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SIMATIC

S7-1500/ET 200MP

Technology Module TM Timer DIDQ 16x24V (6ES7552-1AA00-0AB0)

Device manual

Version 08/2014

Answers for industry.

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ET 200MP/S7-1500 Technology module TM Timer DIDQ 16x24V (6ES7552-1AA00-0AB0)

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Siemens AG
Industry Sector
Postfach 48 48
90026 NÜRNBERG
GERMANY

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Preface

Purpose of the documentation

This manual includes module-specific information on wiring, diagnostics and the technical specifications of the technology module.

General information regarding design and commissioning of the ET 200MP or S7-1500 is available in the ET 200MP or S7-1500 system manuals.

The "Time-based IO" technology supported by the TM Timer DIDQ 16x24V 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).

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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.

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Table of contents

Documentation guide

1

Introduction

This modular documentation of the SIMATIC products covers diverse topics concerning your automation system.

The complete documentation for the ET 200MP and S7-1500 systems consists of the respective system manuals, function manuals and device manuals.

The STEP 7 information system (TIA Portal) also helps you to configure and program your automation system.

Overview of the documentation for TM Timer DIDQ 16x24V technology module

The following table lists further documentation that you will need when using the TM Timer DIDQ 16x24V technology module.

Table 1- 1 Documentation for TM Timer DIDQ 16x24V technology module

Topic	Documentation	Most important contents
System description	System Manual ET 200MP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/59193214)	• Application planning • Installation • Connecting • Commissioning
	S7-1500 Automation System (http://support.automation.siemens.com/WW/view/en/59191792) system manual	
Configuring interference-free controllers	Designing interference-free controllers (http://support.automation.siemens.com/WW/view/en/59193566) Function Manual	• Basics • Electromagnetic compatibility • Lightning protection
Time-based IO	Function manual High-precision input/output with Time-based IO (http://support.automation.siemens.com/WW/view/en/82527590)	• Basics • Configuration • Programming • Diagnostics
Isochronous mode	PROFINET with STEP 7 (http://support.automation.siemens.com/WW/view/en/49948856) function manual	• Benefits • Use • Parameter settings

SIMATIC manuals

All current manuals for the SIMATIC products are available for download free of charge from the Internet (http://www.siemens.com/automation/service&support).

Product overview

2

2.1 Properties

Article number

6ES7552-1AA00-0AB0

View of the module

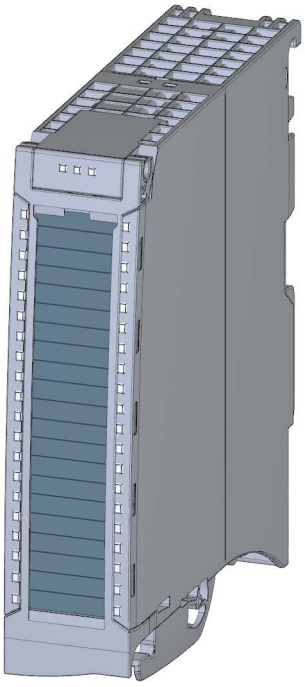


Figure 2-1 View of the TM Timer DIDQ 16x24V module

Properties

The TM Timer DIDQ 16x24V technology module has the following properties:

- Technical properties
  - 16 digital inputs and outputs, electrically isolated in groups of 8
  - Various combinations of digital inputs and outputs can be configured:
    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
  - Configurable substitute values (per digital output)
  - Two supply voltages L+
  - Configurable diagnostics
  - 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
- Supported functions
  - Time stamp function for inputs and outputs (resolution 1 µs)
  - Counting (counting range 32-bit)
  - Oversampling for inputs and outputs
  - Pulse width modulation
- Supported system functions
  - Isochronous mode
  - Firmware Update
  - Identification data I&M

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

2.2 Functions

2.2.1 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)

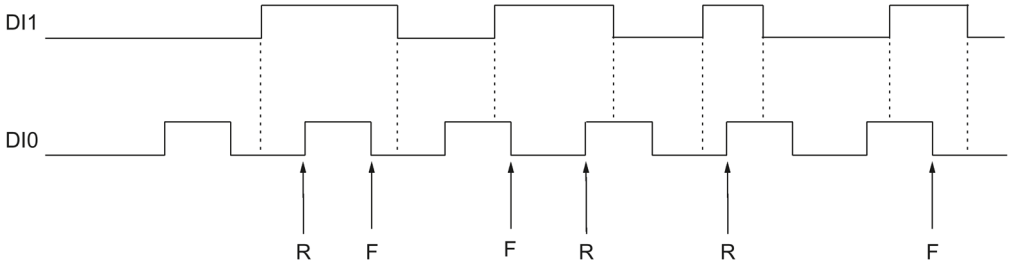
The technology module can detect an associated time stamp for an edge at a digital input. The time stamp indicates when the edge was detected in relation to a time base. These time stamps can be used, for example, to calculate a time difference.

The time stamp is based on the "Time-based IO" technology supported by the technology module and requires isochronous mode.

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. You can override the hardware enable via the control interface (Page 33) with the respective SETEN bit.

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.

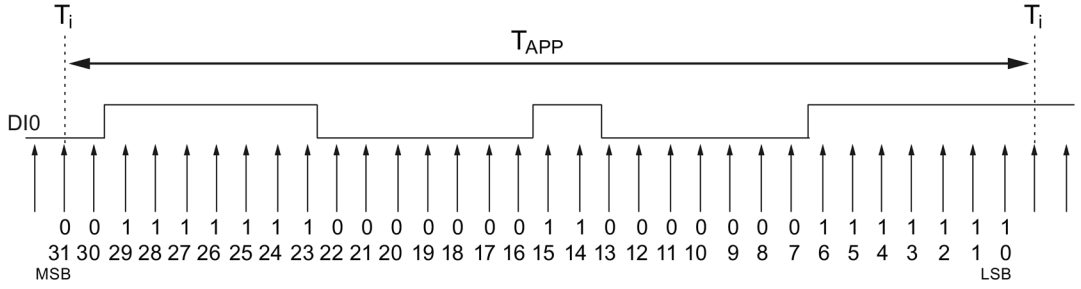
A counter starts at 0, goes up to 2^{32}-1 and starts again at 0 (overflow). The technology module can also count down if an incremental encoder is used. The counter value is returned in the feedback interface (Page 37) as a 32-bit value for each digital input.

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 37) as a 32-bit value.

Oversampling requires isochronous mode. If the OB of the type "Synchronous Cycle" works with a clock different than the send clock, you must use the TIO_SYNC instruction.

The figure below shows an example for Oversampling of DI0:



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

2.2.2 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)

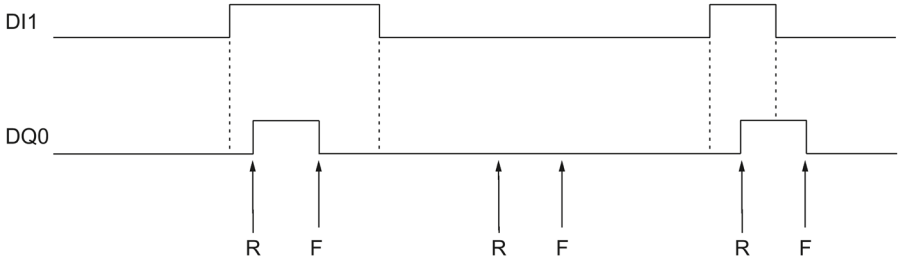
The use of time stamps enables reproducibility of controlled operations with very accurate time. Using this function, the technology module outputs edges at the respective digital output at precisely defined points in time. For example, you can implement a defined reaction time between input and output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

The Timer function is based on Time-based IO and requires isochronous mode.

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. You can override the hardware enable via the control interface (Page 33) with the respective SETEN bit.

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 33) for the respective digital output. The setpoint for the pulse-pause ratio is a percentage and is evaluated with an accuracy of about 3%.

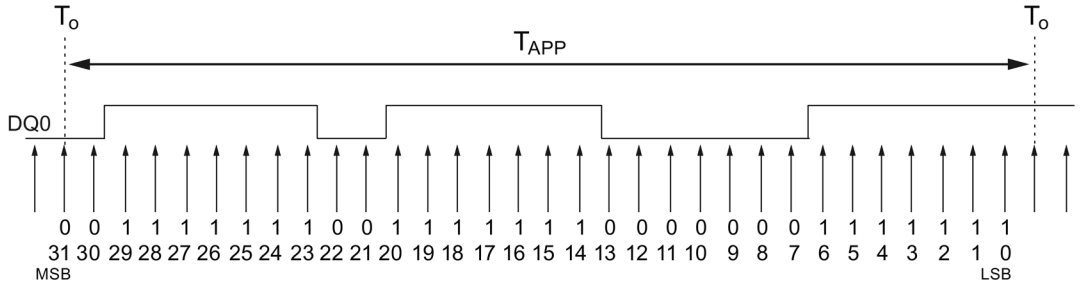
Oversampling

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 33) as a 32-bit string for the respective digital output to the technology module.

Oversampling requires isochronous mode. If the OB of the type "Synchronous Cycle" works with a clock different than the send clock, you must use the TIO_SYNC instruction.

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.

2.2.3 Additional functions

Isochronous mode

The technology module supports the system function "isochronous mode" in distributed mode on PROFINET. 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

In isochronous mode, the cycle of the user program, the transmission of the input signals and processing in the technology module are synchronized.

Data processing

The time stamp, counter values and Oversampling bit string 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.

Diagnostic interrupt

The technology module can trigger a diagnostic interrupt (Page 44), among other things, if no supply voltage is available or if there is an error at the digital outputs.

Input filter

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

Distributed application

You can use the technology module in a distributed system by means of an interface module in the ET 200MP distributed I/O device. The following applications are possible:

- Distributed operation in an S7-1500 system
- Distributed operation in an S7-300/400 system

Centralized application

You can use the technology module centrally in the S7-1500 automation system.

Connecting

3

3.1 Pin assignment

You connect the encoder signals, digital input and digital output signals, encoder supplies and the supply voltage to the 40-pin front connector of the technology module to supply the module and the digital outputs.

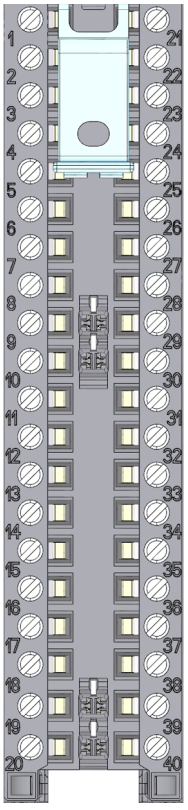
Information on wiring the front connector, creating the cable shield, etc. is available in the ET 200MP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/59193214) system manual and in the Connecting section of the S7-1500 Automation System (http://support.automation.siemens.com/WW/view/en/59191792) system manual.

Pin assignment for the front connector

The pin assignment of the front connector depends on the channel configuration of the TM Timer DIDQ 16x24V.

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

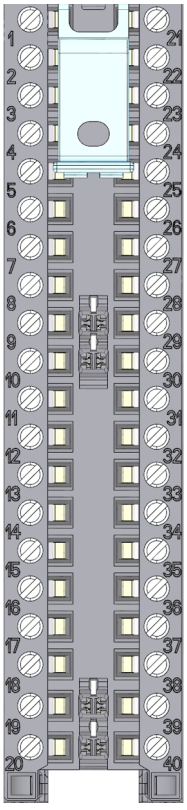
Table 3- 1 Pin assignment of the front connector , channel configuration "0 inputs, 16 outputs"

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
Supply voltage DC 24 V for digital outputs DQ0 to DQ7*	1L+	19		39	2L+	Supply voltage DC 24 V for digital outputs DQ8 to DQ15*
Ground for supply voltage 1L+	1M	20		40	2M	Ground for supply voltage 2L+

* 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".

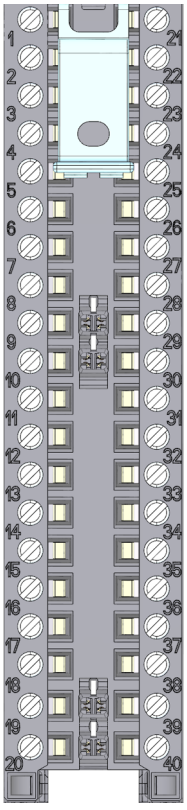
Table 3- 2 Pin assignment of the front connector , channel configuration "3 inputs, 13 outputs"

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
Supply voltage DC 24 V for digital inputs DI0, DI1 and DI3 and digital outputs DQ2 and DQ4 to DQ7*	1L+	19		39	2L+	Supply voltage DC 24 V for digital outputs DQ8 to DQ15*
Ground for supply voltage 1L+	1M	20		40	2M	Ground for supply voltage 2L+

* 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".

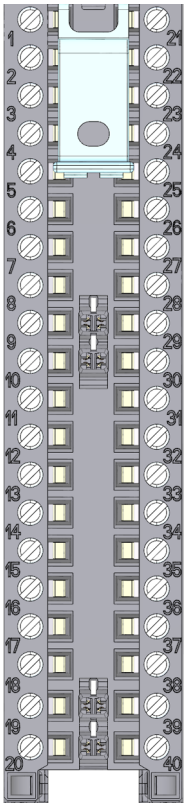
Table 3- 3 Pin assignment of the front connector , channel configuration "4 inputs, 12 outputs"

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
Supply voltage DC 24 V for digital inputs DI1, DI3, DI5 and DI7 and digital outputsDQ0, DQ2, DQ4 and DQ6*	1L+	19		39	2L+	Supply voltage DC 24 V for digital outputs DQ8 to DQ15*
Ground for supply voltage 1L+	1M	20		40	2M	Ground for supply voltage 2L+

* 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".

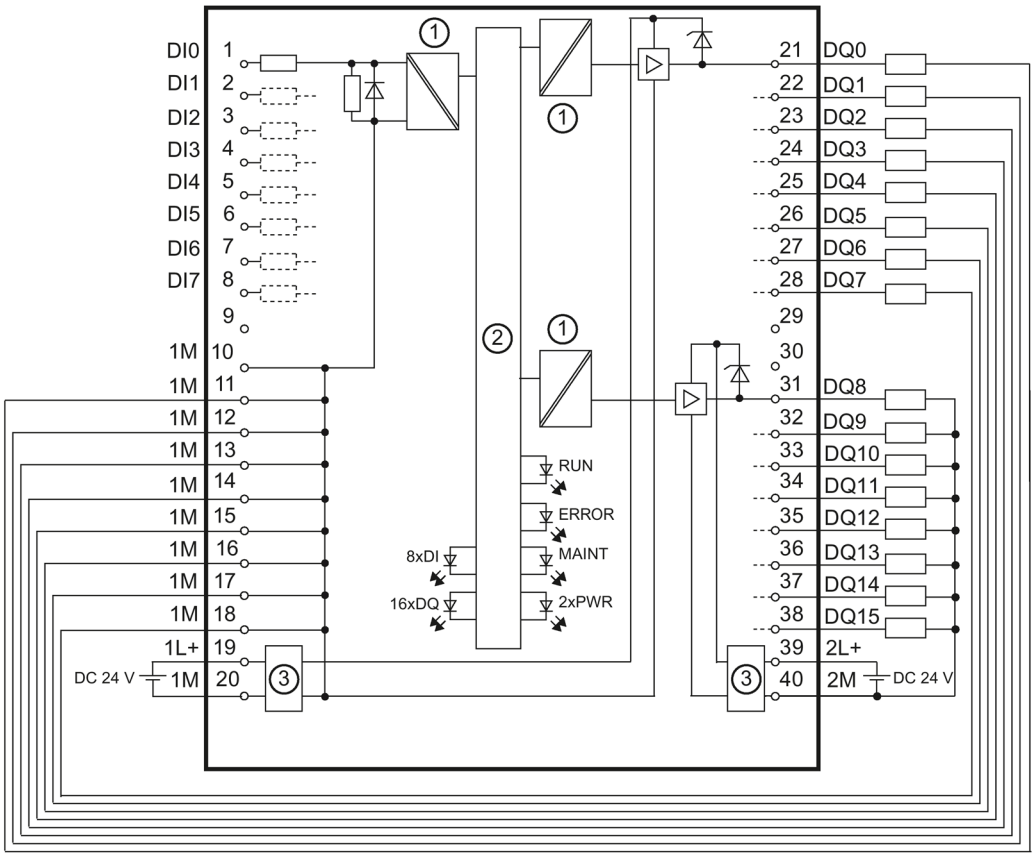
Table 3- 4 Pin assignment of the front connector , channel configuration "8 inputs, 8 outputs"

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
Supply voltage DC 24 V for digital inputs DI0 to DI7*	1L+	19		39	2L+	Supply voltage DC 24 V for digital outputs DQ8 to DQ15*
Ground for supply voltage 1L+	1M	20		40	2M	Ground for supply voltage 2L+

* 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.

Block diagram

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

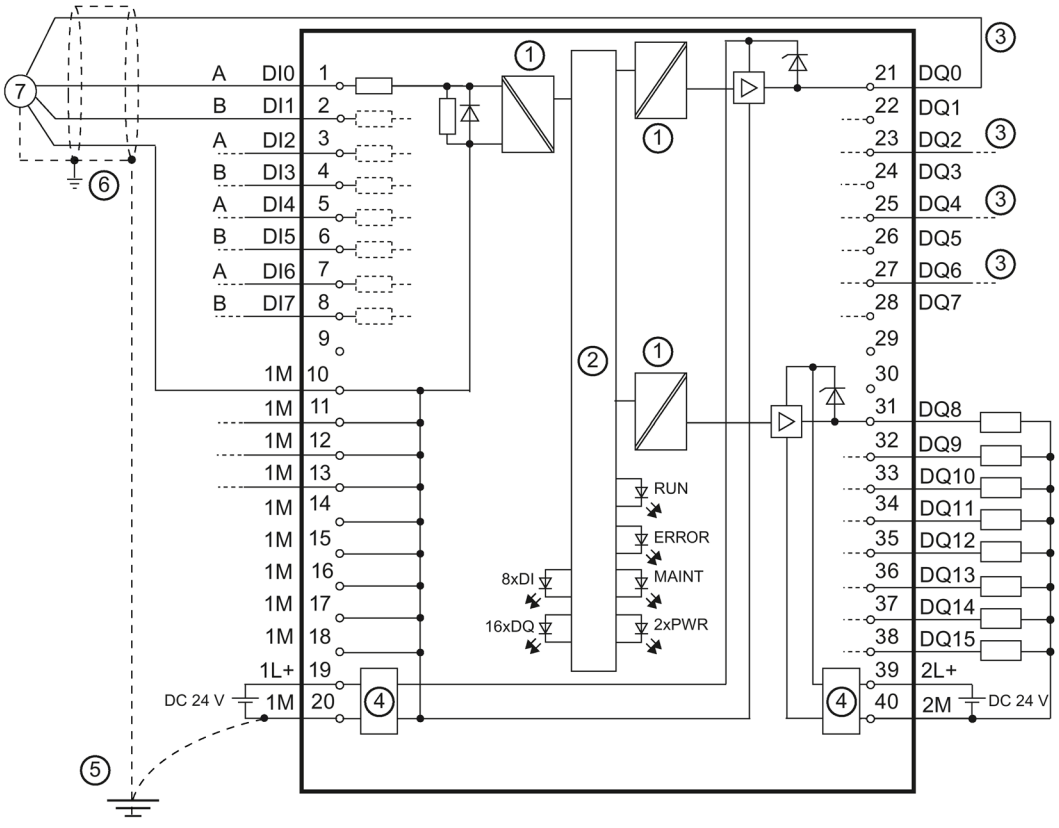


① Electrical isolation
② Technology and backplane bus interface
③ Input filter for supply voltage

Figure 3-1 Block diagram for use of 16 digital outputs

When you connect the encoder you must, depending on the configured input delay and potential effect of interference, ground the shields of the cables between encoder and technology module both through the shield connection element at the front connector (shield bracket and terminal) and at the encoder.

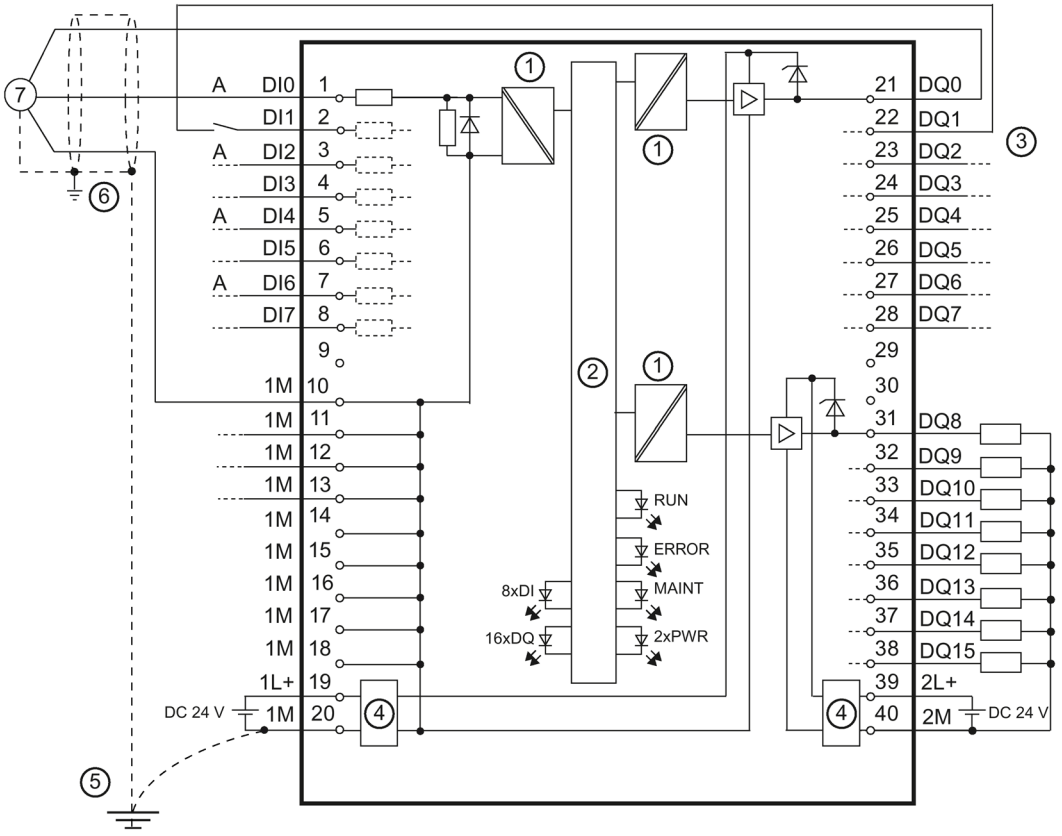
The figure below shows the block diagram of the technology module with four connected incremental encoders.



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
⑥ Shield support at the front connector
⑦ Incremental encoder with A and B signals

Figure 3-2 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
⑥ Shield support at the front connector
⑦ Pulse encoder with signal A

Figure 3-3 Block diagram with pulse encoders and sensors

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 electrically isolating the supply to the inputs and outputs via the terminal pairs 19 and 20 and 39 and 40.

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 45). 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.

Note

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

Digital inputs DI0 to DI7

You can use three, four or eight digital inputs, whereby the number of digital outputs that can be used is reduced accordingly. The technology module can evaluate the edges at the digital inputs for the following functions:

Table 3- 5 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	—	✓	—	✓	—	✓	—	✓
Hardware enable for time-controlled switching	—	✓	—	✓	—	✓	—	✓
Counting with incremental encoder with signals A and B	✓	✓	✓	✓	✓	✓	✓	✓
Counting with pulse encoder with signal A	✓	—	✓	—	✓	—	✓	—
Oversampling	✓	✓	✓	✓	✓	✓	✓	✓

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.

Input filters for digital inputs

You can configure an input filter for each digital input to suppress interference. Signals with a pulse duration below the configured input delay are suppressed.

You can specify the following values for the input delay:

- None
  (input delay of 4 µs, minimum pulse width of 3 µs)
- 0.05 ms
- 0.1 ms (default)
- 0.4 ms
- 0.8 ms

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

Table 3- 6 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 select the "None" or "0.05 ms" option, you have to use shielded cables for connection of the digital inputs. To increase the accuracy of the time stamp function, we recommend the use of shielded cables even for longer input delays. The use of shielded cables limits the jitter to maximum of 1 µs.

Encoder supply

When you use the digital inputs, you can connect incremental encoders and pulse encoders. The terminal opposite the digital input provides the respective DC 24 V supply voltage with reference to 1M and a rated load current of 0.5 A to supply an encoder. The voltage is fed from the 1L+/1M supply voltage and monitored for short-circuit 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 outputs DQ0 to DQ15

You can use 8, 12, 13 or 16 digital outputs, whereby the number of digital inputs that can be used is reduced accordingly. 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.

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.

Note

Relays and contactors can be connected direct without external circuitry.

Configuring/address space

4

4.1 Configuring

Introduction

The technology module is configured and assigned parameters with the configuration software.

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:

Table 4- 1 Applications of the technology module with PROFINET IO

Applications	Components required	Configuration software	In the user program
Distributed operation in an S7-1500 system	• S7-1500 automation system • ET 200MP distributed I/O system • TM Timer DIDQ 16x24V	STEP 7 (TIA Portal): Device configuration and parameter settings with hardware configuration (HWCN)	Time stamp functions: TIO instructions TIO_SYNC, TIO_DI and TIO_DQ Counting, PWM and Oversampling: Direct access to the control and feedback interface (Page 33) of the TM Timer DIDQ 16x24V in the I/O data
Central operation in an S7-1500 system	• S7-1500 automation system • TM Timer DIDQ 16x24V	STEP 7 (TIA Portal): Device configuration and parameter settings with hardware configuration (HWCN)	Counting and PWM: Direct access to the control and feedback interface (Page 33) of the TM Timer DIDQ 16x24V in the I/O data
Distributed operation in an S7-300/400 system	• S7-300/400 automation system • ET 200MP distributed I/O system • TM Timer DIDQ 16x24V	STEP 7 (TIA Portal): Device configuration and parameter settings with hardware configuration (HWCN)	Time stamp functions*, counting, PWM and Oversampling: Direct access to the control and feedback interface (Page 33) of the TM Timer DIDQ 16x24V in the I/O data

* 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:

- 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)
- In the STEP 7 (TIA Portal) information system under "Using technology functions > Counting, measurement and position input > Counting, measurement and position input (S7-1500)"

4.2 Reaction to CPU STOP

You set the response of the technology module to CPU STOP for each channel in the basic parameters.

Table 4- 2 Response of the technology module to CPU STOP depending on parameter assignment

Reaction to CPU STOP	Meaning
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.

4.3 Address space

Address space of the technology module

Table 4- 3 Range of the input addresses and output addresses of the TM Timer DIDQ 16x24V

	Inputs	Outputs
Range	44 bytes	74 bytes

Additional information

A description on how to use the control and feedback interface of TM Timer DIDQ 16x24V can be found in the chapter Control and feedback interface (Page 33).

4.4 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. You can change the parameter assignment in the user program using data record 128 (Page 56).

Parameters of the TM Timer DIDQ 16x24V

You can configure the following parameters:

Table 4- 4 Configurable parameters and their defaults

Parameter	Value range	Default setting
Basic parameters		
Channel configuration of the module	• 0 inputs, 16 outputs • 3 inputs, 13 outputs • 4 inputs, 12 outputs • 8 inputs, 8 outputs	0 inputs, 16 outputs
PWM period for the digital outputs	• 10 ms • 5 ms • 2 ms • 1 ms • 0.5 ms • 0.2 ms	10 ms
Reaction to CPU STOP	• Output substitute value • Keep last value	Output substitute value

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

4.5 Control and feedback interface

Direct access to the control and feedback interface on the PROFINET is not necessary for distributed operation in a S7-1500 system to use the time stamp functions. The TIO instructions TIO_SYNC, TIO_DI and TIO_DQ are available for this case. You can find a detailed description of the use 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).

Additional information on using the control and feedback interface is available in the section Configuring (Page 29).

4.5.1 Assignment of the control interface

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

Control interface

The following table shows control interface assignment:

Table 4- 5 Control interface of the technology module

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

Offset to the start address	Parameter	Meaning		
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; bits must be set to 0
		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 per-centage
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)			

Offset to the start address	Parameter		Meaning
Byte 68	SEL (DI1)	EDGESEL	Bits 5...7: edge selection for time stamp detection DI1:
			000_B: Reserved
			001_B: Rising edges only
			010_B: Falling edges only
			011_B: Rising and falling edge (order depending on occurrence)
			100_B: Reserved
			101_B: First rising, then falling edge
			110_B: First falling, then rising edge
			111_B: Reserved
		REARM	Bit 4: cyclic time stamp detection for DI1
	SEL (DI0)	EDGESEL	Bits 0...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...11: Reserved; bits must be set to 0
		SYN	Bit 0: Synchronization of the module with the user program

Notes on the control bits

Control bit	Notes
SEL (DIm)	This value is supplied by the TIO instruction TIO_DI.
SET_DQm	You can use this bit to set the DQm digital output 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.
STW	This value is controlled by the TIO instruction TIO_SYNC. Detailed information is available on request.
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.

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.

4.5.2 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

The following table shows the assignment of the feedback interface:

Table 4- 6 Feedback interface of the technology module

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/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	Parameter		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: Number of the respective DI or DQ
		Channel mode	Bits 0 to 3: Operating mode of the respective DI or DQ

Notes on the feedback bits

Feedback bit	Notes
STS_DI (DIm)	This bit indicates the status of respective digital input DIm.
EN (DIm/DQm)	This bit indicates that • The respective digital input is active as Timer DI and, if required, is enabled, or • The respective digital output is active as Timer DQ and, if required, is enabled. For digital inputs and digital outputs with the operating modes "Counter", "Oversampling", "Pulse Width Modulation PWM" and for level-controlled hardware enable, this bit is permanently "0".
Layout Property	This value is a module-specific constant and used by the TIO instructions for the recognition of the technology module.
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.
QI (DIm)	This bit indicates that an error has occurred at the respective digital input. 0 means: Supply voltage 1L+ 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 1L+ supply voltage. Refer to the section Diagnostic alarms (Page 45) 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 Diagnostic alarms (Page 45) 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.
ZSW	This value is controlled by the technology module and is used for communication with the TIO instruction TIO_SYNC.

Additional information

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

Interrupts/diagnostic messages

5

5.1 Status and error displays

LEDs

The figure below shows the LEDs (status and error displays) of the TM Timer DIDQ 16x24V.

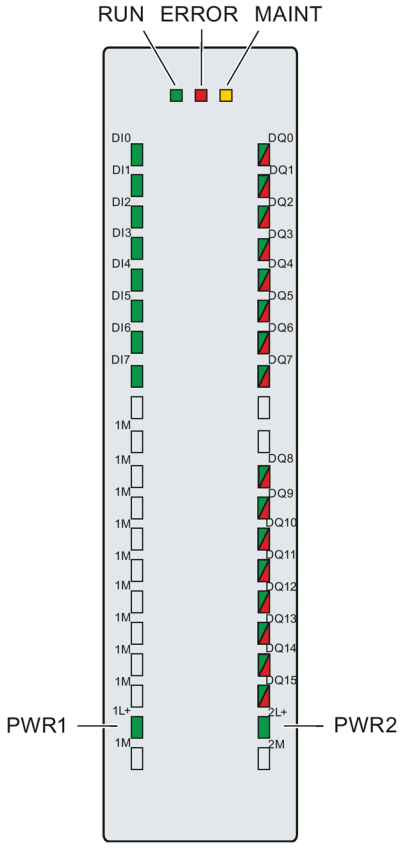


Figure 5-1 LEDs of the TM Timer DIDQ 16x24V

Meaning of the LED displays

The following tables explain the meaning of the status and error displays. Remedial measures for diagnostic alarms can be found in the section Diagnostic alarms (Page 45).

Table 5- 1 Status and error displays RUN/ERROR/MAINT

LEDs			Meaning	To correct or avoid errors
RUN	ERROR	MAINT		
Off	Off	Off	Supply voltage from CPU/power supply module not present or too low	Check or switch on the supply voltage at the PS, at the CPU or at the interface module.
Flashes	Off	Off	The technology module starts and flashes until parameter assignment is complete	—
On	Off	Off	The parameters of the technology module have been assigned.	
On	Flashes	Off	Indicates a group error (at least one error pending)	Evaluate the diagnostic alarms and eliminate the error.
Flashes	Flashes	Flashes	Hardware or firmware defective	Replace the technology module.

Table 5- 2 PWRm/DQm*/ERROR status displays

LEDs			Meaning	To correct or avoid errors
PWRm	DQm*	ERROR		
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	Short-circuit or overload at the encoder supply	• Correct the encoder wiring. • Check the loads connected to the encoder supply.

* Applies for DQ0 to DQ7 when used as encoder supply

ChannelLEDs

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 5- 3 Status displays DIm/DQm*

LEDs DIm/DQm*	Meaning	To correct or avoid errors
□ Off	Digital input / digital output at 0 level	—
■ On	Digital input / digital output at 1 level	—
■ On (DQm)	Diagnostic alarm: e.g. "Error at digital outputs"	Check the wiring or the connected load.

* Applies for DQm when used as digital output

5.2 Trigger a diagnostic interrupt

Enabling the diagnostic interrupts

You enable the diagnostic interrupts at the basic parameters.

The technology module can trigger the following diagnostic interrupts:

Table 5- 4 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	Monitoring is always active. A detected error only triggers a diagnostic interrupt if "Enable diagnostic interrupts" has been enabled in the device parameters. The diagnostic interrupts are not enabled in the default setting.

Reactions to a diagnostic interrupt

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

- The ERROR LED flashes.

  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.

Detailed information on the error event is available with the instruction "RALRM" (read additional interrupt information).

5.3 Diagnostic alarms

Diagnostic alarms

If a diagnostic alarm is pending, the ERROR-LED is flashing.

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 5- 5 Diagnostic alarms, their meaning and remedies

Diagnostic alarm	Error code	Meaning	To correct or avoid errors
Internal error	100_H	Technology module defective	Replace technology module
Watchdog tripped. Module is defective.	103_H	Firmware error	Run firmware update
		Technology module defective	Replace technology module
No supply voltage	$10A_H$	No 1L+ and/or 2L+ supply voltage for the technology module	Feed 1L+ supply voltage (terminal 19) and/or 2L+ (terminal 39) to the technology module
		Front connector not inserted correctly	Insert front connector correctly
Short-circuit or overload at encoder supply	$10E_H$	• Error at encoder supply • Possible causes: – Short-circuit – Overload	• Correct encoder wiring • Check consumers connected to encoder supply
Error at the digital outputs	$10F_H$	• 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	110_H	• 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	506_H	• 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

6

	6ES7552-1AA00-0AB0
Product type designation	TM Timer DIDQ 16x24V
General information	
Product function	
I&M data	Yes; I&M 0
Engineering with	
STEP 7 TIA Portal can be configured/integrated as of version	V13 Update 3
Installation type/mounting	
Rail mounting possible	Yes; S7-1500 mounting rail
Supply voltage	
Load voltage 1L+	
Rated value (DC)	24 V
Low limit of valid range (DC)	19.2 V
High limit of valid range (DC)	28.8 V
Reverse polarity protection	Yes; against destruction
Load voltage 2L+	
Rated value (DC)	24 V
Low limit of valid range (DC)	19.2 V
High limit of valid range (DC)	28.8 V
Reverse polarity protection	Yes; against destruction
Input current	
from load voltage 1L+ (no load), max.	40 mA; without load
from load voltage 2L+ (no load), max.	30 mA; without load
Encoder supply	
Number of outputs	8; max. depending on parameter assignment
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
Power	
Power from the backplane bus	1.3 W
Power loss	
Power loss, typ.	5 W

	6ES7552-1AA00-0AB0
Address area	
Occupied address area	
Inputs	44 bytes
Outputs	74 bytes
Digital inputs	
Number of inputs	8; max. depending on parameter assignment
• In groups of	8
Digital inputs, configurable	Yes
Input characteristics to IEC 61131, Type 3	Yes
Digital input functions, configurable	
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
Hardware enable for digital input	Yes
• Number, max.	4
Hardware enable for digital output	Yes
• Number, max.	4
Input voltage	
Type of input voltage	DC
Rated value, DC	24 V
For signal "0"	-30 V to +5 V
For signal "1"	+11 V to +30 V
Permitted voltage at input, min.	-30 V
Permitted voltage at input, max.	30 V
Input current	
for signal "1", typ.	2.5 mA
Input delay (at rated value of input voltage)	
Minimum pulse width for program reaction	3 µs; with parameter assignment "none"
For standard inputs	
• Configurable	Yes; none / 0.05 / 0.1 / 0.4 / 0.8 ms)
• at "0" to "1", min.	4 µs; with parameter assignment "none"
• at "1" to "0", min.	4 µs; with parameter assignment "none"

	6ES7552-1AA00-0AB0
Cable length	
Cable length shielded, max.	1000 m; depending on sensor, cable quality and edge slope
Cable length unshielded, max.	600 m; depending on sensor, cable quality and edge slope
Digital outputs	
Type of digital output	Transistor
Number of outputs	16; max. depending on parameter assignment
• In groups of	8
M switching	Yes; with high-speed output
Sourcing	Yes
Digital outputs, configurable	Yes
Short-circuit protection	Yes; electronic/thermal
• Response threshold, typ.	1.7 A with standard output; 0.5 A with high-speed output
Limiting of inductive shutdown voltage to	-0.8 V
Control of a digital input	Yes
Digital output functions, configurable	
Digital output with time stamp	Yes
• Number, max.	16
PWM output	Yes
• Number, max.	16
Digital output with oversampling	Yes
• Number, max.	16
Output switching capacity	
With resistive load, max.	0.5 A; 0.1 A with high-speed output
With lamp load, max.	5 W; 1 W with high-speed output
Load resistance range	
Low limit	48 Ω; 240 Ohm with high-speed output
High 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)
Output current	
for signal "1" rated value	0.5 A; 0.1 A with high-speed output, note derating
for signal "1" permissible range, max.	0.6 A; 0.12 A with high-speed output, note derating
for signal "1" minimum load current	2 mA
for signal "0" residual current, max.	0.5 mA

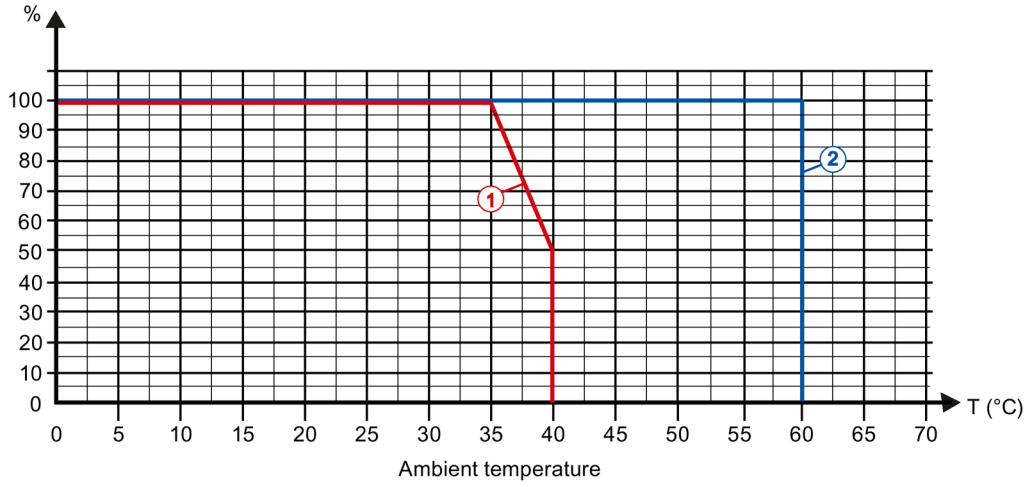
	6ES7552-1AA00-0AB0
Output delay with resistive load	
"0" to "1", max.	1 µs; for high-speed output, 5 µs with standard output
"1" to "0", max.	1 µs; for high-speed output, 6 µs with standard output
Switching frequency	
With resistive load, max.	10 kHz
With lamp load, max.	10 Hz
Total current of outputs	
Max. current per group	4 A
Max. current per module	8 A; note derating
Cable length	
Cable length shielded, max.	1000 m; depending on load and cable quality
Cable length unshielded, max.	600 m; depending on load and cable quality
Encoders	
Supported encoders	
Incremental encoder (asymmetric)	Yes
24 V initiator	Yes
2-wire sensor	Yes
• Permitted quiescent current (2-wire sensor), max.	1.5 mA
Encoder signals, incremental encoders (asymmetrical)	
Input voltage	24 V
Input frequency, max.	50 kHz
Counting frequency, max.	200 kHz; with quadruple evaluation
Cable length shielded, max.	600 m; depends on input frequency, encoder and cable quality; max. 200 m with 50 kHz
Incremental encoder with A/B tracks, phase-shifted by 90°	Yes
Pulse encoder	Yes
24 V encoder signal	
• Permitted voltage at input, min.	-30 V
• Permitted voltage at input, max.	30 V
Interface hardware	
Input characteristics to IEC 61131, Type 3	Yes
Isochronous mode	
Isochronous mode (application synchronized until terminal)	Yes
Bus cycle time (TDP), min.	250 µs
Jitter, max.	1 µs

	6ES7552-1AA00-0AB0
Interrupts/diagnostics/status information	
Activation of substitute values	Yes
Interrupts	
Diagnostic interrupt	Yes
Diagnostic alarms	
Diagnostics	Yes
Monitoring of supply voltage	Yes
Short-circuit	Yes
LED diagnostics display	
RUN LED	Yes; green LED
ERROR LED	Yes; red LED
MAINT LED	Yes; yellow LED
Monitoring of supply voltage (PWR LED)	Yes; green LED
Channel status display	Yes; green LED
For channel diagnostics	Yes; red LED
Integrated functions	
Number of counters	4
Counting frequency (counters), max.	200 kHz; with quadruple evaluation
Counting functions	
Continuous counting	Yes
Electrical isolation	
Electrical isolation channels	
Between the channels and the backplane bus	Yes
Permitted potential difference	
Between different circuits	75 V DC / 60 V AC (basic isolation)
Isolation	
Isolation tested with	707 V DC (type test)
Ambient conditions	
Operating temperature	
Horizontal installation, min.	0 °C
Horizontal installation, max.	60 °C
Vertical installation, min.	0 °C
Vertical installation, max.	40 °C; note derating
Distributed operation	
At 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 TM Timer DIDQ 16x24V 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 6-1 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 6- 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 6- 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.

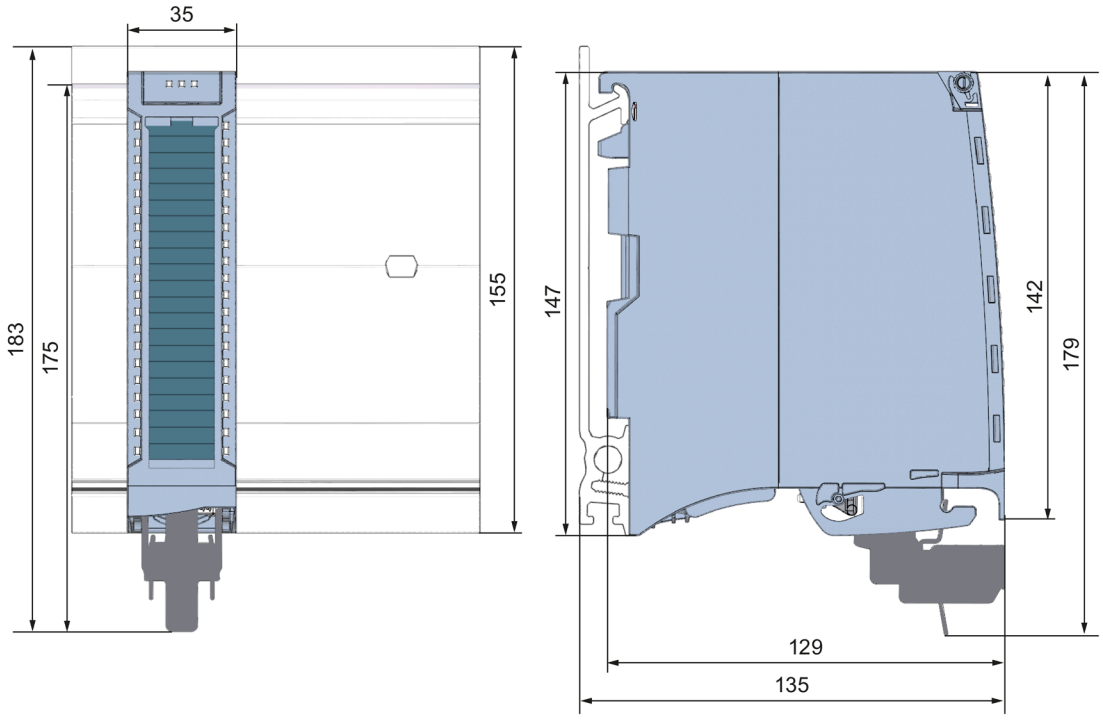


Figure A-1 Dimensional drawing of the TM Timer DIDQ 16x24V technology module

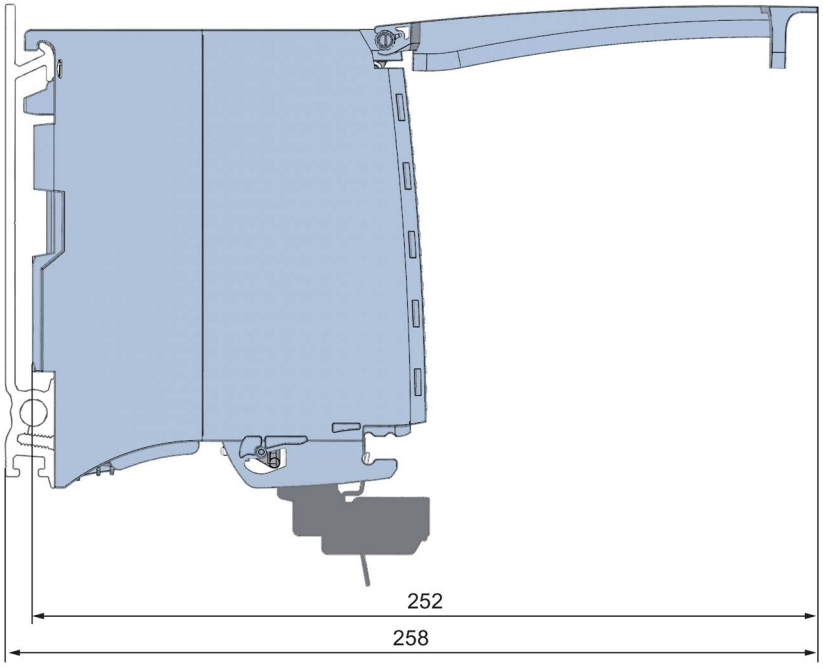


Figure A-2 Dimensional drawing of the TM Timer DIDQ 16x24V module, side view with open front panel

Parameter data record

B

You may edit the module parameters in RUN. The WRREC instruction is used to transfer the parameters to the module using data record 128.

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. If no errors occur, the STATUS output parameter contains the length of the actually transferred data.

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

Structure of data record

The following table shows you the structure of data record 128 for TM Timer DIDQ 16x24V. The values in byte 0 to byte 3 are fixed and may 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:			
					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: Reserved			
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: Reserved	
6	Reserved[2]							
7								

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
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:			
					0000_B: Timer-DI			
					0001_B: Reserved			
					0010_B: Oversampling			
					0011_B: Counter			
					0100_B: Incremental encoder (A, B phase-shifted)			
					0101 to 1111_B: Reserved			
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: Reserved			
					1111_B: 50 kHz			
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 0111_B: Reserved			
					1000_B: Timer DQ			
					1001_B: Reserved			
					1010_B: Oversampling			
					1011_B: PWM			
					1100 to 1111_B: Reserved			
9	Reserved[2]							
10...11	**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: Reserved			
					0010_B: Oversampling			
					0011 to 1111_B: Reserved			
11	Reserved[2]				Input delay:			
					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 1111_B: Reserved			

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
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 0111_B: Reserved			
					1000_B: Timer DQ			
					1001_B: Reserved			
					1010_B: Oversampling			
					1011_B: PWM			
					1100 to 1111_B: Reserved			
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							
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 enable a specific 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 • DI1 • DI2	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.

You can set a hardware enable for the following inputs and outputs:

Table B- 3 Hardware enable options

Digital input / digital output	Hardware enable by digital input...
DI0 or DQ0	DI1
DI2 or DQ2	DI3
DI4 or DQ4	DI5
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 (0010_B)	Hardware enable by **High** level	Hardware enable by **Low** level
Timer DI (0000_B)	When using the SIMOTION control system only	

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 (0000_B) • Oversampling (0010_B)	Input delay	• None • 0.05 ms • 0.1 ms • 0.4 ms • 0.8 ms
• Counter (0011_B) • Incremental encoder (A, B phase-shifted) (0100_B)	Filter frequency	50 kHz (cannot be changed)

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* Contains an implementation class for splay_tree_.
*/
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GCC RUNTIME LIBRARY EXCEPTION

Version 3.1, 31 March 2009

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