

Modicon TM2

High Speed Counter Modules

Hardware Guide

06/2011



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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.

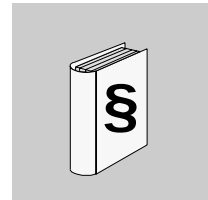
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Table of Contents



	Safety Information	5
	About the Book	7
Chapter 1	General Overview and Rules for Implementing	11
1.1	General Overview	12
	General Description	13
	Physical Description of the Modules	14
	Dimensions	17
	Accessories	18
1.2	General Rules for Implementing	20
	Mounting Positions and Minimum Clearances	21
	Assembling a Module to a Controller	22
	Disassembling a Module from a Controller	24
	How to Install and Remove the Controller with its Expansions from Mounting Rail	25
	How to Directly Mount a Module on a Panel Surface	27
	Wiring Requirements	28
	Grounding	31
Chapter 2	General and Environmental Characteristics	35
	General and Environmental Characteristics	35
Chapter 3	TM200HSC206D• Modules Hardware Implementation. ..	39
	Features	40
	General Information about High Speed Counter Modules	41
	Module and I/O Characteristics	42
	Module Wiring	44
	Display and Status of the High Speed Counter Modules	49
Glossary		51
Index		57

Safety Information



Important Information

NOTICE

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



The addition of this symbol to a Danger 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 an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

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

CAUTION

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

CAUTION

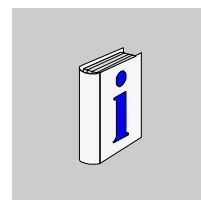
CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** equipment damage.

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 Modicon TM2 HSC Modules. It provides parts descriptions, characteristics, wiring diagrams, installation, and setup for High Speed Counter (HSC) modules.

Validity Note

The information in this manual is applicable **only** for TM200HSC206D• products.

This document has been updated with the release of SoMachine V3.0.

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

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

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

Related Documents

Title of Documentation	Reference Number
Modicon TM2 Expansion Modules Configuration Programming Guide	EIO0000000396 (ENG); EIO0000000397 (FRE); EIO0000000398 (GER); EIO0000000399 (SPA); EIO0000000400 (ITA); EIO0000000401 (CHS)
Modicon M238 Logic Controller High Speed Counting M238 HSC Library Guide	EIO0000000362 (ENG); EIO0000000747 (FRE); EIO0000000748 (GER); EIO0000000749 (SPA); EIO0000000750 (ITA); EIO0000000751 (CHS)
M238 Controller Hardware Guide	EIO0000000016 (ENG); EIO0000000017 (FRE); EIO0000000018 (GER); EIO0000000019 (SPA); EIO0000000020 (ITA); EIO0000000021 (CS)
TM2 HSC Instruction Sheet	AAV86226-00

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

Product Related Information

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

DANGER

EXPLOSION HAZARD

This equipment is suitable for use in non-hazardous locations only.

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

WARNING

LOSS OF CONTROL

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

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

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

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

User Comments

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

General Overview and Rules for Implementing

1

Introduction

This chapter gives a general introduction and the rules for implementing the TM2 Analog I/O modules.

What's in this Chapter?

This chapter contains the following sections:

Section	Topic	Page
1.1	General Overview	12
1.2	General Rules for Implementing	20

1.1 General Overview

Introduction

This section gives a general introduction to the modules.

What's in this Section?

This section contains the following topics:

Topic	Page
General Description	13
Physical Description of the Modules	14
Dimensions	17
Accessories	18

General Description

Introduction

The range of high speed counter modules (HSC) includes:

- TM200HSC206DT module with screw terminal blocks
- TM200HSC206DF module with spring terminal blocks

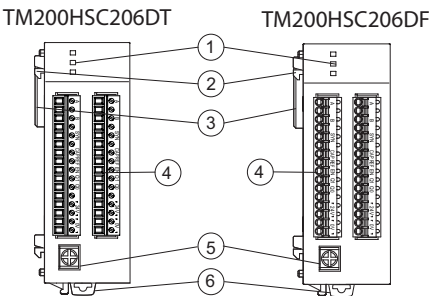
Module Features

The following table shows the TM200HSC206D* modules features, with corresponding counter channels, voltage/current and terminal type:

Reference module	Counter channels	I/Os per channel	Voltage/current	Terminal type
TM200HSC206DT (see page 39)	2	6 inputs	24 Vdc / 5 mA	16-pin removable screw terminal block
		2 outputs	24 Vdc / 0.5 A	
TM200HSC206DF (see page 39)	2	6 inputs	24 Vdc / 5 mA	16-pin removable spring terminal block
		2 outputs	24 Vdc / 0.5 A	

Physical Description of the Modules

Illustration



Elements

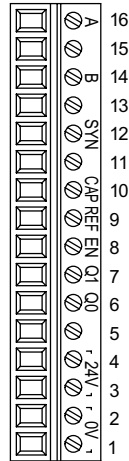
The following table describes the different elements of the two high speed counter modules:

Label	TM200HSC206DT	TM200HSC206DF
1	Data and power connection to the controller or other I/O modules.	
2	16-pin removable screw terminal block	16-pin removable spring terminal block
3	Locking device for attachment to the previous module	
4	LEDs for displaying the channel status and module diagnostics	
5	Clip-on lock	
6	Ground terminal	

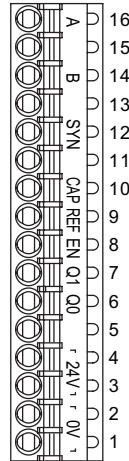
Presentation of screw and spring terminal blocks

The following figure shows a removable screw terminal block (on the left side) and a removable spring terminal block (on the right side):

Screw terminal block



Spring terminal block



The symbol and description of each pin are described in the table below:

Pin number	Symbol	Description
16	A	Input A
15	—	N.C.
14	B	Input B
13	—	N.C.
12	SYNC	Synchronization input
11	—	N.C.
10	CAP	Capture input
9	REF	Reference input
8	EN	Enable input
7	Q1	Output Q1
6	Q0	Output Q0
5	—	N.C.
4	24 V	24 Vdc external power supply
3	24 V	24 Vdc external power supply
2	0 V	0 Vdc external power supply
1	0 V	0 Vdc external power supply

 WARNING

UNINTENDED EQUIPMENT OPERATION

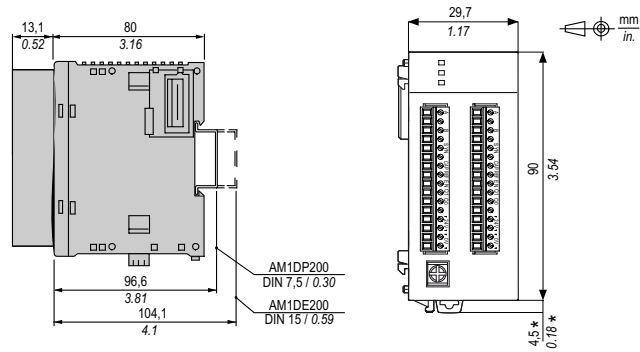
Do not connect wires to unused terminals or terminals marked “Not Connected (N.C.)”.

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

Dimensions

TM200HSC206D• Modules

The following diagrams show the dimensions for the TM200HSC206D• modules:



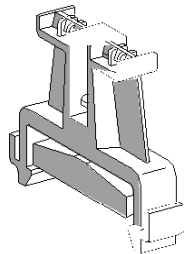
NOTE: * 8.5 mm (0.33 in) when the clip-on lock is pulled out.

Accessories

Terminal Block End Clamp Type AB1AB8P35

Terminal Block End Clamps (reference AB1AB8P35) help reduce side-to-side movement of your controller and modules on the mounting rail. A controller and its associated modules are mounted on the mounting rail between two end clamps in order to improve the shock and vibration characteristics of the assembly.

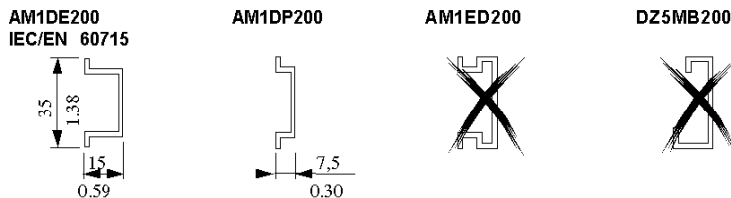
The following picture shows a AB1AB8P35 Terminal Block End Clamp:



The Mounting Rail

You can mount the controller and its expansion modules on a mounting rail. A mounting rail can be attached to a smooth mounting surface or suspended from an Electronic Industries Alliance (EIA) rack or in a Type 4 cabinet.

The following picture shows the different sizes of the mounting rail:



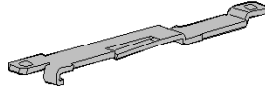
You can order the suitable mounting rail from Schneider Electric:

Rail depth	Catalogue part number
15 mm (0.59 in.)	AM1DE200
7,5 mm (0.30 in.)	AM1DP200

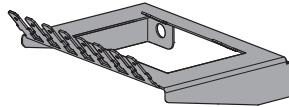
NOTE: Do not use AM1ED200 and DZ5MB200.

TWDXMT5 Panel Mount Kit

The following illustration shows a TWDXMT5 Panel Mount Kit which can be used instead of a mounting rail to mount your controller and I/O modules directly to a panel:

**TM2XMTGB Grounding Bar**

The TM2XMTGB Grounding Bar is used to connect the shields of the cables and the functional ground of the modules to ground (see *Modicon TM2, Analog I/O Modules, Hardware Guide*).



1.2 General Rules for Implementing

Introduction

This section presents the information necessary to install and configure the modules, including mounting, wiring, and grounding requirements.

What's in this Section?

This section contains the following topics:

Topic	Page
Mounting Positions and Minimum Clearances	21
Assembling a Module to a Controller	22
Disassembling a Module from a Controller	24
How to Install and Remove the Controller with its Expansions from Mounting Rail	25
How to Directly Mount a Module on a Panel Surface	27
Wiring Requirements	28
Grounding	31

Mounting Positions and Minimum Clearances

Introduction

For mounting positions and minimum clearances, modules are mounted according to the rules defined for the hardware system that you associate with. Refer to the appropriate *Installation* chapter in the system *Hardware* documentation.

WARNING

UNINTENDED EQUIPMENT OPERATION

- Place devices dissipating the most heat at the top of the cabinet and ensure adequate ventilation.
- Avoid placing this equipment next to or above devices that might cause overheating.
- Install the equipment in a location providing the minimum clearances from all adjacent structures and equipment as directed in this document.
- Install all equipment according to the drawings specified in the related documentation.

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

Assembling a Module to a Controller

Introduction

This section describes how to assemble a module to a controller.

After attaching new I/O modules to the controller, it is important to update and re-download your application program before placing the system back in service. If you do not revise your application program to reflect the addition of new modules, I/O located on the expansion bus may no longer operate normally.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Assembling a Module to a Controller

The following procedure shows how to assemble a controller and a module together.

Step	Action
1	Remove all power and dismount any existing controller/IO assembly from its DIN/panel mounting.
2	Remove the expansion connector sticker from the controller or the outermost installed module.
3	Verify that the locking device (<i>see Modicon TM2, Analog I/O Modules, Hardware Guide</i>) on the new module is in the upper position.
4	Align the internal bus connector on the left side of the module with the internal bus connector on the right side of the controller or module.
5	Press the new module towards the controller or module until it "clicks" into place.
6	Push down the locking device (<i>see Modicon TM2, Analog I/O Modules, Hardware Guide</i>) on the top of the new module to lock it to the controller or previously installed module.

Disassembling a Module from a Controller

Introduction

This section describes how to disassemble a module from a controller.

 **DANGER**

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

Disassembling a Module from a Controller

The following procedure describes how to disassemble a module from a controller.

Step	Action
1	Remove all power from the control system.
2	Dismount the assembled controller and modules from the mounting rail or panel (see <i>page 27</i>).
3	Push up the locking device from the bottom of the module to disengage it from the controller.
4	Pull apart the controller and module.

How to Install and Remove the Controller with its Expansions from Mounting Rail

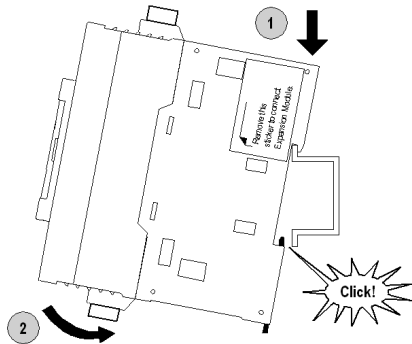
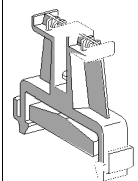
Overview

This section describes how to install and remove the controller with its expansions from a mounting rail.

NOTE: When mounting a controller and its modules on a mounting rail, use two terminal block end clamps of type AB1 AB8P35 or equivalent in order to improve the shock and vibration characteristics of the assembly.

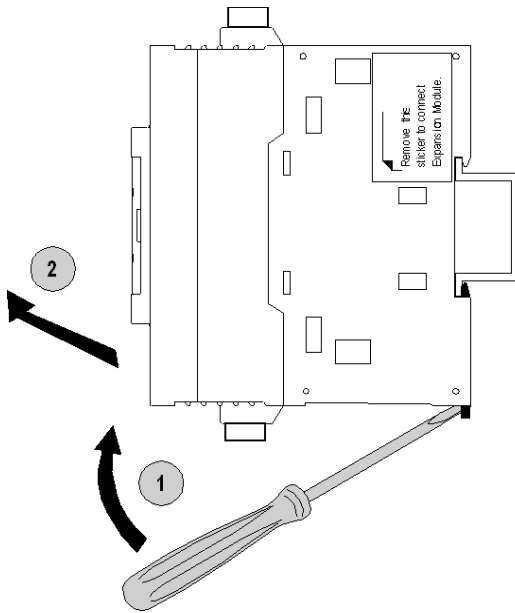
How to Install a Controller with its Expansions on a Mounting Rail

The following procedure describes how to install a controller with its expansions on a mounting rail:

Step	Action
1	Fasten the mounting rail to a panel using screws.
2	Pull down the clip-on lock at the bottom of the controller and module assembly. 
3	Put the top groove of the controller and modules on the mounting rail and press the assembly toward the mounting rail.
4	Push the clip-on lock of the module into the mounting rail.
5	Place two terminal block end clamps on both sides of the controller and module assembly to help minimize side-to-side movement. 

How to Remove a Controller with its Expansions from a Mounting Rail

The following procedure describes how to remove a controller with its expansions from a mounting rail:

Step	Action
1	Insert a flat screwdriver into the slot in the clip-on-lock.  Remove the sticker to connect Expansion Module.
2	Pull down the clip-on lock.
3	Tilt and lift the controller and its associated modules off of the mounting rail from the bottom.

How to Directly Mount a Module on a Panel Surface

Overview

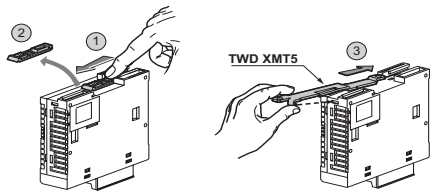
This section shows how to install your module using the Panel Mounting Kit. This section also provides mounting hole layout for all modules. Your module may differ from the module appearing in these illustrations but the procedure is still applicable.

Installing the Panel Mount Kit

The following procedure shows how to install a mounting strip.

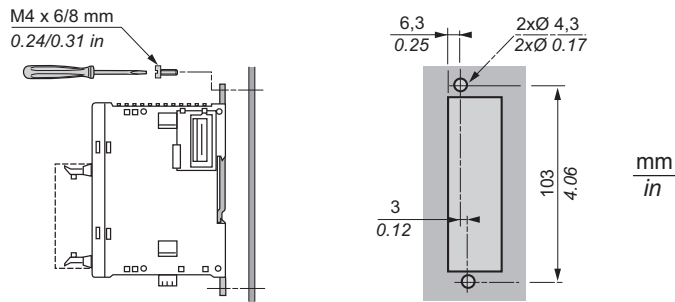
Step	Action
1	Remove the clip-on-lock from the back side of the module by pushing the clip-on lock upwards.
2	Insert the mounting strip, with the hook entering last, into the slot where the clip-on lock was removed.
3	Slide the mounting strip into the slot until the hook enters into the recess in the module.

The following illustration shows how to attach the TWDXMT5 Panel Mount Kit to a module:



Mounting Hole Layout for Modules

The following diagram shows the mounting hole layout for all modules:



Wiring Requirements

Introduction

There are several rules that must be followed when wiring a TM2 I/O module.

If two 16-pin terminal blocks are used for each HSC channel connections (HSC0 and HSC1), each can be plugged into the left or the right connector of the module.

Therefore, despite the indicators on the terminal blocks and module, it is possible to invert the two terminal blocks and thus create incorrect wiring.

Plugging a connector into the wrong socket could cause unintended behavior of the application.

DANGER

UNINTENDED EQUIPMENT OPERATION OR ELECTRIC SHOCK

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

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

NOTE: Clearly and uniquely label each terminal block and connector with an appropriate system of identification.

Wiring Guidelines

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

The following rules must be applied when wiring the analog I/O modules:

- I/O and communication wiring must be kept separate from the power wiring. Route these 2 types of wiring in separate cable ducting.
- Verify that the operating conditions and environment are within the specification values.
- Use proper wire sizes to meet voltage and current requirements.
- Use copper conductors only.
- Use twisted-pair, shielded cables for analog, expert and/or fast I/O.
- Use twisted-pair, shielded cables for networks and field bus (CANopen, serial, Ethernet).

⚠ WARNING

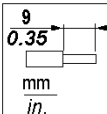
UNINTENDED EQUIPMENT OPERATION

- Use shielded cables for all input, output and communication types specified above.
- Properly ground the cable shields as indicated in the related documentation.
- Route communications and I/O cables separately from power cables.

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

For more details, refer to Grounding (see page 31).

The following table shows the characteristics of the removable screw terminal blocks for TM200HSC206DT:

							
mm ²	0,14...1,5	0,25...0,5	0,25...1,5	0,14...0,5	0,14...0,75	0,25...0,34	0,5
AWG	26...16	24...20	24...16	26...20	26...18	24...22	20

 Ø 2,5 mm (0.10 in)		N.m	0,23
		lb-in.	2.0

Use copper conductors only

The following table shows the characteristics of the functional ground screw:



 Ø 3,5 mm (0.14 in)		N.m	0,5
		lb-in	4.4

Applying torque above the limit may damage the terminal screw or threads.

CAUTION
INOPERABLE EQUIPMENT Do not tighten screw terminals beyond the specified maximum torque (Nm / lb-in.). Failure to follow these instructions can result in equipment damage.

The table below shows the characteristics of the removable spring terminal blocks:

Characteristic		Available
Type of terminal blocks		Spring terminal blocks
Number of wires accommodated		1
Wire gauges accommodated	minimum	AWG 20 (0.5 mm ²)
	maximum	AWG 18 (1 mm ²)
Wiring constraints		To insert and remove wires from the connectors, use a 2,5 x 0,4 mm (0.10 x 0.02 in) screwdriver to open the spring connector by pushing on the corresponding tab. Push the flexible tab down.

Grounding

Presentation

Electromagnetic radiation may interfere with control communications and/or input/output signals to the control system.

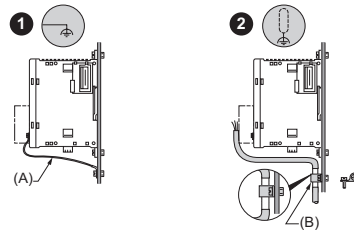
⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Use shielded cables wherever specified for inputs, outputs and communication connections.
- Properly ground the cable shields as indicated in the related documentation.
- Route communication and I/O cables separately from power cables.

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

NOTE: The shielding of the shielded cables for connecting sensors/actuators to the High Speed Counter module should be secured and grounded.

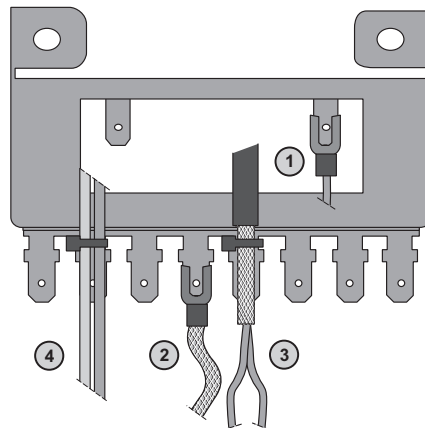


- A** Connection of the functional ground. Use a braid connected directly to the attachment part.
- B** Connection of shields. Connect the cable shielding directly to the attachment part.

Legend	Meaning	Description
1	Functional Ground (FG) terminal for module	Connect the module to the functional ground (FG) terminal with the braid supplied with the module.
2	Functional Ground (FG) terminal for sensors	Attach and earth the shielding of cables as close as possible to the controller base: • Strip the shielding • Attach the cable to the metal support by attaching the clamp to the stripped part of the shielding The shielding must be clamped tightly enough to the metal support to permit good contact.

Grounding Bar TM2XMTGB

The figure below shows how to connect the grounding bar TM2XMTGB:



- 1 Controller functional grounding
- 2 Modules functional grounding
- 3 Analog fast I/O cable shielding
- 4 Cable attachment

NOTE: Schneider Electric recommends the use of the TM2XMTGB Grounding Bar for use with TM2 I/O modules.

WARNING

ACCIDENTAL DISCONNECTION FROM PROTECTIVE GROUND (PE)

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

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

NOTE: Schneider Electric recommends the use of the TM2XMTGB Grounding Bar for use with TM2 I/O modules.

WARNING

ACCIDENTAL DISCONNECTION FROM PROTECTIVE GROUND (PE)

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

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

General and Environmental Characteristics



General and Environmental Characteristics

Introduction

This section presents the general and environmental characteristics for TM200HSC206D• modules.

TM200HSC206D• General Characteristics

 **WARNING**

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

Terminal type	TM200HSC206DT: Removable screw terminal block TM200HSC206DF: Removable spring terminal block
Counter channels	2
Maximum count	+/- 2147483647 (counters use SIGNED LONG registers to store count)
Sensor and actuator voltage range	19.2...30 Vdc including ripple
Maximum power supply current	2.5 A
Power supply protection	External fuse type F, fast-acting 5 x 20, 3.15 A (UL recognized and CSA approved)
Maximum input frequency	60 kHz
Encoder type	Incremental encoder 10 to 30 Vdc model, with source/sink outputs.
Isolation voltage	1500 Vac at 20 mA for 1 minute
Weight	167 g (5.9 oz)

TM200HSC206D• Environmental Characteristics

Modules Climatic and Mechanical Characteristics		
Temperature	Operation	- 10... 55 °C (14...131 °F)
	Storage	- 40...85 °C (- 40...185 °F)
Relative humidity		5...95 % (non-condensing)
Degree of pollution		2 (IEC 60664)
Degree of protection		IP 20 (IEC 60529)
Corrosion immunity		Free from corrosive gases
Altitude	Operation	2000 m (6560 ft) max.
	Storage	3000 m (9842 ft) max.
Vibration resistance	Mounted on a mounting rail	3.5 mm fixed amplitude from 5...8.5 Hz 9.8 m/s ² (1 g _n) fixed acceleration from 8.5...150 Hz
	Plate or panel mounted	10 mm fixed amplitude from 5...8.7 Hz 29.4 m/s ² (3 g _n) fixed acceleration from 8.7...150 Hz
Shock resistance	Mounted on a mounting rail	147 m/s ² (15 g _n) for 11 ms duration
	Plate or panel mounted	294 m/s ² (30 g _n) for 6 ms duration
Bumps	Mounted on a mounting rail	147 m/s ² (15 g _n) for 6 ms duration
	Plate or panel mounted	245 m/s ² (25 g _n) for 6 ms duration

Modules EMC Characteristics	
Electrostatic discharge IEC/EN 61000-4-2	8 kV (air discharge) 6 kV (contact discharge)
Radiated electromagnetic field immunity IEC/EN 61000-4-3	10 V/m (2...2.7 GHz) 10 V/m (80 MHz...2 GHz)
Fast Transient Burst IEC/EN 61000-4-4	Power supply: 2 kV I/O: 1 kV Shielded cable: 1 kV Repetition rate: 5 and 100 kHz
Immunity to conducted disturbances induced by radio-frequency fields IEC/EN 61000-4-6	10 V (0.15...80 MHz)
Surge immunity IEC/EN61000-4-5 24 Vdc circuits	1 kV in Common mode 0.5 kV in differential mode

Modules EMC Characteristics	
Conducted emissions	Class A: according to EN 55022/55011 150 kHz...500 kHz quasi peak 79 dB μ V 500 kHz...30 MHz quasi peak 73 dB μ V
Radiated emissions	Class A: according to EN 55022/55011 d= 10 m (32.81 ft) 30 MHz...230 MHz quasi peak 40 dB μ V Class A: according to EN 55022/55011 d= 10 m (32.81 ft) 230 MHz...2 GHz quasi peak 47 dB μ V

TM200HSC206D• Modules

Hardware Implementation



Introduction

This chapter deals with the hardware characteristics and wiring examples for the TM200HSC206D• modules.

What’s in this Chapter?

This chapter contains the following topics:

Topic	Page
Features	40
General Information about High Speed Counter Modules	41
Module and I/O Characteristics	42
Module Wiring	44
Display and Status of the High Speed Counter Modules	49

Features

Introduction

The TM200HSC206D• modules are high speed counter modules that are compatible with M2xx range controllers.

These modules have:

- Counter-related functions (comparison, capture, reference, reset to 0)
- Outputs for actuator operation (contacts, alarms, relays)

These high speed counter modules allow pulses from a sensor to be counted at a maximum frequency of 60 kHz.

The high speed counter operates in one of the Main Type Modes (see *Modicon M238 Logic Controller, High Speed Counting, M238 HSC Library Guide*), which may be selected using the SoMachine configuration/programming software.

The above aspect is performed from the different SoMachine editors:

- in offline mode
- in online mode

Features

The TM200HSC206D/F provides:

- 2 independent counter channels (HSC0 and HSC1)
- 2 types of removable terminal blocks (screw or spring)

The main characteristics of the TM200HSC206D• modules are as follows.

Type	Application	Number of channels per module	Number of physical inputs per channel	Number of physical outputs per channel	Maximum frequency
TM200HSC206DT TM200HSC206DF	● Counter ● Down counter ● Measurement ● Frequency meter ● Axis monitoring	2	6	2	60 kHz

General Information about High Speed Counter Modules

Introduction

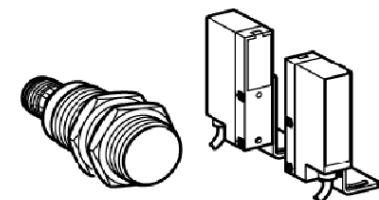
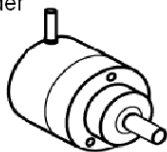
The sensors used on each channel may be:

- 24 Vdc two-wire proximity sensors
- Incremental signal encoders with 10...30 Vdc output and source/sink outputs.

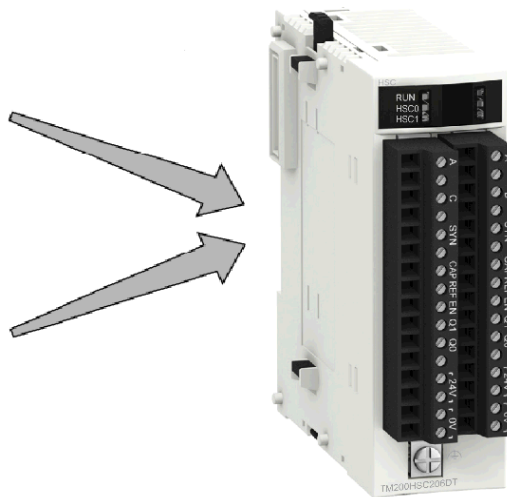
Illustration

The following illustration shows the various sensors.

Incremental encoder



Proximity sensors



Module and I/O Characteristics

Introduction

The TM200HSC206D/F provides 2 independent high speed counter channels (HSC0 and HSC1).

Each HSC channel provides six 24 Vdc digital inputs and two 24 Vdc outputs and contains programmable compare blocks. By default, all HSC channels are disabled.

Power Supply

Use 3 types of power supply:

Type	Voltage	Current	Protection
External power supply	24 Vdc	—	—
	19.2...30 Vdc including ripple	2.5 A max.	External (Fuse, circuit-breaker or self-protected power supply)
Internal power supply provided by the base through the expansion bus	24 Vdc	100 mA	—
	5 Vdc	100 mA	—

Use 3 types of power supply:

- External 24 Vdc.
- Internal through the bus.

In a highly disturbed environment, use a specific external 24 Vdc power supply and a shielded cable for connecting the supply to the module.

Input Characteristics

This table presents the general characteristics of the input channels for the TM200HSC206D• modules:

Number of inputs channels	Six 24 Vdc sink inputs per counter		
IEC 1131-2 Type 1 Digital Inputs: IN A, IN B, IN SYNC	Voltage		30 Vdc max.
	At state 1	Voltage	15 Vdc... 30 Vdc
		Current	5 mA (up to 30 Vdc)
	At state 0	Voltage	5 Vdc max.
		Current	0.5 mA max.
	Current at 15 Vdc		2 mA min.
	Frequency		60 kHz max.

IEC 1131-2 Type 1 Digital Inputs: IN EN, IN REF, IN CAP	Voltage		30 Vdc max.
	At state 1	Voltage	15 Vdc... 30 Vdc
		Current	5 mA (up to 30 Vdc)
	At state 0	Voltage	5 Vdc max.
		Current	0.5 mA max.
	Current at 15 Vdc		2 mA min.
	Frequency		200 Hz max.

Output Characteristics

This table presents the general characteristics of the output channels for the TM200HSC206D• modules:

Number of outputs per channel		2
Type		Source 24 Vdc / 0.5 A
Voltage		19.2...30 Vdc
Minimum load current		None
Maximum load current	Each point	0.5 A
	Per module	2 A
Off state leakage current		0.1 mA max.
On state output voltage drop		3 Vdc max.
Overload current before activation of the protection	Each point	1.5 A max.
Response time		200 µs
Short-circuit and overload		Protection/status per channel: to explain the behavior after the defect disappears (reset)
Fallback value (output channels)	By default	Hold last time
	User configuration	Hold last time Predefined fallback value on one or both channels
Fallback states - Outputs	By default	Fallback to 0
	User configuration	Hold Last State or individually program each channel to assume a 0 or 1 state
Maximum inductive load		DC 13, 0.5A L/R <= 10 ms

Module Wiring

Introduction

The TM200HSC206D• High Speed Counter modules uses the following:

- Two 16-pin connectors for the inputs, the outputs and the power supply.

⚠ 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.

Field sensors

The modules have IEC 61131 Type II inputs that support signals from mechanical switching equipment such as:

- Contact relays
- Push-buttons
- Limit switch sensors
- Switches with 2 or 3 wires

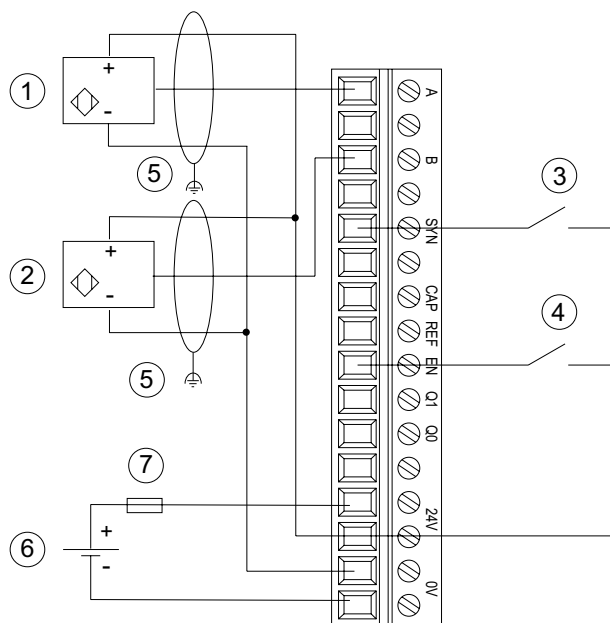
The module can be used with most encoders that have a supply of between 10 and 30 Vdc and source/sink outputs.

Assignment of the 16-Pin Connector

For the physical location of the pin numbers for the 16-pin connector refers to the physical description of the modules (*see page 14*).

Sensor Connections

The example below shows sensors with applied to inputs IN_A and IN_B and equipment applied to inputs IN_EN and IN_SYNC:



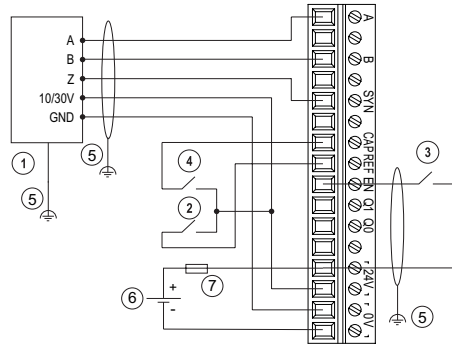
- 1 IN_A input
- 2 IN_B input
- 3 IN_SYNC input (synchronization input)
- 4 IN_EN input (enable input)
- 5 Functional ground
- 6 24 Vdc Power Supply
- 7 External fuse

NOTE: Terminals 0 Vdc and terminals 24 Vdc are connected each other in the module.

NOTE: It is recommended to connect sensors with transistor outputs to SYNC and EN inputs. If connecting sensors with mechanical contacts, set the filtering time of the inputs at 4.2 ms.

Encoder Connection

The following field wiring example shows one incremental encoder used for axis monitoring and the three auxiliary inputs specially used in the largest mode (Free Large Counting):



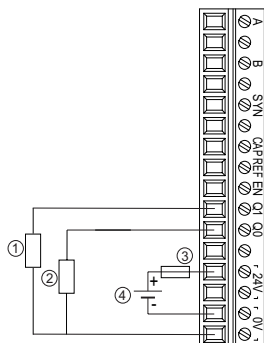
- 1 Encoder (inputs A, B and Z)
- 2 IN_REF input (reference input)
- 3 IN_EN input (enable input)
- 4 IN_CAP input (capture input)
- 5 Functional ground
- 6 24 Vdc Power supply
- 7 External fuse

NOTE: Terminals 0 Vdc and terminal 24 Vdc are connected to each other in the module through the 24 Vdc power supply.

NOTE: It is recommended to connect sensors with transistor outputs to CAP and REF inputs. If connecting sensors with mechanical contacts, set the filtering time of the inputs at 4.2 ms.

Connecting Outputs and Output Supplies

The figure below shows the connection of supplies and actuators to the 16-pin connector:



- 1 Actuator for the Q1 output
- 2 Actuator for the Q0 output
- 3 External fuse
- 4 24 Vdc Power Supply for sensors and actuators

NOTE: 0V and 24V terminals are connected internally.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Use shielded cables wherever specified for inputs, outputs and communication connections.
- Properly ground the cable shields as indicated in the related documentation.
- Route communication and I/O cables separately from power cables.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Field Actuators

The Q0 and Q1 outputs are limited by a maximum current of 0.5 A. Each output has incorporated thermal protection which protects the output against overloads and short circuits. The output re-arms automatically if the overload or short circuit is corrected.

In the case of a short-circuit or current overload, the common group of outputs automatically enter into thermal protection mode (all outputs set to 0), and are then periodically rearmed (each second) to test the connection state. However, you must be aware of the effect of this rearming on the machine or process being controlled.

WARNING
UNINTENDED MACHINE STARTUP Inhibit the automatic rearming of outputs if this feature is an undesirable behavior for your machine or process. Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTE: The automatic rearming feature can be inhibited programmatically. Use the output diagnostics to determine if the output (or group of outputs) have experienced a thermal event (overload or short-circuit) and, if so, set the output(s) to 0 (OFF).

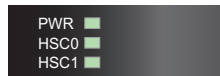
Display and Status of the High Speed Counter Modules

Overview

Each TM200HSC206D• High Speed counter module has 3 LEDs that enable the status of the module to be viewed: PWR, HSC0 and HSC1

Display Screen

The following drawing shows the display screen of a TM200HSC206D• module:

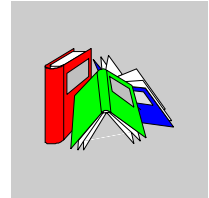


Status LEDs

The following table presents the various module states according to the status LEDs:

PWR	HSCn	Status	Meaning
OFF	OFF	Internal power supply	Not powered
ON	OFF	Internal power supply Channel configuration External power supply	OK Not used or not configured in the application OK
ON	ON (Green)	Power supply Channel External power supply	OK OK OK
ON	ON (Red)	Power supply Channel External power supply	OK OK Power supply error is detected
ON	Flashing (Red)	Outputs status	Overload or short circuit is detected on the outputs Q0 and/or Q1
ON	Flashing (Green)	Fallback status	Module outputs are in fallback states defined in the program configuration. Counting functions interrupted.

Glossary



A

analog input

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

analog output

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

AWG

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

D

De-rating

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

digital I/O

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

DIN

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

E

expansion connector

A connector to attach expansion I/O modules.

expansion connector sticker

A cover to protect the expansion connector.

expansion I/O module

An *expansion input or output module* is either a digital or analog module that adds additional I/O to the base controller.

expert I/O

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

F

FE

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

FG

frequency generator

free wire

The end of a digital I/O cable whose wires do not have a connector. This scheme provides connectivity from controller to digital I/O points.

H**HSC**

high-speed counter.

I**I/O**

input/output

I/O terminals

An *input/output terminal* on the front of an expansion I/O module connects input and output signals.

IEC

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

input filter

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

input terminals

An *input terminal* on the front of an expansion I/O module connects input signals from input devices (such as sensors, push buttons, and limit switches). For some modules, input terminals accept both sink and source DC input signals.

IP 20

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

L

LED

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

N

NC

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

NO

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

O

output terminals

An *output terminal* connects output signals to output devices (such as electromechanical relays and solenoid valves).

P

PE

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

Pt100/Pt1000

Platinum resistance thermometer are characterized by their nominal resistance R_0 at a temperature of 0°C .

- Pt100 ($R_0 = 100 \text{ Ohm}$)
- Pt1000 ($R_0 = 1 \text{ kOhm}$)

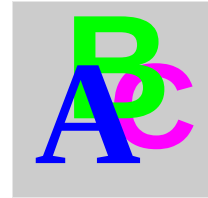
S**sink input**

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

source output

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

Index



A

Accessories, 18
Assembling to a controller, 22

C

Controllers
Disassembling a module, 24

D

Description
TM200HSC206D• modules, 13
Dimensions
TM200HSC206 modules, 17

G

Grounding, 31

M

Mounting Position, 21
Mounting rail
15 mm AM1DE200 rail, 18
725 mm AM1DP200 rail, 18

T

Terminal Block End Clamp type
AB1AB8P35, 18

TM200HSC206D• modules
Description, 13

TM200HSC206D• Modules
Dimensions, 17

TM200HSC206D• modules
Display and diagnostics, 49
General and Environmental Characteristics, 35
I/O Characteristics, 42

TM200HSC206D• Modules
Physical Description, 14

TM200HSC206D• modules
Wiring, 44

TM200HSC206modules
Dimensions, 17

TM2XMTGB, 19

TWDXMT5 mounting strip, 19

W

Wiring requirements, 28

