Modicon TM7

Expansion Blocks Configuration Programming Guide

05/2019

EIO0000003233.00

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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.

Table of Contents

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, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

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

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

PLEASE NOTE

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

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

About the Book

At a Glance

Document Scope

This manual describes the configuration of the Modicon TM7 Input/Output expansion blocks. For further information, refer to the separate documents provided in the EcoStruxure Machine Expert online help.

Validity Note

This document has been updated for the release of EcoStruxure™ Machine Expert V1.1.

Related Documents

Title of Documentation	Reference Number
Modicon TM7 Digital I/O Blocks Hardware guide	*EIO0000003239 (Eng)* *EIO0000003240 (Fre)* *EIO0000003241 (Ger)* *EIO0000003242 (Spa)* *EIO0000003243 (Ita)* *EIO0000003244 (Chs)*
Modicon TM7 Analog I/O Blocks Hardware guide	*EIO0000003245 (Eng)* *EIO0000003246 (Fre)* *EIO0000003247 (Ger)* *EIO0000003248 (Spa)* *EIO0000003249 (Ita)* *EIO0000003250 (Chs)*

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

Product Related Information

⚠ WARNING

LOSS OF CONTROL

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

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

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Terminology Derived from Standards

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

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

Among others, these standards include:

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

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

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

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

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

Chapter 1
I/O Configuration General Information

Introduction

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

What Is in This Chapter?

This chapter contains the following topics:

TM7 Expansion Modules General Description

Introduction

TM5 EtherNet/IP Fieldbus Interface is compatible with TM7 Expansion modules via the TM5 data transmitter electronic module (TM5SBET7).

The range of expansion I/O includes:
- TM7 Digital I/O blocks
- TM7 Analog I/O blocks
- TM7 Power distribution blocks

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

Digital or analog output blocks convert controller internal numerical values into voltages or currents.

Analog temperature blocks convert the temperature measurement values into number values which can be processed by the controller. For temperature measurements, the temperature block returns the measured value using 0.1 °C *(0.18 °F)* steps.

The Power Distribution Blocks PDB are used to manage the power supply for the various I/O blocks. The PDB feeds the TM7 power bus.

NOTE: The TM7 I/O blocks are associated with power cables, TM7 bus cables and I/O cables.

Expansion Block Features

This table lists the digital blocks:

Reference	Number of Channels	Voltage/Current
TM7BDI8B	8 inputs	24 Vdc / 7 mA
TM7BDI16A	16 inputs	24 Vdc / 7 mA
TM7BDI16B	16 inputs	24 Vdc / 7 mA
TM7BDO8TAB	8 outputs	24 Vdc / 2 A
TM7BDM8B[1]	8 inputs 8 outputs	24 Vdc / 4.4 mA 24 Vdc / 0.5 A
TM7BDM16A[1]	16 inputs 16 outputs	24 Vdc / 4.4 mA 24 Vdc / 0.5 A
TM7BDM16B[1]	16 inputs 16 outputs	24 Vdc / 4.4 mA 24 Vdc / 0.5 A
1. I/O is individually configurable as either input or output.		

This table lists the analog blocks:

Reference	Number of Channels	Voltage/Current
TM7BAI4VLA	4 inputs	-10...+10 Vdc
TM7BAI4CLA	4 inputs	0...20 mA
TM7BAO4VLA	4 outputs	-10...+10 Vdc
TM7BAO4CLA	4 outputs	0...20 mA
TM7BAM4VLA	2 inputs 2 outputs	-10...+10 Vdc -10...+10 Vdc
TM7BAM4CLA	2 inputs 2 outputs	0...20 mA 0...20 mA

This table lists the analog temperature input blocks:

Reference	Number of Channels	Sensor Type
TM7BAI4TLA	4 inputs	PT100/1000 KTY10-6/84-130
TM7BAI4PLA	4 inputs	Thermocouple J,K,S

This table lists the power distribution block described in this programming guide:

Reference	Description
TM7SPS1A	TM7 Power Distribution Block

Match Software and Hardware Configuration

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Adding an Expansion Block

Procedure

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

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

- Using the Drag-and-drop Method *(see EcoStruxure Machine Expert, Programming Guide)*
- Using the Contextual Menu or Plus Button *(see EcoStruxure Machine Expert, Programming Guide)*

I/O Configuration

To configure TM7 expansion blocks, proceed as follows:

Step	Action
1	Select the **Devices tree** tab.
2	Double-click the expansion block node. **Result:** The **TM7 Module I/O Mapping** tab of the block appears.

TM7 Module I/O Mapping Tab Description

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

Channels

Variable	Mapp...	Channel	Address	Type	Unit	Description
Inputs						
		DigitalInp...	%IB26	USINT		24 VDC, <1 ms switching delay, sink
ixModu...		DigitalInp...	%IX26...	BOOL		24 VDC, <1 ms switching delay, sink
ixModu...		DigitalInp...	%IX26...	BOOL		24 VDC, <1 ms switching delay, sink
ixModu...		DigitalInp...	%IX26...	BOOL		24 VDC, <1 ms switching delay, sink
ixModu...		DigitalInp...	%IX26...	BOOL		24 VDC, <1 ms switching delay, sink
ixModu...		DigitalInp...	%IX26...	BOOL		24 VDC, <1 ms switching delay, sink
ixModu...		DigitalInp...	%IX26...	BOOL		24 VDC, <1 ms switching delay, sink
ixModu...		DigitalInp...	%IX26...	BOOL		24 VDC, <1 ms switching delay, sink
ixModu...		DigitalInp...	%IX26...	BOOL		24 VDC, <1 ms switching delay, sink

The **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 from the **Variables** tab of the **Software Catalog** by a drag-and-drop action.
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.
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)*.

User-Defined Parameters Tab Description

The **User-Defined Parameters** tab allows you to configure the expansion module.

Click **Defaults** to reset the values to the original values.

Chapter 2
TM7 Digital I/O Expansion Blocks

Introduction

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

To add expansion blocks and to access the configuration screens, refer to Adding an Expansion Block *(see page 14)*.

What Is in This Chapter?

This chapter contains the following topics:

TM7BDI8B, TM7BDI16A and TM7BDI16B

Introduction

TheTM7BDI8B, TM7BDI16A and TM7BDI16B expansion blocks are 24 Vdc digital input blocks with either 8 or 16 inputs.

For further information, refer to the Hardware Guide:

Reference	Refer To
TM7BDI8B	TM7BDI8B Block 8DI 24 Vdc Sink *(see Modicon TM7, Digital I/O Blocks, Hardware Guide)*
TM7BDI16A	TM7BDI16A Block 16DI 24 Vdc Sink *(see Modicon TM7, Digital I/O Blocks, Hardware Guide)*
TM7BDI16B	TM7BDI16B Block 16DI 24 Vdc Sink *(see Modicon TM7, Digital I/O Blocks, Hardware Guide)*

TM7 Module I/O Mapping Tab

Variables can be defined and named in the **TM7 Module I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the I/O Mapping configuration:

Variable	Channel	Type	Description
–	**ModuleOK**	BYTE	State of the compact I/O and electronic modules
Inputs	**DigitalInput00** ... **DigitalInput15**(1)	BOOL	State of input 0 ... State of input 15
(1) The number of **DigitalInput** bit is equal to the block input number.			

For further generic descriptions, refer to I/O Mapping Tab Description *(see page 14)*.

User-Defined Parameters Tab

These modules have no default user-defined parameters.

TM7BDO8TAB

Introduction

TheTM7BDO8TAB expansion block is a 24 Vdc digital output block with 8 outputs.

For further information, refer to TM7BDO8TAB Block 8DO 24 Vdc Source *(see Modicon TM7, Digital I/O Blocks, Hardware Guide)*.

TM7 Module I/O Mapping Tab

Variables can be defined and named in the **TM7 Module I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the I/O Mapping configuration:

Variable	Channel	Type	Description
–	**ModuleOK**	BYTE	State of the compact I/O and electronic modules
	DiagIn1	BYTE	Status bit associated to each output: ● 0: OK ● 1: Error detected
Outputs	**DigitalOutput00** ... **DigitalOutput07**	BOOL	Command of output 0 ... Command of output 7

NOTE: The number of the **DigitalOutput••** corresponds at the same number of the **StatusDigitalOutput••**. The **StatusDigitalOutputs** is not used If the **Output status** parameter is disabled.

For further generic descriptions, refer to I/O Mapping Tab Description *(see page 14)*.

User-Defined Parameters Tab

This module has no default user-defined parameters.

TM7BDM8B, TM7BDM16A and TM7BDM16B

Introduction

The TM7BDM8B, TM7BDM16A and TM7BDM16B expansion blocks are 24 Vdc digital configurable input or output blocks with either 8 or 16 channels.

For further information, refer to the Hardware Guide:

Reference	Refer To
TM7BDM8B	TM7BDM8B Block 8 Configurable DI/DO 24 Vdc *(see Modicon TM7, Digital I/O Blocks, Hardware Guide)*
TM7BDM16A	TM7BDM16A Block 16 Configurable DI/DO 24 Vdc *(see Modicon TM7, Digital I/O Blocks, Hardware Guide)*
TM7BDM16B	TM7BDM16B Block 16 Configurable DI/DO 24 Vdc *(see Modicon TM7, Digital I/O Blocks, Hardware Guide)*

TM7 Module I/O Mapping Tab

Variables can be defined and named in the **TM7 Module I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the I/O Mapping configuration:

Variable	Channel	Type	Description
–	**ModuleOK** (for 16 channel module)	BYTE	State of the compact I/O and electronic modules
	DiagIn1 (for 8 channel module)		Status bit associated to each I/O: • 0: OK • 1: Error detected
Inputs	**Digital Input 1** ... **Digital Input 16**(1)	BOOL	State of input 0 ... State of input 15
Outputs	**Digital Output 1** ... **Digital Output 16**(1)	BOOL	Command of output 0 ... Command of output 15
(1) The number of **Digital Input** or **Digital Output** is equal to the block channel number.			

NOTE: For each channel, there is only one number of **DigitalInput••** or **DigitalOutput••**. The number of the **DigitalOutput••** corresponds at the same number of the **StatusDigitalOutput••**. The **StatusDigitalOutputs** is not used If the **Output status** parameter is disabled.

For further generic descriptions, refer to I/O Mapping Tab Description *(see page 14)*.

User-Defined Parameters Tab

The table describes the user-defined parameters of the module:

Name	Value	Default	Description
Direction01 ... **Direction16**(1)	input output	input	Configures the channel as an input or output.
InputFilter	0...127	0	Specifies the filter time of all digital inputs in the range 0...127 (0...12.7 ms).
(1) The number of **Direction** is equal to the block channel number.			

Chapter 3
TM7 Analog I/O Blocks

Introduction

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

To add expansion blocks and access to the configuration screens, refer to Adding an Expansion Block *(see page 14)*.

What Is in This Chapter?

This chapter contains the following topics:

TM7BAI4VLA

Introduction

The TM7BAI4VLA expansion block is a 4 channel analog input block with 10 Vdc inputs.

For further information, refer to TM7BAI4VLA Block 4AI ±10V *(see Modicon TM7, Analog I/O Blocks, Hardware Guide)*.

TM7 Module I/O Mapping Tab

Variables can be defined and named in the **TM7 Module I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the I/O Mapping configuration:

Variable	Channel	Type	Description
–	**ModuleOK**	BYTE	State of the compact I/O and electronic modules
	DiagnIn	BYTE	Status bit associated to each input: ● 0: OK ● 1: Error detected
Inputs	**AnalogInput1-4 0**	INT	Current value of the input 0
	AnalogInput1-4 1		Current value of the input 1
	AnalogInput1-4 2		Current value of the input 2
	AnalogInput1-4 3		Current value of the input 3

For further generic descriptions, refer to I/O Mapping Tab Description *(see page 14)*.

Filter Level

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

Formula for the evaluation of the input value:

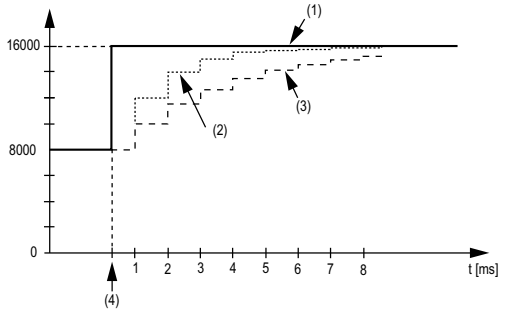
$$Value_{new} = Value_{old} - \frac{Value_{old}}{Filterlevel} + \frac{Inputvalue}{Filterlevel}$$

The following examples show the function of the input 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 limitation = 0

Filter level = 2 or 4

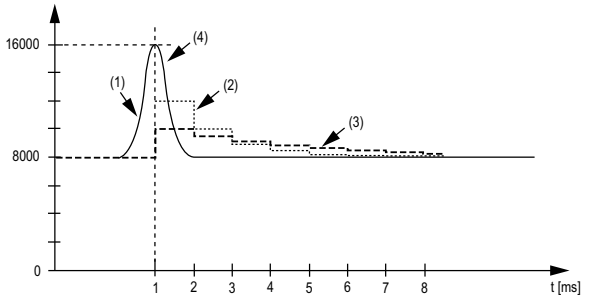


1 Input value
2 Evaluated value: Filter level 2
3 Evaluated value: Filter level 4
4 Input jump

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

Input 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 Limitation

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

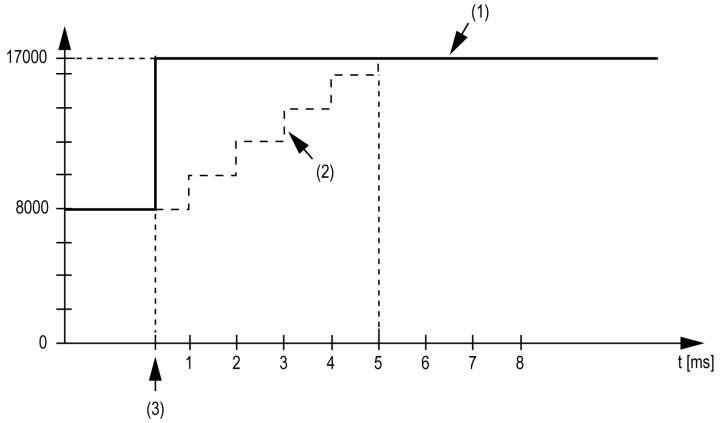
The amount of the change in the input value is verified to make sure the specified limits are not exceeded. If the values are exceeded, the adjusted input value is equal to the old value ± the limit value.

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

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

Input limitation = 2047

Filter level = 2

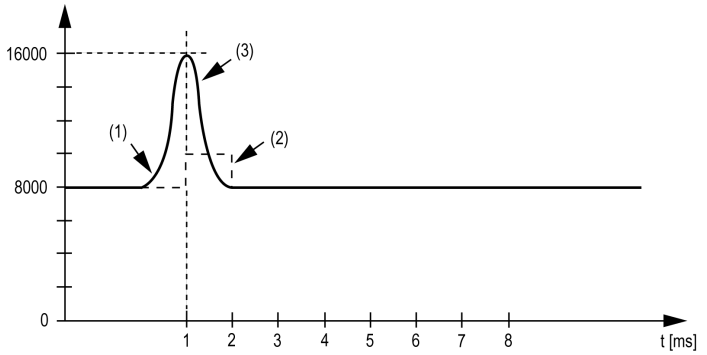


1 Input value
2 Internal adjusted input value before filter
3 Input jump

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

Input limitation = 2047

Filter level = 2



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

User-Defined Parameters Tab

The table describes the user-defined parameters of the module:

Parameter	Value	Default Value	Description
InputFilter	off Level 2 Level 4 Level 8 Level 16 Level 32 Level 64 Level 128	off	Definition of the filter level *(see page 24)*.
InputLimitation	off 4095 511 8191 1023 16383 2047 255	16383	Specifies the limitation of input ramp *(see page 26)*. **NOTE:** Parameter only available if an input filter is selected.

TM7BAI4CLA

Introduction

The TM7BAI4CLA expansion block is a 4 channel analog input block with 20 mA inputs.

For further information, refer to TM7BAI4CLA Block 4AI 0-20mA *(see Modicon TM7, Analog I/O Blocks, Hardware Guide)*.

TM7 Module I/O Mapping Tab

Variables can be defined and named in the **TM7 Module I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the I/O Mapping configuration:

Variable	Channel	Type	Description
–	**ModuleOK**	BYTE	State of the compact I/O and electronic modules
	Status	BYTE	State of all inputs 0...3
Inputs	**AnalogInput00**	INT	Current value of the input 0
	AnalogInput01		Current value of the input 1
	AnalogInput02		Current value of the input 2
	AnalogInput03		Current value of the input 3

For further generic descriptions, refer to I/O Mapping Tab Description *(see page 14)*.

Filter Level

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

Formula for the evaluation of the input value:

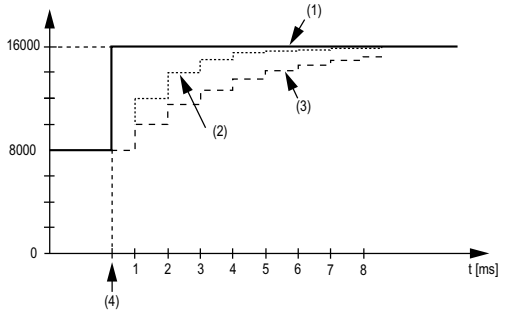
$$Value_{new} = Value_{old} - \frac{Value_{old}}{Filterlevel} + \frac{Inputvalue}{Filterlevel}$$

The following examples show the function of the input 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 limitation = 0

Filter level = 2 or 4

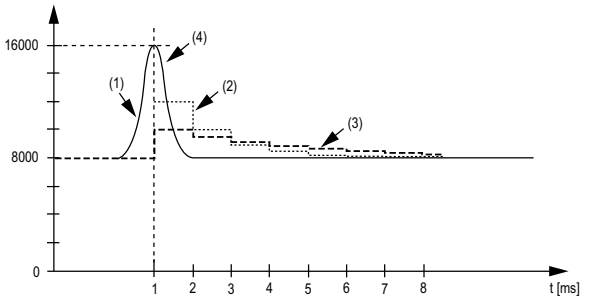


1 Input value
2 Evaluated value: Filter level 2
3 Evaluated value: Filter level 4
4 Input jump

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

Input 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 Limitation

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

The amount of the change in the input value is verified 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.

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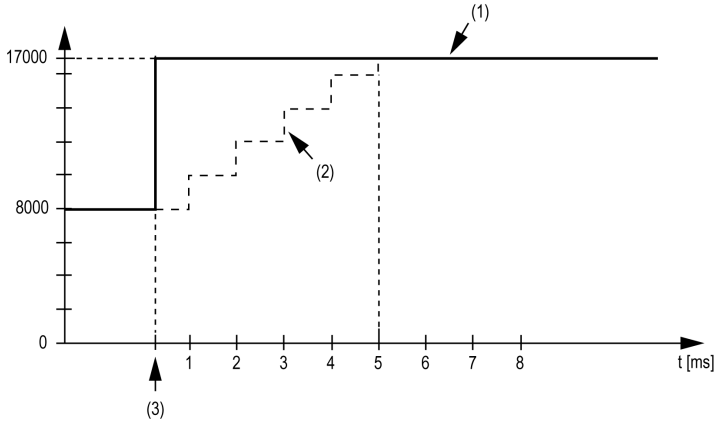

1 Input value
2 Internal adjusted input value before filter
3 Input jump

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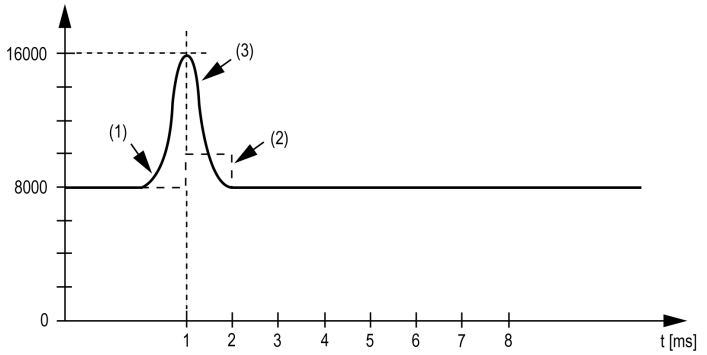
Filter level = 2



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

User-Defined Parameters Tab

The table describes the user-defined parameters of the module:

Parameter	Value	Default Value	Description
InputFilter	off Level 2 Level 4 Level 8 Level 16 Level 32 Level 64 Level 128	off	Definition of the filter level *(see page 24)*.
InputLimitation	off 4095 511 8191 1023 16383 2047 255	16383	Specifies the limitation of input ramp *(see page 26)*. **NOTE:** Parameter only available if an input filter is selected.

TM7BAI4TLA

Introduction

The TM7BAI4TLA expansion block is a 4 channel Analog Resistor Temperature input block with input sensor type PT and KTY or resistor.

For further information, refer to TM7BAI4TLA Block 4AI PT100/PT1000.

TM7 Module I/O Mapping Tab

Variables can be defined and named in the **TM7 Module I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the I/O Mapping configuration:

Variable	Channel	Type	Description
–	**ModuleOK**	BYTE	State of the compact I/O and electronic modules
	DiagIn	BYTE	Status bit associated to each input: ● 0: OK ● 1: Error detected
Inputs	**RTD input 1**	INT	Current value of the input 0
	RTD input 2		Current value of the input 1
	RTD input 3		Current value of the input 2
	RTD input 4		Current value of the input 3

For further generic descriptions, refer to I/O Mapping Tab Description *(see page 14)*.

Analog Inputs

Different resistance or temperature measurements result in different value ranges and data types.

Sensor Type and Channel Deactivation

The block 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 switched off.

This table shows the sensor types:

Sensor Types	Digital Value	Temperature °C (°F)	Resolution °C (°F)
Sensor type PT100	-2000...8500	-200...850 (-328...1562)	0.1 (0.18)
Sensor type PT1000	-2000...8500	-200...850 (-328...1562)	0.1 (0.18)
Sensor type KTY10-6	500...1450	-50...145 (48...293)	0.1 (0.18)
Sensor type KTY84-130	400...3000	-40...300 (40...572)	0.1 (0.18)
Resistance measurement 0.1...4500 Ohm	1...45000	–	0.1 Ohm
Resistance measurement 0.05...2250 Ohm	1...45000	–	0.05 Ohm

User-Defined Parameters Tab

The table describes the user-defined parameters of the module:

Parameter	Value	Default Value	Description
Filter	50Hz 60Hz 250Hz 500Hz	50 Hz	Analog input filter value.
SensorType01 ... **SensorType04**	KTY10 KTY84 PT100 PT1000 0.1 Ohm to 4500 Ohm 0.05 Ohm to 2250 Ohm off	KTY10	Set the sensor type *(see page 33)*. **Off**: the TemperatureXX channel is removed from the **I/O Mapping** tab.

TM7BAI4PLA

Introduction

The TM7BAI4PLA expansion block is a 4 channel Analog Temperature Sensor block with input type J, K, and S thermocouple sensors.

For further information, refer to TM7BAI4PLA Block 4AI thermocouple J/K/S.

TM7 Module I/O Mapping Tab

Variables can be defined and named in the **TM7 Module I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the I/O Mapping configuration:

Variable	Channel	Type	Description
–	**ModuleOK**	BYTE	State of the compact I/O and electronic modules
	DiagIn	BYTE	Status bit associated to each input: ● 0: OK ● 1: Error detected
Inputs	**Temperature 1**	INT	Current value of the input 0
	Temperature 2		Current value of the input 1
	Temperature 3		Current value of the input 2
	Temperature 4		Current value of the input 3
	Terminal Temperature 1	INT	Terminal Temperature of channel 0
	Terminal Temperature 2		Terminal Temperature of channel 1
	Terminal Temperature 3		Terminal Temperature of channel 2
	Terminal Temperature 4		Terminal Temperature of channel 3

For further generic descriptions, refer to I/O Mapping Tab Description *(see page 14)*.

Raw Value Measurement

If a sensor type other than J, K 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.

Terminal Temperature (Cold Junction) Compensation

When using thermocouples, it is necessary to measure the temperature at the terminal connections of the TM7BAI4PLA in order to calculate an accurate absolute temperature at the measuring point of the thermocouple. The sensor used to measure the terminal temperature is integrated in the TM7ACTHA thermocouple connector.

NOTE: At least one terminal temperature sensor TM7ACTHA *(see Modicon TM7, Analog I/O Blocks, Hardware Guide)* 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.

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

The temperature measured at the external reference junction is stored in the I/O area of the TM7BAI4PLA block. The TM7BAI4PLA block calculates the thermocouple temperature internally from the measured voltage and the reference junction temperature value (per channel).

This table provides examples for the possible configurations:

TM7ACTHA Connected on the Input Connector	Description
1	The terminal temperature compensation for all 4 channels is performed using the temperature measured on connector 1.
1 and 3	The terminal temperature compensation for channels I0 and I1 is performed using the temperature measured on connector 1. The terminal temperature compensation for channels I2 and I3 is performed using the temperature measured on connector 3.
1, 2, 3 and 4	The terminal temperature compensation is performed using the temperature measured on the respective connector.
NOTE: For the correspondence between the connectors and channels, refer to Connector and Channel Assignments *(see Modicon TM7, Analog I/O Blocks, Hardware Guide)*.	

Sensor Type and Channel Deactivation

The block is designed for various sensor types. The sensor type must be specified because of the different adjustment values. To save time, individual channels can be switched off.

This table shows the code corresponding sensor types:

Sensor Types	Digital Value	Temperature °C (°F)	Resolution °C (°F)
Sensor type N	-2700...2372	-270...1300 (-454...2372)	0.1 (0.18)
Sensor type R	-500...1664	-50...1664 (-58...3027)	0.1 (0.18)
Sensor type J	-2200...12000	-220...1200 (-364...2192)	0.1 (0.18)
Sensor type K	-2700...13720	-270...1372 (-454...2501)	0.1 (0.18)
Sensor type S	-500...17680	-50...1768 (-58...3214)	0.1 (0.18)
Measurement range of ±32.767 mV	-32768...32767	–	1 µV
Measurement range of ±65.534 mV	-32768...32767	–	2 µV

User-Defined Parameters Tab

The table describes the user-defined parameters of the module:

Parameter	Value	Default Value	Description
Filter	50Hz 60Hz 250Hz 500Hz	50Hz	Analog input filter value.
Sensor type	off J K S N R raw value 1uV raw value 2uV	off	Sets the sensor type *(see page 36)*. The sensor type is applied for all the channels
DisableChannel01 ... **DisableChannel04**	on off	on	**On**: The channel is disabled. **NOTE:** Selectively disabling of unused channels reduces the electronic module cycle time.

TM7BAO4VLA

Introduction

The TM7BAO4VLA expansion block is a 4 channel analog output block with 10 Vdc outputs.

For further information, refer to TM7BAO4VLA Block 4AO ±10V.

TM7 Module I/O Mapping Tab

Variables can be defined and named in the **TM7 Module I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the I/O Mapping configuration:

Variable	Channel	Type	Description
–	**ModuleOK**	BYTE	State of the compact I/O and electronic modules
Outputs	**AnalogOutput 1-4 0**	INT	Command word of the output 0
	AnalogOutput 1-4 1		Command word of the output 1
	AnalogOutput 1-4 2		Command word of the output 2
	AnalogOutput 1-4 3		Command word of the output 3

For further generic descriptions, refer to I/O Mapping Tab Description *(see page 14)*.

User-Defined Parameters Tab

This module has no default user-defined parameters.

TM7BAO4CLA

Introduction

The TM7BAO4CLA expansion block is a 4 channel analog output block with 20 mA inputs.

For further information, refer to TM7BAO4CLA Block 4AO 0-20 mA.

TM7 Module I/O Mapping Tab

Variables can be defined and named in the **TM7 Module I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the I/O Mapping configuration:

Variable	Channel	Type	Description
–	**ModuleOK**	BYTE	State of the compact I/O and electronic modules
Outputs	**AnalogOutput 1-4 0**	INT	Command word of the output 0
	AnalogOutput 1-4 1		Command word of the output 1
	AnalogOutput 1-4 2		Command word of the output 2
	AnalogOutput 1-4 3		Command word of the output 3

For further generic descriptions, refer to I/O Mapping Tab Description *(see page 14)*.

User-Defined Parameters Tab

This module has no default user-defined parameters.

TM7BAM4VLA

Introduction

The TM7BAM4VLA expansion block is a 2 analog input block with 10 Vdc inputs and 2 analog output block with 10 Vdc outputs.

For further information, refer to TM7BAM4VLA Block 2AI/2AO ±10V.

TM7 Module I/O Mapping Tab

Variables can be defined and named in the **TM7 Module I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the I/O Mapping configuration:

Variable	Channel	Type	Description
–	**ModuleOK**	BYTE	State of the compact I/O and electronic modules
	DiagIn	BYTE	Status bit associated to each I/O: ● 0: OK ● 1: Error detected
Inputs	**AnalogInput 1-2 0**	INT	Current value of the input 0
	AnalogInput 1-2 1		Current value of the input 1
Outputs	**AnalogOutput 3-4 0**	INT	Command word of the output 0
	AnalogOutput 3-4 1		Command word of the output 1

For further generic descriptions, refer to I/O Mapping Tab Description *(see page 14)*.

Filter Level

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

Formula for the evaluation of the input value:

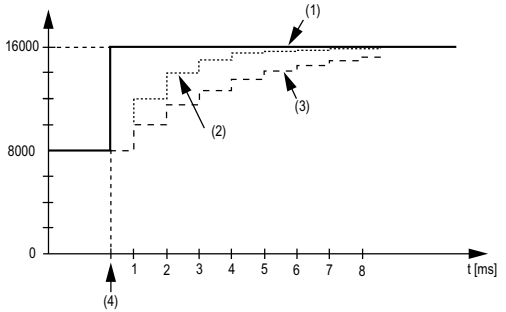
$$Value_{new} = Value_{old} - \frac{Value_{old}}{Filterlevel} + \frac{Inputvalue}{Filterlevel}$$

The following examples show the function of the input 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 limitation = 0

Filter level = 2 or 4

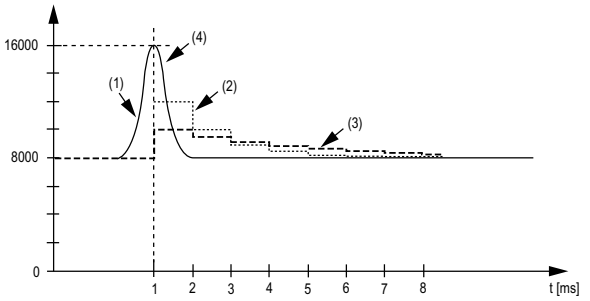


1 Input value
2 Evaluated value: Filter level 2
3 Evaluated value: Filter level 4
4 Input jump

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

Input 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 Limitation

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

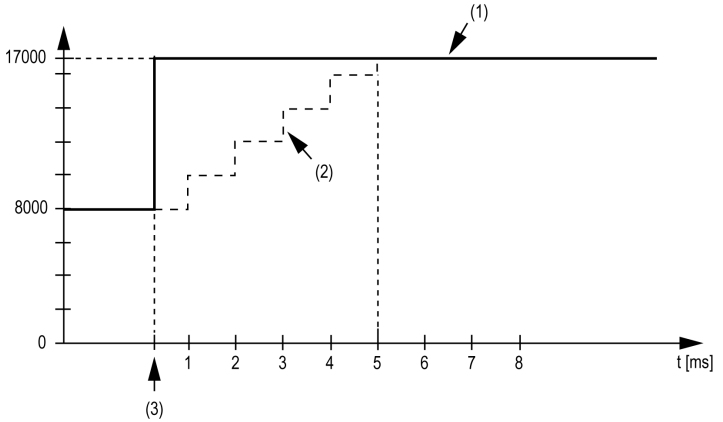
The amount of the change in the input value is checked to make sure the specified limits are not exceeded. If the values are exceeded, the adjusted input value is equal to the old value ± the limit value.

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

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

Input limitation = 2047

Filter level = 2

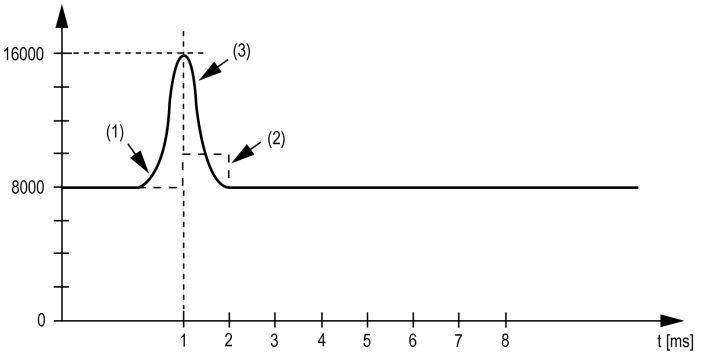


1 Input value
2 Internal adjusted input value before filter
3 Input jump

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

Input limitation = 2047

Filter level = 2



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

User-Defined Parameters Tab

The table describes the user-defined parameters of the module:

Parameter	Value	Default Value	Description
InputFilter	off Level 2 Level 4 Level 8 Level 16 Level 32 Level 64 Level 128	off	Definition of the filter level *(see page 24)*.
InputLimitation	off 4095 511 8191 1023 16383 2047 255	16383	Specifies the limitation of input ramp *(see page 26)*. **NOTE:** Parameter only available if an input filter is selected.

TM7BAM4CLA

Introduction

The TM7BAM4CLA expansion block is a 2 analog input block with 20 mA inputs and 2 analog output block with 20 mA outputs.

For further information, refer to TM7BAM4CLA Block 2AI/2AO 20 mA.

TM7 Module I/O Mapping Tab

Variables can be defined and named in the **TM7 Module I/O Mapping** tab. Additional information such as topological addressing is also provided in this tab.

This table describes the I/O Mapping configuration:

Variable	Channel	Type	Description
–	**ModuleOK**	BYTE	State of the compact I/O and electronic modules
Inputs	**AnalogInput 1-2 0**	INT	Current value of the input 0
	AnalogInput 1-2 1		Current value of the input 1
Outputs	**AnalogOutput 3-4 0**	INT	Command word of the output 0
	AnalogOutput 3-4 1		Command word of the output 1

For further generic descriptions, refer to I/O Mapping Tab Description *(see page 14)*.

Filter Level

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

Formula for the evaluation of the input value:

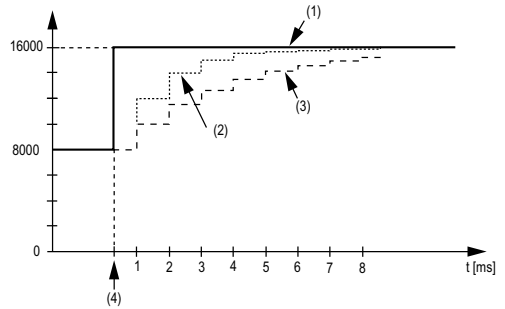
$$Value_{new} = Value_{old} - \frac{Value_{old}}{Filterlevel} + \frac{Inputvalue}{Filterlevel}$$

The following examples show the function of the input 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 limitation = 0

Filter level = 2 or 4

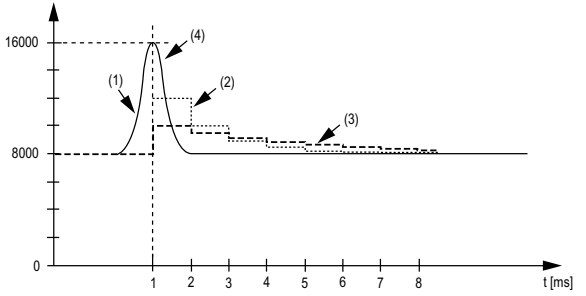


1 Input value
2 Evaluated value: Filter level 2
3 Evaluated value: Filter level 4
4 Input jump

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

Input 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 Limitation

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

The amount of the change in the input value is verified 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.

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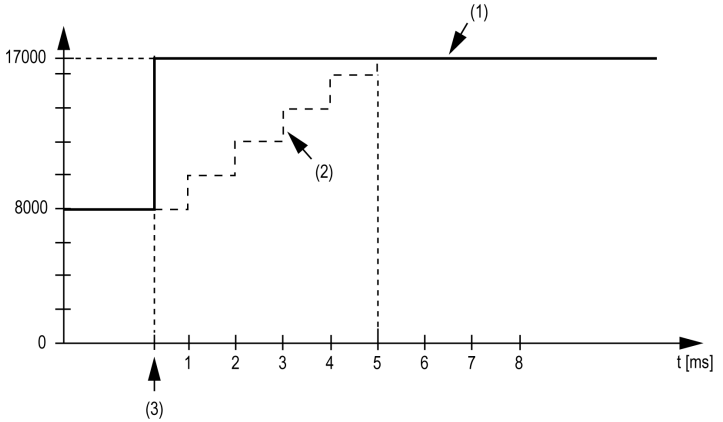
Filter level = 2

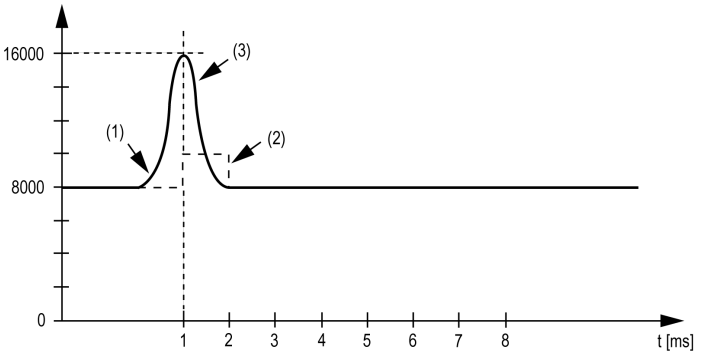


1 Input value
2 Internal adjusted input value before filter
3 Input jump

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

Input limitation = 2047

Filter level = 2



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

User-Defined Parameters Tab

The table describes the user-defined parameters of the module:

Parameter	Value	Default Value	Description
InputFilter	off Level 2 Level 4 Level 8 Level 16 Level 32 Level 64 Level 128	off	Definition of the filter level *(see page 24)*.
InputLimitation	off 4095 511 8191 1023 16383 2047 255	16383	Specifies the limitation of input ramp *(see page 26)*. **NOTE:** Parameter only available if an input filter is selected.

Chapter 4
TM7 Power Distribution Block (PDB)

TM7SPS1A

Introduction

The TM7SPS1A expansion block is a 24 Vdc power distribution block for internal I/O supply.

For further information, refer to TM7SPS1A TM7 Power Distribution Block *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*.

I/O Configuration

There is no parameter configuration for this block.

Glossary

A

analog input

Converts received voltage or current levels into numerical values. You can store and process these values within the logic controller.

analog output

Converts numerical values within the logic controller and sends out proportional voltage or current levels.

C

control network

A network containing logic controllers, SCADA systems, PCs, HMI, switches, ...

Two kinds of topologies are supported:

- flat: all modules and devices in this network belong to same subnet.
- 2 levels: the network is split into an operation network and an inter-controller network.

These two networks can be physically independent, but are generally linked by a routing device.

D

digital I/O

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

I

I/O

(*input/output*)

input filter

A special function that helps reject extraneous signals on input lines due to such things as contact bounce and inducted electrical transients. Inputs provide a level of input filtering using the hardware. Additional filtering with software is also configurable through the programing or the configuration software.

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