td>2.3</td>
<td>TMC2 Electrical Requirements</td>
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</tr>
</tbody>
</table>
Section 2.1
TMC2 General Rules for Implementing

What Is in This Section?
This section contains the following topics:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
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</thead>
<tbody>
<tr>
<td>Environmental Characteristics</td>
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</tr>
<tr>
<td>Certifications and Standards</td>
<td>20</td>
</tr>
</tbody>
</table>
Environmental Characteristics

TMC2

TMC2 cartridge environmental characteristics are the same as the Modicon TM221C Logic Controller (see Modicon M221 Logic Controller, Hardware Guide).
Certifications and Standards

Introduction

The M221 Logic Controllers are designed to conform to the main national and international standards concerning electronic industrial control devices:

- IEC/EN 61131-2
- UL 508

The M221 Logic Controllers have obtained the following conformity marks:

- CE
- CSA (except for TM221C•••U)
- EAC
- RCM
- UL
- cCSAus Hazardous Location (except for TM221C•••U)

For product compliance and environmental information (RoHS, REACH, PEP, EOLI, etc.), go to www.schneider-electric.com/green-premium.
Section 2.2
TMC2 Installation

What Is in This Section?
This section contains the following topics:

<table>
<thead>
<tr>
<th>Topic</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Installation and Maintenance Requirements</td>
<td>22</td>
</tr>
<tr>
<td>TMC2 Installation</td>
<td>24</td>
</tr>
</tbody>
</table>
Installation and Maintenance Requirements

Before Starting

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

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

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

Disconnecting Power

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

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
</table>

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Operating Environment

In addition to the Environmental Characteristics, refer to Product Related Information in the beginning of the present document for important information regarding installation in hazardous locations for this specific equipment.

NOTE: For important safety information and the environment characteristics of the TMC2 cartridges, see the M221 Logic Controller Hardware Guide.

Installation Considerations

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

NOTE: JDYX2 or JDYX8 fuse types are UL-recognized and CSA approved.
TMC2 Installation

Installation Considerations

The TMC2 cartridge is designed to operate within the same temperature range as the controllers, including the controller derating for extended temperature operation, and temperature restrictions associated with the mounting positions. Refer to the controller mounting position and clearance (see Modicon M221 Logic Controller, Hardware Guide) for more information.

Installation

**DANGER**

**ELECTRIC SHOCK 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.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Use protective gloves when installing or removing the cartridges.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

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

**NOTICE**

**ELECTROSTATIC DISCHARGE**

- Verify that empty cartridge slots have their covers in place before applying power to the controller.
- Do not touch the contacts of the cartridge.
- Only handle the cartridge on the housing.
- Take the necessary protective measures against electrostatic discharges.

Failure to follow these instructions can result in equipment damage.
The following table describes the different steps to install a TMC2 cartridge on the controller:

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Disconnect all power from all equipment prior to removing any covers or installing a cartridge.</td>
</tr>
<tr>
<td>2</td>
<td>Remove the cartridge from the packaging.</td>
</tr>
<tr>
<td>3</td>
<td>Press the locking clip on the top of the cartridge cover with an insulated screwdriver and pull up the cover gently.</td>
</tr>
</tbody>
</table>
| 4    | Remove by hand the cartridge slot cover from the controller.  
**NOTE:** Keep the cover to reuse it for the de-installation. |
<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Place the cartridge in the slot on the controller.</td>
</tr>
<tr>
<td>6</td>
<td>Push the cartridge into the slot until it clicks.</td>
</tr>
</tbody>
</table>
De-installation

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ELECTRIC SHOCK OR ARC FLASH</strong></td>
</tr>
<tr>
<td>• 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.</td>
</tr>
<tr>
<td>• Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.</td>
</tr>
<tr>
<td>• Use protective gloves when installing or removing the cartridges.</td>
</tr>
<tr>
<td>• Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.</td>
</tr>
<tr>
<td>• Use only the specified voltage when operating this equipment and any associated products.</td>
</tr>
<tr>
<td><strong>Failure to follow these instructions will result in death or serious injury.</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ELECTROSTATIC DISCHARGE</strong></td>
</tr>
<tr>
<td>• Verify that empty cartridge slots have their covers in place before applying power to the controller.</td>
</tr>
<tr>
<td>• Do not touch the contacts of the cartridge.</td>
</tr>
<tr>
<td>• Only handle the cartridge on the housing.</td>
</tr>
<tr>
<td>• Take the necessary protective measures against electrostatic discharges.</td>
</tr>
<tr>
<td><strong>Failure to follow these instructions can result in equipment damage.</strong></td>
</tr>
</tbody>
</table>
The following table describes the different steps to de-install a TMC2 cartridge from the controller:

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Disconnect all power from all equipment, including connected devices, prior to removing a cartridge.</td>
</tr>
<tr>
<td>2</td>
<td>Press the locking clip on the top of the cartridge with an insulated screwdriver and pull up the cartridge gently.</td>
</tr>
<tr>
<td>3</td>
<td>Remove by hand the cartridge from the controller.</td>
</tr>
<tr>
<td>Step</td>
<td>Action</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
</tr>
<tr>
<td>4</td>
<td>Place the cartridge slot cover in the slot on the controller.</td>
</tr>
<tr>
<td>5</td>
<td>Push the cartridge slot cover into the slot until it clicks.</td>
</tr>
</tbody>
</table>
Section 2.3
TMC2 Electrical Requirements

What Is in This Section?
This section contains the following topics:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiring Best Practices</td>
<td>31</td>
</tr>
<tr>
<td>Grounding the M221 System</td>
<td>34</td>
</tr>
</tbody>
</table>
Wiring Best Practices

Overview

This section describes the wiring guidelines and associated best practices to be respected when using the M221 Logic Controller system.

⚠️ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

⚠️ WARNING

LOSS OF CONTROL

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

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

Wiring Guidelines

The following rules must be applied when wiring a M221 Logic Controller system:

- I/O and communication wiring must be kept separate from the power wiring. Route these 2 types of wiring in separate cable ducting.
- Verify that the operating conditions and environment are within the specification values.
- Use proper wire sizes to meet voltage and current requirements.
- Use copper conductors (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.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNINTENDED EQUIPMENT OPERATION</td>
</tr>
<tr>
<td>- Use shielded cables for all fast I/O, analog I/O and communication signals.</td>
</tr>
<tr>
<td>- Ground cable shields for all analog I/O, fast I/O and communication signals at a single point.</td>
</tr>
<tr>
<td>- Route communication and I/O cables separately from power cables.</td>
</tr>
</tbody>
</table>

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

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

For more details, refer to Grounding Shielded Cables (see page 34).

NOTE: Surface temperatures may exceed 60 °C (140 °F). To conform to IEC 61010 standards, route primary wiring (wires connected to power mains) separately and apart from secondary wiring (extra low voltage wiring coming from intervening power sources). If that is not possible, double insulation is required such as conduit or cable gains.

The cartridge connectors are not removable.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>INOPERABLE EQUIPMENT</td>
</tr>
<tr>
<td>Do not attempt to remove the connectors from the cartridge.</td>
</tr>
</tbody>
</table>

Failure to follow these instructions can result in equipment damage.
Rules for Non-Removable Screw Terminal Block

The following table shows the cable types and wire sizes for a **3.81 mm (0.15 in.) pitch non-removable screw terminal block**:

<table>
<thead>
<tr>
<th>mm²</th>
<th>mm³</th>
<th>AWG</th>
<th>Nm</th>
<th>lb-in</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.14...1.5</td>
<td>0.14...1.5</td>
<td>0.25...1.5</td>
<td>0.25...0.5</td>
<td>2 x 0.5</td>
</tr>
<tr>
<td>25...16</td>
<td>25...16</td>
<td>23...16</td>
<td>22...20</td>
<td>2 x 20</td>
</tr>
</tbody>
</table>

The use of copper conductors is required.

**DANGER**

LOOSE WIRING CAUSES ELECTRIC SHOCK
Tighten connections in conformance with the torque specifications.
Failure to follow these instructions will result in death or serious injury.

**DANGER**

FIRE HAZARD
- Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.
- For relay output (2 A) wiring, use conductors of at least 0.5 mm² (AWG 20) with a temperature rating of at least 80 °C (176 °F).
- For common conductors of relay output wiring (7 A), or relay output wiring greater than 2 A, use conductors of at least 1.0 mm² (AWG 16) with a temperature rating of at least 80 °C (176 °F).

Failure to follow these instructions will result in death or serious injury.
Grounding the M221 System

Overview

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

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UNINTENDED EQUIPMENT OPERATION</strong></td>
</tr>
<tr>
<td>● Use shielded cables for all fast I/O, analog I/O, and communication signals.</td>
</tr>
<tr>
<td>● Ground cable shields for all fast I/O, analog I/O, and communication signals at a single point.</td>
</tr>
<tr>
<td>● Route communications and I/O cables separately from power cables.</td>
</tr>
<tr>
<td><strong>Failure to follow these instructions can result in death, serious injury, or equipment damage.</strong></td>
</tr>
</tbody>
</table>

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

The use of shielded cables requires compliance with the following wiring rules:

● For protective ground connections (PE), metal conduit or ducting can be used for part of the shielding length, provided there is no break in the continuity of the ground connections. For functional ground (FE), the shielding is intended to attenuate electromagnetic interference and the shielding must be continuous for the length of the cable. If the purpose is both functional and protective, as is often the case for communication cables, the cable must have continuous shielding.

● Wherever possible, keep cables carrying one type of signal separate from the cables carrying other types of signals or power.

Protective Ground (PE) on the Backplane

The protective ground (PE) is connected to the conductive backplane by a heavy-duty wire, usually a braided copper cable with the maximum allowable cable section.
Shielded Cables Connections

Cables carrying the fast I/O, analog I/O, and field bus communication signals must be shielded. The shielding must be securely connected to ground. The fast I/O and analog I/O shields may be connected either to the functional ground (FE) or to the protective ground (PE) of your M221 Logic Controller. The field bus communication cable shields must be connected to the protective ground (PE) with a connecting clamp secured to the conductive backplane of your installation.

The shielding of the Modbus cable must be connected to the protective ground (PE).

DANGER

ELECTRIC SHOCK

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

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

Protective Ground (PE) Cable Shielding

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

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Strip the shielding for a length of 15 mm (0.59 in.)</td>
</tr>
<tr>
<td>2</td>
<td>Attach the cable to the conductive backplane plate by attaching the grounding clamp to the stripped part of the shielding as close as possible to the M221 Logic Controller system base.</td>
</tr>
</tbody>
</table>

NOTE: The shielding must be clamped securely to the conductive backplane to ensure a good contact.
**Functional Ground (FE) Cable Shielding**

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

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Install the Grounding Bar directly on the conductive backplane below the M221 Logic Controller system as illustrated.</td>
</tr>
<tr>
<td>2</td>
<td>Strip the shielding for a length of 15 mm (0.59 in.):</td>
</tr>
<tr>
<td>3</td>
<td>Tightly clamp on the blade connector (1) using nylon fastener (2)(width 2.5...3 mm (0.1...0.12 in.)) and appropriate tool.</td>
</tr>
</tbody>
</table>

**NOTE:** Use the TM2XMTGB Grounding Bar exclusively for Functional Ground (FE) connections.

**WARNING**

ACCIDENTAL DISCONNECTION FROM PROTECTIVE GROUND (PE)
- Do not use the TM2XMTGB Grounding Plate to provide a protective ground (PE).
- Use the TM2XMTGB Grounding Plate only to provide a functional ground (FE).

Failure to follow these instructions can result in death, serious injury, or equipment damage.
Part II
TMC2 Standard Cartridges

What Is in This Part?

This part contains the following chapters:

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Chapter Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>TMC2AI2 Analog Voltage, Current Inputs</td>
<td>39</td>
</tr>
<tr>
<td>4</td>
<td>TMC2TI2 Analog Temperature Inputs</td>
<td>45</td>
</tr>
<tr>
<td>5</td>
<td>TMC2AQ2V Analog Voltage Outputs</td>
<td>51</td>
</tr>
<tr>
<td>6</td>
<td>TMC2AQ2C Analog Current Outputs</td>
<td>57</td>
</tr>
<tr>
<td>7</td>
<td>TMC2SL1 Serial Line</td>
<td>63</td>
</tr>
</tbody>
</table>
Chapter 3
TMC2AI2 Analog Voltage, Current Inputs

Overview
This chapter describes the TMC2AI2 cartridge, its characteristics, and its connections.

What is in This Chapter?
This chapter contains the following topics:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMC2AI2 Presentation</td>
<td>40</td>
</tr>
<tr>
<td>TMC2AI2 Characteristics</td>
<td>41</td>
</tr>
<tr>
<td>TMC2AI2 Wiring Diagram</td>
<td>43</td>
</tr>
</tbody>
</table>
TMC2AI2 Analog Voltage, Current Inputs

TMC2AI2 Presentation

Overview

The following features are integrated into the TMC2AI2 cartridge:
- 2 analog inputs (voltage or current)
- non-removable screw terminal block, 3.81 mm (0.15 in.) pitch

Main Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal type</td>
<td>Voltage</td>
</tr>
<tr>
<td>Number of input channels</td>
<td>2</td>
</tr>
<tr>
<td>Input range</td>
<td>0...10 Vdc</td>
</tr>
<tr>
<td>Resolution</td>
<td>12 bits (4096 steps)</td>
</tr>
<tr>
<td>Connection type</td>
<td>3.81 mm (0.15 in.) pitch, non-removable screw terminal block</td>
</tr>
<tr>
<td>Weight</td>
<td>15 g (0.53 oz)</td>
</tr>
</tbody>
</table>
TMC2AI2 Characteristics

Introduction
This section provides a general description of the TMC2AI2 cartridge characteristics.

WARNING

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

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

NOTE: For important safety information and the environment characteristics of the TMC2 cartridges, see the M221 Logic Controller Hardware Guide.

Connectors
The following diagram shows a TMC2AI2 cartridge marking and connectors:
### Input Characteristics

The following table describes the cartridge input characteristics:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal Type</strong></td>
<td><strong>Voltage</strong></td>
</tr>
<tr>
<td>Rated input range</td>
<td>0...10 Vdc</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Input impedance</td>
<td>&gt; 1 MΩ</td>
</tr>
<tr>
<td>Sample duration time</td>
<td>10 ms per enabled channel</td>
</tr>
<tr>
<td>Input type</td>
<td>single-ended</td>
</tr>
<tr>
<td>Operating mode</td>
<td>self-scan</td>
</tr>
<tr>
<td>Conversion mode</td>
<td>SAR type</td>
</tr>
<tr>
<td>Maximum accuracy at ambient temperature: 25 °C (77 °F)</td>
<td>± 0.1 % of full scale</td>
</tr>
<tr>
<td>Temperature drift</td>
<td>± 0.02 % of full scale per 1 °C (1.8 °F)</td>
</tr>
<tr>
<td>Repeatability after stabilization time</td>
<td>± 0.5 % of full scale</td>
</tr>
<tr>
<td>Non-linearity</td>
<td>± 0.01 % of full scale</td>
</tr>
<tr>
<td>Maximum input deviation</td>
<td>± 1.0 % of full scale</td>
</tr>
<tr>
<td>Digital resolution</td>
<td>12 bits (4096 steps)</td>
</tr>
<tr>
<td>Input value of LSB</td>
<td>2.44 mV (0...10 Vdc range)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Data type in application program</td>
<td>scalable from –32768 to 32767</td>
</tr>
<tr>
<td>Input data out of detection range</td>
<td>yes</td>
</tr>
<tr>
<td>Noise resistance maximun temporary deviation during perturbations</td>
<td>± 4.0 % of the full scale maximum when EMC perturbation is applied to the power and I/O wiring</td>
</tr>
<tr>
<td>Cable type and maximum length</td>
<td>twisted-pair shielded</td>
</tr>
<tr>
<td></td>
<td>&lt; 30 m (98.4 ft)</td>
</tr>
<tr>
<td>Crosstalk (maximum)</td>
<td>1 LSB</td>
</tr>
<tr>
<td>Isolation between inputs and internal logic</td>
<td>not isolated</td>
</tr>
<tr>
<td>Maximum continuous overload allowed (without damage)</td>
<td>13 Vdc</td>
</tr>
<tr>
<td>Input filter</td>
<td>software filter: 0...10 s (with 0.1 s increment)</td>
</tr>
</tbody>
</table>
TMC2AI2 Wiring Diagram

Introduction
This cartridge has a non-removable screw terminal block for the connection of the inputs.

Wiring
See Wiring Best Practices (see page 31).

Wiring Diagram
The following figure shows an example of the voltage and current input connection:

(1): Current/Voltage analog output device

NOTE: Each input can be connected to either a voltage or current input.
Chapter 4
TMC2TI2 Analog Temperature Inputs

Overview
This chapter describes the TMC2TI2 cartridge, its characteristics, and its connections.

What is in This Chapter?
This chapter contains the following topics:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMC2TI2 Presentation</td>
<td>46</td>
</tr>
<tr>
<td>TMC2TI2 Characteristics</td>
<td>47</td>
</tr>
<tr>
<td>TMC2TI2 Wiring Diagram</td>
<td>50</td>
</tr>
</tbody>
</table>
TMC2TI2 Presentation

Overview
The following features are integrated into the TMC2TI2 cartridge:
- 2 analog temperature inputs (thermocouple or RTD)
- non-removable screw terminal block, 3.81 mm (0.15 in.) pitch

Main Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal type</td>
<td>Value</td>
</tr>
<tr>
<td>Number of input channels</td>
<td>2</td>
</tr>
<tr>
<td>Input range</td>
<td>type: K, J, R, S, B, E, T, N, C</td>
</tr>
<tr>
<td>Resolution</td>
<td>14 bits</td>
</tr>
<tr>
<td>Connection type</td>
<td>3.81 mm (0.15 in.) pitch, non-removable screw terminal block</td>
</tr>
<tr>
<td>Weight</td>
<td>15 g (0.53 oz)</td>
</tr>
</tbody>
</table>
TMC2TI2 Characteristics

Introduction

This section provides a general description of the TMC2TI2 cartridge characteristics.

WARNING

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

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

NOTE: For important safety information and the environment characteristics of the TMC2 cartridges, see the M221 Logic Controller Hardware Guide.

Connectors

The following diagram shows a TMC2TI2 cartridge marking and connectors:
**Input Characteristics**

The following table describes the cartridge input characteristics:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal Type</strong></td>
<td><strong>Thermocouple</strong></td>
</tr>
<tr>
<td></td>
<td><strong>3 wires RTD</strong></td>
</tr>
<tr>
<td>Rated input range</td>
<td>thermocouple type:</td>
</tr>
<tr>
<td></td>
<td>K: –200...+1300 °C</td>
</tr>
<tr>
<td></td>
<td>(–328...+2372 °F)</td>
</tr>
<tr>
<td></td>
<td>J: –200...+1000 °C</td>
</tr>
<tr>
<td></td>
<td>(–328...+1832 °F)</td>
</tr>
<tr>
<td></td>
<td>R: 0...+1760 °C</td>
</tr>
<tr>
<td></td>
<td>(+32...+3200 °F)</td>
</tr>
<tr>
<td></td>
<td>S: 0...+1760 °C</td>
</tr>
<tr>
<td></td>
<td>(+32...+3200 °F)</td>
</tr>
<tr>
<td></td>
<td>B: 0...+1820 °C</td>
</tr>
<tr>
<td></td>
<td>(+32...+3308 °F)</td>
</tr>
<tr>
<td></td>
<td>E: –200...+800 °C</td>
</tr>
<tr>
<td></td>
<td>(–328...+1472 °F)</td>
</tr>
<tr>
<td></td>
<td>T: –200...+400 °C</td>
</tr>
<tr>
<td></td>
<td>(–328...+752 °F)</td>
</tr>
<tr>
<td></td>
<td>N: –200...+1300 °C</td>
</tr>
<tr>
<td></td>
<td>(–328...+2372 °F)</td>
</tr>
<tr>
<td></td>
<td>C: 0...+2315 °C</td>
</tr>
<tr>
<td></td>
<td>(+32...+4199 °F)</td>
</tr>
<tr>
<td></td>
<td>RTD type:</td>
</tr>
<tr>
<td></td>
<td>Pt100: –200...+850 °C</td>
</tr>
<tr>
<td></td>
<td>(–328...+1562 °F)</td>
</tr>
<tr>
<td></td>
<td>Pt1000: –200...+600 °C</td>
</tr>
<tr>
<td></td>
<td>(–328...+1112 °F)</td>
</tr>
<tr>
<td></td>
<td>Ni100: –60...+180 °C</td>
</tr>
<tr>
<td></td>
<td>(–76...+356 °F)</td>
</tr>
<tr>
<td></td>
<td>Ni1000: –60...+180 °C</td>
</tr>
<tr>
<td></td>
<td>(–76...+356 °F)</td>
</tr>
<tr>
<td>Input impedance</td>
<td>&gt; 1 MΩ</td>
</tr>
<tr>
<td>Sample duration time</td>
<td>125 ms per enabled channel</td>
</tr>
<tr>
<td></td>
<td>250 ms per enabled channel</td>
</tr>
<tr>
<td>Input type</td>
<td>single-ended</td>
</tr>
<tr>
<td>Operating mode</td>
<td>self-scan</td>
</tr>
<tr>
<td>Conversion mode</td>
<td>SAR type</td>
</tr>
</tbody>
</table>
| Maximum accuracy      | K, J, E, T, N: ± 0.1 % of full scale at ambient temperature: 25 °C (77 °F) ± 0.4 % of full scale at temperature < 0 °C (32 °F) R, S: ± 6 °C (10.8 °F) of full scale for measured temperature range: 0...200 °C (32...392 °F) B: not specified C: ± 0.1 % of full scale at ambient temperature: 25 °C (77 °F) ± 0.1 % of full scale at ambient temperature: 25 °C (77 °F) ± 0.02 % of full scale per 1 °C (1.8 °F) Repeatability after stabilization time ± 0.5 % of full scale Non-linearity ± 0.01 % of full scale
### TMC2T12 Analog Temperature Inputs

**Maximum input deviation** ± 1.0 % of full scale

**Digital resolution**
- Thermocouple type: K: 15000 steps, J: 12000 steps, R: 17600 steps, S: 17600 steps, B: 18200 steps, E: 10000 steps, T: 6000 steps, N: 15000 steps, C: 23150 steps
- RTD type: Pt100: 10500 steps, Pt1000: 8000 steps, Ni100: 2400 steps, Ni1000: 2400 steps

**Input value of LSB** 0.1 °C (0.18 °F)

**Data type in application program** scalable from –32768 to 32767

**Input data out of detection range** yes

**Noise resistance**
- Maximum temporary deviation during perturbations: ± 4.0 % of the full scale maximum when EMC perturbation is applied to the power and I/O wiring
- Cable type and maximum length: shielded, < 30 m (98.4 ft)
- Crosstalk (maximum): 1 LSB

**Isolation between inputs and internal logic** not isolated

**Maximum continuous overload allowed (without damage)** 13 Vdc, 40 mA

**Input filter** software filter: 0...10 s (with 0.1 s increment)

### Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Type</td>
<td>Value</td>
</tr>
<tr>
<td>Thermocouple</td>
<td>± 1.0 % of full scale</td>
</tr>
<tr>
<td>3 wires RTD</td>
<td>RTD type: Pt100: 10500 steps, Pt1000: 8000 steps, Ni100: 2400 steps, Ni1000: 2400 steps</td>
</tr>
</tbody>
</table>

**Input value of LSB**

- 0.1 °C (0.18 °F)

**Data type in application program**

- scalable from –32768 to 32767

**Input data out of detection range**

- yes

**Noise resistance**

- Maximum temporary deviation during perturbations: ± 4.0 % of the full scale maximum when EMC perturbation is applied to the power and I/O wiring

**Cable type and maximum length**

- shielded
- < 30 m (98.4 ft)

**Crosstalk (maximum)**

- 1 LSB

**Isolation between inputs and internal logic**

- not isolated

**Maximum continuous overload allowed (without damage)**

- 13 Vdc
- 40 mA

**Input filter**

- software filter: 0...10 s (with 0.1 s increment)

**Behavior when the temperature sensor is disconnected or broken**

- Input value = upper limit
TMC2TI2 Analog Temperature Inputs

TMC2TI2 Wiring Diagram

Introduction
This cartridge has a non-removable screw terminal block for the connection of the inputs.

Wiring
See Wiring Best Practices (see page 31).

Wiring Diagram
The following figure shows an example of RTD and thermocouple probe connection:

(1): Thermocouple

NOTE: Each input can be connected to either an RTD or thermocouple probe.

⚠️ WARNING

UNINTENDED EQUIPMENT OPERATION
Do not connect wires to unused terminals and/or terminals indicated as “No Connection (N.C.).”
Failure to follow these instructions can result in death, serious injury, or equipment damage.
Chapter 5
TMC2AQ2V Analog Voltage Outputs

Overview
This chapter describes the TMC2AQ2V cartridge, its characteristics, and its connections.

What Is in This Chapter?
This chapter contains the following topics:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMC2AQ2V Presentation</td>
<td>52</td>
</tr>
<tr>
<td>TMC2AQ2V Characteristics</td>
<td>53</td>
</tr>
<tr>
<td>TMC2AQ2V Wiring Diagram</td>
<td>55</td>
</tr>
</tbody>
</table>
TMC2AQ2V Presentation

Overview
The following features are integrated into the TMC2AQ2V cartridge:

- 2 analog voltage outputs
- Non-removable screw terminal block, 3.81 mm (0.15 in.) pitch

Main Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal type</strong></td>
<td><strong>Voltage</strong></td>
</tr>
<tr>
<td>Number of output channels</td>
<td>2</td>
</tr>
<tr>
<td>Output range</td>
<td>0...10 Vdc</td>
</tr>
<tr>
<td>Resolution</td>
<td>12 bits (4096 steps)</td>
</tr>
<tr>
<td>Connection type</td>
<td>3.81 mm (0.15 in.) pitch, non-removable screw terminal block</td>
</tr>
<tr>
<td>Weight</td>
<td>15 g (0.53 oz)</td>
</tr>
</tbody>
</table>
TMC2AQ2V Characteristics

Introduction
This section provides a general description of the characteristics of the TMC2AQ2V cartridge.

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

NOTE: For important safety information and the environment characteristics of the TMC2 cartridges, see the M221 Logic Controller Hardware Guide.

Connectors

The following diagram shows a TMC2AQ2V cartridge marking and connectors:
## Output Characteristics

The following table describes the cartridge output characteristics:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Type</td>
<td>Voltage</td>
</tr>
<tr>
<td>Rated output range</td>
<td>0...10 Vdc</td>
</tr>
<tr>
<td>Load impedance</td>
<td>&gt; 2 KΩ</td>
</tr>
<tr>
<td>Application load type</td>
<td>resistive load</td>
</tr>
<tr>
<td>Conversion time</td>
<td>20 ms</td>
</tr>
<tr>
<td>Total output system transfer time</td>
<td>40 ms</td>
</tr>
<tr>
<td>Maximum accuracy at ambient temperature: 25 °C (77 °F)</td>
<td>± 0.3 % of full scale</td>
</tr>
<tr>
<td>Temperature drift</td>
<td>± 0.02 % of full scale per 1 °C (1.8 °F)</td>
</tr>
<tr>
<td>Repeatability after stabilization time</td>
<td>± 0.4 % of full scale</td>
</tr>
<tr>
<td>Non-linearity</td>
<td>± 0.01 % of full scale</td>
</tr>
<tr>
<td>Overshoot</td>
<td>0 %</td>
</tr>
<tr>
<td>Maximum output deviation</td>
<td>± 1.0 % of full scale (including ripple)</td>
</tr>
<tr>
<td>Digital resolution</td>
<td>12 bits (4096 steps)</td>
</tr>
<tr>
<td>Output value of LSB</td>
<td>2.44 mV</td>
</tr>
<tr>
<td>Data type in application program</td>
<td>0..4095 scalable from −32768 to 32767</td>
</tr>
<tr>
<td>Noise resistance maximum temporary deviation during perturbations</td>
<td>± 4.0 % of the full scale maximum when EMC perturbation is applied to the power and I/O wiring</td>
</tr>
<tr>
<td>Noise resistance maximum length</td>
<td>twisted-pair shielded</td>
</tr>
<tr>
<td>Crosstalk (maximum)</td>
<td>&lt; 30 m (98.4 ft)</td>
</tr>
<tr>
<td>Isolation between outputs and internal logic</td>
<td>not isolated</td>
</tr>
</tbody>
</table>
TMC2AQ2V Wiring Diagram

Introduction
This cartridge has a non-removable screw terminal block for the connection of the outputs.

Wiring
See Wiring Best Practices (see page 31).

Wiring Diagram
The following figure shows an example of the voltage output connection:

![Wiring Diagram](image-url)

(1): Voltage analog input device

**WARNING**

UNINTENDED EQUIPMENT OPERATION
Do not connect wires to unused terminals and/or terminals indicated as "No Connection (N.C.)". Failure to follow these instructions can result in death, serious injury, or equipment damage.
Overview
This chapter describes the TMC2AQ2C cartridge, its characteristics, and its connections.

What is in This Chapter?
This chapter contains the following topics:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMC2AQ2C Presentation</td>
<td>58</td>
</tr>
<tr>
<td>TMC2AQ2C Characteristics</td>
<td>59</td>
</tr>
<tr>
<td>TMC2AQ2C Wiring Diagram</td>
<td>61</td>
</tr>
</tbody>
</table>
TMC2AQ2C Presentation

Overview

The following features are integrated into the TMC2AQ2C cartridge:

- 2 analog current outputs
- Non-removable screw terminal block, 3.81 mm (0.15 in.) pitch

Main Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal type</strong></td>
<td><strong>Current</strong></td>
</tr>
<tr>
<td>Number of output channels</td>
<td>2</td>
</tr>
<tr>
<td>Output range</td>
<td>4...20 mA</td>
</tr>
<tr>
<td>Resolution</td>
<td>12 bits (4096 steps)</td>
</tr>
<tr>
<td>Connection type</td>
<td>3.81 mm (0.15 in.) pitch, non-removable screw terminal block</td>
</tr>
<tr>
<td>Weight</td>
<td>15 g (0.53 oz)</td>
</tr>
</tbody>
</table>
TMC2AQ2C Characteristics

Introduction
This section provides a general description of the TMC2AQ2C cartridge characteristics.

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

NOTE: For important safety information and the environment characteristics of the TMC2 cartridges, see the M221 Logic Controller Hardware Guide.

Connectors
The following diagram shows a TMC2AQ2C cartridge marking and connectors:
### Output Characteristics

The following table describes the cartridge output characteristics:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal Type</strong></td>
<td><strong>Current</strong></td>
</tr>
<tr>
<td>Rated output range</td>
<td>4...20 mA</td>
</tr>
<tr>
<td>Load impedance</td>
<td>&lt; 500 Ω</td>
</tr>
<tr>
<td>Application load type</td>
<td>resistive load</td>
</tr>
<tr>
<td>Conversion time</td>
<td>20 ms</td>
</tr>
<tr>
<td>Total output system transfer time</td>
<td>40 ms</td>
</tr>
<tr>
<td>Maximum accuracy at ambient temperature: 25 °C</td>
<td>± 0.3 % of full scale</td>
</tr>
<tr>
<td>Temperature drift</td>
<td>± 0.02 % of full scale per 1 °C (1.8 °F)</td>
</tr>
<tr>
<td>Repeatability after stabilization time</td>
<td>± 0.4 % of full scale</td>
</tr>
<tr>
<td>Non-linearity</td>
<td>± 0.01 % of full scale</td>
</tr>
<tr>
<td>Overshoot</td>
<td>0 %</td>
</tr>
<tr>
<td>Maximum output deviation</td>
<td>± 1.0 % of full scale (including ripple)</td>
</tr>
<tr>
<td>Digital resolution</td>
<td>12 bits (4096 steps)</td>
</tr>
<tr>
<td>Output value of LSB</td>
<td>3.91 μA</td>
</tr>
<tr>
<td>Data type in application program</td>
<td>0..4095 scalable from –32768 to 32767</td>
</tr>
<tr>
<td>Noise resistance maximum temporary deviation</td>
<td>± 4.0 % of the full scale maximum when EMC perturbation is applied</td>
</tr>
<tr>
<td>during perturbations</td>
<td>to the power and I/O wiring</td>
</tr>
<tr>
<td>Twisted-pair shielded</td>
<td></td>
</tr>
<tr>
<td>&lt; 30 m (98.4 ft)</td>
<td></td>
</tr>
<tr>
<td>crosstalk (maximum)</td>
<td>1 LSB</td>
</tr>
<tr>
<td>Isolation between outputs and internal logic</td>
<td>not isolated</td>
</tr>
</tbody>
</table>
TMC2AQ2C Analog Current Outputs

TMC2AQ2C Wiring Diagram

Introduction
This cartridge has a non-removable screw terminal block for the connection of the outputs.

Wiring
See Wiring Best Practices (see page 31).

Wiring Diagram
The following figure shows an example of the current output connection:

![Wiring Diagram]

(1): Current analog input device

**WARNING**

**UNINTENDED EQUIPMENT OPERATION**
Do not connect wires to unused terminals and/or terminals indicated as "No Connection (N.C.)."

Failure to follow these instructions can result in death, serious injury, or equipment damage.
Chapter 7
TMC2SL1 Serial Line

Overview
This chapter describes the TMC2SL1 cartridge, its characteristics, and its connections.

What Is in This Chapter?
This chapter contains the following topics:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMC2SL1 Presentation</td>
<td>64</td>
</tr>
<tr>
<td>TMC2SL1 Characteristics</td>
<td>65</td>
</tr>
<tr>
<td>TMC2SL1 Wiring Diagram</td>
<td>67</td>
</tr>
</tbody>
</table>
TMC2SL1 Presentation

Overview
The following features are integrated into the TMC2SL1 cartridge:
- 1 serial line (RS232 or RS485)
- non-removable screw terminal block, 3.81 mm (0.15 in.) pitch

Main Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard</strong></td>
<td><strong>Serial line RS232</strong></td>
</tr>
<tr>
<td>Number of channels</td>
<td>1</td>
</tr>
<tr>
<td>Connection type</td>
<td>3.81 mm (0.15 in.) pitch, non-removable screw terminal block</td>
</tr>
<tr>
<td>Weight</td>
<td>15 g (0.53 oz)</td>
</tr>
</tbody>
</table>
TMC2SL1 Characteristics

Introduction
This section provides a general description of the TMC2SL1 cartridge characteristics.

WARNING

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

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

NOTE: For important safety information and the environment characteristics of the TMC2 cartridges, see the M221 Logic Controller Hardware Guide.

Connectors

The following diagram shows a TMC2SL1 cartridge marking and connectors:
### Serial Line Characteristics

The following table describes the cartridge serial line characteristics:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software configurable standard</td>
<td>RS232</td>
</tr>
<tr>
<td></td>
<td>RS485</td>
</tr>
<tr>
<td>Baudrate</td>
<td>1200...115200 bps</td>
</tr>
<tr>
<td>Wires</td>
<td>Rx, Tx, common</td>
</tr>
<tr>
<td></td>
<td>DA, DB, common</td>
</tr>
<tr>
<td>Protocol selection</td>
<td>software programmable</td>
</tr>
<tr>
<td>Line polarization</td>
<td>software programmable</td>
</tr>
<tr>
<td>Line end adapter in the cartridge</td>
<td>no</td>
</tr>
<tr>
<td>cable</td>
<td>shielded</td>
</tr>
<tr>
<td>length</td>
<td>&lt; 3 m (9.8 ft)</td>
</tr>
<tr>
<td></td>
<td>&lt; 15 m (49.2 ft)</td>
</tr>
<tr>
<td>Isolation between lines and internal logic</td>
<td>not isolated</td>
</tr>
</tbody>
</table>
TMC2SL1 Wiring Diagram

Introduction
This cartridge has a non-removable screw terminal block for the connection of the serial line wires.

Wiring
See Wiring Best Practices (see page 31).

Wiring Diagram
The following figure shows an example of RS232 serial line connection:

The following figure shows an example of RS485 serial line connection:

NOTE: Only 1 serial line (RS232 or RS485) can be connected to the cartridge.  
NOTE: Only 1 TMC2SL1 cartridge is managed per logic controller.
Part III
TMC2 Application Cartridges

What Is in This Part?

This part contains the following chapters:

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Chapter Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>TMC2HOIS01 Hoisting</td>
<td>71</td>
</tr>
<tr>
<td>9</td>
<td>TMC2PACK01 Packaging</td>
<td>77</td>
</tr>
<tr>
<td>10</td>
<td>TMC2CONV01 Conveying</td>
<td>83</td>
</tr>
</tbody>
</table>
Overview

This chapter describes the TMC2HOIS01 cartridge, its characteristics, and its connections.

What Is in This Chapter?

This chapter contains the following topics:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMC2HOIS01 Presentation</td>
<td>72</td>
</tr>
<tr>
<td>TMC2HOIS01 Characteristics</td>
<td>73</td>
</tr>
<tr>
<td>TMC2HOIS01 Wiring Diagram</td>
<td>75</td>
</tr>
</tbody>
</table>
TMC2HOIS01 Presentation

Overview

The following features are integrated into the TMC2HOIS01 cartridge:

- 2 analog inputs (voltage or current) for hoisting load cells
- non-removable screw terminal block, 3.81 mm (0.15 in.) pitch

Main Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal type</strong></td>
<td>Voltage</td>
</tr>
<tr>
<td>Number of input channels</td>
<td>2</td>
</tr>
<tr>
<td>Input range</td>
<td>0...10 Vdc, 0...20 mA, 4...20 mA</td>
</tr>
<tr>
<td>Resolution</td>
<td>12 bits (4096 steps)</td>
</tr>
<tr>
<td>Connection type</td>
<td>3.81 mm (0.15 in.) pitch, non-removable screw terminal block</td>
</tr>
<tr>
<td>Weight</td>
<td>15 g (0.53 oz)</td>
</tr>
</tbody>
</table>
TMC2HOIS01 Characteristics

Introduction
This section provides a general description of the TMC2HOIS01 cartridge characteristics.

WARNING

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

NOTE: For important safety information and the environment characteristics of the TMC2 cartridges, see the M221 Logic Controller Hardware Guide.

Connectors
The following diagram shows a TMC2HOIS01 cartridge marking and connectors:
Input Characteristics

The following table describes the cartridge input characteristics:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal Type</strong></td>
<td><strong>Voltage</strong></td>
</tr>
<tr>
<td>Rated input range</td>
<td>0...10 Vdc</td>
</tr>
<tr>
<td></td>
<td>0...20 mA</td>
</tr>
<tr>
<td></td>
<td>4...20 mA</td>
</tr>
<tr>
<td>Input impedance</td>
<td>&gt; 1 MΩ</td>
</tr>
<tr>
<td></td>
<td>&lt; 250 Ω</td>
</tr>
<tr>
<td>Sample duration time</td>
<td>10 ms per enabled channel</td>
</tr>
<tr>
<td>Input type</td>
<td>single-ended</td>
</tr>
<tr>
<td>Operating mode</td>
<td>self-scan</td>
</tr>
<tr>
<td>Conversion mode</td>
<td>SAR type</td>
</tr>
<tr>
<td>Maximum accuracy at ambient temperature: 25 °C (77 °F)</td>
<td>± 0.1 % of full scale</td>
</tr>
<tr>
<td>Temperature drift</td>
<td>± 0.02 % of full scale per 1 °C (1.8 °F)</td>
</tr>
<tr>
<td>Repeatability after stabilization time</td>
<td>± 0.5 % of full scale</td>
</tr>
<tr>
<td>Non-linearity</td>
<td>± 0.01 % of full scale</td>
</tr>
<tr>
<td>Maximum input deviation</td>
<td>± 1.0 % of full scale</td>
</tr>
<tr>
<td>Digital resolution</td>
<td>12 bits (4096 steps)</td>
</tr>
<tr>
<td>Input value of LSB</td>
<td>2.44 mV (0...10 Vdc range)</td>
</tr>
<tr>
<td></td>
<td>4.88 μA (0...20 mA range)</td>
</tr>
<tr>
<td></td>
<td>3.91 μA (4...20 mA range)</td>
</tr>
<tr>
<td>Data type in application program</td>
<td>scalable from −32768 to 32767</td>
</tr>
<tr>
<td>Input data out of detection range</td>
<td>yes</td>
</tr>
<tr>
<td>Noise resistance</td>
<td>maximum temporary deviation during perturbations</td>
</tr>
<tr>
<td></td>
<td>± 4.0 % of the full scale maximum when EMC perturbation is applied to the power and I/O wiring</td>
</tr>
<tr>
<td></td>
<td>twisted-pair shielded</td>
</tr>
<tr>
<td></td>
<td>&lt; 30 m (98.4 ft)</td>
</tr>
<tr>
<td></td>
<td>1 LSB</td>
</tr>
<tr>
<td>Isolation between inputs and internal logic</td>
<td>not isolated</td>
</tr>
<tr>
<td>Maximum continuous overload allowed (without damage)</td>
<td>13 Vdc</td>
</tr>
<tr>
<td></td>
<td>40 mA</td>
</tr>
<tr>
<td>Input filter</td>
<td>software filter: 0...10 s (with 0.1 s increment)</td>
</tr>
</tbody>
</table>
TMC2HOIS01 Wiring Diagram

Introduction
This cartridge has a non-removable screw terminal block for the connection of the inputs.

Wiring
See Wiring Best Practices *(see page 31).*

Wiring Diagram

The following figure shows an example of the voltage and current input connection:

*(1): Current/Voltage analog output device

**NOTE:** Each input can be connected to either a voltage or current input.
Chapter 9  
TMC2PACK01 Packaging

Overview
This chapter describes the TMC2PACK01 cartridge, its characteristics, and its connections.

What Is in This Chapter?
This chapter contains the following topics:

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<tr>
<td>TMC2PACK01 Wiring Diagram</td>
<td>81</td>
</tr>
</tbody>
</table>
TMC2PACK01 Presentation

Overview
The following features are integrated into the TMC2PACK01 cartridge:
- 2 analog inputs (voltage or current) for packaging
- non-removable screw terminal block, 3.81 mm (0.15 in.) pitch

Main Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Signal type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of input channels</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Input range</td>
<td>Voltage</td>
<td>0…10 Vdc</td>
</tr>
<tr>
<td></td>
<td>Current</td>
<td>0…20 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4…20 mA</td>
</tr>
<tr>
<td>Resolution</td>
<td></td>
<td>12 bits (4096 steps)</td>
</tr>
<tr>
<td>Connection type</td>
<td></td>
<td>3.81 mm (0.15 in.) pitch, non-removable screw terminal block</td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td>15 g (0.53 oz)</td>
</tr>
</tbody>
</table>
TMC2PACK01 Characteristics

Introduction

This section provides a general description of the TMC2PACK01 cartridge characteristics.

![WARNING]

**UNINTENDED EQUIPMENT OPERATION**

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

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

**NOTE:** For important safety information and the environment characteristics of the TMC2 cartridges, see the M221 Logic Controller Hardware Guide.

Connectors

The following diagram shows a TMC2PACK01 cartridge marking and connectors:
## Input Characteristics

The following table describes the cartridge input characteristics:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal Type</strong></td>
<td><strong>Voltage</strong></td>
</tr>
<tr>
<td>Rated input range</td>
<td>0...10 Vdc</td>
</tr>
<tr>
<td></td>
<td>4...20 mA</td>
</tr>
<tr>
<td>Input impedance</td>
<td>&gt; 1 MΩ</td>
</tr>
<tr>
<td>Sample duration time</td>
<td>10 ms per enabled channel</td>
</tr>
<tr>
<td>Input type</td>
<td>single-ended</td>
</tr>
<tr>
<td>Operating mode</td>
<td>self-scan</td>
</tr>
<tr>
<td>Conversion mode</td>
<td>SAR type</td>
</tr>
<tr>
<td>Maximum accuracy at ambient temperature:</td>
<td>± 0.1 % of full scale</td>
</tr>
<tr>
<td>Temperature: 25 °C (77 °F)</td>
<td>± 0.02 % of full scale per 1 °C (1.8 °F)</td>
</tr>
<tr>
<td>Repeatability after stabilization time</td>
<td>± 0.5 % of full scale</td>
</tr>
<tr>
<td>Non-linearity</td>
<td>± 0.01 % of full scale</td>
</tr>
<tr>
<td>Maximum input deviation</td>
<td>± 1.0 % of full scale</td>
</tr>
<tr>
<td>Digital resolution</td>
<td>12 bits (4096 steps)</td>
</tr>
<tr>
<td>Input value of LSB</td>
<td>2.44 mV (0...10 Vdc range)</td>
</tr>
<tr>
<td></td>
<td>3.91 μA (4...20 mA range)</td>
</tr>
<tr>
<td>Data type in application program</td>
<td>scalable from –32768 to 32767</td>
</tr>
<tr>
<td>Input data out of detection range</td>
<td>yes</td>
</tr>
<tr>
<td>Noise resistance</td>
<td>maximum temporary deviation during perturbations</td>
</tr>
<tr>
<td></td>
<td>± 4.0 % of the full scale maximum when EMC perturbation is</td>
</tr>
<tr>
<td></td>
<td>applied to the power and I/O wiring</td>
</tr>
<tr>
<td></td>
<td>twisted-pair shielded</td>
</tr>
<tr>
<td></td>
<td>&lt; 30 m (98.4 ft)</td>
</tr>
<tr>
<td></td>
<td>1 LSB</td>
</tr>
<tr>
<td>Isolation between inputs and internal</td>
<td>not isolated</td>
</tr>
<tr>
<td>logic</td>
<td></td>
</tr>
<tr>
<td>Maximum continuous overload allowed</td>
<td>13 Vdc</td>
</tr>
<tr>
<td>(without damage)</td>
<td></td>
</tr>
<tr>
<td>Input filter</td>
<td>software filter: 0...10 s (with 0.1 s increment)</td>
</tr>
</tbody>
</table>
TMC2PACK01 Wiring Diagram

Introduction
This cartridge has a non-removable screw terminal block for the connection of the inputs.

Wiring
See Wiring Best Practices (see page 31).

Wiring Diagram
The following figure shows an example of the voltage and current input connection:

![Wiring Diagram]

(1): Current/Voltage analog output device

NOTE: Each input can be connected to either a voltage or current input.
Chapter 10
TMC2CONV01 Conveying

Overview
This chapter describes the TMC2CONV01 cartridge, its characteristics, and its connections.

What is in This Chapter?
This chapter contains the following topics:

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</tr>
</tbody>
</table>
TMC2CONV01 Presentation

Overview

The following features are integrated into the TMC2CONV01 cartridge:

- 1 serial line (RS232 or RS485) for conveying
- non-removable screw terminal block, 3.81 mm (0.15 in.) pitch

Main Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Serial line RS232</td>
</tr>
<tr>
<td></td>
<td>Serial line RS485</td>
</tr>
<tr>
<td>Number of channels</td>
<td>1</td>
</tr>
<tr>
<td>Connection type</td>
<td>3.81 mm (0.15 in.) pitch, non-removable screw terminal block</td>
</tr>
<tr>
<td>Weight</td>
<td>15 g (0.53 oz)</td>
</tr>
</tbody>
</table>
TMC2CONV01 Characteristics

Introduction
This section provides a general description of the TMC2CONV01 cartridge characteristics.

WARNING

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

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

NOTE: For important safety information and the environment characteristics of the TMC2 cartridges, see the M221 Logic Controller Hardware Guide.

Connectors
The following diagram shows a TMC2CONV01 cartridge marking and connectors:

- TMC2CONV01
- Serial
- RS232
- RD
- TD
- GND
- RS485
- DA
- DB
- GND
**Serial Line Characteristics**

The following table describes the cartridge serial line characteristics:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software configurable standard</td>
<td>RS232</td>
</tr>
<tr>
<td>Baudrate</td>
<td>1200..115200 bps</td>
</tr>
<tr>
<td>Wires</td>
<td>Rx, Tx, common</td>
</tr>
<tr>
<td>Protocol selection</td>
<td>software programmable</td>
</tr>
<tr>
<td>Line polarization</td>
<td>–</td>
</tr>
<tr>
<td>Line end adapter in the cartridge</td>
<td>no</td>
</tr>
<tr>
<td>cable</td>
<td>type shielded</td>
</tr>
<tr>
<td>length</td>
<td>&lt; 3 m (9.8 ft)</td>
</tr>
<tr>
<td>Isolation between lines and internal logic</td>
<td>not isolated</td>
</tr>
</tbody>
</table>
TMC2CONV01 Wiring Diagram

Introduction

This cartridge has a non-removable screw terminal block for the connection of the serial line wires.

Wiring

See Wiring Best Practices (see page 31).

Wiring Diagram

The following figure shows an example of RS232 serial line connection:

![RS232 Wiring Diagram](image1)

The following figure shows an example of RS485 serial line connection:

![RS485 Wiring Diagram](image2)

**NOTE:** Only 1 serial line (RS232 or RS485) can be connected to the cartridge.

**NOTE:** Only 1 TMC2CONV01 cartridge is managed per logic controller.
Glossary

M

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

P

PE
(Protective Earth) A common grounding connection to help avoid the hazard of electric shock by keeping any exposed conductive surface of a device at earth potential. To avoid possible voltage drop, no current is allowed to flow in this conductor (also referred to as protective ground in North America or as an equipment grounding conductor in the US national electrical code).
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