Modicon TM3 Bus Coupler

Programming Guide

EIO0000003643.05
01/2022

www.se.com

Legal Information

Table of Contents

Safety Information

Important Information

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

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

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

Please Note

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

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

About the Book

Document Scope

This document describes the configuration of the TM3 bus couplers for EcoStruxure Machine Expert. For further information, refer to the separate documents provided in the EcoStruxure Machine Expert online help.

Validity Note

This document has been updated for the release of EcoStruxure™ Machine Expert V2.0.2.

The technical characteristics of the devices described in the present document also appear online. To access the information online, go to the Schneider Electric home page www.se.com/ww/en/download/.

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

Related Documents

Title of Documentation	Reference Number
TM3 Bus Coupler - Hardware Guide	EIO0000003635 (ENG) EIO0000003636 (FRE) EIO0000003637 (GER) EIO0000003638 (SPA) EIO0000003639 (ITA) EIO0000003640 (CHS) EIO0000003641 (POR) EIO0000003642 (TUR)
TM3 Digital I/O Modules - Hardware Guide	EIO0000003125 (ENG) EIO0000003126 (FRE) EIO0000003127 (GER) EIO0000003128 (SPA) EIO0000003129 (ITA) EIO0000003130 (CHS) EIO0000003424 (POR) EIO0000003425 (TUR)

Title of Documentation	Reference Number
TM3 Analog I/O Modules - Hardware Guide	EIO0000003131 (ENG) EIO0000003132 (FRE) EIO0000003133 (GER) EIO0000003134 (SPA) EIO0000003135 (ITA) EIO0000003136 (CHS) EIO0000003426 (POR) EIO0000003427 (TUR)
TM3 Expert Modules - Hardware Guide	EIO0000003137 (ENG) EIO0000003138 (FRE) EIO0000003139 (GER) EIO0000003140 (SPA) EIO0000003141 (ITA) EIO0000003142 (CHS) EIO0000003428 (POR) EIO0000003429 (TUR)
TM3 Transmitter and Receiver Modules - Hardware Guide	EIO0000003143 (ENG) EIO0000003144 (FRE) EIO0000003145 (GER) EIO0000003146 (SPA) EIO0000003147 (ITA) EIO0000003148 (CHS) EIO0000003430 (POR) EIO0000003431 (TUR)
TM3 Safety Modules - Hardware Guide	EIO0000003353 (ENG) EIO0000003354 (FRE) EIO0000003355 (GER) EIO0000003356 (SPA) EIO0000003357 (ITA) EIO0000003358 (CHS) EIO0000003359 (POR) EIO0000003360 (TUR)
Modicon M241 Logic Controller - Programming Guide	EIO0000003059 (ENG) EIO0000003060 (FRE) EIO0000003061 (GER) EIO0000003062 (SPA) EIO0000003063 (ITA) EIO0000003064 (CHS)

Title of Documentation	Reference Number
Modicon M251 Logic Controller - Programming Guide	EIO0000003089 (ENG) EIO0000003090 (FRE) EIO0000003091 (GER) EIO0000003092 (SPA) EIO0000003093 (ITA) EIO0000003094 (CHS)
Modicon M262 Logic/Motion Controller Programming Guide	EIO0000003651 (ENG) EIO0000003652 (FRE) EIO0000003653 (GER) EIO0000003654 (SPA) EIO0000003655 (ITA) EIO0000003656 (CHS) EIO0000003657 (POR) EIO0000003658 (TUR)
EcoStruxure Machine Expert Programming Guide	EIO0000002854 (ENG) EIO0000002855 (FRE) EIO0000002856 (GER) EIO0000002858 (SPA) EIO0000002857 (ITA) EIO0000002859 (CHS)
EcoStruxure Machine Expert Industrial Ethernet Overview User Guide	EIO0000003053 (ENG) EIO0000003054 (FRE) EIO0000003055 (GER) EIO0000003056 (SPA) EIO0000003057 (ITA) EIO0000003058 (CHS)

You can download these technical publications and other technical information from our website at www.se.com/ww/en/download/ .

Product Related Information

⚠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.

Terminology Derived from Standards

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

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

Among others, these standards include:

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

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

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

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

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

TM3 Bus Coupler Configuration General Information

Introduction

The Modicon TM3 Bus Couplers are devices designed to manage EtherNet/IP, Modbus TCP, CANopen, or Modbus serial line communication protocols. This chapter provides general information to help you configure TM3 bus coupler in EcoStruxure Machine Expert software.

Modicon TM3 Bus Couplers

Introduction

The Modicon TM3 Bus Couplers are devices designed to create distributed architectures in association with EtherNet/IP, TM3 /TM2 I/O modules. They are managed by a controller, via fieldbus:

- TM3BCEIP for EtherNet/IP and Modbus TCP
- TM3BCSL for Modbus Serial Line
- TM3BCCOfor CANopen

For more details, see Modicon TM3 Bus Couplers - Hardware Guide.

Modicon TM3 Bus Couplers

The following table shows the TM3 bus couplers supported by EcoStruxure Machine Expert:

Reference	Port	Communication type	Terminal type
TM3BCEIP, page 29	2 isolated switched Ethernet ports	Ethernet/IP Modbus TCP	RJ45
	1 USB port	USB 2.0	mini-B
TM3BCSL, page 82	2 isolated RS-485 ports (daisy-chained)	Modbus Serial Line	RJ45
	1 USB port	USB 2.0	mini-B
TM3BCCO, page 121	2 isolated CANopen ports (daisy-chained)	CANopen	RJ45
	1 USB port	USB 2.0	mini-B

TM3 General Description

Introduction

The range of TM3 expansion modules includes:

- Digital modules, classified as follows:
  - Input modules, page 12
  - Output modules, page 13
  - Mixed input/output modules, page 14
- Analog modules, classified as follows:
  - Input modules, page 15
  - Output modules, page 16
  - Mixed input/output modules, page 17
- Expert modules, page 17
- Transmitter and receiver modules, page 18
- Safety modules, page 19

TM3 Digital Input Modules

The following table shows the TM3 digital input expansion modules, with corresponding channel type, nominal voltage/current, and terminal type. For information on configuration of these modules, refer to the TM3 Digital I/O Modules Configuration section.

Reference	Channels	Channel Type	Voltage Current	Terminal Type / Pitch
TM3DI8A	8	Regular inputs	120 Vac 7.5 mA	Removable screw terminal block / 5.08 mm
TM3DI8	8	Regular inputs	24 Vdc 7 mA	Removable screw terminal block / 5.08 mm
TM3DI8G	8	Regular inputs	24 Vdc 7 mA	Removable spring terminal block / 5.08 mm
TM3DI16	16	Regular inputs	24 Vdc 7 mA	Removable screw terminal block / 3.81 mm
TM3DI16G	16	Regular inputs	24 Vdc 7 mA	Removable spring terminal block / 3.81 mm
TM3DI16K	16	Regular inputs	24 Vdc 5 mA	HE10 (MIL 20) connector
TM3DI32K	32	Regular inputs	24 Vdc 5 mA	HE10 (MIL 20) connector

TM3 Digital Output Modules

The following table shows the TM3 digital output modules, with corresponding channel type, nominal voltage/current, and terminal type. For information on configuration of these modules, refer to the TM3 Digital I/O Modules Configuration section.

Reference	Channels	Channel Type	Voltage Current	Terminal Type / Pitch
TM3DQ8R	8	Relay outputs	24 Vdc / 240 Vac 7 A maximum per common line / 2 A maximum per output	Removable screw terminal block / 5.08 mm
TM3DQ8RG	8	Relay outputs	24 Vdc / 240 Vac 7 A maximum per common line / 2 A maximum per output	Removable spring terminal block / 5.08 mm
TM3DQ8T	8	Regular transistor outputs (source)	24 Vdc 4 A maximum per common line/0.5 A maximum per output	Removable screw terminal block / 5.08 mm
TM3DQ8TG	8	Regular transistor outputs (source)	24 Vdc 4 A maximum per common line/0.5 A maximum per output	Removable spring terminal block / 5.08 mm
TM3DQ8U	8	Regular transistor outputs (sink)	24 Vdc 4 A maximum per common line/0.5 A maximum per output	Removable screw terminal block / 5.08 mm
TM3DQ8UG	8	Regular transistor outputs (sink)	24 Vdc 4 A maximum per common line/0.5 A maximum per output	Removable spring terminal block / 5.08 mm
TM3DQ16R	16	Relay outputs	24 Vdc / 240 Vac 8 A maximum per common line / 2 A maximum per output	Removable screw terminal block / 3.81 mm
TM3DQ16RG	16	Relay outputs	24 Vdc / 240 Vac 8 A maximum per common line / 2 A maximum per output	Removable spring terminal block / 3.81 mm
TM3DQ16T	16	Regular transistor outputs (source)	24 Vdc 4 A maximum per common line / 0.5 A maximum per output	Removable screw terminal block / 3.81 mm
TM3DQ16TG	16	Regular transistor outputs (source)	24 Vdc 4 A maximum per common line / 0.5 A maximum per output	Removable spring terminal block / 3.81 mm
TM3DQ16U	16	Regular transistor outputs (sink)	24 Vdc 2 A maximum per common line / 0.3 A maximum per output	Removable screw terminal block / 3.81 mm
TM3DQ16UG	16	Regular transistor outputs (sink)	24 Vdc 2 A maximum per common line / 0.3 A maximum per output	Removable spring terminal block / 3.81 mm

Reference	Channels	Channel Type	Voltage Current	Terminal Type / Pitch
TM3DQ16TK (see Modicon TM3, Digital I/O Modules, Hardware Guide)	16	Regular transistor outputs (source)	24 Vdc 2 A maximum per common line / 0.1 A maximum per output	HE10 (MIL 20) connector
TM3DQ16UK (see Modicon TM3, Digital I/O Modules, Hardware Guide)	16	Regular transistor outputs (sink)	24 Vdc 2 A maximum per common line / 0.1 A maximum per output	HE10 (MIL 20) connector
TM3DQ32TK	32	Regular transistor outputs (source)	24 Vdc 2 A maximum per common line / 0.1 A maximum per output	HE10 (MIL 20) connector
TM3DQ32UK	32	Regular transistor outputs (sink)	24 Vdc 2 A maximum per common line / 0.1 A maximum per output	HE10 (MIL 20) connector

TM3 Digital Mixed Input/Output Modules

This following table shows the TM3 mixed I/O modules, with corresponding channel type, nominal voltage/current, and terminal type. For information on configuration of these modules, refer to the TM3 Digital I/O Modules Configuration section.

Reference	Channels	Channel Type	Voltage Current	Terminal Type / Pitch
TM3DM8R	4	Regular inputs	24 Vdc 7 mA	Removable screw terminal block / 5.08 mm
	4	Relay outputs	24 Vdc / 240 Vac 7 A maximum per common line / 2 A maximum per output	
TM3DM8RG	4	Regular inputs	24 Vdc 7 mA	Removable spring terminal block /5.08 mm
	4	Relay outputs	24 Vdc / 240 Vac 7 A maximum per common line / 2 A maximum per output	
TM3DM24R	16	Regular inputs	24 Vdc 7 mA	Removable screw terminal block / 3.81 mm
	8	Relay outputs	24 Vdc / 240 Vac 7 A maximum per common line / 2 A maximum per output	
TM3DM24RG	16	Regular inputs	24 Vdc 7 mA	Removable spring terminal block / 3.81 mm
	8	Relay outputs	24 Vdc / 240 Vac 7 A maximum per common line / 2 A maximum per output	

TM3 Analog Input Modules

The following table shows the TM3 analog input expansion modules, with corresponding channel type, nominal voltage/current, and terminal type. For information on configuration of these modules, refer to the TM3 Analog Input Modules Configuration section.

Reference	Resolution	Channels	Channel Type	Mode	Terminal Type / Pitch
TM3AI2H	16 bit, or 15 bit + sign	2	inputs	0...10 Vdc -10…+10 Vdc 0...20 mA 4...20 mA	Removable screw terminal block / 5.08 mm
TM3AI2HG	16 bit, or 15 bit + sign	2	inputs	0...10 Vdc -10…+10 Vdc 0...20 mA 4...20 mA	Removable spring terminal block / 5.08 mm
TM3AI4	12 bit, or 11 bit + sign	4	inputs	0...10 Vdc -10…+10 Vdc 0...20 mA 4...20 mA	Removable screw terminal block / 3.81 mm
TM3AI4G	12 bit, or 11 bit + sign	4	inputs	0...10 Vdc -10…+10 Vdc 0...20 mA 4...20 mA	Removable spring terminal blocks / 3.81 mm
TM3AI8	12 bit, or 11 bit + sign	8	inputs	0...10 Vdc -10…+10 Vdc 0...20 mA 4...20 mA 0...20 mA extended 4...20 mA extended	Removable screw terminal block / 3.81 mm
TM3AI8G	12 bit, or 11 bit + sign	8	inputs	0...10 Vdc -10…+10 Vdc 0...20 mA 4...20 mA 0...20 mA extended 4...20 mA extended	Removable spring terminal blocks / 3.81 mm
TM3TI4	16 bit, or 15 bit + sign	4	inputs	0...10 Vdc -10…+10 Vdc 0...20 mA 4...20 mA Thermocouple PT100/1000 NI100/1000	Removable screw terminal block / 3.81 mm

Reference	Resolution	Channels	Channel Type	Mode	Terminal Type / Pitch
TM3TI4G	16 bit, or 15 bit + sign	4	inputs	0...10 Vdc -10…+10 Vdc 0...20 mA 4...20 mA Thermocouple PT100/1000 NI100/1000	Removable spring terminal blocks / 3.81 mm
TM3TI4D	16 bit, or 15 bit + sign	4	inputs	Thermocouple	Removable screw terminal block / 3.81 mm
TM3TI4DG	16 bit, or 15 bit + sign	4	inputs	Thermocouple	Removable spring terminal blocks / 3.81 mm
TM3TI8T	16 bit, or 15 bit + sign	8	inputs	Thermocouple NTC/PTC	Removable screw terminal block / 3.81 mm
TM3TI8TG	16 bit, or 15 bit + sign	8	inputs	Thermocouple NTC/PTC	Removable spring terminal blocks / 3.81 mm

TM3 Analog Output Modules

The following table shows the TM3 analog output modules, with corresponding channel type, nominal voltage/current, and terminal type. For information on configuration of these modules, refer to the TM3 Analog Output Modules Configuration section.

Reference	Resolution	Channels	Channel Type	Mode	Terminal Type / Pitch
TM3AQ2	12 bit, or 11 bit + sign	2	outputs	0...10 Vdc -10…+10 Vdc 0...20 mA 4...20 mA	Removable screw terminal block / 5.08 mm
TM3AQ2G	12 bit, or 11 bit + sign	2	outputs	0...10 Vdc -10…+10 Vdc 0...20 mA 4...20 mA	Removable spring terminal block / 5.08 mm
TM3AQ4	12 bit, or 11 bit + sign	4	outputs	0...10 Vdc -10…+10 Vdc 0...20 mA 4...20 mA	Removable screw terminal block / 5.08 mm
TM3AQ4G	12 bit, or 11 bit + sign	4	outputs	0...10 Vdc -10…+10 Vdc 0...20 mA 4...20 mA	Removable spring terminal block / 5.08 mm

TM3 Analog Mixed Input/Output Modules

This following table shows the TM3 analog mixed I/O modules, with corresponding channel type, nominal voltage/current, and terminal type. For information on configuration of these modules, refer to the TM3 Analog Mixed I/O Modules Configuration section.

Reference	Resolution	Channels	Channel Type	Mode	Terminal Type / Pitch
TM3AM6	12 bit, or 11 bit + sign	4	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA	Removable screw terminal block / 3.81 mm
		2	outputs		
TM3AM6G	12 bit, or 11 bit + sign	4	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA	Removable spring terminal block / 3.81 mm
		2	outputs		
TM3TM3	16 bit, or 15 bit + sign	2	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA Thermocouple PT100/1000 NI100/1000	Removable screw terminal block / 5.08 mm
	12 bit, or 11 bit + sign	1	output	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA	
TM3TM3G	16 bit, or 15 bit + sign	2	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA Thermocouple PT100/1000 NI100/1000	Removable spring terminal block / 5.08 mm
	12 bit, or 11 bit + sign	1	output	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA	

TM3 Expert Modules

The following table shows the TM3 expert expansion modules, with corresponding terminal type. For information on configuration of these modules, refer to the TM3 Expert I/O Modules Configuration section.

Reference	Description	Terminal Type / Pitch
TM3XTYS4	TeSys module	4 front connectors RJ-45 1 removable power supply connector / 5.08 mm

TM3 Transmitter and Receiver Modules

The following table shows the TM3 transmitter and receiver expansion modules, with corresponding terminal type. For information on configuration of these modules, refer to the TM3 Transmitter and Receiver I/O Modules Configuration section.

Reference	Description	Terminal Type / Pitch
TM3XTRA1	Data transmitter module for remote I/O	1 front connector RJ-45 1 screw for functional ground connection
TM3XREC1 (see Modicon TM3, Transmitter and Receiver Modules, Hardware Guide)	Data receiver module for remote I/O	1 front connector RJ-45 1 removable power supply connector / 5.08 mm

TM3 Safety Modules

This table contains the TM3 safety modules, with the corresponding channel type, nominal voltage/current, and terminal type:

Reference	Function Category	Channels	Channel type	Voltage Current	Terminal type
TM3SAC5R	1 function, up to category 3	1 or 2 (1)	Safety input	24 Vdc	3.81 mm (0.15 in.) and 5.08 mm (0.20 in.), removable screw terminal block
		Start (2)	Input	100 mA maximum	
		3 in parallel	Relay outputs	24 Vdc / 230 Vac	
			Normally open	6 A maximum per output	
TM3SAC5RG	1 function, up to category 3	1 or 2 (1)	Safety input	24 Vdc	3.81 mm (0.15 in.) and 5.08 mm (0.20 in.), removable spring terminal block
		Start (2)	Input	100 mA maximum	
		3 in parallel	Relay outputs	24 Vdc / 230 Vac	
			Normally open	6 A maximum per output	
TM3SAF5R	1 function, up to category 4	2 (1)	Safety inputs	24 Vdc	3.81 mm (0.15 in.) and 5.08 mm (0.20 in.), removable screw terminal block
		Start	Input	100 mA maximum	
		3 in parallel	Relay outputs	24 Vdc / 230 Vac	
			Normally open	6 A maximum per output	
TM3SAF5RG	1 function, up to category 4	2 (1)	Safety inputs	24 Vdc	3.81 mm (0.15 in.) and 5.08 mm (0.20 in.), removable spring terminal block
		Start	Input	100 mA maximum	
		3 in parallel	Relay outputs	24 Vdc / 230 Vac	
			Normally open	6 A maximum per output	
TM3SAFL5R	2 functions, up to category 3	2 (1)	Safety inputs	24 Vdc	3.81 mm (0.15 in.) and 5.08 mm (0.20 in.), removable screw terminal block
		Start	Input	100 mA maximum	
		3 in parallel	Relay outputs	24 Vdc / 230 Vac	
			Normally open	6 A maximum per output	
TM3SAFL5RG	2 functions, up to category 3	2 (1)	Safety inputs	24 Vdc	3.81 mm (0.15 in.) and 5.08 mm (0.20 in.), removable spring terminal block
		Start	Input	100 mA maximum	
		3 in parallel	Relay outputs	24 Vdc / 230 Vac	
			Normally open	6 A maximum per output	
TM3SAK6R	3 functions, up to category 4	1 or 2 (1)	Safety inputs	24 Vdc	3.81 mm (0.15 in.) and 5.08 mm (0.20 in.), removable screw terminal block
		Start	Input	100 mA maximum	
		3 in parallel	Relay outputs	24 Vdc / 230 Vac	
			Normally open	6 A maximum per output	
TM3SAK6RG	3 functions, up to category 4	1 or 2 (1)	Safety inputs	24 Vdc	3.81 mm (0.15 in.) and 5.08 mm (0.20 in.), removable spring terminal block
		Start	Input	100 mA maximum	
		3 in parallel	Relay outputs	24 Vdc / 230 Vac	
			Normally open	6 A maximum per output	

(1) Depending on external wiring

(2) Non-monitored start

TM3 I/O Configuration General Description

Introduction

The I/O expansion bus of the bus coupler is formed when you assemble the TM3 I/O expansion modules to the bus coupler.

The following modules are supported:

- TM3 Digital (TM3D•)
- TM3 Analog (TM3A•/T•)
- TM3 Safety (TM3S•)
- TM3 TeSys (TM3XTYS4)
- TM3 Transmitter and Receiver (TM3XTRA1, TM3XREC1)

Specific notes:

- Fallback and filter are only supported by firmware version greater than 2.0 for the TM3 Digital (TM3D•) modules
- You can connect a maximum of 10 TM3 Safety modules to one TM3 bus coupler

Fallback Behavior

When encountering fieldbus timeout or releasing of bus ownership in Web server session, the TM3 bus coupler:

- applies the fallback values to the outputs of the expansion modules if they have been configured or
- sets the output values of the expansion modules to 0 if no fallback values have been configured.

The TM3 bus coupler sets the output values of the expansion modules to 0 when:

- a new configuration is received from the controller or
- the following TM3 bus coupler IO region is accessed (read and/or write)
  - TM3BCEIP (Ethernet/IP): Assembly Object (Class ID = 04hex)
  - TM3BCEIP (Modbus TCP)/TM3BCSL: Registers 1 - 199, 3001 - 3999

The configuration request is sent by the controller after any of the following events is done: reset cold, reset warm, communication timeout.

I/O Expansion Bus Error Handling

When the bus coupler detects an expansion module in bus communication error it sets the bus to a "bus off" condition whereby the expansion module outputs, the input image value and the output image value are set to 0. An expansion module is considered to be in bus communication error when an I/O exchange with the expansion module has been unsuccessful for at least 10 consecutive bus task cycles.

Normal I/O expansion bus operation can only be restored after eliminating the source of the error and performing one of the following:

- Power cycle
- New application download
- Issuing a controller **Reset Warm** or **Reset Cold** command with EcoStruxure Machine Expert.

Match Software and Hardware Configuration

The I/O that may be embedded in your controller is independent of the I/O that you may have added in the form of I/O expansion. It is important that the logical I/O configuration within your program matches the physical I/O configuration of your

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

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

The Optional Feature for I/O Expansion Modules

The **Optional module** feature provides a more flexible configuration by the acceptance of the definition of modules that are not physically attached to the logic controller. Therefore, a single application can support multiple physical configurations of I/O expansion modules, allowing a greater degree of scalability without the necessity of maintaining multiple application files for the same application.

You must be fully aware of the implications and impacts of marking I/O modules as optional in your application, both when those modules are physically absent and present when running your machine or process. Be sure to include this feature in your risk analysis.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Include in your risk analysis each of the variations of I/O configurations that can be realized marking I/O expansion modules as optional, and in particular the establishment of TM3 Safety modules (TM3S…) as optional I/O modules, and make a determination whether it is acceptable as it relates to your application.

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

NOTE: For more details about this feature, refer to Optional I/O Expansion Modules, page 21.

Optional I/O Expansion Modules

Presentation

The **Optional module** feature provides a more flexible configuration by the acceptance of the definition of modules that are not physically attached to the controller. Therefore, a single application can support multiple physical configurations of I/O expansion modules, allowing a greater degree of scalability without the necessity of maintaining multiple application files for the same application.

Without the **Optional module** feature, when the controller starts up the I/O expansion bus (following a power cycle, application download or initialization command), it compares the configuration defined in the application with the physical I/O modules attached to the I/O bus. Among other diagnostics made, if the controller determines that there are I/O modules defined in the configuration that are not physically present on the I/O bus, an error is detected and the I/O bus does not start.

With the **Optional module** feature, the controller ignores the absent I/O expansion modules that you have marked as optional, which then allows the controller to start the I/O expansion bus.

The controller starts the I/O expansion bus at configuration time (following a power cycle, application download, or initialization command) even if optional expansion modules are not physically connected to the controller.

The TM3 I/O expansion modules can be marked as optional.

NOTE: TM3 Transmitter/Receiver modules (the TM3XTRA1 and the TM3XREC1) cannot be marked as optional.

You cannot have two modules with the same internal ID code marked as optional without at least one mandatory module placed between them.

You cannot have two modules with the same internal ID code with the first one marked as optional and the second one as mandatory.

You must be fully aware of the implications and impacts of marking I/O modules as optional in your application, both when those modules are physically absent and present when running your machine or process. Be sure to include this feature in your risk analysis.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Include in your risk analysis each of the variations of I/O configurations that can be realized marking I/O expansion modules as optional, and in particular the establishment of TM3 Safety modules (TM3S…) as optional I/O modules, and make a determination whether it is acceptable as it relates to your application.

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

Marking an I/O Expansion Module as Optional

To add an expansion module and mark it as optional in the configuration:

Step	Action
1	Add the expansion module to your controller or bus coupler.
2	In the **Devices tree**, double-click the expansion module.
3	Select the **I/O Configuration** tab.
4	In the **Optional module** line, select **Yes** in the **Value** column:

Shared Internal ID Codes

Controllers and bus couplers identify expansion modules by a simple internal ID code. This ID code is not specific to each reference, but identifies the logical structure of the expansion module. Therefore, different references can share the same ID code.

You cannot have two modules with the same internal ID code declared as optional without at least one mandatory module placed between them.

This table groups the module references sharing the same internal ID code:

Modules sharing the same internal ID code
TM3DI16K, TM3DI16, TM3DI16G
TM3DQ16R, TM3DQ16RG, TM3DQ16T, TM3DQ16TG, TM3DQ16TK, TM3DQ16U, TM3DQ16UG, TM3DQ16UK
TM3DQ32TK, TM3DQ32UK
TM3DI8, TM3DI8G, TM3DI8A

Modules sharing the same internal ID code
TM3DQ8R, TM3DQ8RG, TM3DQ8T, TM3DQ8TG, TM3DQ8U, TM3DQ8UG
TM3DM8R, TM3DM8RG
TM3DM24R, TM3DM24RG
TM3AI2H, TM3AI2HG
TM3AI4, TM3AI4G
TM3AI8, TM3AI8G
TM3AQ2, TM3AQ2G
TM3AQ4, TM3AQ4G
TM3AM6, TM3AM6G
TM3TM3, TM3TM3G
TM3TI4, TM3TI4G
TM3TI4D, TM3TI4DG
TM3TI8T, TM3TI8TG
TM3XTYS4
TM3SAK6R, TM3SAK6RG
TM3SAF5R, TM3SAF5RG
TM3SAC5R, TM3SAC5RG
TM3SAFL5R, TM3SAFL5RG

TM2 General Description

Introduction

The range of TM2 expansion modules includes:

- Digital expansion modules
- Analog expansion modules

Digital Expansion Modules Features

The following table shows the digital expansion modules features:

Module reference	Channels	Channel type	Voltage/current	Reference page
Input Modules				
TM2DAI8DT	8	Inputs	120 Vac 7.5 mA	TM2DAI8DT
TM2DDI8DT	8	Inputs	24 Vdc 7 mA	TM2DDI8DT
TM2DDI16DT	16	Inputs	24 Vdc 7 mA	TM2DDI16DT
TM2DDI16DK	16	Inputs	24 Vdc 5 mA	TM2DDI16DK
TM2DDI32DK	32	Inputs	24 Vdc 5 mA	TM2DDI32DK
Output Modules				
TM2DRA8RT	8	Outputs Relay	30 Vdc/230 Vac 2 A max	TM2DRA8RT
TM2DRA16RT	16	Outputs Relay	30 Vdc/230 Vac 2 A max	TM2DRA16RT
TM2DD08UT	8	Outputs Transistor sink	24 Vdc 0.3 A max per output	TM2DDO8UT
TM2DD08TT	8	Outputs Transistor source	24 Vdc 0.5 A max per output	TM2DDO8TT
TM2DDO16UK	16	Outputs Transistor sink	24 Vdc 0.1 A max per output	TM2DDO16UK
TM2DDO16TK	16	Outputs Transistor source	24 Vdc 0.4 A max per output	TM2DDO16TK
TM2DDO32UK	32	Outputs Transistor sink	24 Vdc 0.1 A max per output	TM2DDO32UK
TM2DDO32TK	32	Outputs Transistor source	24 Vdc 0.4 A max per output	TM2DDO32TK
Mixed Modules				
TM2DMM8DRT	4 4	Inputs Outputs Relay	24 Vdc/7 mA 30 Vdc/230VAC 2 A max	TM2DMM8DRT
TM2DMM24DRF	16 8	Inputs Outputs Relay	24 Vdc/7 mA 30 Vdc/230VAC 2 A max	TM2DMM24DRF

Analog Expansion Modules Features

The following table shows the analog expansion modules features:

Module reference	Channels	Channel type	Voltage/current	Reference page
Input Modules				
TM2AMI2HT	2	High-level inputs	0...10 Vdc 4...20 mA	TM2AMI2HT
TM2AMI2LT	2	Low-level inputs	Thermocouple type J,K,T	TM2AMI2LT
TM2AMI4LT	4	Inputs	0...10 Vdc 0...20 mA PT100/1000 Ni100/1000	TM2AMI4LT
TM2AMI8HT	8	Inputs	0...20 mA 0...10 Vdc	TM2AMI8HT
TM2ARI8HT	8	Inputs	NTC / PTC	TM2ARI8HT
TM2ARI8LRJ	8	Inputs	PT100/1000	TM2ARI8LRJ
TM2ARI8LT	8	Inputs	PT100/1000	TM2ARI8LT
Output Modules				
TM2AMO1HT	1	Outputs	0...10 Vdc 4...20 mA	TM2AMO1HT
TM2AVO2HT	2	Outputs	+/- 10 Vdc	TM2AVO2HT
Mixed Modules				
TM2AMM3HT	2 1	Inputs Outputs	0...10 Vdc 4...20 mA 0...10 Vdc 4...20 mA	TM2AMM3HT
TM2AMM6HT	4 2	Inputs Outputs	0...10 Vdc 4...20 mA 0...10 Vdc 4...20 mA	TM2AMM6HT
TM2ALM3LT	2 1	Low-level inputs Outputs	Thermo J,K,T, PT100 0...10 Vdc 4...20 mA	TM2ALM3LT

Adding a Bus Coupler

Adding a TM3 Ethernet Bus Coupler

To add a TM3 Ethernet bus coupler to your project, select the TM3BCEIP in the **Hardware Catalog**, drag it to the **Devices tree**, and drop it on one of the highlighted nodes.

Select **Ethernet** in the **Devices tree** to configure your bus coupler functions (Modbus or EtherNet/IP), depending on your controller.

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

- Using the Drag-and-drop Method
- Using the Contextual Menu or Plus Button

Adding a TM3 Modbus Serial Line Bus Coupler

To add a TM3 Modbus Serial Line bus coupler to your project, select the TM3BCSL in the **Hardware Catalog**, drag it to the **Devices tree**, and drop it on one of the highlighted nodes.

Select **Serial Line > Modbus I/OScanner > TM3BCSL**.

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

• Using the Drag-and-drop Method

• Using the Contextual Menu or Plus Button

Adding a TM3 CANopen Bus Coupler

To add a TM3 CANopen bus coupler to your project, select the TM3BCCO in the **Hardware Catalog**, drag it to the **Devices tree**, and drop it on one of the highlighted nodes.

Select **CANopen bus > CANopen Performance > TM3BCCO**.

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

• Using the Drag-and-drop Method

• Using the Contextual Menu or Plus Button

Adding an Expansion Module

Adding a Module

To add an expansion module to your controller or a bus coupler, select the expansion module in the **Hardware Catalog**, drag it to the **Devices tree**, and drop it on one of the highlighted nodes.

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

• Using the Drag-and-drop Method

• Using the Contextual Menu or Plus Button

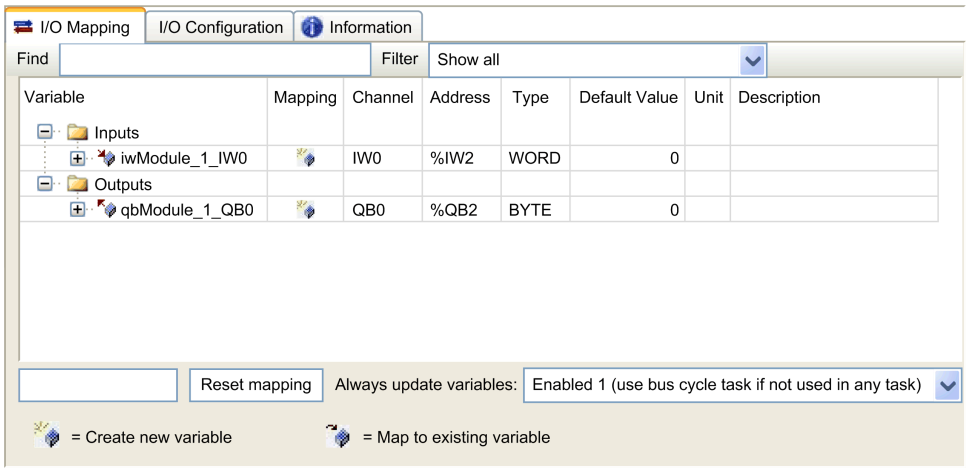
I/O Mapping Tab

The I/O mapping of an expansion module is carried out through the **I/O Mapping** tab of the expansion module configuration.

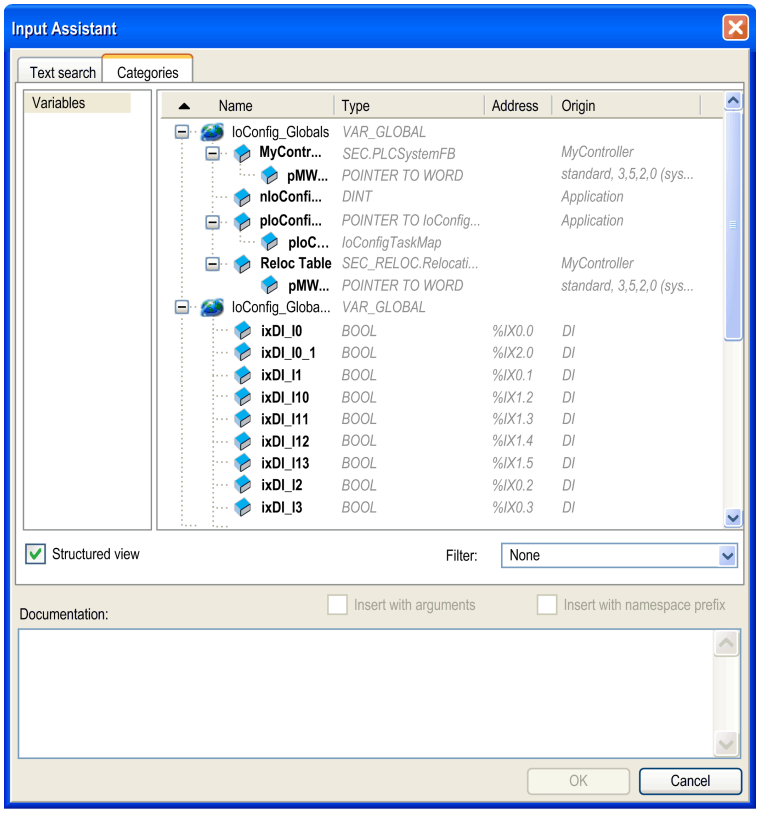
This table describes how to configure an expansion module:

Step	Action
1	Double-click the expansion module node in the **Devices tree** to display the **I/O Mapping** tab.
2	Edit the parameters of the **I/O Mapping** tab to configure the expansion module.

This figure shows the **I/O Mapping** tab:



This table describes each parameter of the **I/O Mapping** tab:

Parameter	Description
Variable	Allows you to map the channel on a variable. **NOTE:** Expand the list of variables from the category **Inputs** or **Outputs**. You can map a channel by either creating a new variable or mapping to an existing variable. **Create new variable**: Double-click the variable to enter the new variable name. A new variable is created if the variable does not already exist. **Map to existing variable**: Double-click the variable and click **[...]** to open the **Input Assistant** window. Select the variable from the list and press **OK**. This figure shows the **Input Assistant** window: 
Mapping	Indicates whether the channel is mapped on a new variable or an existing variable.
Channel	Displays the channel name of the device.
Address	Displays the address of the channel. **NOTE:** If the channel is mapped to an existing variable, corresponding address appears as strikethrough text in the table.
Type	Displays the data type of the channel.
Default Value	Indicates the value taken by the output when the controller is in a **STOPPED** or **HALT** state. Double-click the cell to change the default value. You can toggle between the following values: • No value (*empty cell*) • *TRUE* • *FALSE*
Unit	Displays the unit of the channel value.
Description	Allows you to enter a short description of the channel.

I/O Configuration Tab

This tab allows you to configure the module as an optional module. The following illustration is an example showing the **I/O Configuration** tab:

I/O Mapping | I/O Configuration | Information

Parameter	Type	Value	Default Value	Unit	Description
Optional module	Enumeration of BYTE	No	No		
Inputs					
IW0					
Type	Enumeration of BYTE	Not used	Not used		Range mode
Scope	Enumeration of BYTE	Not used	Not used		Unit
Minimum	INT(-32768...32766)	-32768	-32768		Minimum value
Maximum	INT(-32767...32767)	32767	32767		Maximum value
InputFilter	INT(0...1000)	0	0	x 10 ms	Input filter
Sampling	Enumeration of BYTE	100	100	ms/Channel	Input sampling selection
IW1					
Type	Enumeration of BYTE	Not used	Not used		Range mode
Scope	Enumeration of BYTE	Not used	Not used		Unit
Minimum	INT(-32768...32766)	-32768	-32768		Minimum value
Maximum	INT(-32767...32767)	32767	32767		Maximum value
InputFilter	INT(0...1000)	0	0	x 10 ms	Input filter
Sampling	Enumeration of BYTE	100	100	ms/Channel	Input sampling selection
Outputs					
QW0					
Type	Enumeration of BYTE	Not used	Not used		Range mode
Minimum	INT(-32768...32766)	-32768	-32768		Minimum value
Maximum	INT(-32767...32767)	32767	32767		Maximum value
Diagnostic					
Status Enabled	Enumeration of BYTE	No	Yes		

TM3 Ethernet Bus Coupler

Introduction

This chapter describes how to configure the TM3 Ethernet bus coupler and provides information about Ethernet configuration, Ethernet services and diagnostic. For more details about the device, see Modicon TM3 Bus Coupler - Hardware guide.

TM3 Ethernet Bus Coupler Presentation

Introduction

The TM3 Ethernet bus coupler is a device designed to manage EtherNet/IP and Modbus TCP communication when using expansion modules with a controller in a distributed architecture. The TM3 Ethernet bus coupler supports the TM3 expansion modules, page 12 and the TM2 expansion modules, page 24.

Ethernet Services

The TM3 Ethernet bus coupler supports the following services:

- IPV4
- IPV6
- EtherNet/IP Adapter, page 31
- Modbus TCP/IP server
- Web server, page 53
- Ring topology, page 80
- SNMP, page 63
- DPWS

Ethernet Protocols

The TM3 Ethernet bus coupler supports the following:

- IP (Internet Protocol)
- UDP (User Datagram Protocol)
- TCP (Transmission Control Protocol)
- ARP (Address Resolution Protocol)
- RSTP (Rapid Spanning Tree Protocol)

Connections

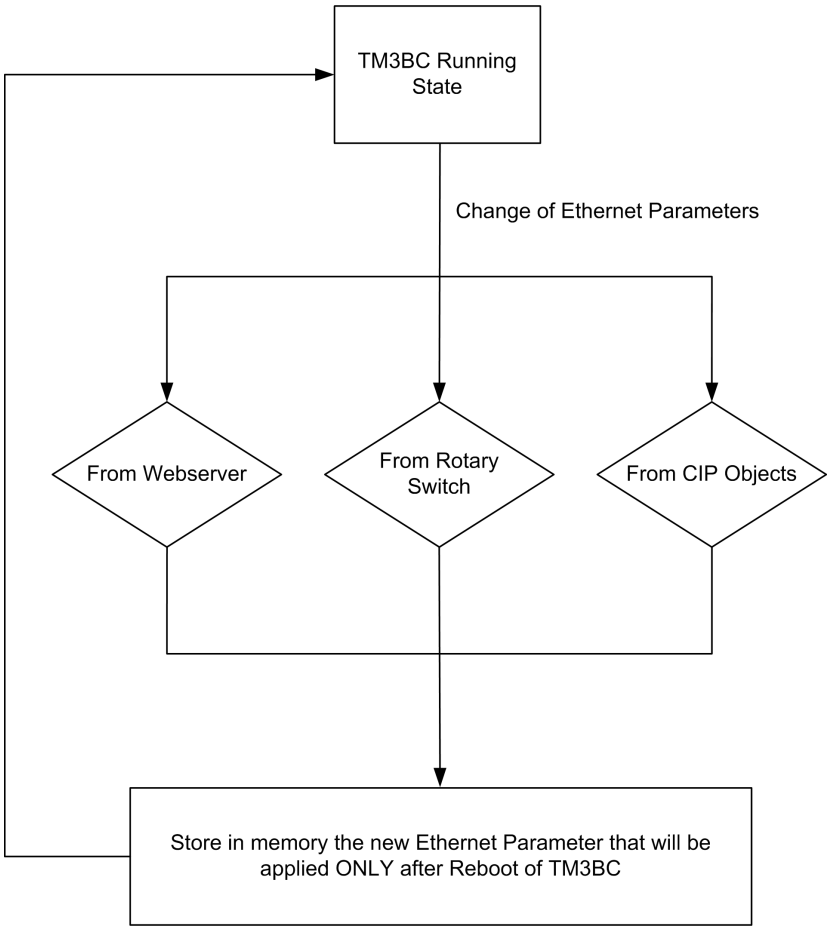
This table shows the maximum number of connections:

Connection Type	Number of Connections
Modbus TCP/IP server	8
EtherNet/IP adapter	• 1 Exclusive Owner (Class 1) • 16 (Class 3)
Web server	32

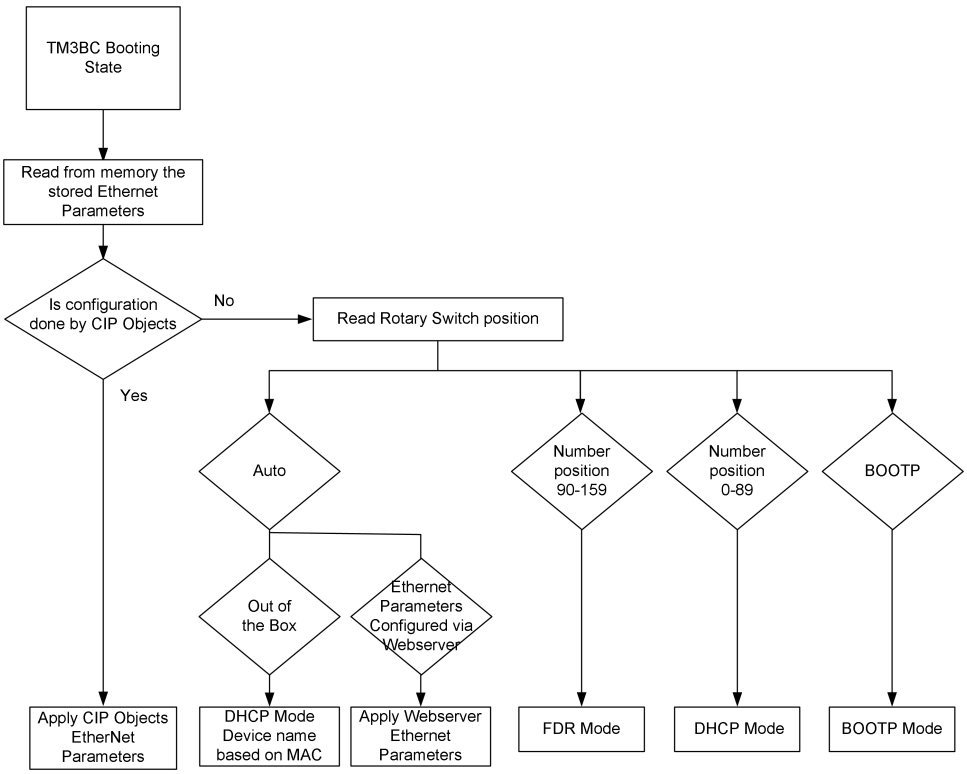
Ethernet Parameters

Ethernet Configuration During Running and Booting States

The following diagram shows the different ways to change the Ethernet parameters of the TM3 Ethernet bus coupler:



The following diagram shows boot process to apply the Ethernet parameters to the TM3 Ethernet bus coupler:



NOTE: After a reset to factory settings, TM3BCEIP has the following default values:

Mode: DHCP

Device Name : TM3BCEIP_MAC4MAC5MAC6

For example, if the MAC address of the TM3BCEIP is 00:80:f4:91:bf:b1 then its device name is: TM3BCEIP_91bfb1.

NOTE: If no DHCP server is present, bus coupler uses its default IP address: 10.10.MAC5.MAC6.

NOTE: If multiple changes have been made, only the last one is taken into account after reboot of the TM3 Ethernet bus coupler.

Changes in rotary switches positions during the running state of TM3 Ethernet bus coupler will replace the Ethernet configuration done via Common Industrial Protocol (CIP) object but only after reboot.

Changes in the Ethernet parameters via Web server during the running state of TM3 Ethernet bus coupler will replace the Ethernet configuration done via CIP object but only after reboot.

Changes in the Ethernet parameters via CIP objects during the running state of TM3 Ethernet bus coupler are applied after reboot, regardless of the position of the rotary switches.

EtherNet/IP Adapter

Introduction

This section describes the configuration of the TM3 Ethernet bus coupler as an EtherNet/IP adapter.

For further information about EtherNet/IP, refer to the www.odva.org website.

EtherNet/IP Adapter Configuration

To configure your TM3 Ethernet bus coupler as an EtherNet/IP adapter, add the bus coupler to your project, page 25 and select **EtherNet IP Scanner > TM3BCEIP**.

EtherNet/IP Parameters Configuration

To configure the EtherNet/IP parameters, double-click the bus coupler node in the **Devices tree**.

In the **Target Settings** tab, you can configure the following parameters:

Element	Description
Address Settings	
IP Address by DHCP	IP address is obtained via DHCP.
	Device name used to retrieve IP address through DHCP, maximum 15 characters.
IP Address by BOOTP	MAC address of the bus coupler.
Fixed IP Address	IP address of the bus coupler.
Electronic Keying	
Check Device Type	Type of the bus coupler.
Check Vendor Type	Vendor code of the bus coupler.
Check Product Type	Product code of the bus coupler.
Check Major Revision	Firmware major version.
Check Minor Revision	Firmware minor version.
Protocol on the fieldbus	
Protocol used by the device	Protocol used. You cannot edit this field.

Electronic Keying signatures are used to identify the bus coupler.

Electronic Keying is information contained in the firmware of the bus coupler (Vendor Code, Product Code, …).

When the controller scanner starts, it compares each selected electronic keying value with the corresponding information in the TM3 Ethernet bus coupler.

If the TM3 Ethernet bus coupler values are not the same as the application values, the controller no longer communicates with the TM3 Ethernet bus coupler.

Connections on EtherNet/IP Adapter

To access a target device, an Originator opens a connection which can include several sessions that send requests.

One explicit connection uses one session (a session is a TCP or UDP connection).

One I/O connection uses one session.

The following table shows the EtherNet/IP connections limitations:

Characteristic	Maximum
Explicit connections	16 (Class 3)
I/O connections	1 (Class 1) Exclusive Owner
Sessions	16

NOTE: The TM3 bus coupler supports cyclic connections. If an Originator opens a connection using a change of state as a trigger, packets are sent at the RPI rate.

EtherNet/IP I/O Mapping Tab

When the data exchanges are configured, you can map variables to be used by the program.

Defined variables are listed in the **EtherNet/IP I/O Mapping** tab.

For more information on this tab, refer to I/O Mapping Dialog.

Bus Cycle Options

Select the **Bus cycle task** to synchronize the EtherNet/IP adapter data:

- **Use parent bus cycle setting** (the default),
- **MAST**
- Any task of the application

  NOTE: This parameter defines the task responsible for copying the %IW and %QW registers from/to the bus coupler.

EtherNet/IP Objects Presentation

EtherNet/IP Objects

The TM3 bus coupler supports the following objects:

Object class	Class ID (hex)	Effect on Interface Behavior
TM3 bus coupler configuration object	65	Stores TM2/TM3 module configurations.
TM3 bus coupler feature configuration object	64	Used to prepare/apply configuration.

Profile

The bus coupler supports the following objects:

Object class	Class ID (hex)	Cat.	Number of Instances	Effect on Interface Behavior
Identity Object, page 34	01	1	1	Supports the reset service
Message Router Object, page 36	02	1	1	Explicit message connection
Assembly Object, page 37	04	2	2	Defines I/O data format
Bus Coupler Diagnostics Object, page 38	64	2	2	Defines I/O data format
Connection Manager Object, page 40	06	–	1	–
TCP/IP Interface Object, page 41	F5	1	1	TCP/IP configuration
Ethernet Link Object, page 42	F6	1	1	Counter and status information
Ethernet/IP Interface Diagnostic Object, page 43	350	1	1	–
I/O Connection Diagnostic Object, page 45	352	1	1	–
Explicit Connection Diagnostic Object , page 47	353	1	1	–

Identify Object (Class ID = 01 hex)

The following table describes the class attributes of the Identity Object:

Attribute ID (hex)	Access	Name	Data Type	Value (hex)	Details
1	Get	Revision	UINT	01	Implementation revision of the Identity Object
2	Get	Max Instances	UINT	01	The largest instance number
3	Get	Number of Instances	UINT	01	The number of object instances
6	Get	Max Class Attribute	UINT	07	The largest class attributes value
7	Get	Max Instance Attribute	UINT	07	The largest instance attributes value

The following table describes the Class Services:

Service Code (hex)	Name	Description
01	Get Attribute All	Returns the value of all class attributes
0E	Get Attribute Single	Returns the value of the specified attribute

The following table describes the Instance Services:

Service Code (hex)	Name	Description
01	Get Attribute All	Returns the value of all class attributes
05	Reset (1)	Initializes EtherNet/IP component (controller reboot)
0E	Get Attribute Single	Returns the value of the specified attribute

(1) Reset Service description:

When the Identity Object receives a Reset request, it:

- determines whether it can provide the type of reset requested
- responds to the request
- attempts to perform the type of reset requested

The Reset common service has one specific parameter, Type of Reset (USINT), with the following values:

Value	Type of Reset
0	Reboots the controller **NOTE:** This is the default value if this parameter is omitted.
1	Not supported
2	Not supported
3...99	Reserved
100...199	Vendor specific
200...255	Reserved

The following table describes the Instance attributes:

Attribute ID (hex)	Access	Name	Data Type	Value (hex)	Details
1	Get	Vendor ID	UINT	F3	Schneider Automation ID
2	Get	Device type	UINT	0C	EIP Adapter
3	Get	Product code	UINT	1009	Bus coupler product code
4	Get	Revision	Struct of USINT, USINT	–	Product revision number of the bus coupler (1). Equivalent to the 2 low bytes of the bus coupler version
5	Get	Status	WORD	–	Status word(2)
6	Get	Serial number	UDINT	–	Serial number of the bus coupler
7	Get	Product name	Struct of USINT, STRING	TM3BCEIP	–

(1) Mapped in a WORD:

- MSB: minor revision (second USINT)
- LSB: major revision (first USINT)

Example: 0205 hex means revision V5.2.

(2) Status word (Attribute 5):

Bit	Name	Description
0	Owned	TRUE indicates that the device is a owner.
1	Reserved	–
2	Configured	TRUE indicates that the device application has been configured.
3	Reserved	–
4...7	Extended Device Status	• 0: Self-testing or undetermined • 1: Firmware update in progress
8	Minor Recoverable Fault	TRUE indicates that the device detected an error, which, under most circumstances, is recoverable. This type of event does not lead to a change in the device state.
9	Minor Unrecoverable Fault	TRUE indicates that the device detected an error, which, under most circumstances, is unrecoverable. This type of event does not lead to a change in the device state.
10	Major Recoverable Fault	TRUE indicates the device detected an error, which requires the device to report an exception and enter into the `HALT` state. This type of event leads to a change in the device state, but, under most circumstances, is recoverable.
11	Major Unrecoverable Fault	TRUE indicates the device detected an error, which requires the device to report an exception and enter into the `HALT` state. This type of event leads to a change in the device state, but, under most circumstances, is not recoverable.
12...15	Reserved	–

Message Router Object (Class ID = 02 hex)

The following table describes the class attributes of the Message Router object:

Attribute ID (hex)	Access	Name	Data Type	Value (hex)	Details
1	Get	Revision	UINT	01	Implementation revision number of the Message Router Object
2	Get	Max Instances	UINT	01	The largest instance number
3	Get	Number of Instance	UINT	01	The number of object instances
4	Get	Optional Instance Attribute List	Struct of UINT, UINT [ ]	–	The first 2 bytes contain the number of the optional instance attributes. Each following pair of bytes represents the number of other optional instance attributes (from 100 to 119).
5	Get	Optional Service List	UINT	0A	The number and list of any implemented optional services attribute (0: no optional services implemented)
6	Get	Max Class Attribute	UINT	07	The largest class attributes value
7	Get	Max Instance Attribute	UINT	02	The largest instance attributes value

The following table describes the Class Services:

Service Code (hex)	Name	Description
01	*Get_Attribute_All*	Returns the value of all class attributes
0E	*Get_Attribute_Single*	Returns the value of the specified attribute

The following table describes the Instance Services:

Service Code (hex)	Name	Description
01	*Get_Attribute_All*	Returns the value of all class attributes
0E	*Get_Attribute_Single*	Returns the value of the specified attribute

The following table describes the Instance attributes:

Attribute ID (hex)	Access	Name	Data Type	Value	Description
1	Get	Implemented Object List	Struct of UINT, UINT [ ]	–	Implemented Object list. The first 2 bytes contain the number of implemented objects. Each 2 bytes that follow represents another implemented class number. This list contains the following objects: • Identity • Message Router • Assembly • Connection Manager • QoS • Port • TCP/IP Interface • Ethernet Link
2	Get	Number available	UINT	16	Maximum number of concurrent CIP (Class 1 or Class 3) connections supported

Assembly Object (Class ID = 04 hex)

The following table describes the class attributes of the Assembly object:

Attribute ID (hex)	Access	Name	Data Type	Value (hex)	Details
1	Get	Revision	UINT	02	Implementation revision of the Assembly object
2	Get	Max Instances	UINT	65	The largest instance number
3	Get	Number of Instances	UINT	03	The number of object instances
4	Get	Optional Instance Attribute List	Struct of: UINT UINT [ ]	01 04	The first 2 bytes contain the number of optional instance attributes. Each following pair of bytes represents the number of other optional instance attributes.
5	Get	Optional Service List	UINT	Not supported	The number and list of any implemented optional services attribute (0: no optional services implemented)
6	Get	Max Class Attribute	UINT	07	The largest class attributes value
7	Get	Max Instance Attribute	UINT	04	The largest instance attributes value

The following table describes the Class Services:

Service Code (hex)	Name	Description
0E	Get Attribute Single	Returns the value of the specified attribute

The following table describes the Instance Services:

Service Code (hex)	Name	Description
0E	Get Attribute Single	Returns the value of the specified attribute
10	Set Attribute Single	Modifies the value of the specified attribute

Instances Supported

The bus coupler supports two assemblies:

Name	Instance	Data Size
TM3BC IO Modules Output Data	100	2...64 words
TM3BC IO Modules Input Data	101	2...64 words

Assembly Assignment

The following table describes the Instance attributes:

Attribute ID (hex)	Access	Name	Data Type	Value	Description
3	Get/Set	Instance Data	ARRAY of Byte	–	Data Set service only available for the controller output
4	Get	Instance Data Size	UINT	128	Size of data in byte

Bus Coupler Diagnostics Object (Class ID = 64 hex)

The following table describes the class attributes of the bus coupler diagnostics object:

Attribute ID (hex)	Access	Name	Data Type	Value (hex)	Details
1	Get	Revision	UINT	01	Implementation revision number of the bus coupler diagnostics object
2	Get	Max Instances	UINT	01	The largest instance number

The following table describes the Class Services:

Service Code (hex)	Name	Description
01	Get_Attribute_All	Returns the value of all class attributes
0E	Get_Attribute_Single	Returns the value of the specified attribute

The following table describes the Instance Services:

Service Code (hex)	Name	Description
0E	Get_Attribute_Single	Returns the value of the specified attribute

Bus Coupler Diagnostics Assignment

The following table describes the Instance attributes:

Attribute ID (hex)	Access	Name	Data Type	Bits	Value	Description
1	Get	System State	UINT	–	–	• 0x0: System is booting • 0x1: TM3 bus is not configured • 0x2: A TM3 configuration is being transferred • 0x3: A valid TM3 configuration is applied successfully • 0x4: TM3 bus is controlled by EIP scanner • 0x5: TM3 bus is controlled by Modbus TCP scanner • 0x6: TM3 bus is controlled by Web server • 0x7: Timeout on fieldbus refresh • 0x8: Firmware update in progress • 0xA: System state transition in progress
2	Get	TM3/TM2 bus and modules status	UINT	0, 1 Module 1	–	Bits value for the module status: • 0: Module ok • 1: Module configuration error • 2: Module runtime error • 3: Module not here but optional Bits value for the bus status: • 0: Bus ok • 1: Bus configuration error • 2: Bus runtime error • 3: Bus not configured
				2, 3 Module 2		
				4, 5 Module 3		
				6, 7 Module 4		
				8, 9 Module 5		
				10, 11 Module 6		
				12, 13 Module 7		
				14, 15 Module 8		
				16, 17 Module 9		
				18, 19 Module 10		
				20, 21 Module 11		
				22, 23 Module 12		
				24, 25 Module 13		
				26, 27 Module 14		
				28, 29 Reserved		
				30, 31 Bus status		

Connection Manager Object (Class ID = 06 hex)

The following table describes the class attributes of the Connection Manager object:

Attribute ID (hex)	Access	Name	Data Type	Value (hex)	Details
1	Get	Revision	UINT	01	Implementation revision of the Connection Manager object
2	Get	Max Instances	UINT	01	The largest instance number
3	Get	Number of Instances	UINT	01	The number of object instances
4	Get	Optional Instance Attribute List	Struct of: UINT UINT [ ]	–	The number and list of the optional attributes. The first word contains the number of attributes to follow and each following word contains another attribute code. Following optional attributes include: • total number of incoming connection open requests • the number of requests rejected due to non-conforming format of the Forward Open • the number of requests rejected because of insufficient resources • the number of requests rejected due to parameter value sent with the Forward Open • the number of Forward Close requests received • the number of Forward Close requests with an invalid format • the number of Forward Close requests that could not be matched to an active connection • the number of connections that have timed out because the other side has stopped producing, or a network was disconnected
6	Get	Max Class Attribute	UINT	07	The largest class attributes value
7	Get	Max Instance Attribute	UINT	08	The largest instance attributes value

The following table describes the Class Services:

Service Code (hex)	Name	Description
01	Get Attribute All	Returns the value of all class attributes
0E	Get Attribute Single	Returns the value of the specified attribute

The following table describes the Instance Services:

Service Code (hex)	Name	Description
01	Get Attribute All	Returns the value of all instance attributes
0E	Get Attribute Single	Returns the value of the specified attribute
4E	Forward Close	Closes an existing connection
52	Unconnected Send	Sends a multi-hop unconnected request
54	Forward Open	Opens a new connection

The following table describes the Instance attributes:

Attribute ID (hex)	Access	Name	Data Type	Value	Description
1	Get	Open Requests	UINT	–	Number of Forward Open service requests received
2	Get	Open Format Rejects	UINT	–	Number of Forward Open service requests which were rejected due to invalid format
3	Get	Open Resource Rejects	ARRAY of Byte	–	Number of Forward Open service requests which were rejected due to lack of resources
4	Get	Open Other Rejects	UINT	–	Number of Forward Open service requests which were rejected for reasons other than invalid format or lack of resources
5	Get	Close Requests	UINT	–	Number of Forward Close service requests received
6	Get	Close Format Requests	UINT	–	Number of Forward Close service requests which were rejected due to invalid format
7	Get	Close Other Requests	UINT	–	Number of Forward Close service requests which were rejected for reasons other than invalid format
8	Get	Connection Timeouts	UINT	–	Total number of connection timeouts that have occurred in connections controlled by this Connection Manager

TCP/IP Interface Object (Class ID = F5 hex)

This object maintains link specific counters and status information for an Ethernet 802.3 communication interface.

The following table describes the class attributes of the TCP/IP Interface Object:

Attribute ID (hex)	Access	Name	Data Type	Value	Details
1	Get	Revision	UINT	4	Implementation revision of the TCP/IP Interface Object
2	Get	Max Instances	UINT	1	The largest instance number
3	Get	Number of Instances	UINT	1	The number of object instances
4	Get	Optional	Struct of: UINT UINT [ ]	–	The first 2 bytes contain the number of optional instance attributes. Each following pair of bytes represents the number of other optional instance attributes.

The following table describes the Class Services:

Service Code (hex)	Name	Description
01	Get Attribute All	Returns the value of all class attributes
0E	Get Attribute Single	Returns the value of the specified attribute

Instance Codes

Only instance 1 is supported.

The following table describes the Instance Services:

Service Code (hex)	Name	Description
01	Get Attribute All	Returns the value of all instance attributes
0E	Get Attribute Single	Returns the value of the specified instance attribute

The following table describes the Instance Attributes:

Attribute ID (hex)	Access	Name	Data Type	Value	Description
1	Get	Status	DWORD	Bit level	• 0: The interface configuration attribute has not been configured. • 1: The interface configuration contains a valid configuration. • 2...15: Reserved.
2	Get	Configuration Capability	DWORD	Bit level	• 0: BOOTP Client • 2: DHCP Client • 4: Configuration Settable • 6: Interface Configuration change requires reset • 7: Acd Capable All other bits are reserved and set to 0.
3	Get	Configuration	DWORD	Bit level	• 0: The interface configuration is valid. • 1: The interface configuration is obtained with BOOTP. • 2: The interface configuration is obtained with DHCP. • 3: Reserved All other bits are reserved and set to 0.
4	Get	Physical Link	UINT	Path size	Number of 16 bits word in the element path
5	Get	Interface configuration	UDINT	IP Address	–
			UDINT	Network Mask	–
			UDINT	Gateway Address	–
			UDINT	Primary Name	–
			UDINT	Secondary Name	0: No secondary name server address has been configured.
			STRING	Default Domain Name	0: No Domain Name is configured
6	Get	Host Name	STRING	–	ASCII characters. 0: No host name is configured

Ethernet Link Object (Class ID = F6 hex)

This object provides the mechanism to configure a TCP/IP network interface device.

The following table describes the class attributes of the Ethernet Link object:

Attribute ID (hex)	Access	Name	Data Type	Value (hex)	Details
1	Get	Revision	UINT	4	Implementation revision of the Ethernet Link Object
2	Get	Max Instances	UINT	3	The largest instance number
3	Get	Number of Instances	UINT	3	The number of object instances

The following table describes the Class Services:

Service Code (hex)	Name	Description
01	Get Attribute All	Returns the value of all class attributes
0E	Get Attribute Single	Returns the value of the specified attribute

Instance Codes

Only instance 1 is supported.

The following table describes the Instance Services:

Service Code (hex)	Name	Description
01	Get Attribute All	Returns the value of all instance attributes
0E	Get Attribute Single	Returns the value of the specified instance attribute

The following table describes the Instance attributes:

Attribute ID (hex)	Access	Name	Data Type	Value	Description
1	Get	Interface Speed	UDINT	–	Speed in Mbit/s (10 or 100)
2	Get	Interface Flags	DWORD	Bit level	• 0: Link status • 1: Half/full duplex • 2...4: Negotiation status • 5: Manual setting / requires reset • 6: Local hardware error detected All other bits are reserved and set to 0.
3	Get	Physical Address	ARRAY of 6 USINT	–	This array contains the MAC address of the product. Format: XX-XX-XX-XX-XX-XX

EtherNet/IP Interface Diagnostic Object (Class ID = 350 hex)

The following table describes the class attributes of the EtherNet/IP Interface Diagnostic object:

Attribute ID (hex)	Access	Name	Data Type	Value (hex)	Details
1	Get	Revision	UINT	01	Increased by 1 on each new update of the object
2	Get	Max Instance	UINT	01	Maximum instance number of the object

The following table describes the instance attributes of the EtherNet/IP Interface Diagnostic object:

Attribute ID (hex)	Access	Name	Data Type	Details
1	Get	Protocols supported	UINT	Protocol(s) supported (0=not supported, 1=supported): • Bit 0: EtherNet/IP • Bit 1: Modbus TCP • Bit 2: Modbus Serial • Bits 3...15: Reserved, 0
2	Get	Connection Diag	STRUCT of	
		Max CIP IO Connections opened	UINT	Maximum number of CIP I/O connections opened.
		Current CIP IO Connections	UINT	Number of CIP I/O connections currently opened.
		Max CIP Explicit Connections opened	UINT	Maximum number of CIP explicit connections opened.
		Current CIP Explicit Connections	UINT	Number of CIP explicit connections currently opened
		CIP Connections Opening Errors	UINT	Incremented on each unsuccessful attempt to open a CIP connection.
		CIP Connections Timeout Errors	UINT	Incremented when a CIP connection is timed out.
		Max EIP TCP Connections opened	UINT	Maximum number of TCP connections opened and used for EtherNet/IP communication.
		Current EIP TCP Connections	UINT	Number of TCP connections currently open and being used for EtherNet/IP communication.
3	Get Clear	IO Messaging Diag	STRUCT of	
		IO Production Counter	UDINT	Incremented each time a Class 0/1 CIP message is sent.
		IO Consumption Counter	UDINT	Incremented each time a Class 0/1 CIP message is received.
		IO Production Send Errors Counter	UINT	Incremented each Time a Class 0/1 message is not sent.
		IO Consumption Receive Errors Counter	UINT	Incremented each time a consumption is received that contains an error.
4	Get Clear	Explicit Messaging Diag	STRUCT of	
		Class3 Msg Send Counter	UDINT	Incremented each time a Class 3 CIP message is sent.
		Class3 Msg Receive Counter	UDINT	Incremented each time a Class 3 CIP message is received.
		UCMM Msg Send Counter	UDINT	Incremented each time a UCMM message is sent.
		UCMM Msg Receive Counter	UDINT	Incremented each time a UCMM message is received.

I/O Connection Diagnostic Object (Class ID = 352 hex)

The following table describes the class attributes of the IO Connection Diagnostic object:

Attribute ID (hex)	Access	Name	Data Type	Value (hex)	Details
1	Get	Revision	UINT	01	Increased by 1 on each new update of the object.
2	Get	Max Instance	UINT	01	Maximum instance number of the object 0...n where n is the maximum number of CIP I/O connections. **NOTE:** There is an IO Connection Diagnostic object instance for both O->T and T->O paths.

The following table describes the instance attributes of the I/O Connection Diagnostic object:

Attribute ID (hex)	Access	Name	Data Type	Details
1	Get Clear	IO Com Diag	STRUCT of	
		IO Production Counter	UDINT	Incremented each time a production is sent.
		IO Consumption Counter	UDINT	Incremented each time a consumption is received.
		IO Production Send Errors Counter	UINT	Incremented each time a production is not sent due to an error.
		IO Consumption Receive Errors Counter	UINT	Incremented each time a consumption is received that contains an error.
		CIP Connection TimeOut Errors	UINT	Incremented each time a connection is timed out.
		CIP Connection Opening Errors	UINT	Incremented on each unsuccessful attempt to open a connection.
		CIP Connection State	UINT	State of the CIP IO connection.
		CIP Last Error General Status	UINT	General status of the last error detected on the connection.
		CIP Last Error Extended Status	UINT	Extended status of the last error detected on the connection.
		Input Com Status	UINT	Communication status of the inputs.
		Output Com Status	UINT	Communication status of the outputs.
2	Get	Connection Diag	STRUCT of	
		Production Connection ID	UDINT	Connection ID for production.
		Consumption Connection ID	UDINT	Connection ID for consumption.
		Production RPI	UDINT	Requested Packet Interval (RPI) for productions, in µs.
		Production API	UDINT	Actual Packet Interval (API) for productions.
		Consumption RPI	UDINT	RPI for consumptions.
		Consumption API	UDINT	API for consumptions.
		Production Connection Parameters	UDINT	Connection parameters for productions.
		Consumption Connection Parameters	UDINT	Connection parameters for consumptions.
		Local IP	UDINT	Local IP address for I/O communication.
		Local UDP Port	UINT	Local UDP port number for I/O communication.
		Remote IP	UDINT	Remote IP address for I/O communication.
		Remote UDP Port	UINT	Remote UDP port number for I/O communication.
		Production Multicast IP	UDINT	Multicast IP address for productions, or 0 if multicast is not used.
		Consumption Multicast IP	UDINT	Multicast IP address for consumptions, or 0 if multicast is not used.
		Protocols supported	UINT	Protocol(s) supported (0 = not supported, 1= supported): • Bit 0: EtherNet/IP • Bit 1: Modbus TCP • Bit 2: Modbus Serial • Bits 3...15: Reserved, 0

Instance Attributes

The following table describes the Class Services:

Service Code (hex)	Name	Description
01	*Get_Attributes_All*	Returns the value of all class attributes.
0E	*Get_Attribute_Single*	Returns the value of a specified attribute.
4C	*Get_and_Clear*	Gets and clears a specified attribute.

Explicit Connections Diagnostic List Object (Class ID = 354 hex)

The following table describes the class attributes of the Explicit Connections Diagnostic List object:

Attribute ID (hex)	Access	Name	Data Type	Value (hex)	Details
1	Get	Revision	UINT	01	Increased by 1 at each new update of the object.
2	Get	Max Instance	UINT	02	Maximum number of concurrent list accesses supported.

The following table describes the instance attributes of the Explicit Connections Diagnostic List object:

Attribute ID (hex)	Access	Name	Data Type	Details
1	Get	Number of Connections	UINT	Total number of open Explicit connections
2	Get	Explicit Messaging Connections Diagnostic List	ARRAY of STRUCT	Contents of instantiated Explicit Connection Diagnostic objects
		Originator Connection ID	UDINT	Originator to Target connection ID
		Originator IP	UDINT	Originator to Target IP address
		Originator TCP Port	UINT	Originator to Target port number
		Target Connection ID	UDINT	Target to Originator connection ID
		Target IP	UDINT	Target to Originator IP address
		Target TCP Port	UINT	Target to Originator port number
		Msg Send Counter	UDINT	Incremented each time a Class 3 CIP message is sent on the connection
		Msg Receive Counter	UDINT	Incremented each time a Class 3 CIP message is sent on the connection

The following table describes the Class Services:

Service Code (hex)	Name	Description
08	Create	Creates an instance of the Explicit Connections Diagnostic List object.
09	Delete	Deletes an instance of the Explicit Connections Diagnostic List object.

Modbus TCP Server

Introduction

Modbus TCP is not based on a hierarchical structure, but on a client/server model.

Without any configuration, the embedded Ethernet port of the bus coupler supports Modbus server.

Modbus TCP Server

The Modbus server supports the Modbus requests:

Function Code Dec (Hex)	Subfunction Dec (Hex)	Function
3 (3)	–	Read holding register (%MW)
6 (6)	–	Write single register (%MW)
16 (10)	–	Write multiple registers (%MW)
22 (16)	-	Mask write register
23 (17)	–	Read/write multiple registers (%MW)
43 (2B)	14 (E)	Read device identification

Modbus TCP Configuration

To configure your TM3 Ethernet bus coupler as a Modbus TCP slave device, add the bus coupler, page 25 and select **Modbus TCP IO Scanner > TM3BCEIP**.

Diagnostic Request

This table contains the data selection code list:

Data Selection Code (hex)	Description
00	Reserved
01	Basic Network Diagnostics
02	Ethernet Port Diagnostic
03	Modbus TCP/Port 502 Diagnostics
04	Modbus TCP/Port 502 Connection Table
05 - 7E	Reserved for other public codes
7F	Data Structure Offsets

TM3 Bus Coupler Modbus TCP Registers

Zone	Access	Registers	Function
Diagnostic Zone	RO	900 - 901	Bus coupler diagnostics
	RO	930 - 931	TM2/TM3 bus and modules status
	RO	932	System state
	RO	991 - 992	Communication diagnostics
	RO	1058...1066	Ethernet communication parameters
	RO	1100...1115	TM3 bus coupler product information
	RO	2512 - 2513	TM3 bus coupler product serial number
IO Scanner Zone	RO	1...99	Subset of bus coupler module input values (first 7 modules)(1)
	RW	101...199	Subset of bus coupler module output values (first 7 modules)(1)
	RO	3001...3499	Bus coupler module input values (all modules)(1)
	RW	3501...3999	Bus coupler module output values (all modules)(1)
	RO	13001...13499	Bus coupler module input values (all modules) for use with HMI devices.
	RO	13501...13999	Bus coupler module output values (all modules) for use with HMI devices.
Direct TM3 Configuration	Refer too How to Configure: Configuration Management Registers, page 71	15000 - 16499	Allow controllers to send TM3 configuration via Modbus requests
(1) Access to those registers returns an error when **System State (register 932)** is not 5 (TM3 bus controlled by modbus TCP). The values of registers 3001…3499, 3501…3999, 13001…13999 are valid only when the **register 931** is 0 (Bus status OK, All module status OK).			

Bus Coupler Diagnostics

Registers	Function	Description
900	Bus coupler diagnostics	Bits (0...8]): Not used
		Bit (9): I/O bus runtime error
		Bits (10-11): Not used
		Bit (13): I/O bus not configured or bus configuration error
		Bits (14-15): Not used
901	I/O modules status	Bit (0...13): Status of first expansion module to status of 14th expansion module
		Bits (14-15): Not used
		0: No error detected
		1: Error detected

TM3/TM2 Bus and Modules Status

Registers	Function	Bits	Description
930	TM3/TM2 bus and modules status	0…1 Module 1	Module status (2 bits per module): • 0x0: Module OK • 0x1: Module configuration error detected • 0x2: Module runtime error detected • 0x3: Module not present but it is optional module
		2…3 Module 2	
		4…5 Module 3	
		6…7 Module 4	
		8…9 Module 5	
		10…11 Module 6	
		12…13 Module 7	
		14…15 Module 8	
931	TM3/TM2 bus and modules status	0…1 Module 9	Module status (2 bits per module): • 0x0: Module OK • 0x1: Module configuration error detected • 0x2: Module runtime error detected • 0x3: Module not present but it is optional module
		2…3 Module 10	
		4…5 Module 11	
		6…7 Module 12	
		8…9 Module 13	
		10…11 Module 14	
		12…13	Reserved
		14…15	Bus status: • 0x0: Bus OK • 0x1: Bus configuration error detected • 0x2: Bus runtime error detected • 0x3: Bus not configured

System State

Registers	Function	Description
932	State of the system	• 0x0: System is booting. • 0x1: TM3 bus is not configured. • 0x2: A TM3 configuration is being transferred. • 0x3: A valid TM3 configuration has been applied successfully. The outputs are set to 0. • 0x4: TM3 bus is controlled by EIP. • 0x5: TM3 bus is controlled by ModbusTCP IO scanner. • 0x6: TM3 bus is controlled by Web server • 0x7: Timeout on fieldbus refresh • 0x8: Firmware update in progress • 0xA: System state transition in progress.
933	TM3/TM2 bus configuration	• Bits [0]: Modbus TCP Data consistency • 0x0: Disable • 0x1: Enable

NOTE: When Modbus TCP is enabled, the values of the status registers (900...901, 930...932) reflect the state of the TM3 Bus Coupler and connected TM3 Expansion modules. Read these status registers before starting IO exchange and take any appropriate actions that might be necessary.

Communication Diagnostic

Registers	Function	Description
991	Number of received messages	Number of messages received.
992	Number of sent messages	Number of messages sent.

Ethernet Communication Parameters

Refer to Configure Network Settings through Modbus command, page 78 on how to use Registers 1050 - 1056 to configure the network configurations.

Registers	Function
1050	Start or apply the network configuration. 1= Start 0= Apply
1051	IP Address HIGH word
1052	IP Address LOW word
1053	Subnet Mask HIGH word
1054	Subnet Mask LOW word
1055	Gateway Address HIGH word
1056	Gateway Address LOW word
1057	Detected error. (Refer to the errors per bit in the table below)
1058	MAC address
1059	
1060	
1061	IP address
1062	
1063	Subnet mask
1064	
1065	Gateway
1066	

This table describes the errors per bit for register 1057:

Bit Field	Error bit (0 = No error, 1 = Error)	Description
Bit 0	Invalid IP	90.0.0.1 and 90.0.0.2 are not allowed, as they are reserved in the bus coupler for RNDIS network.
Bit 1	Invalid IP	Incorrect value for high byte. Value should not be zero. Value should not be greater than or equal to 224. Examples of invalid IP adresses: • 0.xxx.xxx.xxx • 224.xxx.xxx.xx • 255.xxx.xxx.xxx
Bit 2	Invalid IP	Loop back is not allowed. The high byte value of IP address or high byte should not be 127. Example: IP address of 127.xxx.xxx.xxx is not allowed.
Bit 3	Invalid subnet mask	The maximum value allowed for last byte is 252. Examples of invalid subnet mask values: • xxx.xxx.xxx.253 • xxx.xxx.xxx.254 • xxx.xxx.xxx.255
Bit 4	Invalid Subnet mask	Subnet mask must contain continuous ones, with no zero in-between. Example of invalid address: • 160.0.0.0 [10100000.00000000.00000000.00000000]

Bit Field	Error bit (0 = No error, 1 = Error)	Description
Bit 5	Invalid IP	IP address should not be a broadcast address. Broadcast address is calculated by inverting the bits of subnet mask, then bitwise *OR* with IP address. Example: A configuration with IP address of 10.10.0.3 and subnet mask of 255.255.255.252 is invalid because the resulting broadcast address is equal to the IP address.
Bit 6	Invalid Subnet	IP class is not covered. The bitwise *AND* of IP address with inverted bit values of subnet mask should not be 0. Example: An IP address of 10.10.0.4 and a subnet mask of 255.255.255.252 are not allowed as IP class is not covered by subnet mask.
Bit 7	Invalid Gateway	The high byte value of the gateway address is incorrect. Zero is not allowed. 127 is not allowed. The value should be less than 224. Examples of incorrect gateway addresses: • 0.xxx.xxx.xxx • 127.xxx.xxx.xxx • 255.xxx.xxx.xxx
Bit 8	Invalid Gateway	Gateway address of 255.255.255.255 is not allowed.
Bit 9	Invalid IP	Returns error if Gateway address is equal to broadcast address. Broadcast address is calculated by inverting the bits of subnet mask, then bitwise *OR* with IP address. Example of invalid configuration: • IP address: 10.10.0.100 • Subnet mask: 255.255.255.0 • Gateway: 10.10.0.255
Bit 10	Invalid Gateway	Host ID is calculated by inverting the bits of subnet mask, then bitwise *AND* with gateway address. The resultant value should not be 0. Example of invalid configuration: • Subnet mask: 255.255.255.192 • Gateway: 10.10.0.192
Bit 11	Invalid IP	Network is not reachable. Returns error if (IP *AND* subnet) is not equal to (gateway *AND* subnet). Example of invalid configuration: • IP address: 10.10.0.128 • Subnet mask: 255.255.255.192 • Gateway: 10.10.0.64
Bit 12	Invalid subnet	Subnet mask 0.0.0.0 is not allowed.
Bit 13	Not used	–

<table>
<tr><th>Bit Field</th><th>Error bit
(0 = No error, 1 = Error)</th><th colspan="3">Description</th></tr>
<tr><td rowspan="6">Bit 14-15</td><td rowspan="6">Status bits: indicate the status of the network settings configuration</td><td>Bit 15</td><td>Bit 14</td><td>Description</td></tr>
<tr><td>0</td><td>0</td><td>Default value at power on.</td></tr>
<tr><td>0</td><td>1</td><td>Bus coupler is saving the network configuration (after 0is written to Register 1050).</td></tr>
<tr><td>1</td><td>0</td><td>Network configuration is saved, power cycle is pending.</td></tr>
<tr><td>1</td><td>1</td><td>Network configuration is in error or a timeout has occurred.</td></tr>
<tr><td colspan="3">Example:
• Without error, saving configuration: 0x4000
• Configuration saved: 0x8000
• Configuration timeout: 0xC000
• Zero subnet error: 0xD000</td></tr>
</table>

TM3 Bus Coupler Bus Coupler Product Information

Registers	Function
1100	TM3 bus coupler product code
2507-2508	TM3 bus coupler product firmware version
2512-2513	TM3 bus coupler product serial number
2601	Rotary switch **ONES** position
2602	Rotary switch **TENS** position

Web Server

Introduction

The TM3 bus coupler supports a Web server, offering easy access to information such as configuration data, module status, I/O data, network statistics, and diagnostic information. All of this vital information is available using a simple web browser.

In addition the Web server allows you to monitor this information, the bus coupler network and I/O remotely.

You can access the Web server with HTTPS (secure connections). HTTP (non secured connections) is not supported.

The Web server is accessible through the bus coupler USB port, page 172 and Ethernet port by specifying the IP address or hostname in the address bar. You can use the pages of the Web server for network setup and control the I/O module outputs as well as application diagnostics and monitoring. These pages are ready to use with a Web browser. No configuration or programming is required.

Any PC providing a USB (host) port and/or an Ethernet interface can connect to the Web server by using a Web browser.

The Web server can be accessed by the web browsers listed below:

- Microsoft Internet Explorer (version ≥ 11)
- Google Chrome (version ≥ 71)
- Mozilla Firefox (version ≥ 64)
- Microsoft Edge (version ≥ 42)

The Web server allows you to monitor a bus coupler remotely, to perform various maintenance activities including modifications to output modules data and network configuration parameters. Care must be taken to ensure that the immediate physical environment of the machine and process is in a state that will not present safety risks to people or property before exercising control remotely.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Define a secure password for the Web server, and do not allow unauthorized or otherwise unqualified personnel to use this feature.
- Ensure that there is a local, competent, and qualified observer present when operating on the controller from a remote location.
- You must have a complete understanding of the application and the machine/process it is controlling before attempting to adjust data, stopping an application that is operating, or starting the controller remotely.
- Take the precautions necessary to assure that you are operating on the intended controller by having clear, identifying documentation within the controller application and its remote connection.

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

NOTE: The Web server must only be used by authorized and qualified personnel. A qualified person is one who has the skills and knowledge related to the construction and operation of the machine and the process controlled by the application and its installation, and has received safety training to recognize and avoid the hazards involved. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this feature.

Web Server Access

You can manage the user accounts on the Web server on MAINTENANCE / User Accounts, page 62.

By default, the user name is Administrator, and the password is Administrator. You must change the password at the first login.

⚠WARNING

UNAUTHORIZED DATA ACCESS

- Do not expose the device or device network to public networks and the Internet as much as possible.
- Immediately change the default password to a new secure password.
- Do not distribute passwords to unauthorized or otherwise unqualified personnel.
- Restrict access to unauthorized personnel.
- Use additional security layers like VPN for remote access and install firewall mechanisms.
- Validate the effectiveness of these measurements regularly and frequently.

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

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

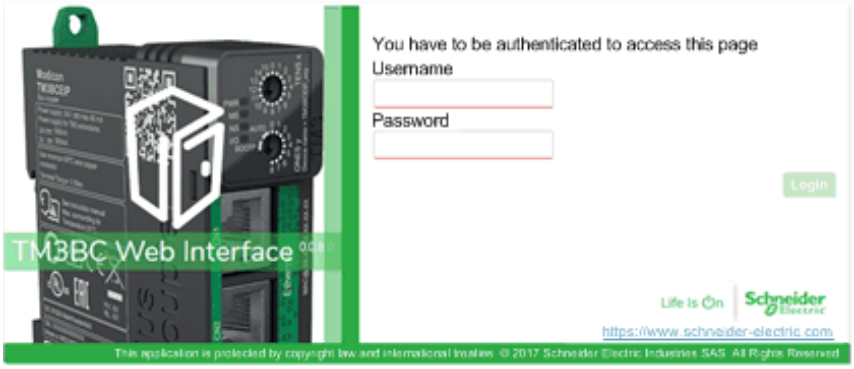
Resetting the Password

To reset the password:

Step	Action
1	Connect to the bus coupler using the USB port. Ensure the Ethernet cable is disconnected.
2	Open the browser.
3	Enter the IP address 90.0.0.1.
4	Move the position of any rotary switch to any other position. **Result: MS** LED is flashing red. The **Restore user accounts** button is displayed.
5	Click **Restore user accounts**.
6	Move the position of the changed rotary switch to its previous position. **Result:** The **Restore user accounts** button is no longer displayed.

Login Page

The login page is the entry point to get authenticated by the Web server. The certificate, page 173 must be validated. To access the website login page shown in the following illustration, type in your navigator the IP address of the TM3 bus coupler or IP address 90.0.0.1 if you are connected by USB. To login to the Web server, enter the user name and password and click **Login**.



The Web server contains the following pages:

- HOME, page 55
- DIAGNOSTICS, page 56
- CONFIGURATION, page 59
- MONITORING, page 59
- MAINTENANCE, page 61

NOTE: The timeout session for each login is ten minutes. When you do not perform any action after you logged in, it redirects you to the login page if you click any button. You need to log in again with user name and password to access the web pages.

HOME Page

The **HOME** page shows the product details of TM3 bus coupler.

The **identification** section of **HOME** page consists of:

Element	Description
Identification	
Vendor ID	Vendor ID of the bus coupler
Vendor Name	Vendor name of the bus coupler
Product ID	Product ID of the bus coupler
Product Name	Product name of the bus coupler
Product Reference	Product reference of the bus coupler
Serial Number	Serial number of the bus coupler
Locate Device 	Click the button to locate the bus coupler. The LEDs of the bus coupler flash red for few seconds.

DIAGNOSTICS Page

The **DIAGNOSTICS** page displays the status of the bus coupler.

The **DIAGNOSTICS** page contains the following sub-pages:

- Device, page 56
- Ethernet, page 57
- EtherNet/IP, page 58
- Modbus TCP, page 58

DIAGNOSTICS / Device

The **Device** sub-page displays the details about identification, page 55 and status of the bus coupler:

Element	Description
Status	
Last Stop Cause	Displays the cause of the last stop of the bus coupler.
USB Port	Displays whether a USB cable is connected to the bus coupler.
Operating Mode	Displays one of the following operating modes of the bus coupler: • **Idle** • **EtherNet/IP** • **Modbus TCP** • **Web interface** • **Firmware update in progress** • **Time Out**
Configuration Status	Displays one of the following configuration status of the bus coupler: • **Not Configured** • **Configured**

DIAGNOSTICS / Ethernet

The **Ethernet** sub-page displays the configuration and status of Ethernet connection:

Element	Description
Configuration	
MAC Address	MAC address of the bus coupler.
Mode	Displays the IP mode of the bus coupler: • DHCP • BOOTP • Manual • FDR
IP Address	IP address of the bus coupler
Subnet Mask	Subnet mask of the bus coupler
Gateway Address	Gateway address of the bus coupler
Reset Reset	Resets all the counter values to zero.
Refresh	Refreshes the values.
Statistics	
TXBytes	Displays the number of the bytes transmitted.
TX Frames	Displays the number of frames transmitted.
ErroneousTXFrames	Displays the number of the frames transmitted in error.
RxBytes	Displays the number of the bytes received.
RX Frames	Displays the number of frames received.
ErroneousRXFrames	Displays the number of the frames received in error.
Reset Reset	Resets all the counter values to zero.
Refresh	Refreshes the values.
Rapid Spanning-Tree Protocol (RSTP)	
Service Status	Displays one of the following status of the bus coupler: • **Running** • **Stopped**
Bridge ID	Made from the **Bridge Priority** and the MAC address.
Bridge Priority	Read only. The **Bridge Priority** is defined in MAINTENANCE / Ethernet, page 65.
Port State (1)	Displays one of the following states of the **CN1** port: • **Disabled** • **Discarding** • **Learning** • **Forwarding**
Port Role (1)	Displays one of the following roles of the **CN1** port: • **Root** • **Designated** • **Backup** • **Alternate** • **Disabled**
Port State (2)	Displays one of the following states of the **CN2** port: • **Disabled** • **Discarding** • **Learning** • **Forwarding**

Element	Description
Port Role (2)	Displays one of the following roles of the **CN2** port: • **Root** • **Designated** • **Backup** • **Alternate** • **Disabled**
Refresh	Refreshes the values.

DIAGNOSTICS / EtherNet/IP

The **EtherNet/IP** sub-page displays the status information of EtherNet/IP:

Element	Description
Reset Reset	Resets all the counter values to zero.
Refresh	Refreshes the values.
Statistics	
TX I/O Messages	Displays the number of I/O messages transmitted through EtherNet/IP.
RX I/O Messages	Displays the number of I/O messages received through EtherNet/IP.
Failed TX I/O Messages	Displays the number of erroneous I/O messages that were not transmitted through EtherNet/IP.
Failed RX I/O Messages	Displays the number of erroneous I/O messages that were not received through EtherNet/IP.
UCMM Requests	Displays the number of UCMM requests.

DIAGNOSTICS / Modbus TCP

The **Modbus TCP** sub-page displays the status information of Modbus TCP:

Element	Description
Reset Reset	Resets all the counter values to zero.
Refresh	Refreshes the values.
Statistics	
TX Messages	Displays the number of Modbus messages transmitted through Modbus TCP.
RX Messages	Displays the number of Modbus messages received through Modbus TCP.
Error Messages	Displays the number of Modbus detected error messages transmitted through Modbus TCP.

CONFIGURATION

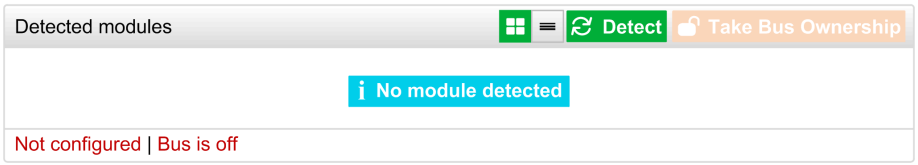
The **CONFIGURATION** page displays the I/O modules configuration imported from the TM3 Bus Coupler IO Configurator. The configuration file is an .SPF format.

Element	Description
PROJECT toolbar	
New	Read only button.
Open	Allows you to import the I/O modules configuration files generated by the TM3 Bus Coupler IO Configurator. Click **Open** to import the files.
Save	Read only button.
CONFIGURATION toolbar	
Apply	Allows you to apply the I/O modules configuration files on the TM3 bus coupler. If the configuration mismatch the hardware, an error message is generated.
DEVICES toolbar	Read only toolbar.

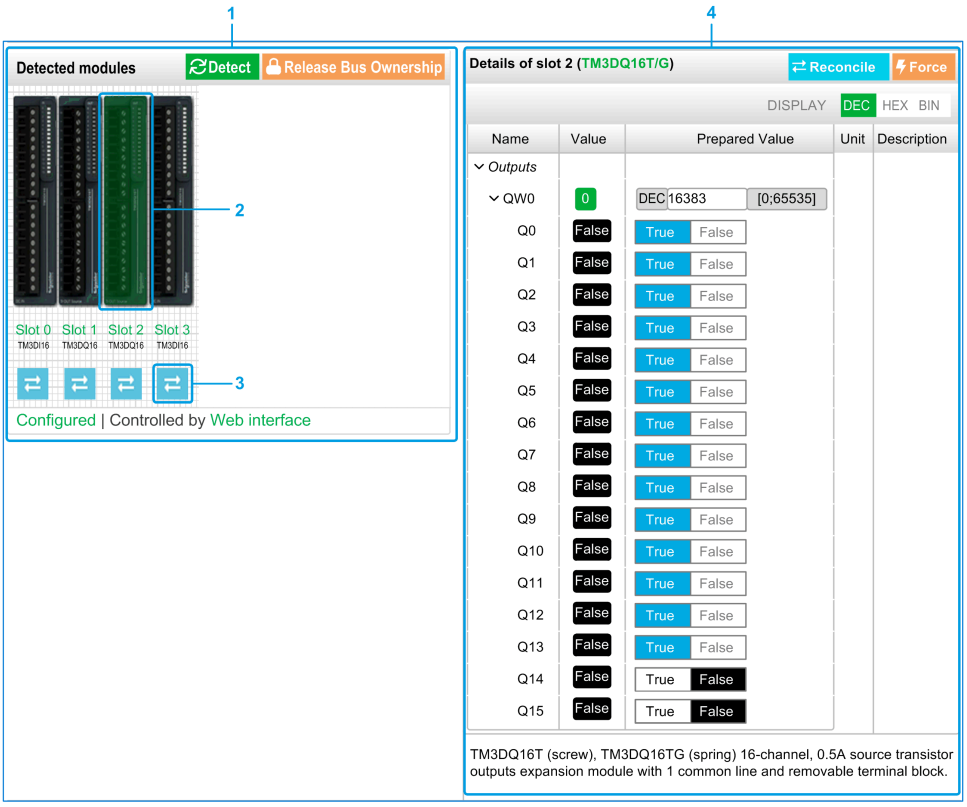
MONITORING Page

The **MONITORING** page displays the TM2 and TM3 expansion modules that are connected to the TM3 bus coupler.

MONITORING page without detected modules:



MONITORING page with modules and details:



1 Bus *Monitoring*

2 Selected module

3 *Reconcile* button

4 Module details

The **MONITORING** page shows and describes all the modules detected by the bus coupler and allows you to:

- See the state of a selected module (running or not running) and the protocol used.
- Read the value of an input or output.
- Force a value to an output by clicking **Force**.
- Identify a module by clicking **Reconcile**.

Element	Description
Detect	Allows you to detect the modules connected to the bus coupler.
Take Bus Ownership **Release Bus Ownership**	Reserves the bus to allow you to force the module outputs. You can click the button when the bus coupler is configured and not controlled by a controller (EtherNet/IP or Modbus TCP)(1). **Result**: You are notified that the I/O bus is controlled by the Web interface. You can edit the output values. Click **Release Bus Ownership** to release the control of the I/O bus.
(1) When connected on EtherNet/IP, the I/O bus is controlled, no matter the controller state. When connected on Modbus TCP, the I/O bus is not controlled when the controller is in `STOPPED` state.	

Module Details

The module details view provides the following data:

- Module name and description
- Module state
- A list of its I/Os

This list of I/Os allows you to view a real-time value of an input and to write the value of an output.

The view has **DISPLAY** buttons to modify the format of the displayed values.

Output Forcing

1. When **Take Bus Ownership** is enabled, click a module to force its outputs.
2. Set the output values you wish to force for the module in the **Prepared Values** column of the list of its I/Os.
3. Click the **Force** button.

   Result: A message is displayed.
4. Click **I agree** to validate the modifications and send them to the bus coupler.

   Click **I disagree** to cancel the modifications.

As the modules are not identified automatically, click the **Reconcile** button to identify the modules.

MAINTENANCE Page

The **MAINTENANCE** page allows you to view and edit the configuration of the bus coupler.

The **MAINTENANCE** page contains the following sub-pages:

MAINTENANCE / User Accounts

The sub-page allows you to enter your login password to access the Web server:

Element	Description
Account Management **Select an account to edit it**	
User Name	List of the following user accounts: • **Administrator** The **Administrator** account is configured with a predefined password (Administrator / Administrator). Modify the predefined password after the first connection. • **Operator** This account is disabled by default. • **Viewer** This account is disabled by default. **NOTE:** Depending on your account, you have access to some web pages. See the table below for the accessible web pages.
Enabled	Selected if the account is enabled.
Account Management **Provide a new password for account**	
Current Password	Enter the current password of the user account.
New Password	Enter a password for the user account. **NOTE:** Minimum ten characters, maximum 32 characters and use a...z, A...Z, 0...9 alphanumeric characters. To reset the password, refer to Resetting the Password, page 55.
Confirm New Password	Enter the password again of the selected account.
Apply	Saves your new password.

This table describes the accessible pages depending on the user account:

Web pages	Sub pages	Administrator	Operator	Viewer
HOME	–	✓	✓	✓
MONITORING	–	✓	✓	–
DIAGNOSTICS	**Device**	✓	✓	✓
	Ethernet	✓	✓	✓
	EtherNet/IP	✓	✓	✓
	Modbus TCP	✓	✓	✓
CONFIGURATION	–	✓	–	–
MAINTENANCE	**Setup**	✓	–	–
	Ethernet	✓	–	–
	User Accounts	✓	✓(1)	✓(1)
	Firmware	✓	–	–
	System Log Files	✓	✓	–
	- **Syslog Server**		–	
	FDR	✓	–	–
(1) You can only modify your user account.				

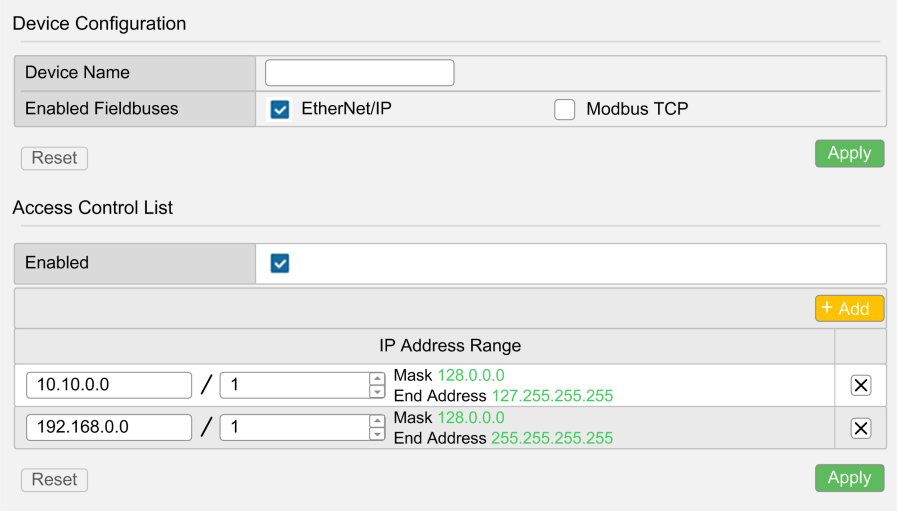
System Use Notification

The sub-page allows you to define a **System Use Notification** message which is displayed to users at log-in:

Element	Description
System Use Notification	
Enabled	When selected, you can define a message that is displayed at log-in.
Message	Displays the message defined.
Reset	Reset to default message.
Apply	Applies your changes.

MAINTENANCE / Setup

The following illustration shows the **Setup** sub-page:



The **Setup** sub-page allows you to change the configuration settings of the bus coupler:

Page	Description
Device Configuration	
Device Name	Name of the bus coupler used in DHCP mode. If you modified the **Device Name**, do a power cycle of the bus coupler to take it into account.
Enabled Fieldbuses	Allows you to select the communication types: • **EtherNet/IP** • **Modbus TCP**
Cancel	Cancels the configuration settings.
Apply (1)	Saves the configuration settings.
Access Control List (ACL)	
Enabled	Enables or disables the ACL management. Enable it to configure the IP address ranges allowed to communicate with the bus coupler.
Add	Adds a line of IP address range.
IP Address Range	Shows the ranges of IP addresses. Each line corresponds to an IP address range allowed to communicate with the bus coupler. The first field represents the starting IP address. The second one is the number of free bits. The maximum number of ranges is 10.
Cancel	Cancels the configuration settings.
Apply (1)	Saves the configuration settings.
SNMP	
Enabled	Enables or disables the SNMP management. Disabled by default.
Read-Only Community String	Shows the community name. Allows you to change the community name. The maximum number of characters is 16.
Cancel	Cancels the configuration settings.
Apply (1)	Saves the configuration settings.
Modbus TCP Data Consistency	
Enabled	Allows an internal copy of the input data registers (3000-3499 or 13000-13499) to be kept since the first read request is received until the second read request is received OR until the monitoring timeout is elapsed. Is enabled by default when the I/O modules configuration need more than 124 words to read the data of the input.
Cancel	Cancels the configuration settings.
Apply (1)	Saves the configuration settings.
TM3 Module and IP Configuration via Modbus Commands	
Enabled	Allows controller to send TM3 configuration via Modbus requests.
Cancel	Cancels the configuration settings.
Apply (1)	Saves the configuration settings.
Device Services	
Discovery (DPWS)	
Enabled	Allows the bus coupler to be located in the LAN via IPv6 or IPv4. Enabled by default.
Cancel	Cancels the configuration settings.
Apply (1)	Saves the configuration settings.
(1) Modifying the *Setup* configuration requires a power cycle of the bus coupler to apply the configuration settings.	

MAINTENANCE / Ethernet

The **Ethernet** sub-page allows you to change the network settings:

Element	Description
Network Configuration	
Mode	Allows you to select the following operating modes of the bus coupler: • **Manual** • **DHCP** • **BOOTP**
IP Address	IP address of the bus coupler. For more information, refer to TM3 Bus Coupler - Hardware Guide.
Subnet Mask	Subnet mask of the bus coupler.
Gateway Address	Gateway address of the bus coupler.
Apply(1)	Saves the configuration settings.
Cancel	Cancels the configuration settings.
Ping Test	
Target IP Address	Allows you to enter the target IP address to check if the bus coupler can reach the device on the network.
Ping	Sends a message to the IP address.
RSTP Configuration	
Enabled	Enables or disables the RSTP configuration.
Bridge Priority	Configure the switch priority to be chosen as the root switch. A low number represents a high priority.
Hello Time (milliseconds)	Read only tab. Interval between the generation of spanning-tree configuration messages by the root switch. These messages mean that the switch is operational.
Maximum Age (milliseconds)	Read only tab. The number of seconds a switch waits without receiving spanning-tree configuration messages before attempting a configuration.
Forward Delay (milliseconds)	Read only tab. The number of seconds the port waits before changing from its spanning-tree learning and listening states to the forwarding state.
(1) Modifying the Ethernet configuration requires a power cycle of the bus coupler to apply the configuration settings.	

MAINTENANCE / Firmware

The **Firmware** sub-page shows the firmware version of the TM3 bus coupler and allows you to update its firmware:

Element	Description
Current Firmware	
Firmware	Firmware version
Web interface	Web server version
Firmware Update **Select a new firmware version**	
Select	Allows you to select the new firmware file for the bus coupler.
Apply	Allows you to apply the new firmware.

NOTE: You cannot update the firmware when the TM3 bus coupler cyclically exchanges data with the logic/motion controller. To make sure the bus coupler is not exchanging data, see **MONITORING**, page 59.

To update the bus coupler firmware:

Step	Action
1	Remove power from the bus coupler.
2	Set the rotary switch **ONES** to the position **AUTO**.
3	Connect the Ethernet cable.
4	Apply power to the bus coupler.
5	Log into the Web server.
6	Verify in the **MONITORING** page that the bus coupler is not exchanging data with the controller.
7	Click **MAINTENANCE** / **Firmware**.
8	Click **Select** then select the firmware file. **Result**: A confirmation window is displayed.
9	Click **I agree**. **Result**: At the end of the download and verification of the file, a confirmation window is displayed.
10	Click **Yes** to close the confirmation window then click **Apply**. **Result**: At the end of the firmware update, a message is displayed to inform you whether the firmware update is completed successfully.

MAINTENANCE / Modules Firmware

The **Modules Firmware** sub-page shows the firmware version of the modules configured and allows you to update its firmware:

Element	Description
Modules Firmware Overview	
Slot	Slot number of the module
Reference	Reference of the module
Current Firmware	Firmware version of the module
Modules Firmware Management **Select a new firmware version**	
Select	Allows you to select the new firmware file for the module. **NOTE:** You can select only a single firmware file. All modules on the bus corresponding to the selected firmware are updated.
Apply	Allows you to apply the new firmware.

NOTE: You cannot update the firmware when the TM3 bus coupler cyclically exchanges data with the logic/motion controller. To make sure the bus coupler is not exchanging data, see **MONITORING**, page 59.

To update the module firmware:

Step	Action	
1	Remove power from the bus coupler.	
2	Set the rotary switch are in address setting position e.g **ONES** to 1, **TENS** to 0.	
3	Connect the USB cable.	
4	Apply power to the bus coupler.	
5	Log into the Web server.	
6	Verify in the **MONITORING** page that the bus coupler is not exchanging data with the controller.	
7	Click **MAINTENANCE** / **Modules Firmware**.	
8	Click **Select** then select the firmware file. **Result**: The firmware file is selected.	
9	Click **Apply**. **Result**: A confirmation window is displayed.	
10	Click **I agree**. **Result**: A restart window is displayed.	
11	Click **Yes**. **Result**: The file is verified and downloaded. Thereafter, a confirmation window is displayed. The TM3 bus coupler reboots and a confirmation window is displayed.	Click **No**. **Result**: The firmware update is canceled.

MAINTENANCE / System Log Files

The **System Log Files** sub-page lists the log files. Some of the information in the log files comes from internal interactions of the firmware and is intended to be used by Schneider Electric Technical Support:

Element	Description
Log Files	
Name	Shows the list of the log files.
Size	Displays the size of the log files.
Download	Allows you to download the log files.
SysLogServer	
Enabled	Enable or disable the **SysLogServer**. Disabled by default.
Port (TCP)	Read-only tab. TCP port number for **SysLogServer**.
IP Address	Allows you to set the bus coupler IP Address.
Cancel	Cancels the configuration settings.
Apply	Saves the configuration settings.
Action	
Send Test Message	Allows you to send a test message stored under the folder /usr/Syslog.

MAINTENANCE / Fast Device Replacement (FDR)

FDR mode activation:

The **Fast Device Replacement (FDR)** service allows you to replace an inoperable device by a new one without the need to configure it.

Mode	Rotary switches position	
FDR mode enabled	**TENS**: 09 to 15	**ONES**: 0 to 9

Element	Description
Device Configuration	
Device Name	Name of the bus coupler. Syntax is TM3BCEIP_+XXY (XX represents **TENS** switch position and Y represents **ONES** rotary switch position). **NOTE:** If the bus coupler is in **AUTO** mode, the name might not respect this syntax.
Ethernet Mode	• Manual • **DHCP** • **BOOTP** • **FDR**
FDR Configuration	
Status	• **Enabled** • **Disabled**
Auto backup	Allows you to enable or disable the automatic backup. When the TM3BCEIP is selected, it sends the .prm file to the FDR server, respecting the timing configured in the automatic backup period.
Auto backup period (seconds)	Allows you to set the backup period **(600-90000 seconds)**. Default value for the backup period is 1800 seconds.
ControlConfiguration	When **FDR** is enabled and **Auto backup** is unchecked • **Server**: at boot, the TM3BCEIP requests for the prm.file and applies the configuration. • **Stored**: at boot, the TM3BCEIP does not request for the prm.file and applies the existing configuration. When **FDR** is enabled and **Auto backup** is checked with a **Backup period** of 600 seconds: • **Server**: at boot, the TM3BCEIP requests for the prm.file and applies the configuration. The TM3BCEIP generates and pushes the prm.file to the server each 600 seconds. • **Stored**: at boot, the TM3BCEIP does not request for the prm.file and applies the existing configuration. The TM3BCEIP generates and pushes the prm.file to the server each 600 seconds.
Cancel	Cancels any changes made to the values.
Apply	Saves the values to the Flash memory.
FDR Restore	
Current State	• **Idle** • **RestoreInProgress** • **Error**
LastError	• **No Error** • **EmptyFile** • **NoFile** • **ServerNotFound** • **GenericError**
Restore Config	Allows you to manually restore (by downloading) the device parameters file from the FDR server to the bus coupler and to apply the configuration received without restarting. This button cannot be clicked when the bus coupler is controlled by the controller or by the Web.
FDR Push	
Current State	• **Idle** • **ConfigurationPushCompleted** • **Error**

Element	Description
LastError	• **No Error** • **EmptyFile** • **NoFile** • **ServerNotFound** • **GenericError**
Push Config	Allows you to manually backup (by uploading) the device parameters file from the bus coupler to the FDR server.

TM3 Configuration via Modbus command

Introduction

This section describes how to send TM3 configuration via Modbus command from a controller. The tables used for this configuration mode are in the appendices. Refer to Direct TM3 Configuration through Modbus Commands, page 176.

TM3 Module Support

The following modules are supported:

- TM3 Digital (TM3D•)
- TM3 Analog (TM3A•/T•)
- TM3 Safety (TM3S•)
- TM3 TeSys (TM3XTYS4)
- TM3 Transmitter and Receiver (TM3XTRA1, TM3XREC1)

Limitations and specific notes:

- TM3 optional configuration are not supported by this feature
- Fallback configuration for TM3 analog output is also supported by bus coupler via this feature. Fallback values, if configured, is applied by the bus coupler to the output of analog expansion modules in the following scenarios:
  - fieldbus communication timeout
  - after releasing bus ownership in Web server
- The transmitter and receiver modules are transparent to the bus couplers. Therefore, you must define which is the first module after the TM3XREC1 module in a remote configuration by defining the value in *First module after expander* register.

⚠WARNING

UNINTENDED MACHINE OPERATION

- Set the value in “First module after expander” register to match the physical configuration.
- Refer to appropriate section on how to configure the transmitter and receiver modules.

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

Enabling TM3 Configuration via Modbus command

The Modbus command is disabled by default. You can enable the Modbus command by using the rotary switches or via the Web server.

To enable the Modbus command by using the rotary switches:

Step	Action
1	Remove power from the bus coupler and disconnect all fieldbus communication cables.
2	Set both rotary switches **ONES** and **TENS** to the position **3**.
3	Apply power to the bus coupler.
4	Wait until the **MS** LED flashes green.
5	Within 60 seconds, set the rotary switch **ONES** to the position **BOOTP/AUTO** and the rotary switch **TENS** to the position **12**. **Result:** The LED **MS**, **NS** and **IO** flash green five times.
6	Wait until the LED **MS**, **NS** and **IO** flash green five times, then hold solid. **Result:** The feature is enabled successfully. The bus coupler is in *STANDBY* state and no operation is allowed.
7	Remove power from the bus coupler.
8	Connect the fieldbus communication cables.
9	Apply power to the bus coupler.

To enable the Modbus command via the Web server:

Step	Action
1	Log into the Web server as Administrator.
2	Click on **MAINTENANCE > Setup**
3	Check the **Modbus TCP** checkbox in the **Device Configuration** view.
4	Check the **Enabled** checkbox in the **TM3 Module and IP Configuration via Modbus Commands** view.
5	Click **Apply**. **Result:** Warning window is displayed.
6	Click **I Agree**. **Result:** A message is displayed to inform you that the configuration will apply after the next boot-up.

See also Maintenance/Setup, page 63.

How to Configure

Proceed as follows to configure the TM3 bus coupler:

Step	Action	
1	Write `1` to Register 15000. **NOTE:** This should be a single write Modbus request.	
2	Write the required configurations to the appropriate Modbus registers. Refer to How to Configure: Module Parameters Registers, page 73 for detailed description of the registers. Refer to Direct TM3 Configuration through Modbus Requests: Registers and Default Values for Supported TM3 Modules, page 176 for the default values for each TM3 module.	
3	Write `0` to Register 15000. **NOTE:** This should be a single write Modbus request.	
4	The Bus coupler apply the configuration	
	Result: If successfully, the configuration is applied and saved in non-volatile memory. Any pre-existing configuration stored in non-volatile memory is overwritten.	**Result:** If an invalid configuration is detected, the configuration is not applied. Check the Error Diagnostics Modbus registers and the TM3/TM2 Bus and Modules Status, page 50 registers for error information. Error description is also saved in log file, which can be retrieved via the Web server. It is recommended to delete any configuration saved in non-volatile memory and send again the correct configuration. Refer to Deleting Permanent Configuration, page 78 on how to delete configuration.

NOTE:

- Step 1 to 3 must be completed within 10 minutes. After 10 minutes, a configuration timeout occurs and the bus coupler interrupts the configuration process.
- Once a configuration is started, no further configuration initialization shall be allowed until the completion of the configuration, or a configuration timeout has occurred.
- For Analog channels, you must set the minimum and maximum values suitable for this application. The bus coupler firmware does not automatically adjust the minimum and maximum values according to type chosen. The analog values from module are scaled according to the range between the minimum and maximum configuration. For example, if channel type is 0 – 10 V, and minimum/maximum is set to 0 V and 10000 V respectively, this means the unit of measure would be 10 V / 10000 = 1 mV.
- For the following types of configuration, it is required to configure the specific minimum and maximum value as defined in the respective compatibility table. Configuring any other value results in a configuration error.
  - TM3AI8 -> 0 – 20 mA extended range and 4 – 20 mA extended range.
  - Any temperature input with scope set to either in Celsius or Fahrenheit, except for Type B and Type C thermocouple in Fahrenheit. For these two specific use case, refer to the compatibility table for the correct configuration (see Direct TM3 Configuration through Modbus Commands, page 176).
  - Input is set to Ohmmeter

Using Rotary Switch to Define the First Module After Expander Value

You can define this value via Modbus command or by using the **TENS** rotary switch.

To define the First Module After Expander Value by using the **TENS** rotary switch:

Step	Action
1	Ensure that the **TENS** rotary switch is set to a position between **0** and **7**. **NOTE:** The **MS** LED flashes red if the rotary switch position is changed after boot-up. You can return the rotary switch to its original position after the configuration process is complete.
2	Start the configuration.
3	During configuration process, write the value 254 to the Register 15001.
4	Once all required configuration values have been written, apply the configuration. **Result:** The bus coupler replaces the value in the Register 15001 with the value defined by the **TENS** rotary switch after configuration is applied successfully.

How to Configure: Module Parameters Registers

This table describes registers dedicated to the overall management of the feature:

Register Address	Description	Access	Comments
15000	Control Start/Stop Configuration	RW	Write: • 1 = Start configuration (start to accept modules configuration commands). • 0 = Apply configuration. Other values result in “Illegal Data Value” exception. Read: • 1 = In configuration state • 0 = Not in configuration state
15001	First module after expander	RW	Index of the first module after the expander module • 255 (default) = No modules after the expander • 0 = 1st physical module • 1 = 2nd physical module • 2 = 3rd physical module • 3 = 4th physical module • 4 = 5th physical module • 5 = 6th physical module • 6 = 7th physical module • 7 = 8th physical module • 254 = Use **TENS** rotary switch value. See Using Rotary Switch to Define the First Module After Expander Value, page 71. No other values allowed.
15002	Remove Permanent Configuration	RW	Allows you to remove saved configuration from non-volatile memory. See Deleting Permanent Configuration, page 78.
15003	Monitoring Timeout	RW	Timeout value of the bus in millisecond. Range value: 0 – 65535. Default value: 10000.
15004-15049	Reserved	RO	The register are reserved and the value is 0.
15050	Configurable	RO	0 = The connected expansion modules are not configurable by using the Modbus command. 1 = The connected expansion modules are configurable by using the Modbus command.
15051	Number of modules	RO	Indicates the number of connected expansion modules.
15052	Enabling feature	RO	0 = TM3 configuration via Modbus command is disabled 1 = TM3 configuration via Modbus command is enabled
15053-15059	Reserved	RO	The register are reserved and the value is 0.
15060	Number of errors	RO	Number of errors detected. **NOTE:** A maximum of 10 errors can be detected. A 11th error is not detected by the firmware.

Register Address	Description	Access	Comments
15061	1st Error - Error Code	RO	Error codes: • Register value 0: *RESERVED* • Register value 1: Invalid Analog channel type • Register value 2: Invalid Analog minimum value • Register value 3: Invalid Analog maximum value • Register value 4: Configured Analog minimum value is greater than configured maximum value • Register value 5: *RESERVED* • Register value 6: Invalid filter value (TM3 Analog modules) • Register value 7: Invalid sampling value • Register value 8: Invalid fallback value (TM3 Analog modules) • Register value 9: Invalid Analog scope • Register value 10: Invalid resistance reference value R_ref (used with NTC thermistor only) • Register value 11: Invalid temperature reference value T_ref (used with NTC thermistor only) • Register value 12: Invalid sensitivity value Beta (used with NTC thermistor only) • Register value 13: Invalid value used to configure Functional Mode (TM3 Digital modules) • Register value 14: Invalid filter value (TM3 Digital modules) • Register value 15: Invalid fallback mode selected (TM3 Digital modules) • Register value 16: Invalid fallback value (TM3 Digital modules) • Register value 17: Invalid value used to enable or disable module diagnostics • Register value 18: Configured Functional mode value is not supported by TM3D• modules with firmware version < 2.0 • Register value 19: Invalid low threshold value (used with Threshold mode only in TM3 Analog modules) • Register value 20: Invalid high threshold value (used with Threshold mode only in TM3 Analog modules) • Register value 21: Configured low threshold value is greater than configured high threshold value (used with Threshold mode only in TM3 Analog modules) • Register value 22 – 99: *RESERVED* • Register value 100: Invalid "First module after expander" value • Register value 101: Connected module does not support direct configuration via Modbus commands • Register value 102: More than 10 TM3S• Safety modules are connected • Register value 103 – 65534: *RESERVED* • Register value 65535: Default value (No error)
15062	1st Error - Module and channel	RO	• [Bits 0 – 4] Channel index (Value range: 0 – 31) • [Bits 5 – 7] Reserved • [Bit 8] 0 = Output, 1 = Input • [Bit 9] 0 = Channel error, 1 = Module error • [Bits 10 – 11] Reserved • [Bits 12 – 15] Module index (Value range: 0 – 13) Module error is applicable to error code 13, 17, 18, 101 and 102. Examples: 1st physical module, 3rd physical output channel = 0x0002 4th physical module, 3rd physical input channel = 0x3102 5th physical module, 4th physical output channel = 0x4003 14th physical module, 32nd physical input channel = 0xD11F 8th physical module, Module error = 0x7200
15063-15080	2nd to 10th Error - Code, and Error - Module and channel	RO	See registers values Error Code and Error - Module and channel, above.
15081-15099	Reserved	RO	The register are reserved and the value is 0.

This table describes the configuration registers division:

Address	Description
15100 - 15199	Configuration parameters of TM3 module at slot number 0
15200 - 15299	Configuration parameters of TM3 module at slot number 1
15300 - 15399	Configuration parameters of TM3 module at slot number 2
15400 - 15499	Configuration parameters of TM3 module at slot number 3
15500 - 15599	Configuration parameters of TM3 module at slot number 4
15600 - 15699	Configuration parameters of TM3 module at slot number 5
15700 - 15799	Configuration parameters of TM3 module at slot number 6
15800 - 15899	Configuration parameters of TM3 module at slot number 7
15900 - 15999	Configuration parameters of TM3 module at slot number 8
16000 - 16099	Configuration parameters of TM3 module at slot number 9
16100 - 16099	Configuration parameters of TM3 module at slot number 10
16200 - 16299	Configuration parameters of TM3 module at slot number 11
16300 - 16399	Configuration parameters of TM3 module at slot number 12
16400 - 16499	Configuration parameters of TM3 module at slot number 13

For each section:

Address Offset	Description	Access	Comments
1XY00	Module Type	RO	Module ID of TM3 module.
1XY01	Number of Configuration Parameters	RO	Depends on the module type. For example, “6” means addresses from [1XY08 - 1XY13] are available for configuration.
1XY02 - 1XY07	Reserved	RO	The register are reserved and the value is 0.
1XY08 - 1XY99	Specific Configuration Parameters	RW	For specific parameter configuration 0xFFFF = the register is not available or invalid for modification.

NOTE: XY indicates the slot to which module is connected. 51 ≤ XY ≤ 64.

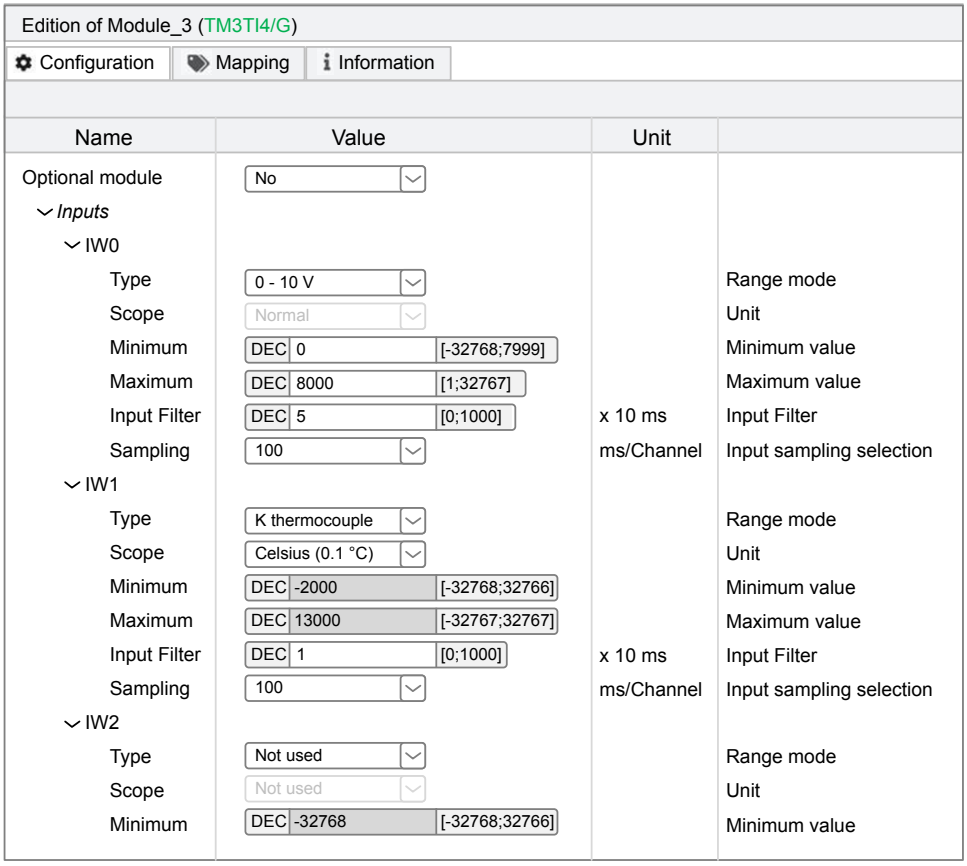
Example: For the first module, “Module Type” is at address 15100 and the 14th module is at address 16400.

How to Configure: TM3 Module Specific Registers

Module Type	Module ID (Read only 1XY00)	Configuration Size (Read only 1XY01) (Read/Write Memory starts from 1XY08)
TM3DI8, page 176	132	9
TM3DI16, page 177	128	17
TM3DI32K, page 178	130	33
TM3DQ8, page 179	133	17
TM3DQ16, page 180	129	33
TM3DQ32TK, TM3DQ32UK, page 182	131	65
TM3DM8R, page 185	134	13
TM3DM24R, page 186	135	33
TM3AI2H, page 187	192	11
TM3AI4, page 188	193	21
TM3AI8, page 190	194	41
TM3TI4, page 193	199	25
TM3TI4D, page 195	203	25
TM3TI8T, page 197	200	89
TM3AQ2, page 202	195	9
TM3AQ4, page 203	196	17
TM3AM6, page 204	197	29
TM3TM3, page 206	198	17
TM3SAC5R	146	0
TM3SAF5R	145	0
TM3SAFL5R	147	0
TM3SAK6R	144	0
TM3XTYS4	136	0

How to Configure: Example

This graphic shows the configuration for a TM3 bus coupler + 1 TM3TI4G



This table shows the Modbus registers to write:

TM3TI4/G	Address	Value	Description
Ch 0 – type	15109	1	0 – 10 V
Ch 0 – Scope	15110	1	Unit in Normal
Ch 0 - Minimum	15111	0	Minimum
Ch 0 - Maximum	15112	8000	Maximum
Ch 0 - Input filter	15113	5	50ms filter time
Ch 0 - Sampling	15114	0	100ms sampling time
Ch 1 – type	15115	7	K Thermocouple
Ch 1 – Scope	15116	2	Unit in Celsius
Ch 1 – Minimum	15117	63536	Minimum (63536 equal to -2000 in signed value)
Ch 1 – Maximum	15118	13000	Maximum
Ch 1 - Input filter	15119	1	10 ms filter time
Ch 1 - Sampling	15120	0	100 ms sampling time

Modbus Command done via “Write Single Register”

- Address: 15000
- Data bytes: [1]

Modbus Command done via “Write Multiple Registers”

- Address: 15108
- Number of registers: 12
- Data bytes: [1, 1, 0, 8000, 5, 0, 7, 2, 63536, 13000, 1, 0]

Modbus Command done via “Write Single Register”

- Address: 15000
- Data bytes: [0]

Deleting Permanent Configuration

The configuration stored in the non-volatile memory can be deleted by using Modbus command. The following conditions are required:

- The configuration via Modbus command is enabled
- The connected modules are configurable via this command
- The bus coupler is not in *configuring* state (see **System State (register 932)**), controlled by the Web server or updating the firmware.

To delete the configuration by using Modbus command:

Step	Action
1	Write `0xFF` to Register 15002.
2	Within 30 seconds, write `0` to Register 15002. **Result:** The bus coupler attempts to delete the stored configuration. **NOTE:** If `0` is not written in the register within 30 seconds, a timeout occurs and the stored configuration is not deleted. Register 15002 is reset to `0` by the bus coupler.
3	Check the **System State (register 932)**): **Result:** When the bus coupler state is in *not configured state* this indicates that the stored configuration has been deleted successfully. The default values are filled in and the error registers are cleared.

Configure Network Settings through Modbus command

You can update:

- The IP address configuration alone (IP address: 1051 - 1052)
- The IP address configuration and the subnet mask configuration (IP address: 1051 - 1052 and subnet mask: 1053 - 1054)
- The IP address configuration, the subnet mask configuration and the Gateway (IP address: 1051 - 1052, subnet mask: 1053 - 1054 and Gateway: 1055 - 1056)

To update the network parameters via Modbus command:

NOTE: A timeout occurs and the configuration is not set if the process described within step 2 is not completed within 60 seconds. When a timeout occurs, register 1050 is reset to 0 by the bus coupler.

Step	Action
1	Set the rotary switch **ONES** to the position **AUTO**.
2	Within 60 seconds: • 2a: Write 1 to Register 1050 as a single write Modbus request • 2b: Write the required network configuration to Registers 1051 – 1056 • 2c: Write 0 to Register 1050 as a single write Modbus request. . **Result:** If the parameters set are valid, the bus coupler saves these parameters. **NOTE:** If the parameters are not valid, the bus coupler updates the error register 1057 and indicates the detected error.
3	Wait for 10 seconds.
4	Remove power from the bus coupler.
5	Apply power to the bus coupler. **Result:** The new network parameters are applied.

NOTE: Refer to the Ethernet Communication Parameters, page 51 table for more details on registers.

Example of a network settings for IP address of 10.10.0.136 (0x0A0A 0088) with mask 255.0.0.0 (0xFF00 0000) and Gateway 10.10.0.6 (0x0A0A 0006):

Step	Register	Value to write
2a	1050	1
2b	1051	0A0A
	1052	0088
	1053	FF00
	1054	0000
	1055	0A0A
	1056	0006
2c	1050	0

Error Management

If the physical setup is not compatible, the register 15050 is set to 0. The configuration via Modbus commands can not apply and the error is written in the log file. Incompatible physical setup includes the following scenarios:

- One or more TM2 modules are present in the bus
- One or more TM3XHSC modules are present in the bus
- More than 10 safety modules are present in the bus

When the module configuration registers are written, the values are not validated until the configuration is applied. If an error is detected during the validation, the details about the first 10 errors (error code, module index and channel) are indicated in the registers 15061 – 15080. Validation stops after the first 10 errors. These 10 errors are logged in the log file. The default values for error registers 15061-15080 are 0xFFFF.

During validation, if an analog channel type is set as “Not Used”, the subsequent register values associated with this channel is automatically set to default values. Any values configured is ignored, and no errors is triggered.

During validation, if the digital module functional level is set as 1, any subsequent configurations associated with functional level 2 (Fallback, Filter) is set to default values. Any values configured is ignored, and no errors is triggered.

Ring Topology (RSTP)

The TM3 bus coupler supports RSTP ring topology.

For more information, refer to **MAINTENANCE / Ethernet**, page 65.

SNMP

Introduction

The Simple Network Management Protocol (SNMP) is used to provide the data and services required for managing a network.

The data is stored in a Management Information Base (MIB). The SNMP protocol is used to read or write MIB data. Implementation of the Ethernet SNMP services is minimal, as only the compulsory objects are handled.

SNMP Server

This table presents the supported standard MIB-2 server objects:

Object	Description	Access	Value
sysDescr	Text description of the device	Read	SCHNEIDER Ethernet TM3 Bus Coupler
sysName	Node administrative name	Read/ Write	TM3BCEIP

The size of these character strings is limited to 50 characters.

The values written are saved to the controller via SNMP client tool software. The Schneider Electric software for this is ConneXview. ConneXview is not supplied with the controller or bus coupler. For more details, refer to www.se.com.

Diagnostic

Overview

In online mode, the **Status** tab of the bus coupler provides monitoring and diagnostics information for the bus coupler and connected modules.

Displaying Diagnostic Information

Step	Action
1	In the **Devices Tree**, double-click the bus coupler node.
2	Select the **Status** tab: • **Running**: The bus coupler is running. • **Configuration error**: At least one configured expansion module is not in the physical configuration. • **?**: I/O module(s) report(s) an error or is (are) unresponsive.

NOTE: When Modbus TCP is enabled, the values of the status registers (900...901, 930...932) reflect the state of the TM3 Bus Coupler and connected TM3 Expansion modules. Read these status registers before starting IO exchange and take any appropriate actions that might be necessary.

TM3 Modbus Serial Line Bus Coupler

Introduction

This chapter describes how to configure the serial line communication of the TM3 Modbus Serial Line Bus Coupler. For more details about the device, see Modicon TM3 Bus Coupler - Hardware guide.

TM3 Modbus Serial Line Bus Coupler Presentation

Introduction

The TM3 Modbus Serial Line bus coupler is a device designed to manage serial line communication when using expansion modules with a controller in a distributed architecture. The TM3 Modbus Serial Line bus coupler supports the TM3 expansion modules, page 12 and the TM2 expansion modules, page 24.

Serial Line Profile

The TM3 Modbus Serial Line bus coupler can be physically connected to the serial port of a master device and it must be declared under a logical node representing the Modbus Serial IOScanner of a device inside EcoStruxure Machine Expert.

Modbus Slave Profile

The TM3 Modbus Serial Line Bus Coupler conforms as a Modbus slave.

The Modbus packet structure is as follows:

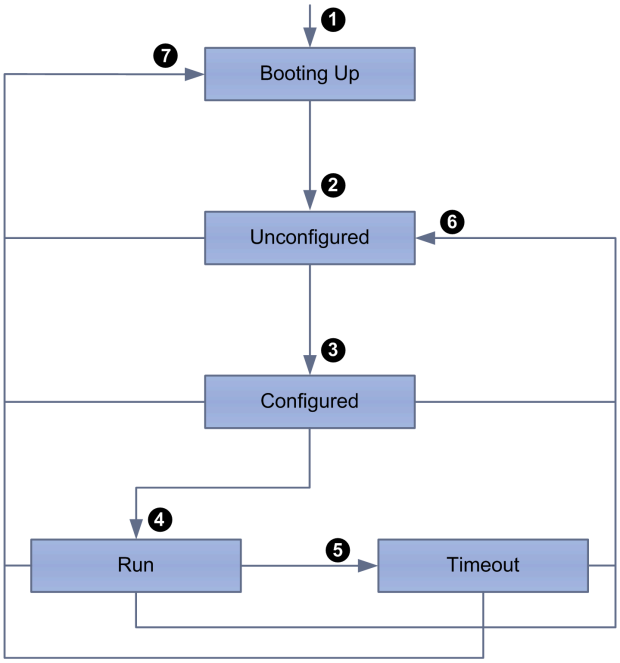
	Modbus Messages		
Address	**Function Code**	**Data**	**CRC**
1 byte	1 byte	n-byte field	2 bytes

The Modbus RTU message frame is as follows:

Slave Address	**Function Code**	**Data**	**CRC**
1 byte	1 byte	0-252 bytes	2 bytes CRC Low, CRC Hi

Serial Line Boot-Up and Operating Mode

The following diagram shows the operating modes of the TM3 Modbus Serial Line Bus Coupler:



The following table describes the transitions during the boot-up process:

Item	Description
1	Device boot-up
2	After boot-up, the device automatically enters the Unconfigured state.
3	The device begins configuration process.
4	The controller has taken control of the device.
5	A timeout error occurred.
6	A reconfiguration process is initialized.
7	An unrecoverable error caused a system reboot.

Serial Line Communication Configuration

The TM3 Modbus Serial Line bus coupler network interface configuration parameters are defined in the following table:

Parameter	Value
Mode	RTU
Parity	EVEN
Stop bit	1
Data bit	8

Serial Line Command List

The list of supported commands is described in the following table:

Modbus Function Code: Dec Index (Hex)	Sub-Function: Sub-Index	Command
3 (0003H)	-	Read n registers
6 (0006H)	-	Write a single register
16 (0010H)	-	Write n registers
22 (0016H)	-	Mask write register
23 (0017H)	-	Read/Write n registers
43 (002BH)	14	Read slave identification registers

Serial Line Identification Objects

The Device Identification Modbus command returns the following objects:

Object ID	Description	Value	Type
0x00	VendorName	Schneider Electric	ASCII String
0x01	ProductCode	0x1109	
0x02	MajorMinorRevision	XYxy (MAJORminor)	

Serial Line Operating Limits

The TM3 Modbus Serial Line bus coupler supports slave address from 1 to 127, corresponding to rotary switch address settings. Using addresses outside of the slave address range may disrupt communications between other devices on that serial line.

⚠CAUTION

UNINTENDED EQUIPMENT OPERATION

Do not use an address outside of the specified range (from 1 to 127).

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

Serial Line Configuration

Introduction

This section describes the options available to setup up a simple operation with the TM3 Modbus Serial Line bus coupler.

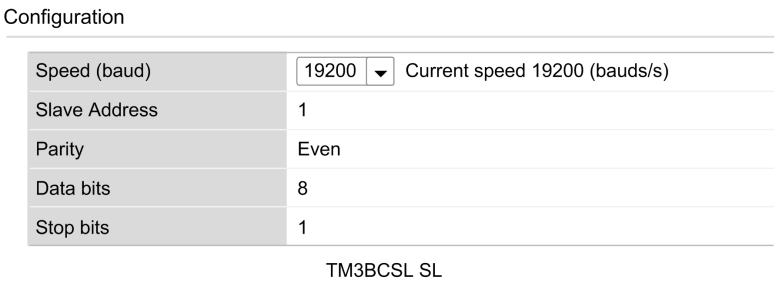
Serial Line Configuration

The following table shows the default configuration of the TM3 Modbus Serial Line bus coupler:

Item	Default State	Empty Application State
TM3 Bus	Inactive if not configured. Outputs values = 0	No module on TM3 Bus.
Modbus	-	No manager is configured.
Rotary Switch	TENS switch in position 0, ONES switch in position 0 (default speed).	-

To configure the Serial Line using the Web server, click **Maintenance** on the **Modbus Serial Line**.

The **Configuration** window is displayed as below:



The following parameters must be identical for each serial device connected to the port.

Element	Description	Configuration supported by the device
Speed (baud)	Transmission speed in baud	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200. Refer to TM3 Bus Coupler Hardware Guide.
Parity	Used for error detection	Even. Refer to Serial Line communication configuration table, page 83.
Data bits	Number of bits for transmitting data	8. Refer to Serial Line communication configuration table, page 83.
Stop bits	Number of stop bits	1. Refer to Serial Line communication configuration table, page 83.
Physical Medium	Specify the medium to use: • RS485 (using polarisation resistor or not) • RS232	RS485
Polarization Resistor	Polarization resistors are integrated in the controller. They are switched on or off by this parameter.	**NOTE:** For proper operation, you must have a single polarization resistor on the RS485 bus.

The serial line ports of your controller are configured for the Machine Expert protocol by default when new or when you update the controller firmware. The Machine Expert protocol is incompatible with that of other protocols such as Modbus Serial Line. Connecting a new controller to, or updating the firmware of a controller connected to, an active Modbus configured serial line can cause the other devices on the serial line to stop communicating. Make sure that the controller is not connected to an active Modbus serial line network before first downloading a valid application having the concerned port or ports properly configured for the intended protocol.

NOTICE
INTERRUPTION OF SERIAL LINE COMMUNICATIONS Be sure that your application has the serial line ports properly configured for Modbus before physically connecting the controller to an operational Modbus Serial Line network. **Failure to follow these instructions can result in equipment damage.**

Modbus Serial IOScanner

Introduction

The TM3 Modbus Serial Line bus coupler is fully-integrated as a Modbus slave device under the Modbus IOScanner.

Add a Modbus IOScanner

To add a Modbus IOScanner on a Serial Line, select the **Modbus IOScanner** in the **Hardware Catalog**, drag it to the **Devices tree**, and drop it on one of the highlighted nodes.

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

• Using the Drag-and-drop Method

• Using the Contextual Menu or Plus Button

Modbus IOScanner Configuration

To configure a Modbus IOScanner on a Serial Line, double-click **Modbus IOScanner** in the **Devices tree**.

The configuration window is displayed with the following parameters:

- **Transmission Mode**
- **Response Timeout (ms)**
- **Time between Frames (ms)**
- **Auto-restart Communication**

Set the parameters as described in this table:

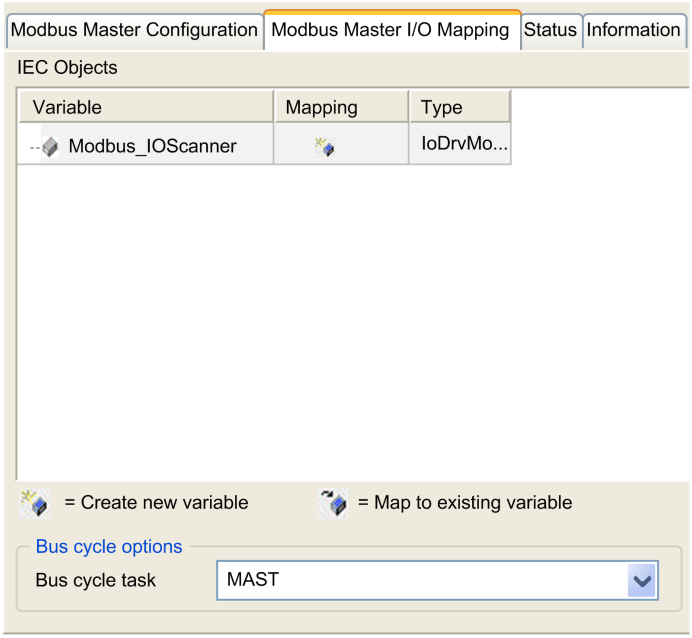
Element	Description
Transmission Mode	Specifies the transmission mode to use: • RTU: uses binary coding and CRC error-checking (8 data bits) • ASCII: messages are in ASCII format, LRC error-checking (7 data bits) Set this parameter identical for each Modbus device on the network. **NOTE:** TM3BCSL supports only RTU.
Response Timeout (ms)	Timeout used in the exchanges.
Time between Frames (ms)	Delay to reduce data collision on the bus. Set this parameter identical for each Modbus device on the network.
Auto-restart Communication	Specifies how communication exceptions are handled: • After a communication error, CODESYS automatically confirms the error and attempts to continue executing the Modbus command • The error must be explicitly confirmed in the slave function block. Set this parameter identical for each Modbus device on the network.

NOTE: Do not use function blocks of the PLCCommunication library on a serial line with a Modbus IOScanner configured. This disrupts the Modbus IOScanner exchange.

Bus Cycle Task Selection

The Modbus IOScanner and the devices exchange data at each cycle of the chosen application task.

To select this task, select the **Modbus Master IO Mapping** tab. The configuration window is displayed as below:



The **Bus cycle task** parameter allows you to select the application task that manages the scanner:

- **Use parent bus cycle setting**: associate the scanner with the application task that manages the controller.
- **MAST**: associate the scanner with the MAST task.
- Another existing task: you can select an existing task and associate it to the scanner. For more information about the application tasks, refer to the EcoStruxure Machine Expert - Programming Guide.

The scan time of the task associated with the scanner must be less than 500 ms.

Adding a TM3 Modbus Serial Line Bus Coupler on the Modbus Serial IOScanner

Introduction

This section describes how to add a device on the Modbus IOScanner.

Adding a TM3 Modbus Serial Line Bus Coupler on the Modbus IOScanner

To add a TM3 Modbus Serial Line bus coupler on the Modbus IOScanner, select the TM3BCSL in the **Hardware Catalog**, drag it to the **Devices tree**, and drop it on the **Modbus_IOScanner** node of the **Devices tree**.

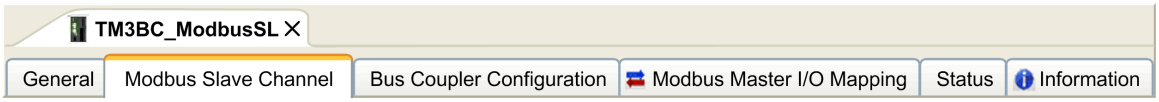
For more information on adding a device to your project, refer to:

• Using the Drag-and-drop Method

• Using the Contextual Menu or Plus Button

TM3 Modbus Serial Line Bus Coupler Configuration

This figure shows the tabs for the module configuration :



Tabs Description

Tab	Description
General	You can access: • **Slave Address**, which is the address configured on the bus coupler. It is limited to 1 - 127. • **Response Timeout [ms]**, which is the amount of time in millisecond a master waits for the bus coupler to respond to a request before determining it is non-responsive and proceed to the next scan.
Modbus Slave Channel	Read only tab. It provides: • Number of scans • Type of scans (read, read/write, write) • Amount of data transferred in each scan
Bus Coupler Configuration	You can access: • **Monitoring Timeout**, which is the amount of time in millisecond the bus coupler waits to respond to a request from the master before determining there is a network and/or a master issue. Then the bus coupler fallback management is triggered. The acceptable range of values is 0 - 65535 milliseconds. A value of 0 disables: ◦ the monitoring timeout in the bus coupler ◦ the fallback management in the bus coupler ◦ the ability to manage the bus coupler via the Web server • **Channels Cycle Time** is the configured time of each scan for the bus coupler.
Modbus Master I/O Mapping	Provides information about the variable name and type associated with the bus coupler.
Status	You can access the state of I/O modules and communication between bus coupler and controller. The states are described by: • **Running**: The bus coupler is running. • **Not running**: The bus coupler is not running and not exchanging data. • **Module reports an error**: At least one expansion module is in error (configuration or run-time error). • **Bus failure**: A bus communication error (either fieldbus or internal TM3 bus) message has been detected.

NOTE: When Modbus TCP is enabled, the values of the status registers (900...901, 930...932) reflect the state of the TM3 Bus Coupler and connected TM3 Expansion modules. Read these status registers before starting IO exchange and take any appropriate actions that might be necessary.

Web Server

Introduction

The TM3 Modbus Serial Line bus coupler supports a Web server, offering easy access to information such as configuration data, module status, I/O data, network

statistics, and diagnostic information. All of this vital information is available using a simple web browser.

In addition the Web server allows you to monitor this information, the bus coupler network and I/O remotely.

You can access the Web server with HTTPS (secure connections). HTTP (non secured connections) is not supported.

The Web server is accessible through the bus coupler USB port, page 172. You can use the pages of the Web server for setup of the network speed and control the I/O modules outputs as well as diagnostics and monitoring. These pages are ready to use with a Web browser. No configuration or programming is required.

Any PC providing a USB (host) port can connect to the Web server by using a Web browser.

The Web server can be accessed by the web browsers listed below:

- Microsoft Internet Explorer (version ≥ 11)
- Google Chrome (version ≥ 71)
- Mozilla Firefox (version ≥ 64)
- Microsoft Edge (version ≥ 42)

The Web server allows you to monitor a bus coupler to perform various maintenance activities including modifications to outputs modules data and network speed configuration. Care must be taken to ensure that the immediate physical environment of the machine and process is in a state that will not present safety risks to people or property before exercising control remotely.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Define a secure password for the Web server, and do not allow unauthorized or otherwise unqualified personnel to use this feature.
- Ensure that there is a local, competent, and qualified observer present when operating on the controller from a remote location.
- You must have a complete understanding of the application and the machine/process it is controlling before attempting to adjust data, stopping an application that is operating, or starting the controller remotely.
- Take the precautions necessary to assure that you are operating on the intended controller by having clear, identifying documentation within the controller application and its remote connection.

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

NOTE: The Web server must only be used by authorized and qualified personnel. A qualified person is one who has the skills and knowledge related to the construction and operation of the machine and the process controlled by the application and its installation, and has received safety training to recognize and avoid the hazards involved. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this feature.

Web Server Access

You can manage the user accounts on the Web server on MAINTENANCE / User Accounts, page 96.

To access Web server, ensure that the rotary switches are in address setting location. For more information regarding address setting, please refer to the Modicon TM3 Bus Coupler - Hardware Guide, Setting the Serial Line Address.

By default, the user name is Administrator, and the password is Administrator. You must change the password at the first login.

⚠WARNING

UNAUTHORIZED DATA ACCESS

- Do not expose the device or device network to public networks and the Internet as much as possible.
- Immediately change the default password to a new secure password.
- Do not distribute passwords to unauthorized or otherwise unqualified personnel.
- Restrict access to unauthorized personnel.
- Use additional security layers like VPN for remote access and install firewall mechanisms.
- Validate the effectiveness of these measurements regularly and frequently.

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

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

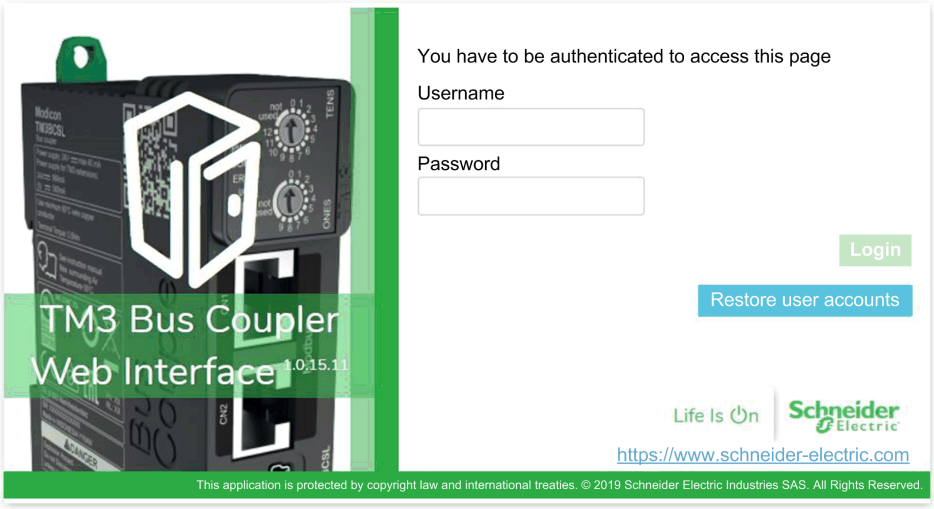
Resetting the Password

To reset the password:

Step	Action
1	Connect to the bus coupler using the USB port.
2	Open the browser.
3	Enter the IP address 90.0.0.1.
4	Move the position of any rotary switch to any other position. **Result: ERR** LED is flashing red. The **Restore user accounts** button is displayed.
5	Click **Restore user accounts**.
6	Move the position of the changed rotary switch to its previous position. **Result:** The **Restore user accounts** button is no longer displayed.

Login Page

The login page is the entry point to get authenticated by the Web server. The certificate, page 173 must be validated. To access the website login page shown in the following illustration, type in your navigator the IP address 90.0.0.1. To login to the Web server, enter the user name and password and click **Login**.



The Web server contains the following pages:

- HOME, page 91
- DIAGNOSTICS, page 91
- CONFIGURATION, page 93
- MONITORING, page 93
- MAINTENANCE, page 95

NOTE: The timeout session for each login is ten minutes. When you do not perform any action after you logged in, it redirects you to the login page if you click any button. You need to log in again with user name and password to access the web pages.

HOME / Equipment Overview

The **HOME** page displays the product details of TM3 bus coupler.

The **Identification** section of **HOME** page consists of:

Element	Description
Vendor Name	Vendor name of the bus coupler
Product ID	Product ID of the bus coupler
Product Name	Product name of the bus coupler
Product Reference	Product reference of the bus coupler
Serial Number	Serial number of the bus coupler
Locate Device Locate Device	Click the button to locate the bus coupler. The LEDs of the bus coupler flash red for few seconds.

DIAGNOSTICS Page

The **DIAGNOSTICS** page shows the status of the bus coupler.

The **DIAGNOSTICS** page contains the following sub-pages:

- Device, page 92
- Modbus Serial Line or Modbus TCP, page 92

DIAGNOSTICS / Device

The **Identification** section shows details about identification, page 91 of the bus coupler:

Element	Description
Vendor Name	Vendor name of the bus coupler
Product ID	Product ID of the bus coupler
Product Name	Product name of the bus coupler
Product Reference	Product reference of the bus coupler
Serial Number	Serial number of the bus coupler

The **Status** section shows details about the status of the bus coupler:

Element	Description
Last Stop Cause	Displays the cause of the last stop of the bus coupler.
USB Port	Displays whether a USB cable is connected to the bus coupler.
Operating Mode	Displays one of the following operating modes of the bus coupler: • **Idle** • **Modbus Serial** • **Web interface** • **Firmware update in progress** • **Time Out**
Configuration Status	Displays one of the following configuration status of the bus coupler: • **Not Configured** • **Configured**

DIAGNOSTICS / Modbus Serial Line

The **Configuration** section displays the status of Serial Line connection:

Element	Description
Current Speed	Transmission speed in baud rate.
Slave Address	Slave address of the bus coupler

The **Statistics** section shows the current configuration of Serial Line connection:

Element	Description
TX Messages	Displays the number of Modbus messages transmitted through the Serial Line.
RX Messages	Displays the number of Modbus messages received through the Serial Line.
Error Messages	Displays the number of Modbus messages with frame errors received through the Serial Line.
Reset	Resets the **Statistics** values to zero.
Refresh	Refreshes the **Statistics** values.

CONFIGURATION

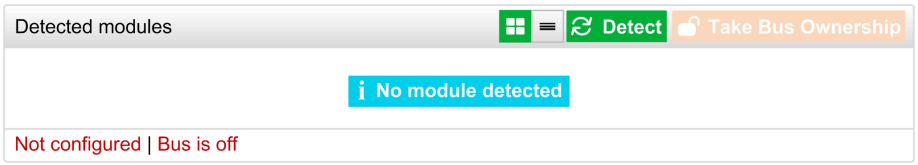
The **CONFIGURATION** page displays the I/O modules configuration imported from the TM3 Bus Coupler IO Configurator. The configuration file is an .SPF format.

Element	Description
PROJECT toolbar	
New	Read only button.
Open	Allows you to import the I/O modules configuration files generated by the TM3 Bus Coupler IO Configurator. Click **Open** to import the files.
Save	Read only button.
CONFIGURATION toolbar	
Apply	Allows you to apply the I/O modules configuration files on the TM3 bus coupler. If the configuration mismatch the hardware, an error message is generated.
DEVICES toolbar	Read only toolbar.

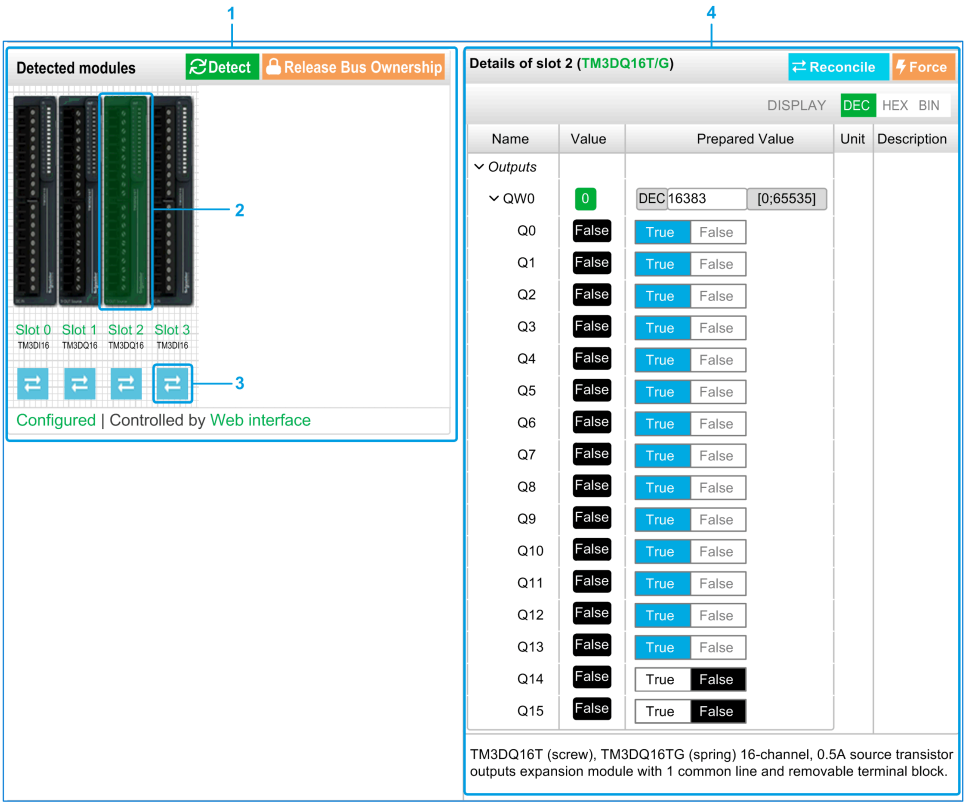
MONITORING Page

The **MONITORING** page displays the expansion modules that are connected to the TM3 bus coupler.

MONITORING page without detected modules:



MONITORING page with modules and details:



1 Bus *Monitoring*

2 Selected module

3 *Reconcile* button

4 Module details

The **MONITORING** page shows and describes all the modules detected by the bus coupler and allows you to:

- See the state of a selected module (running or not running) and the protocol used.
- Read the value of an input or output.
- Force a value to an output by clicking **Force**.
- Identify a module by clicking **Reconcile**.

Element	Description
Detect	Allows you to detect the modules connected to the bus coupler.
Take Bus Ownership **Release Bus Ownership**	Reserves the bus to allow you to force the module outputs. You can click the button when the bus coupler is configured and not controlled by a controller. **Result**: You are notified that the I/O bus is controlled by the Web interface. You can edit the output values. Click **Release Bus Ownership** to release the control of the I/O bus.

Module Details

The module details view provides the following data:

- Module name and description
- Module state
- Filter option to filter I/Os
- A list of its I/Os

This list of I/Os allows you to view a real-time value of an input and to write the value of an output.

The view has **DISPLAY** buttons to modify the format of the displayed values.

Output Forcing

1. When **Take Bus Ownership** is enabled, click a module to force its outputs.
2. Set the output values you wish to force for the module in the **Prepared Values** column of the list of its I/Os.
3. Click the **Force** button.

   Result: A message is displayed.
4. Click **I agree** to validate the modifications and send them to the bus coupler.

   Click **I disagree** to cancel the modifications.

As the modules are not identified automatically, click the **Reconcile** button to identify the modules.

MAINTENANCE Page

The **MAINTENANCE** page allows you to view and edit the configuration of the bus coupler.

The **MAINTENANCE** page contains the following sub-pages:

- User Accounts, page 96
- Firmware, page 97
- Modules Firmware, page 98
- System Log Files, page 99
- Modbus Serial Line, page 99

MAINTENANCE / User Accounts

Account Management

The sub-page allows you to define your login password to access the Web server:

Element	Description
Account Management **Select an account to edit it**	
User Name	List of the following user accounts: • **Administrator** The **Administrator** account is configured with a predefined password (Administrator / Administrator). Modify the predefined password after the first connection. • **Operator** This account is disabled by default. • **Viewer** This account is disabled by default. **NOTE:** Depending on your account, you have access to some web pages. See the table below for the accessible web pages.
Enabled	Selected if the account is enabled.
Account Management **Provide a new password for account**	
Current Password	Enter the current password of the user account.
New Password	Enter a password for the user account. **NOTE:** Minimum ten characters, maximum 32 characters and use a...z, A...Z, 0...9 alphanumeric characters. To reset the password, refer to Resetting the Password, page 90.
Confirm New Password	Enter the password again of the selected account.
Apply	Saves your new password.

This table describes the accessible pages depending on the user account:

Web pages	Sub pages	Administrator	Operator	Viewer
HOME	–	✓	✓	✓
MONITORING	–	✓	✓	–
DIAGNOSTICS	**Device**	✓	✓	✓
	Modbus Serial Line	✓	✓	✓
CONFIGURATION	–	✓	–	–
MAINTENANCE	**User Accounts**	✓	✓[1]	✓[1]
	Firmware	✓	–	–
	System Log Files	✓	✓	–
	Modbus Serial Line	✓	–	–
(1) You can only modify your user account.				

System Use Notification

The sub-page allows you to define a **System Use Notification** message which is displayed to users at log-in:

Element	Description
System Use Notification	
Enabled	When selected, you can define a message that is displayed at log-in.
Message	Displays the message defined.
Reset	Reset to default message.
Apply	Applies your changes.

MAINTENANCE / Firmware

The **Firmware** sub-page shows the firmware version of the TM3 bus coupler and allows you to update its firmware:

Element	Description
Current Firmware	
Firmware	Firmware version
Web interface	Web server version
Firmware Update **Select a new firmware version**	
Select	Allows you to select the new firmware file for the bus coupler.
Apply	Applies the new firmware.
Cancel	Cancels firmware modifications.

NOTE: You cannot update the firmware when the TM3 bus coupler cyclically exchanges data with the logic/motion controller. To make sure the bus coupler is not exchanging data, see **MONITORING**, page 93.

To update the bus coupler firmware:

Step	Action
1	Remove power from the bus coupler.
2	Ensure rotary switches are in address setting position e.g **TENS** to 0, **ONES** to 1.
3	Connect USB cable to PC then to bus coupler.
4	Apply power to the bus coupler.
5	Log into the WWeb server as Administrator.
6	Verify in the **MONITORING** page that the bus coupler is not exchanging data with the controller.
7	Click **MAINTENANCE** / **Firmware**.
8	Click **Select** then select the firmware file. **Result**: A confirmation window is displayed.
9	Click **I agree**. **Result**: At the end of the download and verification of the file, a confirmation window is displayed.
10	Click **Yes** to close the confirmation window then click **Apply**. **Result**: At the end of the firmware update, a message is displayed to inform you whether the firmware update is completed successfully.

MAINTENANCE / Modules Firmware

The **Modules Firmware** sub-page shows the firmware version of the modules configured and allows you to update its firmware:

Element	Description
Modules Firmware Overview	
Slot	Slot number of the module
Reference	Reference of the module
Current Firmware	Firmware version of the module
Modules Firmware Management **Select a new firmware version**	
Select	Allows you to select the new firmware file for the module. **NOTE:** You can select only a single firmware file. All modules on the bus corresponding to the selected firmware are updated.
Apply	Allows you to apply the new firmware.

NOTE: You cannot update the firmware when the TM3 bus coupler cyclically exchanges data with the logic/motion controller. To make sure the bus coupler is not exchanging data, see **MONITORING**, page 93.

To update the module firmware:

Step	Action	
1	Remove power from the bus coupler.	
2	Connect the USB cable.	
3	Apply power to the bus coupler.	
4	Log into the Web server.	
5	Verify in the **MONITORING** page that the bus coupler is not exchanging data with the controller.	
6	Click **MAINTENANCE** / **Modules Firmware**.	
7	Click **Select** then select the firmware file. **Result**: The firmware file is selected.	
8	Click **Apply**. **Result**: A confirmation window is displayed.	
9	Click **I agree**. **Result**: A restart window is displayed.	
10	Click **Yes**. **Result**: The file is verified and downloaded. Thereafter, a confirmation window is displayed. The TM3 bus coupler reboots and a confirmation window is displayed.	Click **No**. **Result**: The firmware update is canceled.

MAINTENANCE / System Log Files

The **System Log Files** sub-page lists the log files. Some of the information in the log files comes from internal interactions of the firmware and is intended to be used by Schneider Electric Technical Support:

Element	Description
Log Files **Select one or more log files to download**	
Select	Allows you to select one or more log files.
Name	Shows the list of the log files.
Size	Displays the size of the log files.
Download	Allows you to download the log files.

MAINTENANCE / Modbus Serial Line

The **Modbus Serial Line** sub-page allows you to change the network settings:

Element	Description
Configuration	
Speed (baud)	Allows you to set the baud rate. You can also set the baud rate using the rotary switch. Refer to Modicon TM3 Bus Coupler Hardware Guide.
Slave Address	Displays the Slave Address value for your device.
Parity	Used for error detection.
Data bits	Displays the number of bits for transmitting data.
Stop bits	Displays the number of stop bits.
Apply	Saves the configuration settings. **NOTE:** Upon confirmation, the bus coupler is automatically reset and the new speed is applied.
Cancel	Cancels configuration modifications.
Modbus Serial Data Consistency	
Enabled	Allows an internal copy of the input data registers (3000-3499 or 13000-13499) to be kept since the first read request is received until the second read request is received OR until the monitoring timeout is elapsed. Is enabled by default when the I/O modules configuration need more than 124 words to read the data of the input.
Cancel	Cancels the configuration settings.
Apply (1)	Saves the configuration settings.
TM3 Module Configuration via Modbus Commands	
Enabled	Allows controller to send TM3 configuration via Modbus command.
Cancel	Cancels the configuration settings.
Apply (1)	Saves the configuration settings.
(1) Modifying the *Setup* configuration requires a power cycle of the bus coupler to apply the configuration settings.	

TM3 Configuration via Modbus Command

Introduction

This section describes how to send TM3 configuration via Modbus command from a controller. The tables used for this configuration mode are in the appendices. Refer to Direct TM3 Configuration through Modbus Commands, page 176.

TM3 Module Support

The following modules are supported:

- TM3 Digital (TM3D•)
- TM3 Analog (TM3A•/T•)
- TM3 Safety (TM3S•)
- TM3 TeSys (TM3XTYS4)
- TM3 Transmitter and Receiver (TM3XTRA1, TM3XREC1)

Limitations and specific notes:

- TM3 optional configuration are not supported by this feature
- Fallback configuration for TM3 analog output is also supported by bus coupler via this feature. Fallback values, if configured, is applied by the bus coupler to the output of analog expansion modules in the following scenarios:
  - fieldbus communication timeout
  - after releasing bus ownership in Web server
- The transmitter and receiver modules are transparent to the bus couplers. Therefore, you must define which is the first module after the TM3XREC1 module in a remote configuration by defining the value in *First module after expander* register.

⚠WARNING

UNINTENDED MACHINE OPERATION

- Set the value in “First module after expander” register to match the physical configuration.
- Refer to appropriate section on how to configure the transmitter and receiver modules.

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

Enabling TM3 Configuration via Modbus command

The Modbus command is disabled by default. You can enable the Modbus command by using the rotary switches or via the Web server.

To enable the Modbus command by using the rotary switches:

Step	Action
1	Remove power from the bus coupler and disconnect all fieldbus communication cables.
2	Set both rotary switches **ONES** and **TENS** to the position **3**.
3	Apply power to the bus coupler.
4	Wait until the **COM** LED is off.
5	Within 60 seconds, set the rotary switch **ONES** to the position **NOT USED** and the rotary switch **TENS** to the position **12**. **Result:** The LED **COM**, **ERR** and **IO** flash green five times.
6	Wait until the LED **COM**, **ERR** and **IO** flash green five times, then hold solid. **Result:** The feature is enabled successfully. The bus coupler is in *STANDBY* state and no operation is allowed.
7	Remove power from the bus coupler.
8	Connect the fieldbus communication cables.
9	Apply power to the bus coupler.

To enable the Modbus command via the Web server:

Step	Action
1	Log into the Web server as Administrator.
2	Click on **MAINTENANCE > Setup**
3	Check the **Enabled** checkbox in the **TM3 Module via Modbus Commands** view.
4	Click **Apply**. **Result:** Warning window is displayed.
5	Click **I Agree**. **Result:** A message is displayed to inform you that the configuration will apply after the next boot-up.

See also **MAINTENANCE** / **Modbus Serial Line**, page 99.

How to Configure

Proceed as follows to configure the TM3 bus coupler:

Step	Action	
1	Write `1` to Register 15000. **NOTE:** This should be a single write Modbus request.	
2	Write the required configurations to the appropriate Modbus registers. Refer to How to Configure: Module Parameters Registers, page 104 for detailed description of the registers. Refer to Direct TM3 Configuration through Modbus Requests: Registers and Default Values for Supported TM3 Modules, page 176 for the default values for each TM3 module.	
3	Write `0` to Register 15000. **NOTE:** This should be a single write Modbus request.	
4	The Bus coupler apply the configuration	
	Result: If successfully, the configuration is applied and saved in non-volatile memory. Any pre-existing configuration stored in non-volatile memory is overwritten.	**Result:** If an invalid configuration is detected, the configuration is not applied. Check the Error Diagnostics Modbus registers and the Serial Line Bus Coupler Status Diagnostics, page 119 registers for error information. Error description is also saved in log file, which can be retrieved via the Web server. It is recommended to delete any configuration saved in non-volatile memory and send again the correct configuration. Refer to Deleting Permanent Configuration, page 109 on how to delete configuration.

NOTE:

- Step 1 to 3 must be completed within 10 minutes. After 10 minutes, a configuration timeout occurs and the bus coupler interrupts the configuration process.
- Once a configuration is started, no further configuration initialization shall be allowed until the completion of the configuration, or a configuration timeout has occurred.
- For Analog channels, you must set the minimum and maximum values suitable for this application. The bus coupler firmware does not automatically adjust the minimum and maximum values according to type chosen. The analog values from module are scaled according to the range between the minimum and maximum configuration. For example, if channel type is 0 – 10 V, and minimum/maximum is set to 0 V and 10000 V respectively, this means the unit of measure would be 10 V / 10000 = 1 mV.
- For the following types of configuration, it is required to configure the specific minimum and maximum value as defined in the respective compatibility table. Configuring any other value results in a configuration error.
  - TM3AI8 -> 0 – 20 mA extended range and 4 – 20 mA extended range.
  - Any temperature input with scope set to either in Celsius or Fahrenheit, except for Type B and Type C thermocouple in Fahrenheit. For these two specific use case, refer to the compatibility table for the correct configuration (see Direct TM3 Configuration through Modbus Commands, page 176).
  - Input is set to Ohmmeter

Using Rotary Switch to Define the First Module After Expander Value

You can define this value via Modbus command or by using the **TENS** rotary switch.

To define the the First Module After Expander Value by using the **TENS** rotary switch:

Step	Action
1	Ensure that the **TENS** rotary switch is set to a position between **0** and **7**. **NOTE:** The **ERR** LED flashes red if the rotary switch position is changed after boot-up. You can return the rotary switch to its original position after the configuration process is complete.
2	Start the configuration.
3	During configuration process, write the value 254 to the Register 15001.
4	Once all required configuration values have been written, apply the configuration. **Result:** The bus coupler replaces the value in the Register 15001 with the value defined by the **TENS** rotary switch after configuration is applied successfully.

How to Configure: Module Parameters Registers

This table describes registers dedicated to the overall management of the feature:

Register Address	Description	Access	Comments
15000	Control Start/Stop Configuration	RW	Write: • 1 = Start configuration (start to accept modules configuration commands). • 0 = Apply configuration. Other values result in “Illegal Data Value” exception. Read: • 1 = In configuration state • 0 = Not in configuration state
15001	First module after expander	RW	Index of the first module after the expander module • 255 (default) = No modules after the expander • 0 = 1st physical module • 1 = 2nd physical module • 2 = 3rd physical module • 3 = 4th physical module • 4 = 5th physical module • 5 = 6th physical module • 6 = 7th physical module • 7 = 8th physical module • 254 = Use **TENS** rotary switch value. See Using Rotary Switch to Define The First Module After Expander Value, page 102. No other values allowed.
15002	Remove Permanent Configuration	RW	Allows you to remove saved configuration from non-volatile memory. See Deleting Permanent Configuration, page 109.
15003	Monitoring Timeout	RW	Timeout value of the bus in millisecond. Range value: 0 – 65535. Default value: 10000.
15004-15049	Reserved	RO	The register are reserved and the value is 0.
15050	Configurable	RO	0 = The connected expansion modules are not configurable by using the Modbus command. 1 = The connected expansion modules are configurable by using the Modbus command.
15051	Number of modules	RO	Indicates the number of connected expansion modules.
15052	Enabling feature	RO	0 = TM3 configuration via Modbus command is disabled 1 = TM3 configuration via Modbus command is enabled
15053-15059	Reserved	RO	The register are reserved and the value is 0.
15060	Number of errors	RO	Number of errors detected. **NOTE:** A maximum of 10 errors can be detected. A 11th error is not detected by the firmware.

Register Address	Description	Access	Comments
15061	1st Error - Error Code	RO	Error codes: • Register value 0: *RESERVED* • Register value 1: Invalid Analog channel type • Register value 2: Invalid Analog minimum value • Register value 3: Invalid Analog maximum value • Register value 4: Configured Analog minimum value is greater than configured maximum value • Register value 5: *RESERVED* • Register value 6: Invalid filter value (TM3 Analog modules) • Register value 7: Invalid sampling value • Register value 8: Invalid fallback value (TM3 Analog modules) • Register value 9: Invalid Analog scope • Register value 10: Invalid resistance reference value R_ref (used with NTC thermistor only) • Register value 11: Invalid temperature reference value T_ref (used with NTC thermistor only) • Register value 12: Invalid sensitivity value Beta (used with NTC thermistor only) • Register value 13: Invalid value used to configure Functional Mode (TM3 Digital modules) • Register value 14: Invalid filter value (TM3 Digital modules) • Register value 15: Invalid fallback mode selected (TM3 Digital modules) • Register value 16: Invalid fallback value (TM3 Digital modules) • Register value 17: Invalid value used to enable or disable module diagnostics • Register value 18: Configured Functional mode value is not supported by TM3D• modules with firmware version < 2.0 • Register value 19: Invalid low threshold value (used with Threshold mode only in TM3 Analog modules) • Register value 20: Invalid high threshold value (used with Threshold mode only in TM3 Analog modules) • Register value 21: Configured low threshold value is greater than configured high threshold value (used with Threshold mode only in TM3 Analog modules) • Register value 22 – 99: *RESERVED* • Register value 100: Invalid "First module after expander" value • Register value 101: Connected module does not support direct configuration via Modbus commands • Register value 102: More than 10 TM3S• Safety modules are connected • Register value 103 – 65534: *RESERVED* • Register value 65535: Default value (No error)
15062	1st Error - Module and channel	RO	• [Bits 0 – 4] Channel index (Value range: 0 – 31) • [Bits 5 – 7] Reserved • [Bit 8] 0 = Output, 1 = Input • [Bit 9] 0 = Channel error, 1 = Module error • [Bits 10 – 11] Reserved • [Bits 12 – 15] Module index (Value range: 0 – 13) Module error is applicable to error code 13, 17, 18, 101 and 102. Examples: 1st physical module, 3rd physical output channel = 0x0002 4th physical module, 3rd physical input channel = 0x3102 5th physical module, 4th physical output channel = 0x4003 14th physical module, 32nd physical input channel = 0xD11F 8th physical module, Module error = 0x7200
15063-15080	2nd to 10th Error - Code, and Error - Module and channel	RO	See registers values Error Code and Error - Module and channel, above.
15081-15099	Reserved	RO	The register are reserved and the value is 0.

This table describes the configuration registers division:

Address	Description
15100 - 15199	Configuration parameters of TM3 module at slot number 0
15200 - 15299	Configuration parameters of TM3 module at slot number 1
15300 - 15399	Configuration parameters of TM3 module at slot number 2
15400 - 15499	Configuration parameters of TM3 module at slot number 3
15500 - 15599	Configuration parameters of TM3 module at slot number 4
15600 - 15699	Configuration parameters of TM3 module at slot number 5
15700 - 15799	Configuration parameters of TM3 module at slot number 6
15800 - 15899	Configuration parameters of TM3 module at slot number 7
15900 - 15999	Configuration parameters of TM3 module at slot number 8
16000 - 16099	Configuration parameters of TM3 module at slot number 9
16100 - 16099	Configuration parameters of TM3 module at slot number 10
16200 - 16299	Configuration parameters of TM3 module at slot number 11
16300 - 16399	Configuration parameters of TM3 module at slot number 12
16400 - 16499	Configuration parameters of TM3 module at slot number 13

For each section:

Address Offset	Description	Access	Comments
1XY00	Module Type	RO	Module ID of TM3 module.
1XY01	Number of Configuration Parameters	RO	Depends on the module type. For example, “6” means addresses from [1XY08 - 1XY13] are available for configuration.
1XY02 - 1XY07	Reserved	RO	The register are reserved and the value is 0.
1XY08 - 1XY99	Specific Configuration Parameters	RW	For specific parameter configuration 0xFFFF = the register is not available or invalid for modification.

NOTE: XY indicates the slot to which module is connected. 51 ≤ XY ≤ 64.

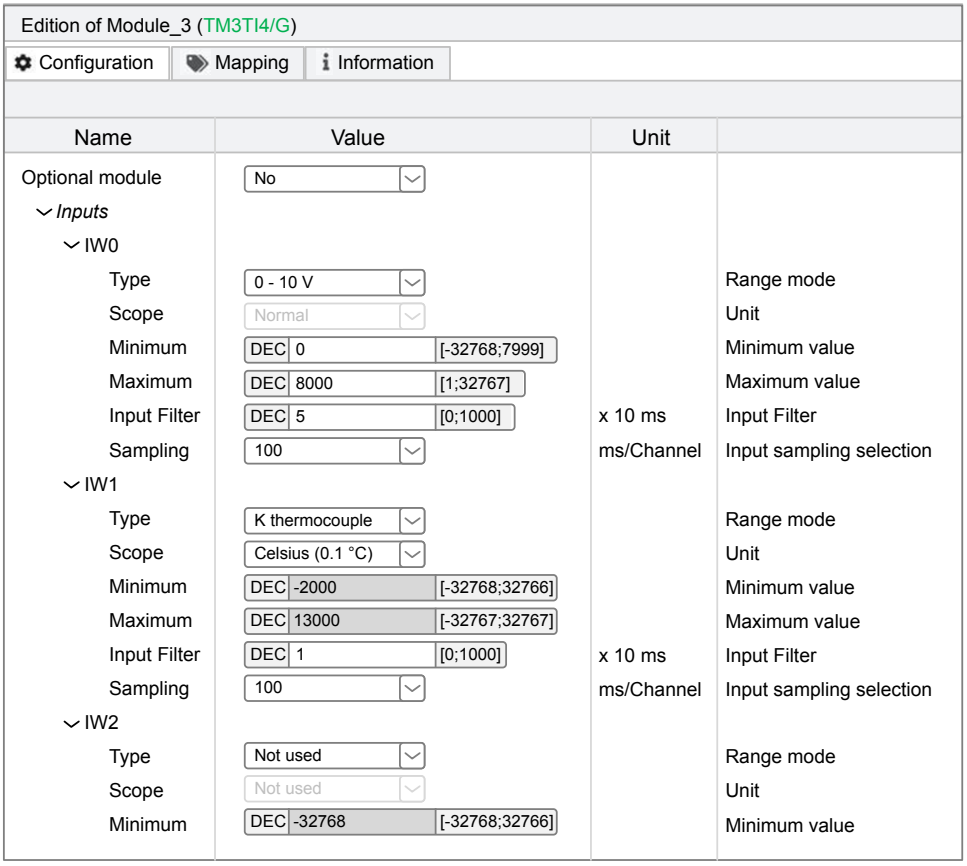
Example: For the first module, “Module Type” is at address 15100 and the 14thmodule is at address 16400.

How to Configure: TM3 Module Specific Registers

Module Type	Module ID (Read only 1XY00)	Configuration Size (Read only 1XY01) (Read/Write Memory starts from 1XY08)
TM3DI8, page 176	132	9
TM3DI16, page 177	128	17
TM3DI32K, page 178	130	33
TM3DQ8, page 179	133	17
TM3DQ16, page 180	129	33
TM3DQ32TK, TM3DQ32UK, page 182	131	65
TM3DM8R, page 185	134	13
TM3DM24R, page 186	135	33
TM3AI2H, page 187	192	11
TM3AI4, page 188	193	21
TM3AI8, page 190	194	41
TM3TI4, page 193	199	25
TM3TI4D, page 195	203	25
TM3TI8T, page 197	200	89
TM3AQ2, page 202	195	9
TM3AQ4, page 203	196	17
TM3AM6, page 204	197	29
TM3TM3, page 206	198	17
TM3SAC5R	146	0
TM3SAF5R	145	0
TM3SAFL5R	147	0
TM3SAK6R	144	0
TM3XTYS4	136	0

How to Configure: Example

This graphic shows the configuration for a TM3 bus coupler + 1 TM3TI4G



This table shows the Modbus registers to write:

TM3TI4/G	Address	Value	Description
Ch 0 – type	15108	1	0 – 10 V
Ch 0 – Scope	15109	1	Unit in Normal
Ch 0 - Minimum	15110	0	Minimum
Ch 0 - Maximum	15111	8000	Maximum
Ch 0 - Input filter	15112	5	50ms filter time
Ch 0 - Sampling	15113	0	100ms sampling time
Ch 1 – type	15114	7	K Thermocouple
Ch 1 – Scope	15115	2	Unit in Celsius
Ch 1 – Minimum	15116	63536	Minimum (63536 equal to -2000 in signed value)
Ch 1 – Maximum	15117	13000	Maximum
Ch 1 - Input filter	15118	1	10 ms filter time
Ch 1 - Sampling	15119	0	100 ms sampling time

Modbus Command done via “Write Single Register”

- Address: 15000
- Data bytes: [1]

Modbus Command done via “Write Multiple Registers”

- Address: 15108
- Number of registers: 12
- Data bytes: [1, 1, 0, 8000, 5, 0, 7, 2, 63536, 13000, 1, 0]

Modbus Command done via “Write Single Register”

- Address: 15000
- Data bytes: [0]

Deleting Permanent Configuration

The configuration stored in the non-volatile memory can be deleted by using Modbus command. The following conditions are required:

- The configuration via Modbus command is enabled
- The connected modules are configurable via this command
- The bus coupler is not in *configuring* state (see **System State (register 932)**), controlled by the Web server or updating the firmware.

To delete the configuration stored by using Modbus command:

Step	Action
1	Write `0xFF` to Register 15002.
2	Within 30 seconds, write `0` to Register 15002. **Result:** The bus coupler attempts to delete the stored configuration. **NOTE:** If `0` is not written in the register within 30 seconds, a timeout occurs and the stored configuration is not deleted. Register 15002 is reset to `0` by the bus coupler.
3	Check the **System State (register 932)**): **Result:** The bus coupler state is in *not configured state* which indicates that the permanent configuration has been deleted successfully. The default values are filled in and the error registers are cleared.

Error Management

If the physical setup is not compatible, the register 15050 is set to 0. The configuration via Modbus commands can not apply and the error is written in the log file. Incompatible physical setup includes the following scenarios:

- One or more TM2 modules are present in the bus
- One or more TM3XHSC modules are present in the bus
- More than 10 safety modules are present in the bus

When the module configuration registers are written, the values are not validated until the configuration is applied. If an error is detected during the validation, the details about the first 10 errors (error code, module index and channel) are indicated in the registers 15061 – 15080. Validation stops after the first 10 errors. These 10 errors are logged in the log file. The default values for error registers 15061-15080 are 0xFFFF.

During validation, if an analog channel type is set as “Not Used”, the subsequent register values associated with this channel is automatically set to default values. Any values configured is ignored, and no errors is triggered.

During validation, if the digital module functional level is set as 1, any subsequent configurations associated with functional level 2 (Fallback, Filter) is set to default values. Any values configured is ignored, and no errors is triggered.

Modbus Register Mapping Presentation

Introduction

The register mapping includes:

- Manufacturer Zone, page 111
- Bus Coupler Zone, page 114

- IO Modules Zone, page 114
  - Attached TM3/TM2 expansion IO modules input register values
  - Attached TM3/TM2 expansion IO modules output register values
  - Attached TM3/TM2 expansion IO modules configuration and status
- TM3 Configuration via Modbus Command, page 102

Overview

The Manufacturer Zone is defined by Registers 0 - 1115.

The following table shows register mapping for the TM3 Modbus Serial Line bus coupler :

Functions	Registers	Description
Subset of Module Input Registers	0	Not used
	1 - 99	Input for module **NOTE:** 1 - 99 is Mirror of 3001 - 3099 (1)
Subset of Module Output Registers	100	Not used
	101 - 199	Output for module **NOTE:** 101 - 199 is Mirror of 3501 - 3599(1)
Diagnostics/Status Registers	900	Bus coupler diagnostics
	901	IO module error Extend to maximum 14 modules
	902 - 929	Reserved
	930 - 931	IO module status
	932	System state
	990 - 993	Serial line communication diagnostics
Managing TM3 Configuration Behavior Registers	1000 - 1008	TM3 configuration action control
Managing Serial Line Connection Registers	1050 - 1054	Serial line communication configuration
Modules Description on IO Bus	1100 - 1115	Product code/firmware version and module ID code
(1) Access to those registers returns an error when System State (register 932) is not 4 (TM3 controlled by Modbus SL IOScanner). The values of registers 3001…3499, 3501…3999, 13001…13999 are valid only when the **register 931** is 0 (Bus status OK, All module status OK).		

The attributes in the table below define the access rights of a particular object:

Attribute	Description
RO	Read Only access.
RW	Read and Write access.

The following zones support the TM3BCSL Modbus data access requirements:

Zone	Registers	Access	Function
Bus Coupler Zone	2500 - 2999	RO	Bus coupler status and configuration
IO Modules Zone	3000 - 3499	RO	Full set of input registers for I/O modules attached to bus coupler (1)
	3500 - 3999	RW	Full set of output registers for I/O modules attached to bus coupler (1)
	4000 - 6999	RW	Configuration of all attached modules
	13000 - 13999	RO	Mirrored IO data to provide access to HMI device
Direct TM3 Configuration	15000 - 16499	Refer to How to Configure: Configuration Management Registers, page 102	Allow controllers to send TM3 configuration directly via Modbus requests
(1) Access to those registers returns an error when System State (register 932) is not 4 (TM3 controlled by Modbus SL IOScanner			

The following table shows the sub-function mapping of the TM3BCSL Modbus:

Functions	Registers	Description
Bus Coupler Status and Configuration	2500 - 2627	-
Full set of IO Modules Inputs Data Registers	3000	Not used
	3001 - 3499	Input values
Full set of IO Modules Outputs Data Registers	3500	Not used
	3501 - 3999	Output values
All attached Modules Configuration	4000 - 6799	IO Module Configuration for 1st to 14th module
Full set of IO Modules Inputs Data Registers (RO) for HMI device	13000	Not used
	13001 - 13499	Input values
Full set of IO Modules Outputs Data Registers (RO) for HMI device	13500	Not used
	13501 - 13999	Output values

Registers in Manufacturer Zone

Input Registers

The following table shows register mapping for expansion module input value. Note this is for backward compatibility purposes with legacy products and application:

Register	Function	Description
0	Not used	-
1	Input value of first expansion module with inputs	Varies depending on module
...	-	-
99	-	-

Output Registers

The following table shows register mapping for expansion module output value. Note this is for backward compatibility purposes with legacy products and application:

Register	Function	Description
100	Not used	-
101	Output value of first expansion module with outputs	Varies depending on module
...	-	-
199	-	-

Diagnostics Registers

Diagnostic registers manage alert and alarm conditions. There are diagnostics registers dedicated for configuration errors, IO module errors, and communication errors among others. Refer to status diagnostic table, page 119.

Management Registers

The following table shows the bus coupler module management registers:

Registers	Functions
1000 - 1004	Reserved registers
1005	Reset expansion bus. This function is used to update the new expansion module I/O parameters. **NOTE:** All outputs are set to zero when the bus is reset.
1006 - 1007	Reserved registers
1009	Fieldbus timeout counter
1010 - 1049	Reserved registers

Managing the Serial Line Connection

The following table shows the serial line connection management registers:

Registers	Function
1050	Slave serial line address
1051	Baud rate
1052	
1053	Parity (Default Even - 2)
1054	Mode (RTU - 0)
1055 - 1099	Reserved registers

NOTE: This is for information only. Modifying the values has no impact on the configuration.

Bus Coupler and Module Description Registers

The following table shows the registers supported by TM3 bus coupler for expansion modules:

Register	Access	Function
1100	RO	TM3 bus coupler product code
1101	RO	TM3 bus coupler software version
1102	RO	Type of expansion module 1
1103	RO	Type of expansion module 2
1104	RO	Type of expansion module 3
1105	RO	Type of expansion module 4
1106	RO	Type of expansion module 5
1107	RO	Type of expansion module 6
1108	RO	Type of expansion module 7
1109	RO	Type of expansion module 8
1110	RO	Type of expansion module 9
1111	RO	Type of expansion module 10
1112	RO	Type of expansion module 11
1113	RO	Type of expansion module 12
1114	RO	Type of expansion module 13
1115	RO	Type of expansion module 14

Registers in Bus Coupler Zone

Bus Coupler Status and Configuration

The following table shows registers used for the Bus Coupler Status and Configuration interface:

Register	Function	Description
2502 - 2506	Reserved	Not used
2507	Firmware major revision	-
2508	Firmware minor revision	-
2512 - 2513	Serial number	-
2514 - 2515	Reserved	Not used
2518	Total number of IO modules detected	Maximum of 14 modules
2519	Slave 0 module ID, if present	-
2520	Slave 1 module ID, if present	-
2521	Slave 2 module ID, if present	-
2522	Slave 3 module ID, if present	-
2523	Slave 4 module ID, if present	-
2524	Slave 5 module ID, if present	-
2525	Slave 6 module ID, if present	-
2526	Slave 7 module ID, if present	-
2527	Slave 8 module ID, if present	-
2528	Slave 9 module ID, if present	-
2529	Slave 10 module ID, if present	-
2530	Slave 11 module ID, if present	-
2531	Slave 12 module ID, if present	-
2532	Slave 13 module ID, if present	-
2601	Value of Rotary switch ONES	-
2602	Value of Rotary switch TENS	-

Registers in IO Modules Zone

Expansion IO Modules Configuration Register

The following table shows the register mapping for TM2/TM3:

Register	Access	Registers	Function
4000 - 6799	RW	n	Module configuration

Input Registers

The following table shows register mapping for expansion module input value:

Register	Function	Bit Assignment
3000	Not used	-
3001	Input value of first expansion module with inputs	Varies depending on module
...	-	-
3499	-	-

Output Registers

The following table shows register mapping for expansion module output value:

Register	Function	Bit Assignment
3500	Not used	-
3501	Output value of first expansion module with outputs	Varies depending on module
...	-	-
3999	-	-

Expansion Module Register Size

The following table provides a reference on the number of read/write registers required to exchange data associated with a particular TM2/TM3:

Reference	Number of Input Registers	Number of Output Registers
TM2 DDI8DT	1	0
TM2 DAI8DT	1	0
TM2 DDI16DT	1	0
TM2 DDI16DK	1	0
TM2 DDI32DK	2	0
TM2 DDO8TT	0	1
TM2 DDO8UT	0	1
TM2 DRA8RT	0	1
TM2 DDO16TK	0	1
TM2 DDDO16UK	0	1
TM2 DRA16RT	0	1
TM2 DDO32TK	0	2
TM2 DDO32UK	0	2
TM2 DMM8DRT	1	1
TM2 DMM24DRF	1	1
TM2 AMI2HT	2	0
TM2 AM01HT	0	1
TM2 AMM3HT	2	1
TM2 AMM6HT	4	2
TM2 ALM3LT	2	1
TM2 AVO2HT	0	2
TM2 AMI2LT	2	0
TM2 AMI4LT	4	0
TM2 AMI8HT	8	0
TM2 ARI8HT	8	0
TM2 ARI8LT	8	0
TM2 ARI8LRJ	8	0
TM3AM6, TM3AM6G	10	2
TM3AI2H, TM3AI2HG	4	0
TM3AI4, TM3AI4G	8	0
TM3AI8, TM3AI8G	16	0
TM3TI4T, TM3TI4TG	8	0
TM3TI8T, TM3TI8TG	16	0
TM3TM3,TM3TM3G	5	1
TM3AQ2, TM3AQ2G	2	2
TM3AQ4, TM3AQ4G	4	4
TM3DI8,TM3DI8G,TM3DI8A	1	0
TM3DI16, TM3DI16G, TM3DI16K	1	0
TM3DI32K	2	0
TM3DM8R, TM3DM8RG	1	1
TM3DM24R,TM3DM24RG	1	1

Reference	Number of Input Registers	Number of Output Registers
TM3DQ8R, TM3DQ8RG, TM3DQ8T, TM3DQ8U, TM3DQ8TG, TM3DQ8UG	0	1
TM3DQ16R, TM3DQ16T, TM3DQ16U, TM3DQ16RG, TM3DQ16TG, TM3DQ16TK, TM3DQ16UG, TM3DQ16UK	0	1
TM3DQ32TK, TM3DQ32UK	0	2
TM3SAC5R, TM3SAF5R, TM3SAFL5R, TM3SAK6R	1	1
TM3XTYS4	1	1

Diagnostic

Overview

In online mode, the **Status** tab of the bus coupler provides monitoring and diagnostics information for the bus coupler and connected modules.

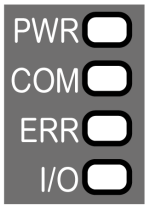
Displaying Diagnostic Information

Bus coupler and expansion module status information is displayed under the **Status** tab of the bus coupler in EcoStruxure Machine Expert.

For more information, refer to **Status** tabs description, page 88.

Status LEDs

The following graphic shows the LEDs of TM3 Modbus Serial Line bus coupler:



The following table describes the status LEDs:

LED	Color	Status	Description
PWR	Green	On	Power is applied.
		Off	Power is removed. All LED indicators are off.
COM	Green	Flashing	Data sending and receiving.
		Off	No data exchanged.
	Red	Flashing	Device is receiving an incorrect data frame.
ERR	Red	Flashing	Device has detected an error that is, under most circumstances, recoverable. For example: • Rotary switch position changed during operational mode. Return to the initial position to reset the LED behavior. • Error detected during firmware update. • Communication and configuration errors.
		Off	No error detected.
I/O	Green	Flashing	Device has received and applied the expansion modules configuration.
		On	Device is communicating with the expansion modules.
	Green Red	Flashing On	The physical configuration is inconsistent with the software configuration. No data exchange (status and I/O) is occurring.
	Green Red	On On	The physical configuration is inconsistent with the software configuration. I/O data is not applied.
	Green Red	On Flashing	At least one TM2 or TM3 expansion module did not respond to the bus coupler for 10 consecutive cycles.
		Off	No configuration. Device is not communicating with the expansion modules.

NOTE: With the exception of the **PWR** LED, each LED is ON for a few seconds, then OFF during boot sequence. The LED behavior rules apply when the boot is completed successfully.

Serial Line Bus Coupler Status Diagnostics

The following table provides detailed information regarding the bus coupler status, expansion module status as well as communication statistics:

Register	Function	Bit	Description
900	Bus and modules status	0…8	Reserved
		9	Communication error or external error
		10…12	Reserved
		13	Expansion modules missing or incorrectly configured
		14…15	Reserved
901	Expansions error	0	Module 1 error
		1	Module 2 error
		2	Module 3 error
		3	Module 4 error
		4	Module 5 error
		5	Module 6 error
		6	Module 7 error
		7	Module 8 error
		8	Module9 error
		9	Module 10 error
		10	Module 11 error
		11	Module 12 error
		12	Module 13 error
		13	Module 14 error
		14…15	Reserved
902 - 929	Reserved	-	Reserved
930	TM3/TM2 bus and modules status	0…1 Module 1	Module status (2 bits per module): • 0x0: Module OK • 0x1: Module configuration error detected • 0x2: Module runtime error detected • 0x3: Module not present but it is optional module
		2…3 Module 2	
		4…5 Module 3	
		6…7 Module 4	
		8…9 Module 5	
		10…11 Module 6	
		12…13 Module 7	
		14…15 Module 8	
931	TM3/TM2 bus and modules status	0…1 Module 9	Module status (2 bits per module): • 0x0: Module OK • 0x1: Module configuration error detected • 0x2: Module runtime error detected • 0x3: Module not present but it is optional module
		2…3 Module 10	
		4…5 Module 11	
		6…7 Module 12	
		8…9 Module 13	
		10…11 Module 14	
		12…13	Reserved
		14…15	Bus status: • 0x0: Bus OK • 0x1: Bus configuration error detected • 0x2: Bus runtime error detected • 0x3: Bus not configured

Register	Function	Bit	Description
932	System State	–	• 0x0: System is booting. • 0x1: TM3 bus is not configured. • 0x2: A TM3 configuration is being transferred. • 0x3: A valid TM3 configuration has been applied successfully. • 0x4: TM3 bus is controlled by Modbus SL IOScanner. • 0x5: TM3 bus is controlled by Web server. • 0x6: Timeout on fieldbus refresh • 0x7: Firmware update in progress • 0x9: System state transition in progress.
933	TM3/TM2 bus configuration	–	• Bits [0]: Modbus Serial Data consistency • 0x0: Disable • 0x1: Enable

NOTE: When Modbus TCP is enabled, the values of the status registers (900...901, 930...932) reflect the state of the TM3 Bus Coupler and connected TM3 Expansion modules. Read these status registers before starting IO exchange and take any appropriate actions that might be necessary.

Serial Line Bus Coupler Communication Diagnostics

The following table provides information regarding the registers for communication management:

Register	Function	Description
990	Not used	–
991	Number of received messages	Number of messages received
992	Number of sent messages	Number of messages sent
993	Number of non-valid messages	Number of corrupted messages (format error in the request, invalid action or CRC)

TM3 CANopen Bus Coupler

Introduction

This chapter describes how to configure the TM3 CANopen Bus Coupler using CANopen communication mode. For more details about the device, see Modicon TM3 Bus Coupler - Hardware guide.

TM3 CANopen Bus Coupler Presentation

Introduction

The TM3 CANopen bus coupler is a device designed to manage CANopen communication when using expansion modules with a controller in a distributed architecture. The TM3 CANopen bus coupler supports the TM3 expansion modules, page 12 and the TM2 expansion modules, page 24

CANopen profile

The TM3 CANopen bus coupler conforms to CiA 401 CANopen device profile for generic I/O modules, and supports the CANopen protocol as defined in CiA 301 CANopen application layer and communication profile. This coupler makes it possible to use PDO/SDO configuration to access and manage I/O values, parameters, and diagnostics.

Device Profile

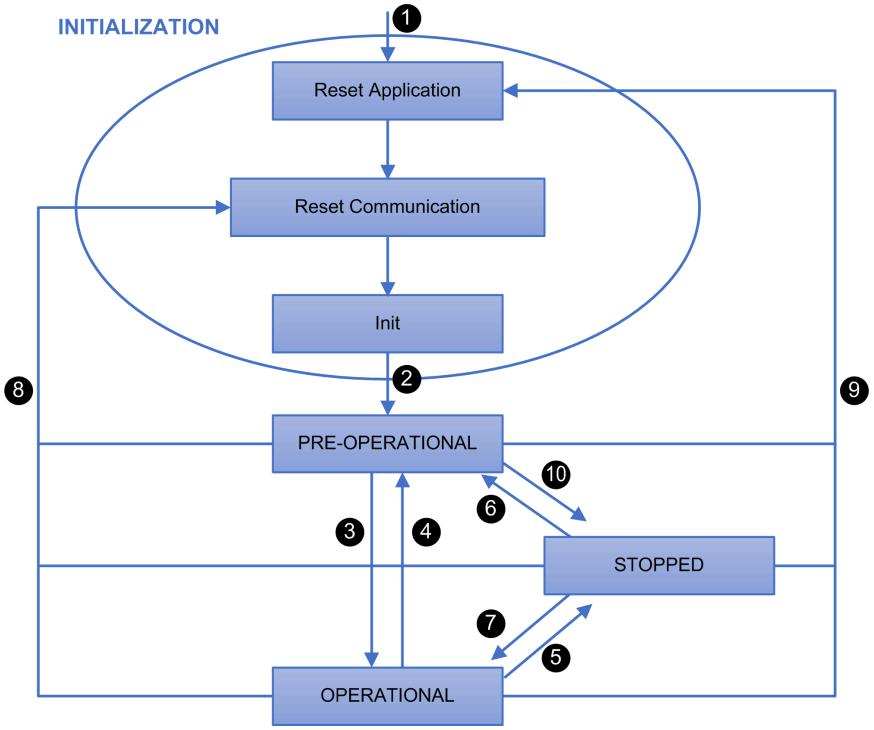
The table below shows functions supported by the TM3 CANopen bus coupler and their codes:

Function	Function Code (Binary)	Function Code (Hex)	Resulting COB-ID (Decimal)
NMT	0000	0	0
SYNC	0001	80	128
EMERGENCY (EMCY)	0001	81 – FF	129 – 255
TPDO1 (Tx)	0011	181 – 1FF	385 – 511
RPDO1 (Rx)	0100	201 – 27F	513 – 639
TPDO2 (Tx)	0101	281 – 2FF	641 – 767
RPDO2 (Rx)	0110	301 – 37F	769 – 895
TPDO3 (Tx)	0111	381 – 3FF	897 – 1023
RPDO3 (Rx)	1000	401 – 47F	1025 – 1151
TPDO4 (Tx)	1001	481 – 4FF	1153 – 1279
RPDO4 (Rx)	1010	501 – 57F	1281 – 1407
SDO (Tx)	1011	581 – 5FF	1409 – 1535
SDO (Rx)	1100	601 – 67F	1537 – 1663
NMT Error Control	1110	701 – 77F	1793 - 1919

NOTE: If additional TPDO/RPDO (from 5th to the last) are required, the COB-IDs are allocated automatically by EcoStruxure Machine Expert and can also be defined manually.

CANopen Boot-up and Operating Modes

The following diagram shows the operating modes of the TM3 CANopen bus coupler:



Number	Description
1	Device power up.
2	After initiation, the device automatically goes into PRE-OPERATIONAL state.
3	The device is configured and the controller takes control of the device. NMT START NODE command received from the controller.
4	The following conditions can cause this transition: • A timeout or a CANopen bus error has occurred and the value in the 1029H object is 00H (PRE-OPERATIONAL) • A NMT ENTER PRE-OPERATIONAL command is received from the controller
5	The following conditions can cause this transition: • A timeout or a CANopen bus error has occurred and the value in the 1029H object is 02H (STOPPED) • A NMT STOP NODE command is received from the controller
6	The device has recovered and the controller sent a NMT ENTER PRE-OPERATIONAL command.
7	The device has recovered and the controller sent a NMT START NODE command.
8	A NMT RESET COMMUNICATION command is sent from the controller. Communication Profile Objects are reset to default values.
9	The controller sent a NMT RESET NODE command. All Objects are reset to default values.
10	The controller sent a NMT STOP NODE command.

The Objects must be well-configured before entering OPERATIONAL state for bus coupler to be properly functional. Specifically, objects related to TM3 configuration must be re-configured prior to entering OPERATIONAL state. For relevant objects, refer to the object in Manufacturer-specific zone section, page 156.

CAN Bus Format

The supported CAN bus format is CAN2.0A for CANopen.

CANopen Transmission and Monitoring

Introduction

CANopen is an open industry-standard communication protocol and device profile specification (EN 50325-4) that is based on the Controller Area Network (CAN) protocol. The “Layer 7” protocol was developed for embedded networking applications and defines communication and device functions for CAN-based systems.

CANopen supports both cyclic and event driven communication, allowing you to reduce bus load to a minimum but still maintain short reaction times.

Process Data Object (PDO)

PDOs are objects which provide the communication interface with process data and enable them to be exchanged in real time. The set of PDOs on a CANopen device describes the implicit exchanges between this device and its communication partners on the network.The exchange of PDOs is authorized when the device is in ‘OPERATIONAL’ mode.

There are two types of PDOs:

- transmit PDO (TPDO): PDO transmitted by the device
- receive PDO (RPDO): PDO received by the device

Transmission Modes

TM3 CANopen bus coupler supports three types of PDO transmission mode:

Transfer Code Type	Transmission Mode	Description
0	Acyclic - Synchronous	Send PDO on first **SYNC** message following an event
1-240	Cyclic - Synchronous	Send PDO every x **SYNC** messages, where x can be configured from 1 to 240
255 (Default)	Asynchronous	Send PDO on event

A further two options are associated with event-triggered PDOs:

- Inhibit Time: The Inhibit Time utility is used to define a minimum time delay before transmission of a new PDO. This avoids overloading the bus where a significant number of events occur in rapid succession. The Inhibit Time is expressed in multiples of 100 µs.

  This feature is available for Type 255 (Asynchronous) transfer.

This table shows an example of values:

Value (dec)	Timing (ms)
0	0
10	1
100	10
1000	100
10000	1000
65535	6553.5

- **Event Time**: The **Event Time** is used to define an expiry time delay where transmission of a PDO will be forced, even if there has been no change in status. The **Event Time** is expressed in milliseconds.

  This feature is available for Type 255 (Asynchronous).

This table shows an example of values:

Value (dec)	Timing (ms)
0	0 (deactivates timer)
10	10
100	100
1000	1000
10000	10000
65535	65535

Service Data Object (SDO)

An SDO allows a device's data to be accessed by using explicit requests. The SDO service is available when the device is in 'OPERATIONAL' or 'PRE-OPERATIONAL' state.

There are two types of SDO:

- Read SDOs (download SDO)
- Write SDOs (upload SDO)

The SDO protocol is based on a Client/Server model. For a Download SDO, the client (typically the controller) sends a request indicating the object to be read. The server (in this case the bus coupler) returns the data contained within the object. For an Upload SDO, the client (typically the controller) sends a request indicating the object to be written to and the desired value. After the object has been updated, the server (in this case the bus coupler) returns a confirmation message.

If an SDO is not processable by the server (bus coupler), the server returns an error code (Abort Code). This applies to both Download and Upload SDO. If the server does not respond within a pre-configured time period (SDO Timeout), the client will issue an SDO timeout abort code.

Error Control Protocols

Error control protocols are used to detect communication errors on the network. There are two protocols: node-guarding and heartbeat. These two monitoring mechanisms are especially important in the CANopen system. Devices connected to the bus do not regularly indicate their presence in operating mode, especially when commanded by **Event**.

> **NOTE:** A CANopen device cannot support monitoring using both monitoring methods - **Guarding** and **Heartbeat** - concurrently. If both configurations are received by the device, it will only use the **Heartbeat** monitoring method.

Node Guarding

In this protocol, the NMT master (typically the controller) polls each NMT slave (bus coupler, for example) at regular time intervals, known as **Guard Time**. The slave responses with its NMT state. If the slave does not receive a poll after a defined period, called **Lifetime**, this slave transitions to the state as configured in the object **1029H**, page 151 and generates a life guarding event. For the bus coupler, it transitions to the state as configured in the object **1029H** (if object **1029H** is left as default), fallback management is engaged, and guarding event is generated. **Lifetime** is defined as follow: **Lifetime** = **Guard Time** x **Lifetime Factor**. The object **100CH** contains the guard time parameter expressed in milliseconds. The object **100DH** contains the **lifetime factor** parameter. **Guard Time** and **Lifetime** can be configured differently for different slaves.

When one of the two parameters **Lifetime Factor** or **Guard Time** is set to 0 (default configuration), the slave does not perform monitoring. To activate monitoring over time, you must enter a value (minimum 2) in the object **100DH** and specify a time in milliseconds in the object **100CH**.

Typical values for the **Guard Time** parameter lie between 200 ms and 2 s.

In order to maintain a more reliable and secure operation, you must enter a **Lifetime Factor** (object **100DH**) with a value of 2 or greater. If a value of 1 is used, and should a delay occur due to the processing of high priority messages or internal processing on the node-guarding master, the slave may inadvertently transition to the state as configured in the object **1029H**.

⚠WARNING

UNINTENDED MACHINE OPERATION

Set the **Lifetime Factor** (object **100DH**) to a value no less than 2 when enabling **Node Guarding**.

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

Monitoring is performed in the following way:

Phase	Description
1	The master sets **Remote-Frames** (or **Remote-Transmit-Request** request messages) on the Guarding-CobID of the slaves to be monitored.
2	The slaves concerned respond by sending the **Guarding** message. This message contains the **Status-Code** of the slave and the **Toggle-Bit**, which changes after each message.
3	The NMT (Network Management Telegram) master compares the **Status** and **Toggle-Bit** information: if they are not in the expected state or if no response is received, the NMT master considers that an error has occurred on the slave.

NOTE: Even if the monitoring function over time is disabled (**Guard Time** and **Lifetime-Factor** registers set to 0), the slave responds to a remote request from the master. For the **Guarding** message, the initial value of the **Toggle-Bit** sent in the first **Guarding** message is 0. Then, the **Toggle** bit changes in each subsequent **Guarding** message, which makes it possible to indicate if a message has been lost.

The network state of the device is indicated in the seven remaining bits:

Network state	Response (hex)
'STOPPED'	04H or 84H
'PRE-OPERATIONAL'	7FH or FFH
'OPERATIONAL'	05H or 85H

Heartbeat Mechanism

In this protocol, the producer transmits a **Heartbeat** message periodically, depending on the **Producer Heartbeat Time** parameter (in milliseconds) configured in object **1017H**. Devices responsible for monitoring this message will have a **Consumer Heartbeat Time** parameter (in milliseconds), configured in object **1016H**. If the producer **Heartbeat** message is not received within the configured time of the consumer devices, the devices generates a **Heartbeat** event. For the bus coupler, it transitions to the CANopen state as configured in the object 1029H, fallback management is engaged and **Heartbeat** event is generated.

The message **Heartbeat** indicates the device status on a byte, composing of:

- The most significant bit is reserved and always has a value of 0
- The 7 least significant bits provide the status for the device producing the **Heartbeat** message

The possible values are as follows:

Status of the Heartbeat Producer	Value (Decimal)
BOOT-UP	0
STOPPED	4
OPERATIONAL	5
'PRE-OPERATIONAL'	127

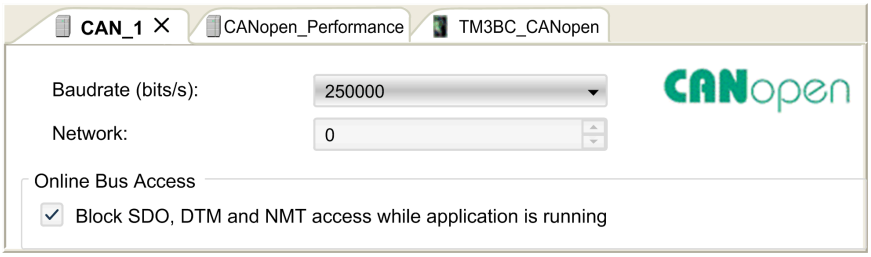
Configuring the CANopen Interface of the Controller

Introduction

This section describes the configuration of the CANopen interface of the controller.

Configuring the CAN Bus

To configure the **CAN** bus of your controller, proceed in the following way:

Step	Action
1	Under the controller, double-click the **CAN_1 (CANopen Bus)** node.
2	Configure the baudrate (by default: 250000 bits/s):  **NOTE:** The **Online Bus Access** option allows you to block the sending of SDO, DTM, and NMT through the status screen.

Adding a CANopen Performance Manager

To add the CANopen Performance functionality on the CANopen bus, select the **CANopen_Performance** in the **Hardware Catalog**, drag it to the **Devices tree**, and drop it on the **CAN_1 (CANopen Bus)** node of the **Devices tree**.

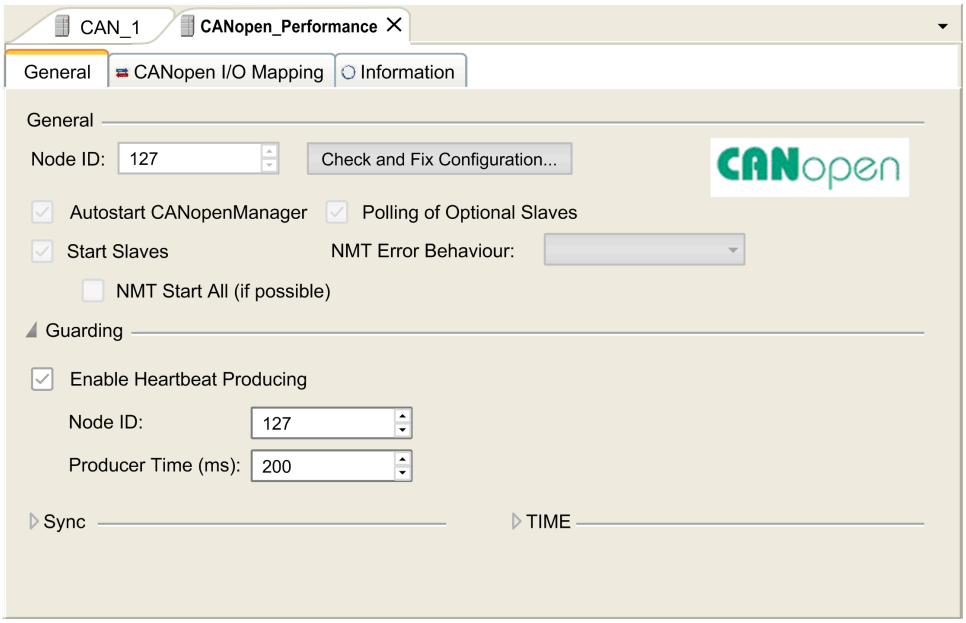
For more information on adding a device to your project, refer to:

- Using the Drag-and-drop Method
- Using the Contextual Menu or Plus Button

Configuring a CANopen Performance Manager

To configure **CANopen_Performance**, double-click **CAN_1 > CANopen Performance** in the **Devices tree.**

This dialog box appears:



The **CANopen_Performance** configuration dialog is divided into four areas:

- **General**: General information containing node ID and enabled configuration options of the controller as a CANopen master.
- **Guarding**: If **Enable Heartbeat Producing** is selected, the controller is configured as a Heartbeat Producer. Refer to **Heartbeat** Mechanism, page 125. The default setting is heartbeat producing at 200 ms.
- **Sync**: When **Enable Sync Producing** is selected, the controller is configured as a sync producer.
- **TIME**: Not editable.

For more details to configure **CANopen_Manager** tab, refer to Software / Communication / Device Editors / CAN-Based Fieldbuses / CANopen / CANopen Manager (Master) / Tab 'CANopen Manager - General' found in the Machine Expert V1.2 online help.

Adding and Configuring of TM3 CANopen Bus Coupler and Expansion Modules on the CANopen bus

Introduction

This section describes how to add a bus coupler on the CANopen bus.

Adding a TM3 CANopen Bus Coupler and Expansion Modules on the CANopen bus

> **NOTE:** You must add a **CANopen_Performance** CANopen manager under the **CAN_1 (CANopen Bus)** node.

To add a TM3 CANopen bus coupler on the CANopen bus, select the **TM3BCCO** in the **Hardware Catalog**, drag it to the **Devices tree**, and drop it under **CAN_1 > CANopen_Performance** CANopen manager of the **Devices tree**.

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

• Using the Drag-and-drop Method

• Using the Contextual Menu or Plus Button

Add the required expansion modules under **TM3BCCO**. Refer to Adding a TM3 CANopen bus coupler, page 26.

TM3 CANopen Bus Coupler Configuration

This figure shows the tabs for the module configuration:

Tabs Description

Tab	Description
General	The Node ID of the bus coupler is configured here. In addition, to access full options, such as node-guarding configuration, select **Enable Expert Setting**. For more details, refer to Software > Communication > Device Editors > CANbus Configuration Editor > CAN-Based Fieldbuses > CANopen > CANopen Manager (Master) > CANopen Remote Device Slave Tab 'CANopen Remote Device - General' found in the EcoStruxure Machine Expert online help. **NOTE:** TM3 CANopen bus coupler cannot be configured as a sync producer.
PDOs	EcoStruxure Machine Expert automatically creates, enables and maps the **Receive PDOs** and **Transmit PDOs** to match the expansion modules after the bus coupler. This enables the bus coupler to properly exchange I/O data with the controller without requiring manual mapping. Hence, no manual configuration (adding/deleting/editing of PDO mapping) is enabled. Modification of the PDO properties is enabled. To do so, double-click the **PDO** to open the **PDO Properties** window. Refer to CANopen Transmission and Monitoring, page 123 for detail. **NOTE:** The bus coupler supports PDO transmission by Remote Transmission Request (RTR), hence this option is disabled.
SDOs	EcoStruxure Machine Expert generates automatically the SDOs commands that will properly configure the bus coupler. Hence, no manual configuration is required or enabled. **NOTE: Enable Expert Setting** in **General** must be enabled to display the detailed comments.
CANopen parameters	Provides information about the parameters associated with the bus coupler.
CANopen I/O Mapping	Provides information about the variable name and type associated with the bus coupler. The bus coupler send information about its diagnostics to the controller. You can map this variable.
Status	You can access: • **NMT Commands** if **Block SDO, STM and NMT access while application is running** is unselected in **CAN_1** window. You can access the state of I/O modules and communication between bus coupler and controller. The states are described by: • **Running**: The bus coupler is running. • **Not running**: The bus coupler is not running and not exchanging data. • **Module reports an error**: At least one expansion module is in error (configuration or run-time error). • **Diagnostic message available**: An error message has been issued by the bus coupler. • **Redundancy Mode Passive**: The fieldbus master is currently not sending data because another master is in active mode.

Special Configuration Associated with all TM2 / TM3 modules with Analog Inputs

CANopen supports data transmission via specific events. For analog inputs, this can be when input values falls below a threshold value (lower limit), exceeds an

upper threshold (upper limit), or when the change in value exceeds the last transmitted value by a specified amount (delta). The event configuration can be done singularly or in combination. For example, if both upper limit of 5000 and delta of 100 is enabled and configured, then a value must both exceed 5000 and have changed by more than +/- 100 before it will be sent.

> **NOTE:** If all events (upper limit, lower limit and delta) are disabled and PDO transmission type is configured as acyclic or asynchronous type (0 or 255), no analog data will be transmitted.

To perform the configuration, after double-clicking on appropriate Analog device, under **I/O Configuration** tab, there will be a section titled **CANopen**. Each available channel will have an option to configure upper limit, lower limit and delta. Below shows an example. By default, upper and lower limit are disabled and delta is enabled with value of 50.

This graphic shows the configuration event when the channel **IW0** is enabled in **Input** section:

Module_1_1

I/O Mapping | I/O Configuration | Information

Parameter	Type	Value	Default Value	Unit	Description
Optional module	Enumeration of BYTE	No	No		
Inputs					
IW0					
Type	Enumeration of BYTE	0 - 10 V	Not used		Range mode
Minimum	INT(-32768...9999)	0	-32768		Minimum value
Maximum	INT(1...32767)	10000	32767		Maximum value
InputFilter	INT(0...10000)	0	0	x 10 ms	Input filter
Sampling	Enumeration of BYTE	1	1	ms/Channel	Input sampling selection
IW1					
Type	Enumeration of BYTE	0 - 10 V	Not used		Range mode
Minimum	INT(-32768...9999)	0	-32768		Minimum value
Maximum	INT(1...32767)	10000	32767		Maximum value
InputFilter	INT(0...10000)	0	0	x 10 ms	Input filter
Sampling	Enumeration of BYTE	1	1	ms/Channel	Input sampling selection
IW2					
IW3					
Diagnostic					
StatusEnabled	Enumeration of BYTE	Yes	Yes		
CANopen					
IW0					
Lower limit	Enumeration of BYTE	No	No		Enable or disable lower limit threshold
Lower limit threshold	INT(0...10000)	0	0		Lower limit threshold value
Upper limit	Enumeration of BYTE	No	No		Enable or disable upper limit threshold
Upper limit threshold	INT(0...10000)	1	0		Upper limit threshold value
Delta interrupt	Enumeration of BYTE	Yes	No		Enable or disable delta interrupt
Delta interrupt threshold	UINT(0...10000)	50	0		Delta interrupt threshold value
IW1					
Lower limit	Enumeration of BYTE	No	No		Enable or disable lower limit threshold
Lower limit threshold	INT(0...10000)	0	0		Lower limit threshold value
Upper limit	Enumeration of BYTE	No	No		Enable or disable upper limit threshold
Upper limit threshold	INT(0...10000)	1	0		Upper limit threshold value
Delta interrupt	Enumeration of BYTE	Yes	No		Enable or disable delta interrupt
Delta interrupt threshold	UINT(0...10000)	50	0		Delta interrupt threshold value
IW2					
IW3					

This graphic shows the configuration event when the channel **IW1** is disabled in **Input** section:

Module_1_1

I/O Mapping | I/O Configuration | Information

Parameter	Type	Value	Default Value	Unit	Description
Optional module	Enumeration of BYTE	No	No		
Inputs					
IW0					
Type	Enumeration of BYTE	0 - 10 V	Not used		Range mode
Minimum	INT(-32768...9999)	0	-32768		Minimum value
Maximum	INT(1...32767)	10000	32767		Maximum value
InputFilter	INT(0...10000)	0	0	x 10 ms	Input filter
Sampling	Enumeration of BYTE	1	1	ms/Channel	Input sampling selection
IW1					
Type	Enumeration of BYTE	0 - 10 V	Not used		Range mode
Minimum	INT(-32768...9999)	0	-32768		Minimum value
Maximum	INT(1...32767)	10000	32767		Maximum value
InputFilter	INT(0...10000)	0	0	x 10 ms	Input filter
Sampling	Enumeration of BYTE	1	1	ms/Channel	Input sampling selection
IW2					
IW3					
Diagnostic					
StatusEnabled	Enumeration of BYTE	Yes	Yes		
CANopen					
IW0					
Lower limit	Enumeration of BYTE	No	No		Enable or disable lower limit threshold
Lower limit threshold	INT(0...10000)	0	0		Lower limit threshold value
Upper limit	Enumeration of BYTE	No	No		Enable or disable upper limit threshold
Upper limit threshold	INT(0...10000)	1	0		Upper limit threshold value
Delta interrupt	Enumeration of BYTE	Yes	No		Enable or disable delta interrupt
Delta interrupt threshold	UINT(0...10000)	50	0		Delta interrupt threshold value
IW1					
Lower limit	Enumeration of BYTE	No	No		Enable or disable lower limit threshold
Lower limit threshold	INT(0...10000)	0	0		Lower limit threshold value
Upper limit	Enumeration of BYTE	No	No		Enable or disable upper limit threshold
Upper limit threshold	INT(0...10000)	1	0		Upper limit threshold value
Delta interrupt	Enumeration of BYTE	Yes	No		Enable or disable delta interrupt
Delta interrupt threshold	UINT(0...10000)	50	0		Delta interrupt threshold value
IW2					
IW3					

Finally, analog input values intrinsically have some fluctuations over time. The level of fluctuations is partly dependent on the stability of the module input. Refer to the TM3 Analog I/O Modules - Hardware Guide to understand the capabilities of the modules used so that proper values are configured for the events.

Web Server

Introduction

The TM3 bus coupler supports a Web server, offering easy access to information such as configuration data, module status, I/O data, network statistics, and diagnostic information. All of this vital information is available using a simple web browser.

In addition the Web server allows you to monitor this information, the bus coupler network and I/O remotely.

You can access the Web server with HTTPS (secure connections). HTTP (non secured connections) is not supported.

The Web server is accessible through the bus coupler USB port, page 172. You can use the pages of the Web server for setup and control as well as application

diagnostics and monitoring. These pages are ready to use with a Web browser. No configuration or programming is required.

Any PC providing a USB (host) port can connect to the Web server by using a Web browser.

The Web server can be accessed by the web browsers listed below:

- Microsoft Internet Explorer (version ≥ 11)
- Google Chrome (version ≥ 71)
- Mozilla Firefox (version ≥ 64)
- Microsoft Edge (version ≥ 42)

The Web server allows you to monitor a bus coupler and its application remotely, to perform various maintenance activities including modifications to data and configuration parameters. Care must be taken to ensure that the immediate physical environment of the machine and process is in a state that will not present safety risks to people or property before exercising control remotely.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Define a secure password for the Web server, and do not allow unauthorized or otherwise unqualified personnel to use this feature.
- Ensure that there is a local, competent, and qualified observer present when operating on the controller from a remote location.
- You must have a complete understanding of the application and the machine/process it is controlling before attempting to adjust data, stopping an application that is operating, or starting the controller remotely.
- Take the precautions necessary to assure that you are operating on the intended controller by having clear, identifying documentation within the controller application and its remote connection.

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

NOTE: The Web server must only be used by authorized and qualified personnel. A qualified person is one who has the skills and knowledge related to the construction and operation of the machine and the process controlled by the application and its installation, and has received safety training to recognize and avoid the hazards involved. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this feature.

Web Server Access

You can manage the user accounts on the Web server on MAINTENANCE / User Accounts, page 137.

To access Web server, ensure that the rotary switch are in address setting location. For more information regarding address setting, please refer to the Modicon TM3 Bus Coupler - Hardware Guide, Setting the CANopen Address.

By default, the user name is Administrator, and the password is Administrator. You must change the password at the first login.

⚠WARNING

UNAUTHORIZED DATA ACCESS

- Do not expose the device or device network to public networks and the Internet as much as possible.
- Immediately change the default password to a new secure password.
- Do not distribute passwords to unauthorized or otherwise unqualified personnel.
- Restrict access to unauthorized personnel.
- Use additional security layers like VPN for remote access and install firewall mechanisms.
- Validate the effectiveness of these measurements regularly and frequently.

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

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

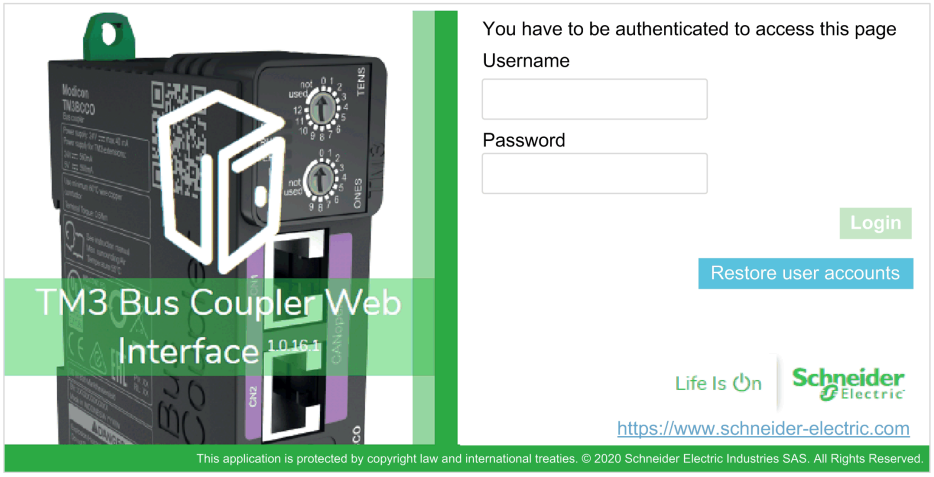
Resetting the Password

To reset the password:

Step	Action
1	Connect to the bus coupler using the USB port.
2	Open the browser.
3	Enter the IP address 90.0.0.1.
4	Move the position of any rotary switch to any other position. **Result: ERR** LED is flashing red. The **Restore user accounts** button is displayed.
5	Click **Restore user accounts**.
6	Move the position of the changed rotary switch to its previous position. **Result:** The **Restore user accounts** button is no longer displayed.

Login Page

The login page is the entry point to get authenticated by the Web server. The certificate, page 173 must be validated. To access the website login page shown in the following illustration, type in your navigator the IP address 90.0.0.1. To login to the Web server, enter the user name and password and click **Login**.



The Web server contains the following pages:

- HOME, page 133
- DIAGNOSTICS, page 133
- MONITORING, page 134
- MAINTENANCE, page 136

NOTE: The timeout session for each login is ten minutes. When you do not perform any action after you logged in, it redirects you to the login page if you click any button. You need to log in again with user name and password to access the web pages.

HOME / Equipment Overview

The **HOME** page displays the product details of TM3 bus coupler.

The **identification** section of **HOME** page consists of:

Element	Description
Identification	
Vendor ID	Vendor ID of the bus coupler
Vendor Name	Vendor name of the bus coupler
Product ID	Product ID of the bus coupler
Product Name	Product name of the bus coupler
Product Reference	Product reference of the bus coupler
Serial Number	Serial number of the bus coupler
Locate Device Locate Device	Click the button to locate the bus coupler. The LEDs of the bus coupler flash red for few seconds.

DIAGNOSTICS Page

The **DIAGNOSTICS** page shows the status of the bus coupler.

The **DIAGNOSTICS** page contains the following sub-pages:

- Device, page 134
- CANopen, page 134

DIAGNOSTICS / Device

The **Status** section shows details about the status of the bus coupler:

Element	Description
Status	
Last Stop Cause	Displays the cause of the last stop of the bus coupler.
USB Port	Displays whether a USB cable is connected to the bus coupler.
Operating Mode	Displays one of the following operating modes of the bus coupler: • **Idle** • **CANopen** • **Web interface** • **Firmware update in progress** • **Time Out**
Configuration Status	Displays one of the following configuration status of the bus coupler: • **Not Configured** • **Configured**

DIAGNOSTICS / CANopen

The **Configuration** section displays the status of CANopen connection:

Element	Description
Bitrate (Kbits/s)	Current transmission speed in kilobits per second.
Node ID	Slave address of bus coupler.

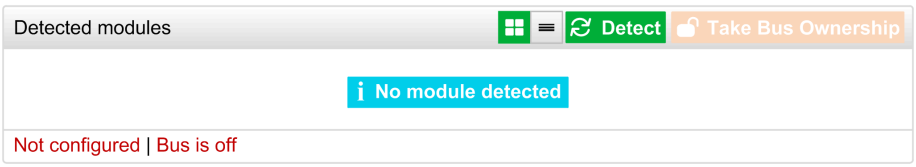
The **Statistics** section shows the current state and latest error messages for the bus coupler:

Element	Description
Device State	Current CANopen state of the bus coupler.
Latest Error	Last 10 EMCY error codes issued by the bus coupler. The latest erros are displayed on top. Timestamp is in seconds since boot-up.

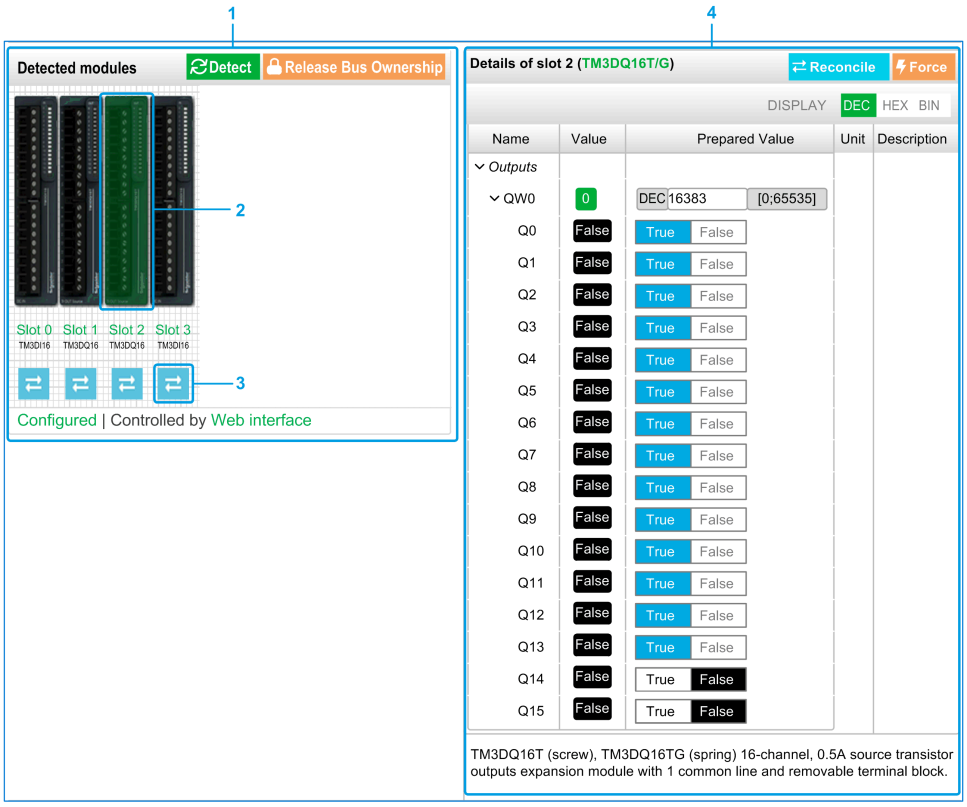
MONITORING Page

The **MONITORING** page displays the expansion modules that are connected to the TM3 bus coupler.

MONITORING page without detected modules:



MONITORING page with modules and details:



1 Bus *Monitoring*

2 Selected module

3 *Reconcile* button

4 Module details

The **MONITORING** page shows and describes all the modules detected by the bus coupler and allows you to:

- See the state of a selected module (running or not running) and the protocol used.
- Read the value of an input or output.
- Force a value to an output by clicking **Force**.
- Identify a module by clicking **Reconcile**.

Element	Description
Detect	Allows you to detect the modules connected to the bus coupler.
Take Bus Ownership **Release Bus Ownership**	Reserves the bus to allow you to force the module outputs. You can click the button when the bus coupler is configured and not controlled by a controller. **Result**: You are notified that the I/O bus coupler is controlled by the Web interface when you are in **Take Bus Ownership** state. You can edit the output values. Click **Release Bus Ownership** to release the control of the I/O bus.

Module Details

The module details view provides the following data:

- Module name and description
- Module state
- Filter option to filter I/Os
- A list of its I/Os

This list of I/Os allows you to view a real-time value of an input and to write the value of an output. You can also view the value in binary state, hexadecimal state and decimal state.

The view has **DISPLAY** buttons to modify the format of the displayed values.

Output Forcing

1. When **Take Bus Ownership** is enabled, click a module to force its outputs.
2. Set the output values you wish to force for the module in the **Prepared Values** column of the list of its I/Os.
3. Click the **Force** button.

   Result: A message is displayed.
4. Click **I agree** to validate the modifications and send them to the bus coupler.

   Click **I disagree** to cancel the modifications.

As the modules are not identified automatically or correctly, click the **Reconcile** button to identify the modules.

MAINTENANCE Page

The **MAINTENANCE** page allows you to view and edit the configuration of the bus coupler.

The **MAINTENANCE** page contains the following sub-pages:

- User Accounts, page 137
- Firmware, page 138
- Modules Firmware, page 139
- System Log Files, page 140
- CANopen, page 140

MAINTENANCE / User Accounts

Account Management

The sub-page allows you to enter your login password to access the Web server:

Element	Description
Account Management **Select an account to edit it**	
User Name	List of the following user accounts: • **Administrator** The **Administrator** account is configured with a predefined password (Administrator / Administrator). Modify the predefined password after the first connection. • **Operator** This account is disabled by default. • **Viewer** This account is disabled by default. **NOTE:** Depending on your account, you have access to some web pages. See the table below for the accessible web pages.
Enabled	Selected if the account is enabled.
Account Management **Provide a new password for account**	
Current Password	Enter the current password of the user account.
New Password	Enter a password for the user account. **NOTE:** Minimum ten characters, maximum 32 characters and use a...z, A...Z, 0...9 alphanumeric characters. To reset the password, refer to Resetting the Password, page 132.
Confirm New Password	Enter the password again of the selected account.
Apply	Saves your new password.

This table describes the accessible pages depending on the user account:

Web pages	Sub pages	Administrator	Operator	Viewer
HOME	–	✓	✓	✓
MONITORING	–	✓	✓	–
DIAGNOSTICS	**Device**	✓	✓	✓
	CANopen	✓	✓	✓
MAINTENANCE	**User Accounts**	✓	✓(1)	✓(1)
	Firmware	✓	–	–
	System Log Files	✓	✓	–
	CANopen	✓	–	–
(1) You can only modify your user account.				

System Use Notification

The sub-page allows you to define a **System Use Notification** message which is displayed to users at log-in:

Element	Description
System Use Notification	
Enabled	When selected, you can define a message that is displayed at log-in.
Message	Displays the message defined.
Reset	Reset to default message.
Apply	Applies your changes.

MAINTENANCE / Firmware

The **Firmware** sub-page shows the firmware version of the TM3 bus coupler and allows you to update its firmware:

Element	Description
Current Firmware	
Firmware	Firmware version
Web interface	Web server version
Firmware Update **Select a new firmware version**	
Select	Allows you to select the new firmware file for the bus coupler.
Apply	Allows you to apply the new firmware.
Cancel	Cancels firmware modifications.

NOTE: You cannot update the firmware when the TM3 bus coupler cyclically exchanges data with the logic/motion controller. To make sure the bus coupler is not exchanging data, see **MONITORING**, page 134.

To update the bus coupler firmware:

Step	Action
1	Remove power from the bus coupler.
2	Ensure rotary switches are in address setting position e.g. **ONES** to 1, **TENS** to 0.
3	Connect USB cable to PC then to bus coupler.
4	Apply power to the bus coupler.
5	Log into the Web server as Administrator.
6	Verify in the **MONITORING** page that the bus coupler is not exchanging data with the controller.
7	Click **MAINTENANCE** / **Firmware**.
8	Click **Select** then select the firmware file. **Result**: A confirmation window is displayed.
9	Click **I agree**. **Result**: At the end of the download and verification of the file, a confirmation window is displayed.
10	Click **Yes** to close the confirmation window then click **Apply**. **Result**: At the end of the firmware update, a message is displayed to inform you whether the firmware update is completed successfully.

MAINTENANCE / Modules Firmware

The **Modules Firmware** sub-page shows the firmware version of the modules configured and allows you to update its firmware:

Element	Description
Modules Firmware Overview	
Slot	Slot number of the module
Reference	Reference of the module
Current Firmware	Firmware version of the module
Modules Firmware Management **Select a new firmware version**	
Select	Allows you to select the new firmware file for the module. **NOTE:** You can select only a single firmware file. All modules on the bus corresponding to the selected firmware are updated.
Apply	Allows you to apply the new firmware.

NOTE: You cannot update the firmware when the TM3 bus coupler cyclically exchanges data with the logic/motion controller. To make sure the bus coupler is not exchanging data, see **MONITORING**, page 134.

To update the module firmware:

Step	Action	
1	Remove power from the bus coupler.	
2	Connect the USB cable.	
3	Apply power to the bus coupler.	
4	Log into the Web server.	
5	Verify in the **MONITORING** page that the bus coupler is not exchanging data with the controller.	
6	Click **MAINTENANCE** / **Modules Firmware**.	
7	Click **Select** then select the firmware file. **Result**: The firmware file is selected.	
8	Click **Apply**. **Result**: A confirmation window is displayed.	
9	Click **I agree**. **Result**: A restart window is displayed.	
10	Click **Yes**. **Result**: The file is verified and downloaded. The, a confirmation window is displayed. The TM3 bus coupler reboots and a confirmation window is displayed.	Click **No**. **Result**: The firmware update is canceled.

MAINTENANCE / System Log Files

The **System Log Files** sub-page lists the log files. Some of the information in the log files comes from internal interactions of the firmware and is intended to be used by Schneider Electric Technical Support:

Element	Description
Log Files **Select one or more log files to download**	
Select	Allows you to select one or more log files.
Name	Shows the list of the log files.
Size	Displays the size of the log files.
Download	Allows you to download the log files.

MAINTENANCE / CANopen

The **Configuration** sub-page allows you to configure the speed of the TM3 bus coupler:

Element	Description
Speed (Kbits/s)	Allows you to set the transmission speed in kilobits per second. You can also set the baud rate using the rotary switch. Refer to Modicon TM3 Bus Coupler Hardware Guide.
Node ID	Displays the Slave Address value for your device.
Apply	Saves the configuration settings. **NOTE:** Upon confirmation, the bus coupler will automatically reset and new speed will be applied.
Cancel	Cancels configuration modifications.

Object Dictionary

Index Ranges

In the CANopen protocol, there are three main sets of profile zones as shown in the table below:

Index	Zone
1000-1A37, page 141	Communication profile zone
2000-3300, page 156	Manufacture-specific zone
6000-6426, page 159	Device-specific profile zone

Object Codes

The object codes are shown in the table below:

Code	Description
ARRAY	A multiple data field object where each data field is a simple variable of the SAME basic data type.
RECORD	A multiple data field object where the data fields may be any combination of simple variables.
VAR	A single value.

Access Attributes

The attribute in the table below defines the access rights of a particular object:

Attribute	Description
Const	Read only access. Value is constant.
RO	Read Only access.
RW	Read and Write access.

Objects in Communication Profile Zone

Communication Objects

The TM3 CANopen bus coupler supports the following communication objects:

Index	Name
1000, page 141	Device type
1001, page 142	Error register
1002, page 143	Manufacturer status register
1003, page 144	Pre-defined error field
1005, page 145	COB-ID SYNC
1006, page 146	Communication cycle period
1008, page 147	Manufacturer device name
100A, page 147	Manufacturer software version
100C, page 147	Guard time
100D, page 148	Life time factor
1014, page 148	COB-ID EMCY
1016, page 149	Consumer heartbeat time
1017, page 149	Producer heartbeat time
1018, page 150	Identity Object
1027, page 150	Module list
1029, page 151	Error behavior
1200, page 152	1st Server SDO parameter
1201, page 152	2nd Server SDO parameter
1400 - 141CH, page 153	1st to 29th receive PDO communication parameter
1600 - 161CH, page 153	1st to 29th receive PDO mapping parameter
1800 - 1837, page 154	1st to 56th transmit PDO communication parameter
1A00 - 1A37, page 155	1st to 56th transmit PDO mapping parameter

Object 1000H: Device Type

This object indicates the device type and its functionalities.

The following table provides a general overview of the object:

Object Attribute	Value
Sub-index	0
Description	-
Code	VAR
Data Type	UNSIGNED32
Access	RO
PDO Allowed	No
Range	UNSIGNED32
Default Value	0x00800191

The object value consists of the following two 16-bit fields:

- Least Significant

  401Dec or 191H (for CANopen standard inputs / outputs).

- Most Significant

  Provides details of the bus coupler's functionalities, described in the following table.

  NOTE: The value depends on the type TM2/TM3 modules connected.

Bit	Meaning
1	The device has digital inputs
2	The device has digital outputs
3	The device has analog inputs
4	The device has analog outputs
5-7	Not used
8	0 = The device supports predefined, generic PDO mapping
	1 = The device supports device-specific PDO mapping
9-16	Not used

Object 1001H: Error Register

This object allows the bus coupler to indicate internal faults. When a fault is detected, the corresponding bit is activated.

The following table provides a general overview of the object:

Object Attribute	Value
Sub-index	0
Description	-
Code	VAR
Data Type	UNSIGNED8
Access	RO
PDO Allowed	Yes
Range	UNSIGNED8
Default Value	-

The following table describes the error type that can be displayed by the bus coupler in the 8-bit field:

Bit	Meaning	Comment
0	Generic error	Set when any error is detected.
1	Reserved (0)	-
2	Reserved (0)	-
3	Reserved (0)	-
4	Communication error	Set when communication issues have occurred.
5	Device specific	Device profile related issues.
6	Reserved (0)	-
7	Manufacturer specific	Set when an error occurs in the application layer (bus coupler issues, firmware update, rotary switch changed).

Object 1002H: Manufacturer Status Register

This object provides key status information of the bus coupler as well as the connected TM2/TM3 modules.

The following table provides a general overview of the object:

Object Attribute	Value
Sub-index	0
Description	-
Code	VAR
Data Type	UNSIGNED32
Access	RO
PDO Allowed	Yes
Range	UNSIGNED32
Default Value	-

Diagnostics data is saved in the 32-bit field. This object is contained in the EMCY message and is transmitted when an error occurs. The table below shows the bit assignment.

Bit	Meaning
0...1	1st expansion module status
2...3	2nd expansion module status
4...5	3rd expansion module status
6...7	4th expansion module status
8...9	5th expansion module status
10...11	6th expansion module status
12...13	7th expansion module status
14...15	8th expansion module status
16...17	9th expansion module status
18...19	10th expansion module status
20...21	11th expansion module status
22...23	12th expansion module status
24...25	13th expansion module status
26...27	14th expansion module status
28...29	Not used
30...31	Bus status

Bit values for the bus status:

- 0 = No fault
- 1 = Configuration fault
- 2 = Runtime fault
- 3 = Not configured

Bit values for the module status:

- 0 = No fault
- 1 = Configuration fault
- 2 = Runtime fault
- 3 = Not configured but optional

Object 1003H: Predefined Error Field

This object stores the most recent faults, as well as their characteristics:

- The EMCY error code is stored in the least significant word.
- Additional Information is stored in the most significant word.
- Subindex 0 contains the number of recorded errors.

The following table provides a general overview of the object:

Object Attribute	**Value**	**Value**
Sub-index	0	1...10
Description	Number of recorded errors	Most recent error
Code	ARRAY	
Data Type	UNSIGNED8	UNSIGNED32
Access	RW	RO
PDO Allowed	No	
Range	0-10	-
Default Value	0	-

This object stores the most recent faults, as well as their characteristics

Byte	**Value**
MSW MSB 21..31	Faulty module number (bus coupler = 0, 1st module = 1,..., 14th module = 14.)
MSW LSB 16..23	Error Register 1001H
LSW 0..15	EMCY Error Code

When a new fault appears, the codes already present are moved into the upper level sub-indexes: the fault in sub-index 1 is moved to sub-index 2, the fault in sub-index 2 is moved to sub-index 3, etc.

The following table provides the EMCY error codes, their diagnostics and causes:

Error Code (EMCY-Byte 0 +1)	Diagnostics	Cause
0x0000	ERROR_RESET_OR_NO_ERROR	An error has been corrected
0x0080	ANALOG_DISABLE	Analog inputs interrupt disabled
0x1000	GENERIC_ERROR	An internal communication error occurred
0x6101	SOFTWARE_RX_QUEUE_OVERRUN	Receive memory capacity exceeded
0x6102	SOFTWARE_TX_QUEUE_OVERRUN	Transmit memory capacity exceeded
0x7001	KPI_CONFIGURATION_TIMEOUT	Bus coupler configuration transfer timeout
0x7002	KPI_CONFIGURATION_ERROR	Bus coupler configuration mismatch
0x7003	KPI_RUNTIME_ERROR	Bus coupler runtime error
0x8110	MESSAGE_LOST	Indicates that one or more CAN message has been lost
0x8120	CAN_IN_ERROR_PASSIVE_MODE	CAN error counter threshold is exceeded and bus coupler has entered passive mode
0x8130	NODE_GUARD_OR_HEARTBEAT_ERROR	The module has not received a node guard message or a heartbeat message within the configured time frame
0x8140	BUS_OFF_RECOVERED	The controller has recovered from a previous CAN bus off situation.
0x8210	PDO_LENGTH	PDO was not processed because the received data length does not match the expected one
0x8250	RPDO_TIMEOUT	RPDO timeout
0xF001	SYNC_TIMEOUT	SYNC timeout
0xFF01	FW_UPDATE_ERROR	An error occurred during the firmware update of bus coupler
0xFF02	TM3_FW_UPDATE_ERROR	An error occurred during the firmware update of expansion module
0xFF03	ROTARY_SWITCH_CHANGED	Rotary switch positions have been changed after power up
0xFF04	KPI_NOT_CONFIGURED_IN_OP	Bus coupler is not configured even though it is in ‘OPERATIONAL’ state

Object 1005H: COB-ID SYNC Message

This object contains the synchronization message identifier.

The following table provides a general overview of the object:

Object Attribute	Value
Sub-index	0
Description	-
Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Allowed	No
Range	UNSIGNED32
Default Value	80H

The communication parameters for the synchronization telegram are stored in this 32-bit field. The structure is shown in table below:

MSb			Bit	LSb
31	30	29	28 - 11	10 - 0
X	0	0	000000000000000000	11-Bit Identifier

The default value is 80H, allowing the device to receive SYNC-telegrams with COB-ID 80H. The following table explains the value of individual bits:

Bit	Value	Meaning	Comment
31 (MSb)	X	-	Unused
30	0	Device does not create sync objects	-
	1	Device creates sync objects	Not supported
29	0	11-Bit ID (CAN 2.0A)	-
	1	29-Bit ID (CAN 2.0B)	Not supported
28-11	If bit 29 = 0	000000000000000000	-
	If bit 29 = 1	Bit 28-11 from 29-Bit ID	Not supported
10-0 (LSb)	-	Bit 10 - 0 of ID identifier	-

Object 1006H: Communication Cycle Period

This object describes the time interval between two SYNC signals. This interval must be at least 10 ms with a minimum increment of 1ms. The entry must be a double word. If unused, the value of this field is zero

The following table provides a general overview of the object:

Object Attribute	Value
Sub-index	0
Description	-
Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Allowed	No
Range	UNSIGNED32
Default Value	0

The following table provides an example of configured values of this object and their respective time intervals:

Value Type	Decimal	Hexadecimal	Interval SYNC in MS
Standard Value	0	0H	-
Minimum Value	10 000	0000 2710H	10
	25 000	0000 61A8H	25
	250 000	0003 D090H	250
	1 000 000	000F 4240H	1 000
	5 000 000	004C 4B40H	5 000
Maximum Value	10 000 000	0098 9680H	10 000

Object 1008H: Manufacturer Device Name

This object contains the device name. Device information can be stored in ASCII string. The default setting for device identification is TM3BCCO.

The following table provides a general overview of the object:

Object Attribute	Value
Sub-index	0
Description	-
Code	VAR
Data Type	Visible String
Access	Const
PDO Allowed	No
Range	-
Default Value	TM3BCCO

Object 100AH: Manufacturer Software Version

This object contains the software version of the bus coupler as an ASCII string, in the form “xx.yy.zz”.

The following table provides a general overview of the object:

Object Attribute	Value
Sub-index	0
Description	-
Code	VAR
Data Type	Visible String
Access	Const.
PDO Allowed	No
Range	-
Default Value	Depends on the embedded firmware

Object 100CH: Guard-Time

This object contains the guard-time parameter expressed in milliseconds.

The following table provides a general overview of the object:

Object Attribute	Value
Sub-index	0
Description	-
Code	VAR
Data Type	UNSIGNED16
Access	RW
PDO Allowed	No
Range	UNSIGNED16
Default Value	0

Object 100DH: Lifetime Factor

This object contains the lifetime factor parameter.

The following table provides a general overview of the object:

Object Attribute	Value
Sub-index	0
Description	-
Code	VAR
Data Type	UNSIGNED8
Access	RW
PDO Allowed	No
Range	UNSIGNED8
Default Value	0

Lifetime is calculated as: Lifetime = Guard-time x Lifetime factor.

If the default value is set to 0, the master is not monitored (no life guarding).

⚠WARNING

UNINTENDED MACHINE OPERATION

Set the **Lifetime Factor** (object **100DH**) to a value no less than 2 when enabling **Node Guarding**.

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

Object 1014H: COB-ID Emergency (EMCY-COB-ID) Message

This object contains the emergency message identifier.

The following table provides a general overview of the object:

Object Attribute	Value
Sub-index	0
Description	-
Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Allowed	No
Range	UNSIGNED32
Default Value	80H+Node-ID

The following table shows the structure of the EMCY object COB-ID:

Bit				
31 (MSb)	**30**	**29**	**28 - 11**	**10 - 0 (LSb)**
0	0	0	00000000000000000-0	11-Bit Identifier

Bit value and definition are shown in the following table:

Bit	Value	Meaning
31 (MSb)	0	Reserved
30	0	Reserved
29	0	11-Bit ID (CAN 2.0A)
	1	29-Bit ID (CAN 2.0B) - Not supported
28-11	If bit 29 = 0	000000000000000000
	If bit 29 = 1	Bit 28-11 from 29 bit ID - Not supported
10-0 (LSb)	-	Bit 10 - 0 of ID identifier

Object 1016H: Consumer Heartbeat Time

The consumer heartbeat time defines the expected heartbeat cycle time in milliseconds. The bus coupler can monitor heartbeat messages from one heartbeat producer device.

The following table provides a general overview of the object:

Object Attribute	Value	Value
Sub-index	0	1
Description	Number of sub-indices	Consumer heartbeat time
Code	ARRAY	
Data Type	UNSIGNED8	UNSIGNED32
Access	RO	RW
PDO Allowed	No	
Range	1H - 7FH	UNSIGNED32
Default Value	1	0

The contents of sub-index 1 is as follows:

Bit	Value
31-24	00000000
23-16	Address of monitored module
15-0	Maximum time to receive heartbeat.

In case of timeout without reception of heartbeat message, the bus coupler sends an EMCY message, applies fallback to the expansion modules I/Os and transitions to the state as configured in object 1029H, page 151.

Object 1017H: Producer Heartbeat Time

This object configures the bus coupler as a heartbeat producer and defines the heartbeat cycle time.

The following table provides a general overview of the object:

Object Attribute	Value
Sub-index	0
Description	-
Code	VAR
Data Type	UNSIGNED16
Access	RW
PDO Allowed	No
Range	UNSIGNED16
Default Value	0

When configured, the bus coupler periodically transmits a heartbeat message to one or more devices in the network. A value of 0 disables the bus coupler as a heartbeat producer.

Object 1018H: Identity Object

This object provides general information about the CANopen device, including the:

- vendor ID
- product code
- revision number
- serial number

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value	Value	Value
Sub-index	0	1	2	3	4
Description	Number of I/Os	Vendor ID	Product code	Revision Number	Serial Number
Code	RECORD	RECORD	RECORD	RECORD	RECORD
Data Type	UNSIGNED8	UNSIGNED32	UNSIGNED32	UNSIGNED32	UNSIGNED32
Access	RO	RO	RO	RO	RO
PDO Allowed	No	No	No	No	No
Range	1H - 4H	UNSIGNED32	UNSIGNED32	UNSIGNED32	UNSIGNED32
Default Value	4	0x0500005a	811044	-	-

The Revision Number, when converted to hexadecimal form, represents the firmware version in "xx.yy.zz" format. For example, if the integer value read back from Sub-index 3 converts to 0x010015 (hexadecimal form), this represents firmware version v1.0.15.

Object 1027H: Module List

This object provides a list of modules connected to the bus coupler.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value	Value
Sub-index	0	1	-	N
Description	Number of connected expansion modules	First module Product code	-	N module code
Code	ARRAY			
Data Type	UNSIGNED8	UNSIGNED16		
Access	RO			
PDO Allowed	No			
Range	0 - 14	UNSIGNED16	-	UNSIGNED16
Default Value	-	-	-	-

When there is no extension module, this object still exists with a value of 14 to represent the maximum number of expansion modules supported. However, the values of other sub-indices are 0.

Object 1029H: Error Behavior

This object is used to define the NMT state of the bus coupler if an error is detected. By default, the bus coupler enters **'PRE-OPERATIONAL'** in an error event

Device failures include the following errors:

- Bus-off state of the CAN interface
- Life guarding or heartbeat event has occurred
- Sync timeout has occurred
- PDO **Event Time** error has occurred

The following table provides a general overview of the object:

Object Attribute	Value	Value
Sub-index	0	1
Description	Number of sub-indices	CANopen state after detection of communication error
Code	ARRAY	
Data Type	UNSIGNED8	
Access	RO	RW
PDO Allowed	No	
Range	UNSIGNED8	
Default Value	1	0

The following table explains the values of sub-index 1:

Value	Definition
00h	Change to NMT state Pre-Operational (only if currently in NMT state Operational)
01h	No change of the NMT state
02h	Change to NMT state Stopped
03h-FFh	Reserved

Object 1200H: Server SDO Parameter

The object contains the SDO parameters of the bus coupler, where the bus coupler acts as a server.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	2
Description	Number of entries	COB-ID Client to Server	COB-ID Server to Client
Code	RECORD		
Data Type	UNSIGNED8	UNSIGNED32	UNSIGNED32
Access	RO		
PDO Allowed	No		
Range	2	UNSIGNED32	UNSIGNED32
Default Value	2	600H + Node-ID	580H + Node ID

The COB-ID structure is shown in table below:

MSb			Bit	LSb
31	30	29	28 - 11	10 - 0
0	0	0	000000000000000000	11-Bit Identifier

The following table explains the value of individual bits:

Bit	Value	Meaning
31 (MSb)	0	SDO exists / is valid
	1	SDO does not exist / is invalid
30	0	Reserved
29	0	11-Bit ID (CAN 2.0A)
	1	29-Bit ID (CAN 2.0B) - Not supported
28-11	If bit 29 = 0	000000000000000000
	If bit 29 = 1	Bit 28-11 from 29-Bit COB-ID - Not supported
10-0 (LSb)	-	Bit 10 - 0 of COB-ID identifier

Object 1201H: Server SDO Parameter

The object contains a second server SDO parameter object.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value	Value
Sub-index	0	1	2	3
Description	Number of entries	COB-ID Client to Server	COB-ID Server to Client	Node-ID of the Client.
Code	RECORD			
Data Type	UNSIGNED8	UNSIGNED32		
Access	RO	RW		
PDO Allowed	No			
Range	3	UNSIGNED32		
Default Value	3	User defined	User defined	-

Object 1400H to 141CH: Receive PDO Communication Parameter

Each object contains the PDO communication parameters for the respective receive PDOs supported by the bus coupler.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value	Value	Value	Value	Value
Sub-index	0	1	2	3	4	5	6
Description	Number of entries	COB-ID	Transmission type	Not applicable		**Event Time**	Not applicable
Code RECORD	RECORD					RECORD	
Data Type	UNSIGNED8	UNSIGNED32	UNSIGNED8			UNSIGNED16	
Access	RO	RW	RW			RW	
PDO Allowed	No					No	
Range	5	UNSIGNED32	UNSIGNED8			UNSIGNED16	
Default Value	5	-	255			0	

The COB-ID structure is shown in table below:

MSb			Bit	LSb
31	30	29	28 - 11	10 - 0
0	X	0	000000000000000000	11-Bit Identifier

The following table explains the value of individual bits:

Bit	Value	Meaning
31 (MSb)	0	PDO exists / is valid
	1	PDO does not exist / is invalid
30	X	Unused
29	0	11-Bit ID (CAN 2.0A)
	1	29-Bit ID (CAN 2.0B)
28-11	If bit 29 = 0	000000000000000000
	If bit 29 = 1	Bit 28-11 from 29-Bit COB-ID - Not supported
10-0 (LSb)	-	Bit 10 - 0 of COB-ID identifier

Allowed transmission type:

-	Cyclic	Acy-clic	Synchro-nous	Asynchro-nous	Comments
0-240	✓	-	✓	-	Data from PDO is taken into account on Sync message
255	-	-	-	✓	Data from PDO is taken into account immediately

Sub-index 05h contains the **Event Time**. The value is defined as multiple of 1 ms. The value of 0 shall disable the **Event Time**. The RPDO may use the time for deadline monitoring. The deadline monitoring is activated within the next reception of an RPDO after configuring the **Event Time**. A timeout results in an indication to the local application.

Object 1600H to 161CH: Receive PDO Mapping Parameter

Each object describes the mapped objects that is transported by the respective PDOs to the bus coupler.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value	Value	Value	Value	Value
Sub-index	0	1	2	3	4	5	n
Description	Number of entries	1st object in PDO	2nd object in PDO	3rd object in PDO	4th object in PDO	5th object in PDO	Nth object in PDO
Code	RECORD						
Data Type	UNSIGNED8	UNSIGNED32					
Access	RW						
PDO Allowed	No						
Range	8	UNSIGNED32					
Default value 1600h 1601h 1602h 1603h Others	 1 1 1 0	 6200 01 08 H 6411 01 10 H 6411 05 10 H 6411 09 10 H 0	 0 6411 02 10 H 6411 06 10 H 6411 0A 10 H 0	 0 6411 03 10 H 6411 07 10 H 6411 0B 10 H 0	 0 6411 04 10 H 6411 08 10 H 6411 0C 10 H 0	0	0

Data Field Structure

Each data object to be transported is represented as follows:

Bits	31 to 16	15 to 8	7 to 0
Data	Index number of object to be transported	Sub-index number of object to be transported	Length of object to be transported (in bits)
Example	6200H	01H	08H

Object 1800H to 1837H: Transmit PDO Communication Parameter

Each object contains the PDO communication parameters for the respective transmit PDOs supported by the bus coupler.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value	Value	Value	Value
Sub-index	0	1	2	3	4	5
Description	Number of entries	COB-ID	Transmission type	Inhibit time	Reserved	**Event Time**
Code	RECORD				Not applicable	RECORD
Data Type	UNSIGNED8	UNSIGNED32	UNSIGNED8	UNSIGNED16		UNSIGNED16
Access	RO	RW				RW
PDO Allowed	No					No
Range	5	UNSIGNED32	UNSIGNED8	UNSIGNED16		UNSIGNED16
Default Value	5	-	255	0		0

The COB-ID structure is shown in table below:

MSb			Bit	LSb
31	30	29	28 - 11	10 - 0
0	0	0	00000000000000000	11-Bit Identifier

The following table explains the value of individual bits:

Bit	Value	Meaning
31 (MSb)	0	PDO exists / is valid
	1	PDO does not exist / is invalid
30	0	RTR allowed on this PDO
	1	No RTR allowed on this PDO - Not supported
29	0	11-Bit ID (CAN 2.0A)
	1	29-Bit ID (CAN 2.0B) - Not supported
28-11	If bit 29 = 0	000000000000000000
	If bit 29 = 1	Bit 28-11 from 29-Bit COB-ID - Not supported
10-0 (LSb)	-	Bit 10 - 0 of COB-ID identifier

Allowed transmission type:

value	Cyclic	Acyclic	Synchro-nous	Asynchro-nous	Comments
0	-	✓	✓	-	send PDO next Sync message following event
1-240	✓	-	✓	-	send PDO every X Sync message
255	-	-	-	✓	Send PDO on event

For a digital input, an event is generated when the input value changes.

For an analog input, depending on the configuration of object 6421H, the following three scenarios can activate an event:

- the input value exceeds an upper threshold value
- the input value falls below a lower threshold value
- the input value changes more than configured delta value

Sub-index 03h contains the inhibit time. The time is the minimum interval between successive PDO transmission if the transmission type is set to 255. The value is defined in multiples of 100 µs. The value of 0 disables the inhibit time.

Sub-index 04h is reserved.

Sub-index 05h contains the **Event Time**. The time is the maximum interval for PDO transmission if the transmission type is set to 255. The value is defined in multiples of 1 ms. The value of 0 disables the **Event Time**.

Object 1A00H to 1A37: Transmit PDO Mapping Parameter

Each object describes the mapped objects that is transmitted by the respective transmit PDOs of the bus coupler.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value	Value	Value	Value	Value
Sub-index	0	1	2	3	4	5	n
Description	Number of entries	1st object in PDO	2nd object in PDO	3rd object in PDO	4th object in PDO	5th object in PDO	Nth object in PDO
Code	RECORD						
Data Type	UNSIGNED8	UNSIGNED32					
Access	RW						
PDO Allowed	No						
Range	8	UNSIGNED32					
Default value 1A00h 1A01h 1A02h 1A03h Others	 1 4 4 4 0	 6000 0108H 6401 0110H 6401 0510H 6401 0910H 0	 0 6401 0210H 6401 0610H 6401 0A10H 0	 0 6401 0310H 6401 0710H 6401 0B10H 0	 0 6401 0410H 6401 0810H 6401 0C10H 0	 0 0 0 0 0	 0

Data Field Structure

Each data object to be transported is represented as follows:

Bits	31 to 16	15 to 8	7 to 0
Data	Index number of object to be transported	Sub-index number of object to be transported	Length of object to be transported (in bits)
Example	6000H	01H	08H

Objects in Manufacturer-specific Zone

Device Manufacturer-specific objects

The TM3 CANopen bus coupler supports the following objects:

Index	Name
2200, page 157	System state
2300, page 157	Analog channel diagnostics
2301, page 157	Analog channel diagnostics interrupt source
2302, page 158	Analog channel diagnostics global interrupt enable
2303, page 158	Analog channel diagnostics interrupt mask
3000, page 159	Configuration buffer
3300, page 159	Extension bus reset

Object 2200H: System State

The following table provides a general overview of the object:

Object Attribute	Value
Name	System State
Code	VAR
Data Type	UNSIGNED8
Access	RO
PDO Allowed	Yes
Range	0-9
Default Value	–

This table indicates the meaning of each value

Value	Meaning
0	SYS_BOOTING
1	SYS_NO_CONF_IO_BUS
2	SYS_CONFIGURING_IO_BUS
3	SYS_CONFIGURED_IO_BUS
4	SYS_RUN_CANOPEN
5	SYS_RUN_WEBSERVER
6	SYS_FIELDBUS_TIMEOUT
7	SYS_FW_UPDATE
8	Reserved for internal use
9	SYS_TRANSITION_IN_PROGRESS

Object 2300H: Analog Channel Diagnostics

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of analog inputs	Read diagnostic byte of first analog channel	Read diagnostic byte of last analog channel
Code	ARRAY		
Data Type	UNSIGNED8		
Access	RO		
PDO Allowed	No	Yes	
Range	0-112	UNSIGNED8	

Object 2301H: Analog Channel Diagnostics Interrupt Source

This object determines which channel's diagnostics byte has produced an interrupt. Bits set relate to the channel number that have produced interrupts. The sub-index is automatically reset after it is read by SDO.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value	Value	Value
Sub-index	0	1	2	3	4
Description	Number of 32-channels group	Analog channel, interrupt source 0-31	Analog channel, interrupt source 32-63	Analog channel, interrupt source 64-95	Analog channel, interrupt source Channel 96-127
Code	ARRAY				
Data Type	UNSIGNED32				
Access	RO				
PDO Allowed	No				
Range	0-4	UNSIGNED32			
Default Value	-				

Object 2302H: Analog Channel Diagnostics Global Interrupt Enable

This object enables and disables globally the interrupt behavior of the Analog Channel Diagnostics. It is activated by default.

The following table provides a general overview of the object:

Object Attribute	Value
Name	Analog channel diagnostic global interrupt enable
Code	VAR
Data Type	Boolean
Access	RW
PDO Allowed	No
Default Value	`TRUE`

- `TRUE` = global interrupt enabled
- `FALSE` = global interrupt disabled

Object 2303H: Analog Channel Diagnostic Interrupt Mask

This object determines which channel status diagnostic can activate an interrupt.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of sub-indices	Interrupt mask for first 8 analog channel diagnostic	Interrupt mask for last 8 analog channel diagnostic
Code	ARRAY		
Data Type	UNSIGNED8		
Access	RO	RW	
PDO Allowed	No		
Range	0-14	UNSIGNED8	
Default Value	14	FFH	

Each sub-index represents one group of 8 analog channel diagnostic. The bit definition is:

- 1 = interrupt enabled
- 0 = interrupt disabled

Object 3000H: Configuration Buffer

The following table provides a general overview of the object:

Object Attribute	Value
Sub-index	0
Description	Configuration Buffer for the internal TM3 configuration data
Code	VAR
Data Type	DOMAIN
Access	RW
PDO Allowed	No
Range	0-2.5 kB

Object 3300H: Extension Bus Reset

This object is used to control the state of the internal TM3 bus.

The following table provides a general overview of the object:

Object Attribute	Value
Name	Extension bus reset
Code	VAR
Data Type	UNSIGNED16
Access	RW
PDO Allowed	No
Default value	0

This table indicates the meaning of each value

Bit register 0	Meaning
Set to 1	Extension bus in reset state
Set to 0	Reset state is released if consistency is correct

Objects in Device-specific Zone

Device-Specific Profile Objects

The supports the following objects:

TM3 CANopen bus coupler

Object 6000H: Digital Inputs 8 Bits Read

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of sub-indices	Read first 8 digital inputs	Read last 8 digital inputs
Code	ARRAY		
Data Type	UNSIGNED8		
Access	RO		
PDO Allowed	No	Yes	
Range	0-180	UNSIGNED8	
Default Value	-		

Object 6002H: Digital Inputs 8 Bits Polarity

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of input 8 bits	Polarity configuration of first 8 digital inputs	Polarity configuration of last 8 digital inputs
Code	ARRAY		
Data Type	UNSIGNED8		
Access	RO	RW	
PDO Allowed	No		
Range	0-180	UNSIGNED8	
Default Value	-	00H	

The bit definition is:

- 1 = input inverted
- 0 = input not inverted

Object 6005H: Global Interrupt Enable Digital 8-bit

This object enables and disables globally the interrupt behavior of the digital inputs.

The following table provides a general overview of the object:

Object Attribute	Value
Name	Digital input global interrupt enable
Code	VAR
Data Type	Boolean
Access	RO
PDO Allowed	No
Default Value	`TRUE`

- `TRUE` = global interrupt enabled
- `FALSE` = global interrupt disabled

Object 6006H: Digital Inputs 8 Bits Interrupt Mask

This object determines which digital input can activate an interrupt. When an interrupt is enabled, any change at the digital input (low-to-high or high-to-low) activates the interrupt.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of sub-indices	Interrupt configuration for the first 8 digital inputs	Interrupt configuration for the last 8 digital inputs
Code	ARRAY		
Data Type	UNSIGNED8		
Access	RO	RW	
PDO Allowed	No		
Range	0-180	UNSIGNED8	
Default Value	-	FFH	

The bit configuration is:

- 1 = interrupt enabled
- 0 = interrupt disabled

Object 6100H: Digital Inputs 16 Bits Read

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of sub-indices	Read first 16 digital inputs	Read last 16 digital inputs
Code	ARRAY		
Data Type	UNSIGNED8	UNSIGNED16	
Access	RO		
PDO Allowed	No	Yes	
Range	0-90	UNSIGNED16	

Object 6102H: Digital Inputs 16 Bits Polarity

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of sub-indices	Polarity configuration of first 16 digital inputs	Polarity configuration of last 16 digital inputs
Code	ARRAY		
Data Type	UNSIGNED8	UNSIGNED16	
Access	RO	RW	
PDO Allowed	No		
Range	0-90	UNSIGNED16	
Default Value	-	00H	

The bit configuration is:

- 1 = input inverted
- 0 = input not inverted

Object 6106H: Digital Inputs 16 Bits Interrupt Mask

This object determines which digital input can activate an interrupt. When an interrupt is enabled, any change at the digital input (low-to-high or high-to-low) activates the interrupt.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of sub-indices	Interrupt configuration for the first 16 digital inputs	Interrupt configuration for the last 16 digital inputs
Code	ARRAY		
Data Type	UNSIGNED8	UNSIGNED16	
Access	RO	RW	
PDO Allowed	No		
Range	0-90	UNSIGNED16	
Default Value	-	FFFFh	

The bit configuration is:

- 1 = interrupt enabled
- 0 = interrupt disabled

Object 6200H: Digital Outputs 8 Bits Write

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value	Value
Sub-index	0	1	2	n
Description	Number of sub-indices	Write to digital outputs 1 to 8	Write to digital outputs 9 to 16	Write to last 8 digital outputs
Code	ARRAY			
Data Type	UNSIGNED8			
Access	RO	RW		
PDO Allowed No	No	Yes		
Range	0-180	UNSIGNED8		
Default Value	-	00H		

Object 6202H: Digital Outputs 8 Bits Polarity

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of sub-indices	Polarity configuration of first 8 digital outputs	Polarity configuration of last 8 digital outputs
Code	ARRAY		
Data Type	UNSIGNED8		
Access	RO	RW	
PDO Allowed	No		
Range	0-180	UNSIGNED8	
Default Value	-	00H	

The bit configuration is:

- 1 = input inverted
- 0 = input not inverted

Object 6300H: Digital Outputs 16 Bits Write

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of sub-indices	Write to first 16 digital outputs	Write to last 16 digital outputs
Code	ARRAY		
Data Type	UNSIGNED16		
Access	RO	RW	
PDO Allowed	No	Yes	
Range	0-90	UNSIGNED16	
Default Value	-	00H	

Object 6302H: Digital Outputs 16 Bits Polarity

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of sub-indices	Polarity configuration of first 16 digital outputs	Polarity configuration of last 16 digital outputs
Code	ARRAY		
Data Type	UNSIGNED16		
Access	RO	RW	
PDO Allowed	No		
Range	0-90	UNSIGNED16	
Default Value	-	00H	

Object 6401H: Analog Inputs 16 Bits Read

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of analog input channels	Read first analog input channel	Read last analog input
Code	ARRAY		
Data Type	UNSIGNED8	INTEGER16	
Access	RO		
PDO Allowed	No	Yes	
Range	0-112	INTEGER16	
Default Value	00H		

Object 6411H: Analog Outputs 16 Bits Write

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of analog output channels	Write to first analog output channel	Write to last analog output channel
Code	ARRAY		
Data Type	UNSIGNED8	INTEGER16	
Access	RO	RW	
PDO Allowed	No	Yes	
Range	0-56	INTEGER16	
Default Value	00		

Object 6421H: Analog Inputs Interrupt Trigger Selection

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of analog inputs	Interrupt trigger selection for first analog input	Interrupt trigger selection for last analog input
Code	ARRAY		
Data Type	UNSIGNED8		
Access	RO	RW	
PDO Allowed	No		
Range	0-112	UNSIGNED8	
Default Value	0H		

Bit	Meaning
0	Upper threshold exceeded
1	Lower threshold exceeded
2	Input change more than delta
3	Not used
4	Not used
5	Not used
6	Not used
7	Not used

Object 6422H: Analog Inputs 16 Bits Interrupt Source

This object determines which channel has produced an interrupt. Bits set relate to the channel number that have produced interrupts. The sub-index is automatically reset after it is read by SDO.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value	Value	Value
Sub-index	0	1	2	3	4
Description	Number of 32-channel groups	Analog input interrupt source, channel 0-31	Analog input interrupt source, channel 32-63	Analog input interrupt source, channel 64-95	Analog input interrupt source, channel 96-127
Code	ARRAY				
Data Type	UNSIGNED8	UNSIGNED32			
Access	RO				
PDO Allowed	No				
Range	0-4	UNSIGNED32			
Default Value	-	0000H			

The bit configuration is:

- 1 = interrupt enabled
- 0 = interrupt disabled

Object 6423H: Analog Input Global Interrupt Enable

This object enables and disables globally the interrupt behavior of the analog inputs.

The following table provides a general overview of the object:

Object Attribute	Value
Name	Analog input global interrupt enable
Code	VAR
Data Type	Boolean
Access	RW
PDO Allowed	No
Default Value	TRUE

- TRUE = global interrupt enabled
- FALSE = global interrupt disabled

Object 6424H: Analog Inputs Upper Limit

This object defines the upper threshold of an analog input to trigger an interrupt event.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of analog input channels	Upper limit of channel 0	Upper limit of channel N
Code	ARRAY		
Data Type	UNSIGNED8	INTEGER32	
Access	RO	RW	
PDO Allowed	No		
Range	0-112	INTEGER32	
Default Value	0	FFFFH	

Object 6425H: Analog Inputs Lower Limit

This object defines the lower threshold of an analog input to trigger an interrupt event.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of analog input channels	Lower limit of channel 0	Lower limit of channel N
Code	ARRAY		
Data Type	UNSIGNED8	INTEGER32	
Access	RO	RW	
PDO Allowed	No		
Range	0-112	INTEGER32	
Default Value	0	0000H	

Object 6426H: Analog Inputs Delta Value

This object defines the delta value of an analog input to trigger an interrupt event. The delta is the threshold to reach between the current value and the last value that was transmitted by the bus coupler.

The following table provides a general overview of the object:

Object Attribute	Value	Value	Value
Sub-index	0	1	n
Description	Number of analog input channels	Delta value of channel 0	Delta value of channel N
Code	ARRAY		
Data Type	UNSIGNED8	UNSIGNED32	
Access	RO	RW	
PDO Allowed	No		
Range	0-112	UNSIGNED32	
Default Value	0	FFFFH	

Diagnostic

Overview

In online mode, the **Status** tab of the bus coupler provides monitoring and diagnostics information for the bus coupler and connected modules.

Displaying Diagnostic Information

The bus coupler status register (object 1002) is accessible as a variable in EcoStruxure Machine Expert. Select the **CANopen I/O Mapping** tab to access the variable.

In addition, bus coupler and expansion module status information is also displayed under the Status tab of the bus coupler in EcoStruxure Machine Expert. tabs description, page 128.

EMCY Telegram

The bus coupler will send an EMCY telegram under certain internal error situations. The telegram is 8-bytes long and its structure is shown in table below.

EMCY Telegram Structure								
Byte	7	6	5	4	3	2	1	0
	Manufacture status register				Affected module number	Error register	EMCY error code	
	Object 1002H				Object 1003H			

For example, in the following diagnostic message `'EMCY Code:7002; Register 80; Field:40 00 01 00 05.'` (displayed in **Status** tab of the bus coupler in EcoStruxure Machine Expert).

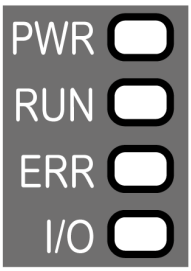
- `7002` matches the bytes 1 and 0 (EMCY error code)
- `80` matches the byte 2 (EMCY Error register)
- `40 00 01 00` matches the bytes 7, 6, 5 and 4 (Manufacture status register)
- `05` matches the byte 3 (Affected module number)

For details of each portion of the telegram, refer to the Object Dictionary, page 140.

If an EMCY telegram is generated, the EMCY error code is displayed in the Web server, page 134. The full EMCY telegram can be seen in EcoStruxure Machine Expert, under **TM3BC_CANopen > Status** tab.

Status LEDs

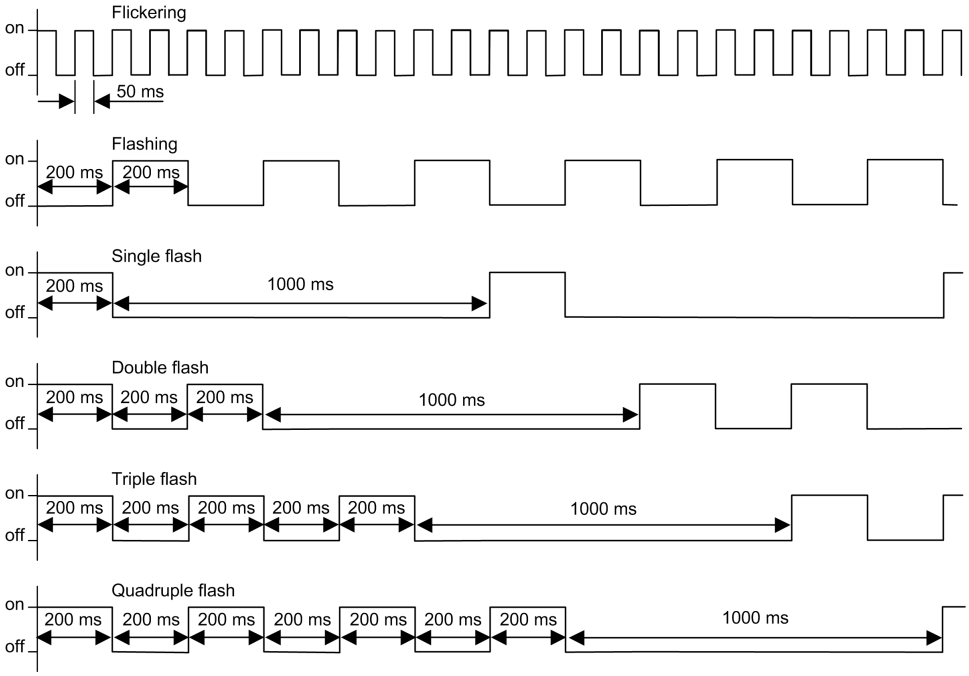
The following graphic shows the LEDs of TM3 CANopen bus coupler:



The following table describes the status LEDs:

LED	Color	Status	Description
PWR	Green	On	Power is applied.
		Off	Power is removed. All LED indicators are off.
RUN	Green	On	Device status is operational.
		Flickering	In conjunction with a flickering **ERR** LED, automatic search for the bus communication speed.
		Flashing	Device status is pre-operational.
		Single flash	Device status is stopped.
		Triple flash	Firmware upgrade.
ERR	Red	On	Bus off.
		Flickering	In conjunction with a flickering **RUN** LED, automatic search for the bus communication speed.
		Flashing	Invalid CANopen stack configuration.
		Single flash	An internal error counter in the CAN controller has reached or exceeded the error frame limit threshold (error frame).
		Double flash	Error control event detected. Detection of a guard event (NMT-Slave or NMT-master) or a heartbeat event (Heartbeat consumer).
		Triple flash	Synchronization error detected: message not received from sync producer within the defined period.
		Quadruple flash	**Event Time** error detected: An expected PDO has not been received before the **Event Time** elapsed.
		Off	No error detected.
I/O	Green	Flashing	Device has received and applied the expansion modules configuration.
		On	Device is communicating with the expansion modules.
	Red	Single flash	Expansion module configuration transfer timeout.
	Green Red	Flashing On	The physical configuration is inconsistent with the software configuration. No data exchange (status and I/O) is occurring.
	Green Red	On On	The physical configuration is inconsistent with the software configuration. I/O data is not applied.
	Green Red	On Flashing	At least one TM2 or TM3 expansion module did not respond to the bus coupler for 10 consecutive cycles.
		Off	No configuration. Device is not communicating with the expansion modules.

This timing diagram shows the different LED flashing behaviors:



NOTE: With the exception of the **PWR** LED, each LED is ON for a few seconds, then OFF during the boot sequence. The LED behavior rules apply when the boot is completed successfully.

USB Configuration

USB Configuration

Introduction

To access the Web server via USB, you can download the **SE RNDIS PSX TM3 Bus Coupler Connection** or configure an Ethernet interface of the USB-RNDIS.

Using the SE RNDIS PSX TM3 Bus Coupler Connection

You can download the **SE RNDIS PSX TM3 Bus Coupler Connection** which creates an RNDIS connection automatically.

Configuring the Virtual Ethernet Link

Follow these steps to configure the Ethernet interface of the USB-RNDIS port:

Step	Action
1	Remove power from the bus coupler.
2	Ensure rotary switches are in address setting position, e.g **TENS** to 0, **ONES** to 1 (address 1 to 127 are allowed)(1).
3	Connect the USB cable to the PC then to the bus coupler.
4	Apply power from the bus coupler.
5	Open **Network and sharing center** on your PC.
6	Click **Change adapter settings** > **Remote NDIS Compatible Device** > **Properties**.
7	Select **Internet Protocol version 4 (TCP/IPv4)**.
8	Click **Properties**.
9	Select **Use the following IP address**: • **IP address**: 90.0.0.2 • **Subnet mask**: 255.0.0.0
10	Click **OK**.
11	Close the **Properties**.
12	In the web browser, enter the IP address 90.0.0.1. **Result**: The Web server is displayed.
(1) For TM3BCSL and TM3BCCO bus couplers only.	

Modicon TM3 Bus Coupler HTTPS Certificates

Modicon TM3 Bus Coupler HTTPS Certificates

Overview

The TM3 bus coupler has an embedded HTTPS server, used to provide secure web communication.

An HTTPS server uses a certificate so that the client can verify server authenticity. For websites connected to the Internet, certificates are normally signed by a trusted certificate authority. Web browsers are then able to verify the authenticity of the Web server by virtue of its certificate.

Modicon TM3 Bus Coupler Self-Signed Certificate

The TM3 bus coupler uses a self-signed certificate. Self-signed certificates must explicitly be accepted by the user when connecting via the web browser.

TM3 bus couplerCertificate Information	
Issued to	TM3BC
Issued by	TM3BC
Validity	30 years

NOTE: You cannot change the certificate information.

Using the Modicon TM3 Bus Coupler Self-Signed Certificate

To prevent the self-signed certificate warning from being displayed:

- Add the certificate to the list of exceptions for the web browser
- Enter the prefix https:// in the address when entering the IP address

  NOTE: If you enter an http:// prefix, the bus coupler redirects to the https:// prefix.

Updating the Firmware

Updating the Firmware of the Bus Coupler

Overview

To update the firmware of the bus coupler, connect to the Web server.

Refer to:

- Ethernet Bus Coupler Web Server, page 66
- Modbus Serial Line Web Server, page 97
- CANopen Web Server, page 138

Factory Reset

Factory Reset

Overview

The factory reset allows you to reset the setting to factory values.

Resetting to Factory Settings

To reset the bus coupler to factory values:

Step	Action
1	Remove power from the bus coupler.
2	Disconnect all communication cables.
3	Set the two rotary switches to position 8 (arrows down).
4	Apply power to the bus coupler.
5	Wait for a minimum of 30 seconds.
6	Set the two rotary switches to position 0 (arrows up).
7	Remove power from the bus coupler.
8	Apply power to the bus coupler.

Appendices

Direct TM3 Configuration through Modbus Commands

List of Supported TM3 Modules

The following tables describes the registers and default values for the supported TM3 modules.

Title	Description
TM3DI8	See TM3DI8, page 176
TM3DI16	See TM3DI16, page 177
TM3DI32K	See TM3DI32K, page 178
TM3DQ8	See TM3DQ8, page 179
TM3DQ16	See TM3DQ16, page 180
TM3DQ32TK, TM3DQ32UK	See TM3DQ32TK, TM3DQ32UK, page 182
TM3DM8R	See TM3DM8R, page 185
TM3DM24R	See TM3DM24R, page 186
TM3AI2H	See TM3AI2H, page 187
TM3AI4	See TM3AI4, page 188
TM3AI8	See TM3AI8, page 190
TM3TI4	See TM3TI4, page 193
TM3TI4D	See TM3TI4D, page 195
TM3TI8T	See TM3TI8T, page 197
TM3AQ2	See TM3AQ2, page 202
TM3AQ4	See TM3AQ4, page 203
TM3AM6	See TM3AM6, page 204
TM3TM3	See TM3TM3, page 206

TM3DI8

This table describes the specific address offsets for TM3DI8 configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Functional Mode	RW	1	1 = Normal Mode 2 = Latch, filter and fallback mode (TM3 DIO module with firmware version (SV) >=2.0)
1XY09	Input Ch 0 - Filter		5	0 = 0 ms 1 = 0.3 ms 2 = 0.5 ms 3 = 1 ms 4 = 2 ms 5 = 4 ms 6 = 12 ms
1XY10	Input Ch 1 - Filter			
1XY11	Input Ch 2 - Filter			
1XY12	Input Ch 3 - Filter			
1XY13	Input Ch 4 - Filter			
1XY14	Input Ch 5 - Filter			
1XY15	Input Ch 6 - Filter			
1XY16	Input Ch 7 - Filter			

TM3DI16

This table describes the specific address offsets for TM3DI16 configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Functional Mode	RW	1	1 = Normal Mode 2 = Latch , filter and fallback mode (TM3 DIO module with firmware version (SV) >=2.0)
1XY09	Input Ch 0 - Filter	RW	5	0 = 0 ms 1 = 0.3 ms 2 = 0.5 ms 3 = 1 ms 4 = 2 ms 5 = 4 ms 6 = 12 ms
1XY10	Input Ch 1 - Filter			
1XY11	Input Ch 2 - Filter			
1XY12	Input Ch 3 - Filter			
1XY13	Input Ch 4 - Filter			
1XY14	Input Ch 5 - Filter			
1XY15	Input Ch 6 - Filter			
1XY16	Input Ch 7 - Filter			
1XY17	Input Ch 8 - Filter			
1XY18	Input Ch 9 - Filter			
1XY19	Input Ch 10 - Filter			
1XY20	Input Ch 11 - Filter			
1XY21	Input Ch 12 - Filter			
1XY22	Input Ch 13 - Filter			
1XY23	Input Ch 14 - Filter			
1XY24	Input Ch 15 - Filter			

TM3DI32K

This table describes the specific address offsets for TM3DI32K configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Functional Mode	RW	1	1 = Normal Mode 2 = Latch , filter and fallback mode (TM3 DIO module with firmware version (SV) >=2.0)
1XY09	Input Ch 0 - Filter		5	0 = 0 ms 1 = 0.3 ms 2 = 0.5 ms 3 = 1 ms 4 = 2 ms 5 = 4 ms 6 = 12 ms
1XY10	Input Ch 1 - Filter			
1XY11	Input Ch 2 - Filter			
1XY12	Input Ch 3 - Filter			
1XY13	Input Ch 4 - Filter			
1XY14	Input Ch 5 - Filter			
1XY15	Input Ch 6 - Filter			
1XY16	Input Ch 7 - Filter			
1XY17	Input Ch 8 - Filter			
1XY18	Input Ch 9 - Filter			
1XY19	Input Ch 10 - Filter			
1XY20	Input Ch 11 - Filter			
1XY21	Input Ch 12 - Filter			
1XY22	Input Ch 13 - Filter			
1XY23	Input Ch 14 - Filter			
1XY24	Input Ch 15 - Filter			
1XY25	Input Ch 16 - Filter			
1XY26	Input Ch 17 - Filter			
1XY27	Input Ch 18 - Filter			
1XY28	Input Ch 19 - Filter			
1XY29	Input Ch 20 - Filter			
1XY30	Input Ch 21 - Filter			
1XY31	Input Ch 22 - Filter			
1XY32	Input Ch 23 - Filter			
1XY33	Input Ch 24 - Filter			
1XY34	Input Ch 25 - Filter			
1XY35	Input Ch 26 - Filter			
1XY36	Input Ch 27 - Filter			
1XY37	Input Ch 28 - Filter			
1XY38	Input Ch 29 - Filter			
1XY39	Input Ch 30 - Filter			
1XY40	Input Ch 31 - Filter			

TM3DQ8

This table describes the specific address offsets for TM3DQ8 configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Functional Mode	RW	1	1 = Normal Mode 2 = Fallback Mode
1XY09	Output Ch 0 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY10	Output Ch 0 - Force Value	RW	0	[0 - 1]
1XY11	Output Ch 1 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY12	Output Ch 1 - Force Value	RW	0	[0 - 1]
1XY13	Output Ch 2 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY14	Output Ch 2 - Force Value	RW	0	[0 - 1]
1XY15	Output Ch 3 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY16	Output Ch 3 - Force Value	RW	0	[0 - 1]
1XY17	Output Ch 4 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY18	Output Ch 4 - Force Value	RW	0	[0 - 1]
1XY19	Output Ch 5 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY20	Output Ch 5 - Force Value	RW	0	[0 - 1]
1XY21	Output Ch 6 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY22	Output Ch 6 - Force Value	RW	0	[0 - 1]
1XY23	Output Ch 7 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY24	Output Ch 7 - Force Value	RW	0	[0 - 1]

TM3DQ16

This table describes the specific address offsets for TM3DQ16 configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Functional Mode	RW	1	1 = Normal Mode 2 = Fallback Mode
1XY09	Output Ch 0 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY10	Output Ch 0 - Force Value	RW	0	[0 - 1]
1XY11	Output Ch 1 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY12	Output Ch 1 - Force Value	RW	0	[0 - 1]
1XY13	Output Ch 2 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY14	Output Ch 2 - Force Value	RW	0	[0 - 1]
1XY15	Output Ch 3 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY16	Output Ch 3 - Force Value	RW	0	[0 - 1]
1XY17	Output Ch 4 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY18	Output Ch 4 - Force Value	RW	0	[0 - 1]
1XY19	Output Ch 5 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY20	Output Ch 5 - Force Value	RW	0	[0 - 1]
1XY21	Output Ch 6 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY22	Output Ch 6 - Force Value	RW	0	[0 - 1]
1XY23	Output Ch 7 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY24	Output Ch 7 - Force Value	RW	0	[0 - 1]
1XY25	Output Ch 8 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY26	Output Ch 8 - Force Value	RW	0	[0 - 1]
1XY27	Output Ch 9 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY28	Output Ch 9 - Force Value	RW	0	[0 - 1]
1XY29	Output Ch 10 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY30	Output Ch 10 - Force Value	RW	0	[0 - 1]

Address Offset	Description	Access	Default value	Comments
1XY31	Output Ch 11 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY32	Output Ch 11 - Force Value	RW	0	[0 - 1]
1XY33	Output Ch 12 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY34	Output Ch 12 - Force Value	RW	0	[0 - 1]
1XY35	Output Ch 13 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY36	Output Ch 13 - Force Value	RW	0	[0 - 1]
1XY37	Output Ch 14 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY38	Output Ch 14 - Force Value	RW	0	[0 - 1]
1XY39	Output Ch 15 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY40	Output Ch 15 - Force Value	RW	0	[0 - 1]

TM3DQ32TK, TM3DQ32UK

This table describes the specific address offsets for TM3DQ32TK and TM3DQ32UK configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Functional Mode	RW	1	1 = Normal Mode 2 = Fallback Mode
1XY09	Output Ch 0 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY10	Output Ch 0 - Force Value	RW	0	[0 - 1]
1XY11	Output Ch 1 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY12	Output Ch 1 - Force Value	RW	0	[0 - 1]
1XY13	Output Ch 2 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY14	Output Ch 2 - Force Value	RW	0	[0 - 1]
1XY15	Output Ch 3 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY16	Output Ch 3 - Force Value	RW	0	[0 - 1]
1XY17	Output Ch 4 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY18	Output Ch 4 - Force Value	RW	0	[0 - 1]
1XY19	Output Ch 5 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY20	Output Ch 5 - Force Value	RW	0	[0 - 1]
1XY21	Output Ch 6 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY22	Output Ch 6 - Force Value	RW	0	[0 - 1]
1XY23	Output Ch 7 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY24	Output Ch 7 - Force Value	RW	0	[0 - 1]
1XY25	Output Ch 8 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY26	Output Ch 8 - Force Value	RW	0	[0 - 1]
1XY27	Output Ch 9 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY28	Output Ch 9 - Force Value	RW	0	[0 - 1]
1XY29	Output Ch 10 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY30	Output Ch 10 - Force Value	RW	0	[0 - 1]

Address Offset	Description	Access	Default value	Comments
1XY31	Output Ch 11 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY32	Output Ch 11 - Force Value	RW	0	[0 - 1]
1XY33	Output Ch 12 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY34	Output Ch 12 - Force Value	RW	0	[0 - 1]
1XY35	Output Ch 13 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY36	Output Ch 13 - Force Value	RW	0	[0 - 1]
1XY37	Output Ch 14 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY38	Output Ch 14 - Force Value	RW	0	[0 - 1]
1XY39	Output Ch 15 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY40	Output Ch 15 - Force Value	RW	0	[0 - 1]
1XY41	Output Ch 16 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY42	Output Ch 16 - Force Value	RW	0	[0 - 1]
1XY43	Output Ch 17 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY44	Output Ch 17 - Force Value	RW	0	[0 - 1]
1XY45	Output Ch 18 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY46	Output Ch 18 - Force Value	RW	0	[0 - 1]
1XY47	Output Ch 19 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY48	Output Ch 19 - Force Value	RW	0	[0 - 1]
1XY49	Output Ch 20 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY50	Output Ch 20 - Force Value	RW	0	[0 - 1]
1XY51	Output Ch 21 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY52	Output Ch 21 - Force Value	RW	0	[0 - 1]
1XY53	Output Ch 22 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY54	Output Ch 22 - Force Value	RW	0	[0 - 1]
1XY55	Output Ch 23 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode

Address Offset	Description	Access	Default value	Comments
1XY56	Output Ch 23 - Force Value	RW	0	[0 - 1]
1XY57	Output Ch 24 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY58	Output Ch 24 - Force Value	RW	0	[0 - 1]
1XY59	Output Ch 25 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY60	Output Ch 25 - Force Value	RW	0	[0 - 1]
1XY61	Output Ch 26 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY62	Output Ch 26 - Force Value	RW	0	[0 - 1]
1XY63	Output Ch 27 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY64	Output Ch 27 - Force Value	RW	0	[0 - 1]
1XY65	Output Ch 28 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY66	Output Ch 28 - Force Value	RW	0	[0 - 1]
1XY67	Output Ch 29 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY68	Output Ch 29 - Force Value	RW	0	[0 - 1]
1XY69	Output Ch 30 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY70	Output Ch 30 - Force Value	RW	0	[0 - 1]
1XY71	Output Ch 31 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY72	Output Ch 31 - Force Value	RW	0	[0 - 1]

TM3DM8R

This table describes the specific address offsets for TM3DM8R configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Functional Mode	RW	1	1 = Normal Mode 2 = Latch , filter and fallback mode (TM3 DIO module with firmware version (SV) >=2.0)
1XY09	Input Ch 0 - Filter	RW	5	0 = 0 ms 1 = 0.3 ms 2 = 0.5 ms 3 = 1 ms 4 = 2 ms 5 = 4 ms 6 = 12 ms
1XY10	Input Ch 1 - Filter	RW	5	
1XY11	Input Ch 2 - Filter	RW	5	
1XY12	Input Ch 3 - Filter	RW	5	
1XY13	Output Ch 0 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY14	Output Ch 0 - Force Value	RW	0	[0 - 1]
1XY15	Output Ch 1 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY16	Output Ch 1 - Force Value	RW	0	[0 - 1]
1XY17	Output Ch 2 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY18	Output Ch 2 - Force Value	RW	0	[0 - 1]
1XY19	Output Ch 3 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY20	Output Ch 3 - Force Value	RW	0	[0 - 1]

TM3DM24R

This table describes the specific address offsets for TM3DM24R configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Functional Mode	RW	1	1 = Normal Mode 2 = Latch , filter and fallback mode (TM3 DIO module with firmware version (SV) >=2.0)
1XY09	Input Ch 0 - Filter	RW	5	0 = 0 ms 1 = 0.3 ms 2 = 0.5 ms 3 = 1 ms 4 = 2 ms 5 = 4 ms 6 = 12 ms
1XY10	Input Ch 1 - Filter			
1XY11	Input Ch 2 - Filter			
1XY12	Input Ch 3 - Filter			
1XY13	Input Ch 4 - Filter			
1XY14	Input Ch 5 - Filter			
1XY15	Input Ch 6 - Filter			
1XY16	Input Ch 7 - Filter			
1XY17	Input Ch 8 - Filter			
1XY18	Input Ch 9 - Filter			
1XY19	Input Ch 10 - Filter			
1XY20	Input Ch 11 - Filter			
1XY21	Input Ch 12 - Filter			
1XY22	Input Ch 13 - Filter			
1XY23	Input Ch 14 - Filter			
1XY24	Input Ch 15 - Filter			
1XY25	Output Ch 0 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY26	Output Ch 0 - Force Value	RW	0	[0 - 1]
1XY27	Output Ch 1 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY28	Output Ch 1 - Force Value	RW	0	[0 - 1]
1XY29	Output Ch 2 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY30	Output Ch 2 - Force Value	RW	0	[0 - 1]
1XY31	Output Ch 3 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY32	Output Ch 3 - Force Value	RW	0	[0 - 1]
1XY33	Output Ch 4 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY34	Output Ch 4 - Force Value	RW	0	[0 - 1]
1XY35	Output Ch 5 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY36	Output Ch 5 - Force Value	RW	0	[0 - 1]

Address Offset	Description	Access	Default value	Comments
1XY37	Output Ch 6 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY38	Output Ch 6 - Force Value	RW	0	[0 - 1]
1XY39	Output Ch 7 - Mode	RW	1	0 = Maintain Mode 1 = Fallback Mode
1XY40	Output Ch 7 - Force Value	RW	0	[0 - 1]

TM3AI2H

This table describes the specific address offsets for TM3AI2H configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Diagnostics Enabled	RW	1	0 = Disable 1 = Enable
1XY09	Ch 0 - Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY10	Ch 0 - Minimum	RW	-32768	-32768 to 32766 (1)
1XY11	Ch 0 - Maximum	RW	32767	-32767 to 32767 (2)
1XY12	Ch 0 - Input filter	RW	0	0 to 1000 Unit: x 10m s
1XY13	Ch 0 - Sampling	RW	0	0 = 1 ms/channel
1XY14	Ch 1 – Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY15	Ch 1 – Minimum	RW	-32768	-32768 to 32766 (1)
1XY16	Ch 1 – Maximum	RW	32767	-32767 to 32767 (2)
1XY17	Ch 1 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY18	Ch 1 - Sampling	RW	0	0 = 1 ms/channel

(1) Minimum value must be less than maximum value.

(2) Maximum value must be greater than minimum value.

TM3AI4

This table describes the specific address offsets for TM3AI4 configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Diagnostics Enabled	RW	1	0 = Disable 1 = Enable
1XY09	Ch 0 - Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY10	Ch 0 - Minimum	RW	-32768	-32768 to 32766 (1)
1XY11	Ch 0 - Maximum	RW	32767	-32767 to 32767 (2)
1XY12	Ch 0 - Input filter	RW	0	0 to 1000 Unit: x 10m s
1XY13	Ch 0 - Sampling	RW	0	0 = 1 ms/channel 1 = 10 ms/channel
1XY14	Ch 1 – Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY15	Ch 1 – Minimum	RW	-32768	-32768 to 32766 (1)
1XY16	Ch 1 – Maximum	RW	32767	-32767 to 32767 (2)
1XY17	Ch 1 - Input filter	RW	0	0 to 1000 Unit: x 10m s
1XY18	Ch 1 - Sampling	RW	0	0 = 1 ms/channel 1 = 10 ms/channel
1XY19	Ch 2 – Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY20	Ch 2 – Minimum	RW	-32768	-32768 to 32766 (1)
1XY21	Ch 2 – Maximum	RW	32767	-32767 to 32767 (2)
1XY22	Ch 2 - Input filter	RW	0	0 to 1000 Unit: x 10m s
1XY23	Ch 2 – Sampling	RW	0	0 = 1 ms/channel 1 = 10 ms/channel
1XY24	Ch 3 – Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY25	Ch 3 – Minimum	RW	-32768	-32767 to 32767 (2)

Address Offset	Description	Access	Default value	Comments
1XY26	Ch 3 – Maximum	RW	32767	-32767 to 32767 (2)
1XY27	Ch 3 - Input filter	RW	0	0 to 1000 Unit: x 10m s
1XY28	Ch 3 - Sampling	RW	0	0 = 1 ms/channel 1 = 10 ms/channel
(1) Minimum value must be less than maximum value. **(2)** Maximum value must be greater than minimum value.				

TM3AI8

These tables describe the specific address offsets and type/scope inputs for TM3AI8 configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Diagnostics Enabled	RW	1	0 = Disable 1 = Enable
1XY09	Ch 0 - Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA 5 = 0 to 20 mA extended range 6 = 4 to 20 mA extended range
1XY10	Ch 0 - Minimum	RW	-32768	Values depend on input type. Refer to the **Type/Scope Input Table** below(1).
1XY11	Ch 0 - Maximum	RW	32767	Values depend on input type. Refer to the **Type/Scope Input Table** below(2).
1XY12	Ch 0 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY13	Ch 0 - Sampling	RW	0	0 = 1 ms/channel 1 = 10 ms/channel
1XY14	Ch 1 – Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA 5 = 0 to 20 mA extended range 6 = 4 to 20 mA extended range
1XY15	Ch 1 – Minimum	RW	-32768	Values depend on input type. Refer to the **Type/Scope Input Table** below(1).
1XY16	Ch 1 – Maximum	RW	32767	Values depend on input type. Refer to the **Type/Scope Input Table** below(2).
1XY17	Ch 1 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY18	Ch 1 - Sampling	RW	0	0 = 1 ms/channel 1 = 10 ms/channel
1XY19	Ch 2 – Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA 5 = 0 to 20 mA extended range 6 = 4 to 20 mA extended range
1XY20	Ch 2 – Minimum	RW	-32768	Values depend on input type. Refer to the **Type/Scope Input Table** below(1).
1XY21	Ch 2 – Maximum	RW	32767	Values depend on input type. Refer to the **Type/Scope Input Table** below(2).

Address Offset	Description	Access	Default value	Comments
1XY22	Ch 2 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY23	Ch 2 – Sampling	RW	0	0 = 1 ms/channel 1 = 10 ms/channel
1XY24	Ch 3 – Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA 5 = 0 to 20 mA extended range 6 = 4 to 20 mA extended range
1XY25	Ch 3 – Minimum	RW	-32768	Values depend on input type. Refer to the **Type/Scope Input Table** below(1).
1XY26	Ch 3 – Maximum	RW	32767	Values depend on input type. Refer to the **Type/Scope Input Table** below(2).
1XY27	Ch 3 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY28	Ch 3 - Sampling	RW	0	0 = 1 ms/channel 1 = 10 ms/channel
1XY29	Ch 4 – Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA 5 = 0 to 20 mA extended range 6 = 4 to 20 mA extended range
1XY30	Ch 4 – Minimum	RW	-32768	Values depend on input type. Refer to the **Type/Scope Input Table** below(1).
1XY31	Ch 4 – Maximum	RW	32767	Values depend on input type. Refer to the **Type/Scope Input Table** below(2).
1XY32	Ch 4 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY33	Ch 4 - Sampling	RW	0	0 = 1 ms/channel 1 = 10 ms/channel
1XY34	Ch 5 – Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA 5 = 0 to 20 mA extended range 6 = 4 to 20 mA extended range
1XY35	Ch 5 – Minimum	RW	-32768	Values depend on input type. Refer to the **Type/Scope Input Table** below(1).
1XY36	Ch 5 – Maximum	RW	32767	Values depend on input type. Refer to the **Type/Scope Input Table** below(2).

Address Offset	Description	Access	Default value	Comments
1XY37	Ch 5 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY38	Ch 5 - Sampling	RW	0	0 = 1 ms/channel 1 = 10 ms/channel
1XY39	Ch 6 – Type	RW	0	Values depend on input type. Refer to the **Type/Scope Input Table** below(1).
1XY40	Ch 6 – Minimum	RW	-32768	Values depend on input type. Refer to the **Type/Scope Input Table** below(2).
1XY41	Ch 6 – Maximum	RW	32767	-32767 to 32767 (2)
1XY42	Ch 6 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY43	Ch 6 - Sampling	RW	0	0 = 1 ms/channel 1 = 10 ms/channel
1XY44	Ch 7 – Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA 5 = 0 to 20 mA extended range 6 = 4 to 20 mA extended range
1XY45	Ch 7 – Minimum	RW	-32768	Values depend on input type. Refer to the **Type/Scope Input Table** below(1).
1XY46	Ch 7 – Maximum	RW	32767	Values depend on input type. Refer to the **Type/Scope Input Table** below(2).
1XY47	Ch 7 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY48	Ch 7 - Sampling	RW	0	0 = 1 ms/channel 1 = 10 ms/channel
(1) Minimum value must be less than maximum value. **(2)** Maximum value must be greater than minimum value.				

Type/Scope Input Table

Modbus register value	Input Type	Minimum	Maximum	Minimum	Maximum
1	0 to 10 V	-32767	32767	–	–
2	-10 to +10 V	-32767	32767	–	–
3	0 to 20 mA	-32767	32767	–	–
4	4 to 20 mA	-32767	32767	–	–
5	0 to 20 mA extended range	–	–	0	23540
6	4 to 20 mA extended range	–	–	1200	23170
NOTE: The 12-bit data (0 to 4095) processed in the analog I/O module can be linear-converted to a value between -32768 and 32767. **NOTE:** The extended ranges are supported by modules from product version (PV) 03, firmware version (SV) 1.4.					

TM3TI4

These tables describe the specific address offsets and type/scope inputs for TM3TI4 configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Diagnostics Enabled	RW	1	0 = Disable 1 = Enable
1XY09	Ch 0 - Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY10	Ch 0 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit
1XY11	Ch 0 - Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY12	Ch 0 - Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY13	Ch 0 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY14	Ch 0 - Sampling	RW	0	0 = 100 ms/channel 1 = 10 ms/channel
1XY15	Ch 1 – Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY16	Ch 1 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit
1XY17	Ch 1 – Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY18	Ch 1 – Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY19	Ch 1 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY20	Ch 1 - Sampling	RW	0	0 = 100 ms/channel 1 = 10 ms/channel
1XY21	Ch 2 – Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY22	Ch 2 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit
1XY23	Ch 2 – Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY24	Ch 2 – Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY25	Ch 2 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY26	Ch 2 – Sampling	RW	0	0 = 100 ms/channel 1 = 10 ms/channel

Address Offset	Description	Access	Default value	Comments
1XY27	Ch 3 – Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY28	Ch 3 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit
1XY29	Ch 3 – Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY30	Ch 3 – Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY31	Ch 3 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY32	Ch 3 - Sampling	RW	0	0 = 100 ms/channel 1 = 10 ms/channel

Type/Scope Input Table

Modbus register value	Input Type	Scope: 1 = Normal	Scope: 2 = Celsius (0.1°C)		Scope: 3 = Fahrenheit (0.1°F except TC Type B, C)	
–	–	Range	Minimum	Maximum	Minimum	Maximum
0	NOT USED	–	–	–	–	–
1	Voltage 0-10 V	-32768 – 32767	–	–	–	–
2	Voltage -10 V +10 V	-32768 – 32767	–	–	–	–
3	Current Input 0-20 mA	-32768 – 32767	–	–	–	–
4	Current Input 4-20 mA	-32768 – 32767	–	–	–	–
7	K thermocouple	-32768 – 32767	-2000	13000	-3280	23720
8	J thermocouple	-32768 – 32767	-2000	10000	-3280	18320
9	R thermocouple	-32768 – 32767	0	17600	320	32000
10	S thermocouple	-32768 – 32767	0	17600	320	32000
11	B thermocouple	-32768 – 32767	0	18200	Not supported. **Type B.**	
12	E thermocouple	-32768 – 32767	-2000	8000	-3280	14720
13	T thermocouple	-32768 – 32767	-2000	4000	-3280	7520
14	N thermocouple	-32768 – 32767	-2000	13000	-3280	23720
15	C thermocouple	-32768 – 32767	0	23150	Not supported. **Type C.**	
16	Pt100 RTD	-32768 – 32767	-2000	8500	-3280	15620
17	Pt1000 RTD	-32768 – 32767	-2000	6000	-3280	11120
18	Ni100 RTD	-32768 – 32767	-600	1800	-760	3560
19	Ni1000 RTD	-32768 – 32767	-600	1800	-760	3560

For **Type B** in Fahrenheit, set Scope to "Normal", with Minimum = 160 and Maximum = 16540. The unit of measure for this configuration is 0.2° F.

For **Type C** in Fahrenheit, set Scope to "Normal", with Minimum = 160 and Maximum = 20995. The unit of measure for this configuration is 0.2° F.

TM3TI4D

These tables describe the specific address offsets and type/scope inputs for TM3TI4D:

Address Offset	Description	Access	Default value	Comments
1XY08	Diagnostics Enabled	RW	1	0 = Disable 1 = Enable
1XY09	Ch 0- Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY10	Ch 0 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit
1XY11	Ch 0 - Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY12	Ch 0 - Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY13	Ch 0 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY14	Ch 0 - Sampling	RW	0	0 = 100 ms/channel
1XY15	Ch 1 – Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY16	Ch 1 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit
1XY17	Ch 1 – Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY18	Ch 1 – Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY19	Ch 1 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY20	Ch 1 - Sampling	RW	0	0 = 100 ms/channel
1XY21	Ch 2 – Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY22	Ch 2 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit
1XY23	Ch 2 – Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY24	Ch 2 – Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY25	Ch 2 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY26	Ch 2 – Sampling	RW	0	0 = 100 ms/channel
1XY27	Ch 3 – Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range

Address Offset	Description	Access	Default value	Comments
1XY28	Ch 3 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit
1XY29	Ch 3 – Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY30	Ch 3 – Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY31	Ch 3 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY32	Ch 3 - Sampling	RW	0	0 = 100 ms/channel

Type/Scope Input Table

Modbus register value	Scope	Input Type: 1 = Normal	Input Type: 2 = Celsius (0.1°C)		Input Type: 3 = Fahrenheit (0.1°F except TC Type B, C)	
–	–	Range	Minimum	Maximum	Minimum	Maximum
0	NOT USED	–	–	–	–	–
7	K thermocouple	-32768 ~ 32767	-2000	13000	-3280	23720
8	J thermocouple	-32768 ~ 32767	-2000	10000	-3280	18320
9	R thermocouple	-32768 ~ 32767	0	17600	320	32000
10	S thermocouple	-32768 ~ 32767	0	17600	320	32000
11	B thermocouple	-32768 ~ 32767	0	18200	Not supported. **Refer to Type B.**	
12	E thermocouple	-32768 ~ 32767	-2000	8000	-3280	14720
13	T thermocouple	-32768 ~ 32767	-2000	4000	-3280	7520
14	N thermocouple	-32768 ~ 32767	-2000	13000	-3280	23720
15	C thermocouple	-32768 ~ 32767	0	23150	Not supported. **Refer to Type C.**	

For Type B in Fahrenheit, set Scope to "Normal", with Minimum = 160 and Maximum = 16540. The unit of measure for this configuration is 0.2° F.

For Type C in Fahrenheit, set Scope to "Normal", with Minimum = 160 and Maximum = 20995. The unit of measure for this configuration is 0.2° F

TM3TI8T

These tables describe the specific address offsets and type/scope inputs for TM3TI8T:

Address Offset	Description	Access	Default value	Comments
1XY08	Diagnostics Enabled	RW	1	0 = Disable 1 = Enable
1XY09	Ch 0 - Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY10	Ch 0 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit 4 = Threshold 5 = Resistance
1XY11	Ch 0 - Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY12	Ch 0 - Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY13	Ch 0 - Rref	RW	330	Reference resistance in ohm at reference temperature (used only with NTC Thermistor). Values: 1 to 65535
1XY14	Ch 0 - Tref	RW	25	Reference temperature value in Celsius (used only with NTC Thermistor). Values: 1 to 1000
1XY15	Ch 0 - Beta	RW	3569	Sensitivity of NTC thermistor in Kelvin (used only with NTC Thermistor). Values: 1 to 32767
1XY16	Ch 0 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY17	Ch 0 - Sampling	RW	0	0 = 100 ms/channel
1XY18	Ch 0 - High threshold	RW	3100	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY19	Ch 0 - Low threshold	RW	1500	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY20	Ch 1 - Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY21	Ch 1 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit 4 = Threshold 5 = Resistance
1XY22	Ch 1 - Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY23	Ch 1 - Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY24	Ch 1 - Rref	RW	330	Reference resistance in ohm at reference temperature (used only with NTC Thermistor). Values: 1 to 65535
1XY25	Ch 1 - Tref	RW	25	Reference temperature value in Celsius (used only with NTC Thermistor). Values: 1 to 1000
1XY26	Ch 1 - Beta	RW	3569	Sensitivity of NTC thermistor in Kelvin (used only with NTC Thermistor). Values: 1 to 32767

Address Offset	Description	Access	Default value	Comments
1XY27	Ch 1 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY28	Ch 1 - Sampling	RW	0	0 = 100 ms/channel
1XY29	Ch 1 - High threshold	RW	3100	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY30	Ch 1 - Low threshold	RW	1500	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY31	Ch 2 - Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY32	Ch 2 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit 4 = Threshold 5 = Resistance
1XY33	Ch 2 - Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY34	Ch 2 - Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY35	Ch 2 - Rref	RW	330	Reference resistance in ohm at reference temperature (used only with NTC Thermistor). Values: 1 to 65535
1XY36	Ch 2 - Tref	RW	25	Reference temperature value in Celsius (used only with NTC Thermistor). Values: 1 to 1000
1XY37	Ch 2 - Beta	RW	3569	Sensitivity of NTC thermistor in Kelvin (used only with NTC Thermistor). Values: 1 to 32767
1XY38	Ch 2 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY39	Ch 2 - Sampling	RW	0	0 = 100 ms/channel
1XY40	Ch 2 - High threshold	RW	3100	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY41	Ch 2 - Low threshold	RW	1500	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY42	Ch 3 - Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY43	Ch 3 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit 4 = Threshold 5 = Resistance
1XY44	Ch 3 - Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY45	Ch 3 - Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY46	Ch 3 - Rref	RW	330	Reference resistance in ohm at reference temperature (used only with NTC Thermistor). Values: 1 to 65535
1XY47	Ch 3 - Tref	RW	25	Reference temperature value in Celsius (used only with NTC Thermistor). Values: 1 to 1000
1XY48	Ch 3 - Beta	RW	3569	Sensitivity of NTC thermistor in Kelvin (used only with NTC Thermistor). Values: 1 to 32767

Address Offset	Description	Access	Default value	Comments
1XY49	Ch 3 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY50	Ch 3 - Sampling	RW	0	0 = 100 ms/channel
1XY51	Ch 3 - High threshold	RW	3100	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY52	Ch 3 - Low threshold	RW	1500	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY53	Ch 4 - Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY54	Ch 4 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit 4 = Threshold 5 = Resistance
1XY55	Ch 4 - Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY56	Ch 4 - Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY57	Ch 4 - Rref	RW	330	Reference resistance in ohm at reference temperature (used only with NTC Thermistor). Values: 1 to 65535
1XY58	Ch 4 - Tref	RW	25	Reference temperature value in Celsius (used only with NTC Thermistor). Values: 1 to 1000
1XY59	Ch 4 - Beta	RW	3569	Sensitivity of NTC thermistor in Kelvin (used only with NTC Thermistor). Values: 1 to 32767
1XY60	Ch 4 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY61	Ch 4 - Sampling	RW	0	0 = 100 ms/channel
1XY62	Ch 4 - High threshold	RW	3100	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY63	Ch 4 - Low threshold	RW	1500	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY64	Ch 5 - Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY65	Ch 5 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit 4 = Threshold 5 = Resistance
1XY66	Ch 5 - Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY67	Ch 5 - Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY68	Ch 5 - Rref	RW	330	Reference resistance in ohm at reference temperature (used only with NTC Thermistor). Values: 1 to 65535
1XY69	Ch 5 - Tref	RW	25	Reference temperature value in Celsius (used only with NTC Thermistor). Values: 1 to 1000
1XY70	Ch 5 - Beta	RW	3569	Sensitivity of NTC thermistor in Kelvin (used only with NTC Thermistor). Values: 1 to 32767

Address Offset	Description	Access	Default value	Comments
1XY71	Ch 5 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY72	Ch 5 - Sampling	RW	0	0 = 100 ms/channel
1XY73	Ch 5 - High threshold	RW	3100	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY74	Ch 5 - Low threshold	RW	1500	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY75	Ch 6 - Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY76	Ch 6 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit 4 = Threshold 5 = Resistance
1XY77	Ch 6 - Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY78	Ch 6 - Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY79	Ch 6 - Rref	RW	330	Reference resistance in ohm at reference temperature (used only with NTC Thermistor). Values: 1 to 65535
1XY80	Ch 6 - Tref	RW	25	Reference temperature value in Celsius (used only with NTC Thermistor). Values: 1 to 1000
1XY81	Ch 6 - Beta	RW	3569	Sensitivity of NTC thermistor in Kelvin (used only with NTC Thermistor). Values: 1 to 32767
1XY82	Ch 6 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY83	Ch 6 - Sampling	RW	0	0 = 100 ms/channel
1XY84	Ch 6 - High threshold	RW	3100	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY85	Ch 6 - Low threshold	RW	1500	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY86	Ch 7 - Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected types
1XY87	Ch 7 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit 4 = Threshold 5 = Resistance
1XY88	Ch 7 - Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY89	Ch 7 - Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY90	Ch 7 - Rref	RW	330	Reference resistance in ohm at reference temperature (used only with NTC Thermistor) Values: 1 to 65535
1XY91	Ch 7 - Tref	RW	25	Reference temperature value in Celsius (used only with NTC Thermistor) Values: 1 to 1000
1XY92	Ch 7 - Beta	RW	3569	Sensitivity of NTC thermistor in Kelvin (used only with NTC Thermistor). Values: 1 to 32767

Address Offset	Description	Access	Default value	Comments
1XY93	Ch 7 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY94	Ch 7 - Sampling	RW	0	0 = 100 ms/channel
1XY95	Ch 7 - High threshold	RW	3100	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY96	Ch 7 - Low threshold	RW	1500	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range

Type/Scope Input Table

Modbus register value	Scope	Input Type: 1 = Normal	Input Type: 2 = Celsius (0.1° C)		Input Type: 3 = Fahrenheit (0.1° F except TC Type B, C)		Input Type: 4 = Threshold		Input Type: 5 = Resistance (Ω)	
–	–	Range	Minimum	Maximum	Minimum	Maximum	High Threshold Range	Low Threshold Range	Minimum	Maximum
0	NOT USED	–	–	–	–	–	–	–	–	–
7	K thermocouple	-32768 ~ 32767	-2000	13000	-3280	23720	–	–	–	–
8	J thermocouple	-32768 ~ 32767	-2000	10000	-3280	18320	–	–	–	–
9	R thermocouple	-32768 ~ 32767	0	17600	320	32000	–	–	–	–
10	S thermocouple	-32768 ~ 32767	0	17600	320	32000	–	–	–	–
11	B thermocouple	-32768 ~ 32767	0	18200	Not supported. **Type B.**		–	–	–	–
12	E thermocouple	-32768 ~ 32767	-2000	8000	-3280	14720	–	–	–	–
13	T thermocouple	-32768 ~ 32767	-2000	4000	-3280	7520	–	–	–	–
14	N thermocouple	-32768 ~ 32767	-2000	13000	-3280	23720	–	–	–	–
15	C thermocouple	-32768 ~ 32767	0	23150	Not supported. **Type C.**		–	–	–	–
20	NTC Thermistor	-32768 ~ 32767	-789	580	-1101	1364	–	–	–	–
21	PTC Thermistor	-32768 ~ 32767	–	–	–	–	100 to 10000	100 to 10000	–	–
22	Ohmmeter	–	–	–	–	–	–	–	100	32000

For **Type B** in Fahrenheit, set Scope to *Normal*, with minimum = 160 and maximum = 16540. The unit of measure for this configuration is 0.2° F.

For **Type C** in Fahrenheit, set Scope to *Normal*, with minimum = 160 and maximum = 20995. The unit of measure for this configuration is 0.2° F.

TM3AQ2

This table describes the specific address offsets for TM3AQ2 configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Diagnostics Enabled	RW	1	0 = Disable 1 = Enable
1XY09	Ch 0 - Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY10	Ch 0 - Minimum	RW	-32768	-32768 to 32766 (1)
1XY11	Ch 0 - Maximum	RW	32767	-32767 to 32767 (2)
1XY12	Ch 0 - Fallback Value	RW	0	The fallback value must be equal to or greater than the minimum value configured but less than or equal to the maximum value configured.
1XY13	Ch 1 -Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY14	Ch 1 - Minimum	RW	-32768	-32768 to 32766 (1)
1XY15	Ch 1 - Maximum	RW	32767	-32767 to 32767 (2)
1XY16	Ch 1 - Fallback Value	RW	0	The fallback value must be equal to or greater than the minimum value configured but less than or equal to the maximum value configured.

(1) Minimum value must be less than maximum value.

(2) Maximum value must be greater than minimum value.

TM3AQ4

This table describes the specific address offsets for TM3AQ4 configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Diagnostics Enabled	RW	1	0 = Disable 1 = Enable
1XY09	Ch 0 - Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY10	Ch 0 - Minimum	RW	-32768	-32768 to 32766 (1)
1XY11	Ch 0 - Maximum	RW	32767	-32767 to 32767 (2)
1XY12	Ch 0 - Fallback Value	RW	0	The fallback value must be equal to or greater than the minimum value configured but less than or equal to the maximum value configured.
1XY13	Ch 1 -Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY14	Ch 1 - Minimum	RW	-32768	-32768 to 32766 (1)
1XY15	Ch 1 - Maximum	RW	32767	-32767 to 32767 (2)
1XY16	Ch 1 - Fallback Value	RW	0	The fallback value must be equal to or greater than the minimum value configured but less than or equal to the maximum value configured.
1XY17	Ch 2 - Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY18	Ch 2 - Minimum	RW	-32768	-32768 to 32766 (1)
1XY19	Ch 2 - Maximum	RW	32767	-32767 to 32767 (2)
1XY20	Ch 2 - Fallback Value	RW	0	The fallback value must be equal to or greater than the minimum value configured but less than or equal to the maximum value configured.
1XY21	Ch 3 - Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY22	Ch 3 - Minimum	RW	-32768	-32768 to 32766 (1)
1XY23	Ch 3 - Maximum	RW	32767	-32767 to 32767 (2)
1XY24	Ch 3 - Fallback Value	RW	0	The fallback value must be equal to or greater than the minimum value configured but less than or equal to the maximum value configured.

(1) Minimum value must be less than maximum value.

(2) Maximum value must be greater than minimum value.

TM3AM6

This table describes the specific address offsets for TM3AM6 configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Diagnostics Enabled	RW	1	0 = Disable 1 = Enable
1XY09	Input Ch 0 - Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY10	Input Ch 0 - Minimum	RW	-32768	-32768 to 32766 (1)
1XY11	Input Ch 0 - Maximum	RW	32767	-32767 to 32767 (2)
1XY12	Input Ch 0 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY13	Input Ch 0 - Sampling	RW	0	0 = 100 ms/channel 1 = 10 ms/channel
1XY14	Input Ch 1 – Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY15	Input Ch 1 – Minimum	RW	-32768	-32768 to 32766 (1)
1XY16	Input Ch 1 – Maximum	RW	32767	-32767 to 32767 (2)
1XY17	Input Ch 1 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY18	Input Ch 1 - Sampling	RW	0	0 = 100 ms/channel 1 = 10 ms/channel
1XY19	Input Ch 2 – Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY20	Input Ch 2 – Minimum	RW	-32768	-32768 to 32766 (1)
1XY21	Input Ch 2 – Maximum	RW	32767	-32767 to 32767 (2)
1XY22	Input Ch 2 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY23	Input Ch 2 – Sampling	RW	0	0 = 100 ms/channel 1 = 10 ms/channel
1XY24	Input Ch 3 – Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY25	Input Ch 3 – Minimum	RW	-32768	-32768 to 32766 (1)

Address Offset	Description	Access	Default value	Comments
1XY26	Input Ch 3 – Maximum	RW	32767	-32767 to 32767 (2)
1XY27	Input Ch 3 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY28	Input Ch 3 - Sampling	RW	0	0 = 100 ms/channel 1 = 10 ms/channel
1XY29	Output Ch 0 - Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY30	Output Ch 0 - Minimum	RW	-32768	-32768 to 32766 (1)
1XY31	Output Ch 0 - Maximum	RW	32767	-32767 to 32767 (2)
1XY32	Output Ch 0 - Fallback Value	RW	0	The fallback value must be equal to or greater than the minimum value configured but less than or equal to the maximum value configured.
1XY33	Output Ch 1 -Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY34	Output Ch 1 - Minimum	RW	-32768	-32768 to 32766 (1)
1XY35	Output Ch 1 - Maximum	RW	32767	-32767 to 32767 (2)
1XY36	Output Ch 1 - Fallback Value	RW	0	The fallback value must be equal to or greater than the minimum value configured but less than or equal to the maximum value configured.

(1) Minimum value must be less than maximum value.

(2) Maximum value must be greater than minimum value.

TM3TM3

These tables describe the specific address offsets and type/scope inputs for TM3TM3 configuration:

Address Offset	Description	Access	Default value	Comments
1XY08	Diagnostics Enabled	RW	1	0 = Disable 1 = Enable
1XY09	Input Ch 0 - Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY10	Input Ch 0 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit
1XY11	Input Ch 0 - Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY12	Input Ch 0 - Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY13	Input Ch 0 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY14	Input Ch 0 - Sampling	RW	0	0 = 100 ms/channel 1 = 10 ms/channel
1XY15	Input Ch 1 - Type	RW	0	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY16	Input Ch 1 - Scope	RW	0	0 = Not used 1 = Normal 2 = Celsius 3 = Fahrenheit
1XY17	Input Ch 1 - Minimum	RW	-32768	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY18	Input Ch 1 - Maximum	RW	32767	Refer to the **Type/Scope Input Table** below for supported values for the selected type/range
1XY19	Input Ch 1 - Input filter	RW	0	0 to 1000 Unit: x 10 ms
1XY20	Input Ch 1 - Sampling	RW	0	0 = 100 ms/channel 1 = 10 ms/channel
1XY21	Output Ch 0 - Type	RW	0	0 = Not used 1 = 0 to 10 V 2 = -10 to +10 V 3 = 0 to 20 mA 4 = 4 to 20 mA
1XY22	Output Ch 0 - Minimum	RW	-32768	-32768 to 32766 (1)
1XY23	Output Ch 0 - Maximum	RW	32767	-32767 to 32767 (2)
1XY24	Output Ch 0 - Fallback Value	RW	0	The fallback value must be equal to or greater than the minimum value configured but less than or equal to the maximum value configured.

(1) Minimum value must be less than maximum value.

(2) Maximum value must be greater than minimum value.

Type/Scope Input Table

Modbus register value	**Scope**	**Input Type: 1 = Normal**	**Input Type: 2 = Celsius (0.1° C)**		**Input Type: 3 = Fahrenheit (0.1° F except TC Type B, C)**	
–	–	Range	Minimum	Maximum	Minimum	Maximum
0	NOT USED	–	–	–	–	–
1	Voltage 0-10 V	-32768 – 32767	–	–	–	–
2	Voltage -10 V +10 V	-32768 – 32767	–	–	–	–
3	Current Input 0-20 mA	-32768 – 32767	–	–	–	–
4	Current Input 4-20 mA	-32768 – 32767	–	–	–	–
7	K thermocouple	-32768 – 32767	-2000	13000	-3280	23720
8	J thermocouple	-32768 – 32767	-2000	10000	-3280	18320
9	R thermocouple	-32768 – 32767	0	17600	320	32000
10	S thermocouple	-32768 – 32767	0	17600	320	32000
11	B thermocouple	-32768 – 32767	0	18200	Not supported. **Refer to Type B.**	
12	E thermocouple	-32768 – 32767	-2000	8000	-3280	14720
13	T thermocouple	-32768 – 32767	-2000	4000	-3280	7520
14	N thermocouple	-32768 – 32767	-2000	13000	-3280	23720
15	C thermocouple	-32768 – 32767	0	23150	Not supported. **Refer to Type C.**	
16	Pt100 RTD	-32768 – 32767	-2000	8500	-3280	15620
17	Pt1000 RTD	-32768 – 32767	-2000	6000	-3280	11120
18	Ni100 RTD	-32768 – 32767	-600	1800	-760	3560
19	Ni1000 RTD	-32768 – 32767	-600	1800	-760	3560

For Type B in Fahrenheit, set Scope to *Normal*, with minimum = 160 and maximum = 16540. The unit of measure for this configuration is 0.2° F.

For Type C in Fahrenheit, set Scope to "*Normal*, with minimum = 160 and maximum = 20995. The unit of measure for this configuration is 0.2° F.

Glossary

A

application:

A program including configuration data, symbols, and documentation.

ARP:

(*address resolution protocol*) An IP network layer protocol for Ethernet that maps an IP address to a MAC (hardware) address.

B

BOOTP:

(*bootstrap protocol*) A UDP network protocol that can be used by a network client to automatically obtain an IP address (and possibly other data) from a server. The client identifies itself to the server using the client MAC address. The server, which maintains a pre-configured table of client device MAC addresses and associated IP addresses, sends the client its pre-configured IP address. BOOTP was originally used as a method that enabled diskless hosts to be remotely booted over a network. The BOOTP process assigns an infinite lease of an IP address. The BOOTP service utilizes UDP ports 67 and 68.

C

CANopen:

An open industry-standard communication protocol and device profile specification (EN 50325-4).

CIP:

(*common industrial protocol*) When a CIP is implemented in a network application layer, it can communicate seamlessly with other CIP-based networks without regard to the protocol. For example, the implementation of CIP in the application layer of an Ethernet TCP/IP network creates an EtherNet/IP environment. Similarly, CIP in the application layer of a CAN network creates a DeviceNet environment. In that case, devices on the EtherNet/IP network can communicate with devices on the DeviceNet network through CIP bridges or routers.

configuration:

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

controller:

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

CRC:

(*cyclical redundancy check*) A method used to determine the validity of a communication transmission. The transmission contains a bit field that constitutes a checksum. The message is used to calculate the checksum by the transmitter according to the content of the message. Receiving nodes, then recalculate the field in the same manner. Any discrepancy in the value of the 2 CRC calculations indicates that the transmitted message and the received message are different.

D

DHCP:

(*dynamic host configuration protocol*) An advanced extension of BOOTP. DHCP is more advanced, but both DHCP and BOOTP are common. (DHCP can handle BOOTP client requests.)

DPWS:

(*devices profile for Web services*) The version 2 of the UPnP (Universal Plug and Play) protocol. A PC or other device can detect DPWS-enabled devices on a network, then discover and access the Web service functionality each device provides.

DTM:

(*device type manager*) Classified into 2 categories:

- Device DTMs connect to the field device configuration components.
- CommDTMs connect to the software communication components.

The DTM provides a unified structure for accessing device parameters and configuring, operating, and diagnosing the devices. DTMs can range from a simple graphical user interface for setting device parameters to a highly sophisticated application capable of performing complex real-time calculations for diagnosis and maintenance purposes.

E

EtherNet/IP Adapter:

An EtherNet/IP Adapter, sometimes also called a server, is an end-device in an EtherNet/IP network. I/O blocks and drives can be EtherNet/IP Adapter devices.

Ethernet:

A physical and data link layer technology for LANs, also known as IEEE 802.3.

expansion bus:

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

F

FDR:

(*fast device replacement*) A service supported by the device, that facilitate the replacement of an inoperable equipment.

firmware:

Represents the BIOS, data parameters, and programming instructions that constitute the operating system on a controller. The firmware is stored in non-volatile memory within the controller.

function:

A programming unit that has 1 input and returns 1 immediate result. However, unlike FBs, it is directly called with its name (as opposed to through an instance), has no persistent state from one call to the next and can be used as an operand in other programming expressions.

Examples: boolean (AND) operators, calculations, conversions (BYTE_TO_INT)

H

HE10:

Rectangular connector for electrical signals with frequencies below 3 MHz, complying with IEC 60807-2.

HSC:

(*high-speed counter*) A function that counts pulses on the controller or on expansion module inputs.

I

I/O:

(*input/output*)

IP:

(*Internet protocol*) Part of the TCP/IP protocol family that tracks the Internet addresses of devices, routes outgoing messages, and recognizes incoming messages.

L

LRC:

(*longitudinal redundancy checking*) An error-detection method for determining the correctness of transmitted and stored data.

M

MAC address:

(*media access control address*) A unique 48-bit number associated with a specific piece of hardware. The MAC address is programmed into each network card or device when it is manufactured.

MIB:

(*management information base*) An object database that is monitored by a network management system like SNMP. SNMP monitors devices are defined by their MIBs. Schneider Electric has obtained a private MIB, groupeschneider (3833).

MSB:

(*most significant bit/byte* The part of a number, address, or field that is written as the left-most single value in conventional hexadecimal or binary notation.

N

NMT:

(*network management*) CANopen protocols that provide services for network initialization, detected error control, and device status control.

O

originator:

In EtherNet/IP explicit messaging, the device, usually the logic controller, that initiates data exchanges with target network devices.

See also *target*

R

RJ45:

A standard type of 8-pin connector for network cables defined for Ethernet.

RPI:

(*requested packet interval)* The time period between cyclic data exchanges requested by the scanner. EtherNet/IP devices publish data at the rate specified by the RPI assigned to them by the scanner, and they receive message requests from the scanner with a period equal to RPI.

RSTP:

(*rapid spanning tree protocol*) A high-speed network protocol that builds a loop-free logical topology for Ethernet networks.

S

SDO:

(*service data object*) A message used by the field bus master to access (read/write) the object directories of network nodes in CAN-based networks. SDO types include service SDOs (SSDOs) and client SDOs (CSDOs).

SNMP:

(*simple network management protocol*) A protocol that can control a network remotely by polling the devices for their status and viewing information related to data transmission. You can also use it to manage software and databases remotely. The protocol also permits active management tasks, such as modifying and applying a new configuration.

T

Target:

In EtherNet/IP, a device is considered to be the target when it is the recipient of a connection request for implicit or explicit messaging communications.

See also *Originator*

NOTE:

TCP:

(*transmission control protocol*) A connection-based transport layer protocol that provides a simultaneous bi-directional transmission of data. TCP is part of the TCP/IP protocol suite.

terminal block:

(*terminal block*) The component that mounts in an electronic module and provides electrical connections between the controller and the field devices.

U

UDP:

(*user datagram protocol*) A connectionless mode protocol (defined by IETF RFC 768) in which messages are delivered in a datagram (data telegram) to a destination computer on an IP network. The UDP protocol is typically bundled with the Internet protocol. UDP/IP messages do not expect a response, and are therefore ideal for applications in which dropped packets do not require retransmission (such as streaming video and networks that demand real-time performance).

Index

Schneider Electric
35 rue Joseph Monier
92500 Rueil Malmaison
France

+ 33 (0) 1 41 29 70 00

www.se.com

As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

EIO0000003643.05