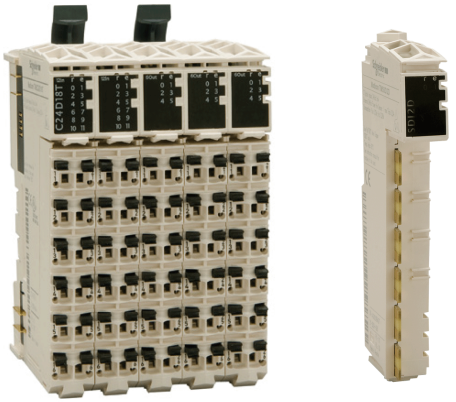
Modicon TM5

Expansion Modules Configuration Programming Guide

04/2012



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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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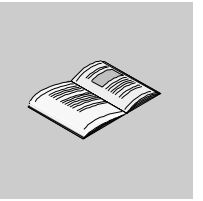
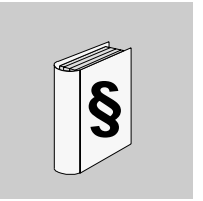


Safety Information



Important Information

NOTICE

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

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

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

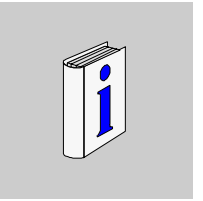
NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

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

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

About the Book



At a Glance

Document Scope

This manual describes the configuration of the Modicon TM5 Input/Output expansion modules. For further information, refer to the separate documents provided in the SoMachine online help.

Validity Note

This document has been updated with the release of SoMachine V3.1.

Related Documents

Title of Documentation	Reference Number
Modicon M258 Logic Controller Programming Guide	EIO0000000402 (Eng); EIO0000000403 (Fre); EIO0000000404 (Ger); EIO0000000405 (Spa); EIO0000000406 (Ita); EIO0000000407 (Chs)
Modicon LMC058 Motion Controller Programming Guide	EIO0000000408 (Eng); EIO0000000409 (Fre); EIO0000000410 (Ger); EIO0000000411 (Spa); EIO0000000412 (Ita); EIO0000000413 (Chs)
Modicon TM5 IoDrvTM5SEAISG Strain Gauge Library Guide	EIO0000001185 (Eng), EIO0000001186 (Fre), EIO0000001187 (Ger), EIO0000001188 (Spa), EIO0000001189 (Ita), EIO0000001190 (Chs)

Modicon TM5 Compact I/O Modules Hardware Guide	EIO0000000456 (Eng); EIO0000000457 (Fre); EIO0000000458 (Ger); EIO0000000459 (Spa); EIO0000000460 (Ita); EIO0000000461 (Chs)
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 Expert (High Speed Counter) Modules Hardware Guide	EIO0000000462 (Eng); EIO0000000463 (Fre); EIO0000000464 (Ger); EIO0000000465 (Spa); EIO0000000466 (Ita); EIO0000000467 (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.

Product Related Information

⚠ WARNING

LOSS OF CONTROL

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

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

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

User Comments

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

I/O Configuration General Information

1

Introduction

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

What's in this Chapter?

This chapter contains the following topics:

General Description

Introduction

The range of expansion I/O includes:

- TM5 Compact I/O modules with integrated modules
- TM5 Digital I/O modules
- TM5 Analog I/O modules
- TM5 Expert I/O modules
- TM5 Transmitter - Receiver 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.

Expert modules are used for counting. They use either a Synchronous Serial Interface (SSI) encoder, incremental encoder (ABR) or event counting.

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

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 has specific thermal or EMC requirements, or as a place holder for later system expansion.

Compact I/O Expansion Features

Reference	Number of Channels	Voltage/Current
TM5C24D18T *(see page 29)*	24 digital inputs	24 Vdc / 3.75 mA
	18 digital outputs	24 Vdc / 0.5 A
TM5C12D8T *(see page 32)*	12 digital inputs	24 Vdc / 3.75 mA
	8 digital outputs	24 Vdc / 0.5 A

Reference	Number of Channels	Voltage/Current
TM5C24D12R *(see page 40)*	24 inputs	24 Vdc / 3.75 mA
	12 relays	24 Vdc / 230 Vac 2 A NO
TM5CAI8O8VL *(see page 43)*	8 analog inputs	-10...+10 Vdc
	8 analog outputs	-10...+10 Vdc
TM5CAI8O8CL *(see page 46)*	8 analog inputs	0...20 mA / 4...20 mA
	8 analog outputs	0...20 mA
TM5CAI8O8CVL *(see page 49)*	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
TM5C12D6T6L *(see page 36)*	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

Digital I/O Expansion Features

Reference	Number of Channels	Voltage/Current
TM5SDI2D *(see page 72)*	2 inputs	24 Vdc / 3.75 mA
TM5SDI4D *(see page 72)*	4 inputs	24 Vdc / 3.75 mA
TM5SDI6D *(see page 72)*	6 inputs	24 Vdc / 3.75 mA
TM5SDI12D *(see page 77)*	12 inputs	24 Vdc / 3.75 mA
TM5SDI2A *(see page 75)*	2 inputs	100...240 Vac
TM5SDI4A *(see page 75)*	4 inputs	100...240 Vac
TM5SDI6U *(see page 75)*	6 inputs	100...120 Vac

Reference	Number of Channels	Voltage/Current
TM5SDO2T *(see page 80)*	2 outputs	24 Vdc / 0.5 A
TM5SDO4T *(see page 80)*	4 outputs	24 Vdc / 0.5 A
TM5SDO6T *(see page 80)*	6 outputs	24 Vdc / 0.5 A
TM5SDO12T *(see page 80)*	12 outputs	24 Vdc / 0.5 A
TM5SDO4TA *(see page 83)*	4 outputs	24 Vdc / 2 A
TM5SDO8TA *(see page 83)*	8 outputs	24 Vdc / 2 A
TM5SDO2R *(see page 86)*	2 outputs	30 Vdc / 230 Vac 5 A C/O
TM5SDO4R *(see page 86)*	4 outputs	30 Vdc / 230 Vac 5 A NO
TM5SDO2S *(see page 88)*	2 outputs	230 Vac / 1 A
TM5SDM12DT *(see page 90)*	8 inputs 4 outputs	24 Vdc / 7 mA 24 Vdc / 0.5 A
TM5SMM6D2L *(see page 92)*	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 109)*	2 inputs	-10...+10 Vdc 0...20 mA / 4...20 mA
TM5SAI4L *(see page 109)*	4 inputs	-10...+10 Vdc 0...20 mA / 4...20 mA
TM5SAI2H *(see page 102)*	2 inputs	-10...+10 Vdc 0...20 mA
TM5SAI4H *(see page 102)*	4 inputs	-10...+10 Vdc 0...20 mA

Reference	Number of Channels	Voltage/Current
TM5SAO2L *(see page 130)*	2 outputs	-10...+10 Vdc 0...20 mA
TM5SAO2H *(see page 130)*	2 outputs	-10...+10 Vdc 0...20 mA
TM5SAO4L *(see page 132)*	4 outputs	-10...+10 Vdc 0...20 mA
TM5SAO4H *(see page 132)*	4 outputs	-10...+10 Vdc 0...20 mA

Temperature Analog Expansion Features

Reference	Number of Channels	Sensor Type
TM5SAI2PH *(see page 118)*	2 inputs	PT100/1000
TM5SAI4PH *(see page 118)*	4 inputs	PT100/1000
TM5SAI2TH *(see page 123)*	2 inputs	Thermocouple J, K, N, S
TM5SAI6TH *(see page 123)*	6 inputs	Thermocouple J, K, N, S

Analog Strain Gauge Input Electronic Modules Features

Reference	Number of Channels	Sensor Type
TM5SEAISG *(see page 129)*	1 input	Full-bridge strain gauge

Expert Expansion Features

Reference	Number of Channels	Encoder Inputs
TM5SE1IC02505 *(see page 136)*	1	5 Vdc Symmetrical
TM5SE1IC01024 *(see page 140)*	1	24 Vdc Asymmetrical
TM5SE2IC01024 *(see page 144)*	2	24 Vdc Asymmetrical

Reference	Number of Channels	Encoder Inputs
TM5SE1SC10005 *(see page 148)*	1	5 Vdc Symmetrical
TM5SDI2DF *(see page 152)*	2	Event counting, gate measurement

Transmitter-Receiver Expansion Features

Reference	Modules Description
TM5SBET1 *(see page 158)*	TM5 data transmitter electronic module.
TM5SBET7 *(see page 160)*	TM5 data transmitter electronic module. It also distributes power to the TM7 bus.
TM5SBER2 *(see page 162)*	TM5 data receiver electronic module. It also distributes power to the TM5 bus and to the 24 Vdc I/O power segment.

Power Distribution Expansion Features

Reference	Modules Description
TM5SPS1 *(see page 166)*	24 Vdc I/O power segment supply
TM5SPS1F *(see page 168)*	24 Vdc I/O power segment supply with integrated fuse
TM5SPS2 *(see page 170)*	24 Vdc I/O power segment supply and TM5 bus supply
TM5SPS2F *(see page 172)*	24 Vdc I/O power segment supply with integrated fuse and TM5 bus supply

Common Distribution Expansion Features

Reference	Number of Channels	Voltage
TM5SPDG12F *(see page 176)*	12	24 Vdc
TM5SPDD12F *(see page 178)*	12	24 Vdc
TM5SPDG5D4F *(see page 180)*	2 x 5	0 Vdc - 24 Vdc
TM5SPDG6D6F *(see page 182)*	2 x 6	0 Vdc - 24 Vdc

Dummy Expansion Features

Reference	Number of channels	Voltage
TM5SD000 *(see page 184)*	–	–

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.

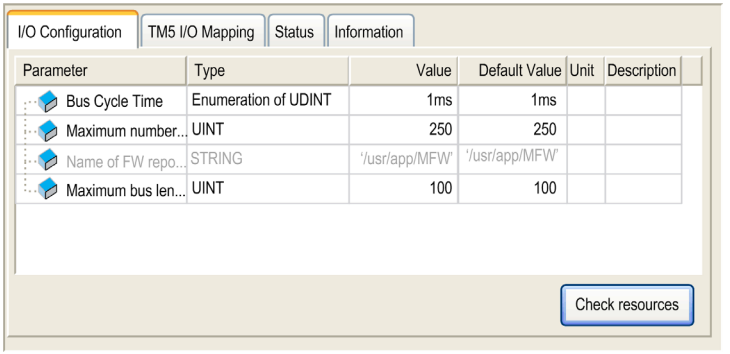
Failure to follow these instructions can result in death, serious injury, or equipment damage.

To verify if the hardware and software configuration match, use the **GVL TM5_Module_R** function regularly to monitor the expansion bus status.

TM5 Manager Configuration

TM5 Manager Configuration

To configure the TM5 Manager, proceed as follows:

Step	Action
1	Select the **Configuration** tab and double-click the controller.
2	Click the **TM5** →**TM5_Manager** entry on the left-hand side. **Result**: The TM5 Manager configuration window is displayed: 

Parameters of the TM5 Manager:

Parameter	Value	Default Value	Unit	Description
Bus Cycle Time	0.5 ms 1 ms 2 ms 3 ms 4 ms 5 ms	1 ms	ms	Expansion Bus Cycle Time
Maximum number of physical slots	Number of Embedded modules...250	250	-	Maximum number of modules on the expansion bus.
Name of FW repository	Not configurable	-	-	This parameter indicates the Flash memory repository for the modules firmware.
Maximum bus length in meters (feet)	1...2500 (3.28...8202)	100 (328)	m	Total cable length used on the expansion bus.

NOTE: For more information about the maximum capacities of your system, refer to the TM5 / TM7 System Planning and Installation Guide.

Bus Cycle Time

Bus Cycle Time can be configured from 0.5 to 5 ms. Very fast cycles reduce the idle time for handling monitoring, diagnostics and acyclic commands.

The Bus Cycle Time follows 2 rules:

- The Bus Cycle Time must be longer than the greatest **Minimum Cycle Time** of any expansion module or block in the configuration.
- The Bus Cycle Time must be long enough to permit the data exchange with all the modules and the blocks. The calculation of this minimum Bus Cycle time is made by the function Check Resources *(see page 20)*.

Minimum Cycle Time

The Minimum Cycle Time of a module or of a block is the time needed by the module or the block to perform I/O management. If the Bus Cycle Time is shorter than this minimum value, the module will not operate properly.

Minimum I/O Update Time

The Minimum I/O Update Time of a module or block is the time needed by the module or block to update I/O on the bus. If the Bus Cycle Time is shorter than this minimum value, the I/O will be updated on the bus at the next Bus Cycle Time.

I/O Management

At the beginning of each task, the %I memory variable for the inputs used in the task is updated with the physical state of the input.

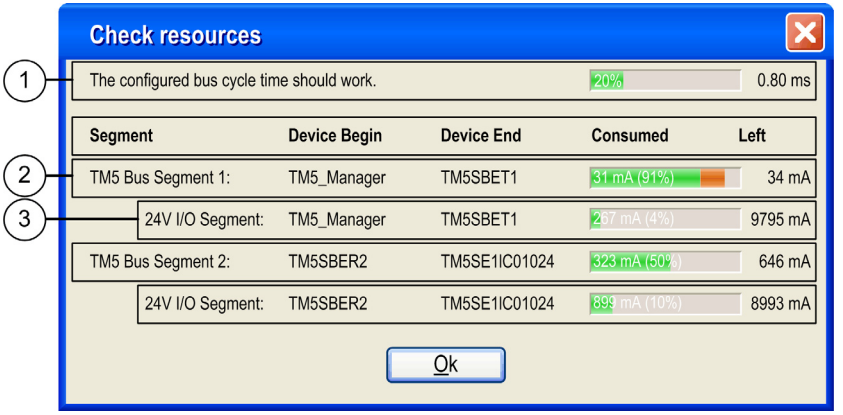
At the end of each task, the used %Q memory variable value for the outputs is updated.

On the next bus cycle after the end of the task configured as the **Bus cycle task**, the physical output is updated from the %Q memory variable value.

For more details on **Bus cycle task**, refer to Logic Controller PLC Settings *(see Modicon M258 Logic Controller, Programming Guide)* or Motion Controller PLC Settings. *(see Modicon M258 Logic Controller, Programming Guide)*

Check Resources

You can check if the Bus Cycle Time is valid and the power supply of the expansion modules and blocks.



To check resources of the expansion modules, proceed as follows:

Legend	Description
1	Indicates if the configured bus cycle time should work or should be increased.
2	Provides the consumption status on the TM5 Bus segment (1)
3	Provides a consumption status on the 24 Vdc I/O power segment (1). This value depends on the **24 Vdc I/O segment external current** on TM5 power supply bus parameter available in the **I/O Configuration** tab. This parameter is not necessarily available with all electronic modules.

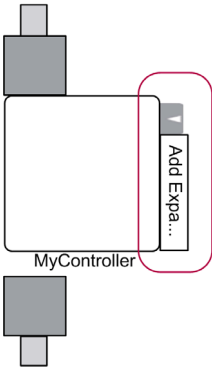
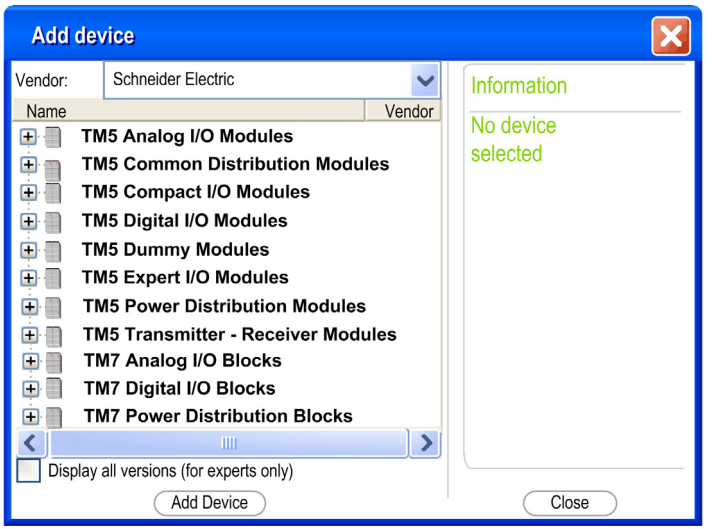
(1) A segment is a group of I/O modules that are supplied by the same Power Distribution Module.

NOTE: The current consumption figures presented by the **Check Resources** function are based on assumed values, and not on actual current measurements. The assumed values for the outputs are based on classic loads but can be adjusted using the 24 Vdc I/O segment external current setting in the I/O Configuration *(see page 22)* tab of each module. The assumptions for input signals are based on known internal loads and are therefore not modifiable. While the use of the Check Resources function to test the power budget is required, it is no substitute for actual and complete system testing and commissioning, refer to the TM5 / TM7 System Planning and Installation Guide.

Adding an Expansion Module

Procedure

The table below describes how to add an expansion module to the controller:

Step	Action
1	Select the **Configuration** tab.
2	In the **Graphical Configuration Editor**, click **Add Expansion**: 
3	In the **Add Device** window, select one expansion module to add: 
4	Click **Add and Close**.

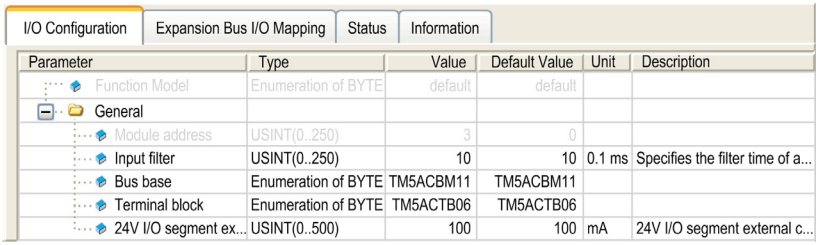
I/O Configuration

To configure TM5 expansion modules, proceed as follows:

Step	Action
1	Select the **Configuration** tab.
2	Double-click the expansion module. **Result:** The **I/O Configuration** tab of the module appears.

I/O Configuration Tab Description

Set the parameters of the expansion module using the **I/O Configuration** tab:

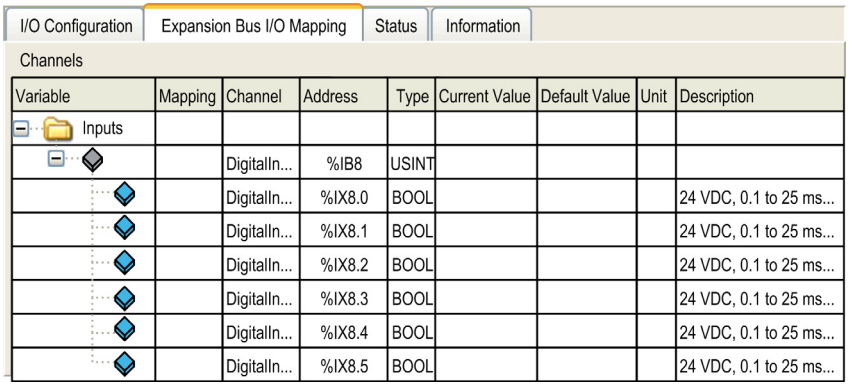


The **I/O Configuration** tab contains the following columns:

Column	Description	Editable
Parameter	Parameter name	No
Type	Parameter data type	No
Value	Value of the parameter	If the parameter is editable, an edit frame can be opened by double-clicking.
Default Value	Default parameter value	No
Unit	Unit value of the parameter	No
Description	Short description of the parameter	No

Expansion Bus I/O Mapping Tab Description

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



The **Expansion Bus I/O Mapping** tab contains the following columns:

Column	Description
Variable	Lets you map the channel on a variable. Double-click the icon to enter the variable name. If it is a new variable, the variable is created. It is also possible to map an existing variable with the variables **Input Assistant** by clicking the**...** button.
Mapping	Indicates if the channel is mapped on a new variable or an existing variable.
Channel	Name of the channel of the device
Address	Address of the channel
Type	Data type of the channel
Current Value	Current value of the channel, displayed in online mode
Default Value	Value taken by the Output when the controller is in a STOPPED or HALT state. For more details, refer to Logic Controller PLC Settings *(see Modicon M258 Logic Controller, Programming Guide)* or Motion Controller PLC Settings *(see Modicon LMC058 Motion Controller, Programming Guide)*. Double-click to change the default value.
Unit	Unit of the channel value
Description	Description of the channel

NOTE: %I value is updated from physical information at the beginning of each task using the **%I**.

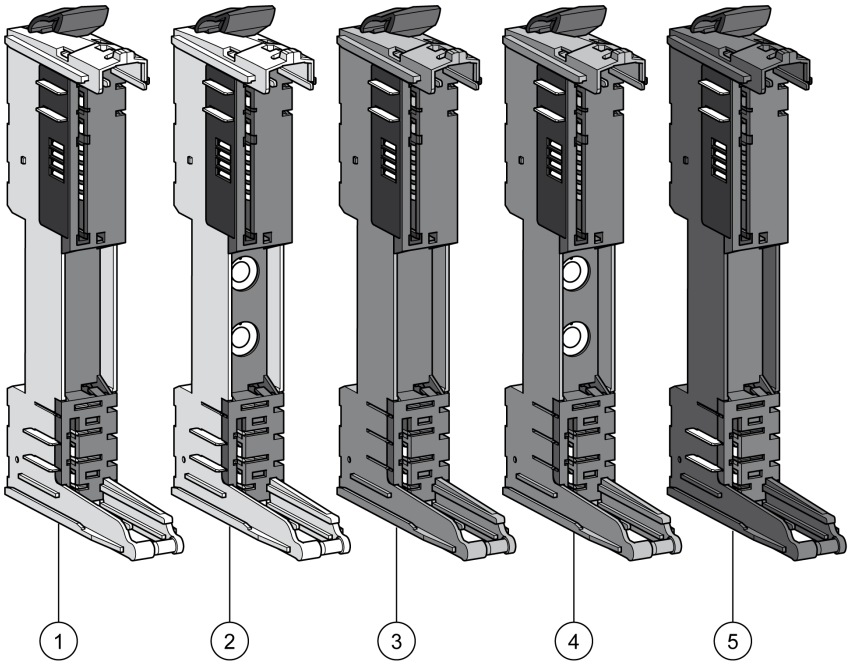
Physical output level is updated from memory variable for the outputs value within the task configured by **Bus cycle task** configuration.

For more details on **Bus cycle task**, refer to Logic Controller PLC Settings *(see Modicon M258 Logic Controller, Programming Guide)* or Motion Controller PLC Settings *(see Modicon LMC058 Motion Controller, Programming Guide)*.

TM5 Bus Bases

Set the TM5 bus base in the **I/O Configuration** tab to be consistent with your hardware configuration. Note that this does not apply to compact I/O modules.

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 (1)	White
3	TM5ACBM01R	Bus base 24 Vdc 24 Vdc I/O power segment left isolated	Gray
4	TM5ACBM05R	Bus base 24 Vdc 24 Vdc I/O power segment left isolated with address setting (1)	Gray
5	TM5ACBM12	Bus base 240 Vac 24 Vdc I/O power segment pass-through isolated from the 240 Vac	Black

(1) 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, that allow you to set the address setting number of the slice. All subsequent slices refer to this offset and are addressed thereafter automatically.

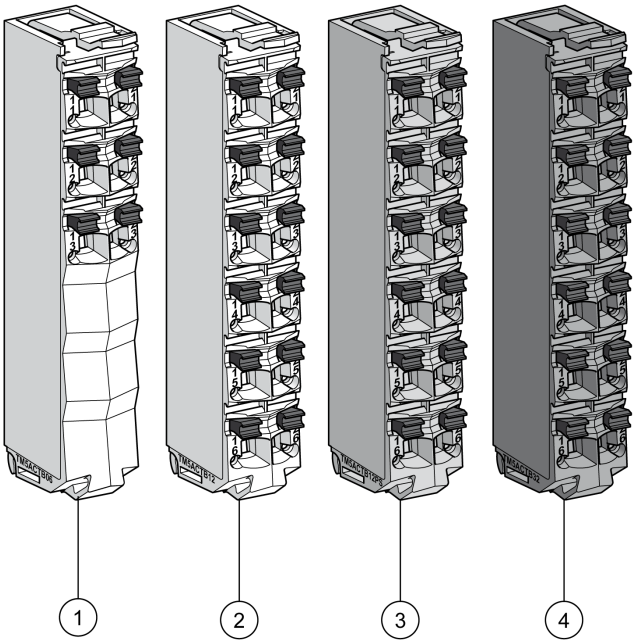
Set the physical address of the TM5ACBM15 and TM5ACBM05R using the **Module address** parameter available from the **I/O Configuration** tab of the module. This parameter becomes editable only when the TM5ACBM15 and TM5ACBM05R are selected in the **Bus base** parameter. The value of the module address set in the **I/O Configuration** tab must be identical to the address set on your hardware.

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

TM5 Terminal Blocks

Set the TM5 terminal block in the **I/O Configuration** tab to be consistent with your hardware configuration.

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), Interface Power Distribution Modules (IPDM) and receiver electronic module (TM5SBER2)	Gray
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 ±10 V and 4AO ±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 ±10 V, 4AI 0-20 mA / 4-20 mA, 4AO ±10 V and 4AO 0-20 mA electronic modules,
- TM5C12D6T6L with the 6In, 6Out, 4AI ±10 V / 0-20 mA / 4-20 mA and 2AO ±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 an expansion electronic module *(see page 21)*.

What's in this Chapter?

This chapter contains the following sections:

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:

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 below describes the **General** parameters of the TM5C24D18T compact I/O module:

Parameter	Value	Default Value	Description
Module address	0...250	0	The address is automatically set when adding the compact I/O modules. The address value depends on the order of adding the module in the SoMachine tree. The compact I/O module do not support the possibility to change the address.

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 ±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 below 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 *(see page 55)*.
Pos.01		
Pos.02	6 digital outputs	Configuration of the digital output 6Out electronic modules *(see page 57)*.
Pos.03		
Pos.04		

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

Refer to the following paragraphs:

- Input Mapping *(see page 30)*, for the input parameters configuration details.
- Output Mapping *(see page 31)*, for the output parameters configuration details.

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

Input Mapping

The table below describes the TM5C24D18T input mapping configuration:

Channel	Type	Description
Pos0_DigitalInputs00	UINT	State of all inputs (bits 12-15 = 0, not used) for the integrated electronic module located at **Pos.00**
DigitalInput00	BOOL	State of input 0
...		...
DigitalInput11		State of input 11
Pos1_DigitalInputs00	UINT	State of all inputs (bits 12-15 = 0, not used) for the integrated electronic module located at **Pos.01**
DigitalInput00	BOOL	State of input 0
...		...
DigitalInput11		State of input 11
Pos2_StatusDigitalOutputs	USINT	Status word of all outputs for the integrated electronic module located at **Pos.02**
StatusDigitalOutput00	BOOL	Status bit associated to each output: ● 0: Ok ● 1: detected error
...		
StatusDigitalOutput05		
Pos3_StatusDigitalOutputs	USINT	Status word of all outputs for the integrated electronic module located at **Pos.03**
StatusDigitalOutput00	BOOL	Status bit associated to each output: ● 0: Ok ● 1: detected error
...		
StatusDigitalOutput05		

Channel		Type	Description
Pos4_StatusDigitalOutputs		USINT	Status word of all outputs for the integrated electronic module located at **Pos.04**
	StatusDigitalOutput00	BOOL	Status bit associated to each output: ● 0: Ok ● 1: detected error
	...		
	StatusDigitalOutput05		
GlobalModuleStatusInputs		UINT	State of the compact IO and the electronic modules
	StatusPos00	BOOL	State of the electronic module in position 0 (OK=1)
	...		...
	StatusPos04		State of the electronic module in position 4 (OK=1)
	Not Used		Bit not used
	GlobalModuleStatus		State of the compact IO (OK=0)

Output Mapping

The table below describes the TM5C24D18T output mapping configuration:

Channel		Type	Description
Pos2_DigitalOutputs		USINT	Command word of all outputs for the integrated electronic module located at **Pos.02**
	DigitalOutput00	BOOL	Command bit of output 0
	...		...
	DigitalOutput05		Command bit of output 5
Pos3_DigitalOutputs		USINT	Command word of all outputs for the integrated electronic module located at **Pos.03**
	DigitalOutput00	BOOL	Command bit of output 0
	...		...
	DigitalOutput05		Command bit of output 5
Pos4_DigitalOutputs		USINT	Command word of all outputs for the integrated electronic module located at **Pos.04**
	DigitalOutput00	BOOL	Command bit of output 0
	...		...
	DigitalOutput05		Command bit of output 5

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 below describes the **General** parameters of the TM5C12D8T compact I/O module:

Parameter	Value	Default Value	Description
Module address	0...250	0	The address is automatically set when adding the compact I/O modules. The address value depends on the order of adding the module in the SoMachine tree. The compact I/O module do not support the possibility to change the address.

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 ±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 below 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 53)*
Pos.01		
Pos.02		
Pos.03	4 digital outputs	Configuration of the digital output 4Out electronic modules *(see page 56)*
Pos.04		

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

Refer to the following paragraphs:
- Input Mapping *(see page 33)*, for the input parameters configuration details.
- Output Mapping *(see page 35)*, for the output parameters configuration details.

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

Input Mapping

The table below describes the TM5C12D8T input mapping configuration:

Channel		Type	Description
Pos0_DigitalInputs		USINT	State of all inputs (bits 4-7 = 0, not used) for the integrated electronic module located at **Pos.00**
	DigitalInput00	BOOL	State of input 0
	...		...
	DigitalInput03		State of input 03
Pos1_DigitalInputs		USINT	State of all inputs (bits 4-7 = 0, not used) for the integrated electronic module located at **Pos.01**
	DigitalInput00	BOOL	State of input 0
	...		...
	DigitalInput03		State of input 3

Channel		Type	Description
Pos2_DigitalInputs		USINT	State of all inputs (bits 4-7 = 0, not used) for the integrated electronic module located at **Pos.02**
	DigitalInput00	BOOL	State of input 0
	...		...
	DigitalInput03		State of input 3
Pos3_StatusDigitalOutputs		USINT	Status word of all outputs for the integrated electronic module located at **Pos.03** (bits 4...7: not used).
	StatusDigitalOutput00	BOOL	Status bit associated to each output: ● 0: Ok ● 1: detected error
	...		
	StatusDigitalOutput03		
Pos4_StatusDigitalOutputs		USINT	Status word of all outputs for the integrated electronic module located at **Pos.04** (bits 4...7: not used).
	StatusDigitalOutput00	BOOL	Status bit associated to each output: ● 0: Ok ● 1: detected error
	...		
	StatusDigitalOutput03		
GlobalModuleStatusInputs		UINT	State of the compact IO and the electronic modules
	StatusPos00	BOOL	State of the electronic module in position 0 (OK=1)
	...		...
	StatusPos04		State of the electronic module in position 4 (OK=1)
	Not used		Bit not used
	GlobalModuleStatus		State of the compact IO (OK=0)

Output Mapping

The table below describes the TM5C12D8T output mapping configuration:

Channel		Type	Description
Pos3_DigitalOutputs		USINT	Command word of all outputs for the integrated electronic module located at **Pos.03** (bits 4...7: not used).
	DigitalOutput00	BOOL	Command bit of output 0
	...		...
	DigitalOutput03		Command bit of output 3
Pos4_DigitalOutputs		USINT	Command word of all outputs for the integrated electronic module located at **Pos.04** (bits 4...7: not used).
	DigitalOutput00	BOOL	Command bit of output 0
	...		...
	DigitalOutput03		Command bit of output 3

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 below describes the **General** parameters of the TM5C12D6T6L compact I/O module:

Parameter	Value	Default Value	Description
Module address	0...250	0	The address is automatically set when adding the compact I/O modules. The address value depends on the order of adding the module in the SoMachine tree. The compact I/O module do not support the possibility to change the address.

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 ±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 below 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 54)*
Pos.01		
Pos.02	6 digital outputs	Configuration of the digital output 6Out electronic module *(see page 57)*
Pos.03	4 analog inputs	Configuration of the analog input 4AI ±10 V / 0-20 mA / 4-20 mA electronic module *(see page 62)*
Pos.04	2 analog outputs	Configuration of the analog output 2AO ±10 V / 0-20 mA electronic module *(see page 70)*

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

Refer to the following paragraphs:

- Input Mapping *(see page 37)*, for the input parameters configuration details.
- Output Mapping *(see page 38)*, for the output parameters configuration details.

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

Input Mapping

The table below describes the TM5C12D6T6L input mapping configuration:

Channel		Type	Description
Pos0_DigitalInputs		USINT	State of all inputs (bits 6-7 = 0, not used) for the integrated electronic module located at **Pos.00**
	DigitalInput00	BOOL	State of input 0
	...		...
	DigitalInput05		State of input5

Channel		Type	Description
Pos1_DigitalInputs		USINT	State of all inputs (bits 6-7 = 0, not used) for the integrated electronic module located at **Pos.01**
	DigitalInput00	BOOL	State of input 0
	...		...
	DigitalInput05		State of input 5
Pos2_StatusDigitalOutputs		USINT	Status word of all outputs for the integrated electronic module located at **Pos.02** (bits 6...7: not used).
	DigitalInput00	BOOL	Status bit associated to each output: ● 0: Ok ● 1: detected error
	...		
	DigitalInput05		
Pos3_AnalogInput00		INT	Current value of input 0
...			...
Pos3_AnalogInput03			Current value of input 3
Pos3_StatusInput		USINT	State of all inputs
GlobalModuleStatusInputs		UINT	State of the compact IO and the electronic modules
	StatusPos00	BOOL	State of the electronic module in position 0 (OK=1)
	...		...
	StatusPos04		State of the electronic module in position 4 (OK=1)
	Not used		Bit not used
	GlobalModuleStatus		State of the compact IO (OK=0)

Output Mapping

The table below describes the TM5C12D6T6L output mapping configuration:

Channel		Type	Description
Pos2_DigitalOutputs		USINT	Command word of all outputs for the integrated electronic module located at **Pos.02** (bits 6...7: not used).
	DigitalOutput00	BOOL	Command bit of output 0
	...		...
	DigitalOutput05		Command bit of output 5
Pos4_AnalogOutput00		INT	Command word of the output 0

Channel	Type	Description
Pos4_AnalogOutput01	INT	Command word of the output 1

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 below describes the **General** parameters of the TM5C24D12R compact I/O module:

Parameter	Value	Default Value	Description
Module address	0...250	0	The address is automatically set when adding the compact I/O modules. The address value depends on the order of adding the module in the SoMachine tree. The compact I/O module do not support the possibility to change the address.

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 ±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 below 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 55)*
Pos.01		
Pos.02	6 relay outputs	Configuration of the digital output relay 6Rel electronic modules *(see page 58)*
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 22)*.

Expansion Bus I/O Mapping Tab

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

Refer to the following paragraphs:
- Input Mapping *(see page 41)*, for the input parameters configuration details.
- Output Mapping *(see page 42)*, for the output parameters configuration details.

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

Input Mapping

The table below describes the TM5C24D12R I/O Mapping configuration:

Channel		Type	Description
Pos0_DigitalInput		UINT	State of all inputs (bits 12-15 = 0, not used) for the integrated electronic module located at **Pos.00**
	DigitalInput00	BOOL	State of input 0
	...		...
	DigitalInput11		State of input 11
Pos1_DigitalInputs00		UINT	State of all inputs (bits 12-15 = 0, not used) for the integrated electronic module located at **Pos.01**
	DigitalInput00	BOOL	State of input 0
	...		...
	DigitalInput11		State of input 11

Channel		Type	Description
GlobalModuleStatusInputs		UINT	State of the compact IO and the electronic modules
	StatusPos00	BOOL	State of the electronic module in position 0 (OK=1)
	...		...
	StatusPos04		State of the electronic module in position 4 (OK=1)
	Not used		Bit not used
	GlobalModuleStatus		State of the compact IO (OK=0)

Output Mapping

The table below describes the TM5C24D12R I/O Mapping configuration:

Channel			Description
Pos2_DigitalOutputs		UINT	Command word of all outputs for the integrated electronic module located at **Pos.02**
	DigitalOutput00	BOOL	Command bit of output 0
	...		...
	DigitalOutput05		Command bit of output 5
Pos4_DigitalOutputs		UINT	Command word of all outputs for the integrated electronic module located at **Pos.04**
	DigitalOuput00	BOOL	Command bit of output 0
	...		...
	DigitalOutput05		Command bit of output 5

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

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 **General** parameters of the TM5CAI8O8VL compact I/O module:

Parameter	Value	Default Value	Description
Module address	0...250	0	The address is automatically set when adding the compact I/O modules. The address value depends on the order of adding the module in the SoMachine tree. The compact I/O modules do not support the possibility to change the address.

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 ±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 ±10 V electronic modules *(see page 59)*
Pos.01		
Pos.03	4 analog outputs	Configuration of the analog output 4AO ±10 V electronic module *(see page 68)*
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 22)*.

Expansion Bus I/O Mapping Tab

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

Refer to the following paragraphs:
- Input Mapping *(see page 44)*, for the input parameters configuration details.
- Output Mapping *(see page 45)*, for the output parameters configuration details.

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

Input Mapping

The table describes the TM5CAI8O8VL input mapping configuration:

Channel	Type	Description
Pos0_AnalogInput00	INT	Current value of input 0
...		...
Pos0_AnalogInput03		Current value of input 3
Pos0_StatusInput	USINT	Status of the analog inputs
Pos1_AnalogInput00	INT	Current value of input 0
...		...
Pos1_AnalogInput03		Current value of input 3
Pos1_StatusInput	USINT	Status of the analog inputs

Channel		Type	Description
GlobalModuleStatusInputs		UINT	State of the compact IO and the electronic modules
	StatusPos00	BOOL	State of the electronic module in position 0 (OK=1)
	StatusPos01		State of the electronic module in position 1 (OK=1)
	Not Used		Bit not used
	StatusPos03		State of the electronic module in position 3 (OK=1)
	StatusPos04		State of the electronic module in position 4 (OK=1)
	Not used		Bit not used
	GlobalModuleStatus		State of the compact IO (OK=0)

Output Mapping

The table describes the TM5CAI8O8VL output mapping configuration:

Channel	Type	Description
Pos3_AnalogOutput00	INT	Command word of the output 0
...		...
Pos3_AnalogOutput03		Command word of the output 3
Pos4_AnalogOutput00	INT	Command word of the output 0
...		...
Pos4_AnalogOutput03		Command word of the output 3

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
- one 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 **General** parameters of the TM5CAI8O8CL compact I/O module:

Parameter	Value	Default Value	Description
Module address	0...250	0	The address is automatically set when adding the compact I/O modules. The address value depends on the order of adding the module in the SoMachine tree. The compact I/O modules do not support the possibility to change the address.

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 ±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 *(see page 60)*
Pos.01		
Pos.03	4 analog outputs	Configuration of the analog output 4AO 0-20 mA electronic module *(see page 69)*
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 22)*.

Expansion Bus I/O Mapping Tab

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

Refer to the following paragraphs:
- Input Mapping for the input parameters configuration details.
- Output Mapping, for the output parameters configuration details.

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

Input Mapping

The table describes the TM5CAI8O8CL input mapping configuration:

Channel	Type	Description
Pos0_AnalogInput00	INT	Current value of input 0
...		...
Pos0_AnalogInput03		Current value of input 3
Pos0_StatusInput	USINT	State of all inputs
Pos1_AnalogInput00	INT	Current value of input 0
...		...
Pos1_AnalogInput03		Current value of input 3
Pos1_StatusInput	USINT	State of all inputs

Channel		Type	Description
GlobalModuleStatusInputs		UINT	State of the compact IO and the electronic modules
	StatusPos00	BOOL	State of the electronic module in position 0 (OK=1)
	StatusPos01		State of the electronic module in position 1 (OK=1)
	Not Used		Bit not used
	StatusPos03		State of the electronic module in position 3 (OK=1)
	StatusPos04		State of the electronic module in position 4 (OK=1)
	Not used		Bit not used
	GlobalModuleStatus		State of the compact IO (OK=0)

Output Mapping

The table describes the TM5CAI8O8CL output mapping configuration:

Channel	Type	Description
Pos3_AnalogOutput00	INT	Command word of the output 0
...		...
Pos3_AnalogOutput03		Command word of the output 3
Pos4_AnalogOutput00	INT	Command word of the output 0
...		...
Pos4_AnalogOutput03		Command word of the output 3

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
- one 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 **General** parameters of the TM5CAI8O8CVL compact I/O module:

Parameter	Value	Default Value	Description
Module address	0...250	0	The address is automatically set when adding the compact I/O modules. The address value depends on the order of adding the module in the SoMachine tree. The compact I/O modules do not support the possibility to change the address.

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 ±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 ±10 V electronic modules *(see page 59)*
Pos.01	4 analog inputs	Configuration of the analog input 4AI 0-20 mA / 4-20 mA electronic modules *(see page 60)*
Pos.03	4 analog outputs	Configuration of the analog output 4AO ±10 V electronic module *(see page 68)*
Pos.04	4 analog outputs	Configuration of the analog output 4AO 0-20 mA electronic module *(see page 69)*

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 22)*.

Expansion Bus I/O Mapping Tab

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

Refer to the following paragraphs:
- Input Mapping for the input parameters configuration details.
- Output Mapping, for the output parameters configuration details.

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

Input Mapping

The table describes the TM5CAI8O8CVL input mapping configuration:

Channel	Type	Description
Pos0_AnalogInput00	INT	Current value of input 0
...		...
Pos0_AnalogInput03		Current value of input 3
Pos0_StatusInput	USINT	State of all inputs

Channel	Type	Description
Pos1_AnalogInput00	INT	Current value of input 0
...		...
Pos1_AnalogInput03		Current value of input 3
Pos1_StatusInput	USINT	State of all inputs
GlobalModuleStatusInputs	UINT	State of the compact IO and the electronic modules
StatusPos00	BOOL	State of the electronic module in position 0 (OK=1)
StatusPos01		State of the electronic module in position 1 (OK=1)
Not Used		Bit not used
StatusPos03		State of the electronic module in position 3 (OK=1)
StatusPos04		State of the electronic module in position 4 (OK=1)
Not used		Bit not used
GlobalModuleStatus		State of the compact IO (OK=0)

Output Mapping

The table describes the TM5CAI8O8CVL output mapping configuration:

Channel	Type	Description
Pos3_AnalogOutput00	INT	Command word of the output 0
...		...
Pos3_AnalogOutput03		Command word of the output 3
Pos4_AnalogOutput00	INT	Command word of the output 0
...		...
Pos4_AnalogOutput03		Command word of the output 3

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:

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 below describes the 4In electronic module parameters configuration:

Parameter	Value	Default Value	Description
Input filter	0...250	10	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms).
24V I/O segment external current	0...500 mA	200 mA	Current derived from the 24 Vdc I/O power segment to supply the sensors connected to the module. This value is used to balance current consumption on the 24Vdc I/O power segment *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*. This value is used exclusively in the calculation of the **Check Resources** function.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

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 below describes the 6In electronic module parameters configuration:

Parameter	Value	Default Value	Description
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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

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 below describes the 12In electronic module parameters configuration:

Parameter	Value	Default Value	Description
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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

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 below describes the 4Out electronic module parameters configuration:

Parameter	Value	Default Value	Description
Output status information	off on	on	Enable or disable the output status reading function. When the value is set to ON, the status is displayed in the **Expansion Bus I/O Mapping** tab. Status bit associated to each output: ● 0: Ok ● 1: detected error, overload or short circuit
24V I/O segment external current	0...2500 mA	1200 mA	This value includes the current to supply actuators and the sum of the current for all outputs simultaneously activated. It is used to balance current consumption on the 24 Vdc I/O power segment *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*. This value is used exclusively in the calculation of the **Check Resources** function.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

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 below describes the 6Out electronic module parameters configuration:

Parameter	Value	Default Value	Description
Output status information	off on	on	Enable or disable the output status reading function. When the value is set to ON, the status is displayed in the **Expansion Bus I/O Mapping** tab. Status bit associated to each output: ● 0: Ok ● 1: detected error, overload or short circuit
24V I/O segment external current	0...3000 mA	2000 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 *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*. This value is used exclusively in the calculation of the **Check Resources** function.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

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 6Rel electronic module does not have any I/O configuration parameter settings.

Analog Input 4AI ±10 V

Overview

The Analog Input 4AI ±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

No parameter settings are required in the **I/O Configuration** tab for the Analog Input 4AI ±10 V electronic module.

Status Input Register

The **Posx_StatusInput** (where x is the analog input electronic module position) byte describes the status of each input channel:

Bit	Description	Bits value
0-1	Channel 00 status	00: No detected error 11: Wire break
2-3	Channel 01 status	
4-5	Channel 02 status	
6-7	Channel 03 status	

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

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

Parameter	Value	Default Value	Description
Channel 00	0 to 20 mA 4 to 20 mA	0 to 20 mA	Specifies the channel type.
Channel 01	0 to 20 mA 4 to 20 mA	0 to 20 mA	
Channel 02	0 to 20 mA 4 to 20 mA	0 to 20 mA	
Channel 03	0 to 20 mA 4 to 20 mA	0 to 20 mA	

Status Input Register

The **Posx_StatusInput** (where x is the analog input electronic module position) byte describes the status of each input channel:

Bit	Description	Bits value
0-1	Channel 00 status	00: No detected error 11: Wire break
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 (µs)**	
	Without filter	**With filter**
Minimum cycle time	100	500
Minimum I/O update time	300	1000

For further information, refer to TM5 Manager Configuration *(see page 18)*.

Analog Input 4AI ±10 V / 0-20 mA / 4-20 mA

Overview

The Analog Input 4AI ±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 ±10 V / 0-20 mA / 4-20 mA electronic module parameters configuration:

Parameter		Value	Default Value	Description
Lower limit (Minimum value)		-32768...32767	-32768	Specifies the lower measurement limit *(see page 63)*.
Upper limit (Maximum value)		-32768...32767	32767	Specifies the upper measurement limit *(see page 63)*.
Input filter		off on	off	Enables / Disables the input filter *(see page 64)*.
Input limitation		off 16383 8191 4095 2047 1023 511 255	off	Defines the input ramp limitation *(see page 66)*. **NOTE:** This Input limitation parameter is only accessible when the **Input filter** parameter is activated.
Channel 00	Channel type	± 10 V 0 to 20 mA 4 to 20 mA	± 10 V	Specifies the channel type.
Channel 01	Channel type	± 10 V 0 to 20 mA 4 to 20 mA	± 10 V	Specifies the channel type.
Channel 02	Channel type	± 10 V 0 to 20 mA 4 to 20 mA	± 10 V	Specifies the channel type.
Channel 03	Channel type	± 10 V 0 to 20 mA 4 to 20 mA	± 10 V	Specifies the channel type.

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 67)*.

Limit values

You can define 2 different type of limits:

- **Lower limit**
- **Upper limit**

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

NOTE: the **Lower limit** cannot be greater than the **Upper limit**.

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

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

NOTE: The **Upper limit** value cannot be less than the **Lower limit** value.

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

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:

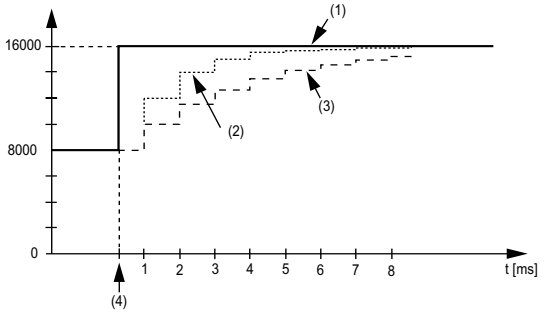
$$Value_{new} = Value_{old} - \frac{Value_{old}}{Filterlevel} + \frac{Inputvalue}{Filterlevel}$$

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

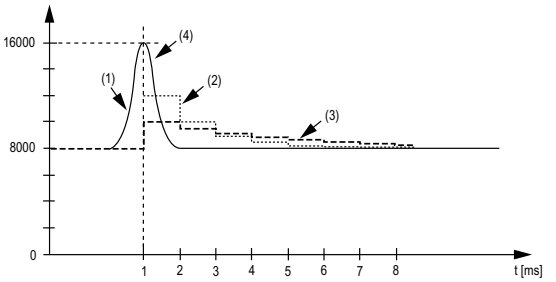


1 Input value
2 Evaluated value: Filter level 2
3 Evaluated value: Filter level 4
4 Input jump

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.

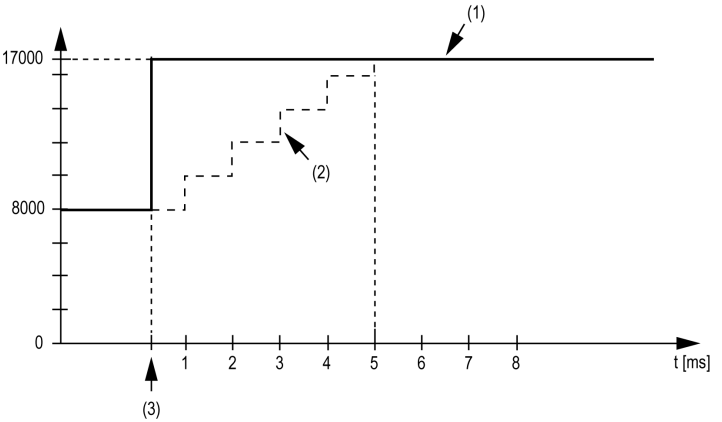
The amount of the change in the input value is checked to make sure the specified limits are not exceeded. If the values are exceeded, the adjusted input value is equal to the old value ± the limit value.

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

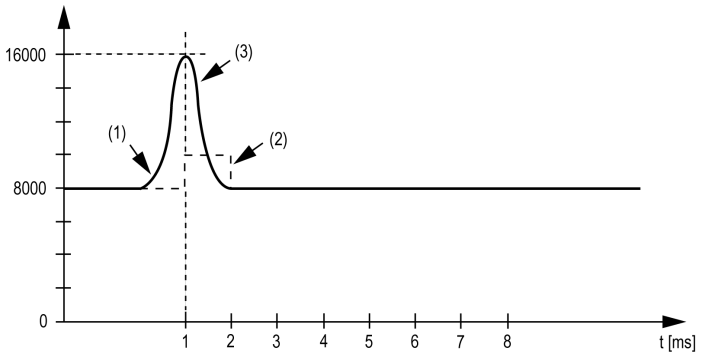


1 Input value
2 Internal adjusted input value before filter
3 Input jump

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 **Posx_StatusInput** (where x is the analog input electronic module position) byte describes the status of each input channel:

Bit	Description	Bits value
0-1	Channel 00 status	00: No detected error 01: Below lower limit value[1] 10: Above upper limit value 11: Wire break
2-3	Channel 01 status	
4-5	Channel 02 status	
6-7	Channel 03 status	

[1] Current signal 0...20 mA
Default setting: The input value has a lower limit. Underflow monitoring is, therefore, not necessary.
After lower limit value changes: The input value is limited to the set value. The status bit is set when the lower limit 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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

Analog Output 4AO ±10 V

Overview

The Analog Output 4AO ±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

No parameter settings are required in the **I/O Configuration** tab for the Analog Output 4AO ±10 V electronic module.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

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

No parameter settings are required in the **I/O Configuration** tab for the Analog Output 4AO 0-20 mA electronic module.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

Analog Output 2AO ±10 V / 0-20 mA

Overview

The Analog Output 2AO ±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 ±10 V / 0-20 mA electronic module parameters configuration:

Parameter		Value	Default Value	Description
Channel 00	Channel type	± 10V 0 to 20mA	± 10V	Specifies the channel type.
Channel 01	Channel type	± 10V 0 to 20mA	± 10V	Specifies the channel type.

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	250
Minimum I/O update time	< 300

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5 Digital I/O Electronic Modules

3

Introduction

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

To add expansion electronic modules, and to access the configuration screens, refer to Adding an expansion electronic module *(see page 21)*.

What's in this Chapter?

This chapter contains the following topics:

TM5SDI2D, TM5SDI4D and TM5SDI6D

Introduction

The TM5SDI2D, TM5SDI4D and TM5SDI6D expansion electronic modules are 24 Vdc Digital Input electronic modules with 2, 4 and 6 inputs respectively.

For further information, refer to the Hardware Guide:

Reference	Refer to
TM5SDI2D	TM5SDI2D Electronic Module 2DI 24 Vdc Sink 3 Wires *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*
TM5SDI4D	TM5SDI4D Electronic Module 4DI 24 Vdc Sink 3 Wires *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*
TM5SDI6D	TM5SDI6D Electronic Module 6DI 24 Vdc Sink 2 Wires *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*

I/O Configuration Tab

To configure the TM5SDI2D, TM5SDI4D and TM5SDI6D electronic modules, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Value	Default Value	Unit	Description
Module address	0...250	Depends on the configuration	-	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.
Input filter	0...250	10 (1 ms)	0.1 ms	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms).
Bus base	TM5ACBM15 TM5ACBM11	TM5ACBM11	-	Specifies the bus base associated with the electronic module.

Parameter	Value	Default Value	Unit	Description
Terminal block	TM5ACTB06 (not for TM5SDI4D) TM5ACTB12	TM5ACTB06 (TM5ACTB12 for TM5SDI4D)	-	Specifies the terminal block associated with the electronic module.
24 V I/O segment external current (Only for TM5SDI2D and TM5SDI4D)	0...500	100 mA (for TM5SDI2D) 200 mA (for TM5SDI4D)	-	Current derived from the 24 Vdc I/O power segment to supply the sensors connected to the module. This value is used to balance current consumption on the 24Vdc I/O power segment *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*. This value is used exclusively in the calculation of the **Check Resources** function.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Description
Inputs	DigitalInputs		USINT	State of all inputs (bits 6-7 = 0, not used)
		DigitalInput00	BOOL	State of input 0
		...		...
		DigitalInput05 *		State of input 5

* The number of DigitalInput bit is equal to the module input number.

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

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 Modicon TM5, Digital I/O Modules, Hardware Guide)*
TM5SDI4A	TM5SDI4A Electronic Module 4DI 100 ... 240 Vac 2 Wires *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*
TM5SDI6U	TM5SDI6U Electronic Module 6DI 100 ... 120 Vac 1 Wire *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*

I/O Configuration Tab

To configure the TM5SDI2A, TM5SDI4A and TM5SDI6U electronic modules, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Value	Default Value	Unit	Description
Input filter	0...250	10 (1 ms)	0.1 ms	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms).
Bus base	TM5ACBM12	TM5ACBM12	-	Specifies the bus base associated with the electronic module.
Terminal block	TM5ACTB32	TM5ACTB32	-	Specifies the terminal block associated with the electronic module.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			**Type**	**Description**
Inputs	DigitalInputs		USINT	State of all inputs
		DigitalInput00	BOOL	State of input 0
		...		...
		DigitalInput05 *		State of input 5
		PowerSupply	BOOL	Status bit associated to external power supply: ● 0: no AC external power supply or < 85 Vac ● 1: AC external power supply OK

* The number of DigitalInput bit is equal to the module input number.

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SDI12D

Introduction

The TM5SDI12D expansion electronic module is a 24 Vdc Digital Inputs electronic module with 12 inputs.

For further information, refer to TM5SDI12D Electronic Module 12DI 24 Vdc Sink 1 Wire *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*.

I/O Configuration Tab

To configure the TM5SDI12D electronic module, select the **I/O Configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Value	Default Value	Unit	Description
Module address	0...250	Depends on the configuration	-	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.
Input filter	0...250	10 (1 ms)	0.1 ms	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms).
Bus base	TM5ACBM15 TM5ACBM11	TM5ACBM11	-	Specifies the bus base associated with the electronic module.
Terminal block	TM5ACTB12	TM5ACTB12	-	Specifies the terminal block associated with the electronic module.

Parameter	Value	Default Value	Unit	Description
24 V I/O segment external current	0...500	100 mA	-	Current derived from the 24 Vdc I/O power segment to supply the sensors connected to the module. This value is used to balance current consumption on the 24Vdc I/O power segment *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*. This value is used exclusively in the calculation of the **Check Resources** function.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Description
Inputs	DigitalInputs		USINT	State of all inputs
		DigitalInput00	BOOL	State of input 0
		...		...
		DigitalInput11		State of input 11

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

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 *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*
TM5SDO4T	TM5SDO4T Electronic Module 4DO 24 Vdc Tr 0.5 A 3 wires *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*
TM5SDO6T	TM5SDO6T Electronic Module 6DO 24 Vdc Tr 0.5 A 2 wires *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*
TM5SDO12T	TM5SDO12T Electronic Module 12DO 24 Vdc Tr 0.5 A 1 wire *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*

I/O Configuration Tab

To configure the TM5SDO2T, TM5SDO4T, TM5SDO6T and TM5SDO12T electronic modules, select the **I/O Configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Value	Default Value	Description
Module address	0...250	Depends on the configuration	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.
Output status information	On Off	On	Enable/Disable read of the output status. **On**: the **StatusDigitalOutputs** word is added to the **Expansion Bus I/O Mapping** tab.
Bus base	TM5ACBM15 TM5ACBM11	TM5ACBM11	Specifies the bus base associated with the electronic module.
Terminal block	TM5ACTB06 TM5ACTB12	TM5ACTB06 TM5ACTB12 (for TM5SDO6T and TM5SDO12T)	Specifies the terminal block associated with the electronic module.

Parameter	Value	Default Value	Description
24 V I/O segment external current	0...1500	700 mA	Current derived from the 24 Vdc I/O power segment to supply the sensors connected to the module. This value is used to balance current consumption on the 24Vdc I/O power segment *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*. This value is used exclusively in the calculation of the **Check Resources** function.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Default value	Description
Inputs	StatusDigitalOutputs		USINT	-	Status word of all outputs
		StatusDigitalOutput00	BOOL	-	Status bit associated to each output: ● 0: Ok ● 1: detected error
		...			
		StatusDigitalOutput11 *			
Outputs	DigitalOuputs		USINT	-	Command word of all outputs
		DigitalOuput00	BOOL	None TRUE FALSE	Command bit of output 0
		...			...
		DigitalOuput11 *			Command bit of output 11

* The number of DigitalOuput bit is equal to the module output number.

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

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 *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*
TM5SDO8TA	TM5SDO8TA Electronic Module 8DO 24 Vdc Tr 2 A 1 Wire *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*

I/O Configuration Tab

To configure the TM5SDO4TA and TM5SDO8TA electronic modules, select the **I/O Configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Value	Default Value	Description
Module address	0...250	Depends on the configuration	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.
Output status information	On Off	On	Enable/Disable read of the output status. **On**: the **StatusDigitalOutputs** word is added to the **Expansion Bus I/O Mapping** tab
Bus base	TM5ACBM15 TM5ACBM11	TM5ACBM11	Specifies the bus base associated with the electronic module.
Terminal block	TM5ACTB12	TM5ACTB12	Specifies the terminal block associated with the electronic module.
Power supply (Only for TM5SDO8TA)	On Off	Off	Enable/Disable read of the power supply status.

Parameter	Value	Default Value	Description
24 V I/O segment external current (Only for TM5SDO4TA)	0...4500	2200 mA	Current derived from the 24 Vdc I/O power segment to supply the sensors connected to the module. This value is used to balance current consumption on the 24Vdc I/O power segment *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*. This value is used exclusively in the calculation of the **Check Resources** function.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Default value	Description
Inputs	StatusDigitalOutputs		USINT	-	Status word of all outputs
		StatusDigitalOutput00	BOOL	-	Status bit associated to each output: ● 0: Ok ● 1: detected error
		...			
		StatusDigitalOutput07 *			
Outputs	DigitalOuputs		USINT	-	Command word of all outputs
		DigitalOuput00	BOOL	None TRUE FALSE	Command bit of output 0
		...			...
		DigitalOuput07 *			Command bit of output 7

* The number of DigitalOuput bit is equal to the module output number.

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SDO2R and TM5SDO4R

Introduction

The TM5SDO2R and TM5SDO4R expansion electronic modules are 30 Vdc 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 Modicon TM5, Digital I/O Modules, Hardware Guide)*
TM5SDO4R	TM5SDO4R Electronic Module 4DO 30 Vdc / 230 Vac 5 A Relay N/O *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*

I/O Configuration Tab

To configure the TM5SDO2R and TM5SDO4R electronic modules, select the **I/O Configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Value	Default Value	Description
Module address	0...250	Depends on the configuration	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	TM5ACBM15 TM5ACBM11	TM5ACBM11	Specifies the bus base associated with the electronic module.
Terminal block	TM5ACTB12	TM5ACTB12	Specifies the terminal block associated with the electronic module.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			**Type**	**Default value**	**Description**
Outputs	DigitalOuputs		USINT	-	Command word of all outputs
		DigitalOuput00	BOOL	None TRUE FALSE	Command bit of output 0
		...			...
		DigitalOuput07 *			Command bit of output 7

* The number of DigitalOuput bit is equal to the module output number.

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

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 *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*.

I/O Configuration Tab

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

The table below describes the modules parameters configuration:

Parameter	Value	Default Value	Description
Module address	0...250	Depends on the configuration	The address is automatically set when adding the modules. The address value depends on the order of adding the module in the SoMachine tree.
Bus base	TM5ACBM12	TM5ACBM12	Specifies the bus base associated with the electronic module.
Terminal block	TM5ACTB32	TM5ACTB32	Specifies the terminal block associated with the electronic module.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			**Type**	**Default value**	**Description**
Inputs	ZeroCrossing		USINT	–	Status zero crossing
		ZeroCrossingInput	BOOL	–	Zero cross detection signal: ● 0: negative half wave ● 1: positive half wave
		Not used		–	–
		Not used		–	–
		Not used		–	–
		ZeroCrossingStatus		–	Status zero cross detection: ● 0: Ok ● 1: detected error
Outputs	DigitalOuputs		USINT	–	Command word of all outputs
		DigitalOuput00	BOOL	None TRUE FALSE	Command bit of output 0
		DigitalOuput01			Command bit of output 1

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SDM12DT

Introduction

The TM5SDM12DT expansion electronic module is a 24 Vdc Digital Inputs 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

To configure the TM5SDM12DT electronic module, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Value	Default Value	Unit	Description
Module address	0...250	Depends on the configuration	-	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.
Input filter	0...250	10 (1 ms)	0.1 ms	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms).
Output status information	On Off	On	-	Enable/Disable read of the output status. **On**: the **StatusDigitalOutputs** word is added to the **Expansion Bus I/O Mapping** tab.
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.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			**Type**	**Default value**	**Description**
Inputs	DigitalInputs		USINT	-	State of all inputs
		DigitalInput00	BOOL	-	State of input 0
		...			
		DigitalInput07			State of input 7
	StatusDigitalOutputs		USINT	-	Status word of all outputs (bits 4...7: not used)
		StatusDigitalOutput00	BOOL	-	Status bit associated to each output: ● 0: Ok ● 1: detected error
		...			
		StatusDigitalOutput03			
Outputs	DigitalOuputs		USINT	-	Command word of all outputs (bits 4...7: not used)
		DigitalOuput00	BOOL	None TRUE FALSE	Command bit of output 0
		...			...
		DigitalOuput03			Command bit of output 3

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SMM6D2L

Introduction

The TM5SMM6D2L expansion electronic modules 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 ±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
General	Module address	0...250	0	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).
	Input latch	on off	off	This parameter allows to activate (when value is **on**) or deactivate (when value is **off**) the input latch.

Parameter		Value	Default Value	Description
Analog Inputs	Lower limit (Minimum value)	-32768...32767	-32768	Specifies the lower measurement limit *(see page 94)*.
	Upper limit (Maximum value)	-32768...32767	32767	Specifies the upper measurement limit *(see page 94)*.
	Channel type	±10 V 0 to 20 mA 4 to 20 mA	±10 V	Specifies the channel type.
	Input filter	off level 2 level 4 level 8 level 16 level 32 level 64 level 128	off	Definition of the filter level *(see page 95)*.
	Input limitation	off 16383 8191 4095 2047 1023 511 255	off	Specifies the limitation of input ramp *(see page 96)*. **NOTE:** Parameter available if an input filter is selected.
Digital Outputs	Output status information	on off	on	Enable/Disable read of the output status. **on**: The **StatusDigitalOutputs** word is added to the **Expansion Bus I/O Mapping** tab.
Analog Outputs	Channel type	±10 V 0 to 20 mA	±10 V	Specifies the channel type.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

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 99)*

Limit Values

You can define 2 different types of limits:

- **Lower limit**
- **Upper limit**

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

NOTE: the **Lower limit** cannot be greater than the **Upper limit**.

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

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

NOTE: The **Upper limit** value cannot be less than the **Lower limit** value.

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

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:

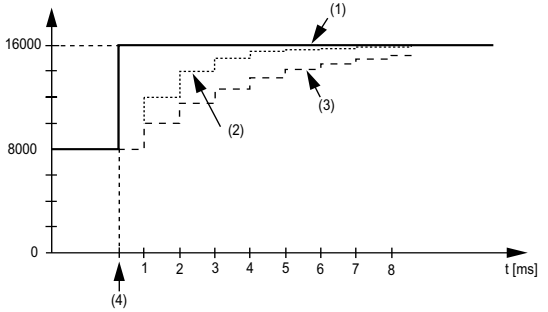
$$Value_{new} = Value_{old} - \frac{Value_{old}}{Filterlevel} + \frac{Inputvalue}{Filterlevel}$$

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

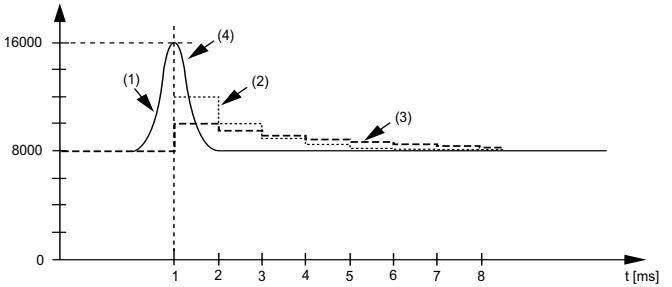


1 Input value.
2 Evaluated value: Filter level 2
3 Evaluated value: Filter level 4
4 Input jump

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.

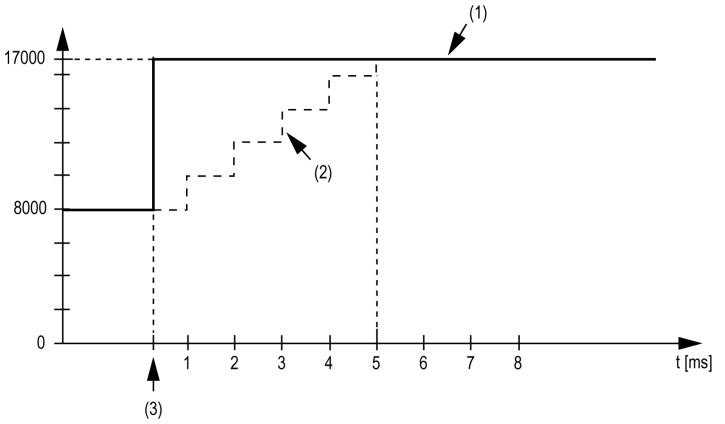
The amount of the change in the input value is checked to make sure the specified limits are not exceeded. If the values are exceeded, the adjusted input value is equal to the old value ± the limit value.

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

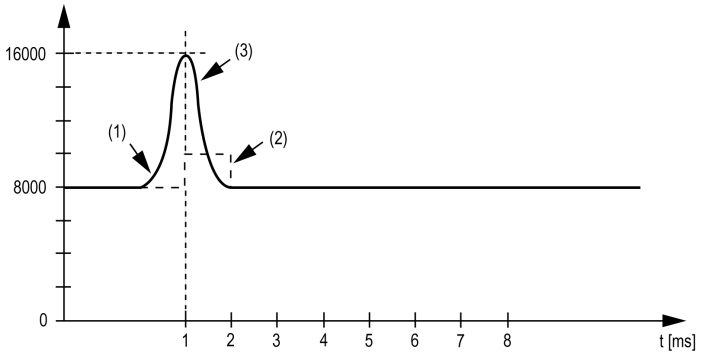


1 Input value
2 Internal adjusted input value before filter
3 Input jump

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)

Expansion Bus I/O Mapping Tab

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

The table describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Value	Description
Inputs	Digital Inputs		USINT	-	State of all inputs.
		DigitalInput00	BOOL	-	State of input 0.
		...			...
		DigitalInput03			State of input 3.
	DigitalInputLatch		USINT	-	Positive edge latched state of the inputs.
		DigitalInput00Latch	BOOL	-	Positive edge latched state of input 00.
		...			...
		DigitalInput03Latch			Positive edge latched state of input 03.
	DigitalInputLatchQuit		USINT	-	Acknowledge latch state of the inputs.
		DigitalInput00LatchQuit	BOOL	-	Acknowledge latch state of input 00.
		...			...
		DigitalInput03LatchQuit			Acknowledge latch state of input 03.
	Analog Inputs				
		AnalogInput00	INT	-	Current value of the input 0.
		StatusInput00	USINT	-	Status of analog input channel (see description in the Status Input Register section of this chapter *(see page 99)*).
Outputs	Digital Outputs				
	DigitalOutputs		USINT	-	Command word of the outputs.
		DigitalOutput00	BOOL	None TRUE FALSE	Command bit of output 0.
		DigitalOutput01			Command bit of output 1.
	Analog Outputs				
		AnalogOutput00	INT	-	Command word of the output 0.

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

Status Input Register

The **StatusInput00** byte describes the status of the analog input channel:

Bit	Description	Bits value
0-1	Channel 00 status	00: No detected error 01: Below lower limit value[1] 10: Above upper limit value 11: Wire break
[1] Current signal 0...20 mA Default setting: The input value has a lower limit. Underflow monitoring is, therefore, not necessary. After lower limit value changes: The input value is limited to the set value. The status bit is set when the lower limit value is passed.		

Cycle Time and I/O Update Time

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

Characteristic	Value (µs)						
	Without filter on analog input channels	**With filter on analog input channels**	**Without filter on digital input channels**	**With filter on digital input channels**	**TM5SAO2H**	**TM5SAO2L**	**On digital output channels**
Minimum cycle time	100	500	100	150	200	250	100
Minimum I/O update time	300	1000	100	200	200	< 300	100

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5 Analog I/O Electronic Modules

4

Introduction

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

To add expansion electronic modules and access to the configuration screens, refer to Adding an expansion electronic module *(see page 21)*.

What's in this Chapter?

This chapter contains the following topics:

TM5SAI2H and TM5SAI4H

Introduction

The TM5SAI2H and TM5SAI4H expansion electronic modules are 10 Vdc Analog Input electronic modules with 2 and 4 inputs respectively.

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 the Hardware Guide:

Reference	Refer to
TM5SAI2H	TM5SAI2H Electronic Module 2AI ±10V/0-20mA 16 Bits *(see Modicon TM5, Analog I/O Modules, Hardware Guide)*
TM5SAI4H	TM5SAI4H Electronic Module 4AI ±10V/0-20mA 16 Bits *(see Modicon TM5, Analog I/O Modules, Hardware Guide)*

I/O Configuration Tab

To configure the TM5SAI2H and TM5SAI4H electronic modules, select the **I/O Configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	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 support the possibility to change the address.
	Sample time	50...10000	100 µs	Time during which all inputs are updated.
	Channel status information	On Off	On	Enable/Disable read of the channel status information **On**: the **Status00** word is added to the **Expansion Bus I/O Mapping** tab.
	Extended channel status information	On Off	Off	Enable/Disable read of the extended channel status information **On**: the **Status01** and **Status02** words are added to the **Expansion Bus I/O Mapping** tab.
	Bus base	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module.
	Terminal block	TM5ACTB06 (only for TM5SAI2H) TM5ACTB12	TM5ACTB06 (for TM5SAI2H) TM5ACTB12 (for TM5SAI4H)	Specifies the terminal block associated with the electronic module.

Parameter	Parameter	Value	Default Value	Description
Channel 00	Channel on/off	On Off	On	Enable/disable the channel. **Off**: The other parameters are fixed to default value in the **Expansion Bus I/O Mapping** tab. **Off**: All the channel bit associated to the input 0 are removed in the **Expansion Bus I/O Mapping** tab.
	Minimum value	-32768...32767	-32768	Limitation minimum value *(see page 104)*
	Maximum value	-32768...32767	32767	Limitation maximum value *(see page 104)*
	Gain	-2147483648... 2147483647	65536	Refer to Scaling *(see page 105)*. 1.0 corresponds with 10000 hex.
	Offset	-2147483648... 2147483647	0	
	Channel type	±10 V 0...20 mA	±10 V	Specifies the channel type.
	Error check	On Off	On	This checks if there is an error on the system.
	Minimum/maximum value check	Off Positive Negative Positive/Negative	Off	Activate minimum and maximum input values *(see page 105)*. Other than **Off**: the **Status03** and **Status04** words are added to the**Expansion Bus I/O Mapping** tab.
	Filter	On Off	Off	Enable/disable the input filter.
	Filter order	1...4	1	Refer to Input Cycle *(see page 106)*. **NOTE:** Parameter only available if an input filter is selected.
	Filter cut off frequency	1...65535	500 Hz	

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

The same Channel00 parameters are also available for:
- Channel01 (for the TM5SAI2H)
- Channel01...03 (for the TM5SAI4H)

Limit Values

The user can specify an upper and lower limit value for each individual channel.

When activated, the input signals are monitored to see if the limit 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 upper or lower limit value.

The result of the signal check is displayed in a corresponding status bit. If necessary, the counters are incremented by one if the value falls outside the range.

Scaling

The raw A/D converter data and the filtered A/D converter data are compared. The system measure and the user measure are grouped internally as a k/d pair to optimize the execution time. Gain and offset can be specified for each individual channel.

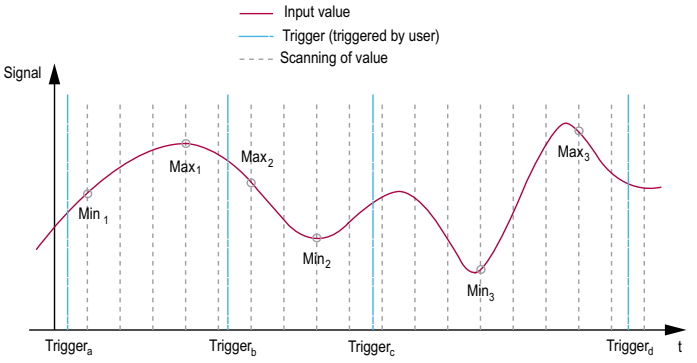
Minimum and Maximum Input Values

The system stores the minimum and maximum values between two trigger events. The function is started by the corresponding trigger edge. The following edges are evaluated depending on the configuration:

- Positive edge
- Negative edge
- Positive and negative edge

The trigger counter counts valid trigger events. In the event that trigger events occur faster than the sampling cycle, the triggering becomes invalid (trigger detected error counter is incremented).

The following example shows how the minimum and maximum input values are recorded:



Trigger Event	Description
Trigger a	The function is started. The system notes the minimum and maximum value of the input signal. The Min./Max values registered by the status bit must be ignored after the initial start.
Trigger b	The minimum value (Min1) and the maximum value (Max1) between Trigger a and Trigger b are given to the register and the new cycle is started. A status bit informs the user as soon as the values are valid.
Trigger c	The minimum value (Min2) and the maximum value (Max2) between Trigger b and Trigger c are given to the register and the new cycle is started. A status bit informs the user as soon as the values are valid.
Trigger d	The minimum value (Min3) and the maximum value (Max3) between Trigger c and Trigger d are given to the register and the new cycle is started. A status bit informs the user as soon as the values are valid.

Input Cycle

The electronic module has an Input cycle 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 (default: 1)
- Filter Cut-off frequency: 1...65535 Hz (default: 500 Hz)

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Default value	Description
Inputs	AnalogInput00		INT	-	Current value of input 0
	...				...
	AnalogInput03				Current value of input 3
	Status04		USINT	-	State of all inputs (Bits 0...3 not used)
		Not used	BOOL	-	-
		...			...
		MinMaxStart00Readback			Readback MinMax Start of input 0
		...			...
		MinMaxStart03Readback			Readback MinMax Start of input 3
	MinInput00		INT	-	Minimum value of input 0
	MaxInput00				Maximum value of input 0
	...				...
	MinInput03				Minimum value of input 3
	MaxInput03				Maximum value of input 3
	Status00		USINT	-	State of all inputs (Bits 5...7 not used)
		Channel00OK	BOOL	-	State of input 0 (0=OK)
		...			...
		Channel03OK			State of input 3 (0=OK)
		Not used			-
		ConvertionCycle			Status convertion cycle bit (0=OK)
	Status01		USINT	-	State of all inputs
		Channel00underflow	BOOL	-	Input 0 underflow (0=OK)
		...			...
		Channel03underflow			Input 3 underflow (0=OK)
		Channel00overflow			Input 0 overflow (0=OK)
		...			...
		Channel03overflow			Input 3 overflow (0=OK)
	Status02		USINT	-	Out of range status of all inputs (Bits 5...7 not used)
		Channel00outofrange	BOOL	-	Input 0 out of range (0=OK)
		...			...
		Channel03outofrange			Input 3 out of range (0=OK)

Channel			Type	Default value	Description
Outputs	Status03		USINT	-	Command word of all outputs (Bits 0...3: not used)
		...	BOOL	None TRUE FALSE	...
		MinMaxStart00			Command bit of Start Min/Max of input 0 (1 = Start)
		...			...
		MinMaxStart03			Command bit of Start Min/Max of input 3 (1 = Start)

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

NOTE: All the bits dedicated to channel 2 and channel 3 are not used (bit=0) for the TM5SAI2H.

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 µs	300 µs
Minimum I/O update time	No limitation on Bus cycle time	

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SAI2L and TM5SAI4L

Introduction

The TM5SAI2L and TM5SAI4L expansion electronic modules are 10 Vdc Analog Input electronic modules with 2 and 4 inputs respectively.

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 the Hardware Guide:

Reference	Refer to
TM5SAI2L	TM5SAI2L Electronic Module 2AI ±10V/0-20mA/4-20mA 12 Bits *(see Modicon TM5, Analog I/O Modules, Hardware Guide)*
TM5SAI4L	TM5SAI4L Electronic Module 4AI ±10V/0-20mA/4-20mA 12 Bits *(see Modicon TM5, Analog I/O Modules, Hardware Guide)*

I/O Configuration Tab

To configure the TM5SAI2L and TM5SAI4L electronic modules, select the **I/O Configuration** tab.

The table below describes the modules parameters configuration:

Parameter		Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	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 support the possibility to change the address.
	Lower limit	-32768...32767	-32767	Specifies the lower measurement limit *(see page 112)*.
	Upper limit	-32768...32767	32767	Specifies the upper measurement limit *(see page 112)*.
	Input filter	Off level 2 level 4 level 8 level 16 level 32 level 64 level 128	Off	Definition of the filter level *(see page 113)*.
	Input limitation	Off 16383 8191 4095 2047 1023 511 255	Off	Specifies the limitation of input ramp *(see page 114)*. **NOTE:** Parameter available if an input filter is selected.
	Bus base	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module.
	Terminal block	TM5ACTB06 (only for TM5SAI2L) TM5ACTB12	TM5ACTB06 (for TM5SAI2L) TM5ACTB12 (for TM5SAI4L)	Specifies the terminal block associated with the electronic module.
Channel 00	Channel type	±10 V 0...20 mA 4...20 mA	±10 V	Specifies the channel type.
Channel 01	Channel type	±10 V 0...20 mA 4...20 mA	±10 V	Specifies the channel type.

Parameter		Value	Default Value	Description
Channel 02	Channel type	±10 V 0...20 mA 4...20 mA	±10 V	Specifies the channel type.
Channel 03	Channel type	±10 V 0...20 mA 4...20 mA	±10 V	Specifies the channel type.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

NOTE: The channel 02 and channel 03 parameters are not available for the TM5SAI2L.

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 117)*

Limit values

You can define 2 different type of limits:

- **Lower limit**
- **Upper limit**

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

NOTE: the **Lower limit** cannot be greater than the **Upper limit**.

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

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

NOTE: The **Upper limit** value cannot be less than the **Lower limit** value.

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

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:

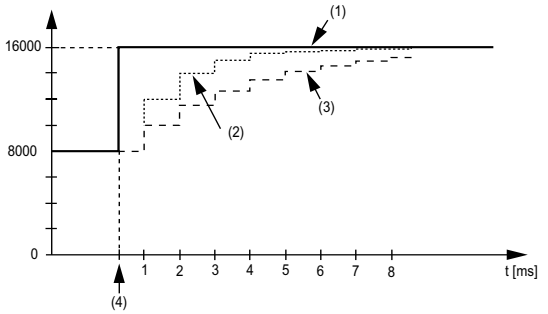
$$Value_{new} = Value_{old} - \frac{Value_{old}}{Filterlevel} + \frac{Inputvalue}{Filterlevel}$$

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

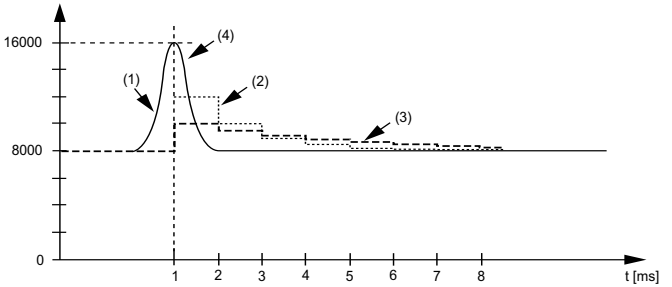


1 Input value.
2 Evaluated value: Filter level 2
3 Evaluated value: Filter level 4
4 Input jump

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.

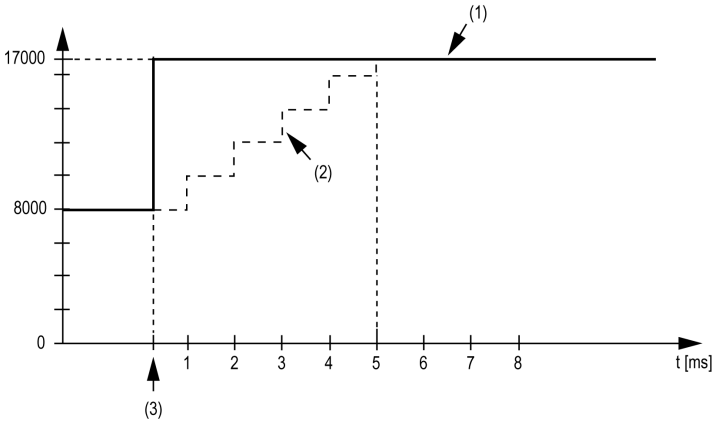
The amount of the change in the input value is checked to make sure the specified limits are not exceeded. If the values are exceeded, the adjusted input value is equal to the old value ± the limit value.

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

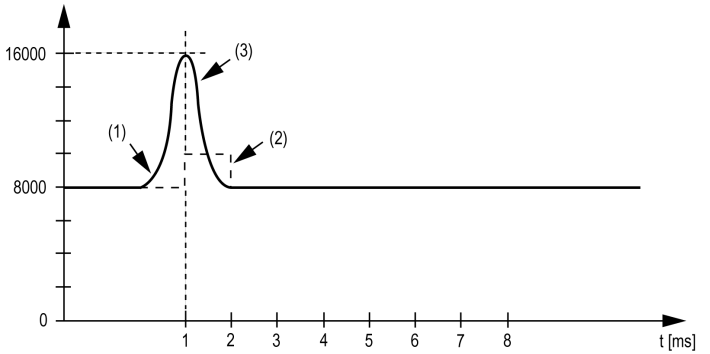


1 Input value
2 Internal adjusted input value before filter
3 Input jump

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)

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel		**Type**	**Default value**	**Description**
Inputs	AnalogInput00	INT	-	Current value of the input 0
	...			...
	AnalogInput03			Current value of the input 3
	StatusInput00	USINT	-	Status of analog input channels (see description below)

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

NOTE: The bytes dedicated to channel 2 and channel 3 are not available for the TM5SAI2L.

Status Input Register

The **StatusInput00** byte describes the status of each input channel:

Bit	**Description**	**Bits value**
0-1	Channel 00 status	00: No detected error 01: Below lower limit value[1] 10: Above upper limit value 11: Wire break
2-3	Channel 01 status	
4-5	Channel 02 status	
6-7	Channel 03 status	

[1]
Current signal 0...20 mA
Default setting: The input value has a lower limit. Underflow monitoring is, therefore, not necessary.
After lower limit value changes: The input value is limited to the set value. The status bit is set when the lower limit value is passed.

NOTE: The bit dedicated to channel 2 and channel 3 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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SAI2PH and TM5SAI4PH

Introduction

The TM5SAI2PH and TM5SAI4PH expansion electronic modules are Analog Resistor Temperature electronic modules with 2 and 4 Inputs 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
TM5SAI2PH	TM5SAI2PH Electronic Module 2AI PT100/PT1000 16 Bits *(see Modicon TM5, Analog I/O Modules, Hardware Guide)*
TM5SAI4PH	TM5SAI4PH Electronic Module 4AI PT100/PT1000 16 Bits *(see Modicon TM5, Analog I/O Modules, Hardware Guide)*

I/O Configuration Tab

To configure the TM5SAI2PH and TM5SAI4PH electronic modules, select the **I/O Configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
Function model		3 wire connection 2 wire connection	3 wire connection	Specifies 3 wire connection or 2 wire connection.

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	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 support the possibility to change the address.
	I/O cycle counter	Off On	Off	Enable or disable I/O cycle counter. **On**: the **IOCycleCounter** word is added in the **Expansion Bus I/O Mapping** tab.
	Input filter	66.7 40 33.3 20 16.7 10 2 1	20 ms	Specifies the filter time on the module.
	Bus base	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module.
	Terminal block	TM5ACTB06 (only for TM5SAI2PH) TM5ACTB12	TM5ACTB06 (for TM5SAI2PH) TM5ACTB12 (for TM5SAI4PH)	Specifies the terminal block associated with the electronic module.
Channel 00	Sensor type	PT100 PT1000 0.1...4500 ohm, 0.1 ohm/bit, 0.05...2250 ohm, 0.05 ohm/bit off	PT100	Specifies the sensor type *(see page 121)*. **Off**: the **Temperature00** channel is removed from the **Expansion Bus I/O Mapping** tab.
Channel 01	Sensor type	PT100 PT1000 0.1...4500 ohm, 0.1 ohm/bit, 0.05...2250 ohm, 0.05 ohm/bit off	PT100	Specifies the sensor type *(see page 121)*. **Off**: the **Temperature01** channel is removed from the **Expansion Bus I/O Mapping** tab.

Parameter	Parameter	Value	Default Value	Description
Channel 02	Sensor type	PT100 PT1000 0.1...4500 ohm, 0.1 ohm/bit, 0.05...2250 ohm, 0.05 ohm/bit off	PT100	Specifies the sensor type *(see page 121)*. **Off**: the **Temperature02** channel is removed from the **Expansion Bus I/O Mapping** tab.
Channel 03	Sensor type	PT100 PT1000 0.1...4500 ohm, 0.1 ohm/bit, 0.05...2250 ohm, 0.05 ohm/bit off	PT100	Specifies the sensor type *(see page 121)*. **Off**: the **Temperature03** channel is removed from the **Expansion Bus I/O Mapping** tab.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

NOTE: The channel 02 and channel03 parameters are not available for the TM5SAI2PH.

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 agitated.

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 and Channel Deactivation

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...45000	–	0.1 Ohm
Resistance measurement 0.05...2250 Ohm	1...45000	–	0.05 Ohm

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel		Type	Default value	Description
Inputs	Temperature00	INT	-	Current value of the input 0
	...			...
	Temperature03			Current value of the input 3
	IOCycleCounter	USINT	-	I/O cycle counter
	StatusInput00	USINT	-	Status of analog input channels (see description below)

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

NOTE: The bytes dedicated to channel 2 and channel 3 are not available for the TM5SAI2PH.

Status Input 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	

NOTE: The bit dedicated to channel 2 and channel 3 are not used (bit=0) for the TM5SAI2PH.

Limit Analog Value

In addition to the status information, the analog value is set to the values listed below, by default, when an 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 upper limit value	+32767 (7FFF hex)	65535 (FFFF hex)
Below lower limit value	-32767 (8001 hex)	0 (0 hex)
Invalid value	-32768 (8000 hex)	65535 (FFFF hex)

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 * (200 ms + filter time)

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SAI2TH and TM5SAI6TH

Introduction

The TM5SAI2TH and TM5SAI6TH expansion electronic modules are Analog Temperature Sensor with 2 and 6 Inputs 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
TM5SAI2TH	TM5SAI2TH Electronic Module 2AI Thermocouple J/K/N/S 16 Bits *(see Modicon TM5, Analog I/O Modules, Hardware Guide)*
TM5SAI6TH	TM5SAI6TH Electronic Module 6AI Thermocouple J/K/N/S 16 Bits *(see Modicon TM5, Analog I/O Modules, Hardware Guide)*

I/O Configuration Tab

To configure the TM5SAI2TH and TM5SAI6TH electronic modules, select the **I/O Configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Value	Default Value	Description
Function model	Internal compensation temperature External compensation temperature	Internal compensation temperature	Refer to External Compensation Temperature *(see page 125)*.

Parameter		Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	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 support the possibility to change the address.
	I/O cycle counter	Off On	Off	Enable/disable I/O cycle counter. **On**: the **IOCycleCounter** word is added to the **Expansion Bus I/O Mapping** tab.
	Input filter	66.7 40 33.3 20 16.7 10 2 1	20 ms	Specifies the filter time on the module.
	Sensor type	J K N S ±32767 µV, 1 µV/bit ±65534 µV, 2 µV/bit	J	Specifies the sensor type *(see page 126)*.
	Enable channel 00	On Off	On	Selectively enabling of not used channels reduces the electronic module cycle time. **Off**: the **Temperature00** word is removed from the **Expansion Bus I/O Mapping** tab.
	...			
	Enable channel 05	On Off	On	Selectively enabling of not used channels reduces the electronic module cycle time. **Off**: the **Temperature05** word is removed from the **Expansion Bus I/O Mapping** tab.
	Bus base	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module.
	Terminal block	TM5ACTB06 TM5ACTB12	TM5ACTB06	Specifies the terminal block associated with the electronic module.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

NOTE: The channel 02... channel05 parameters are not available for the TM5SAI2TH.

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 switched on 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
n channels	(n x (2 x Input Filter time + 200 µs)
1 channel	Corresponds to the Input Filter time

Terminal Temperature (Cold Junction) Compensation

General information

When using thermocouples, it is necessary to measure the temperature at the terminal connections of the TM5SAIxTH in order to calculate an accurate absolute temperature at the measuring point of the thermocouple.

NOTE: At least one terminal temperature sensor is required to determine the temperature measured by the connected thermocouples. Otherwise, a value of 7FFF hex is calculated for all the connected thermocouples.

The accuracy of the temperature measurement of the connected thermocouples is a function of the number of terminal temperature sensors connected to the block.

A terminal temperature compensation junction is useful for the following applications:

- When there is a large distance between the controller and point of measurement.
- To increase precision.

Bridging large distances

When there is a large distance between the controller and the point of measurement, a terminal temperature compensation junction is recommended. The thermocouple voltage is supplied via copper cable from the terminal temperature compensation junction to the terminal on the TM5SAIxTH. The temperature measured at the terminal temperature compensation junction is stored in the I/O area of the TM5SAIxTH electronic module. The TM5SAIxTH electronic module calculates the thermocouple temperature internally from the measured voltage and the reference junction temperature value (per channel).

Increased precision

To increase the precision, a terminal temperature compensation junction is recommended. The construction of the terminal temperature compensation junction is the same as described above. The installation of a terminal temperature compensation junction is especially helpful in the following cases:

- There is a slice next to the TM5SAIxTH that requires more than 1 W.
- There is no slice next to the TM5SAIxTH.
- With strongly fluctuating ambient conditions (draft, temperature).

NOTE: If the J, K, N and S types are used, you must select the external compensation.

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 default setting for all channels is ON. To save time, individual channels can be deactivated.

The table below shows the code corresponding sensor types:

Sensor Types
Sensor type J
Sensor type K
Sensor type N
Sensor type S
Raw value without linearization and terminal temperature compensation. Resolution 1 µV for a measurement range of ±32.767 mV.
Raw value without linearization and terminal temperature compensation. Resolution 2 µV for a measurement range of ±65.534 mV.

Expansion Bus I/O Mapping Tab

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

The table below describes the I/O Mapping configuration:

Channel		Type	Default value	Description
Inputs	Temperature00	INT	-	Current value of the input 0
	...			...
	Temperature05			Current value of the input 5
	IOCycleCounter	USINT	-	IO cycle counter
	StatusInput00	USINT	-	Status of analog input channels (see description below)
Outputs	ExternalCompensation Temperature	INT	-	External compensation temperature

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

NOTE: The channel 2...5 parameters are not available for the TM5SAI2TH.

Status Input Register

The status byte describes the status of each input channel:

Status	Bit	Description	Bits value
StatusInput00	0-1	Channel 00 status	00: No detected error 01: Below lower limit value 10: Above upper limit value 11: Broken wire detected
	2-3	Channel 01 status	
	4-5	Channel 02 status	
	6-7	Channel 03 status	
StatusInput01	0-1	Channel 04 status	00: No detected error 01: Below minimum value 10: Above maximum value 11: Broken wire detected
	2-3	Channel 05 status	
	4-5	Not used	
	6-7	Not used	

NOTE: The bit dedicated to channel 2...5 are not used (bit=0) for the TM5SAI2TH.

The **Statusinput01** byte is not available 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 (µs)**	
	1 input	**n inputs**
Minimum cycle time	150	
Minimum I/O update time	Equal to the filter time	n * (2 * filter time + 200 ms)

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SEAISG

Introduction

The TM5SEAISG is an analog electronic module which allows to convert the output of a 4-wire or 6-wire full-bridge strain gauge to a numeric value.

For further information, refer to the TM5SEAISG Analog Strain Gauge Input Electronic Module *(see Modicon TM5, Analog I/O Modules, Hardware Guide)* and the TM5 IoDrvTM5SEAISG Strain Gauge Library Guide. *(see Modicon TM5, IoDrvTM5SEAISG Strain Gauge, Library Guide)*

TM5SAO2H and TM5SAO2L

Introduction

The TM5SAO2H and TM5SAO2L expansion electronic modules are analog output electronic modules with 2 outputs, ±10 Vdc / 0 to 20 mA.

If you have wired your output 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 the Hardware Guide:

Reference	Refer to
TM5SAO2H	TM5SAO2H Electronic Module 2AO ±10V/0-20mA 16 Bits *(see Modicon TM5, Analog I/O Modules, Hardware Guide)*
TM5SAO2L	TM5SAO2L Electronic Module 2AO ±10V/0-20mA 12 Bits *(see Modicon TM5, Analog I/O Modules, Hardware Guide)*

I/O Configuration Tab

To configure the TM5SAO2H and TM5SAO2L electronic modules, select the **I/O Configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	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 support the possibility to change the address.
	Bus base	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module.
	Terminal block	TM5ACTB06 TM5ACTB12	TM5ACTB06	Specifies the terminal block associated with the electronic module.

Parameter	Parameter	Value	Default Value	Description
Channel00	Channel type	±10 V 0...20 mA	±10 V	Specifies the channel type.
Channel01	Channel type	±10 V 0...20 mA	±10 V	Specifies the channel type.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel		Type	Description
Outputs	AnalogOutput00	INT	Command word of the output 0
	AnalogOutput01		Command word of the output 1

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

Cycle Time and I/O Update Time

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

Characteristic	Value (µs)	
	TM5SAO2H	TM5SAO2L
Minimum cycle time	200	250
Minimum I/O update time	200	< 300

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SAO4H and TM5SAO4L

Introduction

The TM5SAO4H and TM5SAO4L electronic modules are analog outputs electronic modules with 4 outputs, ±10 Vdc / 0 to 20 mA.

If you have wired your output for a voltage measurement, and you configure SoMachine 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
TM5SAO4H	TM5SAO4H Electronic Module 4AO ±10V/0-20mA 16 Bits *(see Modicon TM5, Analog I/O Modules, Hardware Guide)*
TM5SAO4L	TM5SAO4L Electronic Module 4AO ±10V/0-20mA 12 Bits *(see Modicon TM5, Analog I/O Modules, Hardware Guide)*

I/O Configuration Tab

To configure the TM5SAO4H and TM5SAO4L electronic modules, select the **I/O Configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	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) support the possibility to change the address.
	Bus base	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module.
	Terminal block (not available for TM5SAO4L)	TM5ACTB12	TM5ACTB06	Specifies the terminal block associated with the electronic module.

Parameter	Parameter	Value	Default Value	Description
Channel00 ... Channel03	Channel type	±10 V 0...20 mA	±10 V	Specifies the channel type.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel		Type	Description
Outputs	AnalogOutptu00	INT	Command word of the output 0
	AnalogOutptu01		Command word of the output 1
	AnalogOutptu02		Command word of the output 2
	AnalogOutptu03		Command word of the output 3

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

Cycle Time and I/O Update Time

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

Characteristic	Value (µs)	
	TM5SAO4H	TM5SAO4L
Minimum cycle time	200	250
Minimum I/O update time	200	< 400

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5 Expert I/O Electronic Modules

5

Introduction

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

To add expansion electronic modules and access to the configuration screens, refer to Adding an expansion electronic module *(see page 21)*.

What's in this Chapter?

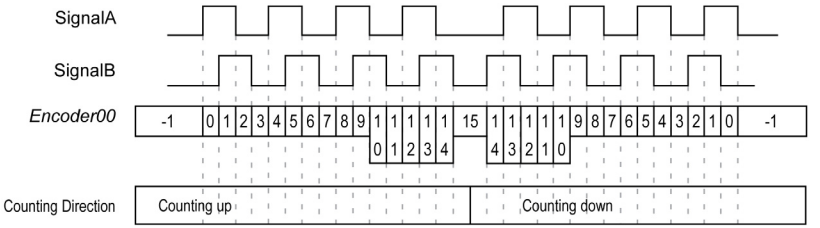
This chapter contains the following topics:

TM5SE1IC02505

Introduction

The TM5SE1IC02505 expansion electronic module is a 5 Vdc or 24 Vdc Expert Inputs electronic module with 1 input channel for ABR incremental encoder.

The encoder signal is counted as shown below:



For further information, refer to TM5SE1IC02505 Electronic Module 1 HSC INC 250 kHz 5 Vdc *(see Modicon TM5, Expert (High Speed Counter) Modules, Hardware Guide)*.

I/O Configuration Tab

To configure the TM5SE1IC02505 electronic module, select the **I/O Configuration** tab.

The table below describes the module parameters configuration:

Parameter		**Value**	**Default Value**	**Description**
Function model		16-bit counter 32-bit counter	16-bit counter	Define the counter value range: • 16-bit: -32768...+32767 • 32-bit: -2147483648...+2147483647
General	Module address	0...250	Depends on configuration	The address is automatically set when adding the modules. The address value depends on the order of adding the module in the SoMachine tree. TheTM5ACBM15 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.
	24 V I/O segment external current	0...300 mA	300 mA	24 V I/O segment external current on TM5 power supply bus. Refer to System Planning and Installation Guide.

Parameter		Value	Default Value	Description
Counter00	Preset value	-32768...32767 (16-bit) - 2147483648...2147483647 (32-bit)	0	Homing preset value for counter, the value set here is applied to the counter value upon completion of the referencing process.
	Reference pulse	Negative edge Positive edge	Negative edge	Select edge of reference pulse for homing.
	Reference enable switch	Off On (active low) On (active high)	Off	Digital input 00 used as reference enable switch.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the **Expansion Bus I/O Mapping** configuration:

Channel			Type	Default value	Description
Inputs	PowerSupply		USINT	-	Status encoder supply (bits 2...7: not used)
		PowerSupply00	BOOL	-	Status encoder supply 24 Vdc (0=OK)
		PowerSupply01			Status encoder supply 5 Vdc (0=OK)
	DigitalInput		USINT	-	State of all digital inputs (bits 6...7: not used)
		SignalA	BOOL	-	Encoder Signal A
		SignalB	BOOL		Encoder Signal B
		SignalR	BOOL		Encoder Reference Impulse
		DigitalInput00	BOOL		State of digital input 0
		DigitalInput01	BOOL		State of digital input 1
	Encoder00		INT	-	Incremental encoder
	StatusInput00		USINT	-	Status incremental encoder 00 (see below)
Outputs	ReferenceModeEncoder00		USINT	-	Reference mode incremental encoder 00

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

StatusInput00 Register

This register contains information regarding whether the referencing process is off, active, or complete.

The following table describes the **StatusInput00** register:

Bit	Description
0-1	Always 0
2	When the referencing is ON, bit is always 1 after the first reference impulse. When the referencing is OFF, bit is always 0.
3	When the referencing is ON, toggle after each completed reference. When the referencing is OFF, bit is always 0.
4	Bit is always 1 after the first reference impulse
5...7	Free-running counter, increased with each reference impulse

Example:

Register value		Description
00000000 bin	00 hex	Referencing off or already in progress
00111100 bin	3C hex	First reference complete, reference value applied in the **Encoder00** register
xxx11100 bin	xB hex	Bits 5...7 are changed sequentially with each reference impulse
xxx1x100 bin	xx hex	Bits changed continuously with the setting continuous referencing. With every reference impulse, the reference value is applied to the **Encoder00** register.

ReferenceModeEncoder00 Register

This register determines the encoder reference mode.

The following table describes the **ReferenceModeEncoder00** register:

Bit	Value	Description
0-1	00	Referencing OFF
	01	One-time reference (single shot)
	11	Continuous referencing
2...5	0000	Bit permanently set = 0
6-7	00	Referencing OFF
	11	Bit permanently set = 1

Example:

Register value		Description
00000000 bin	00 hex	Referencing OFF
11000001 bin	C1 hex	One-time reference (single shot) When starting over after the referencing process is complete, the value 00 hex must be written. Then wait until the **StatusInput00** also takes on the value x0 hex.
11000011 bin	C3 hex	Continuous referencing, referencing occurs at every reference pulse.

Cycle Time and I/O Update Time

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

Characteristic	Value
Minimum cycle time	128 µs
Maximum cycle time	16 ms
Minimum I/O update time	128 µs

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SE1IC01024

Introduction

The TM5SE1IC01024 expansion electronic module is a 24 Vdc Expert input electronic module with 1 input channel for ABR incremental encoder.

For further information, refer to TM5SE1IC01024 Electronic Module 1 HSC INC 100 kHz 24 Vdc *(see Modicon TM5, Expert (High Speed Counter) Modules, Hardware Guide)*.

I/O Configuration Tab

To configure the TM5SE1IC01024 electronic module, select the **I/O Configuration** tab.

The table below describes the module parameters configuration:

Parameter		Value	Default Value	Description
Function model		16-bit counter 32-bit counter	16-bit counter	Define the counter value range: • 16-bit: -32768...+32767 • 32-bit: -2147483648...+2147483647
General	Module address	0...250	Depends on configuration	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.
	24 V I/O segment external current	0...300 mA	300 mA	24 V I/O segment external current on TM5 power supply bus. Refer to System Planning and Installation Guide.
Counter00	Preset value	-32768...32767 (16-bit) - 2147483648...2147483647 (32-bit)	0	Homing preset value for counter, the value set here is applied to the counter value upon completion of the referencing process.
	Reference pulse	Negative edge Positive edge	Negative edge	Select edge of reference pulse for homing.
	Reference enable switch	Off On (active low) On (active high)	Off	Digital input 01 used as reference enable switch.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the **Expansion Bus I/O Mapping** configuration:

Channel			Type	Default value	Description
Inputs	PowerSupply		USINT	-	Status encoder supply (bits 1...7: not used)
		PowerSupply00	BOOL	-	Status encoder supply (0=OK)
	DigitalInput		USINT	-	State of all digital inputs
		SignalA	BOOL	-	Encoder Signal A
		SignalB	BOOL		Encoder Signal B
		SignalR	BOOL		Encoder Signal R
		DigitalInput00	BOOL		State of digital input 0
	Encoder00		INT	-	Incremental encoder
	StatusInput00		USINT	-	Status incremental encoder 00 (see below)
Outputs	ReferenceModeEncoder00		USINT	-	Reference mode incremental encoder 00

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

StatusInput00 Register

This register contains information regarding whether the referencing process is off, active, or complete.

The following table describes the **StatusInput00** register:

Bit	Description
0-1	Always 0
2	Bit is always 1 after the first reference impulse
3	Toggle after each completed reference
4	Bit is always 1 after the first reference impulse
5...7	Free-running counter, increased with each reference impulse

Example:

Register value		Description
00000000 bin	00 hex	Referencing off or already in progress
00111100 bin	3C hex	First reference complete, reference value applied in the **Encoder00** register
xxx11100 bin	xB hex	Bits 5...7 are changed sequentially with each reference impulse
xxx1x100 bin	xx hex	Bits changed continuously with the setting continuous referencing. With every reference impulse, the reference value is applied to the **Encoder00** register.

ReferenceModeEncoder00 Register

This register determines the encoder reference mode.

The following table describes the **ReferenceModeEncoder00** register:

Bit	Value	Description
0-1	00	Referencing OFF
	01	One-time reference (single shot)
	11	Continuous referencing
2...5	0000	Bit permanently set = 0
6-7	00	Referencing OFF
	11	Bit permanently set = 1

Example:

Register value		Description
00000000 bin	00 hex	Referencing OFF
11000001 bin	C1 hex	One-time reference (single shot) When starting over after the referencing process is complete, the value 00 hex must be written. Then wait until the **StatusInput00** also takes on the value 00 hex. Only then can the value C1 hex be written.
11000011 bin	C3 hex	Continuous referencing, referencing occurs at every reference pulse.

Cycle Time and I/O Update Time

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

Characteristic	Value
Minimum cycle time	128 µs
Maximum cycle time	16 ms
Minimum I/O update time	128 µs

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SE2IC01024

Introduction

The TM5SE2IC01024 expansion electronic module is a 24 Vdc Expert input electronic module with 2 input channels for ABR incremental encoder.

For further information, refer to TM5SE2IC01024 Electronic Module 2 HSC INC 100 kHz 24 Vdc *(see Modicon TM5, Expert (High Speed Counter) Modules, Hardware Guide)*.

I/O Configuration Tab

To configure the TM5SE2IC01024 electronic module, select the **I/O Configuration** tab.

The table below describes the module parameters configuration:

Parameter		Value	Default Value	Description
Function model		16-bit counter 32-bit counter	16-bit counter	Define the counter value range: • 16-bit: -32768...+32767 • 32-bit: -2147483648...+2147483647
General	Module address	0...250	Depends on configuration	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.
	24 V I/O segment external current	0...600 mA	600 mA	24 V I/O segment external current on TM5 power supply bus. Refer to System Planning and Installation Guide.
Counter00	Preset value	-32768...32767 (16-bit) - 2147483648...2147483647 (32-bit)	0	Homing preset value for counter, the value set here is applied to the counter value upon completion of the referencing process.
	Reference pulse	Negative edge Positive edge	Negative edge	Select edge of reference pulse for homing.
	Reference enable switch	Off On (active low) On (active high)	Off	Digital input 00 used as reference enable switch.

Parameter		Value	Default Value	Description
Counter01	Preset value	-32768...32767 (16-bit) - 2147483648...2147483647 (32-bit)	0	Homing preset value for counter, the value set here is applied to the counter value upon completion of the referencing process.
	Reference pulse	Negative edge Positive edge	Negative edge	Select edge of reference pulse.
	Reference enable switch	Off On (active low) On (active high)	Off	Digital input 01 used as reference enable switch.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the **Expansion Bus I/O Mapping** configuration:

Channel			Type	Default value	Description
Inputs	PowerSupply		USINT	-	Status encoder supply (bits 1...7: not used)
		PowerSupply00	BOOL	-	Status encoder supply (0=OK)
	DigitalInput		USINT	-	State of all digital inputs
		SignalA	BOOL	-	Encoder Signal A
		SignalB	BOOL		Encoder Signal B
		SignalR	BOOL		Encoder Signal R
		DigitalInput00	BOOL		State of digital input 0
		SignalA	BOOL		Encoder Signal A
		SignalB	BOOL		Encoder Signal B
		SignalR	BOOL		Encoder Signal R
		DigitalInput01	BOOL		State of digital input 1
	Encoder00		INT	-	Incremental encoder
	StatusInput00		USINT	-	Status incremental encoder 00 (see below)
	Encoder01		INT	-	Incremental encoder
	StatusInput01		USINT	-	Status incremental encoder 01 (see below)

Channel		Type	Default value	Description
Outputs	ReferenceModeEncoder00	USINT	-	Reference mode incremental encoder 00
	ReferenceModeEncoder01	USINT	-	Reference mode incremental encoder 01

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

StatusInput0x Register

This register contains information regarding whether the referencing process is off, active, or complete.

The following table describes the **StatusInput0x** register:

Bit	Description
0-1	Always 0
2	Bit is always 1 after the first reference impulse
3	Toggle after each completed reference
4	Bit is always 1 after the first reference impulse
5...7	Free-running counter, increased with each reference impulse

Example:

Register value		Description
00000000 bin	00 hex	Referencing off or already in progress.
00111100 bin	3C hex	First reference complete, reference value applied in the **Encoder0x** register.
xxx11100 bin	xB hex	Bits 5...7 are changed sequentially with each reference impulse.
xxx1x100 bin	xx hex	Bits changed continuously with the setting continuous referencing. With every reference impulse, the reference value is applied to the **Encoder0x** register.

ReferenceModeEncoder0x Register

This register determines the encoder reference mode.

The following table describes the **ReferenceModeEncoder0x** register:

Bit	Value	Description
0-1	00	Referencing OFF
	01	One-time reference (single shot)
	11	Continuous referencing
2...5	0000	Bit permanently set = 0
6-7	00	Referencing OFF
	11	Bit permanently set = 1

Example:

Register value		Description
00000000 bin	00 hex	Referencing OFF
11000001 bin	C1 hex	One-time reference (single shot) When starting over after the referencing process is complete, the value 00 hex must be written. Then wait until the **StatusInput0x** also takes on the value 00 hex. Only then can the value C1 hex be written.
11000011 bin	C3 hex	Continuous referencing, referencing occurs at every reference pulse.

Cycle Time and I/O Update Time

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

Characteristic	Value
Minimum cycle time	128 µs
Maximum cycle time	16 ms
Minimum I/O update time	128 µs

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SE1SC10005

Introduction

The TM5SE1SC10005 expansion electronic module is a 5 Vdc or 24 Vdc Expert Inputs electronic module with 1 input channel for SSI absolute encoder.

For further information, refer to TM5SE1SC10005 Electronic Module 1 HSC SSI 1 Mb 5 Vdc *(see Modicon TM5, Expert (High Speed Counter) Modules, Hardware Guide).*

I/O Configuration Tab

To configure the TM5SE1SC10005 electronic module, select the **I/O Configuration** tab.

The table below describes the module parameters configuration:

Parameter		Value	Default Value	Description
General	Module address	0...250	Depends on configuration	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.
	24 V I/O segment external current	0...300 mA	300 mA	24 V I/O segment external current on TM5 power supply bus. Refer to System Planning and Installation Guide.

Parameter		Value	Default Value	Description
Counter 00	Clock rate	1 MHz 500 kHz 250 kHz 125 kHz	1 MHz	Define the clock rate.
	Data format	Binary Gray	Binary	Data format of SSI encoder.
	Total SSI bit length	0...32	8	Number of bits sent by the SSI encoder per frame.
	Valid SSI bit length	0...32	8	Significant part of the SSI encoder frame. Only the least significant part of the total SSI encoder frame is valid. The complementary most significant part of the frame is ignored and read as 0.
	Monoflop check	High level Low level Ignore	High level	Data line level checked before starting data emission (see description below).

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Monoflop Check Parameter

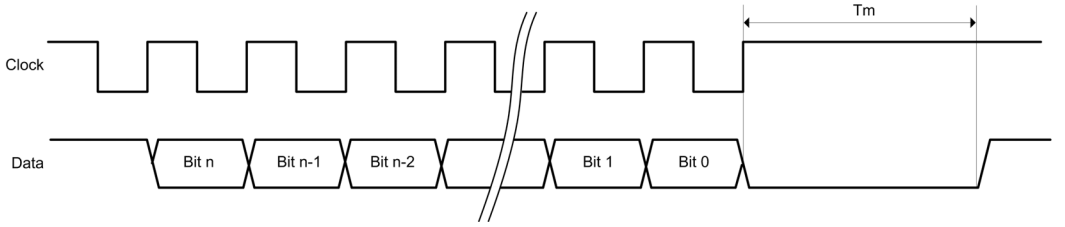
The **Monoflop check** parameter is used to test the data line level before starting data transmission: the clock starts only if the data line level is equal to the specified level.

This level is programmable, you can choose to perform the test or not.

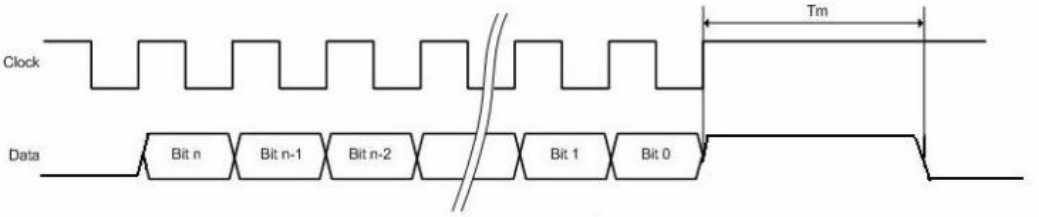
If you test the level, you can select its value (0 or 1) via the interface.

The data line level is checked from Tm after the last rising edge of the clock line

In the example 1, the **Monoflop check** parameter must be configured to high level. This ensures that the clock generation is postponed until the data line goes high.



In the example 2 the **Monoflop check** parameter must be configured to low level. This ensures that the clock generation is postponed until the data line goes low.



Expansion Bus I/O Mapping Tab

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

The table below describes the **Expansion Bus I/O Mapping** configuration:

Channel			**Type**	**Default value**	**Description**
Inputs	PowerSupply		USINT	-	Status encoder supply (bits 2...7: not used)
		PowerSupply00	BOOL	-	Status encoder supply 24 Vdc (0=OK)
		PowerSupply01	BOOL	-	Status encoder supply 5 Vdc (0=OK)
	DigitalInput		USINT	-	State of all digital inputs (bits 0...3, 6-7: not used)
		Reserved	BOOL	-	Not used
		...			
		Reserved			
		DigitalInput00			State of digital input 0
		DigitalInput01			State of digital input 1
	Encoder00		UDINT	-	Encoder position value

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

Cycle Time and I/O Update Time

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

Characteristic	Value
Minimum cycle time	128 µs
Maximum cycle time	16 ms
Minimum I/O update time	128 µs

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SDI2DF

Introduction

The TM5SDI2DF expansion electronic module is a 24 Vdc Input electronic module with 2 inputs.

For further information, refer to TM5SDI2DF Electronic Module 2DI 24 Vdc Sink 3-Wire *(see Modicon TM5, Expert (High Speed Counter) Modules, Hardware Guide)*.

I/O Configuration Tab

To configure the TM5SDI2DF electronic module, select the **I/O Configuration** tab.

The table below describes the module parameters configuration:

Parameter		**Value**	**Default Value**	**Unit**	**Description**
Function model		Default Additional function input latch	Default	-	**Additional function input latch**: the **Status00...Status03** are added to the **Expansion Bus I/O Mapping** tab.
General	Module address	0...250	Depends on configuration	-	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.
	Input filter	0...250	10 (1 ms)	0.1 ms	Specifies the filter time of all digital inputs.
	Bus base	TM5ACBM11 TM5ACBM15	TM5ACBM11	-	Specifies the bus base associated with the electronic module.
	Terminal block	TM5ACTB06 TM5ACTB12	TM5ACTB06	-	Specifies the terminal block associated with the electronic module.
	24 V I/O segment external current	0...500	100	mA	24 V I/O segment external current on TM5 power supply bus. Refer to System Planning and Installation Guide.

Parameter		Value	Default Value	Unit	Description
Counter00 Counter01	Counter mode	Event counter Gate measurement	Event counter	-	Counter mode *(see page 153)*
	Count frequency	48 24 12 6 3 1.5 0.750 0.375 0.1875	48	MHz	Count frequency (Gate measurement mode only)

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Counter Mode

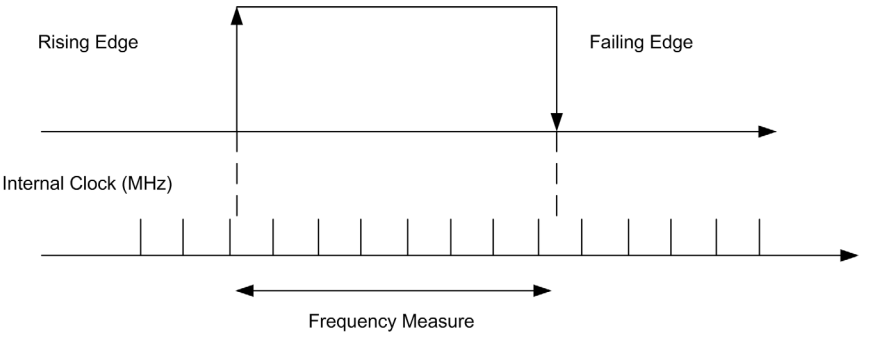
Two counter modes can be used with the TM5SDI2DF electronic module:

Event counter operation consists to transfer the counter status, registered with a fixed offset with respect to the bus cycle and is transferred in the same cycle.

NOTE: The rising edges are registered on the counter input.

Gate measurement consists to use an internal frequency to register the necessary time to reach the gate input.

The following figure describes the Gate measuring principle:



The TM5SDI2DF value is defined by the following equation:

$$SP = \frac{VT}{CF}$$

Where:

SP = Size of Pulse to be measured.

VT = Value of TM5SDI2DF.

CF = Count Frequency.

For example: For a Count Frequency at 3 Mhz and a Size of Pulse to be measured = 15 ms, the Value of TM5SDI2DF is near 46000.

NOTE:

- The recovery time between measurements must be > 100 µs.
- The measurement result is transferred with the falling edge to the result memory.

The following table gives the maximun Size of Pulse to be measured depending on the Count Frequency parameter:

Maximum Size of Pulse	Count Frequency
13.653125 ms	48 MHz
27.30625 ms	24 MHz
54.6125 ms	12 MHz
109.225 ms	6 MHz
218.45 ms	3 MHz
436.9 ms	1.5 MHz
873.8 ms	0.75 MHz
1747.6 ms	0.375 MHz
3542.432432 ms	0.185 MHz

For example: For a Count Frequency at 48 Mhz, the maximum Size of Pulse to be measured = 13 ms.

Additional function input latch

Using this function, the positive edges of the input signal can be latched with a resolution of 200 µs. With the “Acknowledge - input latch” function, the input latch is either reset or prevented from latching.

It works in the same way as a dominant reset RS flip-flop:

R: Status03	S: Status02	Q	Status
0	0	x	Do not change
0	1	1	Set
1	0	0	Reset
1	1	0	Reset

Expansion Bus I/O Mapping Tab

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

The table below describes the **Expansion Bus I/O Mapping** configuration:

Channel			**Type**	**Default value**	**Description**
Inputs	DigitalInput		USINT	-	State of digital inputs (bits 2...7: not used)
		DigitalInput00	BOOL	-	State of digital input 0
		DigitalInput01	BOOL	-	State of digital input 1
	Counter00		UINT	-	Counter 0 value
	Counter01		UINT	-	Counter 1 value
	Status02		USINT	-	
		DigitalInput00Latch	BOOL	-	Positive edge latched state of input 0
		DigitalInput01Latch			Positive edge latched state of input 1
Outputs	Status00		USINT	-	
		Not used	BOOL	-	Not used
		...			
		Not used			
		ResetCounter00			Reset event counter 00 on rising edge
	Status01		USINT	-	
		Not used	BOOL	-	Not used
		...			
		Not used			
		ResetCounter01			Reset event counter 01 on rising edge
	Status03		USINT	-	
		DigitalInput00LatchQuitt	BOOL	-	Acknowledge latch state input 0
		DigitalInput01LatchQuitt			Acknowledge latch state input 1

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

Cycle Time and I/O Update Time

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

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5 Transmitter - Receiver Electronic Modules

6

Introduction

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

To add expansion electronic modules and access to the configuration screens, refer to Adding an expansion electronic module *(see page 21)*.

What's in this Chapter?

This chapter contains the following topics:

TM5SBET1

Introduction

The TM5SBET1 expansion electronic module is a Transmitter electronic module which transmits the TM5 data bus

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

I/O Configuration Tab

To configure the TM5SBET1 electronic module, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	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.
	Module status information	On Off	On	Enable/Disable read of the module information **On**: the **StatusInputs** word is added to the **Expansion Bus I/O Mapping** tab.
	Voltage information	Off On	Off	Enable/Disable read of the additional current/voltage information **On**: the **SupplyVoltage** word is added to the **Expansion Bus I/O Mapping** tab.
	Bus base	TM5ACBM11 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module.
	Terminal block	TM5ACTB06 TM5ACTB12	TM5ACTB06	Specifies the terminal block associated with the electronic module.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Default value	Description
Inputs	StatusInputs		USINT	-	Status of the module (bits 2...7: not used)
		StatusInput00	BOOL	-	Bus power supply warning: • 0 = OK • 1 = low voltage <4.7 V
		Not used			Not used (bit=0)
		StatusInput01			I/O power supply warning: • 0 = OK • 1 = I/O power supply < 20.4 V
	Supply/Voltage		USINT	-	Bus voltage with a resolution of 0.1 V

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SBET7

Introduction

The TM5SBET7 expansion electronic module is a Transmitter electronic module which transmits the TM7 data bus and provides the TM7 power bus to the TM7 expansion I/O blocks.

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

I/O Configuration Tab

To configure the TM5SBET7 electronic module, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	0	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.
	Module status information	On Off	On	Enable/Disable read of the module information **On**: the **StatusInputs** word is added to the **Expansion Bus I/O Mapping** tab.
	Current/Voltage information	Off On	Off	Enable/Disable read of the additional current/voltage information **On**: the **SupplyVoltage** and **SupplyCurrent** words are added to the **Expansion Bus I/O Mapping** tab.
	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.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Default value	Description
Inputs	StatusInputs		USINT	–	Status of the module (bits 2...7: not used)
		StatusInput00	BOOL	–	Bus power supply warning: • 0 = OK • 1 = over current > 0.4 A or low voltage <18 V
		Not used			Not used (bit=0)
		StatusInput01			I/O power supply warning: • 0 = OK • 1 = I/O power supply < 20.4 V
	SupplyCurrent		USINT	-	Bus current with a resolution of 0.01 A
	SupplyVoltage		USINT	-	Bus voltage with a resolution of 0.1 V

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SBER2

Introduction

The TM5SBER2 expansion electronic module is a Receiver electronic module which receives the TM5 data bus.

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

I/O Configuration Tab

To configure the TM5SBER2 electronic module, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	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.
	Module status information	On Off	On	Enable/Disable read of the module information **On**: the **StatusInputs** word is added to the **Expansion Bus I/O Mapping** tab.
	Current/Voltage information	Off On	Off	Enable/Disable read of the additional current/voltage information **On**: the **SupplyCurrent** and **SupplyVoltage** words are added to the **Expansion Bus I/O Mapping** tab.
	Bus base	TM5ACBM01R TM5ACBM05R	TM5ACBM01R	Specifies the bus base associated with the electronic module.
	Terminal block	TM5ACTB12PS	TM5ACTB12PS	Specifies the terminal block associated with the electronic module.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Default value	Description
Inputs	StatusInputs		USINT	-	Status of the module (bits 3...7: not used)
		StatusInput00	BOOL	-	Bus power supply warning: • 0 = OK • 1 = over current >2.3 A or low voltage <4.7 V
		Not used			Not used (bit=0)
		StatusInput01			I/O power supply warning: • 0 = OK • 1 = I/O power supply < 20.4 V
	SupplyCurrent		USINT	-	Bus current with a resolution of 0.1 A
	Supply/Voltage		USINT	-	Bus voltage with a resolution of 0.1 V

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5 Power Supply Electronic Modules

7

Introduction

This chapter provides information to configure power supply expansion electronic modules.

To add expansion electronic modules and access to the configuration screens, refer to Adding an expansion electronic module *(see page 21)*.

What's in this Chapter?

This chapter contains the following topics:

TM5SPS1

Introduction

The TM5SPS1 expansion electronic module is a 24 Vdc power supply electronic module for internal I/O supply.

I/O Configuration Tab

To configure the TM5SPS1 electronic module, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration.	Specifies the electronic module address (only with TM5ACBM05R).
	Module status information	On Off	On	Additional status information **On**: the **StatusInputs** word is added to the **Expansion Bus I/O Mapping** tab.
	Voltage information	Off On	Off	Additional current/voltage information **On**: the **SupplyVoltage** word is added to the **Expansion Bus I/O Mapping** tab.
	Bus base	TM5ACBM01R TM5ACBM05R	TM5ACBM01R	Specifies the bus base associated with the electronic module.
	Terminal block	TM5ACTB12PS	TM5ACTB12PS	Specifies the terminal block associated with the electronic module.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Default value	Description
Inputs	StatusInputs		USINT	-	Status of the module (bits 3...7: not used)
		StatusInput00	BOOL	-	Bus power supply warning: • 0 = OK • 1 = low voltage <4.7 V
		Not used			Not used (bit=0)
		StatusInput01			I/O power supply warning: • 0 = OK • 1 = I/O power supply < 20.4 V
	SupplyVoltage		USINT	-	Bus voltage with a resolution of 0.1 V

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SPS1F

Introduction

The TM5SPS1F expansion electronic module is a 24 Vdc power supply electronic module for internal I/O supply with a fuse.

I/O Configuration Tab

To configure the TM5SPS1F electronic module, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	Specifies the electronic module address (only with TM5ACBM05R).
	Module status information	On Off	On	Additional status information **On**: the **StatusInputs** word is added to the **Expansion Bus I/O Mapping** tab.
	Voltage information	Off On	Off	Additional voltage information **On**: the **SupplyVoltage** word is added to the **Expansion Bus I/O Mapping** tab.
	Bus base	TM5ACBM01R TM5ACBM05R	TM5ACBM01R	Specifies the bus base associated with the electronic module.
	Terminal block	TM5ACTB12PS	TM5ACTB12PS	Specifies the terminal block associated with the electronic module.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Default value	Description
Inputs	StatusInputs		USINT	-	Status of the module (bits 3...7: not used)
		StatusInput00	BOOL	-	Bus power supply warning: • 0 = OK • 1 = low voltage <4.7 V
		StatusInput01			Fuse status: • 0 = OK • 1 = fuse is blown or missing
		StatusInput02			I/O power supply warning: • 0 = OK • 1 = I/O power supply < 20.4 V
	SupplyVoltage		USINT	-	Bus voltage with a resolution of 0.1 V

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SPS2

Introduction

The TM5SPS2 expansion electronic module is a 24 Vdc power supply electronic module for internal I/O supply.

I/O Configuration Tab

To configure the TM5SPS2 electronic module, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	Specifies the electronic module address (only with TM5ACBM05R).
	Module status information	On Off	On	Additional status information **On**: the **StatusInputs** word is added to the **Expansion Bus I/O Mapping** tab.
	Current/voltage information	Off On	Off	Additional current/voltage information **On**: the **SupplyCurrent** and **SupplyVoltage** words are added to the **Expansion Bus I/O Mapping** tab.
	Bus base	TM5ACBM01R TM5ACBM05R	TM5ACBM01R	Specifies the bus base associated with the electronic module.
	Terminal block	TM5ACTB12PS	TM5ACTB12PS	Specifies the terminal block associated with the electronic module.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Default value	Description
Inputs	StatusInputs		USINT	-	Status of the module (bits 3...7: not used)
		StatusInput00	BOOL	-	Bus power supply warning: • 0 = OK • 1 = over current > 2.3 A or low voltage < 4.7 V
		Not used			-
		StatusInput01			I/O power supply warning: • 0 = OK • 1 = I/O power supply < 20.4 V
	SupplyCurrent		USINT	-	Bus current with a resolution of 0.1 A
	SupplyVoltage		USINT	-	Bus voltage with a resolution of 0.1 V

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SPS2F

Introduction

The TM5SPS2F expansion electronic module is a 24 Vdc power supply electronic module for internal I/O supply with a fuse.

I/O Configuration Tab

To configure the TM5SPS2F electronic module, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	Specifies the electronic module address (only with TM5ACBM05R).
	Module status information	On Off	On	Additional status information **On**: the **StatusInputs** word is added to the **Expansion Bus I/O Mapping** tab.
	Current/voltage information	Off On	Off	Additional current/voltage information **On**: the **SupplyCurrent** and **SupplyVoltage** words are added to the **Expansion Bus I/O Mapping** tab.
	Bus base	TM5ACBM01R TM5ACBM05R	TM5ACBM01R	Specifies the bus base associated with the electronic module.
	Terminal block	TM5ACTB12PS	TM5ACTB12PS	Specifies the terminal block associated with the electronic module.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Default value	Description
Inputs	StatusInputs		USINT	-	Status of the module (bits 3...7: not used)
		StatusInput00	BOOL	-	Bus power supply warning: • 0 = OK • 1 = over current > 2.3 A or low voltage < 4.7 V
		Not used			-
		StatusInput01			I/O power supply warning: • 0 = OK • 1 = I/O power supply < 20.4 V
	SupplyCurrent		USINT	-	Bus current with a resolution of 0.1 A
	SupplyVoltage		USINT	-	Bus voltage with a resolution of 0.1 V

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5 Common Distribution Electronic Modules

8

Introduction

This chapter provides information to configure common distribution expansion electronic modules.

To add expansion electronic modules and access to the configuration screens, refer to Adding an expansion electronic module *(see page 21)*.

What's in this Chapter?

This chapter contains the following topics:

TM5SPDG12F

Introduction

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

I/O Configuration Tab

To configure the TM5SPDG12F electronic module, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	Specifies the electronic module address (only with TM5ACBM15).
	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.
	24 V I/O segment external current	0...6300	0 mA	24 V I/O segment external current on TM5 power supply bus. Refer to System Planning and Installation Guide.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Description
Inputs	StatusInputs		USINT	Status of the module (bits 1...7: not used)
		StatusFuse	BOOL	Fuse status: • 0 = OK • 1 = fuse is blown or missing

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SPDD12F

Introduction

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

I/O Configuration Tab

To configure the TM5SPDD12F electronic module, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	Specifies the electronic module address (only with TM5ACBM15).
	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.
	24 V I/O segment external current	0...6300	0 mA	24 V I/O segment external current on TM5 power supply bus. Refer to System Planning and Installation Guide.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Description
Inputs	StatusInputs		USINT	Status of the module (bits 1...7: not used)
		StatusFuse	BOOL	Fuse status: ● 0 = OK ● 1 = fuse is blown or missing

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SPDG5D4F

Introduction

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

I/O Configuration Tab

To configure the TM5SPDG5D4F electronic module, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	Specifies the electronic module address (only with TM5ACBM15).
	Edge counter	Off On	Off	Falling edge counter for power supply **On**: the **Counter00** word is added to the **Expansion Bus I/O Mapping** tab.
	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.
	24 V I/O segment external current	0...6300	0 mA	24 V I/O segment external current on TM5 power supply bus. Refer to System Planning and Installation Guide.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Description
Inputs	StatusInputs		USINT	Status of the module (bits 2...7: not used)
		StatusFuse	BOOL	Fuse status: • 0 = OK • 1 = fuse is blown or missing
		StatusPowerSupply		I/O power supply warning: • 0 = OK • 1 = I/O power supply < 20.4 V
	Counter00		USINT	Number of falling edges of power supply

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SPDG6D6F

Introduction

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

I/O Configuration Tab

To configure the TM5SPDG6D6F electronic module, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	Specifies the electronic module address (only with TM5ACBM15).
	Edge counter	Off On	Off	Falling edge counter for power supply **On**: the **Counter00** word is added to the **Expansion Bus I/O Mapping** tab.
	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.
	24 V I/O segment external current	0...6300	0 mA	24 V I/O segment external current on TM5 power supply bus. Refer to System Planning and Installation Guide.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Expansion Bus I/O Mapping Tab

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

The table below describes the Expansion Bus I/O Mapping configuration:

Channel			Type	Description
Inputs	StatusInputs		USINT	Status of the module (bits 2...7: not used)
		StatusFuse	BOOL	Fuse status: • 0 = OK • 1 = fuse is blown or missing
		StatusPowerSupply		I/O power supply warning: • 0 = OK • 1 = I/O power supply < 20.4 V
	Counter00		USINT	Number of falling edges of power supply

For further generic descriptions, refer to Expansion Bus I/O Mapping Tab Description *(see page 22)*.

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

For further information, refer to TM5 Manager Configuration *(see page 18)*.

TM5SD000

Introduction

The TM5SD000 expansion electronic module is a dummy electronic module.

I/O Configuration Tab

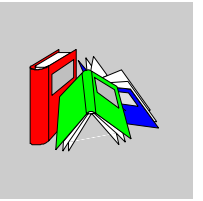
To configure the TM5SD000 electronic module, select the **I/O configuration** tab.

The table below describes the modules parameters configuration:

Parameter	Parameter	Value	Default Value	Description
General	Module address	0...250	Depends on the configuration	Specifies the electronic module address (only with TM5ACBM15).
	Bus base	TM5ACBM11 TM5ACBM12 TM5ACBM15	TM5ACBM11	Specifies the bus base associated with the electronic module.
	Terminal block	TM5ACTB06 TM5ACTB12 TM5ACTB32	TM5ACTB06	Specifies the terminal block associated with the electronic module.

For further generic descriptions, refer to I/O Configuration Tab Description *(see page 22)*.

Glossary



A

analog input

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

analog output

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

AWG

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

B

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.

C

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. CAN multi-master systems ensure high data integrity through the implementation of broadcast messaging and advanced diagnostic mechanisms. 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.

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.

CPDM

controller power distribution module

D

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.

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.

DIN

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

E

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.)

encoder

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

Ethernet

Ethernet is a physical and data link layer technology for LANs, also known as IEE 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/O*s are dedicated modules or channels for advanced features. These features are generally embedded in the module in order to not use the ressources 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 independant of the Controller processing cycle, it just exchanges some information with the Controller CPU.

F

FAST I/O

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

FE

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

Flash memory

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

H

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

I

I/O

input/output

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.

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.

input filter

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

IP 20

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

L

LAN

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

LED

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

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.

M

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.

Modbus

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

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

NEC

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

P

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.

PE

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

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.

Profibus DP

Profibus Decentralised Peripheral is a linear bus with a centralized access procedure of the Master/Slave type. Only Master stations, also known as active stations, have access rights to the bus. The Slave or passive stations can only respond to prompts.The physical connection is a single shielded twisted pair, but fiber optic interfaces are available to create tree, star, or ring structures. Compared to the ISO model, only layers 1, 2 are implemented, since access from the user interface is made directly to the link layer via simple mapping of variables.

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

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.

S

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.

sink input

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

Source output

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

T

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.

U

UL

Underwriters laboratories, US organization for product testing and safety certification.

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