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SIMATIC

S7-1500/ET 200MP Technology module TM Count 2x24V (6ES7550-1AA00-0AB0)

Manual

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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 S7-1500 or ET 200MP is available in the S7-1500 or ET 200MP system manuals.

The counting and measuring functions of the TM Count 2x24V technology module are described in more detail in the Counting, Measurement and Position Detection (http://support.automation.siemens.com/WW/view/en/59709820) Function Manual.

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Documentation guide

1

Introduction

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

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

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

Overview of the documentation provided for technology module TM Count 2x24V

The following table lists further documentation that you will need when using the TM Count 2x24V technology module.

Table 1- 1 Documentation for technology module TM Count 2x24V

Topic	Documentation	Most important contents
System description	S7-1500 Automation System (http://support.automation.siemens.com/WW/view/en/59191792) System Manual ET 200MP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/59193214) System Manual	• Application planning • Installation • Wiring • Commissioning
Designing interference-free controllers	Designing interference-free controllers (http://support.automation.siemens.com/WW/view/en/59193566) Function Manual	• Basics • Electromagnetic compatibility • Lightning protection
Counting and measuring	Counting, measurement and position input (http://support.automation.siemens.com/WW/view/en/59709820) Function Manual	• Counting functions • Measuring functions • Position input • Control and feedback interface
Motion Control	S7-1500 Motion Control (http://support.automation.siemens.com/WW/view/en/59381279) Function Manual	• Configuration • Programming • Commissioning • Diagnostics

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

Order number

6ES7550-1AA00-0AB0

View of the module

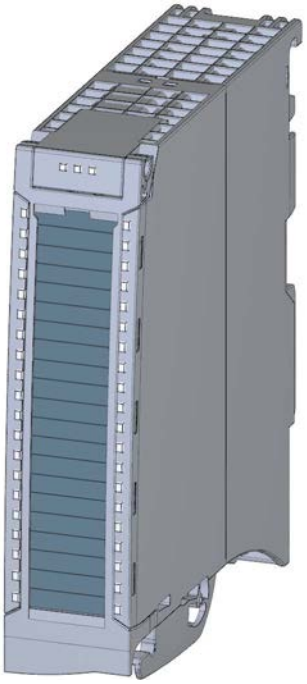


Figure 2-1 View of the TM Count 2x24V module

Properties

The TM Count 2x24V technology module has the following properties:

- Technical properties
  - Width: 35 mm
  - Two channels
  - Interfaces:

    24 V encoder signals A, B and N from sourcing, sinking or push pull encoders and sensors

    24 V encoder supply output, short-circuit proof

    DI0, DI1 and DI2 digital input signals (per channel)

    DQ0 and DQ1 digital output signals (per channel)

    L+ supply voltage
  - Count range: 32 bits
  - Monitoring of encoder signals for wire break channel by channel
  - Hardware interrupts can be configured channel by channel
  - Input filters for suppression of interferences at encoder inputs and digital inputs can be configured
- Supported encoder/signal types
  - 24 V incremental encoder with and without signal N
  - 24 V pulse encoder with direction signal
  - 24 V pulse encoder without direction signal
  - 24 V pulse encoders for up & down pulses
- Supported 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
- Power supply element
- 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 Counting

Counting refers to the recording and adding up of events. The counters of the technology module capture encoder signals and pulses and evaluate them accordingly. The count direction can be specified using encoder or pulse signals or through the user program.

You can control the counting processes with the digital inputs. You can switch the digital outputs exactly at defined counter values, independently of the user program.

You can specify the response of the counters using the functionalities described below.

Counting limits

The counting limits define the counter value range used. The counting limits are configurable and can be modified during runtime with the user program.

The maximum possible counting limit is 2147483647 (2^{31}–1). The minimum possible counting limit is –2147483648 (–2^{31}).

You can configure the response of the counter at the counting limits:

- Continue or stop counting upon violation of a counting limit (automatic gate stop)
- Set counter value to start value or to other counting limit upon violation of a counting limit

Start value

You can configure a start value within the counting limits. The start value can be modified during runtime with the user program.

Depending on the parameter assignment, the technology module can set the current counter value to the start value upon synchronization, upon Capture function activation, upon violation of a counting limit or when the gate is opened.

Gate control

Opening and closing the hardware gate and software gate defines the period of time during which the counting signals are captured.

The control of the hardware gate takes place externally via the digital inputs of the technology module. Control of the software gate takes place via the user program. The hardware gate can be enabled through parameter assignment. The software gate (bit in the control interface of the cyclic I/O data) cannot be disabled.

Capture

You can configure an external reference signal edge that triggers the saving of the current counter value as Capture value. The following external signals can trigger the Capture function:

- Rising or falling edge of a digital input
- Both edges of a digital input
- Rising edge of signal N at the encoder input

You can configure whether counting continues from the current counter value or from the start value after the Capture function.

Hysteresis

You can specify hysteresis for the comparison values, within which a digital output will be prevented from switching again. An encoder can come to a standstill at a specific position, and slight movements may make the counter value fluctuate around this position. If a comparison value or a counting limit lies within this fluctuation range, the corresponding digital output will be switched on and off with corresponding frequency if hysteresis is not used. The hysteresis prevents these unwanted switching operations.

2.2.2 Measuring

The following measuring functions are available:

Measurement type	Description
Frequency measurement	The mean frequency is calculated at set measuring intervals on the basis of the time profile of the count pulses and returned in hertz as the floating point number.
Period measurement	The mean period duration is calculated at set measuring intervals on the basis of the time profile of the count pulses and returned in seconds as the floating point number.
Velocity measurement	The mean velocity is calculated at set measuring intervals on the basis of the time profile of the count pulses and other parameters, and returned in the configured unit of measurement.

The measured value and the counter value are available concurrently in the feedback interface.

Update time

You can configure the interval at which the technology module updates the measured values cyclically as the update time. Setting longer update time intervals allows uneven measured variables to be smoothed and increases measuring accuracy.

Gate control

Opening and closing the hardware gate and software gate defines the period of time during which the counting signals are captured. The update time is asynchronous to the opening of the gate, which means that the update time is not started when the gate is opened. After closing, the last measured value captured continues to be returned.

Measuring ranges

The measuring functions have the following measuring range limits:

Measurement type	Low measuring range limit	High measuring range limit
Frequency measurement	0.04 Hz	800 kHz*
Period measurement	1.25 µs*	25 s
Velocity measurement	Depends on the configured number of "increments per unit" and the "time base for velocity measurement"	

* Applies to 24 V incremental encoders and "quadruple" signal evaluation.

All measured values are returned as signed values. The sign indicates whether the counter value increased or decreased during the relevant time period.

2.2.3 Position input for Motion Control

You can use the technology module with an incremental encoder for position input with S7-1500 Motion Control . Position input is based on the counting function of the technology module which evaluates the captured encoder signals and sends them to the S7-1500 Motion Control.

To do this, select "Position input for Motion Control" in the device configuration of the technology module in STEP 7 (TIA Portal). This mode will automatically apply to all channels of the technology module.

Additional information

A detailed description of the use of Motion Control and its configuration is available in the function manual S7-1500 Motion Control as a download from the Internet (http://support.automation.siemens.com/WW/view/en/59381279).

2.2.4 Additional functions

Synchronization

You can configure the edge of an external reference signal to load the counter with the specified start value. The following external signals can trigger a synchronization:

- Rising or falling edge of a digital input
- Rising edge of signal N at the encoder input
- Rising edge of signal N at the encoder input depending on the level of the assigned digital input

Comparison values

You can specify two comparison values to control the two digital outputs of the channel. If the counter or measured value meets the configured comparison condition, the corresponding digital output can be set to initiate control processes directly in the process. The comparison values are configurable and can be modified during runtime with the user program.

Hardware interrupts

The technology module can trigger a hardware interrupt in the CPU, for example, if a compare event occurs, in the event of overflow or underflow, in the event of a zero crossing of the counter and/or of a change of count direction (direction reversal). You can specify which events (Page 40) are to trigger a hardware interrupt during operation.

Diagnostic interrupt

The technology module can trigger a diagnostic interrupt in the event of a missing supply voltage or an error at the digital outputs, for example. Select the diagnostic interrupts (Page 39) in the device configuration freely.

Input filter

To suppress interference, you can configure an input filter for the 24 V encoder inputs and for the digital inputs.

Centralized application

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

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
- Distributed operation in a third-party system

Isochronous mode

The technology module supports the system function "Isochronous mode". This system function enables position, counter and measured values to be recorded in a defined system cycle.

In isochronous mode, the cycle of the user program, the transmission of the input signals and processing in the technology module are synchronized. The output signals switch immediately if the relevant comparison condition is met.

Wiring

3

3.1 Pin assignment

The encoder signals, the digital input and output signals and the encoder supplies are connected to the 40-pin front connector of the technology module. The supply voltage to supply the module and the digital outputs and generate the encoder supply voltages is connected to the 4-pin power supply element.

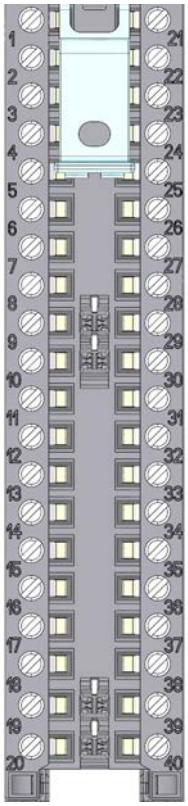
The next two sections detail the pin assignment for the front connector and the power supply element.

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

Pin assignment for the front connector

The table below shows the pin assignment of the front connector.

Table 3- 1 Pin assignment of the front connector

View	Signal name		Designation				
			24 V incremental encoder		24 V pulse encoder		
			With signal N	Without signal N	with direction signal	without direction signal	up/down
	**Counter channel 0**						
	1	CH0.A	Encoder signal A		Counting signal A		Up counting signal A
	2	CH0.B	Encoder signal B		Direction signal B	—	Down counting signal B
	3	CH0.N	Encoder signal N	—			
	4	DI0.0	Digital input DI0				
	5	DI0.1	Digital input DI1				
	6	DI0.2	Digital input DI2				
	7	DQ0.0	Digital output DQ0				
	8	DQ0.1	Digital output DQ1				
	Encoder supply and ground of both counter channels						
	9	24VDC	24 V encoder supply				
	10	M	Ground for encoder supply, digital inputs and digital outputs				
	Counter channel 1						
	11	CH1.A	Encoder signal A		Counting signal A		Up counting signal A
	12	CH1.B	Encoder signal B		Direction signal B	—	Down counting signal B
	13	CH1.N	Encoder signal N	—			
	14	DI1.0	Digital input DI0				
	15	DI1.1	Digital input DI1				
	16	DI1.2	Digital input DI2				
	17	DQ1.0	Digital output DQ0				
	18	DQ1.1	Digital output DQ1				
	19 - 40	—	—				

Pin assignment for the power supply element

The power supply element is plugged onto the front connector and serves to supply the technology module. For this purpose, you need to connect the supply voltage to terminal 41 (L+) and terminal 44 (M). Use terminal 42 (L+) and terminal 43 (M) to loop the supply voltage to the next module.

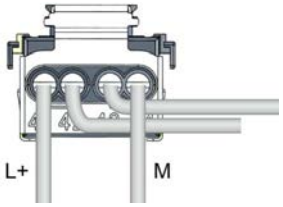


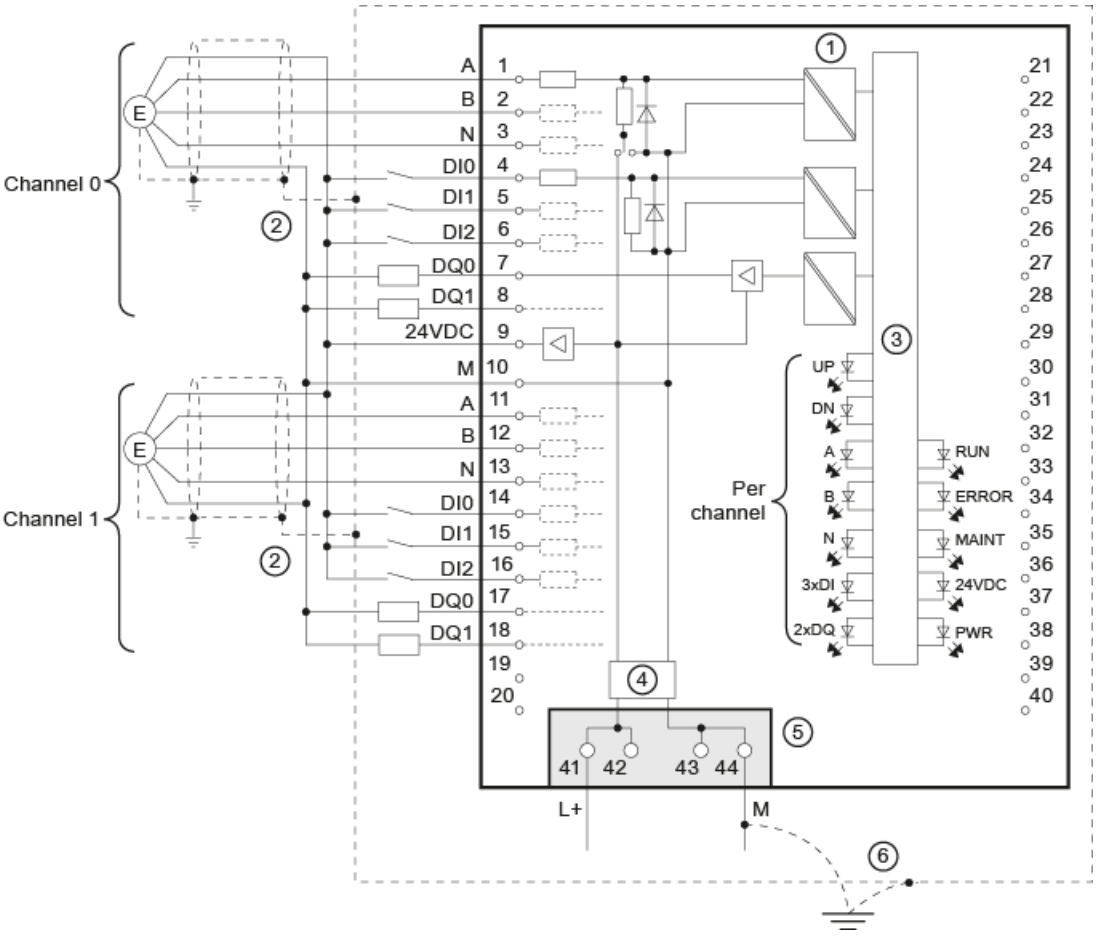
Figure 3-1 Power supply element wiring

L+	DC 24V supply voltage
M	Ground for supply voltage

Block diagram

You must ground the shields of the cables between encoder and technology module both through the shield support at the front connector (shield bracket and terminal) and at the encoder.

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



① Electrical isolation
② Shield support at the front connector
③ Technology and backplane bus interface
④ Input filter
⑤ Supply voltage via power supply element
⑥ Equipotential bonding

Figure 3-2 Block diagram with two incremental encoders

L+/M supply voltage

Connect the supply voltage (DC 24V) to the L+ and M connections. An internal protective circuit protects the technology module from polarity reversal of the supply voltage. The technology module monitors the connection of the supply voltage.

24VDC encoder supply

To supply the encoders and sensors at the digital inputs, the technology module supplies the DC 24V supply voltage at the 24VDC output with reference to M. Voltage is supplied from the L+/M supply voltage and monitored for short circuits and overload.

24 V encoder signals/counting signals

The 24 V encoder signals are designated A, B and N. You can connect the following encoder types:

- Incremental encoder with signal N:

  The signals A, B and N are connected by means of the correspondingly labeled terminals. Signals A and B are the two incremental signals phase-shifted by 90°. N is the zero mark signal which returns one pulse per revolution.

- Incremental encoder without signal N:

  The signals A and B are connected by means of the correspondingly labeled terminals. Signals A and B are the two incremental signals phase-shifted by 90°. The N terminal remains disconnected.

- Pulse encoders without direction signal:

  The counting signal is connected to the A terminal. The count direction is specified via the control interface. The B and N terminals remain disconnected.

- Pulse encoders with direction signal:

  The counting signal is connected to the A terminal. The direction signal is connected to the B terminal. The N terminal remains disconnected.

- Pulse encoders with up counting signal/down:

  The up counting signal is connected to the A terminal. The down counting signal is connected to the B terminal. The N terminal remains disconnected.

The inputs of the two counting channels are not isolated from each other. The inputs are isolated against the backplane bus.

You can connect the following encoders or sensors at inputs A, B and N:

- Sourcing output:
  The inputs A, B and N are switched by the encoder or sensor after 24VDC .
- Sinking output:
  The inputs A, B and N are switched by the encoder or sensor after ground M .
- Push pull:
  The inputs A, B and N are switched by the encoder or sensor alternately after 24VDC and ground M . Monitoring for wire break is possible with this type of encoder/sensor. The wire break detection procedure (alternate switching) allows the counter value to change in the event of an error (wire break) even without count pulses until the wire break is detected.

Input filter for 24 V encoder signals

To suppress interferences, you can configure an input filter for the counting inputs A, B and N. The selected filter frequency is based on a pulse-break ratio of between 40:60 and 60:40. This produces a set minimum pulse/break time. Signal changes with a duration shorter than the minimum pulse/break time are suppressed.

You can specify the following values for the filter frequency:

Table 3- 2 Filter frequency and respective minimum pulse/break time

Filter frequency	Minimum pulse/break time
100 Hz	4.0 ms
200 Hz	2.0 ms
500 Hz	800 µs
1 kHz	400 µs
2 kHz	200 µs
5 kHz	80 µs
10 kHz	40 µs
20 kHz	20 µs
50 kHz	8.0 µs
100 kHz	4.0 µs
200 kHz (default)	2.0 µs

Digital inputs DI0, DI1 and DI2

Three digital inputs are available per counting channel. The digital inputs are used for gate control, synchronization and the Capture function. Alternatively, you can use one or more digital inputs without the functions named and read the signal state of the respective digital input via the feedback interface.

The digital inputs of the two counting channels are not isolated from each other.

Input filters for digital inputs

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

You can specify the following values for the filter time:

- None
- 0.05 ms
- 0.1 ms (default)
- 0.4 ms
- 0.8 ms
- 1.6 ms
- 3.2 ms
- 12.8 ms
- 20 ms

Note

If you select the "None" or "0.05 ms" option, you have to use shielded cables for connection of the digital inputs.

Digital outputs DQ0 and DQ1

Two digital outputs are available per counting channel. The two digital outputs DQ0 and DQ1 can be activated/switched directly by the specified comparison values or by the user program.

The digital outputs of the two counting channels are not isolated from each other.

The digital outputs are 24 V sourcing outputs in reference to M and can carry a rated load current of 0.5 A. They are protected from overload and short-circuit.

Note

Relays and contactors can be connected direct without external circuitry. Information on the maximum possible operating frequencies and the inductance values of the inductive loads at the digital outputs is available in the chapter Technical specifications (Page 41).

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:

Applications	Components required	Configuration software	In the user program
Central and distributed operation in an S7-1500 system with a corresponding ET 200MP system	• S7-1500 automation system • ET 200MP distributed I/O system • TM Count 2x24V	STEP 7 (TIA Portal): • Device configuration with hardware configuration (HWCN) • Parameter setting with High_Speed_Counter technology object	Counting and measuring functions: High_Speed_Counter instruction for the technology object Position input: Direct access to the control and feedback interface (Page 29) of the TM Count 2x24V 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 Count 2x24V	STEP 7 (TIA Portal): Device configuration and parameter settings with hardware configuration (HWCN) STEP 7: Device configuration and parameter settings with GSD file	Direct access to the control and feedback interface (Page 29) of the TM Count 2x24V in the I/O data
Distributed operation in a third-party system	• Third-party automation system • ET 200MP distributed I/O system • TM Count 2x24V	Third-party configuration software: Device configuration and parameter settings with GSD file	Direct access to the control and feedback interface (Page 29) of the TM Count 2x24V in the I/O data

Additional information

A detailed description of the counting and measuring functions and their configuration is available:

- In the Counting, measurement and position input function manual available as a download from the Internet (http://support.automation.siemens.com/WW/view/en/59709820)
- In the STEP 7 (TIA Portal) information system under "Using technology functions > Counting, measurement and position input" > Counting, measurement and position input (S7-1500)"

A detailed description of the use of Motion Control and its configuration is available:

- In the S7-1500 Motion Control Function Manual available as a download from the Internet (http://support.automation.siemens.com/WW/view/en/59381279)
- In the STEP 7 (TIA Portal) information system under "Using technology functions > Motion Control > Motion Control (S7-1200, S7-1500)"

The GSD files for the ET 200MP distributed I/O system are available for download from the Internet (http://support.automation.siemens.com/WW/view/en/68189683).

4.2 Reaction to CPU STOP

Reaction to CPU STOP

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

Table 4- 1 Response of the technology module to CPU STOP depending on parameter assignment

Basic parameters	Reaction to CPU STOP
Continue operation	The technology module remains fully functional. Incoming count pulses are processed. The digital outputs continue to switch according to the parameter assignment.
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: The counter value is set to the start value and the digital outputs switch according to the parameter assignment.
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 technology module is returned to its startup state after a STOP-RUN transition: The counter value is set to the start value and the digital outputs switch according to the parameter assignment.

4.3 Address space

Address space of the technology module

Table 4- 2 Range of the input addresses and output addresses of the TM Count 2x24V

	Inputs	Outputs
Range per counting channel	16 bytes	12 bytes
Total range	32 bytes	24 bytes

Table 4- 3 Range of the input addresses and output addresses of the TM Count 2x24V in "Position input for Motion Control" mode.

	Inputs	Outputs
Range per counting channel	16 bytes	4 bytes
Total range	32 bytes	8 bytes

Additional information

A description on how to use the control and feedback interface of TM Count 2x24V can be found in the chapter Control and feedback interface (Page 29).

4.4 Control and feedback interface

Information on using the control and feedback interface can be found in the section Configuring (Page 25).

A detailed description of the TM Count 2x24V control and feedback bits is available in the Counting, Measurement and Position Input function manual which can be downloaded from the Internet (http://support.automation.siemens.com/WW/view/en/59709820).

4.4.1 Assignment of the control interface

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

Control interface per channel

The following table shows control interface assignment:

Offset to the start address	Parameter	Meaning				
Bytes 0 to 3	Slot 0	Load value (significance of the value is specified in LD_SLOT_0)				
Bytes 4 to 7	Slot 1	Load value (significance of the value is specified in LD_SLOT_1)				
Byte 8	LD_SLOT_0*	Specifies the significance of the value in Slot 0				
		Bit 3	**Bit 2**	**Bit 1**	**Bit 0**	
		0	0	0	0	No action, idle
		0	0	0	1	Load counter value
		0	0	1	0	Reserve
		0	0	1	1	Load start value
		0	1	0	0	Load comparison value 0
		0	1	0	1	Load comparison value 1
		0	1	1	0	Load low counting limit
		0	1	1	1	Load high counting limit
		1	0	0	0	Reserve
		to				
		1	1	1	1	

Offset to the start address	Parameter	Meaning				
Byte 8	LD_SLOT_1*	Specifies the significance of the value in Slot 1				
		Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	
		0	0	0	0	No action, idle
		0	0	0	1	Load counter value
		0	0	1	0	Reserve
		0	0	1	1	Load start value
		0	1	0	0	Load comparison value 0
		0	1	0	1	Load comparison value 1
		0	1	1	0	Load low counting limit
		0	1	1	1	Load high counting limit
		1	0	0	0	Reserve
		to				
		1	1	1	1	
Byte 9	EN_CAPTURE	Bit 7: Capture function enable				
	EN_SYNC_DN	Bit 6: Enable synchronization down				
	EN_SYNC_UP	Bit 5: Enable synchronization up				
	SET_DQ1	Bit 4: Set DQ1				
	SET_DQ0	Bit 3: Set DQ0				
	TM_CTRL_DQ1	Bit 2: Enable technological function DQ1				
	TM_CTRL_DQ0	Bit 1: Enable technological function DQ0				
	SW_GATE	Bit 0: Software gate				
Byte 10	SET_DIR	Bit 7: Count direction (for encoders without direction signal)				
	–	Bits 2 to 6: Reserve; bits must be set to 0				
	RES_EVENT	Bit 1: Reset of saved events				
	RES_ERROR	Bit 0: Reset of saved error states				
Byte 11	–	Bits 0 to 7: Reserve; bits must be set to 0				

* If values are loaded simultaneously via LD_SLOT_0 and LD_SLOT_1, the first value is taken internally from Slot 0 and then the value from Slot 1 is taken. This may lead to unexpected intermediate states.

4.4.2 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 per channel

The following table shows the assignment of the feedback interface:

Offset to the start address	Parameter	Meaning
Bytes 0 to 3	COUNT VALUE	Current counter value
Bytes 4 to 7	CAPTURED VALUE	The last acquired Capture value
Bytes 8 to 11	MEASURED VALUE	Current measured value
Byte 12	–	Bits 3 to 7: Reserve; set to 0
	LD_ERROR	Bit 2: Error when loading via control interface
	ENC_ERROR	Bit 1: Incorrect encoder signal
	POWER_ERROR	Bit 0: Incorrect supply voltage L+
Byte 13	–	Bits 6 to 7: Reserve; set to 0
	STS_SW_GATE	Bit 5: Software gate state
	STS_READY	Bit 4: Technology module started up and configured
	LD_STS_SLOT_1	Bit 3: Load request for Slot 1 detected and carried out (toggling)
	LD_STS_SLOT_0	Bit 2: Load request for Slot 0 detected and carried out (toggling)
	RES_EVENT_ACK	Bit 1: Resetting of status bits active
	–	Bit 0: Reserve; set to 0
Byte 14	STS_DI2	Bit 7: Status DI2
	STS_DI1	Bit 6: Status DI1
	STS_DI0	Bit 5: Status DI0
	STS_DQ1	Bit 4: Status DQ1
	STS_DQ0	Bit 3: Status DQ0
	STS_GATE	Bit 2: Status of internal gate
	STS_CNT	Bit 1: Count pulse detected within the last 0.5 s
	STS_DIR	Bit 0: Direction of last counter value change
Byte 15	STS_M_INTERVAL	Bit 7: Count pulse detected in previous measurement interval
	EVENT_CAP	Bit 6: Capture event has occurred
	EVENT_SYNC	Bit 5: Synchronization has occurred
	EVENT_CMP1	Bit 4: Comparison event for DQ1 has occurred
	EVENT_CMP0	Bit 3: Comparison event for DQ0 has occurred
	EVENT_OFLW	Bit 2: An overflow has occurred
	EVENT_UFLW	Bit 1: An underflow has occurred
	EVENT_ZERO	Bit 0: A zero pass has occurred

Interrupts/diagnostic messages

5

5.1 Status and error displays

LEDs

The following figure shows you the LED displays (status and error displays) of TM Count 2x24V.

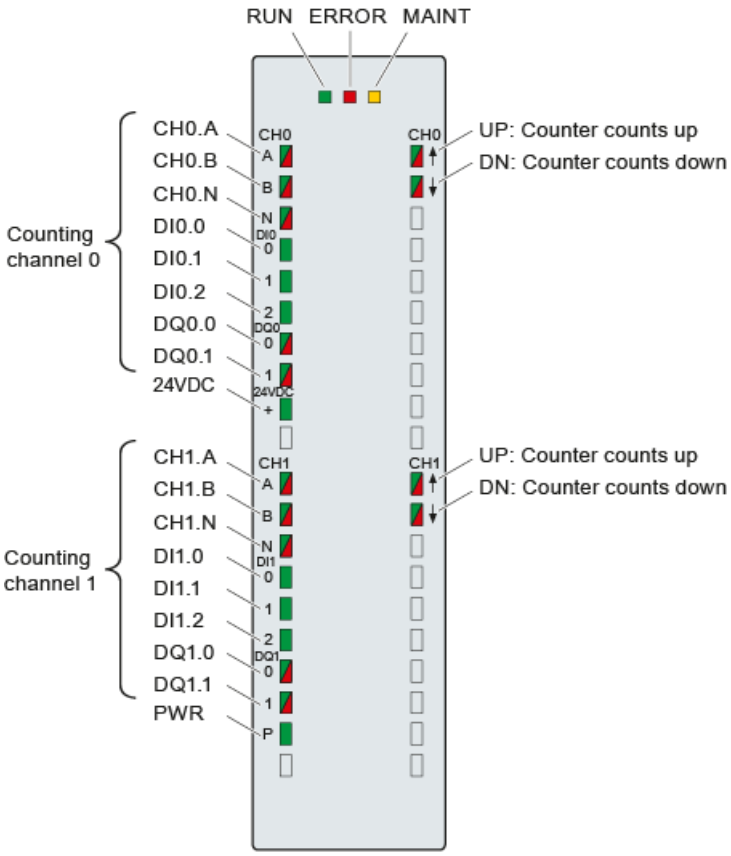


Figure 5-1 LEDs of the TM Count 2x24V

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 messages (Page 36).

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 turn 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 active error)	Evaluate the diagnostic alarms and eliminate the error.
Flashes	Flashes	Flashes	Hardware or firmware defective	Replace the technology module.

Table 5- 2 PWR/24VDC/ERROR status displays

LEDs			Meaning	To correct or avoid errors
PWR	24VDC	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	Off	Flashes	Short-circuit or overload at the encoder supply	• Correct the encoder wiring. • Check the loads connected to the encoder supply.

ChannelLEDs

The LEDs CHn.A, CHn.B, CHn.N and DIn.m indicate the current level of the associated signals. The LEDs of the digital outputs DQn.m indicate the desired state.

The LEDs UP and DN indicate the logical counting direction.

The flashing frequency of the channel LEDs is limited to approximately 12 Hz. If higher frequencies are present, the channel LEDs will flash at 12 Hz instead of indicating the current status.

Table 5- 3 Status displays CHn.m/DIn.m/DQn.m

LEDs CHn.m/DIn.m/DQn.m	Meaning	To correct or avoid errors
□ Off	Counter input/digital input/digital output at 0 level	---
■ On	Counter input/digital input/digital output at 1 level.	---
■ On (CHn.m/DQn.m)	Diagnostic alarm: e.g. wire break, short circuit	Check the wiring or the connected load.

Table 5- 4 Status displays CHn.UP/CHn.DN

LEDs		Meaning
CHn.UP	CHn.DN	
□ Off	□ Off	No count pulse has been detected for the last 0.5 s.
■ On	□ Off	The last count pulse has incremented the counter and took place no more than 0.5 s ago.
□ Off	■ On	The last count pulse has decremented the counter and took place no more than 0.5 s ago.
■ On	■ On	Illegal A/B signal ratio

5.2 Diagnostic messages

Diagnostic alarms

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

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

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
	Dec.	Hex.		
Hardware interrupt lost	22_D	16_H	• Technology module cannot send an interrupt because a previous interrupt has not been processed • Possible causes: – Parameter assignment error – Too many hardware interrupts in too short a time	Change interrupt processing in the CPU and re-assign technology module parameters correspondingly
Internal error	256_D	100_H	Technology module defective	Replace technology module
Watchdog tripped. Module is defective.	259_D	103_H	Firmware error	Run firmware update
			Technology module defective	Replace technology module
External auxiliary voltage missing	266_D	$10A_H$	No technology module L+ supply voltage	Provide L+ supply voltage to technology module
			Front connector not inserted correctly	Insert front connector correctly
Short circuit or overload at external encoder supply	270_D	$10E_H$	• Error at encoder supply • Possible causes: – Short circuit – Overload	• Correction of encoder wiring • Check consumers connected to encoder supply
Error at digital outputs	271_D	$10F_H$	• Error at the digital outputs • Possible causes: – Short circuit – Overload – External feed	• Correct the wiring at the digital outputs • Check consumers connected to the digital outputs
Faulty external auxiliary voltage	272_D	110_H	• Error at supply voltage L+ • Possible causes: – Low voltage – Wiring of L+ supply voltage defective	• Check the L+ supply voltage • Check the wiring of the L+ supply voltage

Diagnostic alarm	Error code		Meaning	To correct or avoid errors
	Dec.	Hex.		
Illegal A/B signal ratio	1280_D	500_H	• Time profile of signals A and B of the incremental encoder does not meet certain specifications • Possible causes: – Signal frequency too high – Encoder faulty – Process wiring faulty	• Correct the process wiring • Check encoder/sensor • Check parameter assignment
Wire break at digital input A, B or N	1285_D	505_H	Channel not connected	Connect the channel
			Resistance of encoder circuit too high	• Use a different encoder type or modify the wiring, for example, use shorter cables with larger cross-sections • Check encoders
			Interruption of the line between technology module and encoder	Correct the process wiring
			Sensor used is sourcing output or sinking output only	Correct parameter assignment
Overheating	1286_D	506_H	Possible causes: • Short circuit or overload at the digital outputs or output of the encoder supply • Ambient temperature outside specifications	• Correct the process wiring • Improve cooling • Check connected loads

5.3 Interrupts

5.3.1 Trigger a diagnostic interrupt

Enabling the diagnostic interrupts

You enable the diagnostic interrupt for wire break and the diagnostic interrupts for additional errors in the basic parameters during device configuration.

A list of all errors that can trigger a diagnostic interrupt is available at Cause of the error triggering a diagnostic interrupt (Page 39).

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).

Default setting

These diagnostic interrupts are not enabled in the default setting.

5.3.2 Cause of the error triggering a diagnostic interrupt

Which errors can trigger a diagnostic interrupt?

The technology module can trigger the following diagnostic interrupts:

Table 5- 6 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.
• Wire break at digital input A, B or N	Monitoring is active if a push-pull switching encoder has been configured. An error detected only triggers a diagnostic interrupt if "Enable diagnostic interrupt on wire break" has been enabled in the device configuration.
• Hardware interrupt lost • External auxiliary voltage missing • Short circuit or overload at external encoder supply • Error at digital outputs • Faulty external auxiliary voltage • Illegal A/B signal ratio • Overheating	Monitoring is always active. An error detected only triggers a diagnostic interrupt if "Enable additional diagnostic interrupts" has been enabled in the device configuration.

5.3.3 Triggering of a Hardware Interrupt

Introduction

For the technology module, you can configure which events are to trigger a hardware interrupt during operation.

What is a Hardware Interrupt?

The technology module will trigger a hardware interrupt as configured in response to specific events/states. When a hardware interrupt occurs, the CPU interrupts execution of the user program and processes the assigned hardware interrupt OB. The event that triggered the interrupt is entered in the start information of the assigned hardware interrupt OB by the CPU.

Activating the hardware interrupts

You activate the hardware interrupts in STEP 7 (TIA Portal) under "Basic parameters > Channel 0 or 1 > Hardware interrupts" during device configuration of the technology module.

A list of the individual hardware interrupts is available at Events which can trigger a hardware interrupt (Page 40).

Lost hardware interrupt

If an event occurs which is supposed to trigger a hardware interrupt but there is an identical, previous event which has not yet been processed, no further hardware interrupt will be triggered. The hardware interrupt is lost. This may lead to the "Hardware interrupt lost" diagnostic interrupt, depending on the parameter assignment.

Default setting

No hardware interrupts are activated in the default setting.

5.3.4 Events which can trigger a hardware interrupt

Which events can trigger a hardware interrupt?

A hardware interrupt is triggered if the condition for changing the respective status bit or event bit in the feedback interface is fulfilled.

The following two tags, among others, are entered in the start information of the assigned hardware interrupt OB when a process interrupt is triggered:

- EventType: Number of the event type to which the event triggering the interrupt belongs
- IChannel: Number of the channel that triggered the hardware interrupt

You can configure hardware interrupts to be triggered for the following event types:

Hardware interrupt	EventType number
Internal gate opening (Gate start)	1
Internal gate closing (Gate stop)	2
Overflow (high counting limit violated)	3
Underflow (low counting limit violated)	4
Compare event for DQ0 has occurred	5
Compare event for DQ1 has occurred	6
Zero pass	7
New capture value available[1)]	8
Synchronization of the counter by an external signal	9
Direction reversal[2)]	10

1) Can only be configured in Counting mode

2) The feedback bit STS_DIR has the default value "0". A hardware interrupt is not triggered when the first counter value or position value is changed immediately after switching on the technology module in *down direction*.

You can activate any combination of events to trigger hardware interrupts.

Technical specifications

6

	6ES7550-1AA00-0AB0
Product type designation	TM Count 2x24V
General information	
Product function	
• I&M data	Yes, I&M 0
Engineering with	
STEP 7 TIA Portal can be configured/integrated as of version	V12.0 / V12.0
STEP 7 can be configured/integrated as of version	as of V5.5 SP3 / -
PROFINET as of GSD version/GSD revision	V2.3 / -
Installation type/mounting	
• Rail mounting possible	Yes; S7-1500 mounting rail
Supply voltage	
Load voltage L+	
• 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
Input current	
• Current consumption, max.	75 mA; without load
Encoder supply	
• Number of outputs	1; one shared 24V encoder supply for both channels
24 V encoder supply	
• 24 V	Yes; L+ (-0.8 V)
• Short-circuit protection	Yes
• Output current, max.	1 A; total current of all encoders/channels
Power	
• Power from the backplane bus	1.3 W
Power loss	
• Power loss, typ.	4 W

	6ES7550-1AA00-0AB0
Address area	
Occupied address area	
• Inputs	16 bytes; per channel
• Outputs	12 bytes; per channel; 4 bytes with Motion Control
Digital inputs	
• Number of inputs	6; 3 per channel
• Digital inputs, configurable	Yes
• Input characteristics to IEC 61131, Type 3	Yes
Digital input functions, configurable	
• Gate start/stop	Yes
• Capture	Yes
• Synchronization	Yes
• Freely assignable digital input	Yes
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, max.	30 V
• Permitted voltage at input, min.	-30 V
Input current	
• for signal "1", typ.	2.5 mA
Input delay (at rated value of input voltage)	
For standard inputs	
• Configurable	Yes; none / 0.05 / 0.1 / 0.4 / 0.8 / 1.6 / 3.2 / 12.8 / 20 ms
• at "0" to "1", min.	6 µs; with parameter assignment "none"
• at "1" to "0", min.	6 µs; with parameter assignment "none"
For counters/technological functions	
• Configurable	Yes
Cable length	
• Cable length shielded, max.	1000 m
• Cable length unshielded, max.	600 m

	6ES7550-1AA00-0AB0
Digital outputs	
Type of digital output	Transistor
• Number of outputs	4; 2 per channel
• Digital outputs, configurable	Yes
• Short-circuit protection	Yes; electronic/thermal
Response threshold, typ.	1 A
Limiting of inductive shutdown voltage to	L+ (-33 V)
• Control of a digital input	Yes
Digital output functions, configurable	
• Switch at comparison values	Yes
• Freely assignable digital output	Yes
Output switching capacity	
• With resistive load, max.	0.5 A; per digital output
• With lamp load, max.	5 W
Load resistance range	
• Low limit	48 Ω
• High limit	12 kΩ
Output voltage	
Type of output voltage	DC
• for signal "1", min.	23.2 V; L+ (-0.8 V)
Output current	
• for signal "1" rated value	0.5 A; per digital output
• for signal "1" permissible range, max.	0.6 A; per digital output
• 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.	50 µs
• "1" to "0", max.	50 µs
Switching frequency	
• With resistive load, max.	10 kHz
• With inductive load, max.	0.5 Hz; to IEC 947-5-1, DC-13; observe derating curve
• With lamp load, max.	10 Hz
Total current of outputs	
• Max. current per module	2 A
Cable length	
• Cable length shielded, max.	1000 m
• Cable length unshielded, max.	600 m

	6ES7550-1AA00-0AB0
Encoders	
Supported encoders	
• 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.	200 kHz
• Counting frequency, max.	800 kHz; with quadruple evaluation
• Signal filter, configurable	Yes
• Cable length shielded, max.	600 m; depends on input frequency, encoder and cable quality; max. 50 m with 200 kHz
• Incremental encoder with A/B tracks, phase-shifted by 90°	Yes
• Incremental encoder with A/B tracks, phase-shifted by 90°, and zero track	Yes
• Pulse encoder	Yes
• Pulse encoder with direction	Yes
• Pulse encoder with one pulse signal per count direction	Yes
24 V encoder signal	
• Permitted voltage at input, max.	30 V
• Permitted voltage at input, min.	-30 V
Interface hardware	
• Input characteristics to IEC 61131, Type 3	Yes
• Sinking/sourcing input	Yes
Isochronous mode	
• Isochronous mode (application synchronized until terminal)	Yes
• Filter and processing time (TWE), min.	130 µs
• Bus cycle time (TDP), min.	250 µs

	6ES7550-1AA00-0AB0
Interrupts/diagnostics/status information	
Interrupts	
• Diagnostic interrupt	Yes
• Hardware interrupt	Yes
Diagnostic alarms	
• Monitoring of supply voltage	Yes
• Wire break	Yes
• Short circuit	Yes
• A/B transition error with incremental encoder	Yes
LED diagnostics display	
• RUN LED	Yes; green LED
• ERROR LED	Yes; red LED
• MAINT LED	Yes; yellow LED
• Monitoring of supply voltage	Yes; green LED
• Channel status display	Yes; green LED
• For channel diagnostics	Yes; red LED
• Count down status display (green)	Yes
• Count up status display (green)	Yes
Integrated functions	
• Number of counters	2
• Counting frequency (counters), max.	800 kHz; with quadruple evaluation
Counting functions	
• Continuous counting	Yes
• Counter response configurable	Yes
• Hardware gate by means of digital input	Yes
• Software gate	Yes
• Event-triggered stop	Yes
• Synchronization by means of digital input	Yes
• Counting range, configurable	Yes
Comparator	
• Number of comparators	2; per channel
• Direction-dependent	Yes
• Can be changed from user program	Yes

	6ES7550-1AA00-0AB0
Position detection	
• Incremental detection	Yes
• Suitable for S7-1500 Motion Control	Yes
Measuring functions	
• Measuring time, configurable	Yes
• Dyn. measuring time adjustment	Yes
• Number of threshold values, configurable	2
Measuring range	
• Frequency measurement, max.	800 kHz
• Frequency measurement, min.	0.04 Hz
• Period measurement, max.	25 s
• Period measurement, min.	1.25 µs
Accuracy	
Frequency measurement	100 ppm; depends on measuring interval and signal evaluation
Velocity measurement	100 ppm; depends on measuring interval and signal evaluation
Period measurement	100 ppm; depends on measuring interval and signal evaluation
Electrical isolation	
Electrical isolation channels	
• Between the channels	No
• Between the channels and the backplane bus	Yes
• Between the channels and load voltage L+	No
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; consider derating with inductive loads
• Vertical installation, min.	0 °C
• Vertical installation, max.	40 °C; consider derating with inductive loads
Distributed operation	
• At SIMATIC S7-1500	Yes
• At Standard Profinet Controller	Yes

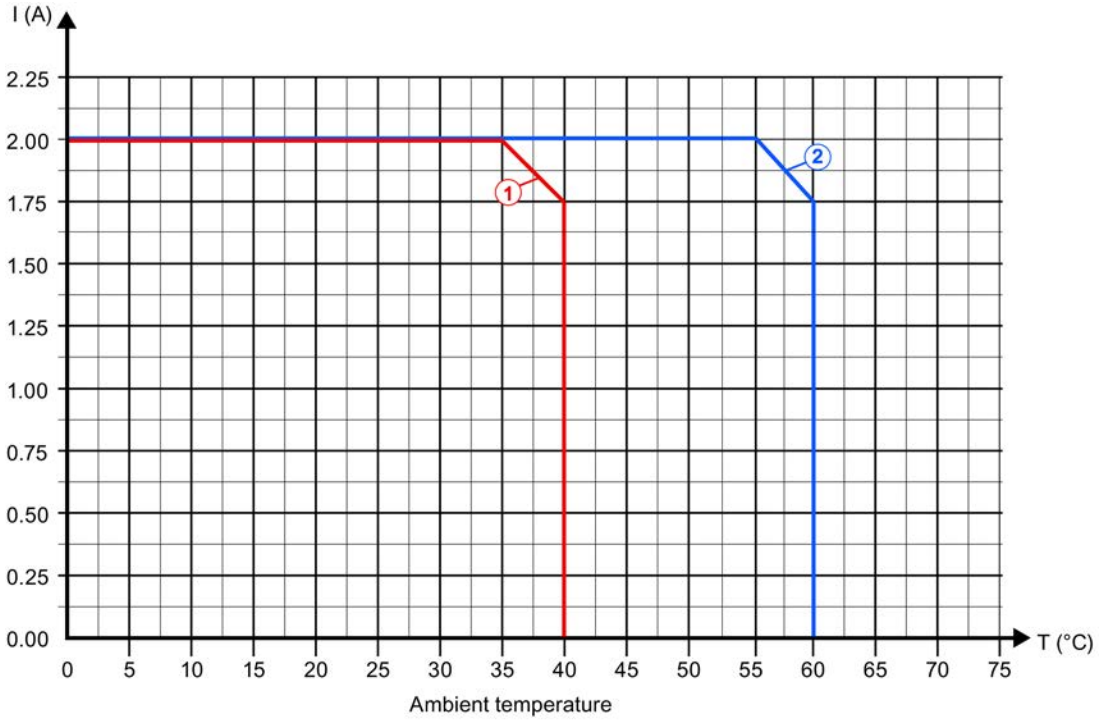
	6ES7550-1AA00-0AB0
Dimensions	
• Width	35 mm
• Height	147 mm
• Depth	129 mm
Weights	
• Weight, approx.	250 g

Derating information for total current of outputs

If the digital outputs of the TM Count 2x24V are operated with inductive loads, you should derate the total current of the loads at the digital outputs of the technology module. The total current is the sum of the load currents at all digital outputs of the module (all channels, without encoder supply).

The following derating curve shows the load capacity of the digital outputs depending on the ambient temperature and mounting position under the following conditions:

- Maximum switching frequency at digital outputs of 0.5 Hz
- Load resistance: 48 Ω (IEC 947-5-1)
- Load inductance: 1150 mH (IEC 947-5-1)



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

Figure 6-1 Total current depending on ambient temperature and mounting position for inductive loads

Note

If the switching frequency is greater than 0.5 Hz or there is greater inductance at the digital outputs, the total current must be reduced further.

Dimensional 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.

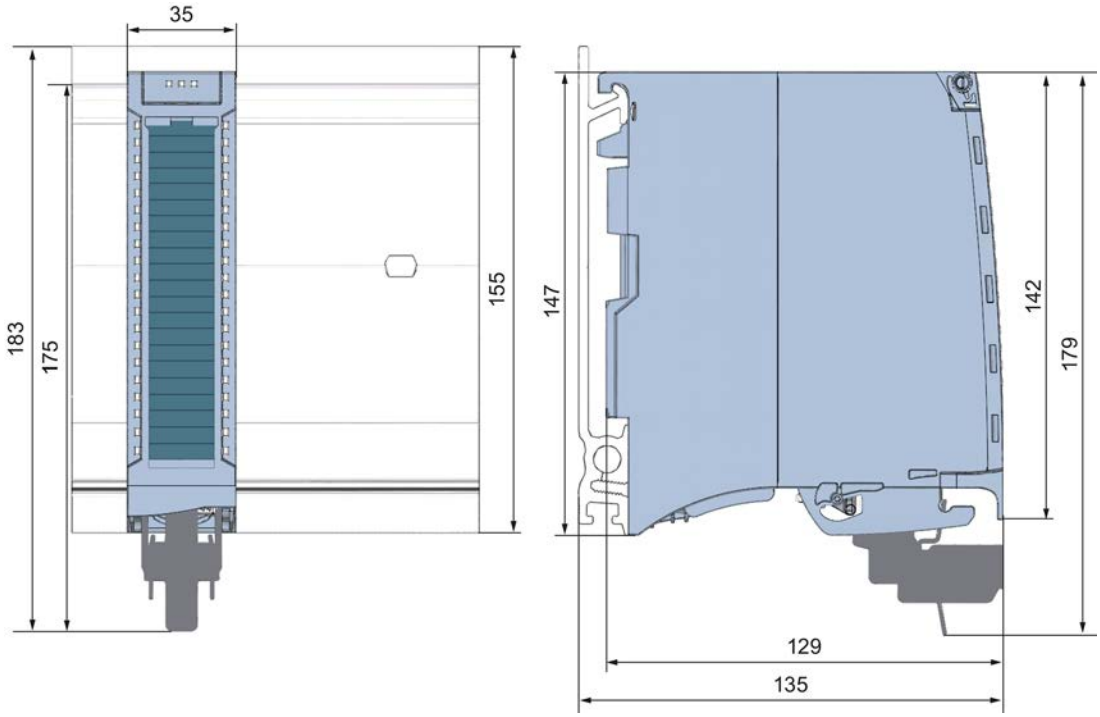


Figure A-1 Dimensional drawing of the TM Count 2x24V technology module

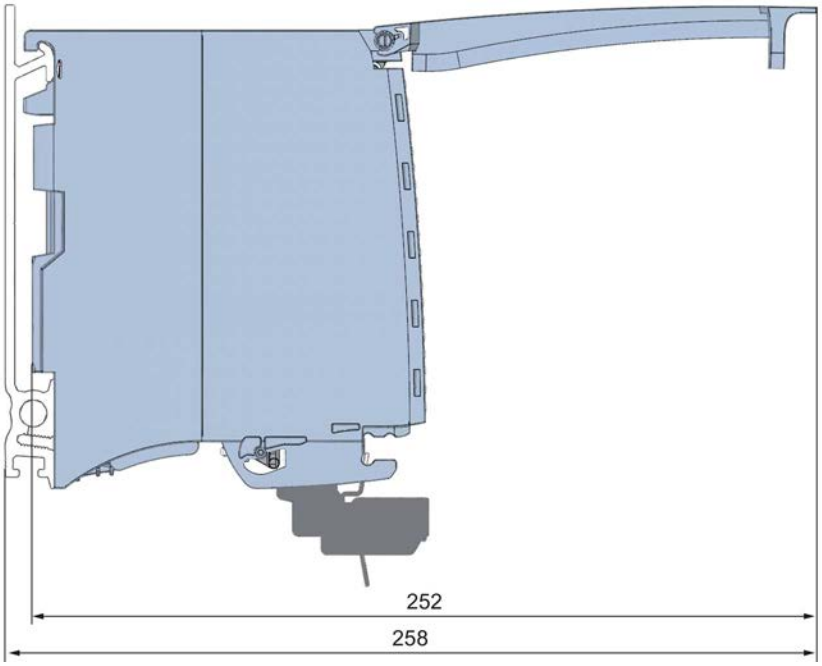


Figure A-2 Dimensional drawing of the TM Count 2x24V module, side view with open front panel

Parameter data records

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 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 (TIA Portal) Online Help.

Structure of the data record for central and distributed configuration with PROFINET

The following tables shows you the structure of data record 128 for TM Count 2x24V with 2 channels. The values in byte 0 to byte 3 are fixed and may not be changed. The value in byte 4 can only be changed by means of new parameter assignment and not in RUN mode.

Table B- 1 Parameter data record 128 for central and distributed configuration with PROFINET

Bit → / Byte channel 0/1 ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0...3	**Header**							
0	Major Version = 0				Minor Version = 1			
1	Length of the parameter data per channel = 48							
2	Reserved[2)]							
3	Reserved[2)]							
4...51	**Counter channel 0**							
52...99	**Counter channel 1**							
4/52	**Operating mode**							
4/52	Reserved[2)]				Operating mode:			
					0000_B: Reserved			
					0001_B: Counting			
					0010_B: Measuring			
					0011 to 1111_B: Reserved			

Bit → / Byte channel 0/1 ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
5/53	**Basic parameters**							
5/53	Reserved[2)]					Enable additional diagnostic interrupts[1)]	Reaction to CPU STOP:	
							00_B: Output substitute value	
							01_B: Keep last value	
							10_B: Continue operation	
							11_B: Reserved	
6...7/ 54...55	**Counter inputs**							
6/54	Sensor type:		Signal evaluation:		Signal type:			
	00_B: Sourcing output		00_B: Single		0000_B: Pulse (A)			
	01_B: Sinking output		01_B: Double		0001_B: Pulse (A) and direction (B)			
	10_B: Push-pull (sinking and sourcing output)		10_B: Quadruple		0010_B: Count up (A), count down (B)			
	11_B: Reserved		11_B: Reserved		0011_B: Incremental encoder (A, B phase-shifted)			
					0100_B: Incremental encoder (A, B, N)			
					0101 to 1111_B: Reserved			
7/55	Reaction to signal N:		Invert direction[1)]	Enable diagnostics interrupt at wire break[1)]	Filter frequency:			
	00_B: No reaction to signal N				0000_B: 100 Hz			
	01_B: Synchronization at signal N				0001_B: 200 Hz			
	10_B: Capture at signal N				0010_B: 500 Hz			
	11_B: Reserved				0011_B: 1 kHz			
					0100_B: 2 kHz			
					0101_B: 5 kHz			
					0110_B: 10 kHz			
					0111_B: 20 kHz			
					1000_B: 50 kHz			
					1001_B: 100 kHz			
					1010_B: 200 kHz			
					1011 to 1111_B: Reserved			

Bit → Byte channel 0/1 ↓	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
8...9/ 56...57	**Hardware interrupts**[1]							
8/56	Reserved[2]	Reserved[2]	Reserved[2]	Change of direction	Underflow (low counting limit violated)	Overflow (high counting limit violated)	Gate stop	Gate start
9/57	Synchronization of the counter by an external signal	New Capture value available	Reserved[2]	Zero pass	Reserved[2]	Comparison event for DQ1 has occurred	Reserved[2]	Comparison event for DQ0 has occurred
10...15/ 58...63	**Behavior of DQ0/1**							
10/58	Set output (DQ1):				Set output (DQ0):			
	0000_B: Use by user program				0000_B: Use by user program			
	0001_B: Between comparison value and high counting limit; Measuring: Measured value >= comparison value				0001_B: Between comparison value and high counting limit; Measuring: Measured value >= comparison value			
	0010_B: Between comparison value and low counting limit; Measuring: Measured value <= comparison value				0010_B: Between comparison value and low counting limit; Measuring: Measured value <= comparison value			
	0011_B: At comparison value for a pulse duration				0011_B: At comparison value for a pulse duration			
	0100_B: Between comparison value 0 and 1				0100_B: Reserved			
	0101_B: After set command from CPU until comparison value				0101_B: After set command from CPU until comparison value			
	0110_B: Not between comparison value 0 and 1				0110 to 1111_B: Reserved			
	0111 to 1111_B: Reserved							
11/59	Count direction (DQ1):		Count direction (DQ0):		Reserved[2]	Reserved[2]	Substitute value for DQ1	Substitute value for DQ0
	00_B: Reserved		00_B: Reserved					
	01_B: Forward		01_B: Forward					
	10_B: Backward		10_B: Backward					
	11_B: In both directions		11_B: In both directions					
12/60	Pulse duration (DQ0):							
13/61	WORD: Value range in ms/10: 0 to 65535_D							
14/62	Pulse duration (DQ1):							
15/63	WORD: Value range in ms/10: 0 to 65535_D							

<table>
<tr><td>Bit →
Byte channel 0/1 ↓</td><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>16/64</td><td colspan="8">Behavior of DI0</td></tr>
<tr><td rowspan="8">16/64</td><td rowspan="3">Behavior of counter value after Capture (DI0):</td><td colspan="2">Edge selection (DI0):</td><td rowspan="2">Select level (DI0):</td><td rowspan="8">Reserved[2)]</td><td colspan="3">Set function of DI (DI0):</td></tr>
<tr><td colspan="2">00_B: Reserved</td><td colspan="3">000_B: Gate start/stop (level-triggered)</td></tr>
<tr><td>01_B: At rising edge</td><td rowspan="2">0_B: Active with high level</td><td colspan="3">001_B: Gate start (edge-triggered)</td></tr>
<tr><td>10_B: At falling edge</td><td colspan="3">010_B: Gate stop (edge-triggered)</td></tr>
<tr><td>0_B: Continue counting</td><td>11_B: At rising and falling edge</td><td>1_B: Active with low level</td><td colspan="3">011_B: Synchronization</td></tr>
<tr><td rowspan="3">1_B: Set to start value and continue counting</td><td rowspan="3"></td><td rowspan="3"></td><td colspan="3">100_B: Enable synchronization at signal N</td></tr>
<tr><td colspan="3">101_B: Capture</td></tr>
<tr><td colspan="3">110_B: Digital input without function</td></tr>
<tr><td colspan="3">111_B: Reserved</td></tr>
<tr><td>17/65</td><td colspan="8">Behavior of DI1:
See Byte 16</td></tr>
<tr><td>18/66</td><td colspan="8">Behavior of DI2:
See Byte 16</td></tr>
<tr><td rowspan="11">19/67</td><td>Frequency:</td><td colspan="3" rowspan="11">Reserved[2)]</td><td colspan="4">Filter time:</td></tr>
<tr><td>0_B: Once</td><td colspan="4">0000_B: None</td></tr>
<tr><td rowspan="2"></td><td colspan="4">0001_B: 0.05 ms</td></tr>
<tr><td>1_B: Periodic</td><td colspan="4">0010_B: 0.1 ms</td></tr>
<tr><td rowspan="8"></td><td colspan="4">0011_B: 0.4 ms</td></tr>
<tr><td colspan="4">0100_B: 0.8 ms</td></tr>
<tr><td colspan="4">0101_B: 1.6 ms</td></tr>
<tr><td colspan="4">0110_B: 3.2 ms</td></tr>
<tr><td colspan="4">0111_B: 12.8 ms</td></tr>
<tr><td colspan="4">1000_B: 20 ms</td></tr>
<tr><td colspan="4">1001 to 1111_B: Reserved</td></tr>
</table>

Bit → Byte channel 0/1 ↓	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
20...43/ 68...91	**Values**							
20...23/ 68...71	High counting limit: DWORD: Value range: –2147483648 to 2147483647_D or 80000000 to $7FFFFFFF_H$							
24...27/ 72...75	Comparison value 0: Operating mode Counting: DWORD: Value range: –2147483648 to 2147483647_D or 80000000 to $7FFFFFFF_H$; Operating mode Measuring: REAL: Floating point number in the configured unit of the measured variable							
28...31/ 76...79	Comparison value 1: Operating mode Counting: DWORD: Value range: –2147483648 to 2147483647_D: or 80000000 to $7FFFFFFF_H$; Operating mode Measuring: REAL: Floating point number in the configured unit of the measured variable							
32...35/ 80...83	Start value: DWORD: Value range: –2147483648 to 2147483647_D or 80000000 to $7FFFFFFF_H$							
36...39/ 84...87	Low counting limit: DWORD: Value range: –2147483648 to 2147483647_D or 80000000 to $7FFFFFFF_H$							
40...43/ 88...91	"Position input for Motion Control" mode: **Reference speed**: DWORD: Value range in 10^{-2} rpm: 600 to 21000000_D; Other mode: **Update time**: DWORD: Value range in µs: 0 to 25000000_D							
44/92	**Counter behavior at limits and gate start**							
44/92	Reaction to gate start:		Reaction to violation of a counting limit:			Reset when counting limit is violated:		
	00_B: Set to start value		000_B: Stop counting			000_B: To other counting limit		
	01_B: Continue with current value		001_B: Continue counting			001_B: To start value		
	10 to 11_B: Reserved		010 to 111_B: Reserved			010 to 111_B: Reserved		

Bit → / Byte channel 0/1 ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
45/93	**Specify measured value**							
45/93	Reserved[2]			Time base for velocity measurement:			Measured variable:	
				000_B: 1 ms			00_B: Frequency	
				001_B: 10 ms			01_B: Period	
				010_B: 100 ms			10_B: Velocity	
				011_B: 1 s			11_B: Reserved	
				100_B: 60 s/1 min				
				101 to 111_B: Reserved				
46/94	Increments per unit:							
47/95	WORD: Value range: 1 to 65535_D							
48/96	Set the hysteresis range: Value range: 0 to 255_D							
49...51/ 97...99	Reserved[2]							

[1] You enable a specific parameter by setting the corresponding bit to 1.

[2] Reserved bits must be set to 0