SIEMENS

Manual

SIMATIC

S7-1500/ET 200MP

Technology module
TM Timer DIDQ 24x24V (6ES7552-1AA01-0AB0)

Edition 01/2025

support.industry.siemens.com

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SIMATIC

S7-1500/ET 200MP Technology Module TM Timer DIDQ 24x24V (6ES7552-1AA01-0AB0)

Equipment Manual

01/2025

A5E34078538-AB

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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Note the following:

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Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Preface

Purpose of the documentation

This Equipment Manual includes module-specific information on the function, wiring, operation, diagnostics, and technical specifications of the technology module.

Generally applicable information on installation and commissioning of the S7-1500 or ET 200MP is available in the system manual S7-1500, ET 200MP Automation System (http://support.automation.siemens.com/WW/view/en/59191792).

The "Time-based IO" technology supported by the technology module is described in detail in the function manual High-precision input/output with Time-based IO (http://support.automation.siemens.com/WW/view/en/82527590).

Conventions

Please observe notes marked as follows:

Note

A note contains important information on the product described in the documentation, on the handling of the product and on the section of the documentation to which particular attention should be paid.

Document history

The following table shows the most important changes to the documentation compared to the previous edition.

Manual edition	Comments
01/2025	Edition for article number 6ES7552-1AA01-0AB0, firmware version V2.0. All sections have been editorially revised.
08/2014	First edition

Open Source Software

Open-source software is used in the firmware of the product described. Open Source Software is provided free of charge. We are liable for the product described, including the open-source software contained in it, pursuant to the conditions applicable to the product. Siemens accepts no liability for the use of the open source software over and above the intended program sequence, or for any faults caused by modifications to the software.

For legal reasons, we are obliged to publish the original text of the license conditions and copyright notices. Please read the information on this on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109740777).

Table of contents

S7-1500/ET 200MP Documentation Guide

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1.1 S7-1500/ET 200MP documentation guide

The documentation for the SIMATIC S7-1500 automation system and the ET 200MP distributed I/O system is arranged into three areas.

This arrangement enables you to access the specific content you require. Changes and supplements to the manuals are documented in a Product Information.

You can download the documentation free of charge from the Internet (https://support.industry.siemens.com/cs/ww/en/view/109742691).

Basic information

The System Manual and Getting Started describe in detail the configuration, installation, wiring and commissioning of the SIMATIC S7-1500 and ET 200MP systems.

The STEP 7 online help supports you in the configuration and programming.

Examples:

- Getting Started S7-1500
- S7-1500/ET 200MP System Manual
- Online help TIA Portal

Device information

Equipment manuals contain a compact description of the module-specific information, such as properties, wiring diagrams, characteristics and technical specifications.

Examples:

- Equipment Manuals CPUs
- Equipment Manuals Interface Modules
- Equipment Manuals Digital Modules
- Equipment Manuals Analog Modules
- Equipment Manuals Communications Modules
- Equipment Manuals Technology Modules
- Equipment Manuals Power Supply Modules

General information

The function manuals contain detailed descriptions on general topics relating to the SIMATIC S7-1500 and ET 200MPsystems.

Examples:

- Function Manual Diagnostics
- Function Manual Communication
- Function Manual Motion Control
- Function Manual Web Server
- Function Manual Cycle and Response Times
- PROFINET Function Manual
- PROFIBUS Function Manual

Product Information

Changes and supplements to the manuals are documented in a Product Information. The Product Information takes precedence over the device and system manuals.

You can find the latest Product Information on the S7-1500 and ET 200MP systems on the Internet (https://support.industry.siemens.com/cs/de/en/view/68052815).

Manual Collection S7-1500/ET 200MP

The Manual Collection contains the complete documentation on the SIMATIC S7-1500 automation system and the ET 200MP distributed I/O system gathered together in one file.

You can find the Manual Collection on the Internet.
(https://support.industry.siemens.com/cs/ww/en/view/86140384)

Manual Collection fail-safe modules

The Manual Collection contains the complete documentation on the fail-safe SIMATIC modules, gathered together in one file.

You can find the Manual Collection on the Internet.

SIMATIC S7-1500 comparison list for programming languages

The comparison list contains an overview of which instructions and functions you can use for which controller families.

You can find the comparison list on the Internet
(https://support.industry.siemens.com/cs/ww/en/view/86630375).

1.2 SIMATIC Technical Documentation

Additional SIMATIC documents will complete your information. You can find these documents and their use at the following links and QR codes.

The Industry Online Support gives you the option to get information on all topics. Application examples support you in solving your automation tasks.

Overview of the SIMATIC Technical Documentation

Here you will find an overview of the SIMATIC documentation available in Siemens Industry Online Support:

Industry Online Support International (https://support.industry.siemens.com/cs/ww/en/view/109742705)

Watch this short video to find out where you can find the overview directly in Siemens Industry Online Support and how to use Siemens Industry Online Support on your mobile device:

Quick introduction to the technical documentation of automation products per video (https://support.industry.siemens.com/cs/us/en/view/109780491)

YouTube video: Siemens Automation Products - Technical Documentation at a Glance (https://youtu.be/TwLSxxRQQsA)

Retention of the documentation

Retain the documentation for later use.

For documentation provided in digital form:

1. Download the associated documentation after receiving your product and before initial installation/commissioning. Use the following download options:
   - Industry Online Support International: (https://support.industry.siemens.com)

     The article number is used to assign the documentation to the product. The article number is specified on the product and on the packaging label. Products with new, non-compatible functions are provided with a new article number and documentation.
   - ID link:

     Your product may have an ID link. The ID link is a QR code with a frame and a black frame corner at the bottom right. The ID link takes you to the digital nameplate of your product. Scan the QR code on the product or on the packaging label with a smartphone camera, barcode scanner, or reader app. Call up the ID link.
2. Retain this version of the documentation.

Updating the documentation

The documentation of the product is updated in digital form. In particular in the case of function extensions, the new performance features are provided in an updated version.

1. Download the current version as described above via the Industry Online Support or the ID link.
2. Also retain this version of the documentation.

mySupport

With "mySupport" you can get the most out of your Industry Online Support.

Registration	You must register once to use the full functionality of "mySupport". After registration, you can create filters, favorites and tabs in your personal workspace.
Support requests	Your data is already filled out in support requests, and you can get an overview of your current requests at any time.
Documentation	In the Documentation area you can build your personal library.
Favorites	You can use the "Add to mySupport favorites" to flag especially interesting or frequently needed content. Under "Favorites", you will find a list of your flagged entries.
Recently viewed articles	The most recently viewed pages in mySupport are available under "Recently viewed articles".
CAx data	The CAx data area gives you access to the latest product data for your CAx or CAe system. You configure your own download package with a few clicks: • Product images, 2D dimension drawings, 3D models, internal circuit diagrams, EPLAN macro files • Manuals, characteristics, operating manuals, certificates • Product master data

You can find "mySupport" on the Internet. (https://support.industry.siemens.com/My/ww/en)

Application examples

The application examples support you with various tools and examples for solving your automation tasks. Solutions are shown in interplay with multiple components in the system - separated from the focus on individual products.

You can find the application examples on the Internet.
(https://support.industry.siemens.com/cs/ww/en/ps/ae)

1.3 Tool support

The tools described below support you in all steps: from planning, over commissioning, all the way to analysis of your system.

TIA Selection Tool

The TIA Selection Tool tool supports you in the selection, configuration, and ordering of devices for Totally Integrated Automation (TIA).

As successor of the SIMATIC Selection Tools , the TIA Selection Tool assembles the already known configurators for automation technology into a single tool.

With the TIA Selection Tool , you can generate a complete order list from your product selection or product configuration.

You can find the TIA Selection Tool on the Internet.
(https://support.industry.siemens.com/cs/ww/en/view/109767888)

SINETPLAN

SINETPLAN, the Siemens Network Planner, supports you in planning automation systems and networks based on PROFINET. The tool facilitates professional and predictive dimensioning of your PROFINET installation as early as in the planning stage. In addition, SINETPLAN supports you during network optimization and helps you to exploit network resources optimally and to plan reserves. This helps to prevent problems in commissioning or failures during productive operation even in advance of a planned operation. This increases the availability of the production plant and helps improve operational safety.

The advantages at a glance

- Network optimization thanks to port-specific calculation of the network load
- Increased production availability thanks to online scan and verification of existing systems
- Transparency before commissioning through importing and simulation of existing STEP 7 projects
- Efficiency through securing existing investments in the long term and the optimal use of resources

You can find SINETPLAN on the Internet
(https://new.siemens.com/global/en/products/automation/industrial-communication/profinet/sinetplan.html).

See also

PRONETA Professional (https://support.industry.siemens.com/cs/ww/en/view/109781283)

Industrial Cybersecurity 2

2.1 Introduction to industrial cybersecurity

Due to the digitalization and increasing networking of machines and industrial plants, the risk of cyber attacks is also growing. Appropriate protective measures are therefore mandatory, particularly in the case of critical infrastructure facilities.

General information on and measures for the topic of industrial cybersecurity is provided in the System Manual (http://support.automation.siemens.com/WW/view/en/59191792).

This section gives an overview of the security-relevant information applying to your SIMATIC device.

2.2 Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity functions that support the secure operation of plants, systems, machines, and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Products and solutions from Siemens form one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For more information on industrial cybersecurity measures, please visit (https://www.siemens.com/cybersecurity-industry).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed here (https://www.siemens.com/cert).

2.3 Cybersecurity-relevant information

Note all cybersecurity-relevant information.

Topics with cybersecurity-relevant information	Reference
Operational application environment and security assumptions	
Requirements for the operational application environment of the system and security assumptions	This section is found in the System Manual (http://support.automation.siemens.com/WW/view/en/59191792).
Security properties of the product	
Access protection Physical protection: • You can protect the CPU against unauthorized access by locking the front flap. Password protection	In addition, observe the information on access protection in the Protection section of the system manual (http://support.automation.siemens.com/WW/view/en/59191792).
Signed firmware update	The topic of a signed firmware update is discussed in the Industrial Cybersecurity section of the System Manual (http://support.automation.siemens.com/WW/view/en/59191792).
Secure operation	
Corrective measures for known risks	Corrective measures for known risks are published on the Siemens ProductCERT (https://www.siemens.com/cert) website. For more information on SIEMENS ProductCERT, refer to the System Manual (http://support.automation.siemens.com/WW/view/en/59191792).
Security checks	Application-specific security measures such as cyclic checks of the configuration via checksums are described in the System Manual (http://support.automation.siemens.com/WW/view/en/59191792).
Recording security events	Information on recording security events can be found in the "Safe operation of CPUs" section of the system manual (http://support.automation.siemens.com/WW/view/en/59191792).
Secure decommissioning Products that contain security-relevant data must be securely decommissioned before disposal or resale.	You can find information on safe decommissioning in the "Secure operation of the system" section of the System Manual (http://support.automation.siemens.com/WW/view/en/59191792).

Product overview

3

3.1 Properties

Article number

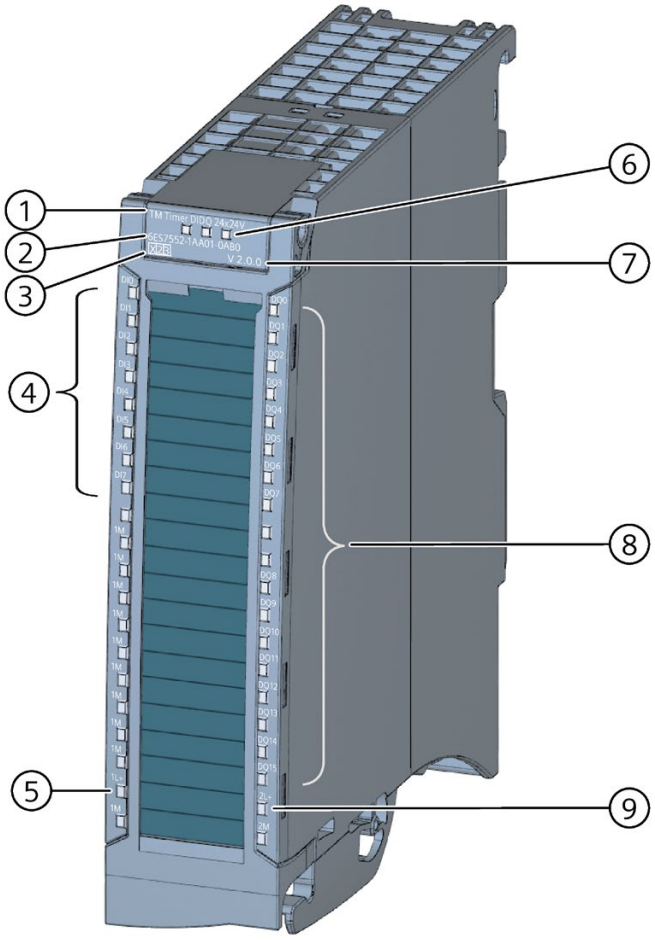
6ES7552-1AA01-0AB0

The TM Timer DIDQ 24x24V with the article number 6ES7552-1AA01-0AB0 is a compatible replacement for the TM Timer DIDQ 16x24V with the article number 6ES7552-1AA00-0AB0 for the non-marine area. For replacement in maritime applications, refer to the Notes on the use of spare parts (Page 20).

Firmware version

This equipment manual describes the properties of firmware version V2.0 of the module.

View of the module



① Module type and designation
② Article number
③ Release number
④ LEDs for status of digital inputs
⑤ LED for supply voltage 1L+
⑥ LEDs for diagnostics
⑦ Firmware version
⑧ LEDs for status of digital outputs
⑨ LED for supply voltage 2L+

Figure 3-1 View of the TM Timer DIDQ 24x24V module

Properties

The technology module has the following properties:

- Technical properties
  - 8 digital inputs and 16 digital outputs
  - Various combinations of digital inputs and outputs can be configured:
    8 digital inputs and 16 digital outputs (new compared to the predecessor module)
    0 digital inputs and 16 digital outputs (for cam applications with numerous outputs)
    3 digital inputs and 13 digital outputs (for applications similar to FM 352 applications)
    4 digital inputs and 12 digital outputs (for flexible mixed operation)
    8 digital inputs and 8 digital outputs (for probe and incremental encoder)
  - Rated output voltage 24V DC
  - Rated output current 0.5 A or 0.1 A (high-speed operation) per digital output
  - 24 V encoder supply output, short-circuit-proof (when configured with < 16 DQ)
  - Configurable substitute values (per digital output)
  - Two supply voltages L+
  - Monitoring of digital outputs for short-circuit
  - Monitoring for faulty supply voltage
  - Configurable input filters for suppression of interference at digital inputs
- Supported encoder/signal types for digital inputs
  - 24 V incremental encoder with A and B signals
  - 24 V pulse encoder with one signal

The module supports the following functions:

Table 3- 1 Configurability of the functions

Function	Firmware version of the module	Configurable as of STEP 7 (TIA Portal)
Firmware update	as of V1.0	V13
I&M identification data	as of V1.0	V13
Parameter reassignment in RUN mode	as of V1.0	V13
Isochronous mode	as of V1.0	V13
Time stamp function for inputs and outputs (resolution 1 µs)	as of V1.0	V13
Counting (counting range 32-bit)	as of V1.0	V13
Oversampling for inputs and outputs	as of V1.0	V13
Pulse width modulation	as of V1.0	V13
Operating with technology objects TO_OutputCam, TO_CamTrack, TO_MeasuringInput:	as of V1.0	V14

Function	Firmware version	Configurable as of
Signed firmware update	as of V2.0	V19 with HSP0436
Additional channel configuration "8 inputs, 16 outputs"	as of V2.0	V19 with HSP0436

Accessories

The following components are supplied with the technology module and can also be ordered separately as spare parts:

- Shield bracket
- Shield terminal
- Labeling strip
- U-connector

Other components

The following component needs to be ordered separately:

- Front connectors, including potential jumpers and cable ties

You can find information on the front connector in the Accessories section of the system manual S7-1500 / ET 200MP Automation system (http://support.automation.siemens.com/WW/view/en/59191792).

3.2 Functions

3.2.1 Detection of the input signals

You can configure up to eight digital inputs for the technology module. You can evaluate the signals at the digital inputs for the following functions:

Time stamp detection (Timer DI)

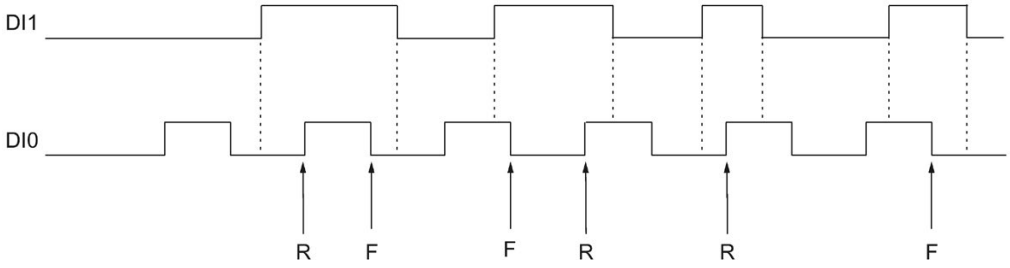
The technology module can detect an associated time stamp for an edge at a digital input. The time stamp indicates when the edge was detected in relation to a time base. These time stamps can be used, for example, to calculate a time difference.

The time stamp detection is based on the "Time-based IO" technology supported by the technology module and requires isochronous mode as well as the use of TIO or Motion Control instructions (Page 35).

Hardware enable (HW enable)

You can configure a hardware enable by a digital input for the detection of time stamps. A hardware enable defines the time window in which the time stamps are acquired.

The figure below shows an example for the detection of time stamps at rising and falling edges with enable of the DI0 through the high level of the DI1:



R Associated time stamp detected at rising DI0-edge

F Associated time stamp detected at falling DI0 edge

Counting

Counting refers to the recording and adding up of events. You can configure up to four counters for the technology module. You can use incremental encoders and pulse encoders at the digital inputs. The two phase-shifted signals from an incremental encoder are evaluated four times. Only the rising or falling edges are counted with the signal of a pulse encoder.

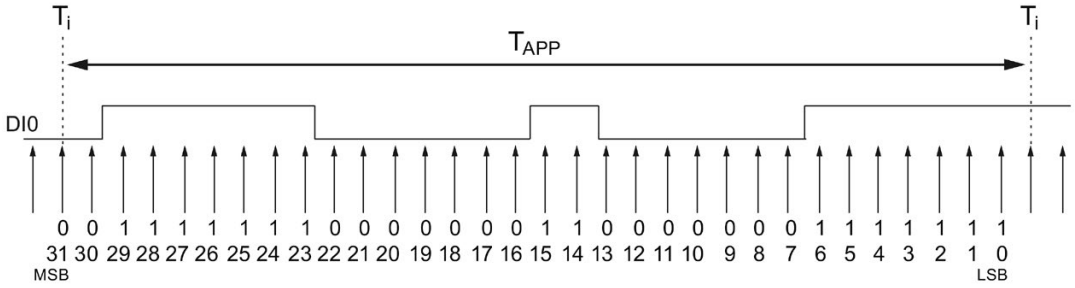
A counter starts at 0, goes up to 2^{32}-1 and starts again at 0 (overflow). The technology module can also count down if an incremental encoder is used. The counter value is returned in the feedback interface (Page 45) as a 32-bit value for each digital input.

Oversampling

The Oversampling function is used by the technology module to detect the status of the respective digital input for each application cycle (for example, OB61) at 32 points in time at regular intervals. The 32 states are returned together in the feedback interface (Page 45) as a 32-bit value.

Oversampling requires isochronous mode and the TIO_SYNC instruction (Page 35).

The figure below shows an example for Oversampling of DI0:



T_{APP} Application cycle

MSB Most significant bit

LSB Least significant bit

3.2.2 Switching the outputs

You can configure up to 16 digital outputs for the technology module. You can configure the following functions for switching the digital outputs:

Time-controlled switching (Timer DQ)

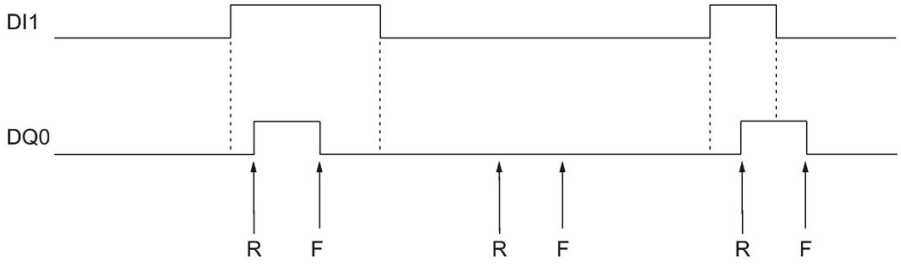
The use of time stamps enables reproducibility of controlled operations with very accurate time. Using this function, the technology module outputs edges at the respective digital output at precisely defined points in time. For example, you can implement a defined reaction time between input and output in conjunction with a digital input.

The Timer function is based on the Time-based IO and requires isochronous mode as well as the use of TIO or Motion Control instructions (Page 35).

Hardware enable (HW enable)

You can configure a hardware enable by means of a digital input for a Timer digital output. A hardware enable defines the time window in which the respective digital output can be set. The resetting of the digital output is independent of the hardware enable. Depending on the channel configuration, the hardware enable is not available on all digital outputs.

The figure below shows an example for the output of rising and falling edges with enable of the DQ0 through the high level of the DI1:



R Specified time of a rising DQ0-edge

F Specified time of a falling DQ0-edge

Pulse width modulation (PWM)

The Pulse width modulation function enables you to specify the time period in the hardware configuration and the pulse-pause ratio in the control interface (Page 40) for the respective digital output. The setpoint for the pulse-pause ratio is a percentage and is evaluated with an accuracy of about 3%.

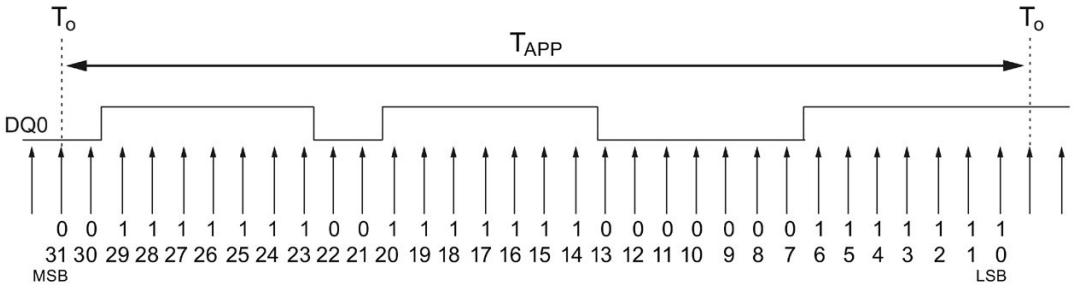
Oversampling

The Oversampling function is used by the technology module to output 32 states at regular intervals for each application cycle (for example, OB61). This allows up to 32 edges at the respective digital output per application cycle.

The 32 states are sent via the control interface (Page 40) as a 32-bit string for the respective digital output to the technology module.

Oversampling requires isochronous mode and the TIO_SYNC instruction (Page 35).

The figure below shows an example for Oversampling of DQ0:



T_{APP} Application cycle
MSB Most significant bit
LSB Least significant bit

Note

When you use the Oversampling function, make sure that the combination of application cycle and the 32-bit output sequence do not result in an output frequency which exceeds the maximum switching frequency for the digital outputs.

3.2.3 Additional functions

Diagnostic interrupt

The technology module can trigger diagnostic interrupts. You enable the diagnostic interrupts in the device configuration.

Input filter

To suppress interference, you can configure an input filter for the digital inputs.

Isochronous mode

The technology module supports the system function "Isochronous mode". This system function is required for the following functions of the technology module:

- Time stamp detection (Timer DI)
- Time-controlled switching (Timer DQ)
- Oversampling of digital input
- Oversampling of digital output

Connecting

4

4.1 Pin assignment

Connect the encoder signals, digital input and digital output signals, encoder supplies and the supply voltages for supplying the module and the digital outputs to the 40-pin front connector of the technology module.

For information on wiring the front connector, connecting the cable shield, etc., see System ManualS7-1500, ET 200MP Automation System (http://support.automation.siemens.com/WW/view/en/59191792), in the Wiring section.

NOTICE
Electromagnetic compatibility The high-frequency switching (> 5 kHz) of the 24 V outputs generates electromagnetic feedback effects on the supply network. To adhere to the limits that correspond to the current state of the art, you have the following options: • Use a separate 24 V power supply unit, e.g. SIMATIC PM 1507 24 V/3 A (article number 6EP1332-4BA00), to supply the module. • Provide a corresponding filter for the 24 V supply. The interference radiation measurements were made with filters of the type "EPCOS SIFI-C B84113C". Use this filter type or a filter with the same characteristic or a characteristic with greater damping.

Pin assignment for the front connector

The pin assignment of the front connector depends on the channel configuration of the TM Timer DIDQ 24x24V.

The following table shows the pin assignment of the front connector for channel configuration "8 inputs, 16 outputs".

Table 4- 1 Pin assignment of the front connector, channel configuration "8 inputs, 16 outputs"

Designation	Signal-name		View	Signal-name		Designation
Digital input DI0	DI0	1		21	DQ0	Digital output DQ0
Digital input DI1	DI1	2		22	DQ1	Digital output DQ1
Digital input DI2	DI2	3		23	DQ2	Digital output DQ2
Digital input DI3	DI3	4		24	DQ3	Digital output DQ3
Digital input DI4	DI4	5		25	DQ4	Digital output DQ4
Digital input DI5	DI5	6		26	DQ5	Digital output DQ5
Digital input DI6	DI6	7		27	DQ6	Digital output DQ6
Digital input DI7	DI7	8		28	DQ7	Digital output DQ7
—	—	9		29	—	—
Ground for digital inputs DI0 to DI7 and digital outputs DQ0 to DQ7	1M	10		30		
	1M	11		31	DQ8	Digital output DQ8
	1M	12		32	DQ9	Digital output DQ9
	1M	13		33	DQ10	Digital output DQ10
	1M	14		34	DQ11	Digital output DQ11
	1M	15		35	DQ12	Digital output DQ12
	1M	16		36	DQ13	Digital output DQ13
	1M	17		37	DQ14	Digital output DQ14
	1M	18		38	DQ15	Digital output DQ15
24 V DC supply voltage for digital inputs DI0 to DI7 and digital outputs DQ0 to DQ7[1]	1L+	19		39	2L+	24 V DC supply voltage for digital outputs DQ8 to DQ15[1]
Ground for supply voltage 1L+	1M	20		40	2M	Ground for supply voltage 2L+

[1] If you would like to supply both load groups with a shared voltage, insert the potential jumpers between terminals 19 and 39 as well as 20 and 40.

The following table shows the pin assignment of the front connector for channel configuration "0 inputs, 16 outputs".

Table 4- 2 Pin assignment of the front connector , channel configuration "0 inputs, 16 outputs"

Designation	Signal-name		View	Signal-name		Designation
—	—	1		21	DQ0	Digital output DQ0
		2		22	DQ1	Digital output DQ1
		3		23	DQ2	Digital output DQ2
		4		24	DQ3	Digital output DQ3
		5		25	DQ4	Digital output DQ4
		6		26	DQ5	Digital output DQ5
		7		27	DQ6	Digital output DQ6
		8		28	DQ7	Digital output DQ7
		9		29	—	—
Ground for digital outputs DQ0 to DQ7	1M	10		30		
	1M	11		31	DQ8	Digital output DQ8
	1M	12		32	DQ9	Digital output DQ9
	1M	13		33	DQ10	Digital output DQ10
	1M	14		34	DQ11	Digital output DQ11
	1M	15		35	DQ12	Digital output DQ12
	1M	16		36	DQ13	Digital output DQ13
	1M	17		37	DQ14	Digital output DQ14
	1M	18		38	DQ15	Digital output DQ15
DC 24 V supply voltage for digital outputs DQ0 to DQ7[1]	1L+	19		39	2L+	Supply voltage DC 24 V for digital outputs DQ8 to DQ15[1]
Ground for supply voltage 1L+	1M	20		40	2M	Ground for supply voltage 2L+

[1] If you would like to supply both load groups with a shared voltage, insert the potential jumpers between terminals 19 and 39 as well as 20 and 40.

The following table shows the pin assignment of the front connector for channel configuration "3 inputs, 13 outputs".

Table 4- 3 Pin assignment of the front connector , channel configuration "3 inputs, 13 outputs"

Designation	Signal-name		View	Signal-name		Designation
Digital input DI0	DI0	1		21	DQ0	Encoder supply 24 V for DI0
Digital input DI1	DI1	2		22	DQ1	Encoder supply 24 V for DI1
—	—	3		23	DQ2	Digital output DQ2
Digital input DI3	DI3	4		24	DQ3	Encoder supply 24 V for DI3
—	—	5		25	DQ4	Digital output DQ4
		6		26	DQ5	Digital output DQ5
		7		27	DQ6	Digital output DQ6
		8		28	DQ7	Digital output DQ7
		9		29	—	—
Ground for encoder supply, digital inputs DI0, DI1 and DI3 and digital outputs DQ2 and DQ4 to DQ7	1M	10		30		
	1M	11		31	DQ8	Digital output DQ8
	1M	12		32	DQ9	Digital output DQ9
	1M	13		33	DQ10	Digital output DQ10
	1M	14		34	DQ11	Digital output DQ11
	1M	15		35	DQ12	Digital output DQ12
	1M	16		36	DQ13	Digital output DQ13
	1M	17		37	DQ14	Digital output DQ14
	1M	18		38	DQ15	Digital output DQ15
24 V DC supply voltage for digital inputs DI0, DI1 and DI3 and digital outputs DQ2 and DQ4 to DQ7[1]	1L+	19		39	2L+	Supply voltage DC 24 V for digital outputs DQ8 to DQ15[1]
Ground for supply voltage 1L+	1M	20		40	2M	Ground for supply voltage 2L+

[1] If you would like to supply both load groups with a shared voltage, insert the potential jumpers between terminals 19 and 39 as well as 20 and 40.

The following table shows the pin assignment of the front connector for channel configuration "4 inputs, 12 outputs".

Table 4- 4 Pin assignment of the front connector , channel configuration "4 inputs, 12 outputs"

Designation	Signal-name		View	Signal-name		Designation
—	—	1		21	DQ0	Digital output DQ0
Digital input DI1	DI1	2		22	DQ1	Encoder supply 24 V for DI1
—	—	3		23	DQ2	Digital output DQ2
Digital input DI3	DI3	4		24	DQ3	Encoder supply 24 V for DI3
—	—	5		25	DQ4	Digital output DQ4
Digital input DI5	DI5	6		26	DQ5	Encoder supply 24 V for DI5
—	—	7		27	DQ6	Digital output DQ6
Digital input DI7	DI7	8		28	DQ7	Encoder supply 24 V for DI7
—	—	9		29	—	—
Ground for encoder supply, digital inputs DI1, DI3, DI5 and DI7 and digital outputs DQ0, DQ2, DQ4 and DQ6	1M	10		30		
	1M	11		31	DQ8	Digital output DQ8
	1M	12		32	DQ9	Digital output DQ9
	1M	13		33	DQ10	Digital output DQ10
	1M	14		34	DQ11	Digital output DQ11
	1M	15		35	DQ12	Digital output DQ12
	1M	16		36	DQ13	Digital output DQ13
	1M	17		37	DQ14	Digital output DQ14
	1M	18		38	DQ15	Digital output DQ15
24 V DC supply voltage for digital inputs DI1, DI3, DI5 and DI7 and digital outputs DQ0, DQ2, DQ4 and DQ6[1]	1L+	19		39	2L+	Supply voltage DC 24 V for digital outputs DQ8 to DQ15[1]
Ground for supply voltage 1L+	1M	20		40	2M	Ground for supply voltage 2L+

[1] If you would like to supply both load groups with a shared voltage, insert the potential jumpers between terminals 19 and 39 as well as 20 and 40.

The following table shows the pin assignment of the front connector for channel configuration "8 inputs, 8 outputs".

Table 4- 5 Pin assignment of the front connector , channel configuration "8 inputs, 8 outputs"

Designation	Signal-name		View	Signal-name		Designation
Digital input DI0	DI0	1		21	DQ0	Encoder supply 24 V for DI0
Digital input DI1	DI1	2		22	DQ1	Encoder supply 24 V for DI1
Digital input DI2	DI2	3		23	DQ2	Encoder supply 24 V for DI2
Digital input DI3	DI3	4		24	DQ3	Encoder supply 24 V for DI3
Digital input DI4	DI4	5		25	DQ4	Encoder supply 24 V for DI4
Digital input DI5	DI5	6		26	DQ5	Encoder supply 24 V for DI5
Digital input DI6	DI6	7		27	DQ6	Encoder supply 24 V for DI6
Digital input DI7	DI7	8		28	DQ7	Encoder supply 24 V for DI7
—	—	9		29	—	—
Ground for encoder supply and digital inputs DI0 to DI7	1M	10		30		
	1M	11		31	DQ8	Digital output DQ8
	1M	12		32	DQ9	Digital output DQ9
	1M	13		33	DQ10	Digital output DQ10
	1M	14		34	DQ11	Digital output DQ11
	1M	15		35	DQ12	Digital output DQ12
	1M	16		36	DQ13	Digital output DQ13
	1M	17		37	DQ14	Digital output DQ14
	1M	18		38	DQ15	Digital output DQ15
24 V DC supply voltage for digital inputs DI0 to DI7[1]	1L+	19		39	2L+	Supply voltage DC 24 V for digital outputs DQ8 to DQ15[1]
Ground for supply voltage 1L+	1M	20		40	2M	Ground for supply voltage 2L+

[1] If you would like to supply both load groups with a shared voltage, insert the potential jumpers between terminals 19 and 39 as well as 20 and 40.

Behavior of the digital outputs following a wire break at the ground connection of the outputs

Due to the characteristics of the output driver used in the module, a wire break causes approximately 25 mA supply current to drain from the digital outputs via a parasitic diode. This behavior may lead to a high signal state even at outputs that are not set. Depending on the nature of the load, 25 mA may be enough to activate a load with high signal state.

Wire twice to ground

To prevent unintended switching of the outputs following a wire break at a ground connection, follow these steps:

1. Route the first ground connection from terminal 20 to the ground connection of the central power supply of the plant.
2. Route the second ground connection from terminal 40 to the ground connection of the central power supply of the plant. If possible, use a different route for this than for the first ground connection.
3. If you do not require galvanic isolation between the two load groups, insert a potential bridge between terminals 20 and 40.
   or
   If you do require the galvanic isolation between the load groups, then insert two cables into terminals 20 and 40 (four cables in total, see the following circuit diagrams).

If a wire break interrupts one of the two ground connections, the outputs are maintained at the required potential via the remaining ground connection.

WARNING

Wire break at ground connection

Always connect *two* cables to the ground connection of the central power supply of the system.

Block diagram

NOTICE

Operation in replacement part scenario

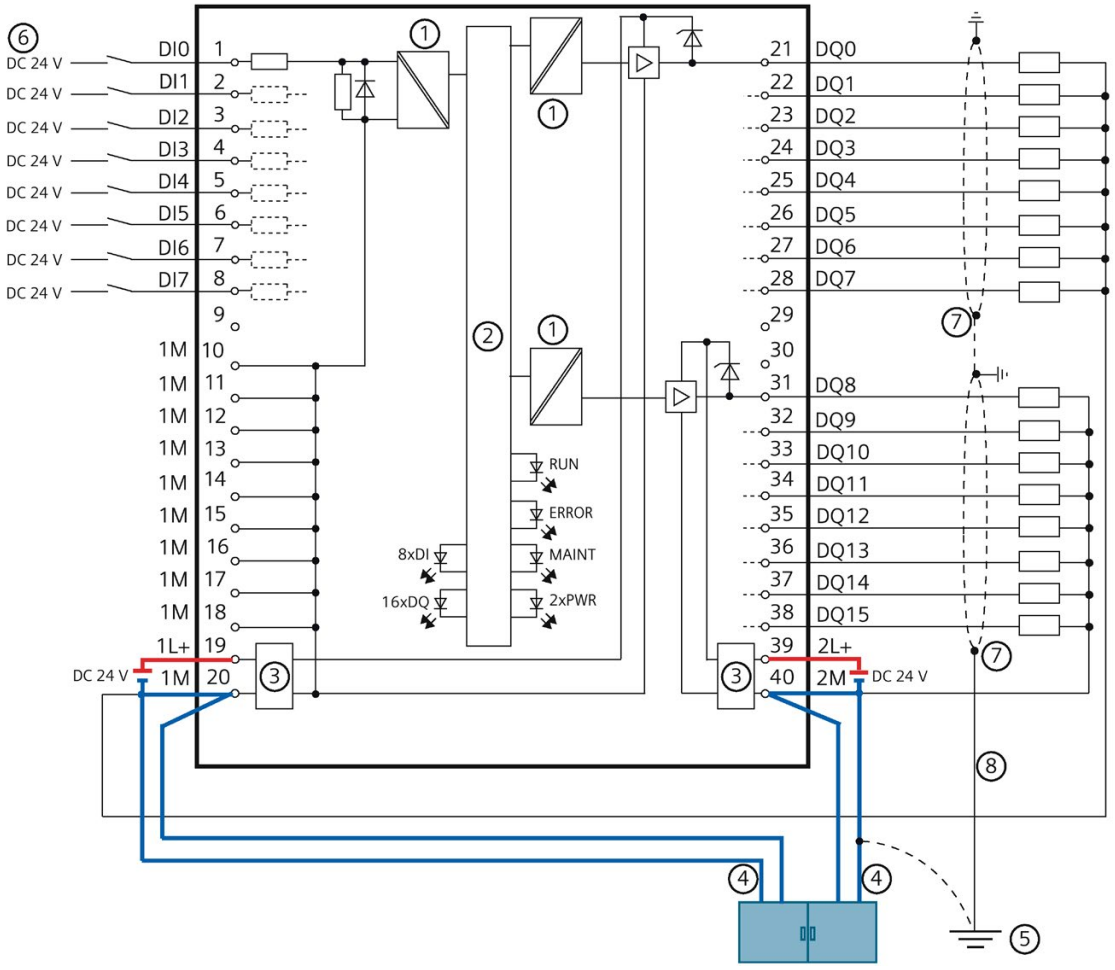
When used as a replacement part, an external connection (at least 1.5 mm^2, maximum length 2 m) must be made to ground via the shield terminal in order to comply with marine approval.

When used in non-marine applications, this connection is recommended to improve interference immunity, but is not mandatory for compliance with the applicable standards.

Note

If you want to use Timer digital inputs and high-speed outputs at the same time, you should minimize the effects of interference by galvanically isolating the supply to the inputs and outputs via the terminal pairs 19 and 20 and 39 and 40.

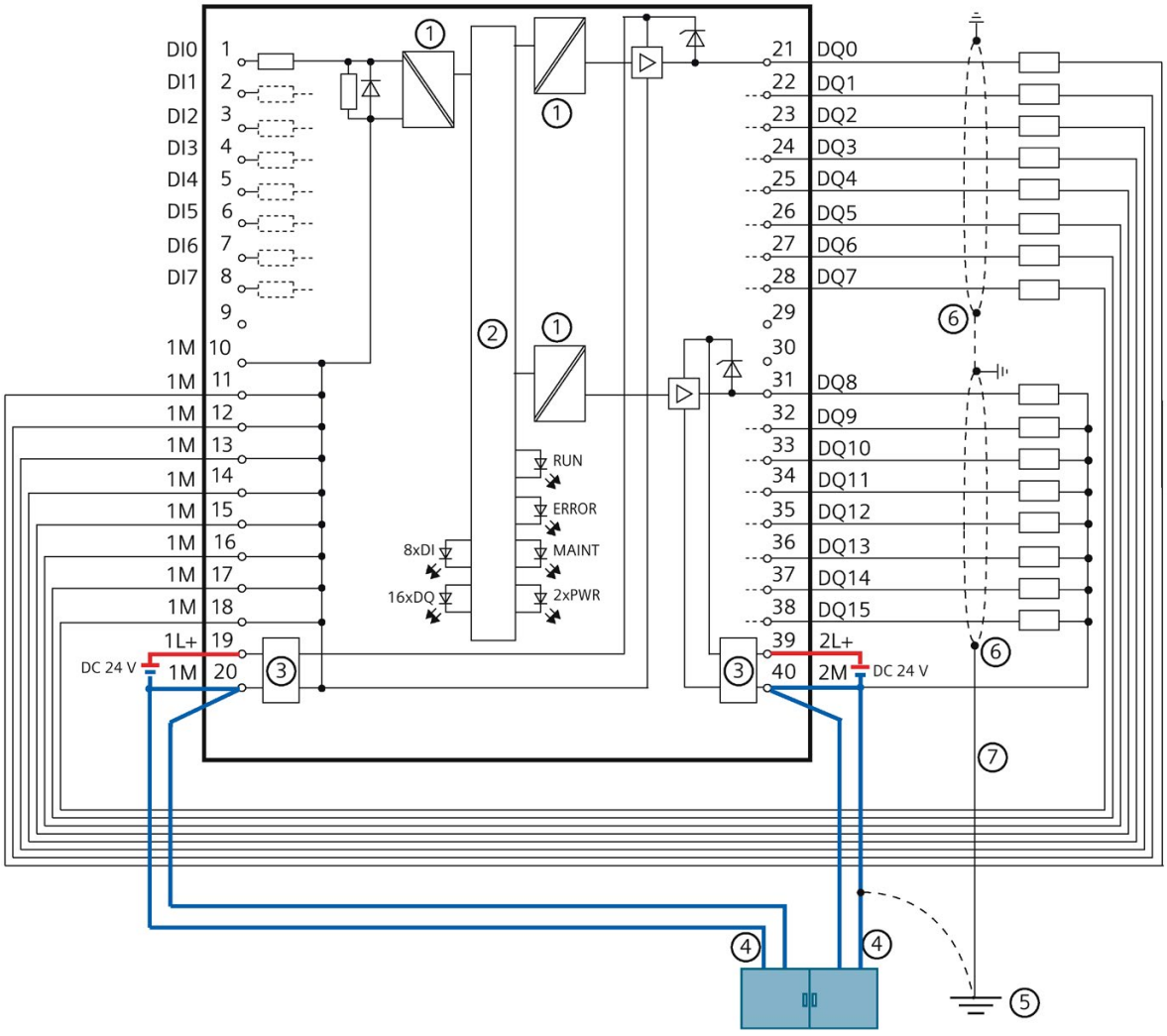
The figure below shows the block diagram of the technology module for the use of all 8 digital inputs and 16 digital outputs.



① Electrical isolation
② Technology and backplane bus interface
③ Input filter for supply voltage
④ Duplicate wiring to the ground connection of the central power supply of the system
⑤ Equipotential bonding (preferably via mounting rail)
⑥ External encoder supply
⑦ Shield support on the front connector (clamp connection of the shields in the shield connection clamp)
⑧ External connection of the shield terminal to the ground (use in case of spare parts)

Figure 4-1 Block diagram for use of 8 digital inputs and 16 digital outputs

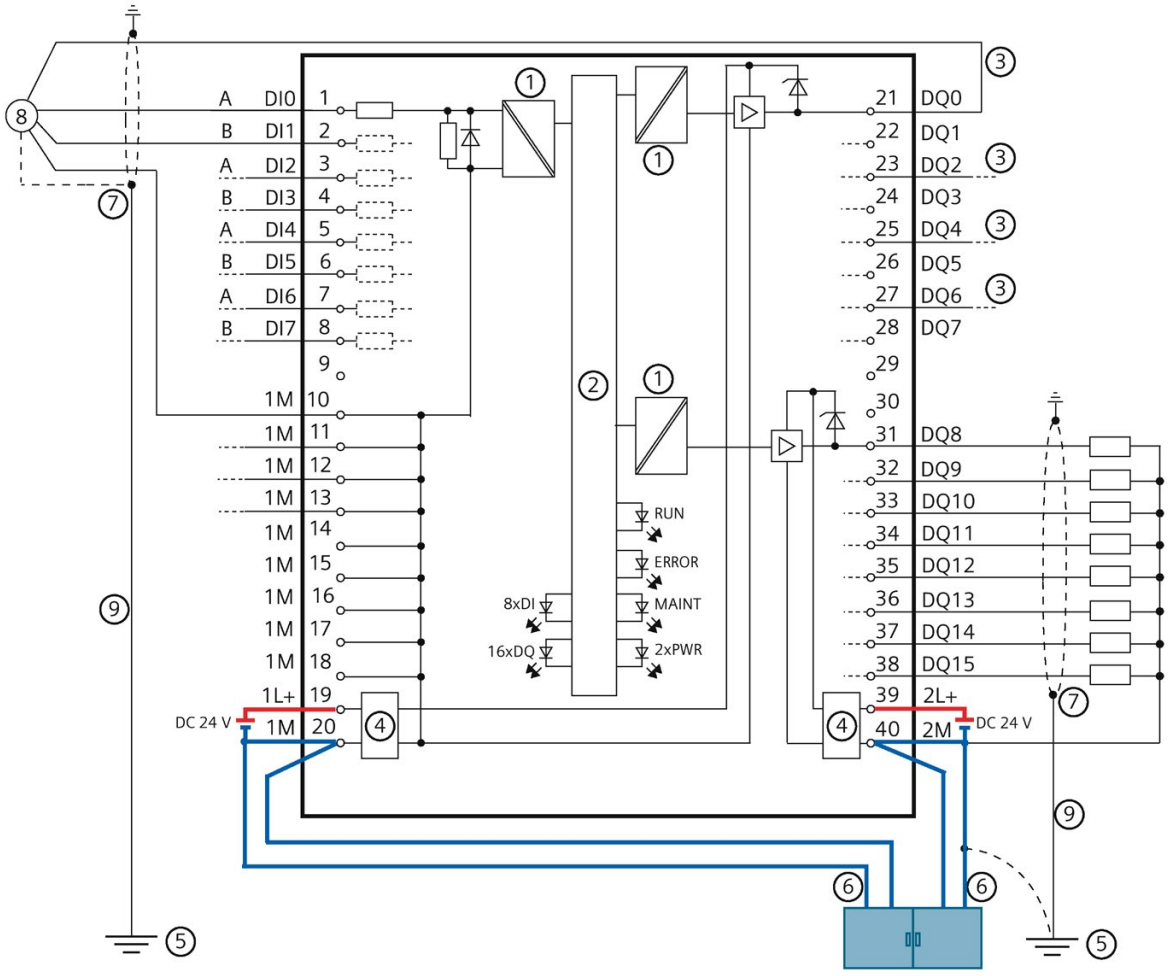
The figure below shows the block diagram of the technology module for the use of the 16 digital outputs.



① Electrical isolation
② Technology and backplane bus interface
③ Input filter for supply voltage
④ Duplicate wiring to the ground connection of the central power supply of the system
⑤ Equipotential bonding (preferably via mounting rail)
⑥ Shield support on the front connector (clamp connection of the shields in the shield connection clamp)
⑦ External connection of the shield terminal to the ground (use in case of spare parts)

Figure 4-2 Block diagram for use of 16 digital outputs

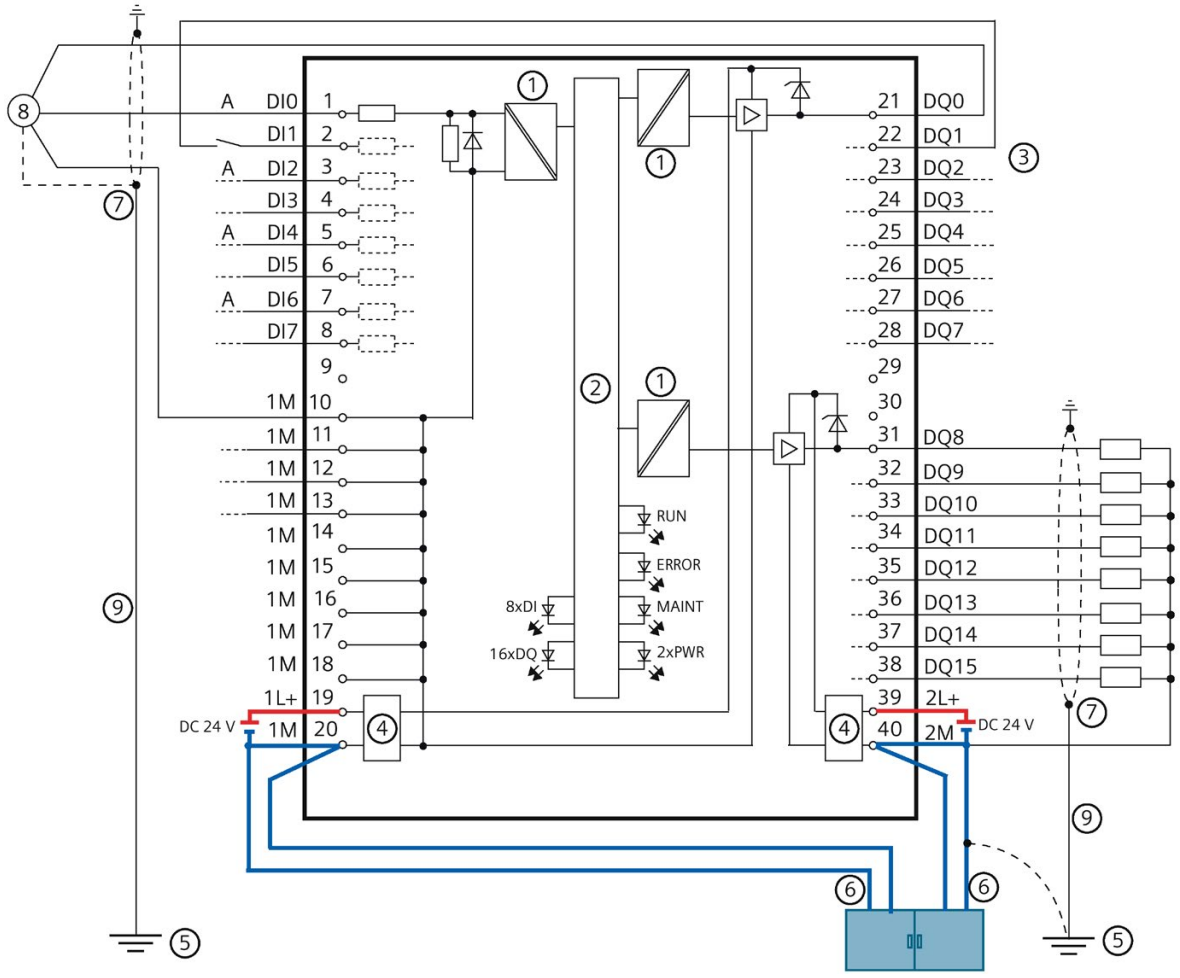
The figure below shows the block diagram of the technology module with four connected incremental encoders.



① Electrical isolation
② Technology and backplane bus interface
③ 24 V supply for respective incremental encoder
④ Input filter for supply voltage
⑤ Equipotential bonding (preferably via mounting rail)
⑥ Duplicate wiring to the ground connection of the central power supply of the system
⑦ Shield support on the front connector (clamp connection of the shields in the shield connection clamp)
⑧ Incremental encoder with A and B signals
⑨ External connection of the shield terminal to the ground (use in case of spare parts)

Figure 4-3 Block diagram with incremental encoders

The following figure shows the block diagram of the technology module to which four pulse encoders and four sensors are connected.



① Electrical isolation
② Technology and backplane bus interface
③ 24 V supplies for pulse encoders and sensors
④ Input filter for supply voltage
⑤ Equipotential bonding (preferably via mounting rail)
⑥ Duplicate wiring to the ground connection of the central power supply of the system
⑦ Shield support on the front connector (clamp connection of the shields in the shield connection clamp)
⑧ Pulse encoder with signal A
⑨ External connection of the shield terminal to the ground (use in case of spare parts)

Figure 4-4 Block diagram with pulse encoders and sensors

Supply voltage

The digital inputs and outputs of the technology module are divided into two load groups that are supplied with DC 24 V. The digital inputs DI0 to DI7 and digital outputs DQ0 to DQ7 are supplied via the 1L+ and 1M connections. The digital outputs DQ8 to DQ15 are supplied via the 2L+ and 2M connections.

You can supply both load groups electrically isolated or non-isolated. If you want to supply both load groups with the same potential (non-isolated), use potential jumpers to loop-through the supply voltage from the load group already supplied to another load group.

The technology module monitors the supply voltage connections. When a load group is not supplied, the lack of supply voltage generates a diagnostic interrupt (Page 54). If you want to prevent this reaction when using only *one* load group, insert the potential jumpers.

An internal protective circuit protects the technology module against damage due to reversed polarity of the supply voltage. Unexpected conditions can occur at the digital outputs with reversed polarity of the supply voltage or wire break at 1M/2M.

Note

Note that a maximum current load of 8 A per potential jumper must not be exceeded.

Encoder supply

When you use the digital inputs, you can connect incremental encoders and pulse encoders. The type of encoder supply depends on the selected channel configuration:

Channel configuration "8 Inputs, 16 outputs"	An external encoder supply is required to supply an encoder.
Other channel configuration	To supply an encoder, the terminal opposite the digital input provides the respective supply voltage 24 V DC with reference to 1M and a rated load current of 0.5 A.

Voltage is supplied from the 1L+/1M supply voltage and monitored for short-circuits and overload.

Note

Note that a total current of 1.2 A for all encoder supplies must not be exceeded.

Note

The outputs of the technology module are disabled during its startup. As a result. the encoder supply can be disabled briefly after an interruption of the PROFINET connection of the associated system.

Digital inputs DI0 to DI7

You can use three, four, or eight digital inputs. The technology module can evaluate the edges at the digital inputs for the following functions:

Table 4- 6 Evaluation of the signals at the digital inputs

Evaluation of the signals for …	**Usable digital inputs**							
	DI0	**DI1**	**DI2**	**DI3**	**DI4**	**DI5**	**DI6**	**DI7**
Time stamp detection	✓	✓	✓	✓	✓	✓	✓	✓
Hardware enable for time stamp detection[1]	—	✓	—	✓	—	✓	—	✓
Hardware enable for time-controlled switching[1]	—	✓	—	✓	—	✓	—	✓
Counting with incremental encoder with signals A and B	✓		✓		✓		✓	
Counting with pulse encoder with signal A	✓	—	✓	—	✓	—	✓	—
Oversampling	✓	✓	✓	✓	✓	✓	✓	✓

[1] Not available for Channel configuration "8 Inputs, 16 outputs"

When you use the counting function, you can connect the following encoder types with 24 V signals to the digital inputs:

- Incremental encoder with signals A and B:

  Signals A and B are each connected via the connections of the digital input pairs DI0/DI1, DI2/DI3, DI4/DI5 and DI6/DI7. Signals A and B are the two incremental signals phase-shifted by 90°.

- Pulse encoder / sensor with signal A:

  Signal A is connected via the connection of the digital input DI0, DI2, DI4 or DI6.

The digital inputs are not electrically isolated from each other or from the digital outputs DQ0 to DQ7. The digital inputs are electrically isolated from the digital outputs DQ8 to DQ15 and the backplane bus.

Note

Checking the interference immunity according to EN 61000-6-2

For fast transients (burst), criterion B applies (at 2 kV according to EN 61000-4-4/IEC 61000-4-4).

Input delay for digital inputs

To suppress interference, you can configure an input delay for each digital input.

The input delay has the following effect on the functions of the signal evaluation at the digital inputs:

Table 4- 7 Influence of the input delay

Function	Influence of the input delay
Time stamp detection	The detected time stamp is moved by the input delay.
Counting	The counter value that was valid at time T_i minus the input delay is returned.
Oversampling	The detected states are moved together by the input delay.

Note

If you set an input delay < 0.1 ms, you must use shielded cables to connect the respective digital input. To increase the accuracy of the time stamp function, we recommend the use of shielded cables even for longer input delays.

Digital outputs DQ0 to DQ15

You can use 8, 12, 13 or 16 digital outputs. The digital outputs can be switched directly at defined points in time or via the user program. Alternatively, you can output pulse width modulation or Oversampling at the respective digital output.

The digital outputs DQ0 to DQ7 are electrically isolated from the digital outputs DQ8 to DQ15 and the backplane bus, but not from the digital inputs. The digital outputs DQ8 to DQ15 are electrically isolated from the digital outputs DQ0 to DQ7; the digital inputs are electrically isolated from the backplane bus.

You can use each of the digital outputs as a high-speed output or as a sourcing output:

- High-speed output (default):
  The digital output works as fast push-pull switch and can carry a rated load current of 0.1 A. A push-pull switch is alternately switched to DC 24 V and ground. This makes for very steep edges.
- Sourcing output:
  The digital output works as 24 V sourcing output in reference to M and can carry a rated load current of 0.5 A.

The digital outputs are protected from overload and short-circuit. Relays and contactors can be connected direct without external circuitry. You can find information on the maximum possible operating frequencies and the inductive loads at the digital outputs in the section Technical specifications (Page 56).

NOTICE

Overtemperature from unsuitable loads

A high-speed output generates edges that are very steep. This creates very powerful charge reversals for the connected load, which can overheat the load at very high switching frequencies.

The connected load must therefore be approved for high input frequencies.

Note

If you use a digital output as sourcing output, the switch-off response / switch-off edge depends on the load. Thus, it is possible that very short pulses cannot be output correctly.

Configuring/address space

5

5.1 Configuring

Introduction

You configure and assign parameters to the technology module with STEP 7 (TIA Portal).

The technology module functions are controlled and monitored by the user program.

System environment

The technology module can be used in the following system environments:

Applications	Components required	Configuration software	In the user program
Central or distributed operation with a CPU S7-1500	• S7-1500 automation system • ET 200MP distributed I/O system • TM Timer DIDQ 24x24V	STEP 7 (TIA Portal): Device configuration and parameter settings with hardware configuration	Time stamp functions and Oversampling: TIO instructions TIO_SYNC, TIO_DI, and TIO_DQ Counting and PWM: Direct access to the control and feedback interface (Page 39) in the I/O data
		STEP 7 (TIA Portal): • Device configuration with hardware configuration • Parameter settings with cam or probe technology object	Motion Control-instructions
Distributed operation with an S7-300/400 CPU	• S7-300/400 automation system • ET 200MP distributed I/O system • TM Timer DIDQ 24x24V	STEP 7 (TIA Portal): Device configuration and parameter settings with hardware configuration	Time stamp functions[1], counting, PWM and Oversampling: Direct access to the control and feedback interface (Page 39) in the I/O data

[1] on request

Additional information

You can find a detailed description of the time stamp functions and their configuration with the TIO instructions TIO_SYNC, TIO_DI and TIO_DQ in:

- In the High-precision input/output with time-based IO function manual as a download from the Internet (http://support.automation.siemens.com/WW/view/en/82527590).
- In the STEP 7 (TIA Portal) (https://docs.tia.siemens.cloud) information system under "Time-based IO (S7-1500)"

You can find a detailed description of configuring the technology module with the technology objects TO_OutputCam, TO_CamTrack and TO_MeasuringInput at:

- In the function manual "S7-1500/S7-1500T Measuring input and cam functions" as a download on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109974351)
- In the information system of STEP 7 (TIA Portal) (https://docs.tia.siemens.cloud) under "Configuring technology modules for Motion Control (S7-1500, S7-1500T)"

Library with PLC data types (LPD)

The "LPD (Library of PLC Datatypes)" contains PLC data types that describe the data structures of the address spaces and data records of I/O and technology modules as well as PROFIdrive drives. The library is available as a download in the Internet (https://support.industry.siemens.com/cs/ww/en/view/109482396).

Hardware Support Package (HSP)

To use the technology module in TIA Portal V19, you need the HSP0436. The module is integrated in the subsequent TIA Portal versions.

You can find the Hardware Support Packages (HSP) for download on the Internet (https://support.industry.siemens.com/cs/ww/en/view/72341852).

Alternatively, they can be accessed for downloading via the menu bar of STEP 7 (TIA Portal): "Options > Support Packages > Download from the Internet".

5.2 Parameters

You can use various parameters in the hardware configuration to define the properties of the technology module in STEP 7 (TIA Portal). Depending on the settings, not all parameters are available. When parameters are assigned in the user program, the parameters are transferred to the module with the "WRREC" instruction via data record 128 (Page 65).

You can set the parameters as follows:

1. Insert the module from the hardware catalog under "Technology modules".
2. Set the device configuration and the parameters of the module in the hardware configuration.
3. Download the project to the CPU.

Parameters of the TM Timer DIDQ 24x24V

The following parameter settings are possible. The default settings of the parameters are shown in bold in the "Value range" column.

Table 5- 1 Configurable parameters of the configuration software and their defaults

Parameter	Value range	Scope
Basic parameters		
Channel configuration of the module	• 8 Inputs, 16 outputs • **0 Inputs, 16 outputs** • 3 inputs, 13 outputs • 4 inputs, 12 outputs • 8 inputs, 8 outputs	Module
PWM period for the digital outputs	• **10 ms** • 5 ms • 2 ms • 1 ms • 0.5 ms • 0.2 ms	Module
Reaction to CPU STOP	• **Output substitute value** • Keep last value	Module
Enable diagnostic interrupts	• **Disabled** • Enabled	Module
Module use from the user program	• Position input for "Motion Control" technology object • Use with instructions from the "Time-based IO" library	Module

Parameter	Value range	Scope
Channel parameters: Digital output (DQm)		
Operating mode of the digital output	• **Timer DQ** • Oversampling • Pulse width modulation PWM	Channel
Substitute value for the digital output	• **0** • 1	Channel
High-speed output (0.1 A)	• Disabled • **Enabled**	Channel
Invert input or output signal	• **Disabled** • Enabled	Channel
Channel parameters: Enable input (DIm)		
HW enable by the digital input	• **Level-triggered** • Edge-triggered	Channel
Level selection for HW enable	• **Active at high level** • Active with low level	Channel
Channel parameters: Digital input (DIm)		
Configuration DI group	• **Incremental encoder (A, B phase-shifted)** • Timer-DI with enable input • Use inputs individually	Channel
Invert counting direction (incremental encoder)	• **Disabled** • Enabled	Channel
Operating mode of the digital input	• Counter • **Timer DI** • Oversampling	Channel
Input delay for the digital input	• None • 0.05 ms • **0.1 ms** • 0.4 ms • 0.8 ms	Channel
Signal evaluation for counters	• **At rising edge** • At falling edge	Channel
Configuration DQ/DI group	• **Timer DQ with enable input** • Use input/output individually	Channel

Explanation of parameters

You can find a detailed description of the parameters in the STEP 7 information system (TIA Portal) (https://docs.tia.siemens.cloud) under "Configuring and parameter assignment of the TIO module (S7-1500)".

5.3 Address space

Address space of the technology module

Table 5- 2 Size of the input and output addresses

	Inputs	**Outputs**
Scope for channel configuration "8 Inputs, 16 outputs"	45 bytes	78 bytes
Scope for other channel configuration	44 bytes	74 bytes

5.4 Control and feedback interface

Direct access to the control and feedback interface on the S7-1500 is not necessary in a PROFINET system to use the time stamp functions. The TIO instructions TIO_SYNC, TIO_DI and TIO_DQ or the Motion Control-instructions are available for this case. You can find a detailed description on how to use the TIO instructions in the function manual High-precision input/output with time-based IO which is available as download on the Internet (http://support.automation.siemens.com/WW/view/en/82527590). You can find a detailed description of the use of the cam or measuring input technology objects in the function manual "S7-1500/S7-1500T Measuring input and cam functions" as a download on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109974351).

Additional information on using the control and feedback interface is available in the section Configuring (Page 35).

5.4.1 Assignment of the control interface

The user program uses the control interface to influence the behavior of the technology module.

Control interface for Channel configuration "8 Inputs, 16 outputs"

The following table shows the assignment of the control interface for the channel configuration "8 inputs, 16 outputs":

Offset to the start address	Parameter	Meaning
Byte 0	SET_DQ (DQ0 ... DQ7)	Bit 7: Set DQ7
		Bit 6: Set DQ6
		Bit 5: Set DQ5
		Bit 4: Set DQ4
		Bit 3: Set DQ3
		Bit 2: Set DQ2
		Bit 1: Set DQ1
		Bit 0: Set DQ0
Byte 1	SET_DQ (DQ8 ... DQ15)	Bit 7: Set DQ15
		Bit 6: Set DQ14
		Bit 5: Set DQ13
		Bit 4: Set DQ12
		Bit 3: Set DQ11
		Bit 2: Set DQ10
		Bit 1: Set DQ9
		Bit 0: Set DQ8
Byte 2	SETEN (DI0 ... DI7)	Bit 7: Override hardware enable for DI7
		Bit 6: Override hardware enable for DI6
		Bit 5: Override hardware enable for DI5
		Bit 4: Override hardware enable for DI4
		Bit 3: Override hardware enable for DI3
		Bit 2: Override hardware enable for DI2
		Bit 1: Override hardware enable for DI1
		Bit 0: Override hardware enable for DI0
Byte 3	SETEN (DQ0 ... DQ7)	Bits 0 to 7: Override hardware enable for DQ8 to DQ15
Byte 4	SETEN (DQ8 ... DQ15)	Bits 0 to 7: Override hardware enable for DQ8 to DQ15

Offset to the start address	Parameter		Meaning		
Bytes 5 to 7	Reserved[1]				
Bytes 8 to 11	TEC_OUT (DQ0)		For DQ operating mode "Timer DQ":	For DQ operating mode "Over-sampling":	For DQ operating mode "Pulse width modulation PWM":
			Byte 0...1: OFF TIME: Starting time stamp of the module for resetting the DQ0	Bytes 0 to 3: 32 states for Over-sampling	Bytes 0 to 2: Reserved[1]
			Bytes 2 to 3: ON TIME: Starting time stamp of the module for setting the DQ0		Byte 3: Pulse-pause ratio for PWM as a percentage
Bytes 12 to 15	TEC_OUT (DQ1)		See bytes 8 to 11		
Bytes 16 to 19	TEC_OUT (DQ2)				
Bytes 20 to 23	TEC_OUT (DQ3)				
Bytes 24 to 27	TEC_OUT (DQ4)				
Bytes 28 to 31	TEC_OUT (DQ5)				
Bytes 32 to 35	TEC_OUT (DQ6)				
Bytes 36 to 39	TEC_OUT (DQ7)				
Bytes 40 to 43	TEC_OUT (DQ8)				
Bytes 44 to 47	TEC_OUT (DQ9)				
Bytes 48 to 51	TEC_OUT (DQ10)				
Bytes 52 to 55	TEC_OUT (DQ11)				
Bytes 56 to 59	TEC_OUT (DQ12)				
Bytes 60 to 63	TEC_OUT (DQ13)				
Bytes 64 to 67	TEC_OUT (DQ14)				
Bytes 68 to 71	TEC_OUT (DQ15)				
Byte 72	SEL (DI1)	EDGESEL	Bits 5...7: edge selection for time stamp detection DI1:		
			000_B: Not permitted		
			001_B: Rising edges only		
			010_B: Falling edges only		
			011_B: Rising and falling edge (order depending on occurrence)		
			100_B: Not permitted		
			101_B: First rising, then falling edge		
			110_B: First falling, then rising edge		
			111_B: Not permitted		
		REARM	Bit 4: cyclic time stamp detection for DI1		
	SEL (DI0)	EDGESEL	Bits 0...3: See SEL (DI1)		
		REARM			
Byte 73	SEL (DI3)		See byte 72		
	SEL (DI2)				
Byte 74	SEL (DI5)		See byte 72		
	SEL (DI4)				
Byte 75	SEL (DI7)		See byte 72		
	SEL (DI6)				
Bytes 76 to 77	STW	MSL	Bits 12...15: sign of life counter (Master Sign of Life)		
		—	Bits 1 to 11: Reserved[1]		
		SYN	Bit 0: Synchronization of the module with the user program		

[1] Reserved bits must be set to 0.

Control interface for other channel configurations

The following table shows the assignment of the control interface for the other channel configurations:

Offset to the start address	Parameters	Meaning		
Byte 0	SET_DQ (DQ0 ... DQ7)	Bit 7: Set DQ7		
		Bit 6: Set DQ6		
		Bit 5: Set DQ5		
		Bit 4: Set DQ4		
		Bit 3: Set DQ3		
		Bit 2: Set DQ2		
		Bit 1: Set DQ1		
		Bit 0: Set DQ0		
Byte 1	SET_DQ (DQ8 ... DQ15)	Bit 7: Set DQ15		
		Bit 6: Set DQ14		
		Bit 5: Set DQ13		
		Bit 4: Set DQ12		
		Bit 3: Set DQ11		
		Bit 2: Set DQ10		
		Bit 1: Set DQ9		
		Bit 0: Set DQ8		
Byte 2	SETEN (DI0/DQ0 ... DI7/DQ7)	Bit 7: Override hardware enable for DI7 or DQ7		
		Bit 6: Override hardware enable for DI6 or DQ6		
		Bit 5: Override hardware enable for DI5 or DQ5		
		Bit 4: Override hardware enable for DI4 or DQ4		
		Bit 3: Override hardware enable for DI3 or DQ3		
		Bit 2: Override hardware enable for DI2 or DQ2		
		Bit 1: Override hardware enable for DI1 or DQ1		
		Bit 0: Override hardware enable for DI0 or DQ0		
Byte 3	SETEN (DQ8 ... DQ15)	Bits 0 to 7: Override hardware enable for DQ8 to DQ15		
Bytes 4 to 7	TEC_OUT (DQ0)	For DQ operating mode "Timer DQ":	For DQ operating mode "Over-sampling":	For DQ operating mode "Pulse width modulation PWM":
		Byte 0...1: OFF TIME:: Starting time stamp of the module for resetting the DQ0	Bytes 0 to 3: 32 states for Over-sampling	Bytes 0 to 2: Reserved[1]
		Bytes 2 to 3: ON TIME: Starting time stamp of the module for setting the DQ0		Byte 3: Pulse-pause ratio for PWM as a percentage

Offset to the start address	Parameters		Meaning
Bytes 8 to 11	TEC_OUT (DQ1)		See bytes 4 to 7
Bytes 12 to 15	TEC_OUT (DQ2)		
Bytes 16 to 19	TEC_OUT (DQ3)		
Bytes 20 to 23	TEC_OUT (DQ4)		
Bytes 24 to 27	TEC_OUT (DQ5)		
Bytes 28 to 31	TEC_OUT (DQ6)		
Bytes 32 to 35	TEC_OUT (DQ7)		
Bytes 36 to 39	TEC_OUT (DQ8)		
Bytes 40 to 43	TEC_OUT (DQ9)		
Bytes 44 to 47	TEC_OUT (DQ10)		
Bytes 48 to 51	TEC_OUT (DQ11)		
Bytes 52 to 55	TEC_OUT (DQ12)		
Bytes 56 to 59	TEC_OUT (DQ13)		
Bytes 60 to 63	TEC_OUT (DQ14)		
Bytes 64 to 67	TEC_OUT (DQ15)		
Byte 68	SEL (DI1)	EDGESEL	Bits 5 to 7: Edge selection for time stamp detection DI1:
			000_B: Not permitted
			001_B: Rising edges only
			010_B: Falling edges only
			011_B: Rising and falling edge (order depending on occurrence)
			100_B: Not permitted
			101_B: First rising, then falling edge
			110_B: First falling, then rising edge
			111_B: Not permitted
		REARM	Bit 4: Cyclic time stamp detection for DI1
	SEL (DI0)	EDGESEL	Bits 0 to 3: See SEL (DI1)
		REARM	
Byte 69	SEL (DI3)		See byte 68
	SEL (DI2)		
Byte 70	SEL (DI5)		See byte 68
	SEL (DI4)		
Byte 71	SEL (DI7)		See byte 68
	SEL (DI6)		
Bytes 72 to 73	STW	MSL	Bits 12...15: Sign of life counter (Master Sign of Life)
		—	Bits 1 to 11: Reserved[1]
		SYN	Bit 0: Synchronization of the module with the user program

[1] Reserved bits must be set to 0.

Notes on the control bits

Control bit	Notes
SET_DQ (DQm)	You can use this bit to set the respective digital output DQm in the DQ operating mode "Timer" DQ.
SETEN (DIm/DQm)	You can use this bit to override the hardware enable that is configured for a digital input DIm or digital output DQm.
TEC_OUT (DQm)	If you use the time stamp function for the respective digital output DQm, the TIO instruction TIO_DQ returns the two output time stamps for the module in this value. If you use the Oversampling function for the respective digital output DQm, you specify the 32 states with this value. If you use pulse width modulation for the respective digital output DQm, you specify the pulse-pause ratio with this value as percentage. The following overview shows how the technology module evaluates the specified percentage.
SEL (DIm)	This value is supplied by the TIO instruction TIO_DI.
STW	This value is controlled by the TIO instruction TIO_SYNC. Detailed information is available on request.

Pulse-pause ratio for PWM

You specify the setpoint for the pulse-pause ratio as a percentage. The technology module outputs the following pulse-pause ratio in each case:

Setpoint in %	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Output value in %	0		3.13			6.25			9.38			12.50				15.63			18.75			21.88		

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
25			28.13			31.25			34.38			37.50				40.63			43.75			46.88			50		

52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
53.13			56.25			59.38			62.50				65.63			68.75			71.88			75			78.13		

80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
81.25			84.38			87.50			90.63				93.75			96.88			100	

Additional information

Detailed information about the time stamp function is available from Technical Supporton request.

5.4.2 Assignment of the feedback interface

The user program receives current values and status information from the technology module by means of the feedback interface.

Feedback interface for Channel configuration "8 Inputs, 16 outputs"

The following table shows the assignment of the feedback interface for the channel configuration "8 inputs, 16 outputs":

Offset to the start address	Parameter	Meaning
Byte 0	STS_DI (DI0 ... DI7)	Bit 7: Status DI7 (when DI7 is used)
		Bit 6: Status DI6 (when DI6 is used)
		Bit 5: Status DI5 (when DI5 is used)
		Bit 4: Status DI4 (when DI4 is used)
		Bit 3: Status DI3 (when DI3 is used)
		Bit 2: Status DI2 (when DI2 is used)
		Bit 1: Status DI1 (when DI1 is used)
		Bit 0: Status DI0 (when DI0 is used)
Byte 1	QI (DI0 ... DI7)	Bit 7: Quality Information DI7
		Bit 6: Quality Information DI6
		Bit 5: Quality Information DI5
		Bit 4: Quality Information DI4
		Bit 3: Quality Information DI3
		Bit 2: Quality Information DI2
		Bit 1: Quality Information DI1
		Bit 0: Quality Information DI0
Byte 2	QI (DQ0 ... DQ7)	Bit 7: Quality Information DQ7
		Bit 6: Quality Information DQ6
		Bit 5: Quality Information DQ5
		Bit 4: Quality Information DQ4
		Bit 3: Quality Information DQ3
		Bit 2: Quality Information DQ2
		Bit 1: Quality Information DQ1
		Bit 0: Quality Information DQ0
Byte 3	QI (DQ08 ... DQ15)	Bit 7: Quality Information DQ15
		Bit 6: Quality Information DQ14
		Bit 5: Quality Information DQ13
		Bit 4: Quality Information DQ12
		Bit 3: Quality Information DQ11
		Bit 2: Quality Information DQ10
		Bit 1: Quality Information DQ9
		Bit 0: Quality Information DQ8

Offset to the start address	Parameter	Meaning		
Bytes 4 to 7	TEC_IN (DI0)	For DI operating mode "Timer DI":	For DI operating mode "Incremental encoder (A, B phase-shifted)" or "Counter":	For DI operating mode "Over-sampling":
		Byte 0...1: 2nd TIME/OFF TIME: Second input time stamp of module	Current counter value	Oversampling value
		Byte 2...3: 1st TIME/ON TIME: First input time stamp of module		
Bytes 8 to 11	TEC_IN (DI1)	See bytes 4 to 7		
Bytes 12 to 15	TEC_IN (DI2)			
Bytes 16 to 19	TEC_IN (DI3)			
Bytes 20 to 23	TEC_IN (DI4)			
Bytes 24 to 27	TEC_IN (DI5)			
Bytes 28 to 31	TEC_IN (DI6)			
Bytes 32 to 35	TEC_IN (DI7)			
Byte 36	EN (DI1)	Bit 7: DI1 active as Timer DI		
	LEC (DI1)	Bit 4...6: Lost edge counter for DI1		
	EN (DI0)	Bit 3: DI0 active as Timer DI		
	LEC (DI0)	Bit 0...2: Lost edge counter for DI0		
Byte 37	EN (DI3)	See byte 36		
	LEC (DI3)			
	EN (DI2)			
	LEC (DI2)			
Byte 38	EN (DI5)			
	LEC (DI5)			
	EN (DI4)			
	LEC (DI4)			
Byte 39	EN (DI7)			
	LEC (DI7)			
	EN (DI6)			
	LEC (DI6)			
Byte 40	EN (DQ7)	Bit 7: DQ7 active as Timer DQ		
	EN (DQ6)	Bit 6: DQ6 active as Timer DQ		
	EN (DQ5)	Bit 5: DQ5 active as Timer DQ		
	EN (DQ4)	Bit 4: DQ4 active as Timer DQ		
	EN (DQ3)	Bit 3: DQ3 active as Timer DQ		
	EN (DQ2)	Bit 2: DQ2 active as Timer DQ		
	EN (DQ1)	Bit 1: DQ1 active as Timer DQ		
	EN (DQ0)	Bit 0: DQ0 active as Timer DQ		
Byte 41	EN (DQ15)	Bit 7: DQ15 active as Timer DQ		
	EN (DQ14)	Bit 6: DQ14 active as Timer DQ		
	EN (DQ13)	Bit 5: DQ13 active as Timer DQ		
	EN (DQ12)	Bit 4: DQ12 active as Timer DQ		
	EN (DQ11)	Bit 3: DQ11 active as Timer DQ		
	EN (DQ10)	Bit 2: DQ10 active as Timer DQ		
	EN (DQ9)	Bit 1: DQ9 active as Timer DQ		
	EN (DQ8)	Bit 0: DQ8 active as Timer DQ		

Offset to the start address	Parameter		Meaning
Byte 42	Layout Property		Module-specific value
Bytes 43 to 44	ZSW	SSL	Bits 12 to 15: Sign of life counter (Slave Sign of Life)
		—	Bits 10 to 11: Reserved
		SYNC	Bit 8: Module is synchronized with the user program
		Channel address	Bits 4 to 7 and 9: Reserved
		Channel mode	Bits 0 to 3: Reserved

Feedback interface for other channel configurations

The following table shows the assignment of the feedback interface for the other channel configurations:

Offset to the start address	Parameters	Meaning
Byte 0	STS_DI (DI0 ... DI7)	Bit 7: Status DI7 (when DI7 is used)
		Bit 6: Status DI6 (when DI6 is used)
		Bit 5: Status DI5 (when DI5 is used)
		Bit 4: Status DI4 (when DI4 is used)
		Bit 3: Status DI3 (when DI3 is used)
		Bit 2: Status DI2 (when DI2 is used)
		Bit 1: Status DI1 (when DI1 is used)
		Bit 0: Status DI0 (when DI0 is used)
Byte 1	QI (DI0 ... DI7)	Bit 7: Quality Information DI7
		Bit 6: Quality Information DI6
		Bit 5: Quality Information DI5
		Bit 4: Quality Information DI4
		Bit 3: Quality Information DI3
		Bit 2: Quality Information DI2
		Bit 1: Quality Information DI1
		Bit 0: Quality Information DI0
Byte 2	QI (DQ0 ... DQ7)	Bit 7: Quality Information DQ7
		Bit 6: Quality Information DQ6
		Bit 5: Quality Information DQ5
		Bit 4: Quality Information DQ4
		Bit 3: Quality Information DQ3
		Bit 2: Quality Information DQ2
		Bit 1: Quality Information DQ1
		Bit 0: Quality Information DQ0

Offset to the start address	Parameters	Meaning		
Byte 3	QI (DQ08 ... DQ15)	Bit 7: Quality Information DQ15		
		Bit 6: Quality Information DQ14		
		Bit 5: Quality Information DQ13		
		Bit 4: Quality Information DQ12		
		Bit 3: Quality Information DQ11		
		Bit 2: Quality Information DQ10		
		Bit 1: Quality Information DQ9		
		Bit 0: Quality Information DQ8		
Bytes 4 to 7	TEC_IN (DI0)	For DI operating mode "Timer DI":	For DI operating mode "Incremental encoder (A, B phase-shifted)" or "Counter":	For DI operating mode "Over-sampling":
		Byte 0...1: 2nd TIME/OFF TIME: Second input time stamp of module	Current counter value	Oversampling Value
		Byte 2...3: 1st TIME/ON TIME: First input time stamp of module		
Bytes 8 to 11	TEC_IN (DI1)	See bytes 4 to 7		
Bytes 12 to 15	TEC_IN (DI2)			
Bytes 16 to 19	TEC_IN (DI3)			
Bytes 20 to 23	TEC_IN (DI4)			
Bytes 24 to 27	TEC_IN (DI5)			
Bytes 28 to 31	TEC_IN (DI6)			
Bytes 32 to 35	TEC_IN (DI7)			
Byte 36	EN (DI1/DQ1)	Bit 7: DI1 active as Timer DI or DQ1 active as Timer DQ		
	LEC (DI1)	Bit 4...6: Lost edge counter for DI1		
	EN (DI0/DQ0)	Bit 3: DI0 active as Timer DI or DQ0 active as Timer DQ		
	LEC (DI0)	Bit 0...2: Lost edge counter for DI0		
Byte 37	EN (DI3/DQ3)	See byte 36		
	LEC (DI3)			
	EN (DI2/DQ2)			
	LEC (DI2)			
Byte 38	EN (DI5/DQ5)			
	LEC (DI5)			
	EN (DI4/DQ4)			
	LEC (DI4)			
Byte 39	EN (DI7/DQ7)			
	LEC (DI7)			
	EN (DI6/DQ6)			
	LEC (DI6)			
Byte 40	EN (DQ15)	Bit 7: DQ15 active as Timer DQ		
	EN (DQ14)	Bit 6: DQ14 active as Timer DQ		
	EN (DQ13)	Bit 5: DQ13 active as Timer DQ		
	EN (DQ12)	Bit 4: DQ12 active as Timer DQ		
	EN (DQ11)	Bit 3: DQ11 active as Timer DQ		
	EN (DQ10)	Bit 2: DQ10 active as Timer DQ		
	EN (DQ9)	Bit 1: DQ9 active as Timer DQ		
	EN (DQ8)	Bit 0: DQ8 active as Timer DQ		

Offset to the start address	Parameters		Meaning
Byte 41	Layout Property		Module-specific value
Bytes 42 to 43	ZSW	SSL	Bits 12...15: sign of life counter (Slave Sign of Life)
		—	Bits 10 to 11: Reserved
		SYNC	Bit 8: Module is synchronized with the user program
		Channel address	Bits 4 to 7 and 9: Reserved
		Channel mode	Bits 0 to 3: Reserved

Notes on the feedback bits

Feedback bit	Notes
STS_DI (DIm)	This bit indicates the status of respective digital input DIm.
QI (DIm)	This bit indicates that an error has occurred at the respective digital input. 0 means: Supply voltage 1L+/2L+ not available or too low or front connector is not plugged 1 means: Supply voltage is present and OK If the diagnostic interrupts are enabled, a diagnostic interrupt is triggered when there is a problem with the supply voltage 1L+/2L+. Refer to the section Diagnostics alarms (Page 54) for details on the diagnostic interrupts.
QI (DQm)	This bit indicates that an error has occurred at the respective digital output. 0 means: Short-circuit, overload or overtemperature 1 means: Supply voltage is present and OK If the diagnostic interrupts are enabled, a diagnostic interrupt is triggered when there is fault at the digital output. Refer to the section Diagnostics alarms (Page 54) for details on the diagnostic interrupts.
TEC_IN (DIm)	If you use the time stamp function for the respective digital input DIm, this value returns the two input time stamps for the module. The input time stamps are read by the TIO instruction TIO_DI and converted to the TIO_Time. If you use the counting function for the respective digital input DIm, this value returns the current counter value. If you use the Oversampling function for the respective digital input DIm, this value returns the 32 states of the DIm.
EN (DIm)	This bit indicates that the respective digital input is active as Timer DI and is enabled if required. For digital inputs with the operating modes "Counter", "Oversampling", "Pulse Width Modulation PWM" and for level-controlled hardware enable, this bit is permanently "0".
EN (DQm)	This bit indicates that the respective digital output is active as Timer DQ and is enabled if required. For digital outputs with the operating modes "Counter", "Oversampling" and "Pulse width modulation PWM", this bit is permanently "0".
LEC (DIm)	This value indicates the number of edges at the respective digital input DIm for which no time stamp could be stored. The module can count a maximum of seven edges per application cycle. The counter is reset with each new application cycle.
Layout Property	This value is a module-specific constant and used by the TIO instructions for the recognition of the technology module.
ZSW	This value is controlled by the technology module and is used for communication with the TIO instruction TIO_SYNC.
Reserved	Reserved bits are set to 0.

Additional information

Detailed information about the time stamp function is available from Technical Supporton request.

5.5 Reaction to CPU STOP

You set the response of the technology module to CPU STOP in the device configuration with the basic parameters (Page 37).

Table 5- 3 Reaction of the technology module to CPU STOP

	Reaction of technology module
Output substitute value	The technology module outputs the configured substitute values at the digital outputs until the next CPU STOP-RUN transition. The technology module is returned to its startup state after a STOP-RUN transition: If you are using counters, the counter values are set to 0 and the digital outputs switch according to the parameter assignment and the setpoints.
Keep last value	The technology module outputs the values at the digital outputs that were valid when the transition to STOP took place until the next CPU STOP-RUN transition. The last valid period duration with the last valid pulse-pause ratio is output for a configured pulse width modulation until the next STOP-RUN transition. The technology module is returned to its startup state after a STOP-RUN transition: If you are using counters, the counter values are set to 0 and the digital outputs switch according to the parameter assignment and the setpoints.

5.6 Isochronous mode

The technology module supports the system function "Isochronous mode". In isochronous mode, the cycle of the user program, the transmission of the input and output data and the processing in the technology module are synchronized with each other.

This system function is required for the following functions of the technology module:

- Time stamp detection (Timer DI)
- Time-controlled switching (Timer DQ)
- Digital input Oversampling
- Digital output Oversampling

Data processing

The counter values and Oversampling bit strings as well as status bits are detected at the time T_i and made available in the feedback interface for retrieval in the current bus cycle. The output of the current Oversampling bit stings is started at the time T_o.

Additional information

You can find a detailed description of the isochronous mode:

- In the Isochronous Mode Function Manual as a download from the Internet (https://support.industry.siemens.com/cs/ww/en/view/109755401).
- In the PROFINET with STEP 7 function manual as a download from the Internet (https://support.industry.siemens.com/cs/ww/en/view/49948856).

Interrupts/diagnostic messages

6

6.1 Status and error displays

LEDs

The following figure shows you the LED displays (status and error displays) of TM Timer DIDQ 24x24V.

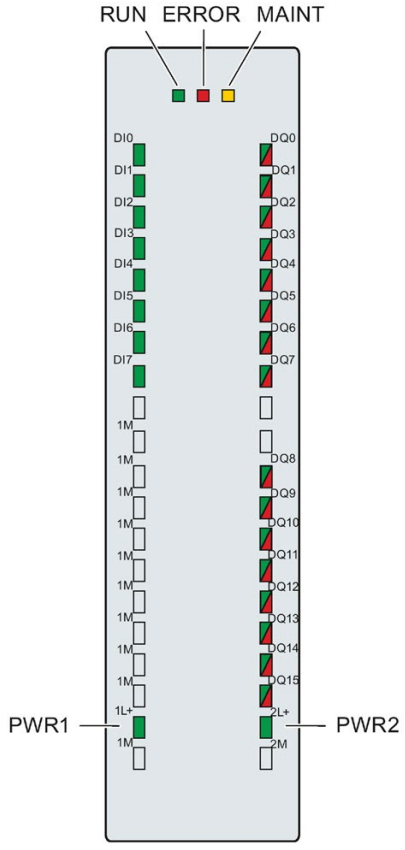


Figure 6-1 LED displays of the TM Timer DIDQ 24x24V

Meaning of the LED displays

The following tables explain the meaning of the status and error displays. Remedial measures for diagnostics alarms can be found in the section Diagnostics alarms (Page 54).

Table 6- 1 Status and error displays RUN/ERROR/MAINT

LEDs			Meaning	To correct or avoid errors
RUN	ERROR	MAINT		
Off	Off	Off	No or insufficient voltage on the backplane bus	• Switch on the CPU/IM and/or the system power supply modules. • Check whether the U connectors are inserted. • Check whether too many modules are inserted.
Flashes	Off	Off	Technology module not configured	—
On	Off	Off	Technology module configured but no module diagnostics	
On	Flashes	Off	Technology module configured and module diagnostics (at least one error present)	Evaluate the diagnostics alarms and eliminate the error.
Flashes	Flashes	Flashes	Hardware or firmware defective	Replace the technology module.

Table 6- 2 PWRm/DQm*/ERROR status displays

LEDs			Meaning	To correct or avoid errors
PWRm	DQm*	ERROR		
Off	Off	Off	Supply voltage too low or missing *and* "Enable diagnostic interrupts" not activated	• Check the supply voltage. • Make sure that the front connector is correctly inserted. • In the device configuration, enable "Enable diagnostic interrupts".
Off	Off	Flashes	Supply voltage too low or missing	• Check the supply voltage. • Make sure that the front connector is correctly inserted.
On	On	Off	Supply voltage is present and OK	—
On	On	Flashes	Indicates module error (an error is present on at least one channel)	Evaluate the diagnostics alarms and eliminate the error.

* Applies for DQ0 to DQ7 when used as encoder supply

Channel LEDs

The DIm LEDs indicate the current level of the associated signals. The LEDs of the digital outputs DQm indicate the desired state.

The flashing frequency of the channel LEDs is limited to approximately 14 Hz. If higher frequencies are present, the channel LEDs will flash at 14 Hz instead of indicating the current status.

Table 6- 3 Status displays DIm

DIm LEDs	Meaning
▫ Off	Digital input at 0 level
■ On	Digital input at 1 level

Table 6- 4 Status displays DQm (when used as digital output)

DQm LEDs	Meaning	To correct or avoid errors
▫ Off	Digital output at 0 level	—
■ On	Digital output at 1 level	—
■ On	Diagnostic message: e.g. "Error at digital outputs"	• Evaluate the diagnostic message • Check the wiring or the connected load.

6.2 Diagnostics alarms

Enabling the diagnostic interrupts

You enable the diagnostic interrupts at the basic parameters.

The technology module can trigger the following diagnostic interrupts:

Table 6- 5 Possible diagnostic interrupts

Diagnostic interrupt	Monitoring
• Internal error • Watchdog tripped. Module is defective.	Monitoring is always active. A diagnostic interrupt is triggered each time an error is detected.
• No supply voltage • Short-circuit or overload at encoder supply • Error at the digital outputs • Supply voltage error • Overtemperature	An error detected only triggers a diagnostic interrupt if "Enable diagnostic interrupts" has been enabled in the device configuration.

Reactions to a diagnostic interrupt

The following happens when an event occurs that triggers a diagnostic interrupt:

- The ERROR LED flashes red.

  Once you have remedied the error, the ERROR LED goes out.
- The S7-1500 CPU interrupts processing of the user program. The diagnostic interrupt OB (e.g. OB 82) is called. The event that triggered the interrupt is entered in the start information of the diagnostic interrupt OB.
- The S7-1500 CPU remains in RUN even if no diagnostic interrupt OB is present in the CPU. The technology module continues working unchanged if this is possible despite the error.

You can obtain detailed information on the error event in the error organization block with instruction "RALRM" (Read additional alarm information), in the information system of STEP 7 and in Function Manual Diagnostics (https://support.industry.siemens.com/cs/ww/en/view/59192926), section "System diagnostics in user program".

Diagnostics alarms

The diagnostics are displayed as plain text in STEP 7 (TIA Portal) in the online and diagnostics view. You can evaluate the error codes with the user program.

The technology module only has one channel as far as diagnostics is concerned. Channel number "0" is therefore displayed for each diagnostic.

The following diagnostics can be signaled:

Table 6- 6 Diagnostics alarms, their meaning and remedies

Diagnostics alarm	Error code	Meaning	To correct or avoid errors
Internal error	100H	Technology module defective	Replace technology module
Watchdog tripped. Module is defective.	103H	Firmware error	Run firmware update
		Technology module defective	Replace technology module
No supply voltage	10AH	• Missing or insufficient supply voltage 1L+ or/and 2L+ • Possible causes: – Wiring of supply voltage 1L+/2L+ faulty – Front connector not inserted correctly	• Check supply voltage 1L+/2L+ • Check wiring of supply voltage 1L+/2L+ • Insert front connector correctly
Short-circuit / overload on the external encoder supply	10EH	• Error at encoder supply • Possible causes: – Short-circuit – Overload	• Check encoder wiring • Check consumers connected to encoder supply
Error at the digital outputs	10FH	• Error at the digital outputs (DQm LED lights up red) • Possible causes: – Short-circuit – Overload	• Correct wiring at the digital outputs • Check consumers connected to the digital outputs
Supply voltage error	110H	• Error at 1L+ and/or 2L+ supply voltage • Possible causes: – Low voltage – Wiring of 1L+ and/or 2L+ supply voltage defective	• Check the 1L+ and/or 2L+ supply voltage • Check the wiring of 1L+ and/or 2L+ supply voltage
Overtemperature	506H	• Possible causes: – Short-circuit or overload at the digital outputs or output of the encoder supply – Ambient temperature outside specifications	• Correct process wiring • Improve cooling • Check connected loads

Technical specifications

7

The following table shows the technical specifications of the module on the issue date. You can find a data sheet with up-to-date technical specifications on the Internet (https://support.industry.siemens.com/cs/de/en/pv/6ES7552-1AA01-0AB0/td?dl=en).

Article number	6ES7552-1AA01-0AB0
General information	
Product type designation	TM Timer DIDQ 24x24V
Firmware version	V2.0
• FW update possible	Yes
Product function	
• I&M data	Yes; I&M0 to I&M3
• Isochronous mode	Yes
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	STEP 7 V19 with HSP or higher
Installation type/mounting	
Rail mounting	Yes; S7-1500 mounting rail
Supply voltage	
Load voltage 1L+	
• Rated value (DC)	24 V
• permissible range, lower limit (DC)	19.2 V
• permissible range, upper limit (DC)	28.8 V
• Reverse polarity protection	Yes; against destruction
Load voltage 2L+	
• Rated value (DC)	24 V
• permissible range, lower limit (DC)	19.2 V
• permissible range, upper limit (DC)	28.8 V
• Reverse polarity protection	Yes; against destruction
Input current	
from load voltage 1L+ (without load), max.	20 mA; without load
from load voltage 2L+ (without load), max.	20 mA; without load
Encoder supply	
Number of outputs	8; max. depending on parameterization
24 V encoder supply	
• 24 V	Yes; L+ (-0.8 V)
• Short-circuit protection	Yes
• Output current, max.	1.2 A; Total current of all encoders / channels, max. 0.5 A per output

Article number	6ES7552-1AA01-0AB0
Power	
Power available from the backplane bus	1.3 W
Power loss	
Power loss, typ.	5 W
Address area	
Address space per module	
• Inputs	45 byte; max. depending on parameterization
• Outputs	78 byte; max. depending on parameterization
Digital inputs	
Number of digital inputs	8; max. depending on parameterization
• in groups of	8
Digital inputs, parameterizable	Yes
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Digital input functions, parameterizable	
• Digital input with time stamp	Yes
– Number, max.	8
• Counter	Yes
– Number, max.	4
• Counter for incremental encoder	Yes
– Number, max.	4
• Digital input with oversampling	Yes
– Number, max.	8
• HW enable for digital input	Yes
– Number, max.	4
• HW enable for digital output	Yes
– Number, max.	4
Input voltage	
• Type of input voltage	DC
• Rated value (DC)	24 V
• for signal "0"	-5 ... +5 V
• for signal "1"	+11 to +30V
• permissible voltage at input, min.	-30 V; -5 V continuous, -30 V brief reverse polarity protection
• permissible voltage at input, max.	30 V
Input current	
• for signal "1", typ.	2.5 mA
Input delay (for rated value of input voltage)	
• Minimum pulse width for program reactions	3 µs for parameterization "none"

Article number	6ES7552-1AA01-0AB0
for standard inputs	
– parameterizable	Yes; none / 0.05 / 0.1 / 0.4 / 0.8 ms
– at "0" to "1", min.	4 µs; for parameterization "none"
– at "1" to "0", min.	4 µs; for parameterization "none"
Cable length	
• shielded, max.	1 000 m; Depending on sensor, cable quality and rate of change
• unshielded, max.	600 m; Depending on sensor, cable quality and rate of change
Digital outputs	
Type of digital output	Transistor
Number of digital outputs	16; max. depending on parameterization
• in groups of	8
Current-sinking	Yes; With High Speed output
Current-sourcing	Yes
Digital outputs, parameterizable	Yes
Short-circuit protection	Yes; electronic/thermal
• Response threshold, typ.	1.7 A with Standard output, 0.5 A with High Speed output
Limitation of inductive shutdown voltage to	-0.8 V
Controlling a digital input	Yes
Digital output functions, parameterizable	
• Digital output with time stamp	Yes
– Number, max.	16
• PWM output	Yes
– Number, max.	16
• Digital output with oversampling	Yes
– Number, max.	16
Switching capacity of the outputs	
• with resistive load, max.	0.5 A; 0.1 A with High Speed output
Load resistance range	
• lower limit	48 Ω; 240 ohm with High Speed output
• upper limit	12 kΩ
Output voltage	
• Type of output voltage	DC
• for signal "0", max.	1 V; With High Speed output
• for signal "1", min.	23.2 V; L+ (-0.8 V)

Article number	6ES7552-1AA01-0AB0
Output current	
• for signal "1" rated value	0.5 A; 0.1 A with High Speed output, observe derating
• for signal "1" permissible range, max.	0.6 A; 0.12 A with High Speed output, observe derating
• for signal "1" minimum load current	2 mA
• for signal "0" residual current, max.	0.5 mA
Output delay with resistive load	
• "0" to "1", max.	1 µs; With High Speed output, 5 µs with Standard output
• "1" to "0", max.	1 µs; With High Speed output, 6 µs with Standard output
Switching frequency	
• with resistive load, max.	10 kHz
Total current of the outputs	
• Current per group, max.	4 A
• Current per module, max.	8 A; Observe derating
Cable length	
• shielded, max.	1 000 m; depending on load and cable quality
• unshielded, max.	600 m; depending on load and cable quality
Encoder	
Connectable encoders	
• Incremental encoder (asymmetrical)	Yes
• 24 V initiator	Yes
• 2-wire sensor	Yes
– permissible quiescent current (2-wire sensor), max.	1.5 mA
Encoder signals, incremental encoder (asymmetrical)	
• Input voltage	24 V
• Input frequency, max.	50 kHz
• Counting frequency, max.	200 kHz; with quadruple evaluation
• Cable length, shielded, max.	600 m; Depending on input frequency, encoder and cable quality; max. 200 m at 50 kHz
• Incremental encoder with A/B tracks, 90° phase offset	Yes
• pulse encoder	Yes
Interface types	
• Input characteristic curve in accordance with IEC 61131, type 3	Yes

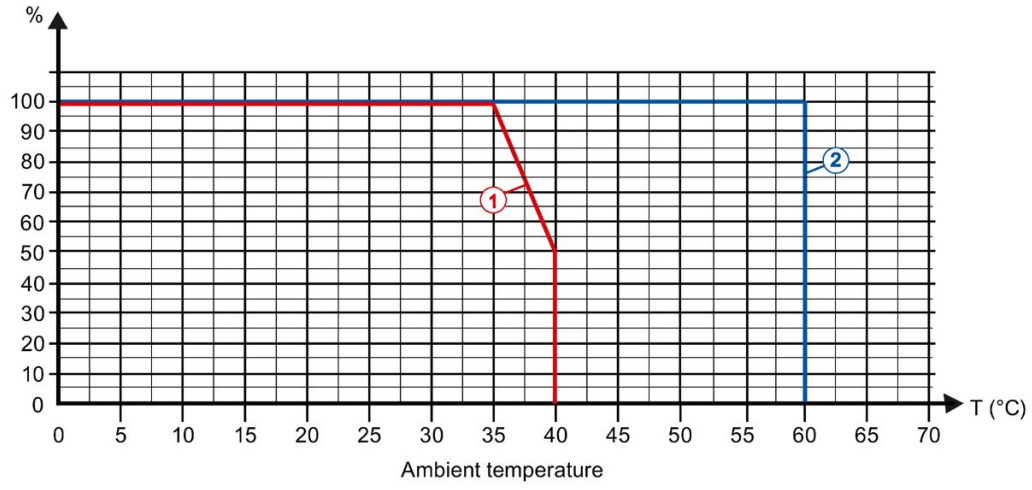
Article number	6ES7552-1AA01-0AB0
Isochronous mode	
Bus cycle time (TDP), min.	250 µs
Jitter, max.	1 µs
Interrupts/diagnostics/status information	
Diagnostics function	Yes
Substitute values connectable	Yes
Alarms	
• Diagnostic alarm	Yes
Diagnoses	
• Monitoring the supply voltage	Yes
• Short-circuit	Yes
Diagnostics indication LED	
• RUN LED	Yes; green LED
• ERROR LED	Yes; red LED
• MAINT LED	Yes; Yellow LED
• Monitoring of the supply voltage (PWR-LED)	Yes; green LED
• Channel status display	Yes; green LED
• for channel diagnostics	Yes; red LED
Integrated Functions	
Counter	Yes
• Number of counters	4
• Counting frequency, max.	200 kHz; with quadruple evaluation
Counting functions	
• Continuous counting	Yes
Position detection	
• Incremental acquisition	Yes
Potential separation	
Potential separation channels	
• between the channels and backplane bus	Yes
Isolation	
Isolation tested with	707 V DC (type test)
product functions / security / header	
signed firmware update	Yes
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-30 °C
• horizontal installation, max.	60 °C
• vertical installation, min.	-30 °C
• vertical installation, max.	40 °C; Observe derating

Article number	6ES7552-1AA01-0AB0
Altitude during operation relating to sea level	
• Installation altitude above sea level, max.	5 000 m; restrictions for installation altitudes > 2 000 m, see ET 200MP system manual
Decentralized operation	
to SIMATIC S7-1500	Yes
Dimensions	
Width	35 mm
Height	147 mm
Depth	129 mm
Weights	
Weight, approx.	320 g

Derating information for standardized total current of outputs

If the digital outputs of the module are operated with resistive loads, you should derate the standardized total current of the loads at the digital outputs for each load group of the technology module. The standardized total current is the standardized total of the mean output currents at all digital outputs and encoder supplies related to its nominal current in each case.

You should derate only if the system is mounted vertically. The following derating curve shows the load capacity of the digital outputs for each load group depending on the ambient temperature and mounting position:



① Vertical installation of the system
② Horizontal installation of the system

Figure 7-1 Standardized total current for each load group depending on ambient temperature and mounting position for resistive loads

Example

The following table shows the calculation of the standardized total current for each load group for the channel configuration "3 inputs, 13 outputs":

Table 7- 1 Calculation of the standardized total current (1L+)

Load group of the supply voltage 1L+					
Digital output	**Use as encoder supply**	**High-speed output (0.1 A)**	**Output current**		
			Nominal value according to parameter assignment	**Mean value**	**Mean value in relation to the nominal value**
DQ0	Yes	—	0.5 A	0.3 A	60 %
DQ1	Yes	—	0.5 A	0.4 A	80 %
DQ2	No	No	0.5 A	0.5 A	100 %
DQ3	Yes	—	0.5 A	0.4 A	80 %
DQ4	No	Yes	0.1 A	0.05 A	50 %
DQ5	No	No	0.5 A	0.15 A	30 %
DQ6	No	Yes	0.1 A	0.09 A	90 %
DQ7	No	No	0.5 A	0.35 A	70 %
Total					560 %
Standardized total current = total / number of outputs = 560 % / 8 outputs					**70 %**

Table 7- 2 Calculation of the standardized total current (2L+)

Load group of the supply voltage 2L+					
Digital output	**Use as encoder supply**	**High-speed output (0.1 A)**	**Output current**		
			Nominal value according to parameter assignment	**Mean value**	**Mean value in relation to the nominal value**
DQ8	—	Yes	0.1 A	0.05 A	50 %
DQ9	—	Yes	0.1 A	0.07 A	70 %
DQ10	—	No	0.5 A	0.5 A	100 %
DQ11	—	No	0.5 A	0.4 A	80 %
DQ12	—	Yes	0.1 A	0.09 A	90 %
DQ13	—	No	0.5 A	0.15 A	30 %
DQ14	—	Yes	0.1 A	0.04 A	40 %
DQ15	—	No	0.5 A	0.25 A	50 %
Total					510 %
Standardized total current = total / number of outputs = 510 % / 8 outputs					**64 %**

For the determination of the maximum ambient temperature for the technology module, the higher standardized total current of the two load groups is considered. In this example, it amounts to 70 %. With a standardized total current of 70 % and vertical mounting of the system, the ambient temperature according to the derating curve may amount to a maximum of approx. 38 °C .

Dimension drawing

A

The dimensional drawing of the module on the mounting rail, as well as a dimensional drawing with open front panel, are provided in the appendix. Always observe the specified dimensions for installation in cabinets, control rooms, etc.

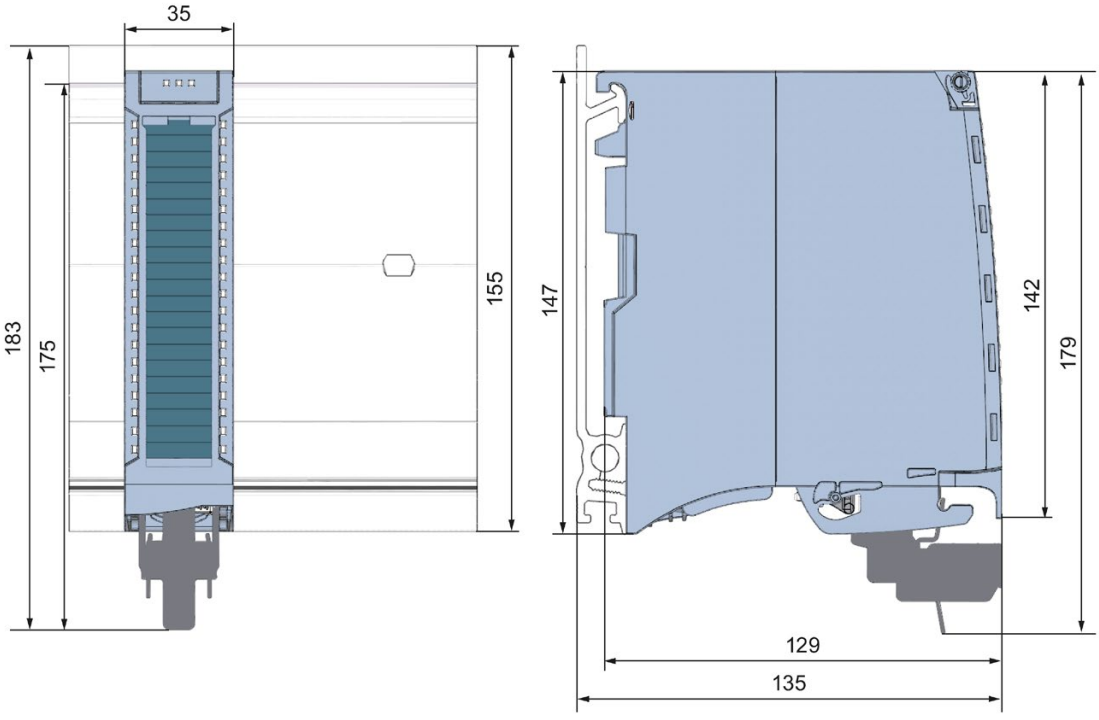


Figure A-1 Dimensional drawing of the TM Timer DIDQ 24x24V technology module

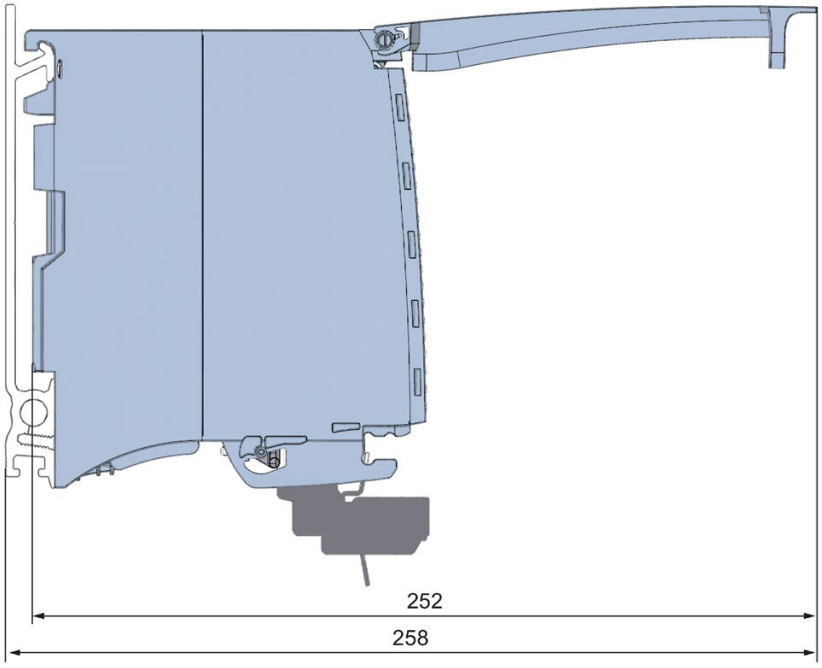


Figure A-2 Dimensional drawing of the TM Timer DIDQ 24x24V module, side view with open front panel

Parameter data record

B

B.1 Parameter assignment and structure of the parameter data record

You have the option of reassigning module parameters with the user program while the CPU is in RUN mode. The parameters are transferred to the module using data record 128, for example with the WRREC instruction.

If errors occur during the transfer or validation of parameters with the WRREC instruction, the module continues operation with the previous parameter assignment. A corresponding error code is then written to the STATUS output parameter.

The description of the WRREC instruction and the error codes is available in the STEP 7 online help (TIA Portal).

NOTICE
TIO instructions If you use the TIO instructions, you must reset them after each writing of the data record 128. To do this, set the TIO_SYNC parameter OperatingState to 0. You can find a detailed description of the TIO instructions in the High-precision input/output with time-based IO function manual available as download on the Internet (http://support.automation.siemens.com/WW/view/en/82527590).

Structure of data record 128 for channel configuration "8 inputs, 16 outputs"

The following table shows the structure of data record 128 for the channel configuration "8 inputs, 16 outputs" of the TM Timer DIDQ 24x24V. The values in byte 0 to byte 3 are fixed and may not be changed.

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Header							
0	Reserved[2)]		Major Version = 1		Minor Version = 0			
1	Length of the parameter data = 52							
2	Reserved[2)]							
3								

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Basic parameters							
4	Reserved[2)]				PWM period for the digital outputs:			
					0000_B: 10 ms			
					0001_B: 5 ms			
					0010_B: 2 ms			
					0011_B: 1 ms			
					0100_B: 0.5 ms			
					0101_B: 0.2 ms			
					0110 to 1111_B: Not permitted			
5	Reserved[2)]					Enable diagnostic interrupt[1)]	Reaction to CPU STOP:	
							00_B: Output substitute value	
							01_B: Keep last value	
							10 to 11_B: Not permitted	
6	Reserved[2)]							
7								
	Channel parameters for DI0							
8	Reserved[2)]		Invert input signal[1]	HW enable with next digital input (for Timer DI)[1]	Operating mode of the digital input:			
					0000_B: Timer DI			
					0001_B: Not permitted			
					0010_B: Oversampling			
					0011_B: Counter			
					0100_B: Incremental encoder (A, B phase-shifted)			
					0101 to 1111_B: Not permitted			
9	Reserved[2)]				Input delay / Filter frequency:			
					0000_B: None			
					0001_B: 0.05 ms			
					0010_B: 0.1 ms			
					0011_B: 0.4 ms			
					0100_B: 0.8 ms			
					0101 to 1110_B: Not permitted			
					1111_B: 50 kHz			
	Channel parameters for DI1							
10	Reserved[2)]		Invert input signal[1]	Reserved[2)]	Operating mode of the digital input:			
					0000_B: Timer DI			
					0001_B: Not permitted			
					0010_B: Oversampling			
					0011_B: Counter			
					0100_B: Incremental encoder (A, B phase-shifted)			
					0101 to 1111_B: Not permitted			

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
11	Reserved[2)]				Input delay:			
					0000B: None			
					0001B: 0.05 ms			
					0010B: 0.1 ms			
					0011B: 0.4 ms			
					0100B: 0.8 ms			
					0101 to 1110B: Not permitted			
					1111B: 50 kHz			
12...13	**Channel parameters for DI2:** See bytes 8 and 9							
14...15	**Channel parameters for DI3:** See bytes 10 and 11							
16...17	**Channel parameters for DI4:** See bytes 8 and 9							
18...19	**Channel parameters for DI5:** See bytes 10 and 11							
20...21	**Channel parameters for DI6:** See bytes 8 and 9							
22...23	**Channel parameters for DI7:** See bytes 10 and 11							
	Channel parameters for DQ0							
24	High-speed output (0.1 A)[1]	Substitute value	Invert the output signal[1]	Reserved[2]	Operating mode of the digital output:			
					0000 to 0111B: Not permitted			
					1000B: Timer DQ			
					1001B: Not permitted			
					1010B: Oversampling			
					1011B: PWM			
					1100 to 1111B: Not permitted			
25	Reserved[2]							
	Channel parameters for DQ1							
26	High-speed output (0.1 A)[1]	Substitute value	Invert the output signal[1]	Reserved[2]	Operating mode of the digital output:			
					0000 to 0111B: Not permitted			
					1000B: Timer DQ			
					1001B: Not permitted			
					1010B: Oversampling			
					1011B: PWM			
					1100 to 1111B: Not permitted			
27	Reserved[2]							
28...29	**Channel parameters for DQ2:** See bytes 24 to 25							
30...31	**Channel parameters for DQ3:** See bytes 26 to 27							
32...33	**Channel parameters for DQ4:** See bytes 24 to 25							

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
34...35	**Channel parameters for DQ5:** See bytes 26 to 27							
36...37	**Channel parameters for DQ6:** See bytes 24 to 25							
38...39	**Channel parameters for DQ7:** See bytes 26 to 27							
40...41	**Channel parameters for DQ8:** See bytes 26 to 27							
42...43	**Channel parameters for DQ9:** See bytes 26 to 27							
44...45	**Channel parameters for DQ10:** See bytes 26 to 27							
46...47	**Channel parameters for DQ11:** See bytes 26 to 27							
48...49	**Channel parameters for DQ12:** See bytes 26 to 27							
50...51	**Channel parameters for DQ13:** See bytes 26 to 27							
52...53	**Channel parameters for DQ14:** See bytes 26 to 27							
54...55	**Channel parameters for DQ15:** See bytes 26 to 27							

[1] You activate the respective parameter by setting the associated bit to 1.

[2] Must be set to 0.

Structure of the data record for other channel configurations

The following table shows you the structure of data record 128 for the other channel configurations of the TM Timer DIDQ 16x24V. The values in byte 0 to byte 3 are fixed and must not be changed.

Table B- 1 Parameter data record 128

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0...3	**Header**							
0	Reserved[2]		Major Version = 0		Minor Version = 1			
1	Length of the parameter data = 36							
2	Reserved[2]							
3								
4...7	**Basic parameters**							
4	Reserved[2]				PWM period for the digital outputs:			
					0000B: 10 ms			
					0001B: 5 ms			
					0010B: 2 ms			
					0011B: 1 ms			
					0100B: 0.5 ms			
					0101B: 0.2 ms			
					0110 to 1111B: Not permitted			
5	Reserved[2]					Enable diagnostic interrupts[1]	Reaction to CPU STOP:	
							00B: Output substitute value	
							01B: Keep last value	
							10 to 11B: Not permitted	
6	Reserved[2]							
7								
8...9	**Channel parameters for DI0**							
8	Reserved[2]		Invert input signal[1]	HW enable with next digital input[1]	Operating mode of the digital input:			
					0000B: Timer DI			
					0001B: Not permitted			
					0010B: Oversampling			
					0011B: Counter			
					0100B: Incremental encoder (A, B phase-shifted)			
					0101 to 1111B: Not permitted			
9	Reserved[2]				Input delay / Filter frequency:			
					0000B: None			
					0001B: 0.05 ms			
					0010B: 0.1 ms			
					0011B: 0.4 ms			
					0100B: 0.8 ms			
					0101 to 1110B: Not permitted			
					1111B: 50 kHz			

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
8...9	**Channel parameters for DQ0**							
8	High-speed output (0.1 A)[1]	Substitute value	Invert output signal[1]	HW enable with next digital input[1]	Operating mode of the digital output:			
					0000 to 0111B: Not permitted			
					1000B: Timer DQ			
					1001B: Not permitted			
					1010B: Oversampling			
					1011B: PWM			
					1100 to 1111B: Not permitted			
9	Reserved[2]							
10...11	**Channel parameters for DI1**							
10	Reserved[2]		Invert input signal[1]	Reserved[2]	Operating mode of the digital input:			
					0000B: Timer DI			
					0001B: Not permitted			
					0010B: Oversampling			
					0011 to 1111B: Not permitted			
11	Reserved[2]				Input delay:			
					0000B: None			
					0001B: 0.05 ms			
					0010B: 0.1 ms			
					0011B: 0.4 ms			
					0100B: 0.8 ms			
					0101 to 1111B: Not permitted			
10...11	**Channel parameters for DQ1**							
10	High-speed output (0.1 A)[1]	Substitute value	Invert output signal[1]	Reserved[2]	Operating mode of the digital output:			
					0000 to 0111B: Not permitted			
					1000B: Timer DQ			
					1001B: Not permitted			
					1010B: Oversampling			
					1011B: PWM			
					1100 to 1111B: Not permitted			
11	Reserved[2]							
12...13	**Channel parameters for DI2/DQ2:** See bytes 8 and 9							
14...15	**Channel parameters for DI3/DQ3:** See bytes 10 and 11							
16...17	**Channel parameters for DI4/DQ4:** See bytes 8 and 9							
18...19	**Channel parameters for DI5/DQ5:** See bytes 10 and 11							
20...21	**Channel parameters for DI6/DQ6:** See bytes 8 and 9							
22...23	**Channel parameters for DI7/DQ7:** See bytes 10 and 11							

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
24...25	**Channel parameters for DQ8:** See bytes 10 and 11							
26...27	**Channel parameters for DQ9:** See bytes 10 and 11							
28...29	**Channel parameters for DQ10:** See bytes 10 and 11							
30...31	**Channel parameters for DQ11:** See bytes 10 and 11							
32...33	**Channel parameters for DQ12:** See bytes 10 and 11							
34...35	**Channel parameters for DQ13:** See bytes 10 and 11							
36...37	**Channel parameters for DQ14:** See bytes 10 and 11							
38...39	**Channel parameters for DQ15:** See bytes 10 and 11							

[1] You activate the respective parameter by setting the corresponding bit to 1.

[2] Must be set to 0.

Counting

The following table shows the properties for counting that you can set in the channel parameters of the respective digital input:

Table B- 2 Setting options for counting

Operating mode for counting	**Usable digital inputs**	**"Invert input signal" set to...**	
		0	**1**
Counter (0011_B)	• DI0 • DI2 • DI4 • DI6	Counting of **rising** edges	Counting of **falling** edges
Incremental encoder (A, B phase-shifted) (0100_B)	• DI0 with DI1 (all bits of the channel parameters for DI1 are set to 0) • DI2 with DI3 (all bits of the channel parameters for DI3 are set to 0) • DI4 with DI5 (all bits of the channel parameters for DI5 are set to 0) • DI6 with DI7 (all bits of the channel parameters for DI7 are set to 0)	Counting direction **not inverted**	Counting direction **inverted**

Hardware enable (HW enable)

You can use a hardware enable by an enable input for the operating modes "Timer DI" and "Timer DQ". You set a hardware enable with bit 4 of the respective channel parameter.

Depending on the channel configuration, you can set a hardware enable for the following inputs/outputs:

Table B- 3 Hardware enable options

Channel configuration "8 Inputs, 16 outputs"	**Other channel configuration**	**Hardware enable by digital input...**
Digital input	**Digital input / digital output**	
DI0	DI0 or DQ0	DI1
DI2	DI2 or DQ2	DI3
DI4	DI4 or DQ4	DI5
DI6	DI6 or DQ6	DI7

You set a hardware enable with the channel parameters of the enable input "Operating mode" and "Invert" signal input:

Table B- 4 Setting options for enable input

Operating mode	**"Invert input signal" set to...**	
	0	**1**
Oversampling (0010B)	Hardware enable by **High** level	Hardware enable by **Low** level
Timer DI (0000B)	Only when used with the "Motion Control" technology object	

Input filter

The following overview shows the input filters that can be set for specific operating modes of a digital input:

Table B- 5 Setting options for the input filter

Operating mode of the digital input	**Type of input filter**	**Assignable values**
• Timer DI (0000B) • Oversampling (0010B)	Input delay	• None • 0.05 ms • 0.1 ms • 0.4 ms • 0.8 ms
• Counter (0011B) • Incremental encoder (A, B phase-shifted) (0100B)	Filter frequency	50 kHz (cannot be changed)

B.2 Parameter validation error with data record 128

If you make the parameter setting in STEP 7 (TIA Portal), the parameter values are checked before they are transferred to the technology module. This process prevents parameter errors.

In other use cases, the technology module checks the transferred data record. If the technology module finds invalid or inconsistent parameter values, it outputs an error code (see below). The new data record is rejected in this case, and work continues with the current parameter values until a valid data record has been transferred.

WRREC

When the CPU is in the operating state RUN, you can change the data record with the instruction WRREC (Write Record). In case of errors, the WRREC instruction returns corresponding error codes in the STATUS parameter.

Example:

Let us assume that by running WRREC, an illegal value, such as 8, is written to the module for the operating mode of a digital input. As a consequence, the module rejects the entire data record. You can recognize this by evaluating the STATUS output parameter of the WRREC instruction. The STATUS output parameter is output as an ARRAY[1..4] of BYTE data with the value 16#DF80E111:

Example of WRREC STATUS data	Address	Meaning
DF_H	STATUS[1]	Error while writing a data record in central or distributed operation via PROFINET/PROFIBUS (IEC 61158-6)
80_H	STATUS[2]	Error occurred reading or writing a data record in a central or distributed operation via PROFINET/PROFIBUS (IEC 61158-6)
$E1_H$	STATUS[3]	Module-specific error
11_H	STATUS[4]	Error code from the table below: A DIm that digital input used was configured as a DQm.

Error codes

The following table shows the module-specific error codes and their meaning for data record 128.

Error code in the STATUS parameter (hexadecimal)				Meaning	Remedy
Byte 0	**Byte 1**	**Byte 2**	**Byte 3**		
DF	80	B0	00	Data record number unknown	Enter valid number for data record
DF	80	B1	01	Length of data record incorrect	• Enter value 56D for channel configuration "8 Inputs, 16 outputs" • Enter value 40D for a different channel configuration.
DF	80	B2	00	Slot invalid or not accessible	• Check whether module is inserted or removed. • Check assigned values for parameters of the WRREC instruction.
DF	80	E0	01	Wrong version	• Check byte 0. • Enter valid values.
DF	80	E0	02	Length of the parameter data not correct	• Enter value 52D for channel configuration "8 Inputs, 16 outputs" • Enter value 36D for different channel configuration.
DF	80	E1	FE	Channel configuration does not match the version	Enter the version that matches the channel configuration.
DF	80	E1	11	DIm used configured as DQm	DIm used configured as DIm.