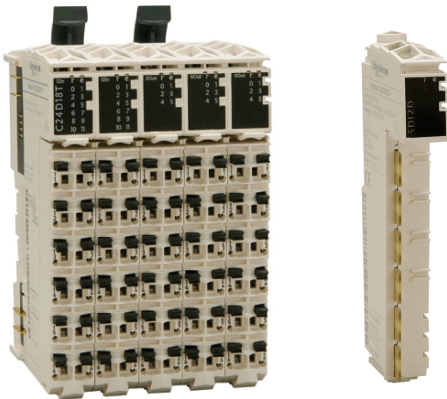


# Modicon TM5

## Expansion Modules DTM Configuration Programming Guide

04/2012



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The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

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

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

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

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

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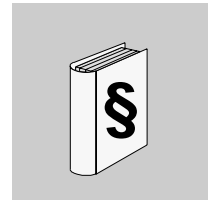
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## Safety Information



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### Important Information

#### NOTICE

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



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



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

### **DANGER**

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

### **WARNING**

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

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 **CAUTION**

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

***NOTICE***

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

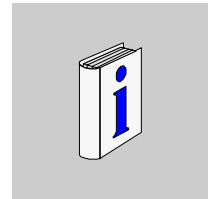
**PLEASE NOTE**

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.

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# About the Book



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## At a Glance

### Document Scope

This manual describes the DTM configuration of the Modicon TM5 Input/Output expansion modules.

### Validity Note

This document has been updated with the release of the Performance Distributed I/O Configuration Software V1.0.

### Related Documents

Title of Documentation	Reference Number
Modicon TM5 / TM7 CANopen Interface I/O Block Programming Guide	EIO0000000697 (Eng), EIO0000000698 (Fre), EIO0000000699 (Ger), EIO0000000700 (Spa), EIO0000000701 (Ita), EIO0000000702 (Chs)
Modicon TM5 / TM7 Flexible System - System Planning and Installation Guide	EIO0000000426 (Eng), EIO0000000427 (Fre), EIO0000000428 (Ger), EIO0000000429 (Spa), EIO0000000430 (Ita), EIO0000000431 (Chs)
Modicon TM5 CANopen Interface Hardware Guide	EIO0000000691 (Eng), EIO0000000692 (Fre), EIO0000000693 (Ger), EIO0000000694 (Spa), EIO0000000695 (Ita), EIO0000000696 (Chs)

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Modicon TM5 Digital I/O Modules Hardware Guide	EIO0000000444 (Eng), EIO0000000445 (Fre), EIO0000000446 (Ger), EIO0000000447 (Spa), EIO0000000448 (Ita), EIO0000000449 (Chs)
Modicon TM5 Analog I/O Modules Hardware Guide	EIO0000000450 (Eng), EIO0000000451 (Fre), EIO0000000452 (Ger), EIO0000000453 (Spa), EIO0000000454 (Ita), EIO0000000455 (Chs)
Modicon TM5 Transmitter and Receiver Modules Hardware Guide	EIO0000000468 (Eng), EIO0000000469 (Fre), EIO0000000470 (Ger), EIO0000000471 (Spa), EIO0000000472 (Ita), EIO0000000473 (Chs)

You can download these technical publications and other technical information from our website at [www.schneider-electric.com](http://www.schneider-electric.com).



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## 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.<sup>1</sup>
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

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

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

### **WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

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

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

## User Comments

We welcome your comments about this document. You can reach us by e-mail at [techcomm@schneider-electric.com](mailto:techcomm@schneider-electric.com).



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# I/O Configuration General Information



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## Introduction

This chapter provides the general considerations to configure I/O expansion modules.

## What's in this Chapter?

This chapter contains the following topics:

Topic	Page
General Description	12
Adding TM5 Expansion Modules / TM5 Bus Bases and TM5 Terminal Blocks	18

## General Description

### Introduction

The range of expansion modules includes:

- TM5 Compact I/O modules with integrated modules
- TM5 Digital modules
- TM5 Analog modules
- TM5 Transmitter - Receiver modules
- TM5 CANopen Interface power distribution modules
- TM5 Power distribution modules
- TM5 Common distribution modules
- TM5 Dummy modules

Compact, digital or analog input modules convert measured values (voltages, currents) into numerical values which can be processed by the controller.

Compact, digital or analog output modules convert controller internal numerical values into voltages or currents.

The data transmitter and receiver modules handle the communication between remote module via expansion bus cables.

The CANopen interface power distribution modules are used to manage power supply for the various I/O modules.

The power distribution modules are used to manage the power supply for the various I/O modules.

The common distribution modules provide 0 Vdc and/or 24 Vdc terminal connections for the 24 Vdc I/O power segment(s), integrated into the bus bases, which expand the wiring possibilities for sensors and actuators.

The dummy module is a non-functional module. This module is used to separate modules which have specific thermal or EMC requirements, or as a place holder for other later system expansion.

## Compact I/O Expansion Features

Reference	Number of electronic modules	Voltage/current
TM5C24D18T (see page 25)	24 digital inputs	24 Vdc / 3.75 mA
	18 digital outputs	24 Vdc / 0.5 mA
TM5C12D8T (see page 27)	12 digital inputs	24 Vdc / 3.75 mA
	8 digital outputs	24 Vdc / 0.5 mA
TM5C12D6T6L (see page 29)	12 digital inputs	24 Vdc / 3.75 mA
	6 digital outputs	24 Vdc / 0.5 A
	4 analog inputs	-10...+10 Vdc 0...20 mA/4...20 mA
	2 analog outputs	-10...+10 Vdc 0...20 mA
TM5C24D12R (see page 31)	24 inputs	24 Vdc / 3.75 mA
	12 relays	24 Vdc / 230 Vac 2 A NO
TM5CAI8O8VL (see page 33)	8 analog inputs	-10...+10 Vdc
	8 analog outputs	-10...+10 Vdc
TM5CAI8O8CL (see page 35)	8 analog inputs	0...20 mA / 4...20 mA
	8 analog outputs	0...20 mA
TM5CAI8O8CVL (see page 37)	4 analog inputs	-10...+10 Vdc
	4 analog inputs	0...20 mA / 4...20 mA
	4 analog outputs	-10...+10 Vdc
	4 analog outputs	0...20 mA

## Digital I/O Expansion Features

Reference	Number of channels	Voltage/current
TM5SDI2D (see page 64)	2 inputs	24 Vdc / 3.75 mA
TM5SDI4D (see page 64)	4 inputs	24 Vdc / 3.75 mA
TM5SDI6D (see page 64)	6 inputs	24 Vdc / 3.75 mA
TM5SDI12D (see page 67)	12 inputs	24 Vdc / 3.75 mA
TM5SDI2A (see page 66)	2 inputs	100...240 Vac
TM5SDI4A (see page 66)	4 inputs	100...240 Vac
TM5SDI6U (see page 66)	6 inputs	100...120 Vac
TM5SDO2T (see page 68)	2 outputs	24 Vdc / 0.5 A
TM5SDO4T (see page 68)	4 outputs	24 Vdc / 0.5 A
TM5SDO4TA (see page 72)	4 outputs	24 Vdc / 2 A
TM5SDO6T (see page 68)	6 outputs	24 Vdc / 0.5 A
TM5SDO8TA (see page 72)	8 outputs	24 Vdc / 2 A
TM5SDO12T (see page 68)	12 outputs	24 Vdc / 0.5 A
TM5SDO2R (see page 75)	2 outputs	30 Vdc / 230 Vac 5 A C/O
TM5SDO4R (see page 75)	4 outputs	30 Vdc / 230 Vac 5 A NO
TM5SDO2S (see page 77)	2 outputs	230 Vac / 1 A
TM5SDM12DT (see page 78)	8 inputs	24 Vdc / 3.75 mA
	4 outputs	24 Vdc / 0.5 A
TM5SMM6D2L (see page 80)	4 digital inputs	24 Vdc / 3.3 mA
	2 digital outputs	24 Vdc / 0.5 A
	1 analog input	-10...+10 Vdc 0...20 mA / 4...20 mA
	1 analog output	-10...+10 Vdc 0...20 mA

**Analog I/O Expansion Features**

Reference	Number of channels	Voltage/current
TM5SAI2L (see page 95)	2 inputs	-10...+10 Vdc 0...20 mA / 4...20 mA
TM5SAI2H (see page 90)	2 inputs	-10...+10 Vdc 0...20 mA
TM5SAI4L (see page 95)	4 inputs	-10...+10 Vdc 0...20 mA / 4...20 mA
TM5SAI4H (see page 90)	4 inputs	-10...+10 Vdc 0...20 mA
TM5SAO2L (see page 114)	2 outputs	-10...+10 Vdc 0...20 mA
TM5SAO2H (see page 112)	2 outputs	-10...+10 Vdc 0...20 mA
TM5SAO4L (see page 114)	2 outputs	-10...+10 Vdc 0...20 mA
TM5SAO4H (see page 112)	4 outputs	-10...+10 Vdc 0...20 mA

**Temperature Analog Expansion Features**

Reference	Number of channels	Sensor Type
TM5SAI2PH (see page 103)	2 inputs	PT100 / PT 1000
TM5SAI4PH (see page 103)	4 inputs	PT100 / PT 1000
TM5SAI2TH (see page 107)	2 inputs	Thermocouple J, K, S, N
TM5SAI6TH (see page 107)	6 inputs	Thermocouple J, K, S, N

## Transmitter-Receiver Expansion Features

Reference	Modules description
TM5SBET1 <i>(see page 118)</i>	TM5 data transmitter electronic module.
TM5SBET7 <i>(see page 120)</i>	TM7 data transmitter electronic module.
TM5SBER2 <i>(see page 122)</i>	TM5 data receiver electronic module.

## Interface Power Distribution Expansion Features

Reference	Modules description
TM5SPS3 <i>(see page 128)</i>	TM5 CANopen Interface Power Distribution Module

## Power Distribution Expansion Features

Reference	Modules description
TM5SPDM <i>(see page 128)</i>	TM5 Power Distribution Module
TM5SPDMF <i>(see page 128)</i>	TM5 Power Distribution Module with integrated Fuse

## Common Distribution Expansion Features

Reference	Number of channels	Voltage
TM5SPDG12F <i>(see page 134)</i>	12	0 Vdc
TM5SPDD12F <i>(see page 135)</i>	12	24 Vdc
TM5SPDG5D4F <i>(see page 137)</i>	2 x 5	0 Vdc - 24 Vdc
TM5SPDG6D6F <i>(see page 139)</i>	2 x 6	0 Vdc - 24 Vdc



## Dummy Expansion Features

Reference	Number of channels	Voltage
TM5SD000 (see page 141)	–	–

## 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, it is imperative that you 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 will no longer function while the embedded I/O that may be present in your controller will continue to operate.

### **WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

Update the configuration of your program each time you add or delete an I/O expansion, 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.**

## Adding TM5 Expansion Modules / TM5 Bus Bases and TM5 Terminal Blocks

### Overview

In order to configure your TM5/TM7 distributed I/O configuration, you must create your configuration with your frame application (for example: SoMachine).

In your frame application, select the device to open the DTM configuration for that device.

Each frame application has its own way of creating a configuration; refer to your frame application online help for more details.

### I/O Configuration Tab Description

The expansion modules are set up from the **I/O Configuration** tab:

TM5SDI2D  
TM5SDI2D  
2 Digital Inputs 24 Vdc, Sink, IEC 61131-2, Type 1

<TM5 Bus:-> 003 TM5SDI2D - Configuration

IO Configuration

Group/Parameter	Type	Value	Default Value	Description
Properties				
Function model	STRING	default	default	Select the module's operating mode
General				
Module Address	USINT (2..63)	3	2	Address of the module on the expansion bus TM5
Bus Base	STRING	TM5ACBM11	TM5ACBM11	Select the Bus Base
Terminal Block	STRING	TM5ACTB06	TM5ACTB06	Select the Terminal Block
Input filter	USINT (0...250)	10	10	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms)
Power Sensor Current	STRING	500 mA	500 mA	Adjust the Power Current to supply the sensors connected to the module

Help      Ok      Cancel      Apply

Disconnected      Data set

The **I/O Configuration** tab contains the following columns:

Column	Description	Editable
<b>Group/Parameter</b>	Parameter name	No
<b>Type</b>	Parameter data type	No
<b>Value</b>	Parameter value	If the parameter is editable, an edit frame can be opened by double-clicking.
<b>Default Value</b>	Default parameter value	No
<b>Description</b>	Parameter short description	No

For further descriptions, refer to DTM Graphical User Interface (*see Generic CANopen Device Type Manager, User Manual*).

### General Control Buttons

The **OK Button** confirms the latest settings. All changed values are applied on the frame application database. The DTM Graphic User Interface (GUI) closes.

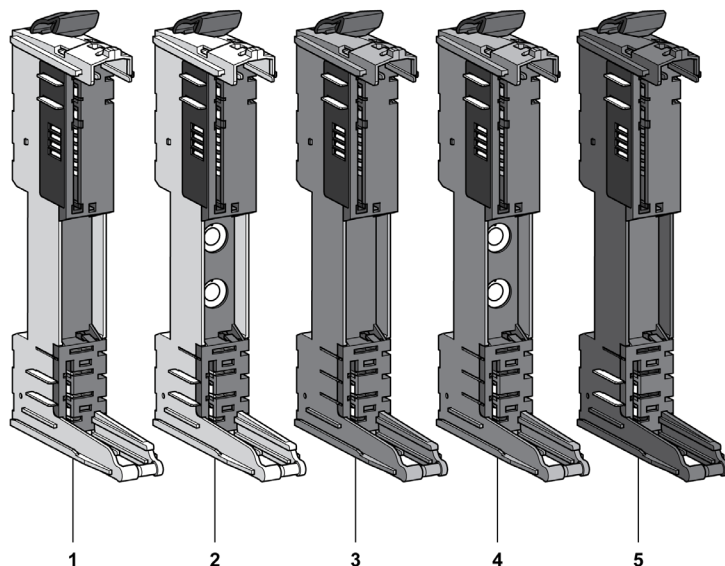
The **Cancel Button** cancels the latest changes. Confirm your decision in the **Cancel** dialog box that no changes are stored. The DTM GUI closes.

The **Apply Button** confirms the latest settings. All changed values are applied on the frame application database. The DTM GUI remains opened.

The **Help Button** opens the DTM online help.

## TM5 Bus Bases

The following figure shows the TM5 bus bases:



Number	Reference	Description	Color
1	TM5ACBM11	Bus base 24 Vdc 24 Vdc I/O power segment pass-through	White
2	TM5ACBM15	Bus base 24 Vdc 24 Vdc I/O power segment pass-through with address setting	White
3	TM5ACBM01R	Bus base 24 Vdc 24 Vdc I/O power segment left isolated	Grey
4	TM5ACBM05R	Bus base 24 Vdc 24 Vdc I/O power segment left isolated with address setting	Grey
5	TM5ACBM12	Bus base 240 Vac 24 Vdc I/O power segment pass-through insulated of 240 Vac	Black

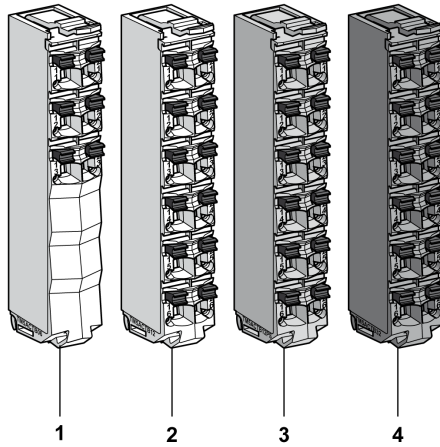
In certain cases, it is necessary to define specific slices or potential groups at a fixed address, regardless of the preceding modules in the backplane. For this purpose, there are bus bases in the TM5 System with address setting rotary switches, which allow you to set the address setting number of the slice. All subsequent slices refer to this offset and are addressed again automatically.

The TM5ACBM15 and TM5ACBM05R bus bases have the address setting.

For further information, refer to *TM5 Addressing (see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*.

## TM5 Terminal Blocks

The following figure shows the TM5 terminal blocks:



Number	Reference	Description	Color
1	TM5ACTB06	6-pin terminal block designed for 24 Vdc I/O modules	White
2	TM5ACTB12	12-pin terminal block designed for 24 Vdc I/O modules	White
3	TM5ACTB12PS	12-pin terminal block designed for 24 Vdc Power Distribution Modules (PDM)	Grey
4	TM5ACTB32	12-pin terminal block designed for 240 Vac I/O modules	Black



---

# TM5 Compact I/O Modules

# 2

---

## Introduction

This chapter provides information to configure compact I/O and their integrated electronic modules:

- TM5C24D18T with the 12In and 6Out electronic modules,
- TM5C12D8T with the 4In and 4Out electronic modules,
- TM5C24D12R with the 12In and 6Rel electronic modules,
- TM5CAI8O8VL with the 4AI  $\pm 10$  V and 4AO  $\pm 10$  V electronic modules,
- TM5CAI8O8CL with the 4AI 0-20 mA / 4-20 mA and 4AO 0-20 mA electronic modules,
- TM5CAI8O8CVL with the 4AI  $\pm 10$  V, 4AI 0-20 mA / 4-20 mA, 4AO  $\pm 10$  V and 4AO 0-20 mA electronic modules,
- TM5C12D6T6L with the 6In, 6Out, 4AI  $\pm 10$  V / 0-20 mA / 4-20 mA and 2AO  $\pm 10$  V / 0-20 mA electronic modules.

To add the expansion electronic modules contained in the compact I/O modules, and to access the configuration screens, refer to Adding a TM5 Expansion Module (*see page 18*).

## What's in this Chapter?

This chapter contains the following sections:

Section	Topic	Page
2.1	TM5 Compact I/O Modules	24
2.2	Integrated Electronic Modules	39

## 2.1 TM5 Compact I/O Modules

---

### Introduction

This section shows you how to configure the compact I/O modules.

### What's in this Section?

This section contains the following topics:

Topic	Page
TM5C24D18T	25
TM5C12D8T	27
TM5C12D6T6L	29
TM5C24D12R	31
TM5CAI8O8VL	33
TM5CAI8O8CL	35
TM5CAI8O8CVL	37



## TM5C24D18T

### Introduction

The TM5C24D18T compact I/O module is a set of five TM5 24 Vdc input and output electronic modules assembled together.

This set includes:

- two digital input electronic modules
- three digital output electronic modules

For further information, refer to the TM5C24D18T General Description (see *Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration Tab

To configure the TM5C24D18T compact I/O module, select the **I/O Configuration** tab.

The table describes the parameters of the TM5C24D18T compact I/O module:

Group / Parameter		Value	Default Value	Description
Properties	Function model	default	default	Sets the operating mode supported by the module. TM5C24D18T supports only one mode.
General	Module Address	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).

Set each of the I/O electronic modules individually using the **Pos.xx - SDEM** (SDEM = Short Description of the Electronic Module, like 12In, 6Out, 4AI  $\pm 10$  V / 0-20 mA / 4-20 mA etc.) folders available.

#### NOTE:

- **Pos.** stands for the position of the electronic module within the compact I/O module.
- **xx** is the index number of the electronic module position (from 00 to 04).

The table provides the I/O electronic module type associated with the positions 0 to 4 (**Pos.00** to **Pos.04**) on the TM5C24D18T compact I/O module:

I/O Electronic Module Position	Type	Refer to
Pos.00	12 digital inputs	Configuration of the digital input 12In electronic modules ( <i>see page 42</i> ).
Pos.01		
Pos.02	6 digital outputs	Configuration of the digital output 6Out electronic modules ( <i>see page 45</i> ).
Pos.03		
Pos.04		

For further generic descriptions, refer to I/O Configuration Tab Description (*see page 18*).

### Module Status

The **Island Summary** of the CANopen interface has 2 fields to indicate the status of the compact I/O and its electronic modules. Each field has a 8 bits encoding as shown below:

Bit	Description
0	StatusPos00 (ok = 1)
1	StatusPos01 (ok = 1)
2	StatusPos02 (ok = 1)
3	StatusPos03 (ok = 1)
4	StatusPos04 (ok = 1)
5...7	Not used

Bit	Description
0...6	Not used
7	GlobalModuleStatus (ok = 0)

## TM5C12D8T

### Introduction

The TM5C12D8T compact I/O module is a set of five TM5 24 Vdc input and output electronic modules assembled together.

This set includes:

- three digital input electronic modules
- two digital output electronic modules

For further information, refer to the TM5C12D8T General Description (*see Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration Tab

To configure the TM5C12D8T compact I/O module, select the **I/O Configuration** tab.

The table describes the parameters of the TM5C12D8T compact I/O module:

Group / Parameter		Value	Default Value	Description
Properties	Function model	default	default	Sets the operating mode supported by the module. TM5C12D8T supports only one mode.
General	Module Address	2...63	2	Displays the address defined in the Address Setting tab ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).

Set each of the I/O electronic modules individually using the **Pos.xx - SDEM** (SDEM = Short Description of the Electronic Module, like 12In, 6Out, 4AI  $\pm 10$  V / 0-20 mA / 4-20 mA etc.) folders available.

#### NOTE:

- **Pos.** stands for the position of the electronic module within the compact I/O module.
- **xx** is the index number of the electronic module position (from 00 to 04).

The table provides the I/O electronic module type associated with the positions 0 to 4 (**Pos.00** to **Pos.04**) on the TM5C12D8T compact I/O module:

I/O Electronic Module Position	Type	Refer to
Pos.00	4 digital inputs	Configuration of the digital input 4In electronic modules (see page 40)
Pos.01		
Pos.02		
Pos.03	4 digital outputs	Configuration of the digital output 4Out electronic modules (see page 43)
Pos.04		

For further generic descriptions, refer to I/O Configuration Tab Description (see page 18).

### Module Status

The **Island Summary** of the CANopen interface has 2 fields to indicate the status of the compact I/O and its electronic modules. Each field has a 8 bits encoding as shown below:

Bit	Description
0	StatusPos00 (ok = 1)
1	StatusPos01 (ok = 1)
2	StatusPos02 (ok = 1)
3	StatusPos03 (ok = 1)
4	StatusPos04 (ok = 1)
5...7	Not used

Bit	Description
0...6	Not used
7	GlobalModuleStatus (ok = 0)

## TM5C12D6T6L

### Introduction

The TM5C12D6T6L compact I/O module is a set of five TM5 24 Vdc input and output electronic modules assembled together.

This set includes:

- two digital input electronic modules
- one digital output electronic module
- one analog input electronic module
- one analog output electronic module

For further information, refer to the TM5C12D6T6L General Description (see *Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration Tab

To configure the TM5C12D6T6L compact I/O module, select the **I/O Configuration** tab.

The table describes the parameters of the TM5C12D6T6L compact I/O module:

Group / Parameter		Value	Default Value	Description
Properties	Function model	default	default	Sets the operating mode supported by the module. TM5C12D6T6L supports only one mode.
General	Module Address	2..63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).

Set each of the I/O electronic modules individually using the **Pos.xx - SDEM** (SDEM = Short Description of the Electronic Module, like 12In, 6Out, 4AI  $\pm 10$  V / 0-20 mA / 4-20 mA etc.) folders available.

#### NOTE:

- **Pos.** stands for the position of the electronic module on the compact I/O electronic module.
- **xx** is the index number of the electronic module position (from 00 to 04).

The table provides the I/O electronic module type associated with the positions 0 to 4 (**Pos.00** to **Pos.04**) on the TM5C12D6T6L compact I/O module:

I/O Electronic Module Position	Type	Refer to
Pos.00	6 digital inputs	Configuration of the digital input 6In electronic modules (see page 41)
Pos.01		
Pos.02	6 digital outputs	Configuration of the digital output 6Out electronic module (see page 45)
Pos.03	4 analog inputs	Configuration of the analog input 4AI $\pm 10$ V / 0-20 mA / 4-20 mA electronic module (see page 52)
Pos.04	2 analog outputs	Configuration of the analog output 2AO $\pm 10$ V / 0-20 mA electronic module (see page 61)

For further generic descriptions, refer to I/O Configuration Tab Description (see page 18).

### Module Status

The **Island Summary** of the CANopen interface has 2 fields to indicate the status of the compact I/O and its electronic modules. Each field has a 8 bits encoding as shown below:

Bit	Description
0	StatusPos00 (ok = 1)
1	StatusPos01 (ok = 1)
2	StatusPos02 (ok = 1)
3	StatusPos03 (ok = 1)
4	StatusPos04 (ok = 1)
5...7	Not used

Bit	Description
0...6	Not used
7	GlobalModuleStatus (ok = 0)

## TM5C24D12R

### Introduction

The TM5C24D12R compact I/O module is a set of five TM5 24 Vdc input and output electronic modules assembled together.

This set includes:

- two digital input electronic modules
- two relay electronic modules
- one dummy module (see *Modicon TM5, Compact I/O Modules, Hardware Guide*).

For further information, refer to the TM5C24D12R General Description (see *Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration Tab

To configure the TM5C24D12R compact I/O module, select the **I/O Configuration** tab.

The table describes the parameters of the TM5C24D12R compact I/O module:

Group / Parameter		Value	Default Value	Description
Properties	Function model	default	default	Sets the operating mode supported by the module. TM5C24D12R supports only one mode.
General	Module Address	2..63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).

Set each of the I/O electronic modules individually using the **Pos.xx - SDEM** (SDEM = Short Description of the Electronic Module, like 12In, 6Out, 4AI  $\pm 10$  V / 0-20 mA / 4-20 mA etc.) folders available.

#### NOTE:

- **Pos.** stands for the position of the electronic module within the compact I/O module.
- **xx** is the index number of the electronic module position (from 00 to 04).

The table provides the I/O electronic module type associated with the positions 0 to 4 (**Pos.00** to **Pos.04**) on the TM5C24D12R compact I/O module:

I/O Electronic Module Position	Type	Refer to
Pos.00	12 digital inputs	Configuration of the digital input 12In electronic modules (see page 42)
Pos.01		
Pos.02	6 relay outputs	Configuration of the digital output relay 6Rel electronic modules (see page 47)
Pos.04		

**NOTE:** Pos.03 does not appear in the **I/O Configuration** tab as this is the dummy module that cannot be configured.

For further generic descriptions, refer to I/O Configuration Tab Description (see page 18).

### Module Status

The **Island Summary** of the CANopen interface has 2 fields to indicate the status of the compact I/O and its electronic modules. Each field has a 8 bits encoding as shown below:

Bit	Description
0	StatusPos00 (ok = 1)
1	StatusPos01 (ok = 1)
2	StatusPos02 (ok = 1)
3	Not used
4	StatusPos04 (ok = 1)
5...7	Not used

Bit	Description
0...6	Not used
7	GlobalModuleStatus (ok = 0)



## TM5CAI8O8VL

### Introduction

The TM5CAI8O8VL compact I/O module is a set of four TM5 24 Vdc input and output electronic modules assembled together.

This set includes:

- 2 analog input electronic modules
- 1 dummy module (see *Modicon TM5, Compact I/O Modules, Hardware Guide*)
- 2 analog output electronic modules

For further information, refer to the TM5CAI8O8VL General Description (see *Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration Tab

To configure the TM5CAI8O8VL compact I/O module, select the **I/O Configuration** tab.

The table describes the parameters of the TM5CAI8O8VL compact I/O module:

Group / Parameter		Value	Default Value	Description
Properties	Function model	default	default	Sets the operating mode supported by the module. TM5CAI8O8VL supports only one mode.
General	Module Address	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).

Set each of the I/O electronic modules individually using the **Pos.xx - SDEM** (SDEM = Short Description of the Electronic Module, like 12In, 6Out, 4AI  $\pm 10$  V / 0-20 mA / 4-20 mA etc.) folders available.

#### NOTE:

- **Pos.** stands for the position of the electronic module on the compact I/O electronic module.
- **xx** is the index number of the electronic module position (from 00 to 04).

The table provides the I/O electronic module type associated with the positions 0 to 4 (**Pos.00** to **Pos.04**) on the TM5CAI8O8VL compact I/O module:

I/O Electronic Module Position	Type	Refer to
Pos.00	4 analog inputs	Configuration of the analog input 4AI $\pm 10$ V electronic modules (see page 48)
Pos.01		
Pos.03	4 analog outputs	Configuration of the analog output 4AO $\pm 10$ V electronic module (see page 59)
Pos.04		

**NOTE:** Pos.02 does not appear in the **I/O Configuration** tab as this is the dummy module that cannot be configured.

For further generic descriptions, refer to I/O Configuration Tab Description (see page 18).

### Module Status

The **Island Summary** of the CANopen interface has 2 fields to indicate the status of the compact I/O and its electronic modules. Each field has a 8 bits encoding as shown below:

Bit	Description
0	StatusPos00 (ok = 1)
1	StatusPos01 (ok = 1)
2	Not used
3	StatusPos02 (ok = 1)
4	StatusPos03 (ok = 1)
5...7	Not used

Bit	Description
0...6	Not used
7	GlobalModuleStatus (ok = 0)

## TM5CAI8O8CL

### Introduction

The TM5CAI8O8CL compact I/O module is a set of four TM5 24 Vdc input and output electronic modules assembled together.

This set includes:

- 2 analog input electronic modules
- 1 dummy module (see *Modicon TM5, Compact I/O Modules, Hardware Guide*)
- 2 analog output electronic modules

For further information, refer to the TM5CAI8O8CL General Description (see *Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration Tab

To configure the TM5CAI8O8CL compact I/O module, select the **I/O Configuration** tab.

The table describes the parameters of the TM5CAI8O8CL compact I/O module:

Group / Parameter		Value	Default Value	Description
Properties	Function model	default	default	Sets the operating mode supported by the module. TM5CAI8O8CL supports only one mode.
General	Module Address	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).

Set each of the I/O electronic modules individually using the **Pos.xx - SDEM** (SDEM = Short Description of the Electronic Module, like 12In, 6Out, 4AI  $\pm 10$  V / 0-20 mA / 4-20 mA etc.) folders available.

#### NOTE:

- **Pos.** stands for the position of the electronic module on the compact I/O electronic module.
- **xx** is the index number of the electronic module position (from 00 to 04).

The table provides the I/O electronic module type associated with the positions 0 to 4 (**Pos.00** to **Pos.04**) on the TM5CAI8O8CL compact I/O module:

I/O Electronic Module Position	Type	Refer to
Pos.00	4 analog inputs	Configuration of the analog input 4AI 0-20 mA / 4-20 mA electronic modules ( <i>see page 50</i> )
Pos.01		
Pos.03	4 analog outputs	Configuration of the analog output 4AO 0-20 mA electronic module ( <i>see page 60</i> )
Pos.04		

**NOTE:** Pos.02 does not appear in the **I/O Configuration** tab as this is the dummy module that cannot be configured.

For further generic descriptions, refer to I/O Configuration Tab Description (*see page 18*).

### Module Status

The **Island Summary** of the CANopen interface has 2 fields to indicate the status of the compact I/O and its electronic modules. Each field has a 8 bits encoding as shown below:

Bit	Description
0	StatusPos00 (ok = 1)
1	StatusPos01 (ok = 1)
2	Not used
3	StatusPos02 (ok = 1)
4	StatusPos03 (ok = 1)
5...7	Not used

Bit	Description
0...6	Not used
7	GlobalModuleStatus (ok = 0)

## TM5CAI8O8CVL

### Introduction

The TM5CAI8O8CVL compact I/O module is a set of four TM5 24 Vdc input and output electronic modules assembled together.

This set includes:

- 2 analog input electronic modules
- 1 dummy module (see *Modicon TM5, Compact I/O Modules, Hardware Guide*)
- 2 analog output electronic modules

For further information, refer to the TM5CAI8O8CVL General Description (see *Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration Tab

To configure the TM5CAI8O8CVL compact I/O module, select the **I/O Configuration** tab.

The table describes the parameters of the TM5CAI8O8CVL compact I/O module:

Group / Parameter		Value	Default Value	Description
Properties	Function model	default	default	Sets the operating mode supported by the module. TM5CAI8O8CVL supports only one mode.
General	Module Address	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).

Set each of the I/O electronic modules individually using the **Pos.xx - SDEM** (SDEM = Short Description of the Electronic Module, like 12In, 6Out, 4AI  $\pm 10$  V / 0-20 mA / 4-20 mA etc.) folders available.

#### NOTE:

- **Pos.** stands for the position of the electronic module on the compact I/O electronic module.
- **xx** is the index number of the electronic module position (from 00 to 04).

The table provides the I/O electronic module type associated with the positions 0 to 4 (**Pos.00** to **Pos.04**) on the TM5CAI8O8CVL compact I/O module:

I/O Electronic Module Position	Type	Refer to
Pos.00	4 analog inputs	Configuration of the analog input 4AI $\pm 10$ V electronic modules (see page 48)
Pos.01	4 analog inputs	Configuration of the analog input 4AI 0-20 mA / 4-20 mA electronic modules (see page 50)
Pos.03	4 analog outputs	Configuration of the analog output 4AO $\pm 10$ V electronic module (see page 59)
Pos.04	4 analog outputs	Configuration of the analog output 4AO 0-20 mA electronic module (see page 60)

**NOTE:** Pos.02 does not appear in the **I/O Configuration** tab as this is the dummy module that cannot be configured.

For further generic descriptions, refer to I/O Configuration Tab Description (see page 18).

### Module Status

The **Island Summary** of the CANopen interface has 2 fields to indicate the status of the compact I/O and its electronic modules. Each field has a 8 bits encoding as shown below:

Bit	Description
0	StatusPos00 (ok = 1)
1	StatusPos01 (ok = 1)
2	Not used
3	StatusPos02 (ok = 1)
4	StatusPos03 (ok = 1)
5...7	Not used

Bit	Description
0...6	Not used
7	GlobalModuleStatus (ok = 0)

## 2.2 Integrated Electronic Modules

### Introduction

This section provides the electronic modules parameters available in order to configure the compact I/O modules.

### What's in this Section?

This section contains the following topics:

Topic	Page
Digital Input 4In	40
Digital Input 6In	41
Digital Input 12In	42
Digital Output 4Out	43
Digital Output 6Out	45
Digital Output Relay 6Rel	47
Analog Input 4AI $\pm 10$ V	48
Analog Input 4AI 0-20 mA / 4-20 mA	50
Analog Input 4AI $\pm 10$ V / 0-20 mA / 4-20 mA	52
Analog Output 4AO $\pm 10$ V	59
Analog Output 4AO 0-20 mA	60
Analog Output 2AO $\pm 10$ V / 0-20 mA	61

## Digital Input 4In

### Overview

The Digital Input 4In electronic module is a 24 Vdc electronic module with 4 inputs. For further information, refer to the description of this electronic module in the Compact I/O Modules Hardware Guide (see *Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration

The table describes the 4In electronic module parameters configuration:

Parameter	Value	Default Value	Description
Enable	on off	off	Enables / Disables the related electronic module. This could reduce the number of PDOs exchanged on the CANopen bus. PDOs of an un-used electronic module cannot be mapped.
Input filter	0...250	10	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms).
Power sensor current	0 mA 100 mA 200 mA 300 mA 400 mA 500 mA	500 mA	Set the current to supply the sensors connected to the module. This value is used to balance consumption current on the 24Vdc I/O power segment (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ). Electronic module configuration is not changed by this variable.

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)	
	Without filter	With filter
Minimum cycle time	100	150
Minimum I/O update time	100	200



## Digital Input 6In

### Overview

The Digital Input 6In electronic module is a 24 Vdc electronic module with 6 inputs. For further information, refer to the description of this electronic module in the Compact I/O Modules Hardware Guide (see *Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration

The table describes the 6In electronic module parameters configuration:

Parameter	Value	Default Value	Description
Enable	on off	off	Enables / Disables the related electronic module. This could reduce the number of PDOs exchanged on the CANopen bus. PDOs of an un-used electronic module cannot be mapped.
Input filter	0...250	10	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms).

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value ( $\mu$ s)	
	Without filter	With filter
Minimum cycle time	100	150
Minimum I/O update time	100	200

## Digital Input 12In

### Overview

The Digital Input 12In electronic module is a 24 Vdc electronic module with 12 inputs.

For further information, refer to the description of this electronic module in the Compact I/O Modules Hardware Guide (*see Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration

The table describes the 12In electronic module parameters configuration:

Parameter	Value	Default Value	Description
Enable	on off	off	Enables / Disables the related electronic module. This could reduce the number of PDOs exchanged on the CANopen bus. PDOs of an un-used electronic module cannot be mapped.
Input filter	0...250	10	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms).

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)	
	Without filter	With filter
Minimum cycle time	100	150
Minimum I/O update time	100	200

## Digital Output 4Out

### Overview

The Digital Output 4Out electronic module is a 24 Vdc electronic module with 4 outputs.

For further information, refer to the description of this electronic module in the Compact I/O Modules Hardware Guide (*see Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration

The table describes the 4Out electronic module parameters configuration:

Parameter	Value	Default Value	Description
Enable	on off	off	Enables / Disables the related electronic module. This could reduce the number of PDOs exchanged on the CANopen bus. PDOs of an un-used electronic module cannot be mapped.
Output status	off on	on	on: Reads the output status.
Power Actuator Current	0 mA 100 mA 200 mA 300 mA 400 mA 500 mA	500 mA	Set the current to supply actuators connected to the module. This value is used to balance consumption current on the 24 Vdc I/O power segment ( <i>see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide</i> ). Electronic module configuration is not changed by this variable.
Total Output Current	500 mA 1000 mA 1500 mA 2000 mA	2000 mA	Set the maximum current calculated, as determined by the requirements of the actuators, for all simultaneously activated outputs. This value is used to balance consumption current on the 24 Vdc I/O power segment ( <i>see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide</i> ). Electronic module configuration is not changed by this variable.

Parameter		Value	Default Value	Description
Channel 00 Channel 01 Channel 02 Channel 03	FallBack Mode	Set to 0 Set to 1 Last current state	Set to 0	Set the fall back mode in case of communication loss on the field bus. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5 / TM7 bus. In this case, the outputs assume the value of 0.

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)
Minimum cycle time	100
Minimum I/O update time	100

## Digital Output 6Out

### Overview

The Digital Output 6Out electronic module is a 24 Vdc electronic module with 6 outputs.

For further information, refer to the description of this electronic module in the Compact I/O Modules Hardware Guide (*see Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration

The table describes the 6Out electronic module parameters configuration:

Parameter		Value	Default Value	Description
Enable		on off	off	Enables / Disables the related electronic module. This could reduce the number of PDOs exchanged on the CANopen bus. PDOs of an un-used electronic module cannot be mapped.
Output status		off on	on	on: Reads the output status.
Total Output Current		500 mA 1000 mA 2000 mA 3000 mA	3000 mA	Current derived from the 24 Vdc I/O power segment. The value to set is the sum of current of all outputs simultaneously activated. It is used to balance current consumption on the 24 Vdc I/O power segment ( <i>see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide</i> ). This value is used exclusively in the calculation of the <b>Check Resources</b> function.
Channel 00 Channel 01 Channel 02 Channel 03 Channel 04 Channel 05	FallBack Mode	Set to 0 Set to 1 Last current state	Set to 0	Set the fall back mode in case of communication loss on the field bus. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5 / TM7 bus. In this case, the outputs assume the value of 0.

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value ( $\mu\text{s}$ )
Minimum cycle time	100
Minimum I/O update time	100

## Digital Output Relay 6Rel

### Overview

The Digital Output Relay 6Rel electronic module is equipped with 6 relay outputs. For further information, refer to the description of this electronic module in the Compact I/O Modules Hardware Guide (see *Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration

The table describes the 6Rel electronic module parameters configuration:

Parameter		Value	Default Value	Description
Enable		on off	off	Enables / Disables the related electronic module. This could reduce the number of PDOs exchanged on the CANopen bus. PDOs of an un-used electronic module cannot be mapped.
Channel 00 Channel 01 Channel 02 Channel 03 Channel 04 Channel 05	FallBack Mode	Set to 0 Set to 1 Last current state	Set to 0	Set the fall back mode in case of communication loss on the field bus. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5 / TM7 bus. In this case, the outputs assume the value of 0.

## Analog Input 4AI $\pm 10$ V

### Overview

The Analog Input 4AI  $\pm 10$  V electronic module is equipped with 4 12-bit inputs.

For further information, refer to the description of this electronic module in the Compact I/O Modules Hardware Guide (see *Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration

The table describes the 4AI  $\pm 10$  V electronic module parameters configuration:

Parameter		Value	Default Value	Description
Enable		on off	off	Enables / Disables the related electronic module. This could reduce the number of PDOs exchanged on the CANopen bus. PDOs of an un-used electronic module cannot be mapped.
Input status		on off	off	on: Reads the diagnostic status of the inputs.
Channel 00 Channel 01 Channel 02 Channel 03	Channel type	$\pm 10$ V	$\pm 10$ V	Specifies the channel type. You cannot change this parameter.
	Delta Interrupt Mode	Checked Unchecked	Checked	Activates the delta interrupt mode. Delta interrupt mode defines the delta value which may trigger a PDO send.
	Delta Interrupt Value	0...10000	100	Sets the delta interrupt value. <b>NOTE:</b> Sets the highest value compatible with your application to avoid unnecessary communication on the bus.
	Lower Limit Mode	Checked Unchecked	Unchecked	Activates the lower limit interrupt mode. Lower limit interrupt mode defines the lower limit which will trigger communication on the bus.
	Lower Limit Value	-32768...32767	-32768	Sets the lower limit value.
	Upper Limit Mode	Checked Unchecked	Unchecked	Activates the upper limit interrupt mode. Upper limit interrupt mode defines the upper limit which will trigger communication on the bus.
	Upper Limit Value	-32768...32767	32767	Sets the upper limit value.

### Analog Inputs

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.



### Status Information Register

The **StatusInput** byte describes the status of each input channel:

Bit	Description	Bits value
0-1	Channel 00 status	00: No detected error 01: Below Minimum value 10: Above Maximum value 11: Broken wire detected
2-3	Channel 01 status	
4-5	Channel 02 status	
6-7	Channel 03 status	

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value ( $\mu$ s)	
	Without filter	With filter
Minimum cycle time	100	500
Minimum I/O update time	300	1000

## Analog Input 4AI 0-20 mA / 4-20 mA

### Overview

The Analog Input 4AI 0-20 mA / 4-20 mA electronic module is equipped with 4 12-bit inputs.

For further information, refer to the description of this electronic module in the Compact I/O Modules Hardware Guide (see *Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration

The table describes the 4AI 0-20 mA / 4-20 mA electronic module parameters configuration:

Parameter		Value	Default Value	Description	
Enable		on off	off	Enables / Disables the related electronic module. This could reduce the number of PDOs exchanged on the CANopen bus. PDOs of an un-used electronic module cannot be mapped.	
Input status		on off	off	on: Reads the diagnostic status of the inputs.	
Channel 00 Channel 01 Channel 02 Channel 03	Channel type	0...20 mA 4...20 mA	0...20 mA	Specifies the channel type.	
	Delta Interrupt Mode	Checked Unchecked	Checked	Activates the delta interrupt mode. Delta interrupt mode defines the delta value which may trigger a PDO send.	
	Delta Interrupt Value	0...10000	100	Sets the delta interrupt value. <b>NOTE:</b> Sets the highest value compatible with your application to avoid unnecessary communication on the bus.	
	Lower Limit Mode	Checked Unchecked	Unchecked	Activates the lower limit interrupt mode. Lower limit interrupt mode defines the lower limit which will trigger communication on the bus.	
	Lower Limit Value	0...20 mA	0...32767	0	Sets the lower limit value.
		4...20 mA	-8192...32767		
	Upper Limit Mode	Checked Unchecked	Unchecked	Activates the upper limit interrupt mode. Upper limit interrupt mode defines the upper limit which will trigger communication on the bus.	
	Upper Limit Value	0...20 mA	0...32767	32767	Sets the upper limit value.
4...20 mA		-8192...32767			

## Analog Inputs

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

## Status Information Register

The **StatusInput** byte describes the status of each input channel:

Bit	Description	Bits value
0-1	Channel 00 status	00: No detected error 01: Below Minimum value 10: Above Maximum value
2-3	Channel 01 status	
4-5	Channel 02 status	
6-7	Channel 03 status	

## Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value ( $\mu$ s)	
	Without filter	With filter
Minimum cycle time	100	500
Minimum I/O update time	300	1000

## Analog Input 4AI $\pm 10$ V / 0-20 mA / 4-20 mA

### Overview

The Analog Input 4AI  $\pm 10$  V / 0-20 mA / 4-20 mA electronic module is equipped with 4 12-bit inputs.

For further information, refer to the description of this electronic module in the Compact I/O Modules Hardware Guide (*see Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration

The table below describes the 4AI  $\pm 10$  V / 0-20 mA / 4-20 mA electronic module parameters configuration:

Parameter	Value	Default Value	Description
Enable	on off	off	Enables / Disables the related electronic module. This could reduce the number of PDOs exchanged on the CANopen bus. PDOs of an un-used electronic module cannot be mapped.
Input filter	on off	off	Enables / Disables the input filter ( <i>see page 55</i> ).
Input status	on off	off	on: Reads the diagnostic status of the inputs.
Minimum value	-32768...32767	-32768	Specifies the minimum measurement value ( <i>see page 54</i> ).
Maximum value	-32768...32767	32767	Specifies the maximum measurement value ( <i>see page 54</i> ).

Parameter		Value	Default Value	Description
Channel 00 Channel 01 Channel 02 Channel 03	Channel type	±10 V 0...20 mA 4...20 mA	±10 V	Specifies the channel type.
	Delta Interrupt Mode	Checked Unchecked	Checked	Activates the delta interrupt mode. Delta interrupt mode defines the delta value which may trigger a PDO send.
	Delta Interrupt Value	0...10000	100	Sets the delta interrupt value. <b>NOTE:</b> Sets the highest value compatible with your application to avoid unnecessary communication on the bus.
	Lower Limit Mode	Checked Unchecked	Unchecked	Activates the lower limit interrupt mode. Lower limit interrupt mode defines the lower limit which will trigger communication on the bus.
	Lower Limit Value	±10 V -32768...32767	-32768	Sets the lower limit value.
		0...20 mA 0...32767	0	
		4...20 mA -8192...32767	0	
	Upper Limit Mode	Checked Unchecked	Unchecked	Activates the upper limit interrupt mode. Upper limit interrupt mode defines the upper limit which will trigger communication on the bus.
	Upper Limit Value	±10 V -32768...32767	32767	Sets the upper limit value.
		0...20 mA 0...32767		
		4...20 mA -8192...32767		

## Analog Inputs

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

## Input Cycle

The electronic module is equipped with a configurable Input cycle. Filtering is deactivated for shorter cycle times.

If the Input cycle is active, then the channels are scanned in ms cycles. The time offset between the channels is 200 µs. The conversion takes place asynchronously to the network cycle. Refer to Cycle time and I/O update time (*see page 58*).

**Limit values**

You can define 2 different type of limits:

- **Minimum value**
- **Maximum value**

The **Minimum value** range is between -32768 to 32767. This value is applied on every channel of the module being configured.

**NOTE:** The **Minimum value** cannot be greater than the **Maximum value**.

Channel Configuration	Digital Value Behavior	Comments
± 10V	-10 V = -32768 +10 V = +32767	If the <b>Minimum value</b> is configured between -32768 and +32767, the digital value is limited to the <b>Minimum value</b> .
0 to 20 mA	0 mA = 0 20 mA = +32767	If the <b>Minimum value</b> is configured between -32768 and 0, the digital value is limited to 0. If the <b>Minimum value</b> is configured between 0 and 32 767, the digital value is limited to the <b>Minimum value</b> .
4 to 20 mA	0 mA = -8192 4 mA = 0 20 mA = +32767	If the <b>Minimum value</b> is configured between -32768 and -8192, the digital value is limited to -8192. If the <b>Minimum value</b> is configured between -8192 and 32767, the digital value is limited to the <b>Minimum value</b> .

The **Maximum value** range is between -32768 to 32767. This value is applied on every channel of the module being configured.

**NOTE:** The **Maximum value** cannot be less than the **Minimum value**.

Channel Configuration	Digital Value Behavior	Comments
± 10V	-10 V = -32768 +10 V = +32767	If the <b>Maximum value</b> is configured between -32768 and +32767, the digital value is limited to the <b>Maximum value</b> .
0 to 20 mA	0 mA = 0 20 mA = +32767	If the <b>Maximum value</b> is configured between -32768 and 0, the digital value stays at 0, hence, the <b>Maximum value</b> must be set to a positive value. If the <b>Maximum value</b> is configured between 1 and +32767, the digital value is limited to the <b>Maximum value</b> .
4 to 20 mA	0 mA = -8192 4 mA = 0 20 mA = +32767	If the <b>Maximum value</b> is configured between -32768 and -8192, the digital value is limited to -8192. If the <b>Maximum value</b> is configured between -8192 and 32767, the digital value is limited to the <b>Maximum value</b> .

## Filter Level

The input value is evaluated according to the filter level. An input ramp limitation can then be applied using this evaluation.

Formula for the evaluation of the input value:

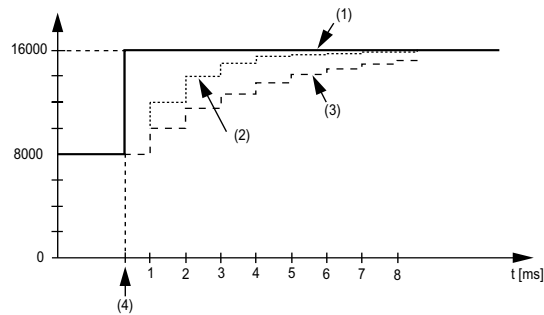
$$Value_{new} = Value_{old} - \frac{Value_{old}}{Filterlevel} + \frac{Inputvalue}{Filterlevel}$$

The following examples show the function of the input ramp limitation based on an input jump and a disturbance.

**Example 1:** The input value makes a jump from 8,000 to 16,000. The diagram displays the evaluated value with the following settings:

Input ramp limitation = 0

Filter level = 2 or 4

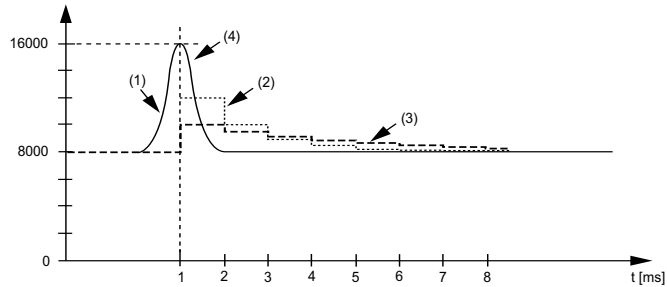


- 1 Input value
- 2 Evaluated value: Filter level 2
- 3 Evaluated value: Filter level 4
- 4 Input jump

**Example 2:** A disturbance is imposed on the input value. The diagram shows the evaluated value with the following settings:

Input ramp limitation = 0

Filter level = 2 or 4



- 1 Input value.
- 2 Evaluated value: Filter level 2
- 3 Evaluated value: Filter level 4
- 4 Disturbance (Spike)

## Input Ramp Limitation

Input ramp limitation can only take place when a filter is used. Input ramp limitation is executed before filtering takes place.

The amount of the change in the input value is checked to make sure the specified limits are not exceeded. If the values are exceeded, the adjusted input value is equal to the old value  $\pm$  the limit value.

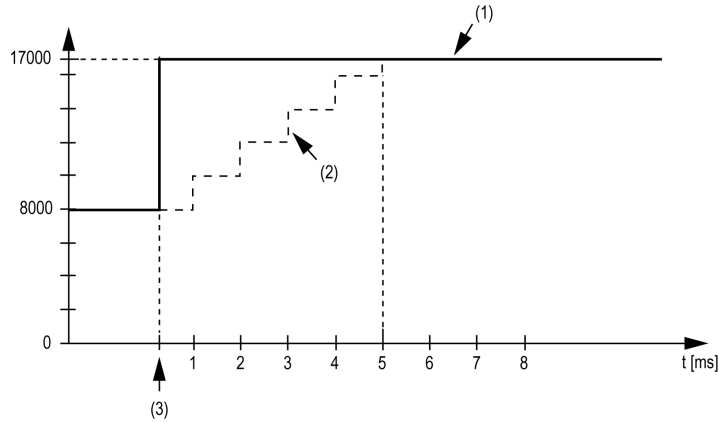
The input ramp limitation is well suited for suppressing disturbances (spikes). The following examples show the function of the input ramp limitation based on an input jump and a disturbance.



**Example 1:** The input value makes a jump from 8,000 to 17,000. The diagram displays the adjusted input value for the following settings:

Input ramp limitation = 2047

Filter level = 2

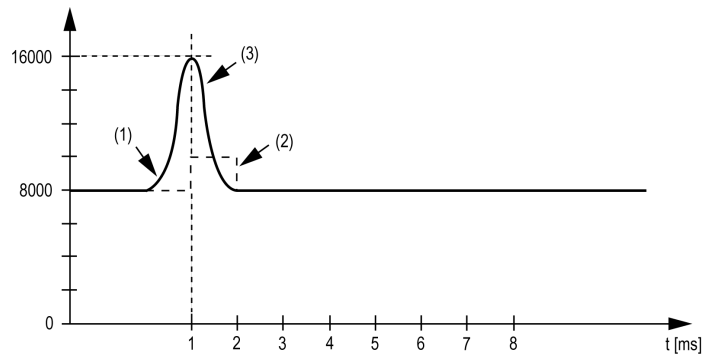


- 1 Input value
- 2 Internal adjusted input value before filter
- 3 Input jump

**Example 2:** A disturbance is imposed on the input value. The diagram shows the adjusted input value with the following settings:

Input ramp limitation = 2047

Filter level = 2



- 1 Input value
- 2 Internal adjusted input value before filter
- 3 Disturbance (Spike)

### Status Information Register

The **StatusInput** byte describes the status of each input channel:

Bit	Description	Bits value
0-1	Channel 00 status	00: No detected error
2-3	Channel 01 status	01: Below Minimum value <sup>1</sup>
4-5	Channel 02 status	10: Above Maximum value
6-7	Channel 03 status	11: Broken wire detected (only for voltage configuration)
<sup>1</sup> Current signal 0...20 mA <u>Default setting:</u> The input value has a Minimum value. Underflow monitoring is, therefore, not necessary. <u>After Minimum value changes:</u> The input value is limited to the set value. The status bit is set when the Minimum value is passed.		

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)	
	Without filter	With filter
Minimum cycle time	100	500
Minimum I/O update time	300	1000

## Analog Output 4AO $\pm 10$ V

### Overview

The Analog Output 4AO  $\pm 10$  V electronic module is equipped with 4 12-bit outputs. For further information, refer to the description of this electronic module in the Compact I/O Modules Hardware Guide (see *Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration

The table describes the 4AO  $\pm 10$  V electronic module parameters configuration:

Parameter		Value	Default Value	Description
Enable		on off	off	Enables / Disables the related electronic module. This could reduce the number of PDOs exchanged on the CANopen bus. PDOs of an un-used electronic module cannot be mapped.
Channel 00 Channel 01 Channel 02 Channel 03	Output Type	$\pm 10$ V	$\pm 10$ V	Specifies the channel type. You cannot change this parameter.
	FallBack Mode	Min. value Set to 0 Max. value Last current state Predefined value	Set to 0	Set the fall back mode in case of communication loss on the field bus. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5 / TM7 bus. In this case, the outputs assume the value of 0.
	FallBack Value	-32768...32767	0	Sets the fall back value to a fixed value.

### Cycle Time and I/O Update Time

The table gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value ( $\mu$ s)
Minimum cycle time	250
Minimum I/O update time	< 300

## Analog Output 4AO 0-20 mA

### Overview

The Analog Output 4AO 0-20 mA electronic module is equipped with 4 12-bit outputs.

For further information, refer to the description of this electronic module in the Compact I/O Modules Hardware Guide (*see Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration

The table describes the 4AO 0-20 mA electronic module parameters configuration:

Parameter		Value	Default Value	Description
Enable		on off	off	Enables / Disables the related electronic module. This could reduce the number of PDOs exchanged on the CANopen bus. PDOs of an un-used electronic module cannot be mapped.
Channel 00 Channel 01 Channel 02 Channel 03	Output Type	0...20 mA	0...20 mA	Specifies the channel type. You cannot change this parameter.
	FallBack Mode	Set to 0 Max. value Last current state Predefined value	Set to 0	Set the fall back mode in case of communication loss on the field bus. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5 / TM7 bus. In this case, the outputs assume the value of 0.
	FallBack Value	0...32767	0	Sets the fall back value to a fixed value.

### Cycle Time and I/O Update Time

The table gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)
Minimum cycle time	250
Minimum I/O update time	< 300

## Analog Output 2AO $\pm 10$ V / 0-20 mA

### Overview

The Analog Output 2AO  $\pm 10$  V / 0-20 mA electronic module is equipped with 2 12-bit outputs.

For further information, refer to the description of this electronic module in the Compact I/O Modules Hardware Guide (see *Modicon TM5, Compact I/O Modules, Hardware Guide*).

### I/O Configuration

The table below describes the 2AO  $\pm 10$  V / 0-20 mA electronic module parameters configuration:

Parameter		Value	Default Value	Description
Enable		on off	off	Enables / Disables the related electronic module. This could reduce the number of PDOs exchanged on the CANopen bus. PDOs of an un-used electronic module cannot be mapped.
Channel 00 Channel 01	Output Type	$\pm 10$ V 0...20mA	$\pm 10$ V	Specifies the channel type. You cannot change this parameter.
	FallBack Mode	Min. Value Set to 0 Max. value Last current state Predefined value	Set to 0	Set the fall back mode in case of communication loss on the field bus. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5 / TM7 bus. In this case, the outputs assume the value of 0.
	FallBack Value	- 32768...32767	0	Sets the fall back value to a fixed value.

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value ( $\mu$ s)
Minimum cycle time	250
Minimum I/O update time	< 300



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# TM5 Digital I/O Modules

# 3

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## Introduction

This chapter provides information to configure digital I/O expansion modules.

To add expansion modules and to access the configuration screens, refer to Adding a TM5 Expansion Module (*see page 18*).

## What's in this Chapter?

This chapter contains the following topics:

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TM5SDI2D and TM5SDI4D	64
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## TM5SDI2D and TM5SDI4D

### Introduction

The TM5SDI2D and TM5SDI4D expansion electronic modules are 24 Vdc digital input electronic modules with 2 and 4 inputs respectively.

For further information, refer to the Hardware Guide:

Reference	Refer to
TM5SDI2D	TM5SDI2D Electronic Module 2DI 24 Vdc Sink (see <i>Modicon TM5, Digital I/O Modules, Hardware Guide</i> )
TM5SDI4D	TM5SDI4D Electronic Module 4DI 24 Vdc Sink (see <i>Modicon TM5, Digital I/O Modules, Hardware Guide</i> )

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SDI... supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 allows you to change the address.
	<b>Terminal block</b>	TM5ACTB06 TM5ACTB12	TM5ACTB06	Specifies the terminal block associated with the electronic module.
	<b>Input filter</b>	0...250	10	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms).
	<b>Power sensor current</b>	0 mA 100 mA 200 mA 300 mA 400 mA 500 mA	500 mA	Set the current to supply the sensors connected to the module. This value is used to balance consumption current on the 24Vdc I/O power segment (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ). Electronic module configuration is not changed by this variable.



**Cycle Time and I/O Update Time**

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

<b>Characteristic</b>	<b>Value (<math>\mu</math>s)</b>	
	<b>Without filter</b>	<b>With filter</b>
Minimum cycle time	100	150
Minimum I/O update time	100	200

## TM5SDI2A, TM5SDI4A and TM5SDI6U

### Introduction

The TM5SDI2A, TM5SDI4A and TM5SDI6U expansion electronic modules are 100-240 Vac input electronic modules with 2, 4 and 6 inputs respectively.

For further information, refer to the Hardware Guide:

Reference	Refer to
TM5SDI2A	TM5SDI2A Electronic Module 2DI 100...240 Vac 3 Wires (see <i>Modicon TM5, Digital I/O Modules, Hardware Guide</i> )
TM5SDI4A	TM5SDI4A Electronic Module 4DI 100...240 Vac 2 Wires (see <i>Modicon TM5, Digital I/O Modules, Hardware Guide</i> )
TM5SDI6U	TM5SDI6U Electronic Module 6DI 100...120 Vac 1 Wire (see <i>Modicon TM5, Digital I/O Modules, Hardware Guide</i> )

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SDI... supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM12	TM5ACBM12	Specifies the bus base associated with the electronic module.
	<b>Terminal block</b>	TM5ACTB32	TM5ACTB32	Specifies the terminal block associated with the electronic module.
	<b>Input filter</b>	0...250	10	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms).

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)	
	Without filter	With filter
Minimum cycle time	100	150
Minimum I/O update time	100	200

## TM5SDI6D and TM5SDI12D

### Introduction

The TM5SDI6D and TM5SDI12D expansion electronic modules are 24 Vdc digital input electronic modules with 6 and 12 inputs respectively.

For further information, refer to the Hardware Guide:

Reference	Refer to
TM5SDI6D	TM5SDI6D Electronic Module 6DI 24 Vdc Sink (see <i>Modicon TM5, Digital I/O Modules, Hardware Guide</i> )
TM5SDI12D	TM5SDI12D Electronic Module 12DI 24 Vdc Sink (see <i>Modicon TM5, Digital I/O Modules, Hardware Guide</i> )

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SDI... supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 allows you to change the address.
	<b>Terminal block</b>	TM5ACTB06 (TM5SDI6D only) TM5ACTB12	TM5ACTB12	Specifies the terminal block associated with the electronic module.
	<b>Input filter</b>	0...250	10	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms).

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value ( $\mu$ s)	
	Without filter	With filter
Minimum cycle time	100	150
Minimum I/O update time	100	200

## TM5SDO2T, TM5SDO4T, TM5SDO6T and TM5SDO12T

### Introduction

The TM5SDO2T, TM5SDO4T, TM5SDO6T and TM5SDO12T expansion electronic modules are 24 Vdc digital outputs electronic modules with 2, 4, 6 or 12 outputs respectively.

For further information, refer to the Hardware Guide:

Reference	Refer to
TM5SDO2T	TM5SDO2T Electronic Module 2DO 24 Vdc Tr 0.5 A 3 Wires ( <i>see Modicon TM5, Digital I/O Modules, Hardware Guide</i> )
TM5SDO4T	TM5SDO4T Electronic Module 4DO 24 Vdc Tr 0.5 A 3 wires ( <i>see Modicon TM5, Digital I/O Modules, Hardware Guide</i> )
TM5SDO6T	TM5SDO6T Electronic Module 6DO 24 Vdc Tr 0.5 A 2 wires ( <i>see Modicon TM5, Digital I/O Modules, Hardware Guide</i> )
TM5SDO12T	TM5SDO12T Electronic Module 12DO 24 Vdc Tr 0.5 A 1 wire ( <i>see Modicon TM5, Digital I/O Modules, Hardware Guide</i> )

## I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SDO... supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 allows you to change the address.
	<b>Terminal block</b>	TM5ACTB06 TM5SDO6T only TM5ACTB12	TM5ACTB12	Specifies the terminal block associated with the electronic module.
	<b>Output status</b>	On Off	Off	On: Reads the output status.
	<b>Total output current (for TM5SDO2T)</b>	200 mA 400 mA 600 mA 800 mA 1000 mA	1000 mA	Set the maximum current calculated, as determined by the requirements of the actuators, for all simultaneously activated outputs. This value is used to balance consumption current on the 24Vdc I/O power segment ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ). Electronic module configuration is not changed by this variable.

Group/Parameter	Value	Default Value	Description
	<b>Total output current</b> (for TM5SDO4T)	500 mA 1000 mA 1500 mA 2000 mA	2000 mA  Set the maximum current calculated, as determined by the requirements of the actuators, for all simultaneously activated outputs. This value is used to balance consumption current on the 24Vdc I/O power segment (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ). Electronic module configuration is not changed by this variable.
	<b>Total output current</b> (for TM5SDO6T)	500 mA 1000 mA 2000 mA 3000 mA	3000 mA  Set the maximum current calculated, as determined by the requirements of the actuators, for all simultaneously activated outputs. This value is used to balance consumption current on the 24Vdc I/O power segment (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ). Electronic module configuration is not changed by this variable.
	<b>Total Output current</b> (for TM5SDO12T)	1000 mA 2000 mA 3000 mA 4000 mA 6000 mA	3000 mA  Set the maximum current calculated, as determined by the requirements of the actuators, for all simultaneously activated outputs. This value is used to balance consumption current on the 24Vdc I/O power segment (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ). Electronic module configuration is not changed by this variable.
	<b>Power actuator current</b> (for TM5SDO2T, TM5SDO4T)	0 mA 100 mA 200 mA 300 mA 400 mA 500 mA	500 mA  Set the current to supply actuators connected to the module. This value is used to balance consumption current on the 24Vdc I/O power segment (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ). Electronic module configuration is not changed by this variable

Group/Parameter		Value	Default Value	Description
Channel 00*	Fall back mode	Set to 0 Set to 1 Last current state	Set to 0	Set the fall back mode in case of communication loss on the field bus. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5/TM7 bus. In this case the outputs assume the value of 0.

\* The same channel 00 parameters are also available for:

- channel 01 (TM5SDO2T)
- channel 01...03 (TM5SDO4T)
- channel 01...05 (TM5SDO6T)
- channel 01...11 (TM5SDO12T)

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)
Minimum cycle time	100
Minimum I/O update time	100

## TM5SDO4TA and TM5SDO8TA

### Introduction

The TM5SDO4TA and TM5SDO8TA expansion electronic modules are 24 Vdc digital output electronic modules with 4 and 8 outputs respectively.

For further information, refer to the Hardware Guide:

Reference	Refer to
TM5SDO4TA	TM5SDO4TA Electronic Module 4DO 24 Vdc Tr 2 A 3 Wires ( <i>see Modicon TM5, Digital I/O Modules, Hardware Guide</i> )
TM5SDO8TA	TM5SDO8TA Electronic Module 8DO 24 Vdc Tr 2 A 1 Wire ( <i>see Modicon TM5, Digital I/O Modules, Hardware Guide</i> )



## I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SDO... supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 allows you to change the address.
	<b>Terminal block</b>	TM5ACTB12	TM5ACTB12	Specifies the terminal block associated with the electronic module.
	<b>Output status</b>	On Off	Off	On: Reads the output status.
	<b>Total Output current</b> (for TM5SDO4TA)	1000 mA 2000 mA 3000 mA 4000 mA 6000 mA	3000 mA	Set the maximum current calculated, as determined by the requirements of the actuators, for all simultaneously activated outputs. This value is used to balance consumption current on the 24Vdc I/O power segment ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ). Electronic module configuration is not changed by this variable.
	<b>Power actuator current</b> (for TM5SDO4TA)	0 mA 100 mA 200 mA 300 mA 400 mA 500 mA	500 mA	Set the current to supply actuators connected to the module. This value is used to balance consumption current on the 24Vdc I/O power segment ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ). Electronic module configuration is not changed by this variable.
	<b>External power status</b> (for TM5SDO8TA)	On Off	Off	On: Reads the external 24 Vdc output power supply status.

Group/Parameter	Value	Default Value	Description
<b>Channel 00*</b>	<b>Fall back mode</b>	Set to 0 Set to 1 Last current state	Set the fall back mode in case of communication loss on the field bus. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5/TM7 bus. In this case the outputs assume the value of 0.

\* The same channel 00 parameters are also available for:

- channel 01...03 (TM5SDO4TA)
- channel 01...07 (TM5SDO8TA)

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)
Minimum cycle time	100
Minimum I/O update time	100

## TM5SDO2R and TM5SDO4R

### Introduction

The TM5SDO2R and TM5SDO4R expansion electronic modules are 30 Vdc / 230 Vac relay digital outputs electronic modules with 2 and 4 outputs respectively.

For further information, refer to the Hardware Guide:

Reference	Refer to
TM5SDO2R	TM5SDO2R Electronic Module 2DO 30 Vdc/230 Vac 5A Relay C/O (see <i>Modicon TM5, Digital I/O Modules, Hardware Guide</i> )
TM5SDO4R	TM5SDO4R Electronic Module 4DO 30 Vdc / 230 Vac 5 A Relay N/O (see <i>Modicon TM5, Digital I/O Modules, Hardware Guide</i> )

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SDO... supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM12	TM5ACBM12	Specifies the bus base associated with the electronic module.
	<b>Terminal block</b>	TM5ACTB32	TM5ACTB32	Specifies the terminal block associated with the electronic module.
<b>Channel 00</b>	<b>Fall back mode</b>	Set to 0 Set to 1 Last current state	Set to 0	Set the fall back mode in case of communication loss on the field bus. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5/TM7 bus. In this case the outputs assume the value of 0.

The same channel 00 parameters are also available for:

- channel 01(TM5SDO2R)
- channel 01...03 (TM5SDO4R)

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value ( $\mu\text{s}$ )
Minimum cycle time	100
Minimum I/O update time	100

## TM5SDO2S

### Introduction

The TM5SDO2S expansion electronic module is a 240 Vac Digital Outputs electronic module with 2 outputs.

For further information, refer to TM5SDO2S Electronic Module 2DO 240 Vac 1 A 3 wires.

### I/O Configuration Tab

To configure the TM5SDO2S electronic module, select the **I/O Configuration** tab.

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SDO2S supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab.
	<b>Bus base</b>	TM5ACBM12	TM5ACBM12	Specifies the bus base associated with the electronic module.
	<b>Terminal block</b>	TM5ACTB32	TM5ACTB32	Specifies the terminal block associated with the electronic module.
<b>Channel 00</b>	<b>Fall back mode</b>	Set to 0 Set to 1 Last current state	Set to 0	Set the fall back mode in case of communication loss on the field bus. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5/TM7 bus. In this case the outputs assume the value of 0.

The same channel 00 parameters are also available for channel 01.

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value ( $\mu$ s)
Minimum cycle time	100
Minimum I/O update time	100

## TM5SDM12DT

### Introduction

The TM5SDM12DT expansion electronic module is a 24 Vdc digital electronic module with 8 inputs and 4 outputs.

For further information, refer to TM5SDM12DT Electronic Module 8DI/4DO Tr 1 Wire (see *Modicon TM5, Digital I/O Modules, Hardware Guide*).

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SDM12DT supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 allows you to change the address.
	<b>Terminal block</b>	TM5ACTB12	TM5ACTB12	Specifies the terminal block associated with the electronic module.
	<b>Input filter</b>	0...250	10	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms).
	<b>Output status</b>	On Off	Off	On: Reads the output status.
	<b>Output current</b>	500 mA 1000 mA 1500 mA 2000 mA	2000 mA	Set the current for all activated outputs.
<b>Channel 00</b>	<b>Fall back mode</b>	Set to 0 Set to 1 Last current state	Set to 0	Set the fall back mode in case of communication loss on the field bus. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5/TM7 bus. In this case the outputs assume the value of 0.

The same channel 00 parameters are also available for channel 01...11.

**Cycle Time and I/O Update Time**

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

<b>Characteristic</b>	<b>Value (<math>\mu</math>s)</b>	
	<b>Without filter</b>	<b>With filter</b>
Minimum cycle time	100	150
Minimum I/O update time	100	200

## TM5SMM6D2L

### Introduction

The TM5SMM6D2L expansion electronic module is a mixed module with 4 digital inputs, 2 digital outputs, 1 analog input, and 1 analog output.

If you have wired your input for a voltage measurement, and you configure SoMachine for a current type of configuration, you may permanently damage the electronic module.

### **NOTICE**

#### **INOPERABLE EQUIPMENT**

Be sure that the physical wiring of the module is compatible with the software configuration for the module.

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

For further information, refer to TM5SMM6D2L Electronic Module 4DI/2DO 24Vdc Tr 0.5A / 1AI/1AO  $\pm 10V/0-20mA$  12 Bits 1 Wire (see *Modicon TM5, Digital I/O Modules, Hardware Guide*).



## I/O Configuration Tab

To configure the TM5SMM6D2L electronic module, select the **I/O Configuration** tab.

The table describes the modules parameters configuration:

Parameter		Value	Default Value	Description
Properties	Function model	default	default	Sets the operating mode supported by the module. TM5SMM6D2L supports only one mode.
General	Module Address	2...63	2	The address is automatically set when adding the modules. The address value depends on the order of adding the module in the SoMachine tree. The TM5ACBM15 supports the possibility to change the address.
	Bus Base	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module.
	Terminal Block	TM5ACTB12	TM5ACTB12	Specifies the terminal block associated with the electronic module.
Digital inputs	Input filter	0...250	10	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms).
Digital outputs	Output status	on off	off	on: Reads the output status.
	Total Output Current	250 mA 500 mA 1000 mA	1000 mA	The current of those outputs activated at the same time is adjusted to the selected value.
Channel 00 Channel 01	FallBack Mode	Set to 0 Set to 1 Last current state	Set to 0	Set the fall back mode in case of communication loss on the field bus. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5 / TM7 bus. In this case, the outputs assume the value of 0.

Parameter		Value	Default Value	Description
Analog inputs	Input filter	off level 2 level 4 level 8 level 16 level 32 level 64 level 128	off	Definition of the filter level ( <i>see page 85</i> ).
	Input status	on off	off	on: Reads the diagnostic status of the input.
	Minimum Value	-32768...32767	-32768	Specifies the lower measurement limit ( <i>see page 83</i> ).
	Maximum Value	-32768...32767	32767	Specifies the upper measurement limit ( <i>see page 83</i> ).
	Channel type	±10 V 0...20 mA 4...20 mA	±10 V	Specifies the channel type.
	Delta Interrupt Mode	Checked Unchecked	Checked	Activates the delta interrupt mode. The Delta interrupt mode uses the delta value to trigger a PDO send.
	Delta Interrupt Value	0...10000	100	Set the delta interrupt value. <b>NOTE:</b> Set a value to avoid unnecessary communication on the bus due to minor fluctuations of the analog conversion.
	Lower Limit Mode	Checked Unchecked	Unchecked	Activates the lower limit interrupt mode. Lower limit interrupt mode defines the lower limit which will trigger communication on the bus.
	Lower Limit Value	-32768...32767	-32768	Sets the lower limit value.
	Upper Limit Mode	Checked Unchecked	Unchecked	Activates the upper limit interrupt mode. Upper limit interrupt mode defines the upper limit which will trigger communication on the bus.
Upper Limit Value	-32768...32767	32767	Sets the upper limit value.	

Parameter		Value	Default Value	Description
Analog outputs	Fallback Configuration	on	on	Enable/Disable the fallback mode for the analog outputs.
	Output type	±10 V 0...20 mA	±10 V	Specifies the type of the output signal.
	FallBack Mode	Min. value Set to 0 Max. value Last current state Predefined value	Set to 0	Set the fall back mode in case of communication loss on the field bus. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5 / TM7 bus. In this case, the outputs assume the value of 0.
	FallBack Value	-32768...32767	0	Select a value the outputs will adopt in fall back mode if the parameter <b>FallBack Mode</b> is set to <b>Predefined value</b> .

For further generic descriptions, refer to I/O Configuration Tab Description (*see page 18*).

## Analog Inputs

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

## Input Cycle

The electronic module is equipped with a configurable Input cycle. Filtering is deactivated for shorter cycle times.

If the Input cycle is active, then the channels are scanned in ms cycles. The time offset between the channels is 200 µs. The conversion takes place asynchronously to the network cycle.

## Limit Values

You can define 2 different types of limits:

- **Minimum value**
- **Maximum value**

The **Minimum value** range is between -32768 and 32767. This value is applied on every channel of the module being configured.

**NOTE:** The **Minimum value** cannot be greater than the **Maximum value**.

Channel Configuration	Digital Value Behavior	Comments
± 10V	-10 V = -32768 +10 V = +32767	If the <b>Minimum value</b> is configured between -32768 and +32767, the digital value is limited to the <b>Minimum value</b> .
0...20 mA	0 mA = 0 20 mA = +32767	If the <b>Minimum value</b> is configured between -32768 and 0, the digital value is limited to 0. If the <b>Minimum value</b> is configured between 0 and 32767, the digital value is limited to the <b>Minimum value</b> .
4...20 mA	0 mA = -8192 4 mA = 0 20 mA = +32767	If the <b>Minimum value</b> is configured between -32768 and -8192, the digital value is limited to -8192. If the <b>Minimum value</b> is configured between -8192 and 32767, the digital value is limited to the <b>Minimum value</b> .

The **Maximum value** range is between -32768 and 32767. This value is applied on every channel of the module being configured.

**NOTE:** The **Maximum value** cannot be less than the **Minimum value**.

Channel Configuration	Digital Value Behavior	Comments
± 10V	-10 V = -32768 +10 V = +32767	If the <b>Maximum value</b> is configured between -32768 and +32767, the digital value is limited to the <b>Maximum value</b> .
0...20 mA	0 mA = 0 20 mA = +32767	If the <b>Maximum value</b> is configured between -32768 and 0, the digital value stays at 0, hence, the <b>Maximum value</b> must be set to a positive value. If the <b>Maximum value</b> is configured between 1 and +32767, the digital value is limited to the <b>Maximum value</b> .
4...20 mA	0 mA = -8192 4 mA = 0 20 mA = +32767	If the <b>Maximum value</b> is configured between -32768 and -8192, the digital value is limited to -8192. If the <b>Maximum value</b> is configured between -8192 and 32767, the digital value is limited to the <b>Maximum value</b> .

## Filter Level

The input value is evaluated according to the filter level. An input ramp limitation can then be applied using this evaluation.

Formula for the evaluation of the input value:

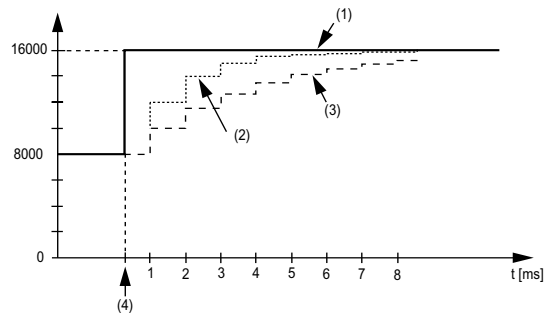
$$Value_{new} = Value_{old} - \frac{Value_{old}}{Filterlevel} + \frac{Inputvalue}{Filterlevel}$$

The following examples show the function of the input ramp limitation based on an input jump and a disturbance.

**Example 1:** The input value makes a jump from 8000 to 16000. The diagram displays the evaluated value with the following settings:

Input ramp limitation = 0

Filter level = 2 or 4

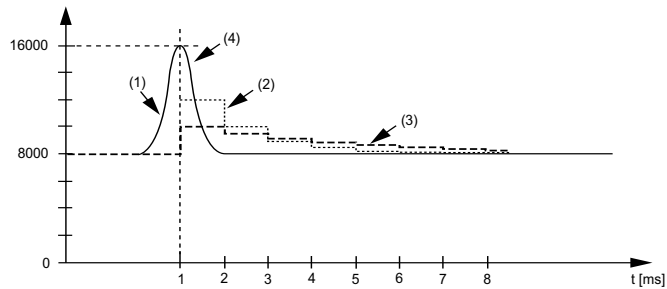


- 1 Input value.
- 2 Evaluated value: Filter level 2
- 3 Evaluated value: Filter level 4
- 4 Input jump

**Example 2:** A disturbance is imposed on the input value. The diagram shows the evaluated value with the following settings:

Input ramp limitation = 0

Filter level = 2 or 4



- 1 Input value
- 2 Evaluated value: Filter level 2
- 3 Evaluated value: Filter level 4
- 4 Disturbance (Spike)

## Input Ramp Limitation

Input ramp limitation can only take place when a filter is used. Input ramp limitation is executed before filtering takes place.

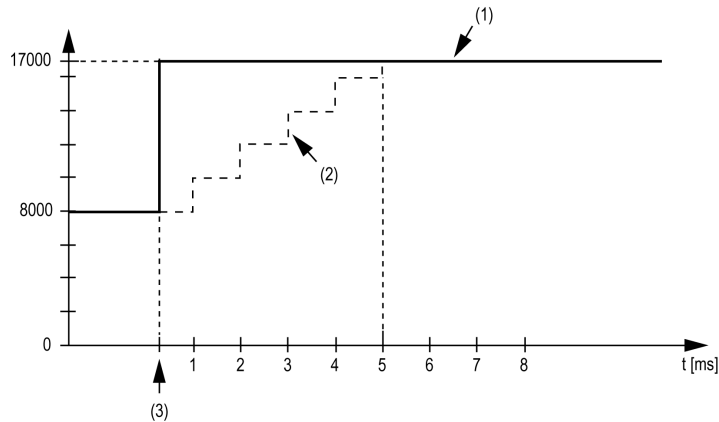
The amount of the change in the input value is checked to make sure the specified limits are not exceeded. If the values are exceeded, the adjusted input value is equal to the old value  $\pm$  the limit value.

The input ramp limitation is well suited for suppressing disturbances (spikes). The following examples show the function of the input ramp limitation based on an input jump and a disturbance.

**Example 1:** The input value makes a jump from 8,000 to 17,000. The diagram displays the adjusted input value for the following settings:

Input ramp limitation = 2047

Filter level = 2

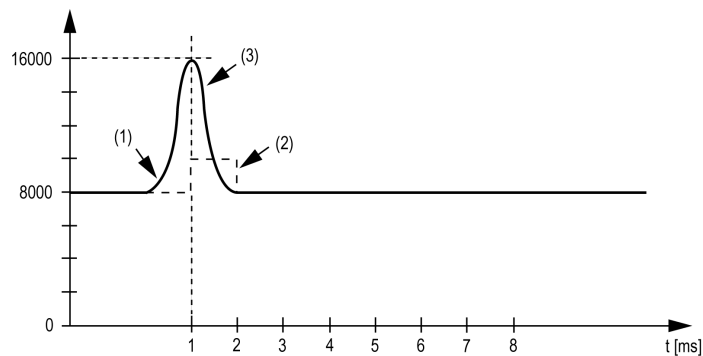


- 1 Input value
- 2 Internal adjusted input value before filter
- 3 Input jump

**Example 2:** A disturbance is imposed on the input value. The diagram shows the adjusted input value with the following settings:

Input ramp limitation = 2047

Filter level = 2



- 1 Input value
- 2 Internal adjusted input value before filter
- 3 Disturbance (Spike)

### Status Input Register

The **StatusInput** byte describes the status of the analog input channel:

Bit	Description	Bits value
0-1	Channel 00 status	00: No detected error 01: Below Minimum value <sup>1</sup> 10: Above Maximum value 11: Broken wire detection (only for voltage configuration)
<sup>1</sup> Current signal 0...20 mA <u>Default setting:</u> The input value has a Minimum value. Underflow monitoring is, therefore, not necessary. <u>After Minimum value changes:</u> The input value is limited to the set value. The status bit is set when the Minimum value is passed.		



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# TM5 Analog I/O Modules

# 4

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## Introduction

This chapter provides information to configure analog I/O expansion modules.

To add expansion modules and access to the configuration screens, refer to Adding a TM5 Expansion Module (*see page 18*).

## What's in this Chapter?

This chapter contains the following topics:

Topic	Page
TM5SAI2H and TM5SAI4H	90
TM5SAI2L and TM5SAI4L	95
TM5SAI2PH and TM5SAI4PH	103
TM5SAI2TH and TM5SAI6TH	107
TM5SAO2H and TM5SAO4H	112
TM5SAO2L and TM5SAO4L	114

## TM5SAI2H and TM5SAI4H

### Introduction

The TM5SAI2H and TM5SAI4H expansion electronic modules are  $\pm 10$  Vdc/0-20 mA analog input electronic modules with 2 and 4 inputs respectively.

If you have wired your input for a voltage measurement and you configure for a current type of configuration, you may permanently damage the electronic module.

### **NOTICE**

#### **INOPERABLE EQUIPMENT**

Be sure that the physical wiring of the module is compatible with the software configuration for the module.

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

For further information, refer to the Hardware Guide:

<b>Reference</b>	<b>Refer to</b>
TM5SAI2H	TM5SAI2H Electronic Module 2AI $\pm 10$ V/0-20 mA 16 Bits (see <i>Modicon TM5, Analog I/O Modules, Hardware Guide</i> )
TM5SAI4H	TM5SAI4H Electronic Module 4AI $\pm 10$ V/0-20 mA 16 Bits (see <i>Modicon TM5, Analog I/O Modules, Hardware Guide</i> )

## I/O Configuration Tab

The table below describes the modules parameters configuration for the TM5SAI2H and TM5SAI4H electronic modules:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SAI... supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 allows you to change the address.
	<b>Terminal block</b>	TM5ACTB06 TM5ACTB12	TM5ACTB06 TM5ACTB12 (for TM5SAI4H)	Specifies the terminal block associated with the electronic module.
	<b>Sample time (µs)</b>	50...10000	2000	Sets the sample time.
	<b>Channel diagnostic</b>	On Off	Off	On: Reads the Input Status Register. ( <i>see page 93</i> )
	<b>Channel status</b>	On Off	Off	On: Reads the channel status, conversion cycle and synchronization status.

Group/Parameter	Value	Default Value	Description	
<b>Channel 00</b>	<b>Channel On/Off</b>	On Off	On	Enables (On) / Disables (Off) the channel. Off: The other parameters assume their default value and the channel is deactivated. <b>NOTE:</b> Disable any unused channels to avoid unnecessary communication on the bus.
	<b>Channel configuration</b>			
	<b>Channel type</b>	-10...+10 V 0...20 mA	-10...+10 V	Specifies the channel type.
	<b>Minimum value</b>	-32768...32767	-32768	Limitation minimum value ( <i>see page 93</i> ).
	<b>Maximum value</b>	-32768...32767	32767	Limitation maximum value ( <i>see page 93</i> ).
	<b>Delta interrupt mode</b>	Checked Unchecked	Checked	Activates the delta interrupt mode. The Delta interrupt mode uses the delta value to trigger a PDO send.
	<b>Delta interrupt value</b>	0...10000	100	Set the delta interrupt value. <b>NOTE:</b> Set a value to avoid unnecessary communication on the bus due to minor fluctuations of the analog conversion.
	<b>Lower limit mode</b>	Checked Unchecked	Unchecked	Activates the lower limit interrupt mode. Lower limit interrupt mode defines the lower limit which will trigger communication on the bus.
	<b>Lower limit value</b>	-32768...32767	-32768	Sets the lower limit value ( <i>see page 93</i> ).
	<b>Upper limit mode</b>	Checked Unchecked	Unchecked	Activates the upper limit interrupt mode. Upper limit interrupt mode defines the upper limit which will trigger communication on the bus.
	<b>Upper limit value</b>	-32768...32767	32767	Sets the upper limit value ( <i>see page 93</i> ).
	<b>Filter</b>	On Off	On	Activates the filter.
	<b>Filter configuration</b>			
	<b>Order</b>	1...4	1	Sets the filter order. <b>NOTE:</b> Parameter only available if the filter is activated.
	<b>Cut off frequency (Hz)</b>	1...65535	500	Sets the cut off frequency. <b>NOTE:</b> Parameter only available if the filter is activated.

The same channel 00 parameters are also available for:

- channel 01 (TM5SAI2H)
- channel 01...03 (TM5SAI4H)

**NOTE:** To economize cycle time, do not activate a channel when there is no sensor connected.

### Limit Values

The input signal is monitored at the maximum and minimum values:

Limit value (default)	Voltage signal ±10 V		Current signal 0...20 mA	
	<b>Maximum value</b>	+10 V	+32767	20 mA
<b>Minimum value</b>	- 10 V	-32768	0 mA	0 <sup>1</sup>

<sup>1</sup> The analog value is limited down to 0

The user can specify a maximum and minimum value for each individual channel.

When activated, the input signals are monitored to see if the entry values are exceeded. The defined limit values are used for this. If the analog value goes beyond the defined range, then it is limited to the **Maximum value** and **Minimum values**.

The result of the signal check is displayed in a corresponding status bit.

### Limit Analog Value

In addition to the channel status, the analog value is set to the values listed below, by default, when an error is detected. The analog value is limited to the new values if the limit values were changed.

Detected error type	Digital value
Broken wire	+32767 (7FFF hex)
Above maximum value	+32767 (7FFF hex)
Below minimum value	-32767 (8001 hex)
Invalid value	-32768 (8000 hex)

### Input Status Register

The input status register describes the status of each input channel:

Bit	Description	Bits value
0-1	Channel 00 status	00: No detected error
2-3	Channel 01 status	01: Below minimum value
4-5	Channel 02 status	10: Above maximum value
6-7	Channel 03 status	11: Broken wire detected (only for voltage configuration)

**NOTE:** The bits dedicated to channel 02 and 03 are not used (bit=0) for the TM5SAI2H.

### Filter

The electronic module has a filter that can be configured separately for each individual channel. The order and cut-off frequency can be specified for each individual channel:

- Filter Order: 1...4
- Filter Cut-off frequency: 1...65535 Hz

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)	
	Default priority	High priority with trace function
Minimum cycle time	200	300
Minimum I/O update time	No limitation on bus cycle time	

## TM5SAI2L and TM5SAI4L

### Introduction

The TM5SAI2L and TM5SAI4L expansion electronic modules are  $\pm 10$  Vdc/0...20 mA/4...20 mA analog input electronic modules with 2 and 4 inputs respectively.

If you have wired your input for a voltage measurement and you configure for a current type of configuration, you may permanently damage the electronic module.

### **NOTICE**

#### **INOPERABLE EQUIPMENT**

Be sure that the physical wiring of the module is compatible with the software configuration for the module.

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

For further information, refer to the Hardware Guide:

Reference	Refer to
TM5SAI2L	TM5SAI2L Electronic Module 2AI $\pm 10$ V/0...20 mA/4...20 mA 12 Bits (see <i>Modicon TM5, Analog I/O Modules, Hardware Guide</i> )
TM5SAI4L	TM5SAI4L Electronic Module 4AI $\pm 10$ V/0...20 mA/4...20 mA 12 Bits (see <i>Modicon TM5, Analog I/O Modules, Hardware Guide</i> )

**I/O Configuration Tab**

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SAI... supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 allows you to change the address.
	<b>Terminal block</b>	TM5ACTB06 TM5ACTB12	TM5ACTB06 TM5ACTB12 (for TM5SAI4L)	Specifies the terminal block associated with the electronic module.
	<b>Input filter</b>	Off level 2 level 4 level 8 level 16 level 32 level 64 level 128	Off	Definition of the filter level. Filter level (see page 99)
	<b>Ramp limitation</b>	Off 16383 8191 4095 2047 1023 511 255	255	Specifies the limitation of input ramp. <b>NOTE:</b> Parameter available if an input filter is selected.
	<b>Inputs status</b>	On Off	Off	On: Reads the Input Status Register (see page 102).
	<b>Minimum value</b>	-32768...32767	-32768	Limitation minimum value.
	<b>Maximum value</b>	-32768...32767	32767	Limitation maximum value.



Group/Parameter	Value	Default Value	Description	
Channel 00	Channel type	-10...+10 V 0...20 mA 4...20 mA	-10...+10 V	Specifies the channel type.
	Delta interrupt mode	Checked Unchecked	Checked	Activates the delta interrupt mode. The Delta interrupt mode uses the delta value to trigger a PDO send.
	Delta interrupt value	0...10000	100 $\mu$ s	Set the delta interrupt value.. <b>NOTE:</b> Set a value to avoid unnecessary communication on the bus due to minor fluctuations of the analog conversion.
	Lower limit mode	Checked Unchecked	Unchecked	Activates the lower limit interrupt mode. Lower limit interrupt mode defines the lower limit which will trigger communication on the bus.
	Lower limit value	-32768...32767	-32768	Sets the lower limit value ( <i>see page 98</i> ).
	Upper limit mode	Checked Unchecked	Unchecked	Activates the upper limit interrupt mode. Upper limit interrupt mode defines the upper limit which will trigger communication on the bus.
	Upper limit value	-32768...32767	32767	Sets the upper limit value ( <i>see page 98</i> ).

The same channel 00 parameters are also available for:

- channel 01 (TM5SAI2L)
- channel 01...03 (TM5SAI4L)

## Analog Inputs

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

## Input Cycle

The electronic module is equipped with a configurable Input cycle. Filtering is deactivated for shorter cycle times.

If the Input cycle is active, then the channels are scanned in ms cycles. The time offset between the channels is 200  $\mu$ s. The conversion takes place asynchronously to the network cycle.

**Limit values**

You can define 2 different type of limits:

- **Minimum value**
- **Maximum value**

The **Minimum value** range is between -32768 to 32767. This value is applied on every channel of the module being configured.

**NOTE:** the **Minimum value** cannot be greater than the **Maximum value**.

Channel Configuration	Digital Value Behavior	Comments
± 10 V	-10 V = -32768 +10 V = +32767	If the <b>Minimum value</b> is configured between -32768 and +32767, the digital value is limited to the <b>Lower limit</b> value.
0...20 mA	0 mA = 0 20 mA = +32767	If the <b>Minimum value</b> is configured between -32768 and 0, the digital value is limited to 0. If the <b>Minimum value</b> is configured between 0 and 32 767, the digital value is limited to the <b>Minimum value</b> .
4...20 mA	0 mA = -8192 4 mA = 0 20 mA = +32767	If the <b>Minimum value</b> is configured between -32768 and -8192, the digital value is limited to -8192. If the <b>Minimum value</b> is configured between -8192 and 32767, the digital value is limited to the <b>Minimum value</b> .

The **Maximum value** range is between -32768 to 32767. This value is applied on every channel of the module being configured.

**NOTE:** The **Maximum value** cannot be less than the **Minimum value**.

Channel Configuration	Digital Value Behavior	Comments
± 10 V	-10 V = -32768 +10 V = +32767	If the <b>Maximum value</b> is configured between -32768 and +32767, the digital value is limited to the <b>Maximum value</b> .
0...20 mA	0 mA = 0 20 mA = +32767	If the <b>Maximum value</b> is configured between -32768 and 0, the digital value stays at 0, hence, the <b>Maximum value</b> must be set to a positive value. If the <b>Maximum value</b> is configured between 1 and +32767, the digital value is limited to the <b>Maximum value</b> .
4...20 mA	0 mA = -8192 4 mA = 0 20 mA = +32767	If the <b>Maximum value</b> is configured between -32768 and -8192, the digital value is limited to -8192. If the <b>Maximum value</b> is configured between -8192 and 32767, the digital value is limited to the <b>Maximum value</b> .

## Filter Level

The input value is evaluated according to the filter level. A **Ramp limitation** can then be applied using this evaluation.

Formula for the evaluation of the input value:

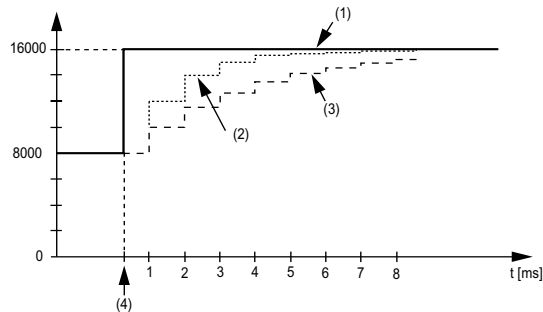
$$Value_{new} = Value_{old} - \frac{Value_{old}}{Filterlevel} + \frac{Inputvalue}{Filterlevel}$$

The following examples show the function of the **Ramp limitation** based on an input jump and a disturbance.

**Example 1:** The input value makes a jump from 8000 to 16000. The diagram displays the evaluated value with the following settings:

**Ramp limitation = 0**

Filter level = 2 or 4

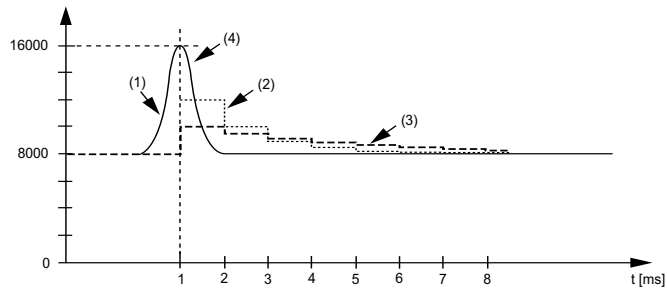


- 1 Input value
- 2 Evaluated value: Filter level 2
- 3 Evaluated value: Filter level 4
- 4 Input jump

**Example 2:** A disturbance is imposed on the input value. The diagram shows the evaluated value with the following settings:

Ramp limitation = 0

Filter level = 2 or 4



- 1 Input value
- 2 Evaluated value: Filter level 2
- 3 Evaluated value: Filter level 4
- 4 Disturbance (Spike)

## Ramp Limitation

Ramp limitation can only take place when a filter is used. Ramp limitation is executed before filtering takes place.

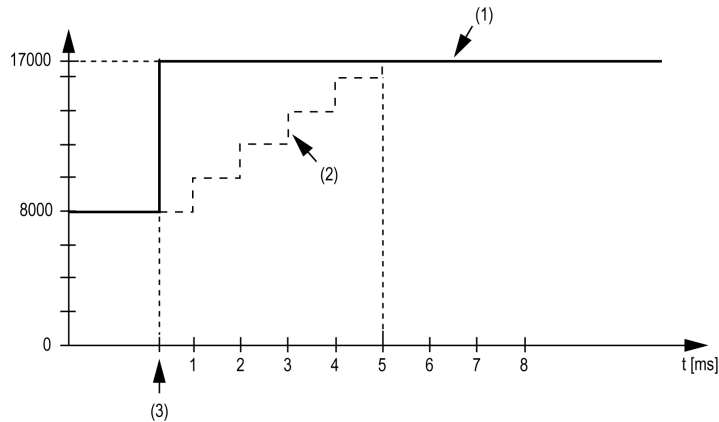
The amount of the change in the input value is checked to make sure the specified limits are not exceeded. If the values are exceeded, the adjusted input value is equal to the old value  $\pm$  the limit value.

The Ramp limitation is well suited for suppressing disturbances (spikes). The following examples show the function of the Ramp limitation based on an input jump and a disturbance.

**Example 1:** The input value makes a jump from 8000 to 17000. The diagram displays the adjusted input value for the following settings:

Ramp limitation = 2047

Filter level = 2

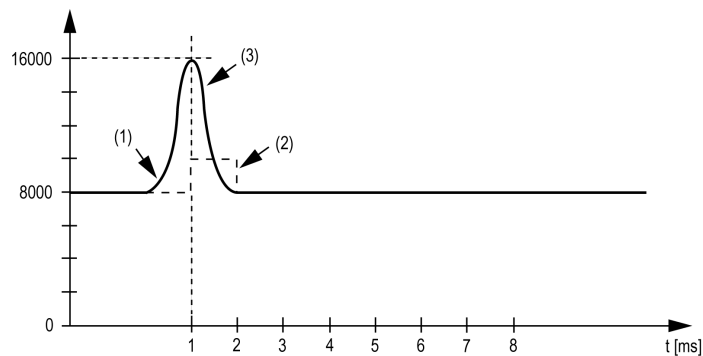


- 1 Input value
- 2 Internal adjusted input value before filter
- 3 Input jump

**Example 2:** A disturbance is imposed on the input value. The diagram shows the adjusted input value with the following settings:

Ramp limitation = 2047

Filter level = 2



- 1 Input value
- 2 Internal adjusted input value before filter
- 3 Disturbance (Spike)

### Input Status Register

The input status register describes the status of each input channel:

Bit	Description	Bits value
0-1	Channel 00 status	00: No detected error
2-3	Channel 01 status	01: Below minimum value
4-5	Channel 02 status	10: Above maximum value
6-7	Channel 03 status	11: Broken wire detected (only for voltage configuration)

**NOTE:** The bits dedicated to channel 02 and 03 are not used (bit=0) for the TM5SAI2L.

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)	
	Without filter	With filter
Minimum cycle time	100	500
Minimum I/O update time	300	1000

## TM5SAI2PH and TM5SAI4PH

### Introduction

The TM5SAI2PH and TM5SAI4PH expansion electronic modules are Analog Resistor Temperature electronic modules with 2 and 4 Inputs respectively.

For further information, refer to the Hardware Guide:

Reference	Refer to
TM5SAI2PH	TM5SAI2PH Electronic Module 2AI PT100/PT1000 16 Bits ( <i>see Modicon TM5, Analog I/O Modules, Hardware Guide</i> )
TM5SAI4PH	TM5SAI4PH Electronic Module 4AI PT100/PT1000 16 Bits ( <i>see Modicon TM5, Analog I/O Modules, Hardware Guide</i> )

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter	Parameter	Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	3-wires 2-wires	3-wires	Sets 3 wires or 2 wires connection.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 supports the possibility to change the address.
	<b>Terminal block</b>	TM5ACTB06 TM5ACTB12	TM5ACTB06 TM5ACTB12 (for TM5SAI4PH)	Specifies the terminal block associated with the electronic module.
	<b>Input filter</b>	66.7 40 33.3 20 16.7 10 2 1	20 ms	Specifies the filter time on the module
	<b>Inputs status</b>	On Off	Off	On: Reads the Input Status Register ( <i>see page 106</i> ).

Group/Parameter	Parameter	Value	Default Value	Description
Channel 00	Sensor type	PT100 PT1000 0.1...4500 Ohm (0.1 Ohm/bit) 0.05...2250 Ohm (0.05 Ohm/bit) Off	PT100	Sets the sensor type (see page 105). <b>NOTE:</b> Setting the sensor type to off deactivates the channel.
	Delta interrupt mode	Checked Unchecked	Checked	Activates the delta interrupt mode. The Delta interrupt mode uses the delta value to trigger a PDO send.
	Delta interrupt value	0...1000	50	Set the delta interrupt value. <b>NOTE:</b> Set a value to avoid unnecessary communication on the bus due to minor fluctuations of the analog conversion.
	Lower limit mode	Checked Unchecked	Unchecked	Activates the lower limit interrupt mode. Lower limit interrupt mode defines the lower limit which will trigger communication on the bus.
	Lower limit value	-2000...8500	-2000	Sets the lower limit value (see page 105).
	Upper limit mode	Checked Unchecked	Unchecked	Activates the upper limit interrupt mode. Upper limit interrupt mode defines the upper limit which will trigger communication on the bus.
	Upper limit value	-2000...8500	8500	Sets the upper limit value (see page 105).

The same channel 00 parameters are also available for:

- channel 01 (TM5SAI2PH)
- channel 01...03 (TM5SAI4PH)

**NOTE:** To economize cycle time, do not activate a channel when there is no sensor connected.

## Analog Inputs

The converted analog values are output by the electronic module in the registers. Different resistance or temperature measurements result in different value ranges and data types.



### Timing Setting

The timing setting for data acquisition is made using the converter hardware. All activated inputs are converted during each conversion cycle.

### Conversion Time

The conversion time for the channels depends on their use. For the formulas listed in the table, 'n' corresponds to the number of channels that are activated.

Channel uses	Conversion time
1 channel	1 x Input Filter time
n channels with the same sensor type	n x (Input Filter time + 20 ms)
n channels with different sensor types	n x (2 x Input Filter time + 20 ms)

### Reduce Conversion Time

If an input is not necessary, it can be deactivated by setting the sensor type to Off, thereby reducing the refresh time.

The time saved is: Timesaving = 2 x 20 ms + Input Filter time

The Input Filter time is the conversion time for the remaining channels.

### Sensor Type

The electronic module is designed for temperature and resistance measurement. The sensor type must be specified because of the different adjustment values for temperature and resistance. To save time, individual channels can be deactivated by setting the sensor type to Off.

The table below shows the sensor types:

Sensor Types	Digital value	Temperature °C (°F)	Resolution
Sensor type PT100	-2000...8500	-200...850 (-328...1562)	0.1° C (0.18° F)
Sensor type PT1000	-2000...8500	-200...850 (-328...1562)	0.1° C (0.18° F)
Resistance measurement 0.1...4500 Ohm	1...4500	—	0.1 Ohm
Resistance measurement 0.05...2250 Ohm	1...4500	—	0.05 Ohm

### Limit Analog Value

In addition to the status information, the analog value is set to the values listed below, by default, when a detected error occurs. The analog value is limited to the new values if the limit values were changed.

Detected error type	Temperature measurement Digital value for detected error	Resistance measurement Digital value for detected error
Wire break	+32767 (7FFF hex)	65535 (FFFF hex)
Above maximum value	+32767 (7FFF hex)	65535 (FFFF hex)
Below minimum value	-32767 (8001 hex)	0 (0 hex)
Invalid value	-32768 (8000 hex)	65535 (FFFF hex)

### Input Status Register

The input status register describes the status of each input channel:

Bit	Description	Bits value
0-1	Channel 00 status	00: No detected error
2-3	Channel 01 status	01: Below minimum range
4-5	Channel 02 status	10: Above maximum range
6-7	Channel 03 status	11: Broken wire detected

**NOTE:** The bits dedicated to channel 02 and 03 are not used (bit=0) for the TM5SAI2PH.

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)	
	1 input	n inputs
Minimum cycle time	100	
Minimum I/O update time	Equal to the filter time	n x (200 ms + filter time)

## TM5SAI2TH and TM5SAI6TH

### Introduction

The TM5SAI2TH and TM5SAI6TH expansion electronic modules are Analog Temperature Sensor with 2 and 6 inputs respectively.

For further information, refer to the Hardware Guide:

Reference	Refer to
TM5SAI2TH	TM5SAI2TH Electronic Module 2AI Thermocouple J/K/N/S 16 Bits (see <i>Modicon TM5, Analog I/O Modules, Hardware Guide</i> )
TM5SAI6TH	TM5SAI6TH Electronic Module 6AI Thermocouple J/K/N/S 16 Bits (see <i>Modicon TM5, Analog I/O Modules, Hardware Guide</i> )

## I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Internal compensation	Internal compensation	Sets the operating mode supported by the module. TM5SAI... supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 supports the possibility to change the address.
	<b>Terminal block</b>	TM5ACTB06 TM5ACTB12	TM5ACTB06 TM5ACTB12 (for TM5SAI6TH)	Specifies the terminal block associated with the electronic module.
	<b>Inputs status</b>	On Off	Off	On: Reads the Input Status Register ( <i>see page 111</i> ).
	<b>Input filter</b>	66.7 40 33.3 20 16.7 10 2 1	20 ms	Specifies the filtering time for all analog inputs.
	<b>Sensor type</b>	J K S N ±32767 µV, 1 µV/bit ±65534 µV, 2 µV/bit	J	Sets the sensor type ( <i>see page 110</i> ).

Group/Parameter	Value	Default Value	Description	
Channel 00	Channel On/Off	On Off	On	Enables (On) / Disables (Off) the channel. Off: The other parameters are fixed to default value.
	Delta interrupt mode	Checked Unchecked	Checked	Activates the delta interrupt mode. The Delta interrupt mode uses the delta value to trigger a PDO send.
	Delta interrupt value	0...1000	50	Set the delta interrupt value. <b>NOTE:</b> Set a value to avoid unnecessary communication on the bus due to minor fluctuations of the analog conversion.
	Lower limit mode	Checked Unchecked	Unchecked	Activates the lower limit interrupt mode. <b>NOTE:</b> Sets the highest value compatible with your application to avoid unnecessary communication on the bus.
	Lower limit value	-2100...12000	-2100	Sets the lower limit value ( <i>see page 110</i> ).
	Upper limit mode	Checked Unchecked	Unchecked	Activates the upper limit interrupt mode. Upper limit interrupt mode defines the upper limit which will trigger communication on the bus.
	Upper limit value	-2100...12000	12000	Sets the upper limit value ( <i>see page 110</i> ).

The same channel 00 parameters are also available for:

- channel 01 (TM5SAI2TH)
- channel 01...05 (TM5SAI6TH)

**NOTE:** To economize cycle time, do not activate a channel when there is no sensor connected.

## Analog Inputs

The converted analog values are output by the electronic module in the registers. The sensor type configured affects the value ranges.

## Raw Value Measurement

If a sensor type other than J, K, N or S is used, the terminal temperature must be measured on at least one input. Based on this value, the user must perform a terminal temperature compensation.

### Timing Setting

The timing setting for data acquisition is made using the converter hardware. All activated inputs are converted during each conversion cycle. A terminal temperature measurement also takes place.

If an input is not necessary, it can be deactivated by setting the channel to Off, thereby reducing the refresh time. The measurement of the terminal temperature is deactivated.

### Conversion Time

The conversion time depends on the number of channels used. For the formulas listed in the table, 'n' corresponds to the number of channels that are activated.

Channel uses	Conversion time
1 channel	Correspond to the Input Filter time
n channels	$n \times (2 \times \text{Input Filter time} + 200 \mu\text{s})$

### Sensor Type and Channel Deactivation

The electronic module is designed for various sensor types. The sensor type must be specified because of the different adjustment values.

The table below shows the code corresponding sensor types:

Sensor Types	Digital value	Temperature ° C (° F)	Resolution
Sensor type J	-2200...12000	-220...1200 (-364...2192)	0.1° C (0.18° F)
Sensor type K	-2700...13720	-270...1372 (-454...2501)	0.1° C (0.18° F)
Sensor type S	-500...17680	-50...1768 (-58...3214)	0.1° C (0.18° F)
Sensor type N	-2700...13000	-270...1300 (-454...2372)	0.1° C (0.18° F)
Measurement range of ±32.767 mV	-32768...32767	–	1 µV
Measurement range of ±65.534 mV	-32768...32767	–	2 µV

## Input Status Register

The input status register describes the status of each input channel:

Bit	Description	Bits value
StatusInput 00		00: No detected error
0-1	Channel 00 status	01: Below minimum range
2-3	Channel 01 status	10: Above maximum range
4-5	Channel 02 status	11: Broken wire detected
6-7	Channel 03 status	
StatusInput 01		
0-1	Channel 04 status	
2-3	Channel 05 status	
4-7	Not used	

**NOTE:** The bits dedicated to channel 02 to 05 are not used (bit=0) for the TM5SAI2TH.

## Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value ( $\mu$ s)	
	1 input	n inputs
Minimum cycle time	150	
Minimum I/O update time	Equal to the filter time	$n \times (2 \times \text{filter time} \times 200 \text{ ms})$

## TM5SAO2H and TM5SAO4H

### Introduction

The TM5SAO2H and TM5SAO4H expansion electronic modules are  $\pm 10$  Vdc/0...20 mA analog output electronic modules with 2 and 4 outputs respectively.

### **NOTICE**

#### **INOPERABLE EQUIPMENT**

Be sure that the physical wiring of the module is compatible with the software configuration for the module.

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

For further information, refer to the Hardware Guide:

Reference	Refer to
TM5SAO2H	TM5SAO2H Electronic Module 2AO $\pm 10$ V/0...20 mA 16 Bits (see <i>Modicon TM5, Analog I/O Modules, Hardware Guide</i> )
TM5SAO4H	TM5SAO4H Electronic Module 4AO $\pm 10$ V/0...20 mA 16 Bits (see <i>Modicon TM5, Analog I/O Modules, Hardware Guide</i> )

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter	Parameter	Value	Default Value	Description
Properties	Function model	Default	Default	Sets the operating mode supported by the module. TM5SAO... supports only one mode.
General	Module address	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	Bus base	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 supports the possibility to change the address.
	Terminal block	TM5ACTB06 TM5ACTB12	TM5ACTB06 TM5ACTB12 (for TM5SAO4H)	Specifies the terminal block associated with the electronic module.



Group/Parameter	Parameter	Value	Default Value	Description
Channel 00	Output type	-10...+10 V 0...20 mA	-10...+10 V	Sets the type of output signal.
	Fall back Mode	Min. value Set to 0 Max. value Last current state Predefined value	Set to 0	Sets the fall back mode in case of communication loss. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5/TM7 bus. In this case the outputs assume the value of 0.
	Fall back value	-32768...32767	Depends of fall back mode	Display or set the fall back value.

The same channel 00 parameters are also available for:

- channel 01 (TM5SAO2H)
- channel 01...03 (TM5SAO4H)

### Limit Values

The output signal has a fall back value:

Limit fall back value	Voltage signal $\pm 10$ V	Current signal 0...20 mA
Max. value	+32767	+32767
Min. value (default)	-32768	0 <sup>1</sup>

<sup>1</sup> The analog value is limited down to 0

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value ( $\mu$ s)	
	TM5SAO2H	TM5SAO4H
Minimum cycle time	200	200
Minimum I/O update time	200	200

## TM5SAO2L and TM5SAO4L

### Introduction

The TM5SAO2L and TM5SAO4L electronic modules are  $\pm 10$  Vdc/0-20 mA analog outputs electronic modules with 2 and 4 outputs respectively.

If you have wired your output for a voltage measurement and you configure a current type of configuration, you may permanently damage the electronic module.

### **NOTICE**

#### **INOPERABLE EQUIPMENT**

Be sure that the physical wiring of the module is compatible with the software configuration for the module.

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

For further information, refer to the Hardware Guide:

Reference	Refer to
TM5SAO2L	TM5SAO2L Electronic Module 2AO $\pm 10$ V/0-20 mA 12 Bits (see <i>Modicon TM5, Analog I/O Modules, Hardware Guide</i> )
TM5SAO4L	TM5SAO4L Electronic Module 4AO $\pm 10$ V/0-20 mA 12 Bits (see <i>Modicon TM5, Analog I/O Modules, Hardware Guide</i> )

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter	Parameter	Value	Default Value	Description
Properties	Function model	Default	Default	Sets the operating mode supported by the module. TM5SAO... supports only one mode.
General	Module address	2..63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	Bus base	TM5ACBM11 TM5ACBM15	TM5ACBM11	Select the bus base associated with the electronic module. The TM5ACBM15 supports the possibility to change the address.
	Terminal block	TM5ACTB06 TM5ACTB12	TM5ACTB06 TM5ACTB12 (for TM5SAO4L)	Select the terminal block associated with the electronic module.

Group/Parameter	Parameter	Value	Default Value	Description
Channel 00	Output type	-10...+10 V 0...20 mA	-10...+10 V	Set the channel type.
	Fall back Mode	Min. value Set to 0 Max. value Last current state Predefined value	Set to 0	Set the fall back mode in case of communication loss. The fall back mode indicates the fall back value adopted by outputs in the event of an internal error detection or a communication loss. Fall backs are not activated in case of communication loss on the TM5/TM7 bus. In this case the outputs assume the value of 0.
	Fall back value	-32768...32767	Depends of the Fall back mode	Display or set the fall back value.

The same channel 00 parameters are also available for:

- channel 01 (TM5SAO2L)
- channel 01...03 (TM5SAO4L)

### Limit Values

The output signal has a fall back value:

Limit fall back value	Voltage signal $\pm 10$ V	Current signal 0...20 mA
Max. value	+32767	+32767
Min. value (default)	-32768	0 <sup>1</sup>

<sup>1</sup> The analog value is limited down to 0

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value ( $\mu$ s)	
	TM5SAO2L	TM5SAO4L
Minimum cycle time	250	250
Minimum I/O update time	<300	<400



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# TM5 Transmitter and TM5 Receiver Electronic Modules

# 5

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## Introduction

This chapter provides information to configure transmitter or receiver expansion electronic modules.

To add expansion electronic modules and access to the configuration screens, refer to *Adding a TM5 Expansion Module (see page 18)*.

## What's in this Chapter?

This chapter contains the following topics:

Topic	Page
TM5SBET1	118
TM5SBET7	120
TM5SBER2	122

## TM5SBET1

### Introduction

The TM5 System provides a virtual rack system through a decentralized backplane. The decentralized backplane contains a local configuration and several remote configurations connected together using specific expansion bus cables. The TM5 transmitter and receiver electronic modules handle the communication between remote electronic modules via expansion bus cables. The TM5SBET1 expansion electronic module is a 24 Vdc transmitter electronic module.

For further information, refer to TM5SBET1 Transmitter Electronic Module (see *Modicon TM5, Transmitter and Receiver Modules, Hardware Guide*).

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SBET1 supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 supports the possibility to change the address.
	<b>Terminal block</b>	TM5ACTB12	TM5ACTB12	Specifies the terminal block associated with the electronic module.
	<b>Power status</b>	On Off	Off	On: Reads the power status (see page 119).
	<b>Power values</b>	On Off	Off	On: Reads the power values (see page 119).

### Power Status and Power Value

When the **Power status** is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	StatusInput00	Bus power supply error detection: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = low voltage &lt;4.7 V</li> </ul>
	StatusInput01	I/O power supply error detection: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = I/O power supply &lt; 20.4 V</li> </ul>

When the **Power value** is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	SupplyCurrent	Bus current with a resolution of 0.1 A
	SupplyVoltage	Bus voltage with a resolution of 0.1 V <sup>1</sup>
<b>1</b> Divide the value by 10 to have the voltage or current value. For example: when reading the voltage, if the value = 57, the voltage = 5.7 V		

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)
Minimum cycle time	100
Minimum I/O update time	2000

## TM5SBET7

### Introduction

The TM5SBET7 expansion electronic module is a 24 Vdc transmitter electronic module. In a remote configuration, the TM5SBET7 generates power for the TM7 power bus. The TM5SBET7 is the connection to the external 24 Vdc power supply and the beginning of the power distribution for the TM7 remote configuration. The power is supplied by one external isolated power supply depending on current needs and capabilities.

For further information, refer to TM5SBET7 Transmitter Electronic Module (see *Modicon TM5, Transmitter and Receiver Modules, Hardware Guide*).

### I/O Configuration Tab

For further generic descriptions, refer to I/O Configuration Tab Description (see page 18).

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SBET7 supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM05R supports the possibility to change the address.
	<b>Terminal block</b>	TM5ACTB12	TM5ACTB12	Specifies the terminal block associated with the electronic module.
	<b>Power status</b>	On Off	Off	On: Reads the power status (see page 121).
	<b>Power values</b>	On Off	Off	On: Reads the power values (see page 121).



### Power Status and Power Value

When the **Power status** is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	StatusInput00	Bus power supply error detection: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = low voltage &lt; 4.7 V</li> </ul>
	StatusInput01	I/O power supply error detection: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = I/O power supply &lt; 20.4 V</li> </ul>

When the **Power value** is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	SupplyCurrent	Bus current with a resolution of 0.01 A <sup>1</sup>
	SupplyVoltage	Bus voltage with a resolution of 0.1 V <sup>2</sup>
<p><b>1</b> Divide the value by 100 to have the current value. For example: when the value = 57, the current = 0.57 A</p> <p><b>2</b> Divide the value by 10 to have the voltage value. For example: when the value = 63, the voltage = 6.3 V</p>		

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)
Minimum cycle time	100
Minimum I/O update time	2000

## TM5SBER2

### Introduction

The TM5 System provides a virtual rack system through a decentralized backplane. The decentralized backplane contains a local configuration and several remote configurations connected together using specific expansion bus cables. The TM5 transmitter and receiver electronic modules handle the communication between remote electronic modules via expansion bus cables. The TM5SBER2 expansion electronic module is a 24 Vdc receiver electronic module.

For further information, refer to TM5SBER2 Receiver Electronic Module (see *Modicon TM5, Transmitter and Receiver Modules, Hardware Guide*).

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SBER2 supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5/ TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM01R TM5ACBM05R	TM5ACBM01R	Specifies the bus base associated with the electronic module. The TM5ACBM05R supports the possibility to change the address.
	<b>Terminal block</b>	TM5ACTB12PS	TM5ACTB12PS	Specifies the terminal block associated with the electronic module.
	<b>Power status</b>	On Off	Off	On: Reads the power status (see page 123).
	<b>Power values</b>	On Off	Off	On: Reads the power values (see page 123).
	<b>I/O supply current</b>	1000...10000 mA	10000 mA	Sets the maximum current supplied to the 24 Vdc I/O Power Segment.

### Power Status and Power Value

When the **Power status** is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	StatusInput00	Bus power supply error detection: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = low voltage &lt; 4.7 V</li> </ul>
	StatusInput01	I/O power supply error detection: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = I/O power supply &lt; 20.4 V</li> </ul>

When the **Power value** is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	SupplyCurrent	Bus current with a resolution of 0.1 A
	SupplyVoltage	Bus voltage with a resolution of 0.1 V <sup>1</sup>
<b>1</b> Divide the value by 10 to have the voltage or current value. For example: when reading the voltage, if the value = 57, the voltage = 5.7 V		

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)
Minimum cycle time	100
Minimum I/O update time	2000



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# TM5 CANopen Interface Power Distribution Modules

# 6

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## TM5SPS3

### Introduction

The TM5SPS3 CANopen Interface Power Distribution Module (IPDM) distributes power to the field bus interface and the expansion modules connected on the expansion bus.

For further information, refer to TM5 CANopen Interface Power Distribution Module (see *Modicon TM5, CANopen Interface, Hardware Guide*).

### I/O Configuration Tab

The table below provides the modules parameters configuration:

Group/Parameter	Value	Default Value	Description	
<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SPS3 supports only one mode.	
<b>General</b>	<b>Module address</b>	1	1	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBN1	TM5ACBN1	Specifies the bus base associated with the electronic module.
	<b>Terminal block</b>	TM5ACTB12PS	TM5ACTB12PS	Specifies the terminal block associated with the electronic module.
	<b>Power status</b>	Off On	Off	On: Reads the power status (see page 126).
	<b>Power values</b>	Off On	Off	On: Reads the power values (see page 126).
	<b>I/O Supply current</b>	1000...10000 mA	10000 mA	Set the maximum current supplied to the 24 Vdc I/O Power Segment.

### Power Status and Power Value

When the **Power status** parameter is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	StatusInput00	Bus power supply error detection: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = low voltage &lt; 4.7 V</li> </ul>
	StatusInput01	I/O power supply error detection: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = I/O power supply &lt; 20.4 V</li> </ul>

When the **Power value** parameter is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	SupplyCurrent	Bus current with a resolution of 0.1 A
	SupplyVoltage	Bus voltage with a resolution of 0.1 V <sup>1</sup>
<b>1</b> Divide the value by 10 to have the voltage or current value. For example: when reading the voltage, if the value = 57, the voltage = 5.7 V		

### Cycle Time and I/O Update Time

Characteristic	Value (µs)
Minimum cycle time	100
Minimum I/O update time	200

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# TM5 Power Distribution Modules

# 7

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## Introduction

This chapter provides information to configure power distribution modules.

To add expansion modules and access to the configuration screens, refer to Adding a TM5 Expansion Module (*see page 18*).

## What's in this Chapter?

This chapter contains the following topics:

Topic	Page
TM5SPDM	128
TM5SPDMF	130

## TM5SPDM

### Introduction

In the configuration, you will find the TM5SPDM pseudo-reference. This is not an actual product reference, but a container for the actual power distribution module you may subsequently choose. Under this pseudo-reference, you can define either a TM5SPS1 or TM5SPS2.

The reason for the pseudo-reference is to manage more easily the substitution of the TM5SPS1 for the TM5SPS2, or vice-versa, without disrupting the rest of the configuration.

The default for the TM5SPDM is the TM5SPS1, only provides power to the 24 Vdc I/O Power Segment and not to the TM5 Power Bus. However, later you may come to find the need to add such power and substitute the TM5SPS2 instead. With the TM5SPDM placeholder, this substitution is a simple matter that will prevent the need to first remove the I/O modules already defined and served by the original PDM.

For further information, refer to TM5 Power Distribution Modules (*see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide*).

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	TM5SPS1 TM5SPS2	TM5SPS1	Specifies the power distribution module type: <ul style="list-style-type: none"> <li>● TM5SPS1 without TM5 Power Bus</li> <li>● TM5SPS2 with TM5 Power Bus</li> </ul>
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM01R TM5ACBM05R	TM5ACBM01R	Specifies the bus base associated with the electronic module. Select the electronic module address (only with TM5ACBM05R).
	<b>Terminal block</b>	TM5ACTB12PS	TM5ACTB12PS	Specifies the terminal block associated with the electronic module.
	<b>Power status</b>	On Off	Off	On: Reads the power status ( <i>see page 129</i> ).
	<b>Power values</b>	On Off	Off	On: Reads the power supply values ( <i>see page 129</i> )
	<b>I/O Supply current</b>	1000...10000 mA	10000 mA	Set the maximum current supplied to the 24 Vdc I/O Power Segment (in mA).



## Power Status and Power Value

When the **Power status** parameter is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	StatusInput00	Bus power supply error detection: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = low voltage &lt; 4.7 V</li> </ul>
	StatusInput01	Fuse status TM5SPS2 only: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = fuse is ruptured or missing</li> </ul>
	StatusInput02	I/O power supply error detection: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = I/O power supply &lt; 20.4 V</li> </ul>

When the **Power value** parameter is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	SupplyVoltage	Bus voltage with a resolution of 0.1 V <sup>1</sup>
<b>1</b> Divide the value by 10 to have the voltage value. For example: when reading the voltage, if the value = 57, the voltage = 5.7 V		

## Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)
Minimum cycle time	100
Minimum I/O update time	200

## Mounting Power Distribution Modules

Mounting power distribution modules rules:

- Do not mount power distribution modules side by side.
- Do not mount a power distribution module and a Receiver module side by side.
- Performance Distributed I/O Configuration software does not allow mounting incompatible modules side by side.

## TM5SPDMF

### Introduction

In the configuration, you will find the TM5SPDMF pseudo-reference. This is not an actual product reference, but a container for the actual power distribution module you may subsequently choose. Under this pseudo-reference, you can define either a TM5SPS1F or TM5SPS2F.

The reason for the pseudo-reference is to manage more easily the substitution of the TM5SPS1F for the TM5SPS2F, or vice-versa, without disrupting the rest of the configuration.

The default for the TM5SPDMF is the TM5SPS1F, only provides power to the 24 Vdc I/O Power Segment and not to the TM5 Power Bus. However, later you may come to find the need to add such power and substitute the TM5SPS2F instead. With the TM5SPDMF placeholder, this substitution is a simple matter that will prevent the need to first remove the I/O modules already defined and served by the original PDM.

For further information, refer to TM5 Power Distribution Modules (*see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide*).

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter	Value	Default Value	Description	
	<b>Function model</b> TM5SPS1F TM5SPS2F	TM5SPS1F	Specifies the power distribution module type: <ul style="list-style-type: none"> <li>● TM5SPS1F without TM5 Power Bus</li> <li>● TM5SPS2F with TM5 Power Bus.</li> </ul>	
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM01R TM5ACBM05R	TM5ACBM01R	Specifies the bus base associated with the electronic module. Select the electronic module address (only with TM5ACBM05R).
	<b>Terminal block</b>	TM5ACTB12PS	TM5ACTB12PS	Specifies the terminal block associated with the electronic module.
	<b>Power status</b>	On Off	Off	On: Reads the power status ( <i>see page 131</i> ).
	<b>Power values</b>	On Off	Off	On: Reads the power supply values ( <i>see page 131</i> )
	<b>I/O Supply current</b>	1000...6300 mA	6300 mA	Set the maximum current supplied to the 24 Vdc I/O Power Segment (in mA).

### Power Status and Power Value

When the **Power status** parameter is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	StatusInput00	Bus power supply error detection: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = low voltage &lt; 4.7 V</li> </ul>
	StatusInput01	Fuse status (TM5SPS2F only): <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = fuse is ruptured or missing</li> </ul>
	StatusInput02	I/O power supply error detection: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = I/O power supply &lt; 20.4 V</li> </ul>

When the **Power value** parameter is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	SupplyCurrent	Bus current with a resolution of 0.1 A ( TM5SPS2F only)
	SupplyVoltage	Bus voltage with a resolution of 0.1 V <sup>1</sup>
<p><b>1</b> Divide the value by 10 to have the voltage or current value.                      For example: when reading the voltage, if the value = 57, the voltage = 5.7 V</p>		

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)
Minimum cycle time	100
Minimum I/O update time	200

### Mounting Power Distribution Modules

Mounting power distribution modules rules:

- Do not mount power distribution modules side by side.
- Do not mount a power distribution module and a Receiver module side by side.
- Performance Distributed I/O Configuration software does not allow mounting incompatible modules side by side.



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# TM5 Common Distribution Modules (CDM)



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## Introduction

This chapter provides information to configure common distribution expansion Modules.

To add expansion electronic modules and access to the configuration screens, refer to Adding TM5 expansion module (*see page 18*).

## What's in this Chapter?

This chapter contains the following topics:

Topic	Page
TM5SPDG12F	134
TM5SPDD12F	135
TM5SPDG5D4F	137
TM5SPDG6D6F	139

## TM5SPDG12F

### Introduction

The TM5SPDG12F provides 12 x Ground potential distribution electronic module with a fuse.

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
Properties	Function model	Default	Default	Sets the operating mode supported by the module. TM5SPDG12F supports only one mode.
General	Module address	2...63	2	Displays the address defined in the Address Setting tab ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	Bus base	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 supports the possibility to change the address.
	Terminal block	TM5ACTB12	TM5ACTB12	Specifies the terminal block associated with the electronic module.
	Fuse status	On Off	Off	On: Reads the status of the internal fuse.

### Fuse Status

When the **Fuse status** parameter is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	StatusFuse	Fuse status: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = fuse is ruptured or missing</li> </ul>

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)
Minimum cycle time	100
Minimum I/O update time	100

## TM5SPDD12F

### Introduction

The TM5SPDD12F expansion electronic module is a 12 x 24 Vdc potential distribution electronic module with fuse.

The module is equipped with an exchangeable fuse between the 24 Vdc potential on the terminal block and the 24 Vdc of the 24 Vdc I/O power segment.

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter	Value	Default Value	Description	
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SPDD12F supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 supports the possibility to change the address.
	<b>Terminal block</b>	TM5ACTB12	TM5ACTB12	Specifies the terminal block associated with the electronic module.
	<b>Fuse status</b>	On Off	Off	On: Reads the status of the internal fuse.

### Fuse Status

When the **Fuse status** parameter is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	StatusFuse	Fuse status: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = fuse is ruptured or missing</li> </ul>

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value ( $\mu$ s)
Minimum cycle time	100
Minimum I/O update time	100



## TM5SPDG5D4F

### Introduction

The TM5SPDG5D4F expansion electronic module is a 12 x 24 Vdc potential distribution electronic module with a fuse.

The module is equipped with an exchangeable fuse between the 24 Vdc potential on the terminal block and the external 24 Vdc power source.

For further information, refer to TM5SPDG5D4F Electronic Module 5x0 Vdc and 5x24 Vdc (see *Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide*).

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
Properties	Function model	Default	Default	Sets the operating mode supported by the module. TM5SPDG5D4F supports only one mode.
General	Module address	2...63	2	Displays the address defined in the Address Setting tab (see <i>Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	Bus base	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 supports the possibility to change the address.
	Terminal block	TM5ACTB12	TM5ACTB12	Specifies the terminal block associated with the electronic module.
	Power status	On Off	Off	On: Reads the power status (see page 137).

### Power Status

When the **Power status** parameter is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	StatusFuse	Fuse status: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = fuse is ruptured or missing</li> </ul>
	StatusPowerSupply	I/O power supply warning: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = I/O power supply &lt; 20.4 V</li> </ul>

### Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value ( $\mu$ s)
Minimum cycle time	100
Minimum I/O update time	100

## TM5SPDG6D6F

### Introduction

The TM5SPDG6D6F expansion electronic module is a 6 x Ground and 6 x 24 Vdc potential distribution electronic module with a fuse.

The module is equipped with an exchangeable fuse between the 24 Vdc potential on the terminal block and 24 Vdc of the 24 Vdc I/O power segment.

For further information, refer to TM5SPDG6D6F Electronic Module 6x0 Vdc and 6x24 Vdc (*see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide*).

### I/O Configuration Tab

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SPDG6D6F supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 supports the possibility to change the address.
	<b>Terminal block</b>	TM5ACTB12	TM5ACTB12	Specifies the terminal block associated with the electronic module.
	<b>Power status</b>	On Off	Off	On: Reads the power status ( <i>see page 140</i> ).
	<b>Device current</b>	0...4000 mA	0	Set the value of current of the 24 Vdc I/O Power Segment to supply external devices.

## Power Status

When the **Power status** parameter is “on”, the status register provides the following information:

Module/Channel		Description
Inputs	StatusFuse	Fuse status: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = fuse is ruptured or missing</li> </ul>
	StatusPowerSupply	I/O power supply warning: <ul style="list-style-type: none"> <li>● 0 = OK</li> <li>● 1 = I/O power supply &lt; 20.4 V</li> </ul>

## Cycle Time and I/O Update Time

The table below gives the module characteristics allowing the TM5 Bus Cycle Time configuration:

Characteristic	Value (µs)
Minimum cycle time	100
Minimum I/O update time	100

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# TM5 Dummy Module



# 9

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## TM5SD000

### Introduction

The TM5SD000 expansion electronic module is a dummy electronic module. This module is used to separate modules which have specific thermal or EMC requirements, or as a place holder for later system expansion. For further information, refer to TM5SD000 Dummy Module (*see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide*).

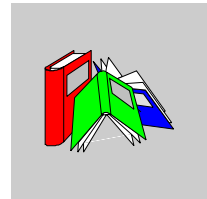
**I/O Configuration Tab**

The table below describes the modules parameters configuration:

Group/Parameter		Value	Default Value	Description
<b>Properties</b>	<b>Function model</b>	Default	Default	Sets the operating mode supported by the module. TM5SD000 supports only one mode.
<b>General</b>	<b>Module address</b>	2...63	2	Displays the address defined in the Address Setting tab ( <i>see Modicon TM5 / TM7, CANopen Interface, Programming Guide</i> ).
	<b>Bus base</b>	TM5ACBM11 TM5ACBM12 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module. The TM5ACBM15 supports the possibility to change the address.
	<b>Terminal block</b>	TM5ACTB06 TM5ACTB12 TM5ACTB32	TM5ACTB06	Specifies the terminal block associated with the electronic module ( <i>see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide</i> ).
	<b>I/O Power Segment current</b>	0 mA 500 mA 1000 mA 2000 mA 4000 mA 6000 mA	0	This value is used to reserve some current from the 24 Vdc I/O Power Segment in order to avoid power supply problems when the dummy module is replaced by the destined module ( <i>see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide</i> ).

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# Glossary



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## 0-9

### %I

According to the IEC standard, %I represents an input bit (for example a language object of type digital IN).

### %IW

According to the IEC standard, %IW represents an input word register (for example a language object of type analog IN).

### %MW

According to the IEC standard, %MW represents a memory word register (for example a language object of type memory word).

### %Q

According to the IEC standard, %Q represents an output bit (for example a language object of type digital OUT).

### %QW

According to the IEC standard, %QW represents an output word register (for example a language object of type analog OUT).

### 1-phase counter

A *1-phase counter* uses 1 hardware input as counter input. It usually counts up or counts down when there is pulse signal in the input.

**2-phase counter**

A *2-phase counter* uses the phase difference between 2 input counter signals to count up or count down.

**A**

**ADC**

*analog/digital converter*

**AFB**

*application function block*

**AMOA**

An *address of modbus of option application board* installed on the drive.

**analog input**

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

**analog output**

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

**application source**

The *application source* file can be uploaded to the PC to reopen a SoMachine project. This source file can support a full SoMachine project (for example, one that includes HMI application).

**ARP**

The *address resolution protocol* is the IP network layer protocol for Ethernet that maps an IP address to a MAC (hardware) address.



**ARRAY**

An **ARRAY** is a table containing elements of a single type. The syntax is as follows:  
ARRAY [<limits>] OF <Type>

**Example 1:** ARRAY [1..2] OF **BOOL** is a 1-dimensional table with 2 elements of type **BOOL**.

**Example 2:** ARRAY [1..10, 1..20] OF **INT** is a 2-dimensional table with 10x20 elements of type **INT**.

**ARW**

*anti-reset windup*

**ASCII**

The *american standard code for information interchange* is a communication protocol for representing alphanumeric characters (letters, numbers, and certain graphic and control characters).

**assigned variable**

A variable is "assigned" if its location in controller memory can be known. For example, the `Water_pressure` variable is said to be assigned through its association with memory location `%MW102.Water_pressure`.

**ATC**

*analog tension control*

**ATV**

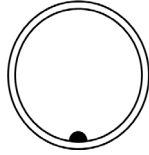
ATV is the model prefix for Altivar drives. (For example, "ATV312" refers to the Altivar 312 variable speed drive.)

**AWG**

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

**A coded**

These connectors have one raised key on the male connector and one mating slot on the female connector. This is the standard coding used for sensors and distribution box applications:

**B****BCD**

The *binary coded decimal format* represents decimal numbers between 0 and 9 with a set of 4 bits (a nybble/nibble, also titled as Halfbyte). In this format, the 4 bits used to encode decimal numbers have an unused range of combinations. For example, the number 2,450 is encoded as 0010 0100 0101 0000

**BOOL**

A *Boolean* type is the basic data type in computing. A **BOOL** variable can have one of these values: 0 (**FALSE**), 1 (**TRUE**). A bit that is extracted from a word is of type **BOOL**, for example: `%MW10.4` is a fifth bit a memory word number 10.

**Boot application**

Files that contain machine dependent parameters:

- machine name
- device name or IP address
- Modbus Serial Line address
- Routing table

**BOOTP**

The *bootstrap protocol* is 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.

**bps**

*bit per second* as a definition of transmission rate, also given in conjunction with multiplier kilo (kbps) and mega (mbps).

**BSH**

BSH is a Lexium servo motor from Schneider Electric.

**bus base**

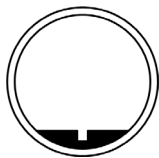
A *bus base* is a mounting device that is designed to seat an electronic module on a DIN rail and connect it to the TM5 bus for M258 and LMC058 controllers. Each base bus extends the TM5 data and to the power buses and the 24 Vdc I/O power segment. The electronic modules are added to the TM5 system through their insertion on the base bus. The base bus also supplies the articulation point for the terminal blocks.

**BYTE**

When 8 bits are grouped together, they are called a **BYTE**. You can enter a **BYTE** either in binary mode or in base 8. The **BYTE** type is encoded in an 8-bit format that ranges from 16#00 to 16#FF (in hexadecimal format).

**B coded**

These connectors have one raised key on the female connector and one mating slot on the male connector. These connectors (also called reverse keyed) are used for field bus applications:

**C****calibration**

Graduates a piece of measuring apparatus.

## **CAN**

The *controller area network* protocol (ISO 11898) for serial bus networks is designed for the interconnection of smart devices (from multiple manufacturers) in smart systems for real-time industrial applications. Originally developed for use in automobiles, CAN is now used in a variety of industrial automation control environments.

## **CANmotion**

CANmotion is a CANopen-based motion bus with an additional mechanism that provides synchronization between the motion controller and the drives.

## **CANopen**

CANopen is an open industry-standard communication protocol and device profile specification.

## **CFC**

The *continuous function chart* (an extension of the IEC61131-3 standard) is a graphical programming language that works like a flowchart. By adding simple logic blocks (AND, OR, etc.), each function or function block in the program is represented in this graphical format. For each block, the inputs are on the left and the outputs on the right. Block outputs can be linked to inputs of other blocks in order to create complex expressions.

## **CiA**

*CAN in automation* is a non-profit group of manufacturers and users dedicated to developing and supporting CAN-based higher layer protocols.

## **CIP**

When the *common industrial protocol* 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.

## **CMU**

The *current measurement unit* is used to convert the relative current value (%) provided by TeSys into a real ISO value (A).

**configuration**

The *configuration* includes the arrangement and interconnection of hardware components within a system and the hardware and software selections that determine the operating characteristics of the system.

**controller**

A *controller* (or “programmable logic controller,” or “programmable controller”) is used to automate industrial processes.

**controller status output**

The *controller status output* is a special function used in circuits that are external to the controller that control the power supply to the output devices or the controller power supply.

**CPDM**

*controller power distribution module*

**CRC**

A network message’s *cyclic redundancy check* field contains a small number of bits that produce a checksum. The message is calculated by the transmitter according to the message’s content. Receiving nodes then recalculate the field. Any discrepancy in the two CRC fields indicates that the transmitted message and the received message are different.

**crosstalk**

The crosstalk is an undesired signal caused by a capacitive, inductive or conductive coupling between two channels.

**CSA**

The *canadian standards association* defines and maintains standards for industrial electronic equipment in hazardous environments.

**CTS**

*Clear to send* is a data transmission signal and acknowledges the RDS signal from the transmitting station.

**cyclic task**

The cyclic scan time has a fixed duration (interval) specified by the user. If the current scan time is shorter than the cyclic scan time, the controller waits until the cyclic scan time has elapsed before starting a new scan.

**D**

**data log**

The controller logs events relative to the user application in a data log.

**DCE**

*Data communications equipment* describes devices (often modems) that start, stop, and sustain network sessions.

**Derating**

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

**DHCP**

The *dynamic host configuration protocol* is an advanced extension of BOOTP. DHCP is a more advanced, but both DHCP and BOOTP are common. (DHCP can handle BOOTP client requests.)

**digital I/O**

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

**DIN**

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

**DINT**

A *double integer* type is encoded in a 32-bit format.

**DNS**

The *domain name system* is the naming system for computers and devices connected to a LAN or the Internet.

**drop cable**

A *drop cable* is the unterminated derivation cord used to connect a TAP to a device.

**DSR**

*Data set ready* is a data transmission signal.

**DTM**

With *device type managers* representing the field device in SoMachine, direct communications are possible to every single field device via SoMachine, the controller and the field bus, thus avoiding the need for individual cable connections.

**DWORD**

A *double word* type is encoded in a 32-bit format.

**E****EDS**

*Electronic data sheet* contains for example the properties of a device e.g. parameters and settings of a drive.

**EEPROM**

*Electrically erasable programmable read-only memory* is a type of non-volatile memory used to store data that must be saved when power is removed.

**EIA**

The *electronic industries alliance* is the trade organization for establishing electrical/electronic and data communication standards (including RS-232 and RS-485) in the United States.

**EIA rack**

An *electronic industries alliance rack* is a standardized (EIA 310-D, IEC 60297 and DIN 41494 SC48D) system for mounting various electronic modules in a stack or rack that is 19 inches (482.6 mm) wide.

**electronic module**

In a programmable controller system, most electronic modules directly interface to the sensors, actuators, and external devices of the machine/process. This electronic module is the component that mounts in a bus base and provides electrical connections between the controller and the field devices. Electronic modules are offered in a variety of signal levels and capacities. (Some electronic modules are not I/O interfaces, including power distribution modules and transmitter/receiver modules.)

**EN**

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

**encoder**

An *encoder* is a device for length or angular measurement (linear or rotary encoders).

**Equipment**

An *Equipment* is a part of the *Machine*.

**ERC**

*eccentric roller conveyor*

**ESD**

*electrostatic discharge*

**Ethernet**

*Ethernet* is a physical and data link layer technology for LANs, also known as IEEE 802.3.

**EtherNet/IP**

The *ethernet industrial protocol* is an open communications protocol for manufacturing automation solutions in industrial systems. EtherNet/IP is in a family of networks that implements Common Industrial Protocol at its upper layers. The supporting organization (ODVA) specifies EtherNet/IP to accomplish global adaptability and media independence.



**expansion bus**

The *expansion bus* is an electronic communication bus between expansion modules and a CPU.

**expansion I/O module**

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

**expert I/O**

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

**F****FAST I/O**

*FAST I/Os* are specific I/Os with some electrical features (response time, for example) but the treatment of these channels is done by the Controller CPU.

**FAST task**

The *FAST task* is a periodic, high-priority task of a short duration that is run on a processor through its programming software. The task fast speed keeps it from interfering with the execution of lower priority master (MAST) tasks. A FAST task is useful when fast periodic changes in discrete inputs need to be monitored.

**FB**

A *function block* performs a specific automation function, such as speed control, interval control, or counting. A function block comprises configuration data and a set of operating parameters.

**FBD**

A *function block diagram* is a graphically oriented programming language, compliant with IEC 61131-3. It works with a list of networks whereby each network contains a graphical structure of boxes and connection lines which represents either a logical or arithmetic expression, the call of a function block, a jump, or a return instruction.

**FDT**

*Field device tool* for standardized communications between field devices and SoMachine.

**FE**

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

**FG**

*frequency generator*

**firmware**

The *firmware* represents the operating system on a controller.

**Flash memory**

*Flash memory* is nonvolatile memory that can be overwritten. It is stored on a special EEPROM that can be erased and reprogrammed.

**FTP**

*File transfer protocol* is a standard network protocol (built on a client-server architecture), to exchange and manipulate files over TCP/IP based networks.

**function**

A *function*:

- is a POU that returns 1 immediate result
- is directly called with its name (as opposed to through an instance)
- has no persistent state from one call to the next
- can be used as an operand in expressions

Examples: boolean (AND) operators, calculations, conversions (BYTE\_TO\_INT)

**function block (FB)**

See *FB*.

**function block diagram (FBD)**

See *FBD*.

**FWD**

*forward*

## G

### gross weight

Indication of the load weight on an instrument when no tare or predefining device has been used.

### GVL

The *global variable list* manages global variables that are available in every application POU.

## H

### HE10

Rectangular connector for electrical signals with frequencies below 3MHz, complying with IEC60807-2.

### HMI

A *human-machine interface* is an operator interface (usually graphical) for industrial equipment.

### hot swapping

*Hot swapping* is the replacement of a component with a like component while the system remains operational. The replacement component begins to function automatically after it is installed.

### HSC

*high-speed counter*

### HVAC

*Heating ventilation and air conditioning* applications monitor and control indoor environments.

## I

### I/O

*input/output*

### I/O scan

An *input/output scan* continuously polls I/O modules to collect data bits and status, error, and diagnostics information. This process monitors inputs and controls outputs.

### I/O terminal

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

### ICMP

The *internet control message protocol* reports errors and provides information related to datagram processing.

### IEC

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

### IEC 61131-3

The IEC 61131-3 is an *international electrotechnical commission* standard for industrial automation equipment (like controllers). IEC 61131-3 deals with controller programming languages and defines 2 graphical and 2 textual programming language standards:

- **graphical:** ladder diagram, function block diagram
- **textual:** structured text, instruction list

### IEEE

The *institute of electrical and electronics engineers* is a non-profit international standards and conformity assessment body for advances in all fields of electrotechnology.

**IEEE 802.3**

IEEE 802.3 is a collection of IEEE standards defining the physical layer, and the media access control (MAC) sublayer of the data link layer, of wired Ethernet.

**IL**

A program written in the *instruction list* language is composed of a series of instructions executed sequentially by the controller. Each instruction includes a line number, an instruction code, and an operand. (IL is IEC 61131-3 compliant.)

**immediate addressing**

The direct method of addressing memory objects, including physical inputs and outputs, used in programming instructions as operands and parameters by using their direct address (for example, %Iwx or %QWx).

The use of immediate addressing in your program may avoid the need to create symbols for these objects, but there are also disadvantages. For example, if you change the program configuration by adding or deleting devices or I/O modules or slices, the immediate addresses used as programming instruction operands and/or parameters are not updated and must be corrected manually, which may cause extensive program modifications and lead to incorrect programming instructions. (See *symbolic addressing*.)

**input filter**

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

**input terminal**

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

**instruction list language (IL)**

Refer to IL.

**INT**

A single *integer* is encoded in 16 bits.

**IP**

The *internet protocol* is part of the TCP/IP protocol family that tracks the Internet addresses of devices, routes outgoing messages, and recognizes incoming messages.

**IP 20**

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

**IP 67**

*Ingress protection* rating according to IEC 60529. IP67 modules are completely protected against ingress of dust and contact. Ingress of water in harmful quantity is not possible when the enclosure is immersed in water up to 1m.

**IP 67**

*Ingress protection* rating according to IEC 60529. IP67 modules are completely protected against ingress of dust and contact. Ingress of water in harmful quantity is not possible when the enclosure is immersed in water up to 1 m (3.28 ft.).

**K**

**Kd**

derivative gain

**Ki**

integral gain

**Kp**

proportional gain

---

## L

**Ladder Diagram language**

See *LD*.

**LAN**

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

**latching input**

A *latching input* module interfaces with devices that transmit messages in short pulses. Incoming pulses are captured and recorded for later examination by the application.

**LCD**

*liquid crystal display*

**LD**

A program in the *ladder diagram* language includes a graphical representation of instructions of a controller program with symbols for contacts, coils, and blocks in a series of rungs executed sequentially by a controller. IEC 61131-3 compliant.

**LED**

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

**LINT**

*Long integer* is a 64-bit variable (4 times INT or two times DINT).

**LMC**

*lexium motion control*

**load receiver device**

Part of instrument that will receive the load.

**located variable**

A *located variable* has an address. (See *unlocated variable*.)

**LRC**

*longitudinal redundancy checking*

**LREAL**

*Long real* is a 64-bit variable.

**LSB**

The *least significant bit* (or *least significant byte*) is the part of a number, address, or field that is written as the right-most single value in conventional hexadecimal or binary notation.

**LWORD**

A *long word* type is encoded in a 64-bit format.

**M**

**MAC address**

The *media access control address* is 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.

**Machine**

A *Machine* consists of several *functions* and/or *equipments* which build the machine.

**Magelis**

Magelis is the commercial name for Schneider Electric's range of HMI terminals.

**MAST**

A master (MAST) task is a processor task that is run through its programming software. The MAST task has two sections:

- **IN:** Inputs are copied to the IN section before execution of the MAST task.
- **OUT:** Outputs are copied to the OUT section after execution of the MAST task.

**master/slave**

The single direction of control in a network that implements the master/slave model is always from a master device or process to one or more slave devices.



**maximum weight**

Maximum measuring capacity, not taking account of the additive capacity of the tare.

**MIB**

The *management information base* is an object database that is monitored by a network management system like SNMP. SNMP monitors devices that are defined by their MIBs. Schneider has obtained a private MIB, *groupeschneider* (3833).

**minimum I/O update time**

The *minimum I/O update time* is the minimum time it takes for the bus cycle to shut down to force an I/O update at each cycle.

**minimum weight**

Load value under which measuring results can be marred by a relative detected error that is too large.

**Modbus**

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

**Modbus SL**

*Modbus serial line*

**MSB**

The *most significant bit* (or *most significant byte*) is the part of a number, address, or field that is written as the left-most single value in conventional hexadecimal or binary notation.

**N****NAK**

*negative acknowledge*

**NC**

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

**NEC**

The *national electric code* dictates the safe installation of electrical wiring and equipment.

**NEMA**

The *national electrical manufacturers association* publishes standards for the performance of various classes of electrical enclosures. The NEMA standards cover corrosion resistance, ability to protect from rain and submersion, etc. For IEC member countries, the IEC 60529 standard classifies the ingress protection rating for enclosures.

**net weight (net)**

Weight indication of a load placed on an instrument after a tare device has been used.

Net weight = Gross weight - Tare weight

**network**

A network includes interconnected devices that share a common data path and protocol for communications.

**Nibble**

A *Nibble* is a half-byte (representing 4 bits of a byte).

**NMT**

*Network management* protocols provide services for network initialization, error control, and device status control.

**NMT state machine**

A *network management state machine* defines the communication behavior of any CANopen device. The CANopen NMT state machine consists of an initialization state, a pre-operational state, an Operational state, and a stopped state. After power-on or reset, the device enters the initialization state. After the device initialization is finished, the device automatically enters the pre-operational state and announces the state transition by sending the boot-up message. In this manner, the device indicates that it is ready to work. A device that stays in pre-operational state may start to transmit SYNC-, Time Stamp-, or Heartbeat message. In this state, the device can not communicate through a PDO; it must do so with an SDO. In the operational state, the device can use all supported communication objects.

**NO**

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

**node**

A *node* is an addressable device on a communication network.

**O****ODVA**

The *open deviceNet vendors association* supports the family of network technologies that are built on CIP (EtherNet/IP, DeviceNet, and CompoNet).

**OS**

*Operating system*. Can be used for Firmware that can be uploaded/downloaded by the user.

**OSI**

The *open system interconnection* reference model is a 7-layer model that describes network protocol communications. Each abstract layer receives services from the layer below it and provides services to the layer above.

**OTB**

*Optimized terminal block*, used in the context of Advantys I/O distributed module

**output terminal**

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

## P

### **pallet**

A *pallet* is a portable platform, which is used for storing or moving goods.

### **PCI**

A *peripheral component interconnect* is an industry-standard bus for attaching peripherals.

### **PDM**

A *power distribution module* distributes either AC or DC field power to a cluster of I/O modules.

### **PDO**

A *process data object* is transmitted as an unconfirmed broadcast message or sent from a producer device to a consumer device in a CAN-based network. The transmit PDO from the producer device has a specific identifier that corresponds to the receive PDO of the consumer devices.

### **PDU**

*protocol data unit*

### **PE**

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

### **periodic execution**

The master task is executed either cyclically or periodically. In periodic mode, you determine a specific time (period) in which the master task must be executed. If it is executed under this time, a waiting time is generated before the next cycle. If it is executed over this time, a control system indicates the overrun. If the overrun is too high, the controller is stopped.

### **persistent data**

Value of persistent data that will be used at next application change or cold start. Only get re-initialized at a reboot of the controller or reset origin. Especially they maintain their values after a download.

**PI**

*proportional integral*

**PID**

*proportional, integral and derivative control*

**PLC**

The *programmable logic controller* is the “brain” of an industrial manufacturing process. It automates a process, used instead of relay control systems. PLCs are computers suited to survive the harsh conditions of the industrial environment.

**PLCopen**

The PLCopen standard brings efficiency, flexibility, and manufacturer independence to the automation and control industry through the standardization of tools, libraries, and modular approaches to software programming.

**PLI**

*pulse latch input*

**post-configuration**

Post-configuration files contain machine-independent parameters, including:

- machine name
- device name or IP address
- Modbus serial line address
- routing table

**POU**

A *program organization unit* includes a variable declaration in source code and the corresponding instruction set. POUs facilitate the modular reuse of software programs, functions, and function blocks. Once declared, POUs are available to one another. SoMachine programming requires the utilization of POUs.

## **POU FB**

*Program organization unit function block* types are user programs that can be defined by the user in the ST, IL, LD, or FBD languages. You can use POU FB types in an application to:

- simplify the design and entry of the program
- make the program easier to read
- simplify debugging
- reduce the amount of generated code

## **power supply terminals**

The power supply is connected to these terminals to provide power to the controller.

## **Profibus DP**

Profibus Decentralized Peripheral

An open bus system that uses an electrical network based on a shielded 2-wire line or an optical network based on a fiber-optic cable. DP transmission allows for high-speed, cyclic exchange of data between the controller CPU and the distributed I/O devices.

## **protocol**

A *protocol* is a convention or standard that controls or enables the connection, communication, and data transfer between two computing endpoints.

## **Pt100/Pt1000**

Platinum resistance thermometer are characterized by their nominal resistance  $R_0$  at a temperature of  $0^\circ \text{C}$ .

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

## **PTO**

*Pulse train outputs* are used to control for instance stepper motors in open loop.

## **PWM**

*Pulse width modulation* is used for regulation processes (e.g. actuators for temperature control) where a pulse signal is modulated in its length. For these kind of signals, transistor outputs are used.

## R

### RAM

*random access memory*

### REAL

*Real* is a numeric data type. The REAL type is encoded in a 32-bit format.

### real-time clock (RTC)

See RTC

### reflex output

In a counting mode, the high speed counter current value is measured against its configured thresholds to determine the state of these dedicated outputs.

### retained data

A *retained data* value is used in the next power-on or warm start. The value is retained even after an uncontrolled shutdown of the controller or a normal switch-off of the controller.

### RFID

*Radio-frequency identification* is an automatic identification method that relies on the storage and remote retrieval of data using RFID tags or transponders.

### RJ-45

This *registered jack* is a modular connector that is commonly implemented in communication networks.

### RPDO

A *receive PDO* sends data to a device in a CAN-based network.

### RPM

*revolutions per minute*

### RPS

*revolutions per second*

**RS-232**

*RS-232* (also known as EIA RS-232C or V.24) is a standard type of serial communication bus, based on three wires.

**RS-485**

*RS-485* (also known as EIA RS-485) is a standard type of serial communication bus, based on two wires.

**RTC**

The *real-time clock* option keeps the time for a limited amount of time even when the controller is not powered.

**RTS**

*Request to send* is a data transmission signal and will be acknowledged by the CTS signal from the destination node.

**RTU**

A *remote terminal unit* is a device that interfaces with objects in the physical world to a distributed control system or SCADA system by transmitting telemetry data to the system and/or altering the state of connected objects based on control messages received from the system.

**RxD**

*receiving data* (data transmission signal)

**S**

**SCADA**

A *supervisory control and data acquisition* system monitors, manages, and controls industrial applications or processes.

**scale division**

Value in mass units, expressing the difference between two consecutive indications for one numerical indication.



**scan**

A controller scanning program performs 3 basic functions: [1] It reads inputs and places these values in memory; [2] it executes the application program 1 instruction at a time and stores results in memory; [3] It uses the results to update outputs.

**SDO**

A *service data object* message is 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).

**SEL-V**

A system that follows IEC 61140 guidelines for *safety extra low voltage* is protected in such a way that voltage between any 2 accessible parts (or between 1 accessible part and the PE terminal for Class 1 equipment) does not exceed a specified value under normal conditions or under single-fault conditions.

**Sequential Function Chart**

See *SFC*.

**SERCOS**

The *SErial Realtime COmmunications System* is a digital control bus that interconnects:

- motion controls,
- drives,
- I/Os,
- sensors and actuators, for numerically controlled machines and systems.

It is a standardized and open controller-to-intelligent digital device interface, designed for high-speed serial communication of standardized closed-loop real-time data.

**SERCOS III**

Industrial Ethernet based on the SERCOS implementation.

**SFC**

A program written in the *sequential function chart* language can be used for processes that can be split into steps. SFC is composed of steps with associated actions, transitions with associated logic condition, and directed links between steps and transitions. (The SFC standard is defined in IEC 848. It is IEC 61131-3 compliant.)

**sink input**

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

**SINT**

*Signed integer* is a 16-bit value.

**SL**

*serial line*

**SMS**

The *short message service* is a standard communication service for telephones (or other devices) that send short text messages over the mobile communications system.

**SNMP**

The *simple network management protocol* can control a network remotely by polling the devices for their status, performing security tests, and viewing information relating to data transmission. It can also be used to manage software and databases remotely. The protocol also permits active management tasks, such as modifying and applying a new configuration

**source output**

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

**SSI**

*Serial synchronous interface* is a common interface for relative and absolute measurement systems like encoders.

**ST**

See *structured text*.

**STN**

*Scan Twisted Nematic* (also known as passive matrix)

**STRING**

A **STRING** variable is a series of ASCII characters.

**Structured Text**

A program written in the *structured text* (ST) language includes complex statements and nested instructions (such as iteration loops, conditional executions, or functions). ST is compliant with IEC 61131-3.

**symbol**

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

**symbolic addressing**

The indirect method of addressing memory objects, including physical inputs and outputs, used in programming instructions as operands and parameters by first defining symbols for them using these symbols in association with the programming instructions.

In contrast to immediate addressing, this is the recommended method because if the program configuration changes, symbols are automatically updated with their new immediate address associations, whereas any immediate addresses used as operands or parameters are not. (See *immediate addressing*.)

**system time**

An internal clock provides a device with the system time.

**system variable**

A system variable structure provides controller data and diagnostic information and allows sending commands to the controller.

**T****TAP**

A *terminal access point* is a junction box connected to the trunk cable that allows you to plug in drop cables.

**tare**

Load placed on the load receiver along with the product to be weighed.

**tare device**

Device allowing the instrument indication to be moved to zero when a load is positioned on the load receiver:

**tare predefining device**

Device allowing a predefined tare value to be subtracted from a gross weight value and indicating the result of the calculation. The load range is consequently reduced.

**Tare Value**

Weight value of a load, determined by a tare full-bridge strain gauge electronic module.

**taring**

Action allowing the instrument indication to be moved to zero when a load is positioned on the load receiver.

**task**

A group of sections and subroutines, executed cyclically or periodically for the MAST task, or periodically for the FAST task.

A task possesses a level of priority and is linked to inputs and outputs of the controller. These I/O are refreshed in consequence.

A controller can have several tasks.

**TCP**

A *transmission control protocol* is a connection-based transport layer protocol that provides a reliable simultaneous bi-directional transmission of data. TCP is part of the TCP/IP protocol suite.

**terminal block**

The *terminal block* is the component that mounts in an electronic module and provides electrical connections between the controller and the field devices.

**TFT**

*thin film transmission* (also known as active matrix)

**threshold output**

*Threshold outputs* are controlled directly by the HSC according to the settings established during configuration.

**TP**

A *touch probe* is a position capture that is triggered by a fast input signal (quick sensor). On the rising edge of the touch probe input the position of an encoder is captured. Example: This is used for packaging machines to capture the position of a printmark on a film to cut always on the same position.

**TPDO**

A *transmit PDO* reads data from a device in a CAN-based system.

**trunk cable**

A *trunk cable* is the main cable that is terminated at both physical ends with line termination resistors.

**TVDA**

*tested validated documented architectures*

**TxD**

TxD represents a transmit signal.

**U****UDINT**

An *unsigned double integer* is encoded in 32 bits.

**UDP**

The *user datagram protocol* is 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).

**UINT**

An *unsigned integer* is encoded in 16 bits.

**UL**

*Underwriters Laboratories*, US organization for product testing and safety certification.

**unlocated variable**

An *unlocated variable* does not have an address. (See *located variable*.)

**UTC**

*coordinated universal time*

**V**

**VSD**

*variable speed drive*

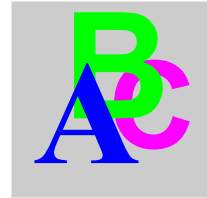
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The *WORD* type is encoded in a 16-bit format.

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