

Modicon TM7

Expansion Blocks Configuration Programming Guide

11/2015



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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, 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 SoMachine online help.

Validity Note

This document has been updated for the release of SoMachine V4.1 SP2.

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 TM7 Digital I/O Blocks Hardware guide	EIO0000000703 (Eng), EIO0000000704 (Fre), EIO0000000705 (GER), EIO0000000706 (Spa), EIO0000000707 (Ita), EIO0000000708 (Chs)
Modicon TM7 Analog I/O Blocks Hardware guide	EIO0000000709 (Eng), EIO0000000710 (Fre), EIO0000000711 (GER), EIO0000000712 (Spa), EIO0000000713 (Ita), EIO0000000714 (Chs)

You can download these technical publications and other technical information from our website at <http://download.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.

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
EN 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2008	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
EN 1088:2008 ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2006	Safety of machinery - Emergency stop - Principles for design
EN/IEC 62061:2005	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 61784-3:2008	Digital data communication for measurement and control: Functional safety field buses.
2006/42/EC	Machinery Directive
2004/108/EC	Electromagnetic Compatibility Directive
2006/95/EC	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 *EC Machinery Directive (EC/2006/42)* 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:

Topic	Page
TM7 Expansion Modules General Description	12
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TM7 Expansion Modules General Description

Introduction

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 described in this programming guide:

Reference	Number of Channels	Voltage/Current	Refer To
TM7BDI8B	8 inputs	24 Vdc / 7 mA	TM7BDI8B, TM7BDI16A and TM7BDI16B (see page 22)
TM7BDI16B	16 inputs	24 Vdc / 7 mA	TM7BDI8B, TM7BDI16A and TM7BDI16B (see page 22)
TM7BDI16A	16 inputs	24 Vdc / 7 mA	TM7BDI8B, TM7BDI16A and TM7BDI16B (see page 22)
TM7BDO8TAB	8 outputs	24 Vdc / 2 A	TM7BDO8TAB (see page 24)
TM7BDM8B ¹	8 inputs 8 outputs	24 Vdc / 4.4 mA 24 Vdc / 0.5 A	TM7BDM8B, TM7BDM16A and TM7BDM16B (see page 26)
TM7BDM16A ¹	16 inputs 16 outputs	24 Vdc / 4.4 mA 24 Vdc / 0.5 A	TM7BDM8B, TM7BDM16A and TM7BDM16B (see page 26)
TM7BDM16B ¹	16 inputs 16 outputs	24 Vdc / 4.4 mA 24 Vdc / 0.5 A	TM7BDM8B, TM7BDM16A and TM7BDM16B (see page 26)
¹ I/O is individually configurable as either input or output			

This table lists the analog blocks described in this programming guide:

Reference	Number of Channels	Voltage/Current	Refer To
TM7BAI4VLA	4 inputs	-10...+10 Vdc	TM7BAI4VLA (see page 30)
TM7BAI4CLA	4 inputs	0...20 mA	TM7BAI4CLA (see page 37)
TM7BAO4VLA	4 outputs	-10...+10 Vdc	TM7BAO4VLA (see page 53)
TM7BAO4CLA	4 outputs	0...20 mA	TM7BAO4CLA (see page 54)
TM7BAM4VLA	2 inputs 2 outputs	-10...+10 Vdc -10...+10 Vdc	TM7BAM4VLA (see page 55)
TM7BAM4CLA	2 inputs 2 outputs	0...20 mA 0...20 mA	TM7BAM4CLA (see page 62)

This table lists the analog temperature input blocks described in this programming guide:

Reference	Number of Channels	Sensor Type	Refer To
TM7BAI4TLA	4 inputs	PT100/1000 KTY10-6/84-130	TM7BAI4TLA (see page 44)
TM7BAI4PLA	4 inputs	Thermocouple J,K,S	TM7BAI4PLA (see page 48)

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

Reference	Description	Refer To
TM7SPS1A	TM7 Power Distribution Block	TM7SPS1A (see page 69)

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, 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 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.

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

Adding a TM7 Expansion Module

To add a TM7 expansion module, refer to the Modicon TM7 Expansion Blocks Configuration Programming Guide (*see page 18*).

TM5 Manager Configuration

TM5 Manager Configuration

To configure the TM5 Manager, proceed as follows:

Step	Action
1	In the Devices tree , expand the TM5 node.
2	Double-click the TM5_Manager node. Result: The TM5 Manager configuration window is displayed.
3	Select the I/O Configuration tab.

Parameters of the I/O Configuration:

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:

- Be longer than the greatest **Minimum Cycle Time** of any expansion module or block in the configuration.
- Be long enough to permit the data exchange with all the modules and the blocks.

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.

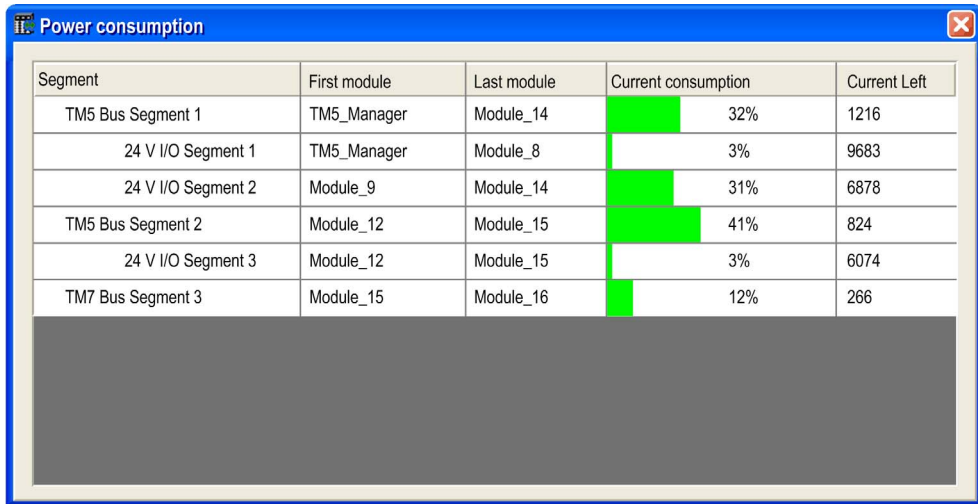
On the next bus cycle after the end of the task configured as the **Bus cycle task**, the physical output is updated from the %Q memory variable value.







For more details on **Bus cycle task**, refer to the controller **PLC settings** tab.

Power Consumption

To display the estimated power consumption of the expansion modules:

Step	Action
1	Right-click the TM5_Manager node of the Device tree .
2	Select Power consumption .



Segment	First module	Last module	Current consumption	Current Left
TM5 Bus Segment 1	TM5_Manager	Module_14	 32%	1216
24 V I/O Segment 1	TM5_Manager	Module_8	 3%	9683
24 V I/O Segment 2	Module_9	Module_14	 31%	6878
TM5 Bus Segment 2	Module_12	Module_15	 41%	824
24 V I/O Segment 3	Module_12	Module_15	 3%	6074
TM7 Bus Segment 3	Module_15	Module_16	 12%	266

NOTE: The current consumption figures presented by the **Power consumption** 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 Modicon TM5, Expansion Modules Configuration, Programming Guide*) 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 **Power consumption** 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 (*see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide*).

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 *SoMachine, Programming Guide*)
- Using the Contextual Menu or Plus Button (see *SoMachine, 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 I/O Mapping tab of the block appears.

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:

I/O Mapping I/O configuration Information							
Channels							
Variable	Mapp...	Channel	Address	Type	Default Va...	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

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.
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 (<i>see Modicon M258 Logic Controller, Programming Guide</i>) or Motion Controller PLC Settings (<i>see Modicon LMC058 Motion Controller, Programming Guide</i>). 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*).

I/O Configuration Tab Description

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

Parameter	Type	Value	Default Value	Unit	Description
General					
Module address	USINT(0..250)	10	0		
Input filter	Enumeration of BYTE	off	off		Definition of filter level
Input limitation	Enumeration of BYTE	off	off		Limitation of input ramp

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

Chapter 2

TM7 Digital I/O 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 18*).

What Is in This Chapter?

This chapter contains the following topics:

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TM7BDO8TAB	24
TM7BDM8B, TM7BDM16A and TM7BDM16B	26

TM7BDI8B, TM7BDI16A and TM7BDI16B

Introduction

The TM7BDI8B, 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 <i>Modicon TM7, Digital I/O Blocks, Hardware Guide</i>)
TM7BDI16A	TM7BDI16A Block 16DI 24 Vdc Sink (see <i>Modicon TM7, Digital I/O Blocks, Hardware Guide</i>)
TM7BDI16B	TM7BDI16B Block 16DI 24 Vdc Sink (see <i>Modicon TM7, Digital I/O Blocks, Hardware Guide</i>)

I/O Configuration Tab

To configure the TM7BDI8B, TM7BDI16A and TM7BDI16B expansion blocks, select the **I/O configuration** tab.

This table describes the blocks parameters configuration:

Parameter		Value	Default Value	Description
General	Module address	0...250	0	The address is automatically set when adding the blocks. The address value depends on the order of adding the block in the Devices tree . TM7 Blocks do not support the ability to change the address.

I/O Mapping Tab

Variables can be defined and named in the **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
Inputs	DigitalInputs00	USINT	State of all inputs 0...7
	DigitalInputs01 (Only for TM7BDI16A and TM7BDI16B)	USINT	State of all inputs 8...15
	– DigitalInput00 ... – DigitalInput15 *	BOOL	State of input 0 ... State of input 15

* 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 20](#)).

Cycle Time and I/O Update Time

This table gives the block characteristics allowing the Bus Cycle Time configuration:

Characteristic	Value (µs)
Minimum cycle time	150
Minimum I/O update time	150

For further information, refer to Manager Configuration ([see page 15](#)).

TM7BDO8TAB

Introduction

The TM7BDO8TAB 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*).

I/O Configuration Tab

To configure the TM7BDO8TAB expansion blocks, select the **I/O configuration** tab.

This table describes the blocks parameters configuration:

Parameter		Value	Default Value	Description
General	Module address	0...250	0	The address is automatically set when adding the blocks. The address value depends on the order of adding the block in the Devices tree . TM7 Blocks do not support the ability to change the address.
	Output status	On Off	On	Enables/Disables the read of the output status. On : the StatusDigitalOutputs word is added to the I/O Mapping tab.

I/O Mapping Tab

Variables can be defined and named in the **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
Inputs	StatusDigitalOutputs	USINT	Status of all outputs 0...7
	– StatusDigitalOutput00 ... – StatusDigitalOutput07	BOOL	Status bit associated to each output: ● 0: OK ● 1: Error detected
	Outputs	DigitalOutputs	USINT
	– 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 20).

Cycle Time and I/O Update Time

This table gives the block characteristics allowing the Bus Cycle Time configuration:

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

For further information, refer to Manager Configuration ([see page 15](#)).

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 <i>Modicon TM7, Digital I/O Blocks, Hardware Guide</i>)
TM7BDM16A	TM7BDM16A Block 16 Configurable DI/DO 24 Vdc (see <i>Modicon TM7, Digital I/O Blocks, Hardware Guide</i>)
TM7BDM16B	TM7BDM16B Block 16 Configurable DI/DO 24 Vdc (see <i>Modicon TM7, Digital I/O Blocks, Hardware Guide</i>)

I/O Configuration Tab

To configure the TM7BDM8B, TM7BDM16A and TM7BDM16B expansion blocks, select the **I/O configuration** tab.

This table describes the blocks parameters configuration:

Parameter		Value	Default Value	Description
General	Module address	0...250	0	The address is automatically set when adding the blocks. The address value depends on the order of adding the block in the Devices tree . TM7 Blocks do not support the ability to change the address.
	Input filter	0...250	10	Specifies the filter time of all digital inputs in the range 0...250 (0...25 ms).
	Output status	On Off	Off	Enables/Disables the read of the output status. On : the StatusDigitalOutputs word is added to the I/O Mapping tab.
Channel Configuration	Channel 00 ... Channel 15 *	Input Output	Input	Select the channel type: digital input or digital output.

* The number of **Channel** is equal to the block channel number.

I/O Mapping Tab

Variables can be defined and named in the **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
Inputs	DigitalInputs00	USINT	State of all inputs 0..7
	DigitalInputs01 (Only for TM7BDM16A and TM7BDM16B)	USINT	State of all inputs 8...15
	– DigitalInput00 ...	BOOL	State of input 0 ...
	– DigitalInput15 *		State of input 15
	StatusDigitalOutputs	UINT	Status of all outputs 0...15 *
	– StatusDigitalOutput00 ... – StatusDigitalOutput15 *	BOOL	Status bit associated to each output: ● 0: OK ● 1: Error detected
Outputs	DigitalOutputs00	USINT	Command of all outputs 0...7
	DigitalOutputs01 (Only for TM7BDM16A and TM7BDM16B)	USINT	Command of all outputs 8...15
	– DigitalOutput00 ...	BOOL	Command of output 0 ...
	– DigitalOutput15 *		Command of output 15

* The number of **DigitalInput** or **DigitalOutput** 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 18](#)).

Status Output Register

The **StatusOutput00** describes the status of each output channel:

Bit	Description	Bits Value
0	Channel 00 status	0: No error detected 1: Short circuit or overcurrent
...	...	
15 ¹	Channel 15 status	
¹ The bit number is the same as the block channel number		

Cycle Time and I/O Update Time

This table gives the block characteristics allowing the Bus Cycle Time configuration:

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

For further information, refer to Manager Configuration ([see page 15](#)).

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 18*).

What Is in This Chapter?

This chapter contains the following topics:

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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*).

I/O Configuration Tab

To configure the TM7BAI4VLA expansion block, select the **I/O configuration** tab.

This table describes the blocks parameters configuration:

Parameter		Value	Default Value	Description
General	Module address	0...250	0	The address is automatically set when adding the blocks. The address value depends on the order of adding the block in the Devices tree . TM7 Blocks do not support the ability to change the address.
	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 32).
	Input limitation	Off 16383 8191 4095 2047 1023 511 255	Off	Specifies the limitation of input ramp (see page 34). NOTE: Parameter only available if an input filter is selected.

I/O Mapping Tab

Variables can be defined and named in the **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
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
	StatusInputs	USINT	State of all inputs 0...3

For further generic descriptions, refer to I/O Mapping Tab Description ([see page 20](#)).

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:

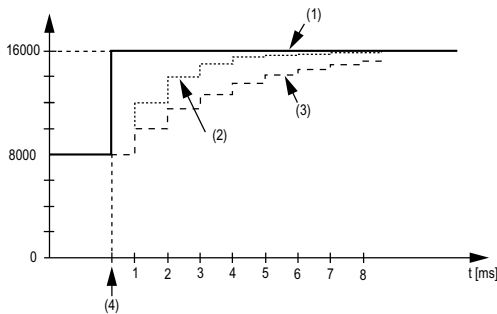
$$Value_{new} = Value_{old} - \frac{Value_{old}}{Filterlevel} + \frac{Inputvalue}{Filterlevel}$$

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

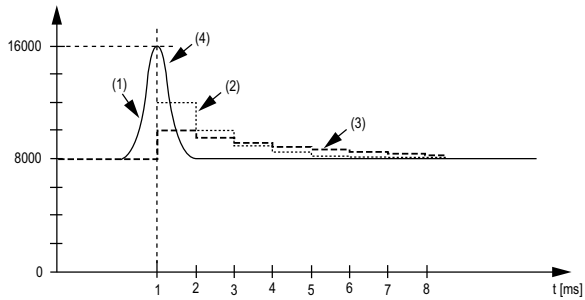


- 1 Input value
- 2 Evaluated value: Filter level 2
- 3 Evaluated value: Filter level 4
- 4 Input jump

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.

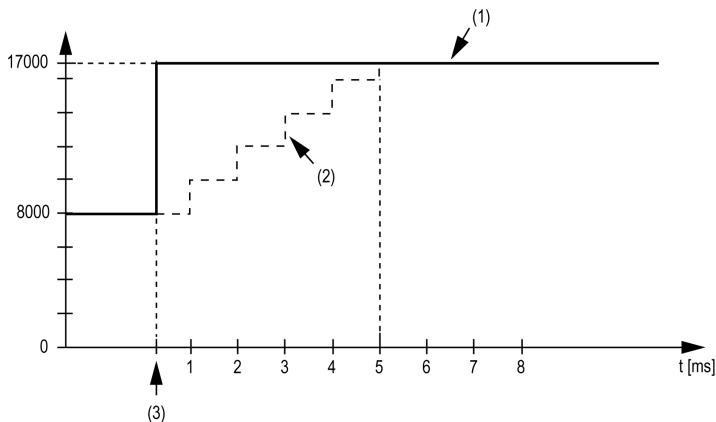
The amount of the change in the input value is verified to make sure the specified limits are not exceeded. If the values are exceeded, the adjusted input value is equal to the old value \pm the limit value.

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

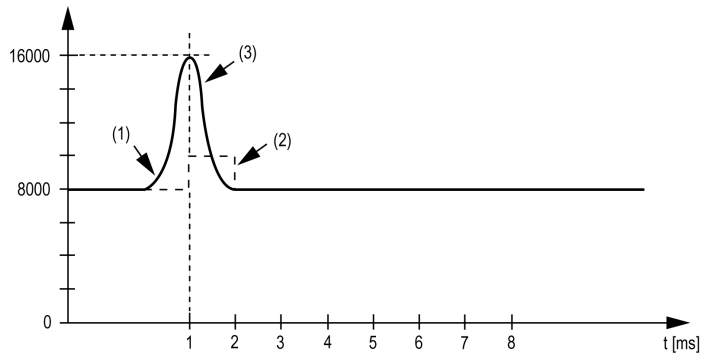


- 1 Input value
- 2 Internal adjusted input value before filter
- 3 Input jump

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)

Status Input Register

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

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

Out of Range Values

Out of Range Values	
Below lower limit	-32768
Above upper limit	32767

Cycle Time and I/O Update Time

This table gives the block characteristics allowing the Bus Cycle Time configuration:

Characteristic	Value (μ s)	
	Without Filter	With Filter
Minimum cycle time	250	500
Minimum input update time	300	1000

For further information, refer to Manager Configuration ([see page 15](#)).

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*).

I/O Configuration Tab

To configure the TM7BAI4CLA expansion block, select the **I/O configuration** tab.

This table describes the blocks parameters configuration:

Parameter		Value	Default Value	Description
General	Module address	0...250	0	The address is automatically set when adding the blocks. The address value depends on the order of adding the block in the Devices tree . TM7 Blocks do not support the ability to change the address.
	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 38).
	Input limitation	Off 16383 8191 4095 2047 1023 511 255	Off	Specifies the limitation of input ramp (see page 41). NOTE: Parameter only available if an input filter is selected.

I/O Mapping Tab

Variables can be defined and named in the **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
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
	StatusInputs	USINT	State of all inputs 0...3

For further generic descriptions, refer to I/O Mapping Tab Description ([see page 20](#)).

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:

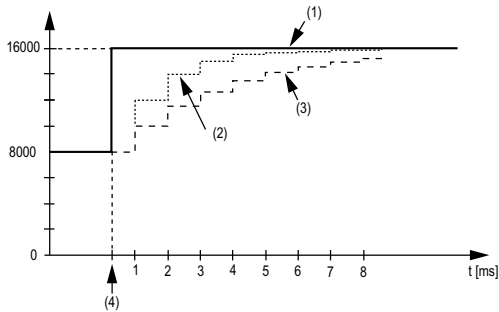
$$Value_{new} = Value_{old} - \frac{Value_{old}}{Filterlevel} + \frac{Inputvalue}{Filterlevel}$$

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

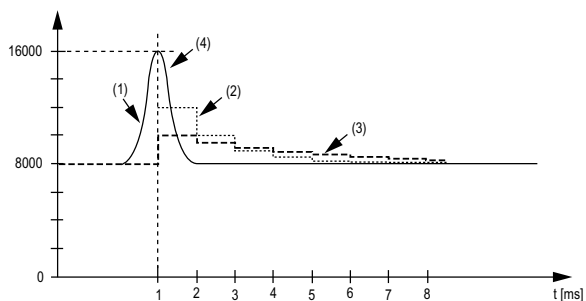


- 1 Input value
- 2 Evaluated value: Filter level 2
- 3 Evaluated value: Filter level 4
- 4 Input jump

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.

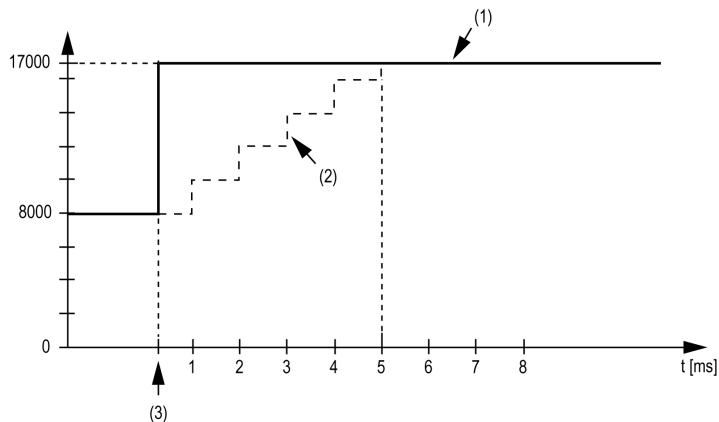
The amount of the change in the input value is verified to make sure the specified limits are not exceeded. If the values are exceeded, the adjusted input value is equal to the old value \pm the limit value.

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

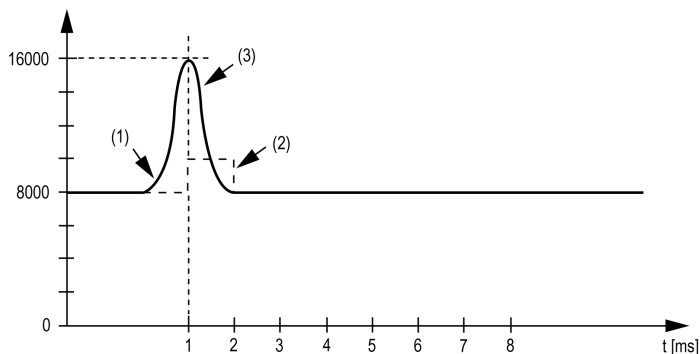


- 1 Input value
- 2 Internal adjusted input value before filter
- 3 Input jump

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)

Status Input Register

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

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

Out of Range Values

Out of Range Values	
Below lower limit	0
Above upper limit	32767

Cycle Time and I/O Update Time

This table gives the block characteristics allowing the Bus Cycle Time configuration:

Characteristic	Value (μs)	
	Without Filter	With Filter
Minimum cycle time	250	500
Minimum input update time	300	1000

For further information, refer to Manager Configuration ([see page 15](#)).

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.

I/O Configuration Tab

To configure the TM7BAI4TLA expansion block, select the **I/O configuration** tab.

This table describes the blocks parameters configuration:

Parameter		Value	Default Value	Description
General	Module address	0...250	0	The address is automatically set when adding the blocks. The address value depends on the order of adding the block in the Devices tree . TM7 Blocks do not support the ability to change the address.
	Input filter	20 16.67 4 2	20 ms	Definition of the filter level (see page 32).
Temperature00	Sensor type	PT100 PT1000 KTY10-6 KTY84-130 0.1 Ohm to 4500 Ohm, (0.1 Ohm/bit) 0.05 Ohm to 2250 Ohm, (0.05 Ohm/bit) Off	PT100	Set the sensor type (see page 46). Off: the Temperature00 channel is removed from the I/O Mapping tab.
Temperature01	Sensor type	PT100 PT1000 KTY10-6 KTY84-130 0.1 Ohm to 4500 Ohm, (0.1 Ohm/bit) 0.05 Ohm to 2250 Ohm, (0.05 Ohm/bit) Off	PT100	Set the sensor type (see page 46). Off: the Temperature01 channel is removed from the I/O Mapping tab.

Parameter		Value	Default Value	Description
Temperature02	Sensor type	PT100 PT1000 KTY10-6 KTY84-130 0.1 Ohm to 4500 Ohm, (0.1 Ohm/bit) 0.05 Ohm to 2250 Ohm, (0.05 Ohm/bit) Off	PT100	Set the sensor type (<i>see page 46</i>). Off: the Temperature02 channel is removed from the I/O Mapping tab.
Temperature03	Sensor type	PT100 PT1000 KTY10-6 KTY84-130 0.1 Ohm to 4500 Ohm, (0.1 Ohm/bit) 0.05 Ohm to 2250 Ohm, (0.05 Ohm/bit) Off	PT100	Set the sensor type (<i>see page 46</i>). Off: the Temperature03 channel is removed from the I/O Mapping tab.

I/O Mapping Tab

Variables can be defined and named in the **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
Inputs	Temperature00	INT	Current value of the input 0
	Temperature01		Current value of the input 1
	Temperature02		Current value of the input 2
	Temperature03		Current value of the input 3
	StatusInputs	UINT	Bit 0-7: State of all inputs 0...3 Bit 8-15: I/O Cycle Counter

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

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

Limit Analog Value

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

Detected Error Type	Temperature Measurement Digital Value for Detected Error	Resistance Measurement Digital Value for Detected Error
Broken wire detected	+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)

Status Input Register

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

Bit	Description	Bits Value
0-1	Channel 00 status	00: No error detected 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	
8-15	I/O Cycle Counter.	

Cycle Time and I/O Update Time

This table gives the block characteristics allowing the Bus Cycle Time configuration:

Characteristic	Value (μ s)	
	1 Input	n Inputs
Minimum cycle time	200	
Minimum input update time	Equal to the filter time	$n \times (3 \times \text{filter time} + 15 \text{ ms})$

For further information, refer to Manager Configuration ([see page 15](#)).

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.

I/O Configuration Tab

To configure the TM7BAI4PLA expansion block, select the **I/O configuration** tab.

This table describes the blocks parameters configuration:

Parameter		Value	Default Value	Description
General	Module address	0...250	0	The address is automatically set when adding the blocks. The address value depends on the order of adding the block in the Devices tree . TM7 Blocks do not support the ability to change the address.
	Input filter	20 16.67 4 2	20 ms	Definition of the filter level (see page 32).
	Sensor type	J K S ±32767 µV (1 µV/bit) ±65534 µV (2 µV/bit)	J	Sets the sensor type (see page 51). The sensor type is applied for all the channels
	Enable channel 00	On Off	On	Enables/Disables the channel. Off: The channel is deactivated. The Temperature00 and the TerminalTemperature00 words are removed from the I/O Mapping tab.
	Enable channel 01	On Off	On	Enables/Disables the channel. Off: The channel is deactivated. The Temperature01 and the TerminalTemperature01 words are removed from the I/O Mapping tab.
	Enable channel 02	On Off	On	Enables/Disables the channel. Off: The channel is deactivated. The Temperature02 and the TerminalTemperature02 words are removed from the I/O Mapping tab.
	Enable channel 03	On Off	On	Enables/Disables the channel. Off: The channel is deactivated. The Temperature03 and the TerminalTemperature03 words are removed from the I/O Mapping tab.

I/O Mapping Tab

Variables can be defined and named in the **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
Inputs	Temperature00	INT	Current value of the input 0
	Temperature01		Current value of the input 1
	Temperature02		Current value of the input 2
	Temperature03		Current value of the input 3
	TerminalTemperature00	INT	Terminal Temperature of channel 0
	TerminalTemperature01		Terminal Temperature of channel 1
	TerminalTemperature02		Terminal Temperature of channel 2
	TerminalTemperature03		Terminal Temperature of channel 3
	StatusInputs	UINT	Bit 0-7: State of all inputs 0...3 Bit 8-15: I/O Cycle Counter

For further generic descriptions, refer to I/O Mapping Tab Description ([see page 18](#)).

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 <i>Modicon TM7, Analog I/O Blocks, Hardware Guide</i>).	

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 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

Status Input Register

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

Bit	Description	Bits Value
0-1	Channel 00 status	00: No error detected
2-3	Channel 01 status	01: Below lower limit value
4-5	Channel 02 status	10: Above upper limit value
6-7	Channel 03 status	11: Broken wire detected
8-15	I/O Cycle Counter.	

Cycle Time and I/O Update Time

This table gives the block characteristics allowing the Bus Cycle Time configuration:

Characteristic	Value (μ s)	
	1 Input	n Inputs
Minimum cycle time	200	
Minimum input update time	Equal to the filter time	$(n+1) \times (3 \times \text{filter time} + 2 \text{ ms})$

For further information, refer to Manager Configuration ([see page 15](#)).

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 $\pm 10V$.

I/O Configuration Tab

To configure the TM7BAO4VLA expansion block, select the **I/O configuration** tab. This table describes the blocks parameters configuration:

Parameter		Value	Default Value	Description
General	Module address	0...250	0	The address is automatically set when adding the blocks. The address value depends on the order of adding the block in the Devices tree . TM7 Blocks do not support the ability to change the address.

I/O Mapping Tab

Variables can be defined and named in the **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
Outputs	AnalogOutput00	INT	Command word of the output 0
	AnalogOutput01		Command word of the output 1
	AnalogOutput02		Command word of the output 2
	AnalogOutput03		Command word of the output 3

For further generic descriptions, refer to I/O Mapping Tab Description ([see page 18](#)).

Cycle Time and I/O Update Time

This table gives the block characteristics allowing the Bus Cycle Time configuration:

Characteristic	Value (μs)
Minimum cycle time	250
Minimum output update time	400

For further information, refer to Manager Configuration ([see page 15](#)).

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.

I/O Configuration Tab

To configure the TM7BAO4CLA expansion block, select the **I/O configuration** tab. This table describes the blocks parameters configuration:

Parameter		Value	Default Value	Description
General	Module address	0...250	0	The address is automatically set when adding the blocks. The address value depends on the order of adding the block in the Devices tree . TM7 Blocks do not support the ability to change the address.

I/O Mapping Tab

Variables can be defined and named in the **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
Outputs	AnalogOutput00	INT	Command word of the output 0
	AnalogOutput01		Command word of the output 1
	AnalogOutput02		Command word of the output 2
	AnalogOutput03		Command word of the output 3

For further generic descriptions, refer to I/O Mapping Tab Description ([see page 18](#)).

Cycle Time and I/O Update Time

This table gives the block characteristics allowing the Bus Cycle Time configuration:

Characteristic	Value (µs)
Minimum cycle time	250
Minimum output update time	400

For further information, refer to Manager Configuration ([see page 15](#)).

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 $\pm 10V$.

I/O Configuration Tab

To configure the TM7BAM4VLA expansion block, select the **I/O configuration** tab.

This table describes the blocks parameters configuration:

Parameter		Value	Default Value	Description
General	Module address	0...250	0	The address is automatically set when adding the blocks. The address value depends on the order of adding the block in the Devices tree . TM7 Blocks do not support the ability to change the address.
	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 57).
	Input limitation	Off 16383 8191 4095 2047 1023 511 255	Off	Specifies the limitation of input ramp (see page 59). NOTE: Parameter only available if an input filter is selected.

I/O Mapping Tab

Variables can be defined and named in the **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
Inputs	AnalogInput00	INT	Current value of the input 0
	AnalogInput01		Current value of the input 1
	StatusInputs	USINT	State of all inputs 0...1
Outputs	AnalogOutput00	INT	Command word of the output 0
	AnalogOutput01		Command word of the output 1

For further generic descriptions, refer to I/O Mapping Tab Description ([see page 18](#)).

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:

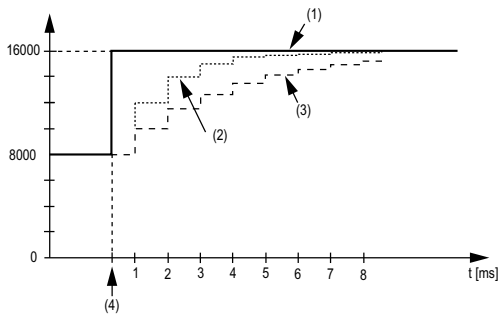
$$Value_{new} = Value_{old} - \frac{Value_{old}}{Filterlevel} + \frac{Inputvalue}{Filterlevel}$$

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

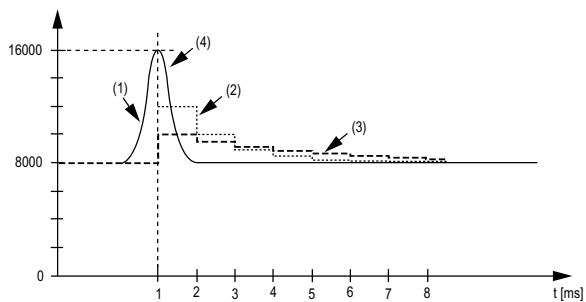


- 1 Input value
- 2 Evaluated value: Filter level 2
- 3 Evaluated value: Filter level 4
- 4 Input jump

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.

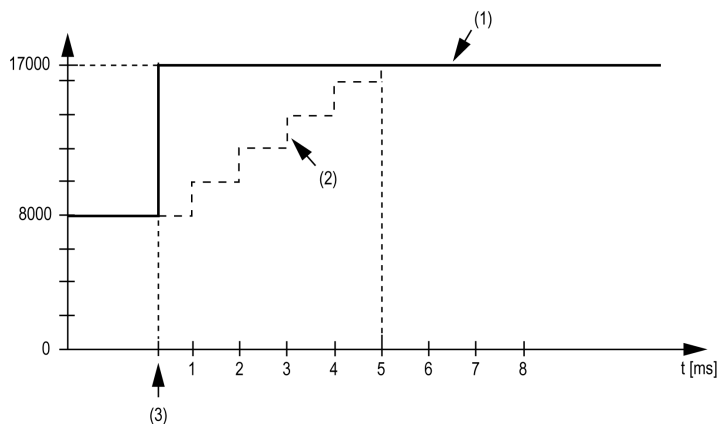
The amount of the change in the input value is checked to make sure the specified limits are not exceeded. If the values are exceeded, the adjusted input value is equal to the old value \pm the limit value.

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

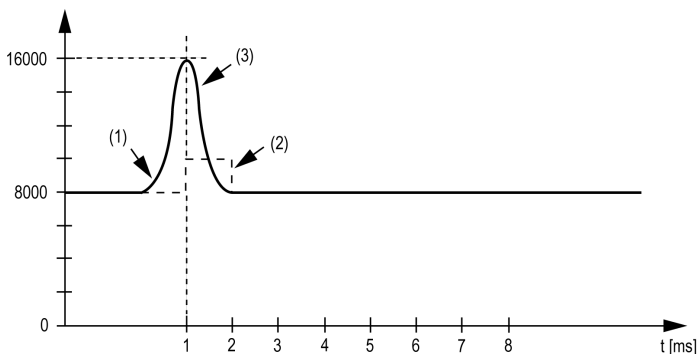


- 1 Input value
- 2 Internal adjusted input value before filter
- 3 Input jump

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)

Status Input Register

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

Bit	Description	Bits value
0-1	Channel 00 status	00: No error detected
2-3	Channel 01 status	01: Below lower limit value
4-5	Not used	10: Above upper limit value
6-7	Not used	11: Broken wire detected

Out of Range Values

Out of Range Values	
Below lower limit	-32768
Above upper limit	32767

Cycle Time and I/O Update Time

This table gives the block characteristics allowing the Bus Cycle Time configuration:

Characteristic	Value (μ s)	
	Without Filter	With Filter
Minimum cycle time	250	500
Minimum input update time	400	1000
Minimum output update time	400	—

For further information, refer to Manager Configuration ([see page 15](#)).

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.

I/O Configuration Tab

To configure the TM7BAM4CLA expansion block, select the **I/O configuration** tab.

This table describes the blocks parameters configuration:

Parameter		Value	Default Value	Description
General	Module address	0...250	0	The address is automatically set when adding the blocks. The address value depends on the order of adding the block in the Devices tree . TM7 Blocks do not support the ability to change the address.
	Input filter	Off level 2 level 4 level 8 level 16 level 32 level 64 level 128	Off	Definition of the filter level (<i>see page 64</i>).
	Input limitation	Off 16383 8191 4095 2047 1023 511 255	Off	Specifies the limitation of input ramp (<i>see page 66</i>). NOTE: Parameter only available if an input filter is selected.

I/O Mapping Tab

Variables can be defined and named in the **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
Inputs	AnalogInput00	INT	Current value of the input 0
	AnalogInput01		Current value of the input 1
	StatusInputs	USINT	State of all inputs 0...1
Outputs	AnalogOutput00	INT	Command word of the output 0
	AnalogOutput01		Command word of the output 1

For further generic descriptions, refer to I/O Mapping Tab Description ([see page 18](#)).

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:

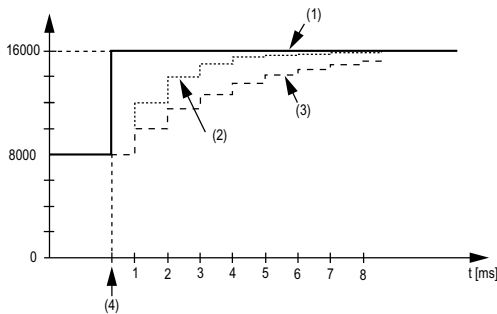
$$Value_{new} = Value_{old} - \frac{Value_{old}}{Filterlevel} + \frac{Inputvalue}{Filterlevel}$$

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

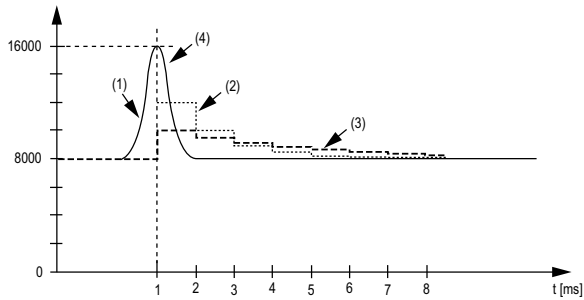


- 1 Input value
- 2 Evaluated value: Filter level 2
- 3 Evaluated value: Filter level 4
- 4 Input jump

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.

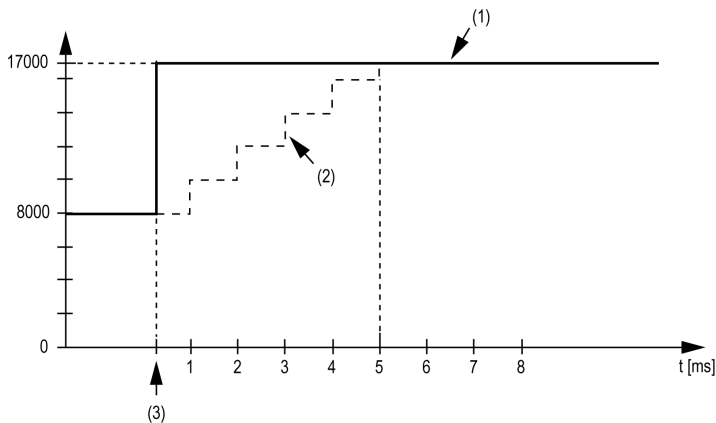
The amount of the change in the input value is verified to make sure the specified limits are not exceeded. If the values are exceeded, the adjusted input value is equal to the old value \pm the limit value.

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

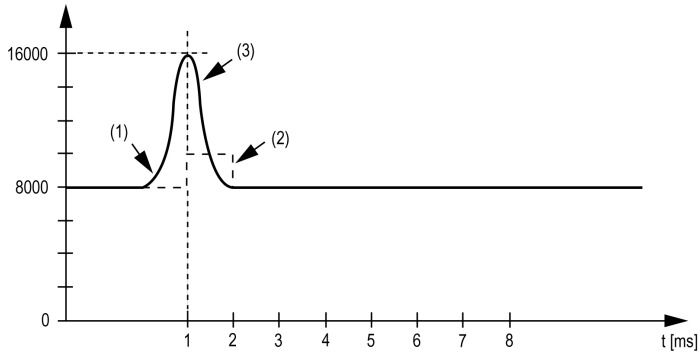


- 1 Input value
- 2 Internal adjusted input value before filter
- 3 Input jump

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)

Status Input Register

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

Bit	Description	Bits value
0-1	Channel 00 status	00: No error detected 10: Above upper limit value
2-3	Channel 01 status	
4-5	Not used	
6-7	Not used	

Out of Range Values

Out of Range Values	
Below lower limit	0
Above upper limit	32767

Cycle Time and I/O Update Time

This table gives the block characteristics allowing the Bus Cycle Time configuration:

Characteristic	Value (μ s)	
	Without Filter	With Filter
Minimum cycle time	250	500
Minimum input update time	400	1000
Minimum output update time	400	—

For further information, refer to Manager Configuration ([see page 15](#)).

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.



!

%I

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

%Q

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

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

configuration

The arrangement and interconnection of hardware components within a system and the hardware and software parameters that determine the operating characteristics of the system.

controller

Automates industrial processes (also known as programmable logic controller or programmable controller).

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.

E

expansion bus

An electronic communication bus between expansion I/O modules and a controller.

F

firmware

Represents the BIOS, data parameters, and programming instructions that constitute the operating system on a controller. The firmware is stored in non-volatile memory within the controller.

flash memory

A non-volatile memory that can be overwritten. It is stored on a special EEPROM that can be erased and reprogrammed.

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 programming or the configuration software.

M

minimum I/O update time

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 is updated on the bus at the next bus cycle time.

ms

(millisecond)

T

task

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

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

A controller can have several tasks.

V**variable**

A memory unit that is addressed and modified by a program.

W**WORD**

A type encoded in a 16-bit format.



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