

SIEMENS



Manual

SIMATIC

S7-1500/ET 200MP

Technology module
TM Count 2x24V (6ES7550-1AA01-0AB0)

Edition

08/2026

support.industry.siemens.com

SIMATIC

S7-1500/ET 200MP Technology module TM Count 2x24V (6ES7550-1AA01-0AB0)

Equipment Manual

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Warning notice system

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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

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

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified persons are those who, because of their training and experience, are familiar with the installation, assembly, commissioning, operation, decommissioning and disassembly of the product and can recognize risks and avoid possible hazards.

Proper use of Siemens products

Note the following:

WARNING

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

Trademarks

All names identified by ® are registered trademarks of Siemens Aktiengesellschaft. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

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

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Introduction

Purpose of the documentation

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

Generally-applicable information on installation and commissioning of the S7-1500 or ET 200MP is available in the S7-1500/ET 200MP Automation system

(<https://support.industry.siemens.com/cs/ww/en/view/59191792>) System Manual.

The counting and measuring functions of the TM Count 2x24V technology module are described in more detail in the Counting, Measurement and Position Detection

(<https://support.industry.siemens.com/cs/ww/en/view/59709820>) Function Manual.

Conventions

Please observe notes marked as follows:

NOTE

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

Recycling and disposal

For environmentally sustainable recycling and disposal of your old equipment, contact a certified electronic waste disposal service and dispose of the equipment according to the applicable regulations in your country

(<https://support.industry.siemens.com/cs/ww/en/view/109976696>).

ID Link for the digital nameplate

The ID Link is a globally unique identifier in accordance with IEC 61406, which you will find as a QR code on your product.

You can recognize the ID Link from the black frame corner at the bottom right of its frame.

The ID Link takes you to the digital nameplate of your product.

Scan the QR code on the product or packaging label using a smartphone camera, bar code scanner, or reader app. Open the ID Link.

In the digital nameplate you will find product data, manuals, Declarations of Conformity, certificates, and other useful information on your product.

Standards

You can find a dated reference to the respective standards or EU Declaration of Conformity on the Internet (<https://sieportal.siemens.com/su/blGuK>).

Document history

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

Manual edition	Comments	Firmware version
08/2026	The following sections have been revised: - Industrial cybersecurity (Page 16) - Product overview (Page 19) - Configuring/address space (Page 31) - Interrupts/diagnostic messages (Page 69) - Technical specifications (Page 75)	V3.0.0
12/2020	The following sections have been revised: - Product overview (Page 19) - Wiring (Page 26) - Configuring/address space (Page 31) - Interrupts/diagnostic messages (Page 69) - Technical specifications (Page 75)	V2.0
06/2018	The following sections have been revised: - Product overview (Page 19) - Configuring/address space (Page 31) - Interrupts/diagnostic messages (Page 69) - Parameter data record (Page 84)	V1.3
06/2013	First edition	V1.0

1.1 SiePortal

You can find current information on the following topics quickly and easily here:

- **Catalog and Order System**

Ordering system for automation and drive solutions based on Totally Integrated Automation (TIA) and Totally Integrated Power (TIP).

- **Product support**

All the information and extensive know-how on your product, technical specifications, FAQs, certificates, downloads, and manuals.

- **Application examples**

Tools and examples to solve your automation tasks – as well as function blocks, performance information and videos.

- **Services**

Information about Industry Services, Field Services, Technical Support, spare parts and training offers.

- **Forums**
For answers and solutions concerning automation technology.
- **mySiePortal**
Your personal working area in SiePortal for notifications, support requests and configurable documents.

This information is provided by SiePortal on the Internet (<https://sieportal.siemens.com>).

1.2 Open Source Software

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

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

1.3 S7-1500/ET 200MP Documentation Guide



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

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

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

Basic information



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

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

Examples:

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

Device information



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

Examples:

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

General information



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

Examples:

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

Product Information

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

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

Manual Collection S7-1500/ET 200MP

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

You can find the Manual Collection on the Internet.

(<https://support.industry.siemens.com/cs/ww/en/view/86140384>)

Manual Collection fail-safe modules

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

You can find the Manual Collection on the Internet.

(<https://support.industry.siemens.com/cs/ww/en/view/109806400>)

SIMATIC S7-1500 comparison list for programming languages

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

You can find the comparison list on the Internet

(<https://support.industry.siemens.com/cs/ww/en/view/86630375>).

1.3.1 SIMATIC Technical Documentation

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

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

Overview of the SIMATIC Technical Documentation

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



Industry Online Support International

(<https://support.industry.siemens.com/cs/ww/en/view/109742705>)

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



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



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

Retention of the documentation

Retain the documentation for later use.

For documentation provided in digital form:

1. Download the associated documentation after receiving your product and before initial installation/commissioning. Use the following download options:
 - Industry Online Support International: (<https://support.industry.siemens.com>)
The article number is used to assign the documentation to the product. The article number is specified on the product and on the packaging label. Products with new, non-compatible functions are provided with a new article number and documentation.
 - ID link:
Your product may have an ID link. The ID link is a QR code with a frame and a black frame corner at the bottom right. The ID link takes you to the digital nameplate of your product. Scan the QR code on the product or on the packaging label with a smartphone camera, barcode scanner, or reader app. Call up the ID link.
2. Retain this version of the documentation.

Updating the documentation

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

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

mySupport

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

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

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

Application examples

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

You can find the application examples on the Internet.

(<https://support.industry.siemens.com/cs/ww/en/ps/ae>)

AI-powered online support chat

The "Automation Knowledge Guide" function is an advanced AI-controlled platform that gives you access to the powerful knowledge base of the Siemens Support Portal

(<https://sieportal.siemens.com/en-ww/support>). You do not just receive mechanical answers to your questions, but precise, interactive informational material. This allows you to effectively speed up your research and decision processes.

The following link (<https://support.industry.siemens.com/cs/ww/en/view/109974274>) provides current information on the availability of "Automation Knowledge Guide":

You can also access the entry by means of the "AI powered Online Support Chat" command in the "Help" menu in TIA Portal.

1.3.2 Tool support

Tools

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

TIA Selection Tool

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

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

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

You can find the TIA Selection Tool on the Internet. (<https://www.siemens.com/en-us/products/tia/selection-tool/>)

SIMATIC Automation Tool

You can use the SIMATIC Automation Tool to perform commissioning and maintenance activities on various SIMATIC S7 stations as bulk operations independent of TIA Portal.

The SIMATIC Automation Tool offers a wide range of functions:

- Scanning of a PROFINET/Ethernet system network and identification of all connected CPUs
- Assignment of addresses (IP, subnet, Gateway) and device name (PROFINET device) to a CPU

- Transfer of the date and the programming device/PC time converted to UTC time to the module
- Program download to CPU
- RUN/STOP mode switchover
- CPU localization through LED flashing
- Reading out of CPU error information
- Reading the CPU diagnostic buffer
- Reset to factory settings
- Firmware update of the CPU and connected modules

You can find the SIMATIC Automation Tool on the Internet.

(<https://support.industry.siemens.com/cs/ww/en/view/98161300>)

PRONETA

SIEMENS PRONETA (PROFINET network analysis) is a commissioning and diagnostic tool for PROFINET networks. PRONETA Basic has two core functions:

- In the network analysis, you get an overview of the PROFINET topology. Compare a real configuration with a reference installation or make simple parameter changes, e.g. to the names and IP addresses of the devices.
- The "IO test" is a simple and rapid test of the wiring and the module configuration of a plant, including documentation of the test results.

You can find SIEMENS PRONETA Basic on the Internet:

(<https://support.industry.siemens.com/cs/ww/en/view/67460624>)

SIEMENS PRONETA Professional is a licensed product that offers you additional functions. It offers you simple asset management in PROFINET networks and supports operators of automation systems in automatic data collection/acquisition of the components used through various functions:

- The user interface (API) offers an access point to the automation cell to automate the scan functions using MQTT or a command line.
- With PROFIenergy diagnostics, you can quickly detect the current pause mode or the readiness for operation of devices that support PROFIenergy and change these as needed.
- The data record wizard supports PROFINET developers in reading and writing acyclic PROFINET data records quickly and easily without PLC and engineering.

You can find SIEMENS PRONETA Professional on the Internet.

(<https://www.siemens.com/proneta-professional>)

SINETPLAN

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

The advantages at a glance

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

You can find SINETPLAN on the Internet

(<https://new.siemens.com/global/en/products/automation/industrial-communication/profinet/sinetplan.html>).

MultiFieldbus Configuration Tool

MultiFieldbus Configuration Tool (MFCT) is PC-based software and supports the configuration of MultiFieldbus-Devices and DALI-modules. In addition, the MFCT offers convenient options for bulk firmware updating of ET 200 devices with MultiFieldbus-support and reading of service data for many other Siemens devices.

Functional scope of the MFCT

- MultiFieldbus configuration:
Engineering, configuration and diagnostics of MultiFieldbus-devices, provision of the required project files (project, UDT-, CSV- and EDS-file), transfer/export of the files to device and/or data memory.
- DALI configuration:
Device selection and online configuration of DALI modules.
- TM FAST:
Generation and download of FPGA-UPD- and FPGA-DB-files.
- Maintenance:
Topology scan of a Ethernet network, reading of service data, parameter assignment and firmware update.
- Settings:
Language switching German / English, network scanner speed, setting of the network adapter, installation of GSDML-and EDS-files.
- Event diagnostics for CM PTP:
Reading out and analyzing the parameter settings and communication of a CM PTP.

System/installation requirements for MFCT

The MFCT runs under Microsoft Windows and does not require installation or administrator rights.

For MFCT you must also install the following software:

- Microsoft .NET Framework 4.8 (You can find an Offline Installer on the Internet. (<https://support.microsoft.com/en-us/topic/microsoft-net-framework-4-8-offline-installer-for-windows-9d23f658-3b97-68ab-d013-aa3c3e7495e0>))
- NPcap from directory "Misc"
- PG/PC interface from directory "Misc"
- Microsoft C++ Redistributable for x86-systems (you can find the installation data for download on the Internet. (https://aka.ms/vs/15/release/vc_redist.x86.exe))

The download of the tool and more information as well as documentation on the individual functions of the MFCT can be found on the Internet.

(<https://support.industry.siemens.com/cs/ww/en/view/109773881>)

Industrial cybersecurity

2.1 Introduction to industrial cybersecurity

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

General information on and measures for the topic of industrial cybersecurity is provided in the System Manual (<https://support.industry.siemens.com/cs/ww/en/view/59191792>).

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

2.2 Cybersecurity information

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

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Products and solutions from Siemens form one element of such a concept. Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

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

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

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

2.3 Measures for protecting the operational application environment

Purpose and intended application environment

The TM Count 2x24V is designed as a technology module for the S7-1500 automation system/ET 200MP distributed I/O system in industrial automation plants. It enables counting with 24 V incremental/pulse encoders.

Classification by security context for the product

An appropriate operational application environment is necessary in order to protect the product from cyber threats. You achieve this by considering the following classification into categories according to the security context and by implementing the necessary measures.

The description of the categories is available in the System Manual S7-1500, ET 200MP (<https://support.industry.siemens.com/cs/ww/en/view/59191792>), in the section "Description of the operational environment (security context)".

Category	Phase of use/Access	Classification	Required measures
Persons	Installing	Instructed Person	• Training on the product • Documented training processes
	Wiring	Instructed Person	
	Configuring, programming	Skilled Person	• Regular training on product, plant, cybersecurity • Documented training processes • Clear roles and responsibilities • Monitoring and checking of employee qualifications
	Testing, commissioning, maintenance	Skilled Person	
	Decommissioning	Instructed Person	• Training on the product • Documented training processes
Physical access	Device with interfaces, wiring	Controlled	• Installation in lockable control cabinets with cylinder locks • Access control with keys, card systems or biometric methods • Monitoring of critical areas with cameras or alarm systems • Physical separation of publicly accessible areas • Accompaniment of non-employees
Communication access	Access via PROFINET IO, PROFIBUS DP	Controlled	• Physical protection of the network infrastructure • Cable protection by laying bus cables in protected cable ducts/channels • Protection of unused ports with port blockers
	Access from the plant network	Limited	• Network segmentation using routers • Communication control by means of firewalls • Deactivation of communications services and ports that are not required • User management/authentication for CPUs/CPs used as gateway

More information

Also consider all aspects of industrial cybersecurity in the S7-1500, ET 200MP System Manual. There you will find detailed descriptions of:

- Comprehensive security concepts
- Secure operation of CPUs and systems
- Overview of the protective functions
- User management and access control
- Network security and communication protection
- Remaining residual risks

2.4 Cybersecurity-relevant information

Note all cybersecurity-relevant information.

Topics with cybersecurity-relevant information	Reference
Operating environment and security measures	
Operating environment and security measures	This section is found in the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
Security properties of the product	
Access protection	In addition, observe the information on access protection in the Protection chapter of the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
Signed firmware update	The topic of a signed firmware update is discussed in the Industrial Cybersecurity section of the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
Secure operation	
Corrective measures for known risks	Corrective measures for known risks are published on the Siemens ProductCERT (https://www.siemens.com/cert) website. For more information on SIEMENS ProductCERT, refer to the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
Security checks	Application-specific security measures such as cyclic checks of the configuration via checksums are described in the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).

Product overview

3.1 Properties

Article number

6ES7550-1AA01-0AB0

The TM Count 2x24V technology module with article number 6ES7550-1AA01-0AB0 is a compatible replacement for the TM Count 2x24V with article number 6ES7550-1AA00-0AB0. The TM Count 2x24V with article number 6ES7550-1AA01-0AB0 can be used in configurations in which the TM Count 2x24V with article number 6ES7550-1AA00-0AB0 is configured. It then has the functional scope of the TM Count 2x24V with article number 6ES7550-1AA00-0AB0.

Firmware version

This equipment manual describes the properties of firmware version V3.0 of the module.

View of the module

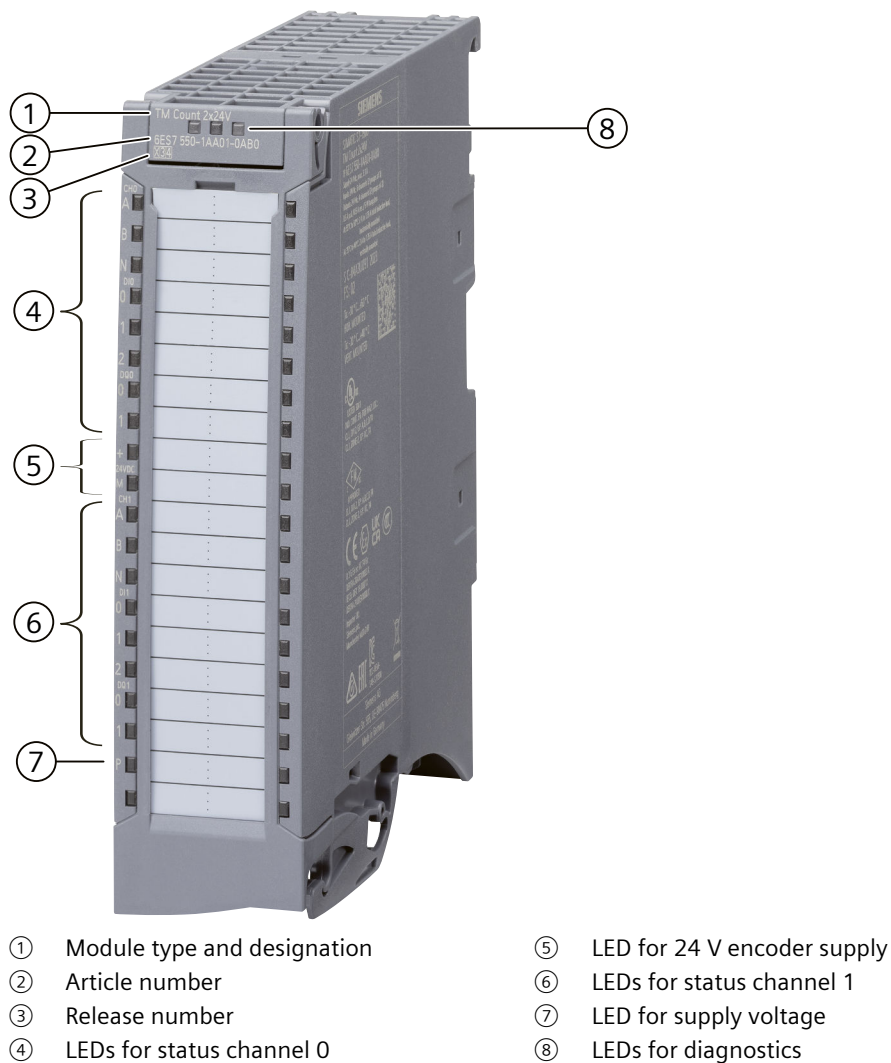


Figure 3-1 View of the TM Count 2x24V module

Properties

The technology module has the following properties:

- Technical properties
 - Two channels
 - Interfaces:
 - 24 V encoder signals A, B and N from sourcing, sinking or push-pull encoders and sensors
 - 24 V encoder supply, short-circuit-proof
 - DI0, DI1 and DI2 digital input signals (per channel)
 - DQ0 and DQ1 digital output signals (per channel)
 - Supply voltage L+

- 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 N signal
 - 24 V incremental encoder without N signal
 - 24 V pulse encoder with direction signal
 - 24 V pulse encoder without direction signal
 - 24 V pulse encoder with up/down count signal

The module supports the following functions:

Table 3-1 Version dependencies of the functions

Function	Firmware version of module	Configurable as of		
		STEP 7 (TIA Portal)	GSD	
			PROFINET IO	PROFIBUS DP
Firmware update	V1.0 or higher	V13	X	—
I&M identification data	V1.0 or higher	V13	X	X
Parameter reassignment in RUN	V1.0 or higher	V13	X	X
Isochronous mode	V1.0 or higher	V13	—	—
Counting/measuring	V1.0 or higher	V13	X	X
Operating with "Counting and measuring" technology object	V1.0 or higher	V13	—	—
Position input for "Motion Control" technology object	V1.0 or higher	V13	—	—
Operation with the "Measuring input" technology object	V1.3 or higher	V15 with HSP0256	—	—
Fast Mode	V2.0 or higher	V16 with HSP0332	X	X
Display of digital input states in the process image for position detection for "Motion Control" technology object	V2.0 or higher	V16 with HSP0332	—	—
Signed firmware update	V3.0 or higher	V21.1	X	—

Firmware versions V1.x are available for article number 6ES7550-1AA00-0AB0. Firmware versions V2.0 and V3.0 are available for article number 6ES7550-1AA01-0AB0. Firmware updates are supported within the same major version of the firmware. It is not possible to switch to a different major version via a firmware update.

You can configure the module with article number 6ES7550-1AA01-0AB0 as **replacement part compatible** with article number 6ES7550-1AA00-0AB0.

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

For more information on accessories, refer to the "System overview" chapter of the S7-1500/ET 200MP Automation System

(<https://support.industry.siemens.com/cs/ww/en/view/59191792>) System Manual.

3.2 Functions

3.2.1 Detection of counting signals

Counting is the detecting and adding up of events. The counters of the technology module detect 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. In addition, you can read the signal state of the respective digital input via the feedback interface.

You can specify the counter characteristics using the functions 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.

You can configure the behavior of the counter at the counting limits.

Start value

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

Gate control

You can define the time window in which the count signals are acquired with the hardware gate (HW gate) and software gate (SW gate).

Capture (Latch)

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 the N signal at the encoder input

The "Frequency of Capture function" parameter specifies whether the function is executed at each configured edge or only once after each enable.

Measuring input

If you use Position input for Motion Control ([Page 24](#)), you can use the "Measuring input" technology object to execute a measuring input function with a hardware digital input.

Hardware interrupts

The technology module can trigger a hardware interrupt in the CPU, for example, if a comparison 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 during operation are to trigger a hardware interrupt.

3.2.2 Measured value determination

The following high-accuracy measurement functions are available (accuracy up to 100 ppm):

- Frequency measurement with the unit of hertz
- Period measurement with the unit of seconds
- Velocity measurement with a flexibly adaptable unit

Update time

You can configure the interval at which the technology module updates the measured values cyclically as the update time.

Gate control

You can define the time window in which the count signals are acquired with the hardware gate (HW gate) and software gate (SW gate).

3.2.3 Switching the outputs at comparison values

The available digital outputs DQ0 and DQ1 can be directly activated/switched by the specified comparison values or via the user program. The comparison values are configurable and can be modified during runtime with the user program. This enables very fast reaction times to be achieved.

Comparison values in the Counting mode

You define two comparison values in the Counting mode. If the current counter value meets the configured comparison condition, the corresponding digital output can be set to directly initiate control processes in the process.

Comparison values in the Measuring mode

You define two comparison values in the Measuring mode. If the current measured value meets the configured comparison condition, the corresponding digital output can be set to directly initiate control processes in the process.

3.2.4 Position input for Motion Control

You can use the technology module for position detection for the following axis technology objects of S7-1500 Motion Control :

- TO_PositioningAxis
- TO_SynchronousAxis
- TO_ExternalEncoder

In this operating mode, you can use the measuring input technology object (TO_MeasuringInput) to execute a measuring input function with hardware digital input DI1.

Additional information

You can find a detailed description of the use of Motion Control and its configuration in the following:

- Function manual S7-1500 Motion Control available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/59381279>)
- Function manual S7-1500T Motion Control available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109481326>)

3.2.5 Fast Mode

You can use the technology module in Fast Mode for very fast input of the counter value in case of compressed functionality. A reduced feedback interface but no control interface is available in Fast Mode. This allows you to use a shorter send clock for the CPU.

3.2.6 Additional functions

Synchronization

You can configure the edge of an external reference signal that loads 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

The "Frequency of synchronization" parameter specifies whether the function is executed at each configured edge or only once after each enable.

Hysteresis

You can specify a hysteresis for the comparison values within which a digital output will be prevented from switching again.

Diagnostic interrupt

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

Input filter

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

Isochronous mode

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

Wiring

4.1 Pin assignment and block diagram

You connect the encoder signals, the digital input and output signals and the encoder supplies to the 40-pin front connector of the technology module. In addition, you connect the supply voltage for supplying the module and digital outputs and for producing the encoder supply voltages to the 4-pin power supply element.

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

You can find information on wiring the front connector, shielding the cable, etc., in system manual S7-1500 / ET 200MP Automation System

(<https://support.industry.siemens.com/cs/ww/en/view/59191792>), section Wiring.

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, you must 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 through to the next module.

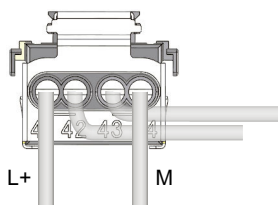


Figure 4-1 Connection of power supply element

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

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.

Encoder supply

For supplying the encoders and sensors connected to the digital inputs, the technology module provides a 24 V DC supply voltage at output 24VDC (terminal 9) with reference to M (terminal 10). The voltage is monitored for short-circuit and overload.

Pin assignment for the front connector

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

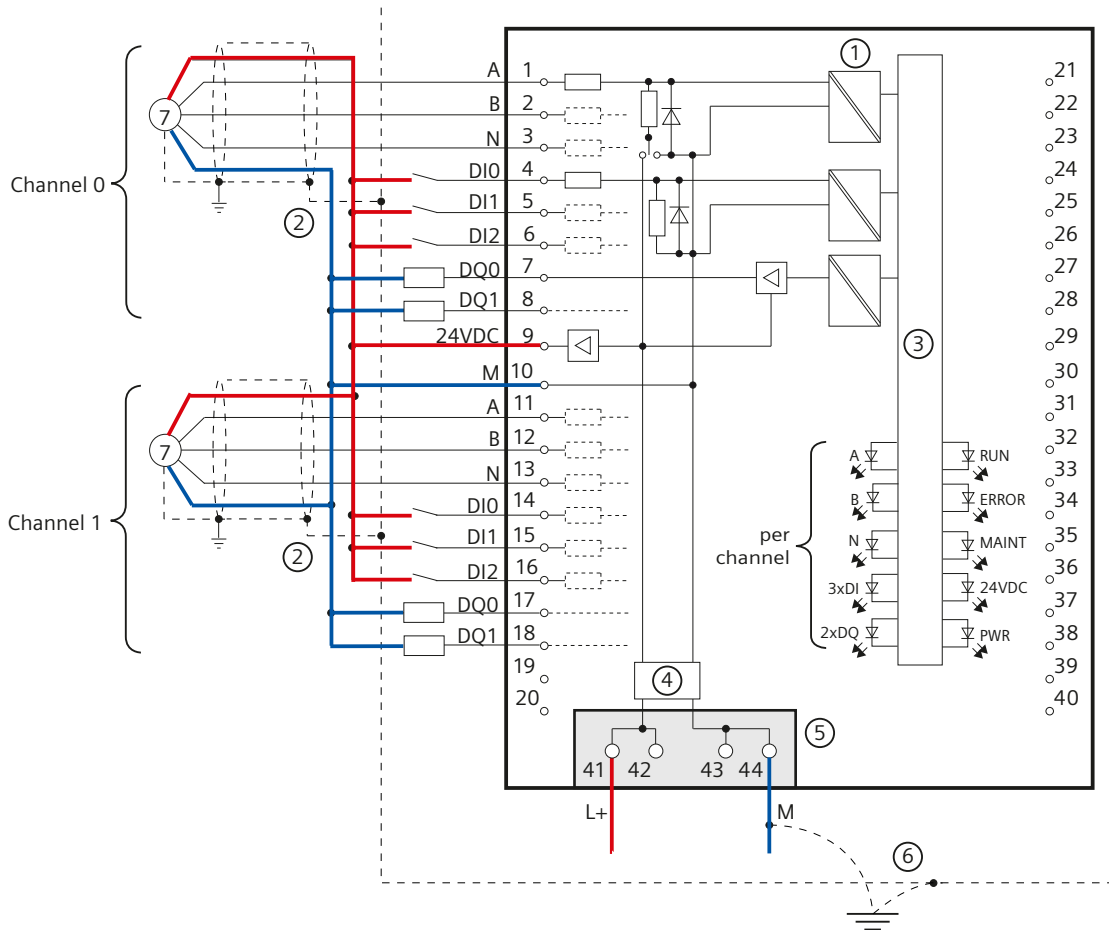
Table 4-1 Pin assignment of the front connector

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		Count signal A		Up count signal A
	2	CH0.B	Encoder signal B		Direction signal B	—	Down count 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 the two counter channels						
	9	24VDC	Encoder supply 24 V DC				
	10	M	Ground for encoder supply, digital inputs and digital outputs				
	Counter channel 1						
	11	CH1.A	Encoder signal A		Count signal A		Up count signal A
	12	CH1.B	Encoder signal B		Direction signal B	—	Down count 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	—	—				

Circuit 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 circuit 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
- ⑦ Incremental encoder

Figure 4-2 Circuit diagram with two incremental encoders

Digital inputs DI0, DI1 , and DI2

You can use three digital inputs. The digital inputs are used for gate control, synchronization, and the Capture function.

The digital inputs of the two counter channels are not isolated from each other. The digital inputs are isolated from the backplane bus.

Input delay for digital inputs

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

NOTE

If you set an input delay < 0.1 ms, you must use shielded leads for connecting the digital inputs.

Digital outputs DQ0 and DQ1

You can use two digital outputs. The digital outputs of the two counter channels are not isolated from each another.

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 against overload and short-circuit.

Relays and contactors can be directly connected without an external protective circuit. You can find information on the maximum possible operating frequencies and the inductance values of the inductive loads connected to the digital outputs in section Technical specifications ([Page 75](#)).

24 V encoder signals/count signals

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

- Incremental encoder with N signal:
The A, B and N signals are connected using the correspondingly marked terminals. The A and B signals are the two incremental signals with a by 90° phase shift. N is the zero mark signal that supplies one pulse per revolution.
- Incremental encoder without N signal:
The A and B signals are connected using the correspondingly marked terminals. The A and B signals are the two incremental signals with a by 90° phase shift. The N terminal remains unconnected.
- Pulse encoder without direction signal:
The count signal is connected to the A terminal. The count direction can be specified via the control interface. The B and N terminals remain unconnected.

4.1 Pin assignment and block diagram

- Pulse encoder with direction signal:
The count signal is connected to the A terminal. The direction signal is connected to the B terminal. With a high level, the direction signal is counted down. The N terminal remains unconnected.
- Pulse encoder with up/down count signal:
The up count signal is connected to the A terminal. The down count signal is connected to the B terminal. The N terminal remains unconnected.

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

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

- Sourcing output:
The A, B and N inputs are switched by the encoder or sensor to 24VDC .
- Sinking output:
The A, B and N inputs are switched by the encoder or sensor to ground M .
- Push-pull:
The A, B and N inputs are switched by the encoder or sensor alternately to 24VDC and ground M . Monitoring for wire break is possible with this type of encoder/sensor.

Configuring/address space

5.1 Operating with "Counting and measurement" technology object

5.1.1 Configuring

Introduction

You configure the technology module and assign its parameters with STEP 7 (TIA Portal). The technology object is used to control and monitor the functions of the technology module.

System environment

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

Applications	Components required	Configuration software	In the user program
Central operation with an S7-1500 CPU	- S7-1500 automation system - TM Count 2x24V	STEP 7 (TIA Portal): - Device configuration with hardware configuration - Parameter setting with High_Speed_Counter technology object	High_Speed_Counter instruction
Distributed operation with an S7-1500 CPU	- S7-1500 automation system - ET 200MP distributed I/O system - TM Count 2x24V		

Additional information

You can find a detailed description of the counting and measurement functions and their configuration in the following:

- Function manual Counting, Measurement and Position Detection available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/59709820>)
- In the STEP 7 (TIA Portal) (<https://docs.tia.siemens.cloud>) information system under "Counting, measurement and position detection (S7-1500)"

Hardware Support Packages (HSP)

Firmware versions $\leq$ V1.3 of the module (6ES7550-1AA00-0AB0) are integrated as of TIA Portal Version V16. Firmware version V2.0 of the module (6ES7550-1AA01-0AB0) is integrated as of TIA Portal Version V17. Firmware version V3.0 of the module (6ES7550-1AA01-0AB0) is integrated as of TIA Portal Version V21.1. You can configure the module with article number 6ES7550-1AA01-0AB0 as replacement part compatible with article number 6ES7550-1AA00-0AB0. Firmware version V3.0 can be configured as firmware version V2.0 without any functional limitations.

5.1 Operating with "Counting and measurement" technology object

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

You can also access this download from the menu bar of STEP 7 (TIA Portal): "Options > Support packages > Download from the Internet".

5.1.2 Reaction to CPU STOP

You set the reaction of the technology module to a STOP of the CPU on a channel-by-channel basis in the basic parameters of the device configuration.

Table 5-1 Reaction of technology module to CPU STOP

Option	Meaning
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. If a digital output with the "At comparison value for a pulse duration" function is set at CPU STOP, the digital output is reset after the pulse duration elapses. 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.

5.1.3 Parameter setting

You specify the properties of the technology module using various parameters. Depending on the settings, not all parameters are available. When parameters are assigned in the user program, the parameters are transferred to the module with the "WRREC" instruction and data record 128 (Page 84).

You set the parameters of the module as follows in this operating mode:

1. Insert the module from the hardware catalog under "Technology modules".
2. Set the mode "Operating with technology object "Counting and measuring"" and the further device configuration in the hardware configuration.
3. Insert the High_Speed_Counter technology object from the project tree in folder "Technology objects > Add new object > Counting and measuring".
You can find information on configuring with a technology object in function manual Counting, measurement and position detection (<http://support.automation.siemens.com/WW/view/en/59709820>).
4. Open the configuration of the High_Speed_Counter technology object, e.g. using the Configuration button  in the instruction for the technology object.
5. Set the parameters of the technology object.
6. Download the project to the CPU.

NOTE

You can operate one channel in the "Operation with the 'Counting and measuring' technology object" mode and the other channel in the "Manual operation (without technology object)" mode.

Parameters of the TM Count 2x24V

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

Table 5-2 Settable parameters and their default setting

Parameter	Value range	Scope
Reaction to CPU STOP	• Output substitute value • Keep last value • Continue operation	Channel
Enable diagnostic interrupt on wire break	• Deactivated • Activated	Channel
Enable additional diagnostic interrupts	• Deactivated • Activated	Channel
Hardware interrupt: New Capture value available	• Deactivated • Activated	Channel
Hardware interrupt: Synchronization of the counter by an external signal	• Deactivated • Activated	Channel
Hardware interrupt: Gate start	• Deactivated • Activated	Channel
Hardware interrupt: Gate stop	• Deactivated • Activated	Channel
Hardware interrupt: Overflow (high counting limit violated)	• Deactivated • Activated	Channel
Hardware interrupt: Underflow (low counting limit violated)	• Deactivated • Activated	Channel
Hardware interrupt: Direction reversal	• Deactivated • Activated	Channel
Hardware interrupt: Zero crossing	• Deactivated • Activated	Channel
Hardware interrupt: Comparison event for DQ0 occurred	• Deactivated • Activated	Channel
Hardware interrupt: Comparison event for DQ1 occurred	• Deactivated • Activated	Channel

5.1 Operating with "Counting and measurement" technology object

The following parameter settings are possible in the technology object:

Table 5-3 Settable parameters and their default setting

Parameter	Value range	Scope
Signal type	- Pulse (A) Pulse (A) and direction (B) - Count up (A), count down (B) - Incremental encoder (A, B phase-shifted) - Incremental encoder (A, B, N)	Channel
Signal evaluation for counter inputs	Single - Double - Quadruple	Channel
Invert direction (counter inputs)	Deactivated - Activated	Channel
Filter frequency for counter inputs	100 Hz 200 Hz 500 Hz 1 kHz 2 kHz 5 kHz 10 kHz 20 kHz 50 kHz 100 kHz 200 kHz	Channel
Sensor type	Sourcing output - Sinking output - Push-pull (sinking and sourcing output)	Channel
Reaction to signal N	No reaction to signal N - Synchronization at signal N - Capture at signal N	Channel
Frequency of synchronization	Once - Periodic	Channel
Frequency of Capture function	- Once Periodic	Channel
Counting high limit	-2147483648... 2147483647	Channel
Start value	-2147483648... 0 ...2147483647	Channel
Counting low limit	-2147483648 ...2147483647	Channel
Reaction to violation of a counting limit	- Stop counting Continue counting	Channel
Reset when counting limit is violated	To opposite counting limit - To start value	Channel
Reaction to gate start	- Set to start value Continue with current value	Channel
Set function of DI	- Gate start/stop (level-triggered) - Gate start (edge-triggered) - Gate stop (edge-triggered) - Synchronization - Enable synchronization at signal N - Capture Digital input without function	Channel

5.1 Operating with "Counting and measurement" technology object

Parameter	Value range	Scope
Input delay for digital inputs	- None 0.05 ms 0.1 ms 0.4 ms 0.8 ms 1.6 ms 3.2 ms 12.8 ms 20 ms	Channel
Edge selection for DI	At rising edge - At falling edge - At rising and falling edge	Channel
Select level for DI	Active with high level - Active with low level	Channel
Behavior of counter value after Capture with DI	Continue counting - Set to start value and continue counting	Channel
Comparison value 0	-2147483648... 0 ...2147483647	Channel
Comparison value 1	-2147483648... 10 ...2147483647	Channel
Operating mode	Use count value as reference - Use measured value as reference	Channel
Set output	Between comparison value and count high limit / measured value $\geq$ comparison value - Between comparison value and low limit / measured value $\leq$ comparison value - Between comparison value 0 and 1 - Not between comparison values 0 and 1 - At comparison value for a pulse duration - After set command from CPU until comparison value - Use by user program	Channel
Count direction of DQ function	- Up - Down In both directions	Channel
Pulse duration	0.0... 500.0 ...6553.5 ms	Channel
Substitute value for DQ0	0 1	Channel
Substitute value for DQ1	0 1	Channel
Hysteresis (in increments)	0 ...255	Channel
Measured variable	Frequency - Period - Velocity	Channel
Update time of the measuring function	0... 10 ...25000 ms	Channel
Time base for velocity measurement	1 ms 10 ms 100 ms 1 s 60 s	Channel
Increments per unit	1 ...65535	Channel

Explanation of parameters

You can find a detailed description of the parameters in function manual Counting, Measurement and Position Detection in sections Basic parameters and Configuring the High_Speed_Counter available for download on the Internet (<http://support.automation.siemens.com/WW/view/en/59709820>).

5.1.4 Address space

Address space of the technology module

Table 5-4 Size of input and output addresses of the TM Count 2x24V when operating with "Counting and measurement" technology object

	Inputs	Outputs
Size per counting channel	16 bytes	12 bytes
Total size	32 bytes	24 bytes

The control and feedback interface is compatible with manual operation (Page 41) and is operated by the instruction High_Speed_Counter.

5.1.5 Isochronous mode

The technology module supports the "Isochronous mode" system function. This system function enables counter values and measured values to be acquired 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. A change in the state of a digital input immediately affects the planned reaction of the technology module.

For clock synchronization in this operating mode, use an OB of the type "Synchronous Cycle" (such as OB61). The High_Speed_Counter instruction is called in the assigned OB.

The update time for the measured value is synchronized with the system cycle in a suitable ratio and, if necessary, adapted in length. If you set "0", the measured value is updated once per system cycle.

Data processing

The data that was transmitted to the technology module in the current bus cycle via the control interface takes effect when it is processed in the internal technology module cycle. At the time the input data is read (T_i), the counter value and the measured value as well as status bits are acquired and made available in the feedback interface for retrieval in the current bus cycle.

Isochronous mode parameters

In isochronous mode, the "Filter frequency" parameter can affect the isochronous mode parameters of the sync domain.

Because the isochronous parameters are not checked in RUN, changing the parameter in RUN can result in the technology module no longer processing the control and feedback interface correctly. You prevent this by selecting the option with the greatest time demand as early as during the offline parameter assignment.

Additional information

You can find a detailed description of isochronous mode in the following:

- In the STEP 7 (TIA Portal) information system
- Function manual PROFINET with STEP 7 available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/49948856>)

5.2 Position input for "Motion Control" technology object

5.2.1 Configuring

Introduction

You configure the technology module and assign its parameters with STEP 7 (TIA Portal). The technology object is used to control and monitor the functions of the technology module.

System environment

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

Applications	Components required	Configuration software	In the user program
Central operation with an S7-1500 CPU	• S7-1500 automation system • TM Count 2x24V	STEP 7 (TIA Portal): • Device configuration with hardware configuration • Parameter setting with axis and measuring input technology objects	Motion Control instructions
Distributed operation with an S7-1500 CPU	• S7-1500 automation system • ET 200MP distributed I/O system • TM Count 2x24V		

Additional information

You can find a detailed description of the use of Motion Control and its configuration in the following:

- Function manual S7-1500 Motion Control available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/59381279>)
- Function manual S7-1500T Motion Control available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109481326>)
- Information system of STEP 7 (TIA Portal) under "Using technology functions > Motion Control > Motion Control (S7-1200, S7-1500)"

You can find a description of configuring the technology module for position detection in the following:

- Function manual Counting, Measurement and Position Detection available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/59709820>)
- In the STEP 7 (TIA Portal) (<https://docs.tia.siemens.cloud>) information system under "Counting, measurement and position detection (S7-1500)"

Hardware Support Packages (HSP)

Firmware versions $\leq$ V1.3 of the module (6ES7550-1AA00-0AB0) are integrated as of TIA Portal Version V16. Firmware version V2.0 of the module (6ES7550-1AA01-0AB0) is integrated as of TIA Portal Version V17. Firmware version V3.0 of the module (6ES7550-1AA01-0AB0) is integrated as of TIA Portal Version V21.1. You can configure the module with article number 6ES7550-1AA01-0AB0 as replacement part compatible with article number 6ES7550-1AA00-0AB0. Firmware version V3.0 can be configured as firmware version V2.0 without any functional limitations.

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

You can also access this download from the menu bar of STEP 7 (TIA Portal): "Options > Support packages > Download from the Internet".

5.2.2 Parameter setting

You specify the properties of the technology module using various parameters. Depending on the settings, not all parameters are available.

You set the parameters of the module as follows in this operating mode:

1. Insert the module from the hardware catalog under "Technology modules".
2. Set the mode "Position detection for technology object "Motion Control"" and the other module parameters in the hardware configuration.
3. Insert the axis technology object and, if necessary, the measuring input technology object from the project tree in folder "Technology objects > Add new object > Motion Control". You can find information on configuring with axis technology objects in function manual S7-1500T Motion Control (<https://support.industry.siemens.com/cs/ww/en/view/109481326>).
4. Open the configuration of the axis technology object, e.g. using the Configuration button  in the respective instruction for the technology object.
5. Set the parameters of the technology objects.
6. Download the project to the CPU.

NOTE

This operating mode applies automatically to both channels of the technology module.

Parameters of the TM Count 2x24V

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

Table 5-5 Programmable parameters

Parameter	Value range	Scope
Signal type	- Pulse (A) - Pulse (A) and direction (B) - Count up (A), count down (B) - Incremental encoder (A, B phase-shifted) Incremental encoder (A, B, N)	Channel
Invert direction (counter inputs)	Deactivated - Activated	Channel
Signal evaluation for counter inputs	Single - Double - Quadruple	Channel
Filter frequency for counter inputs	100 Hz 200 Hz 500 Hz 1 kHz 2 kHz 5 kHz 10 kHz 20 kHz 50 kHz 100 kHz 200 kHz	Channel
Sensor type	Sourcing output - Sinking output - Push-pull (sinking and sourcing output)	Channel
Signal selection for reference mark 0	- DI0 Signal N of incremental encoder	Channel
Measuring input	DI1	Channel
Encoder type	- Linear Rotary	Channel
Increments per revolution / steps per revolution	1...65535	Channel
Reference speed	6.00... 3000.00 ...210000.00 U/min	Channel
Distance between increments	1... 16000 ...25000000 nm	Channel
Fine-resolution increment distance	is calculated automatically (read-only)	Channel
Reference velocity	0,60... 16,00 ...600,00 m/min	Channel
Enable diagnostic interrupt on wire break	Deactivated - Activated	Channel
Enable additional diagnostic interrupts	Deactivated - Activated	Channel

Explanation of parameters

You can find a detailed description of the parameters in function manual Counting, Measurement and Position Detection, section Module parameters (position input for Motion Control) available for download on the Internet

(<http://support.automation.siemens.com/WW/view/en/59709820>).

5.2.3 Address space

Address space of the technology module

Table 5-6 Size of input and output addresses of the TM Count 2x24V with position input for "Motion Control" technology object

	Inputs	Outputs
Size per counting channel	16 bytes	4 bytes
Total size	32 bytes	8 bytes

5.2.4 Control interface and feedback interface

5.2.4.1 Assignment of the control interface

The control interface is reserved for Motion Control instructions.

5.2.4.2 Assignment of the feedback interface

The feedback interface is reserved for Motion Control instructions with the exception of status information via the digital inputs.

Byte offset relative to start address Channel 0/1 ↓ ↓		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	16	Reserved				STS_DI0	STS_DI1	Reserved	STS_DI2
1	17	Reserved							
...	...								
15	31								

5.2.5 Isochronous mode

The technology module supports the "Isochronous mode" system function. Counter values can be acquired in a fixed system cycle with this system function.

In isochronous mode, the cycle of the user program, the transmission of the input signals and processing in the technology module are synchronized. A change in the state of a digital input immediately affects the planned reaction of the technology module.

For clock synchronization in this operating mode, use an OB of type "MC-Servo". Isochronous mode is needed when using the output cam and cam track technology objects. When the measuring input technology is used in combination with hardware digital input DI1, isochronous mode is not needed.

Data processing

The data that was transmitted to the technology module in the current bus cycle via the control interface takes effect when it is processed in the internal technology module cycle. At the time the input data is read in (T_i), the counter value and the status bits are acquired and made available in the feedback interface for retrieval in the current bus cycle.

Isochronous mode parameters

In isochronous mode, the "Filter frequency" parameter can affect the isochronous mode parameters of the sync domain.

Because the isochronous parameters are not checked in RUN, changing the parameter in RUN can result in the technology module no longer processing the control and feedback interface correctly. You prevent this by selecting the option with the greatest time demand as early as during the offline parameter assignment.

Additional information

You can find a detailed description of isochronous mode in the following:

- In the STEP 7 (TIA Portal) information system
- Function manual PROFINET with STEP 7 available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/49948856>)

5.3 Manual operation (without technology object)

5.3.1 Configuring

Introduction

You configure the technology module and assign its parameters with the configuration software.

The functions of the technology module are controlled and checked by the user program via the control and feedback interface.

System environment

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

Applications	Components required	Configuration software	In the user program
Central operation with an S7-1500 CPU	- S7-1500 automation system - TM Count 2x24V	STEP 7 (TIA Portal): Device configuration and parameter setting with hardware configuration	Direct access to control and feedback interface in the I/O data
Distributed operation with an S7-1500 CPU	- S7-1500 automation system - ET 200MP distributed I/O system - TM Count 2x24V	STEP 7 (TIA Portal): Device configuration and parameter setting with hardware configuration	
Distributed operation with an S7-1200 CPU	- S7-1200 automation system - ET 200MP distributed I/O system - TM Count 2x24V	STEP 7 (TIA Portal): Device configuration and parameter setting with hardware configuration	
Distributed operation with an S7-300/400 CPU	- S7-300/400 automation system - ET 200MP distributed I/O system - TM Count 2x24V	STEP 7 (TIA Portal): Device configuration and parameter setting with hardware configuration STEP 7: Device configuration and parameter setting with GSD file	
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 setting with GSD file	

Additional information

You can find a detailed description of the counting and measurement functions and their configuration in the following:

- Function manual Counting, Measurement and Position Detection available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/59709820>)
- In the STEP 7 (TIA Portal) (<https://docs.tia.siemens.cloud>) information system under "Counting, measurement and position detection (S7-1500)"

Hardware Support Packages (HSP)

Firmware versions $\leq$ V1.3 of the module (6ES7550-1AA00-0AB0) are integrated as of TIA Portal Version V16. Firmware version V2.0 of the module (6ES7550-1AA01-0AB0) is integrated as of TIA Portal Version V17. Firmware version V3.0 of the module (6ES7550-1AA01-0AB0) is integrated as of TIA Portal Version V21.1. You can configure the module with article number 6ES7550-1AA01-0AB0 as replacement part compatible with article number 6ES7550-1AA00-0AB0. Firmware version V3.0 can be configured as firmware version V2.0 without any functional limitations.

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

You can also access this download from the menu bar of STEP 7 (TIA Portal): "Options > Support packages > Download from the Internet".

GSD file

The respective GSD file for the ET 200MP distributed I/O system is available for download on the Internet:

- GSD file for PROFINET IO (<https://support.industry.siemens.com/cs/ww/en/view/68189683>)
- GSD file for PROFIBUS DP (<https://support.industry.siemens.com/cs/ww/en/view/80206700>)

5.3.2 Reaction to CPU STOP

You set the reaction of the technology module to a STOP of the CPU on a channel-by-channel basis in the basic parameters of the device configuration.

Table 5-7 Reaction of technology module to CPU STOP

Option	Meaning
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. If a digital output with the "At comparison value for a pulse duration" function is set at CPU STOP, the digital output is reset after the pulse duration elapses. 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.

5.3.3 Parameter setting

You specify the properties of the technology module using various parameters. Depending on the settings, not all parameters are available. When parameters are assigned in the user program, the parameters are transferred to the module with the "WRREC" instruction and data record 128 (Page 84).

You set the parameters of the module as follows in this operating mode:

Parameter setting using...	Basic procedure
Hardware configuration in STEP 7 (TIA Portal)	1. Insert the module from the hardware catalog under "Technology modules". 2. Set the device configuration and the parameters of the module in the hardware configuration. "Manual operation (without technology object)" must be set as the operating mode. 3. Download the project to the CPU.
Hardware configuration with GSD file for distributed operation on PROFINET IO	1. Install the current PROFINET GSD file. You will then find the module in the hardware catalog under "Other field devices > PROFINET IO > I/O". 2. Set the parameters in the hardware configuration. You can find information on the respective dependencies of the parameters in function manual Counting, Measurement and Position Detection (http://support.automation.siemens.com/WW/view/en/59709820). 3. Download the project to the CPU.

Parameter setting using...	Basic procedure
Hardware configuration with GSD file for distributed operation on PROFIBUS DP	1. Install the current PROFIBUS GSD file. You will then find the module in the hardware catalog under "Other field devices > PROFIBUS DP > I/O". 2. Set the parameters in the hardware configuration. You can find information on the respective dependencies of the parameters in function manual Counting, Measurement and Position Detection (http://support.automation.siemens.com/WW/view/en/59709820). The parameters marked with ¹ in the following tables are not configurable in the PROFIBUS GSD file. 3. Download the project to the CPU. The parameters marked with ¹ in the following tables are downloaded with their default setting. 4. If necessary, set the parameters marked with ¹ in the user program using data record 128.

NOTE

You can operate one channel in the "Operation with the 'Counting and measuring' technology object" mode and the other channel in the "Manual operation (without technology object)" mode.

Parameters of the TM Count 2x24V

The following parameter settings are possible:

Table 5-8 Settable parameters and their default setting

Parameter	Value range	Scope
Operating mode ³	• Counting • Measuring	Channel
Reaction to CPU STOP ¹	• Output substitute value • Keep last value • Continue operation	Channel
Substitute value for DQ0 ¹	• 0 • 1	Channel
Substitute value for DQ1 ¹	• 0 • 1	Channel
Enable diagnostic interrupt on wire break ²	• Deactivated • Activated	Channel
Enable additional diagnostic interrupts	• Deactivated • Activated	Channel
Hardware interrupt: New Capture value available ¹	• Deactivated • Activated	Channel
Hardware interrupt: Synchronization of the counter by an external signal ¹	• Deactivated • Activated	Channel

¹ Because the number of parameters is limited to a maximum of 244 bytes per station in the PROFIBUS GSD configuration, the possible parameter assignments are limited. The parameters are preassigned default settings in the module. If your PROFIBUS master supports the "Write/read data record" function, you can set these parameters using data record 128.

² When a GSD file is used, this diagnostic interrupt is enabled with the "Enable additional diagnostic interrupts" parameter and is then not separately configurable.

³ When configuring with a GSD file, you determine the operating mode when you select the module name.

Parameter	Value range	Scope
Hardware interrupt: Gate start ¹	- Deactivated - Activated	Channel
Hardware interrupt: Gate stop ¹	- Deactivated - Activated	Channel
Hardware interrupt: Over-flow (high counting limit violated) ¹	- Deactivated - Activated	Channel
Hardware interrupt: Under-flow (low counting limit violated) ¹	- Deactivated - Activated	Channel
Hardware interrupt: Direction reversal ¹	- Deactivated - Activated	Channel
Hardware interrupt: Zero crossing ¹	- Deactivated - Activated	Channel
Hardware interrupt: Comparison event for DQ0 occurred ¹	- Deactivated - Activated	Channel
Hardware interrupt: Comparison event for DQ1 occurred ¹	- Deactivated - Activated	Channel
Signal type	- Pulse (A) Pulse (A) and direction (B) - Count up (A), count down (B) - Incremental encoder (A, B phase-shifted) - Incremental encoder (A, B, N)	Channel
Invert direction (counter inputs) ¹	- Deactivated - Activated	Channel
Signal evaluation for counter inputs	Single - Double - Quadruple	Channel
Filter frequency for counter inputs ¹	100 Hz 200 Hz 500 Hz 1 kHz 2 kHz 5 kHz 10 kHz 20 kHz 50 kHz 100 kHz 200 kHz	Channel
Sensor type	Sourcing output - Sinking output - Push-pull (sinking and sourcing output)	Channel
Reaction to signal N ¹	No reaction to signal N - Synchronization at signal N - Capture at signal N	Channel

¹ Because the number of parameters is limited to a maximum of 244 bytes per station in the PROFIBUS GSD configuration, the possible parameter assignments are limited. The parameters are preassigned default settings in the module. If your PROFIBUS master supports the "Write/read data record" function, you can set these parameters using data record 128.

² When a GSD file is used, this diagnostic interrupt is enabled with the "Enable additional diagnostic interrupts" parameter and is then not separately configurable.

³ When configuring with a GSD file, you determine the operating mode when you select the module name.

5.3 Manual operation (without technology object)

Parameter	Value range	Scope
Frequency of synchronization ¹	- Once - Periodic	Channel
Frequency of Capture function ¹	- Once Periodic	Channel
High counting limit ¹	-2147483648... 2147483647	Channel
Start value ¹	-2147483648... 0 ...2147483647	Channel
Counting low limit ¹	-2147483648 ...2147483647	Channel
Reaction to violation of a counting limit	- Stop counting Continue counting	Channel
Reset when counting limit is violated	To opposite counting limit - To start value	Channel
Reaction to gate start	- Set to start value Continue with current value	Channel
Set function of DI	- Gate start/stop (level-triggered) - Gate start (edge-triggered) - Gate stop (edge-triggered) - Synchronization - Enable synchronization at signal N - Capture Digital input without function	Channel
Select level for DI ¹	Active with high level - Active with low level	Channel
Edge selection for DI ¹	At rising edge - At falling edge - At rising and falling edge	Channel
Behavior of counter value after Capture with DI ¹	Continue counting - Set to start value and continue counting	Channel
Input delay for digital inputs ¹	- None 0.05 ms 0.1 ms 0.4 ms 0.8 ms 1.6 ms 3.2 ms 12.8 ms 20 ms	Channel
Set output	Between comparison value and count high limit / measured value >= comparison value - Between comparison value and low limit / measured value <= comparison value - At comparison value for a pulse duration - After set command from CPU until comparison value - Between comparison value 0 and 1 - Not between comparison value 0 and 1 - Use by user program	Channel
Comparison value 0 ¹	-2147483648... 0 ...2147483647	Channel

¹ Because the number of parameters is limited to a maximum of 244 bytes per station in the PROFIBUS GSD configuration, the possible parameter assignments are limited. The parameters are preassigned default settings in the module. If your PROFIBUS master supports the "Write/read data record" function, you can set these parameters using data record 128.

² When a GSD file is used, this diagnostic interrupt is enabled with the "Enable additional diagnostic interrupts" parameter and is then not separately configurable.

³ When configuring with a GSD file, you determine the operating mode when you select the module name.

Parameter	Value range	Scope
Comparison value 1 ¹	-2147483648... 10 ...2147483647	Channel
Count direction of DQ function ¹	- Up - Down In both directions	Channel
Pulse duration ¹	0.1... 500.0 ...6553.5 ms	Channel
Hysteresis (in increments) ¹	0 ...255	Channel
Measured variable	Frequency - Period - Velocity	Channel
Update time of the measuring function ¹	0... 10 ...25000 ms	Channel
Time base for velocity measurement ¹	1 ms 10 ms 100 ms 1 s 60 s	Channel
Increments per unit ¹	1 ...65535	Channel

¹ Because the number of parameters is limited to a maximum of 244 bytes per station in the PROFIBUS GSD configuration, the possible parameter assignments are limited. The parameters are preassigned default settings in the module. If your PROFIBUS master supports the "Write/read data record" function, you can set these parameters using data record 128.

² When a GSD file is used, this diagnostic interrupt is enabled with the "Enable additional diagnostic interrupts" parameter and is then not separately configurable.

³ When configuring with a GSD file, you determine the operating mode when you select the module name.

Explanation of parameters

You can find a detailed description of the parameters in function manual Counting, Measurement and Position Detection, sections Basic parameters and Manual operation available for download on the Internet

(<http://support.automation.siemens.com/WW/view/en/59709820>).

5.3.4 Address space

Address space of the technology module

Table 5-9 Size of input and output addresses of the TM Count 2x24V with manual operation

	Inputs	Outputs
Size per counting channel	16 bytes	12 bytes
Total size	32 bytes	24 bytes

5.3.5 Control and feedback interface

NOTE

The control and feedback interface is compatible with the control and feedback interface of the TM Count 1x24V, TM PosInput 2 and TM PosInput 1 technology modules of the S7-1500 automation system.

5.3.5.1 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 the assignment of the control interface:

Byte off-set from start address Channel 0/1 ↓ ↓		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	12	SLOT_0: DINT or REAL: Load value (meaning of the value is specified in LD_SLOT_0) Value range: −2147483648 to 2147483647 _D or 80000000 to 7FFFFFFF _H							
...	...								
3	15								
4	16	SLOT_1: DINT or REAL: Load value (meaning of the value is specified in LD_SLOT_1) Value range: −2147483648 to 2147483647 _D or 80000000 to 7FFFFFFF _H							
...	...								
7	19								
8	20	LD_SLOT_1				LD_SLOT_0			
9	21	EN_CAPTURE	EN_SYNC_DN	EN_SYNC_UP	SET_DQ1	SET_DQ0	TM_CTRL_DQ1	TM_CTRL_DQ0	SW_GATE
10	22	SET_DIR	Reserved					RES_EVENT	RES_ERROR
11	23	Reserved							

Explanations

Control bit/value	Explanations
SLOT_m	You specify the load value with this value. You specify the meaning of the value in LD_SLOT_m. If you want to load a comparison value in the "Measuring" operating mode, specify the load value as floating-point number (REAL). In all other cases, you specify the load value as an integer (DINT). Value range: -2147483648 to 2147483647 _D or 80000000 to 7FFFFFFF _H
LD_SLOT_m	Use this load request to specify the meaning of the value in SLOT_m: • 0000_B means: No action, idle • 0001_B means: Load counter value • 0010_B not permitted • 0011_B means: Load start value • 0100_B means: Load comparison value 0 • 0101_B means: Load comparison value 1 • 0110_B means: Load counting low limit • 0111_B means: Load counting high limit • 1000 to 1111_B not permitted The technology module executes the respective action as soon as LD_SLOT_m changes. If values are loaded simultaneously using LD_SLOT_0 and LD_SLOT_1, the value from SLOT_0 is internally applied first and then the value from SLOT_1. This can produce unexpected intermediate states.
EN_CAPTURE	Use this bit to enable the Capture function. Resetting this bit resets a set EVENT_CAP in the feedback interface.
EN_SYNC_DN	Use this bit to enable the synchronization of the counter when counting down with an incremental encoder or pulse encoder. Resetting this bit resets a set EVENT_SYNC in the feedback interface.
EN_SYNC_UP	Use this bit to enable the synchronization of the counter when counting up with an incremental encoder or pulse encoder. Resetting this bit resets a set EVENT_SYNC in the feedback interface.
SET_DQ0	Use this bit to set digital output DQ0 when TM_CTRL_DQ0 is set to 0. In the case of the function "After set command from CPU until comparison value", SET_DQ0 is effective regardless of TM_CTRL_DQ0 as long as the counter value is not equal to the comparison value.
SET_DQ1	Use this bit to set digital output DQ1 when TM_CTRL_DQ1 is set to 0. In the case of the function "After set command from CPU until comparison value", SET_DQ1 is effective regardless of TM_CTRL_DQ1 as long as the counter value is not equal to the comparison value.
TM_CTRL_DQ0	Use this bit to enable the technological function of digital output DQ0. • 0 means: SET_DQ0 defines the state of DQ0 • 1 means: assigned function defines the state of DQ0
TM_CTRL_DQ1	Use this bit to enable the technological function of digital output DQ1. • 0 means: SET_DQ1 defines the state of DQ1 • 1 means: assigned function defines the state of DQ1
SW_GATE	Use this bit to open and close the software gate when using an incremental encoder or pulse encoder. Together, the software gate and the hardware gate form the internal gate. The technology module only counts when the internal gate is open. • 0 means: Software gate closed • 1 means: Software gate open The digital inputs of the technology module externally control the hardware gate. The hardware gate can be activated by parameter assignment. The software gate cannot be deactivated.
SET_DIR	Use this bit to specify the count direction for signal type "Pulse (A)". • 0 means: Up • 1 means: Down
RES_EVENT	Use this bit to trigger the reset of the saved events in the EVENT_ZERO, EVENT_OFLW, EVENT_UFLW, EVENT_CMP0, EVENT_CMP1 feedback bits.
RES_ERROR	Use this bit to trigger the reset of the saved error states LD_ERROR and ENC_ERROR.
Reserved	Reserved bits must be set to 0.

5.3.5.2 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 per channel

The following table shows the assignment of the feedback interface:

Byte off-set from start address Channel 0/1 ↓ ↓		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	16	COUNT_VALUE: DINT: Current counter value							
...	...								
3	19								
4	20	CAPTURED_VALUE: DINT: The last acquired Capture value							
...	...								
7	23								
8	24	MEASURED_VALUE: REAL: Current measured value							
...	...								
11	27								
12	28	Reserved					LD_ERROR	ENC_ERROR	POWER_ERROR
13	29	Reserved		STS_SW_GATE	STS_READY	LD_STS_SLOT_1	LD_STS_SLOT_0	RES_EVENT_ACK	Reserved
14	30	STS_DI2	STS_DI1	STS_DI0	STS_DQ1	STS_DQ0	STS_GATE	STS_CNT	STS_DIR
15	31	STS_M_INTERVAL	EVENT_CAP	EVENT_SYNC	EVENT_CMP1	EVENT_CMPO	EVENT_OFLW	EVENT_UFLW	EVENT_ZERO

NOTE

Data validity

The data of the feedback interface is valid when STS_READY is set to 1. STS_READY is set to 0 during module startup.

Explanations

Feedback bit/value	Explanations
CAPTURED_VALUE	This DINT value indicates the last acquired 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 The "Frequency of Capture function" parameter specifies whether the function is executed at each configured edge or only once after each enable.
COUNT_VALUE	This DINT value indicates the current counter value.
MEASURED_VALUE	This value indicates the current measured value with data type REAL: • Frequency: The mean frequency is calculated from the time profile of the count pulses or position value changes in one measurement interval and returned as a floating-point number in the unit of hertz. • Period: The mean period is calculated from the time profile of the count pulses or position value changes in one measurement interval and returned as a floating-point number in the unit of seconds. • Velocity: The mean velocity is calculated from the time profile of the count pulses or position value changes in one measurement interval and returned as a floating-point number in the configured unit. The measured values are returned as a signed value. The sign indicates whether the counter value went up or down in the relevant time interval. The update time is asynchronous to the opening of the internal gate, i.e. the update time is not started when the gate opens. After the internal gate closes, the last calculated measured value continues to be returned.
LD_ERROR	This bit indicates that an error occurred (latching) during loading via the control interface. The loaded values were not applied. When using an incremental or pulse encoder, one of the following conditions is not fulfilled: • Low counting limit $\leq$ counter value $\leq$ high counting limit • Low counting limit $\leq$ start value $\leq$ high counting limit • Low counting limit $\leq$ comparison value 0/1 $\leq$ high counting limit The bit is reset once you have acknowledged the error with RES_ERROR .
ENC_ERROR	This bit indicates that one of the following errors has occurred at the encoder signals (retentive) for the respective technology module: • Wire break of digital input A, B or N (with push-pull encoder) • Invalid transition of A/B signals (with incremental encoder) If you have enabled the diagnostic interrupts, the respective diagnostic interrupt is triggered in the event of encoder signal errors. For information on the meaning of the diagnostic interrupts, refer to the manual for the respective technology module. The bit is reset once you have acknowledged the error with RES_ERROR .
POWER_ERROR	This bit indicates that supply voltage L+ is not present or is too low or the front connector is not inserted. If you have enabled the diagnostic interrupts (Page 71), the diagnostics interrupt "Supply voltage missing" is triggered at a supply voltage error. When supply voltage L+ is available at a sufficient level once again, POWER_ERROR is automatically set to 0.
STS_SW_GATE	This bit indicates the status of the software gate. • 0 means: Gate closed • 1 means: Gate open
STS_READY	This bit indicates that the technology module supplies valid user data. The technology module has been started up and configured.
LD_STS_SLOT_0	This bit indicates by a status change (toggling) that the load request for SLOT_0 (LD_SLOT_0) was detected and performed.
LD_STS_SLOT_1	This bit indicates by a status change (toggling) that the load request for SLOT_1 (LD_SLOT_1) was detected and performed.
RES_EVENT_ACK	This bit indicates that the reset of event bit EVENT_SYNC, EVENT_CMP0, EVENT_CMP1, EVENT_OFLW, EVENT_UFLW, EVENT_ZERO is active.
STS_DIO	This bit indicates the status of digital input DIO.

Feedback bit/value	Explanations
STS_DI1	This bit indicates the status of digital input DI1.
STS_DI2	This bit indicates the status of digital input DI2.
STS_DQ0	This bit indicates the status of digital output DQ0.
STS_DQ1	This bit indicates the status of digital output DQ1.
STS_GATE	This bit indicates the status of the internal gate when using an incremental or pulse encoder. 0 means: Gate closed 1 means: Gate open
STS_CNT	This bit indicates that at least one count pulse or a position value change has been detected in the last approx. 0.5 s.
STS_DIR	This bit indicates the count direction of the last count pulse or the direction of the last position value change. 0 means: Down 1 means: Up
STS_M_INTERVAL	This bit indicates that at least one count pulse or a position value change was detected in the previous measurement interval.
EVENT_CAP	This bit indicates that a Capture event has occurred and a counter value has been saved in CAPTURED_VALUE . You reset the state by resetting EN_CAPTURE .
EVENT_SYNC	This bit indicates the saved state that the counter was loaded with the start value by an external reference signal (synchronization) when using an incremental or pulse encoder. You reset the state by resetting EN_SYNC_UP or EN_SYNC_DN .
EVENT_CMP0	This bit indicates the saved state that a comparison event (state change) has occurred for the digital output DQ0 based on the selected comparison condition. You reset the state by acknowledgment with RES_EVENT. If the counter value is set to the start value in counting operating mode, EVENT_CMP0 is not set.
EVENT_CMP1	This bit indicates the saved state that a comparison event (state change) has occurred for the digital output DQ1 based on the selected comparison condition. You reset the state by acknowledgment with RES_EVENT. If the counter value is set to the start value in counting operating mode, EVENT_CMP1 is not set.
EVENT_OFLW	This bit indicates the saved state which shows that there was a counter value overflow. You reset the state by acknowledgment with RES_EVENT.
EVENT_UFLW	This bit indicates the saved state which shows that there was a counter value underflow. You reset the state by acknowledgment with RES_EVENT.
EVENT_ZERO	This bit indicates the saved state that the counter value or position value experienced a zero crossing. You reset the state by acknowledgment with RES_EVENT. If the "Zero crossing" hardware interrupt is enabled, it can also be triggered by the system if "0" is outside the configured value range.
Reserved	Reserved bits are set to 0.

5.3.6 Isochronous mode

The technology module supports the "Isochronous mode" system function. This system function enables counter values and measured values to be acquired 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. A change in the state of a digital input immediately affects the planned reaction of the technology module.

For clock synchronization in this operating mode, use an OB of the type "Synchronous Cycle" (such as OB61). The input and output data are processed in the assigned OB.

The update time for the measured value is synchronized with the system cycle in a suitable ratio and, if necessary, adapted in length. If you set "0", the measured value is updated once per system cycle.

Data processing

The data that was transmitted to the technology module in the current bus cycle via the control interface takes effect when it is processed in the internal technology module cycle. At the time the input data is read in (T_i), the counter value and the measured value as well as status bits are acquired and made available in the feedback interface for retrieval in the current bus cycle.

Isochronous mode parameters

In isochronous mode, the "Filter frequency" parameter can affect the isochronous mode parameters of the sync domain.

Because the isochronous parameters are not checked in RUN, changing the parameter in RUN can result in the technology module no longer processing the control and feedback interface correctly. You prevent this by selecting the option with the greatest time demand as early as during the offline parameter assignment.

Additional information

You can find a detailed description of isochronous mode in the following:

- In the STEP 7 (TIA Portal) information system
- Function manual PROFINET with STEP 7 available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/49948856>)

5.4 Fast Mode

You can use the technology module in Fast Mode for very fast acquisition of the counter value with compressed functionality. A reduced feedback interface but no control interface is available in Fast Mode. This allows you to use a shorter send clock for the CPU.

The range of functions of the technology module has the following limitations in Fast Mode:

- Parameter change in RUN only possible with data record 128
- Count/position value range: 25 bits
- No measured value available
- No software gate available
- No Capture function available
- No hardware interrupts available
- Combined error message (feedback bit) that is acknowledged automatically

5.4.1 Configuring

Introduction

You configure the technology module and assign its parameters with the configuration software.

The user program evaluates and controls the functions of the technology module via the user program and feedback interface.

System environment

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

Applications	Components required	Configuration software	In the user program
Central operation with an S7-1500 CPU	- S7-1500 automation system - TM Count 2x24V	STEP 7 (TIA Portal): Device configuration and parameter setting with hardware configuration	Direct access to feedback interface in the I/O data
Distributed operation with an S7-1500 CPU	- S7-1500 automation system - ET 200MP distributed I/O system - TM Count 2x24V	STEP 7 (TIA Portal): Device configuration and parameter setting with hardware configuration	
Distributed operation with an S7-1200 CPU	- S7-1200 automation system - ET 200MP distributed I/O system - TM Count 2x24V	STEP 7 (TIA Portal): Device configuration and parameter setting with hardware configuration	
Distributed operation with an S7-300/400 CPU	- S7-300/400 automation system - ET 200MP distributed I/O system - TM Count 2x24V	STEP 7 (TIA Portal): Device configuration and parameter setting with hardware configuration STEP 7: Device configuration and parameter setting with GSD file	
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 setting with GSD file	

Additional information

You can find a detailed description of the counting and measurement functions and their configuration in the following:

- Function manual Counting, Measurement and Position Detection available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/59709820>)
- In the STEP 7 (TIA Portal) (<https://docs.tia.siemens.cloud>) information system under "Counting, measurement and position detection (S7-1500)"

Hardware Support Packages (HSP)

Fast Mode is available as of firmware version V2.0 of the module (6ES7550-1AA01-0AB0). Firmware version V2.0 of the module is integrated as of TIA Portal Version V17. Firmware version V3.0 of the module (6ES7550-1AA01-0AB0) is integrated as of TIA Portal Version V21.1. Firmware version V3.0 can be configured as firmware version V2.0 without any functional limitations.

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

You can also access this download from the menu bar of STEP 7 (TIA Portal): "Options > Support packages > Download from the Internet".

GSD file

The respective GSD file for the ET 200MP distributed I/O system is available for download on the Internet:

- GSD file for PROFINET IO (<https://support.industry.siemens.com/cs/ww/en/view/68189683>)
- GSD file for PROFIBUS DP (<https://support.industry.siemens.com/cs/ww/en/view/80206700>)

5.4.2 Reaction to CPU STOP

You set the reaction of the technology module to a STOP of the CPU on a channel-by-channel basis in the basic parameters of the device configuration.

Table 5-10 Reaction of technology module to CPU STOP

Option	Meaning
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. If a digital output with the "At comparison value for a pulse duration" function is set at CPU STOP, the digital output is reset after the pulse duration elapses. 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.

5.4.3 Parameter setting

You specify the properties of the technology module using various parameters. Depending on the settings, not all parameters are available. When parameters are assigned in the user program, the parameters are transferred to the module with the "WRREC" instruction and data record 128 (Page 84).

You set the parameters of the module as follows in this operating mode:

Parameter setting using...	Basic procedure
Hardware configuration in STEP 7 (TIA Portal)	1. Insert the module from the hardware catalog under "Technology modules". 2. Set the operating mode "Fast Mode" and the other module parameters in the hardware configuration. 3. Download the project to the CPU.
Hardware configuration with GSD file for distributed operation on PROFINET IO	1. Install the current PROFINET GSD file. You will then find the module in the hardware catalog under "Other field devices > PROFINET IO > I/O". 2. Set the parameters in the hardware configuration. 3. Download the project to the CPU.
Hardware configuration with GSD file for distributed operation on PROFIBUS DP	1. Install the current PROFIBUS GSD file. You will then find the module in the hardware catalog under "Other field devices > PROFIBUS DP > I/O". 2. Set the parameters in the hardware configuration. The parameters marked with ¹ in the following tables are not configurable in the PROFIBUS GSD file. 3. Download the project to the CPU. The parameters marked with ¹ in the following tables are downloaded with their default setting. 4. If necessary, set the parameters marked with ¹ in the user program using data record 128.

Parameters of the TM Count 2x24V

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

Table 5-11 Configurable parameters

Parameter	Value range	Scope
Reaction to CPU STOP ¹	• Output substitute value • Keep last value • Continue operation	Channel
Substitute value for DQ0 ¹	• 0 • 1	Channel
Substitute value for DQ1 ¹	• 0 • 1	Channel
Enable diagnostic interrupt on wire break ²	• Deactivated • Activated	Channel
Enable additional diagnostic interrupts	• Deactivated • Activated	Channel
Signal type		Channel

Parameter	Value range	Scope
Invert direction ¹ (counter inputs)	- Deactivated - Activated	Channel
Signal evaluation for counter inputs	- Single - Double - Quadruple	Channel
Filter frequency for counter inputs ¹	100 Hz 200 Hz 500 Hz 1 kHz 2 kHz 5 kHz 10 kHz 20 kHz 50 kHz 100 kHz 200 kHz	Channel
Sensor type	- Sourcing output - Sinking output - Push-pull (sinking and sourcing output)	Channel
Reaction to signal N ¹	- No reaction to signal N - Synchronization at signal N	Channel
High counting limit ¹	1...33554431	Channel
Start value ¹	0...33554431	Channel
Counting low limit ¹	0...33554430	Channel
Reaction to violation of a counting limit	- Stop counting - Continue counting	Channel
Reset when counting limit is violated	- To opposite counting limit - To start value	Channel
Reaction to gate start	- Set to start value - Continue with current value	Channel
Set function of DI	- Gate start/stop (level-triggered) - Gate start (edge-triggered) - Gate stop (edge-triggered) - Synchronization - Enable synchronization at signal N - Digital input without function	Channel
Input delay for digital inputs ¹	- None 0.05 ms 0.1 ms 0.4 ms 0.8 ms 1.6 ms 3.2 ms 12.8 ms 20 ms	Channel
Select level for DI ¹	- Active with high level - Active with low level	Channel
Edge selection for DI ¹	- At rising edge - At falling edge	Channel

¹ Because the number of parameters is limited to a maximum of 244 bytes per station in the PROFIBUS GSD configuration, the possible parameter assignments are limited. The parameters are preassigned default settings in the module. If your PROFIBUS master supports the "Write/read data record" function, you can set these parameters using data record 128.

² When a GSD file is used, this diagnostic interrupt is enabled with the "Enable additional diagnostic interrupts" parameter and is then not separately configurable.

5.4 Fast Mode

Parameter	Value range	Scope
Frequency of synchronization ¹	- Once - Periodic	Channel
Count direction for synchronization	- Up - Down - In both directions	Channel
Set output	- Between comparison value and high limit - Between comparison value and low limit - Between comparison value 0 and 1 - At comparison value for a pulse duration - Digital output without function	Channel
Comparison value 0 ¹	0...33554431	Channel
Comparison value 1 ¹	0...10...33554431	Channel
Count direction of DQ function ¹	- Up - Down - In both directions	Channel
Pulse duration ¹	0...500.0...6553.5 ms	Channel
Hysteresis (in increments) ¹	0...255	Channel

¹ Because the number of parameters is limited to a maximum of 244 bytes per station in the PROFIBUS GSD configuration, the possible parameter assignments are limited. The parameters are preassigned default settings in the module. If your PROFIBUS master supports the "Write/read data record" function, you can set these parameters using data record 128.

² When a GSD file is used, this diagnostic interrupt is enabled with the "Enable additional diagnostic interrupts" parameter and is then not separately configurable.

5.4.4 Explanation of parameters

Signal type

You can select from the following signal types:

Signal type	Meaning
Incremental encoder (A, B phase-shifted)	An incremental encoder with phase-shifted A and B signals is connected.
Incremental encoder (A, B, N)	An incremental encoder with phase-shifted signals A and B and a zero signal N is connected.
Pulse (A) and direction (B)	A pulse encoder (signal A) with direction signal (signal B) is connected.
Pulse (A)	A pulse encoder (signal A) without direction signal is connected.
Count up (A), count down (B)	Signals for counting up (signal A) and down (signal B) are connected.

Invert direction

You can invert the counting direction to adapt it to the process.

The inverting of the direction is configurable and active for the following signal types:

- Incremental encoder (A, B phase-shifted)
- Incremental encoder (A, B, N)

Signal evaluation

With the parameter assignment of the signal evaluation, you specify which edges of the signals are counted.

You can select from the following options:

Signal evaluation	Meaning
Single	The edges of signal A are evaluated during a low level of signal B.
Double	Each edge of signal A is evaluated.
Quadruple	Each edge of signals A and B is evaluated.

The parameter can be assigned with the following signal types:

- Incremental encoder (A, B phase-shifted)
- Incremental encoder (A, B, N)

Filter frequency

By configuring the filter frequency, you suppress interferences at the counting inputs A, B and N.

The selected filter frequency is based on a pulse/break ratio of between around 40:60 and around 60:40. This results in a specific minimum pulse/break time. Signal changes with a duration shorter than the minimum pulse/break time are suppressed.

You can select from the following filter frequencies:

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	2.0 µs

Reaction to signal N

You use this parameter to specify which reaction to signal N is triggered.

You can select from the following options:

Option	Meaning
No reaction to signal N	The counter is not affected by signal N.
Synchronization at signal N	The counter is set to the start value at signal N. If you select the function "Enable synchronization at signal N" for a digital input, the synchronization depends on the level at the digital input.

NOTE

You can only select the reaction to signal N if you have selected the "Incremental encoder (A, B, N)" signal type.

NOTE

If you select "Synchronization at signal N", you can choose the "Enable synchronization at signal N" function for a digital input.

Frequency of synchronization

This parameter is used to define the frequency of the following events:

- Synchronization at signal N
- Synchronization as function of a digital input

You can select from the following options:

Option	Meaning
Once	The counter is only set at the first signal N or the first configured edge of the digital input.
Periodic	The counter is set at each signal N or each configured edge of the digital input.

Count direction of the synchronization

You use this parameter to specify the count direction for which the following functions are enabled:

- Synchronization at signal N
- Synchronization as function of a digital input

You can select from the following options:

Option	Meaning
In both directions	Synchronization takes place regardless of the count direction.
Up	Synchronization only takes place when the counter is counting up.
Down	Synchronization only takes place when the counter is counting down.

Sensor type

With the parameter assignment of the sensor type, you specify how the counter inputs are switched.

You can select from the following options:

Option	Meaning
Sourcing output	The encoder or sensor switches the A, B and N inputs to 24 V DC.
Sinking output	The encoder or sensor switches the A, B and N inputs to M.
Push-pull (sinking and sourcing output)	The encoder or sensor switches the A, B and N inputs to alternately to M and 24 V DC.

"Push-pull" is usually selected when incremental encoders are used. If using 2-wire sensors, such as light barriers or proximity switches, you need to select the corresponding wiring "sourcing output" or "sinking output".

The data sheet of the encoder includes information on whether your incremental encoder is a push-pull encoder.

NOTE

If you use a push-pull encoder and the sensor type "Push-pull (sinking and sourcing output)" is configured, you can monitor the encoder signals for wire break.

High counting limit

With the parameter assignment of the counting high limit, you limit the counting range. You can enter a value up to 33554431 ($2^{25}-1$). You must enter a value above the counting low limit.

Counting low limit

With the parameter assignment of the counting low limit, you limit the counting range. You can enter a value starting with 0. You must enter a value below the counting high limit.

Start value

With the parameter assignment of the start value, you specify the value at which counting is begun and is to continue in the case of defined events. You must enter a value at or within the counting limits.

Reaction to violation of a counting limit

You can configure the following reaction to violation of a counting limit:

Reaction	Meaning
Stop counting	After violation of a counting limit, counting is stopped and the internal gate is closed. To restart counting, you may have to close and reopen the hardware gate.
Continue counting	Counting is continued with the start value or at the opposite counting limit depending on the additional parameter assignment.

Reset when counting limit is violated

You can reset the counter when a counting limit is violated:

Reset the value	Meaning
To start value	The counter value is set to the start value.
To opposite counting limit	The counter value is set to the opposite counting limit in each case.

Reaction to gate start

You can configure the following reaction to gate start:

Reaction	Meaning
Set to start value	When the gate is opened, the counter value is set to the start value.
Continue with current value	When the gate is opened, counting is continued with the last counter value.

NOTE

The parameter is only effective when you have configured a HW gate.

Set function of DI

With the parameter assignment of a digital input, you specify which function the digital input triggers when switched.

You can select from the following options:

Function of a digital input	Meaning
Gate start/stop (level-triggered)	The level at the respective digital input opens and closes the HW gate.
Gate start (edge-triggered)	The configured edge at the respective digital input opens the HW gate.
Gate stop (edge-triggered)	The configured edge at the respective digital input closes the HW gate.
Synchronization	The configured edge at the respective digital input sets the counter to the start value.
Enable synchronization at signal N	The active level at the respective digital input enables synchronization of the counter at signal N.
Digital input without function	No technological function is assigned to the respective digital input. You can read the signal status of the digital input via the feed-back interface.

NOTE

Each function, except "Digital input without function", can be used only once per counter and can no longer be selected for the other digital inputs in each case.

Input delay

You use this parameter to suppress signal noise at the digital inputs. Changes to the signal are only detected if they remain stable for longer than the configured input delay time.

NOTE

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

NOTE

You configure the input delay under "Behavior of DI0" for all digital inputs together. The input delay is also displayed under "Behavior of DI1" and "Behavior of DI2".

Select level

You use this parameter to specify the level at which the digital input is active.
You can select from the following options:

Level	Meaning
Active with high level	The respective digital input is active when it is set.
Active with low level	The respective digital input is active when it is not set.

The parameter can be configured for the following functions of a digital input:

- Gate start/stop (level-triggered)
- Enable synchronization at signal N

Edge selection

You use this parameter to specify the edge of the digital input at which the configured function is triggered.

You can select from the following options depending on the function selected:

- At rising edge
- At falling edge

The parameter can be configured for the following functions of a digital input:

- Gate start (edge-triggered)
- Gate stop (edge-triggered)
- Synchronization

Set output

With the parameter assignment of a digital output, you specify the condition upon which the digital output switches.

You can select from the following options:

Function of a digital output	Meaning
Between comparison value and high limit	The respective digital output is active if: Comparison value $\leq$ counter value $\leq$ counting high limit
Between comparison value and low limit	The respective digital output is active if: Low limit $\leq$ counter value $\leq$ comparison value
Between comparison value 0 and 1	The digital output DQ1 is active if: Comparison value 0 $\leq$ counter value $\leq$ comparison value 1
At comparison value for a pulse duration	The respective digital output is active once for the configured time and count direction when the counter value corresponds to the comparison value.
Digital output without function	The respective digital output is set to 0 irrespective of the reaction to CPU STOP.

NOTE

You can only set the "Between comparison value 0 and 1" function for digital output DQ1 and only if you have selected the "Digital output without function" function for digital output DQ0.

Comparison value 0

With the parameter assignment of the comparison value, you specify the counter value at which the digital output DQ0 switches as a result of the selected comparison event.

You must enter an integer (DINT) that is greater than or equal to the counting low limit. If you use the DQ function "Between comparison value 0 and 1", comparison value 0 must be less than comparison value 1.

Comparison value 1

With the parameter assignment of the comparison value, you specify the counter value at which the digital output DQ1 switches as a result of the selected comparison event.

You must enter an integer (DINT) that is less than or equal to the counting high limit. If you use the DQ function "Between comparison value 0 and 1", comparison value 0 must be less than comparison value 1.

Count direction

You use this parameter to specify the count direction for which the selected functions is valid: You can select from the following options:

Count direction	Meaning
In both directions	The comparison and switching of the respective digital output takes places regardless of the count direction.
Up	The comparison and switching of the respective digital output only takes place when the counter counts up.
Down	The comparison and switching of the respective digital output only takes place when the counter counts down.

The parameter can be configured for the following functions:

- Between comparison value 0 and 1
- At comparison value for a pulse duration

Pulse duration

With the parameter assignment of the pulse duration for the "At comparison value for a pulse duration" function, you specify how many milliseconds the respective digital output is active.

If you enter "0" and the counter value corresponds to the respective comparison value, the digital output is active until the next count pulse.

Hysteresis (in increments)

With the parameter assignment of the hysteresis, you specify a range around the comparison values. Within the hysteresis range, the digital outputs cannot switch again before the counter value has left this range.

An encoder can stop at a certain position, and slight movements can cause the counter value to fluctuate around this position. If a comparison value or counting limit is within the fluctuation range and a hysteresis is not used, the associated digital output will switch on and off with corresponding frequency. The hysteresis prevents these unwanted switching actions.

Regardless of the hysteresis value, the hysteresis range ends at the low or counting high limit. If you enter "0", the hysteresis is turned off.

5.4.5 Address space

Address space of the technology module

Table 5-12 Range of the input addresses and output addresses of the TM Count 2x24V in Fast Mode

	Inputs	Outputs
Range per counting channel	4 bytes	0 bytes
Total range	8 bytes	0 bytes

5.4.6 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:

Byte offset relative to start address Channel 0/1 ↓ ↓		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	4	LS	STS_READY	STS_DI2	EXT_F	STS_DI0	STS_DIR	STS_DI1	COUNT_VALUE (Bit 24)
1	5	COUNT_VALUE (Bits 0 to 23): DINT: Current counter value							
2	6								
3	7								

Explanation of feedback bits

Feedback bit	Explanations
LS	As a sign of life, this bit indicates through a state change (toggling) that isochronous mode is functioning and that the module has updated the feedback interface in the respective bus cycle. This bit is set to 0 in non-isochronous mode.
STS_READY	This bit indicates that the technology module supplies valid user data. The technology module has been started up and configured.
STS_DI2	This bit indicates the status of digital input DI2.
EXT_F	This bit indicates that one of the following errors has occurred at the encoder signals for the technology module: • Load voltage missing • Wire break of digital input A, B or N (with push-pull encoder) • Invalid transition of A/B signals (with incremental encoder) If you have enabled the diagnostic interrupts, the respective diagnostic interrupt is triggered in the event of encoder signal errors. For information on the meaning of the diagnostics interrupts, refer to the section Diagnostics alarms. The bit is reset automatically as soon as an error no longer exists.
STS_DI0	This bit indicates the status of digital input DI0.
STS_DIR	This bit indicates the count direction of the last count pulse. 0 means: Down 1 means: Up
STS_DI1	This bit indicates the status of digital input DI1.
COUNT_VALUE (Bit 0..24)	This value returns the current counter value in the first 25 bits of a DINT value.

See also

[Diagnostic alarms \(Page 71\)](#)

5.4.7 Isochronous mode

The technology module supports the "Isochronous mode" system function. Counter values can be acquired in a fixed system cycle with this system function.

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. A change in the state of a digital input immediately affects the planned reaction of the technology module.

Fast Mode is particularly suitable for short send clocks of the CPU starting from 125 µs because only input data is used.

For clock synchronization in this operating mode, use an OB of the type "Synchronous Cycle" (such as OB61).

Data processing

At the time the input data is read in (T_i), the counter value and the status bits are acquired and made available in the feedback interface for retrieval in the current bus cycle.

Isochronous mode parameters

In isochronous mode, the "Filter frequency" parameter can affect the isochronous mode parameters of the sync domain.

Because the isochronous parameters are not checked in RUN, changing the parameter in RUN can result in the technology module no longer processing the control and feedback interface correctly. You prevent this by selecting the option with the greatest time demand as early as during the offline parameter assignment.

Additional information

You can find a detailed description of isochronous mode in the following:

- In the STEP 7 (TIA Portal) information system
- Function manual PROFINET with STEP 7 available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/49948856>)

Interrupts/diagnostic messages

6.1 Status and error display

LEDs

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

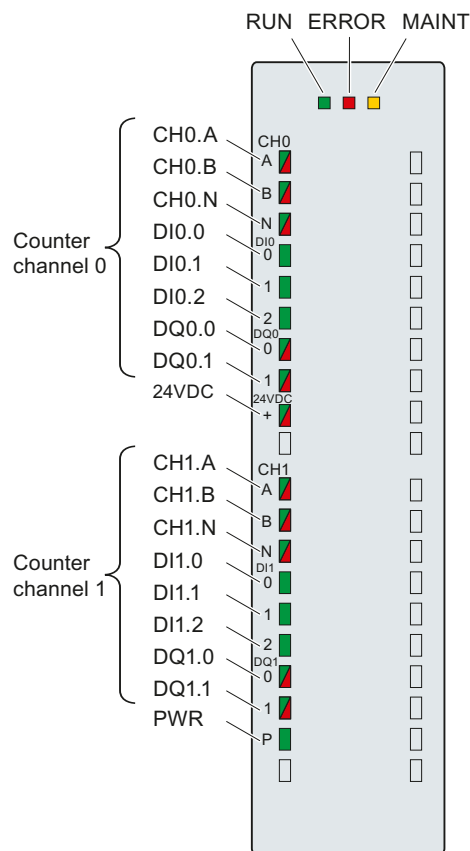


Figure 6-1 LED displays of the TM Count 2x24V

6.1 Status and error display

Meaning of the LED displays

The following tables explain the meaning of the status and error displays. Corrective measures for diagnostic alarms can be found in the Diagnostic alarms [\(Page 71\)](#) section.

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

LEDs			Meaning	Remedy
RUN	ERROR	MAINT		
 Off	 Off	 Off	Missing or insufficient voltage on the backplane bus	- Switch on the CPU and/or the system power supply modules. - Check whether the U connectors are plugged in correctly. - Check whether too many modules are plugged in.
 Flashes	 Off	 Off	Technology module parameters not set	---
 On	 Off	 Off	Technology module parameters set and no module diagnostics	
 On	 Flashes	 Off	Technology module parameters set and module diagnostics (at least one error is present)	Evaluate the diagnostic alarms and eliminate the error.
 Flashes	 Flashes	 Flashes	Hardware or firmware defective	Replace the technology module.

Table 6-2 PWR/24VDC/ERROR status displays

LEDs			Meaning	Remedy
PWR	24VDC	ERROR		
 Off	 Off	 Off	Supply voltage too low or missing <i>and</i> "Enable additional diagnostic interrupts" not enabled	- Check the supply voltage. - Make sure that the front connector is correctly inserted. - In the device configuration, enable "Enable additional diagnostic interrupts".
 Off	 Off	 Flashes	Supply voltage too low or missing	- Check the supply voltage. - Make sure that the front connector is correctly inserted.
 On	 On	 Off	Supply voltage is present and OK. Sensor supply is OK.	---
 On	 On	 Off	Short-circuit or overload at the encoder supply	- Check the encoder wiring. - Check the loads connected to the encoder supply. - Check the supply voltage.
 On	 On	 Flashes		

Channel LEDs

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

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 6-3 Status displays CHn.m/DIn.m/DQn.m

LEDs CHn.m/DIn.m/DQn.m	Meaning	Remedy
□ 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.

6.2 Diagnostic alarms

Enabling of diagnostic interrupts

You enable the diagnostic interrupts in the device configuration with the basic parameters.

The technology module can trigger the following diagnostic interrupts:

Table 6-4 Possible diagnostic interrupts

Diagnostic interrupt	Monitoring
- Parameter error - Hardware interrupt lost¹ - 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. When an error is detected, a diagnostic interrupt is only triggered if "Enable diagnostic interrupt on wire break" is activated in the device configuration.
- Supply voltage missing - Short-circuit / overload at external encoder supply - Error at digital outputs - Illegal A/B signal ratio	When an error is detected, a diagnostic interrupt is only triggered if "Enable additional diagnostic interrupts" is activated in the device configuration.

¹ Not available in "Position detection for "Motion Control"" technology object" and ""Fast Mode"" operating modes

Reactions to a diagnostic interrupt

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

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

You can obtain detailed information on the error event in the error organization block with instruction "RALRM" (Read additional alarm information), in the information system of STEP 7 and in function manual Diagnostics

6.2 Diagnostic alarms

(<https://support.industry.siemens.com/cs/ww/en/view/59192926>), section "System diagnostics in user program".

If the module is operated as a distributed module with PROFIBUS DP in an ET 200MP system, you have the option of reading out diagnostic data with the RDREC or RD_REC instruction using data record 0 and 1. You can find the structure of the data records in the manual for the IM 155-5 DP ST interface module available for download on the Internet

(<https://support.industry.siemens.com/cs/ww/de/view/78324181>).

Diagnostic alarms

The display of diagnostics is in plain 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 6-5 Diagnostic alarms, their meaning, and corrective measures

Diagnostic alarm	Error code	Meaning	Remedy
Parameter error	10 _H	The received parameter data record is invalid	Check parameter data record
Hardware interrupt lost	16 _H	- Module cannot issue interrupt because a preceding interrupt has not yet been processed - Possible cause: Too many hardware interrupts in too short a time	- Change interrupt processing in the CPU and re-assign technology module parameters correspondingly - Check frequency of interrupts from the process
Watchdog tripped. Module is defective.	103 _H	Firmware error	Run firmware update
		Technology module defective	Replace technology module
Supply voltage missing	10A _H	- Missing or insufficient supply voltage L+ - Possible causes: - Wiring of supply voltage L+ faulty - Front connector not inserted correctly	- Check supply voltage L+ - Check wiring of supply voltage L+ - Insert front connector correctly
Short-circuit / overload at external encoder supply	10E _H	- Error at encoder supply - Possible causes: - Short circuit - Overload	- Check encoder wiring - Check consumers connected to encoder supply
Error at digital outputs	10F _H	- Error at the digital outputs (LED display DQn.m lit red) - Possible causes: - Short circuit - Overload	- Check encoder wiring at the digital outputs - Check consumers connected to the digital outputs
Illegal A/B signal ratio	500 _H	- Time profile of signals A and B of the incremental encoder does not meet certain requirements (relative phase shift of the two signals is too small) - Possible causes: - Signal frequency too high - Encoder faulty - Process wiring faulty	- Check process wiring - Check encoder/sensor - Check parameter assignment
Wire break at digital input A, B or N	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 encoder
		Interruption of the line between technology module and encoder	Check process wiring

Diagnostic alarm	Error code	Meaning	Remedy
Wire break at digital input A, B or N	505 _H	Sensor used is sourcing output or sinking output only	Correct parameter assignment

6.3 Hardware interrupts

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.

Lost hardware interrupt

If an event occurs that is to trigger a hardware interrupt and the preceding event has not yet been processed, another hardware interrupt cannot be triggered. The hardware interrupt is lost and the diagnostic interrupt "Lost hardware interrupt" is triggered.

Enabling of hardware interrupts

A hardware interrupt is triggered when the condition for the change of the respective status or event bit in the feedback interface is met.

You enable the hardware interrupts in the device configuration with the basic parameters. You can configure hardware interrupts to be triggered for the following event types:

- Opening of internal gate (gate start)
- Closing of internal gate (gate stop)
- Overflow (high counting limit violated)
- Underflow (low counting limit violated)
- Comparison event for DQ0 has occurred
- Comparison event for DQ1 has occurred
- Zero crossing³
- New Capture value available¹
- Synchronization of the counter by an external signal
- Direction reversal²

¹ Only configurable in Counting mode

6.3 Hardware interrupts

² Feedback bit STS_DIR is preassigned with "0". If the first counter value change occurs in the *downwards direction* directly after switching on the technology module, no hardware interrupt is triggered.

³ When the "Zero crossing" hardware interrupt is enabled, for system-related reasons it can also be triggered if "0" is outside the configured value range.

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

You can obtain detailed information on the event in the hardware interrupt organization block with instruction "RALRM" (Read additional alarm information) and in the information system of STEP 7.

Which channel of the module and which event has triggered the hardware interrupt is entered in the start information of the organization block. The following figure shows the assignment to the bits of the local data double word 8.

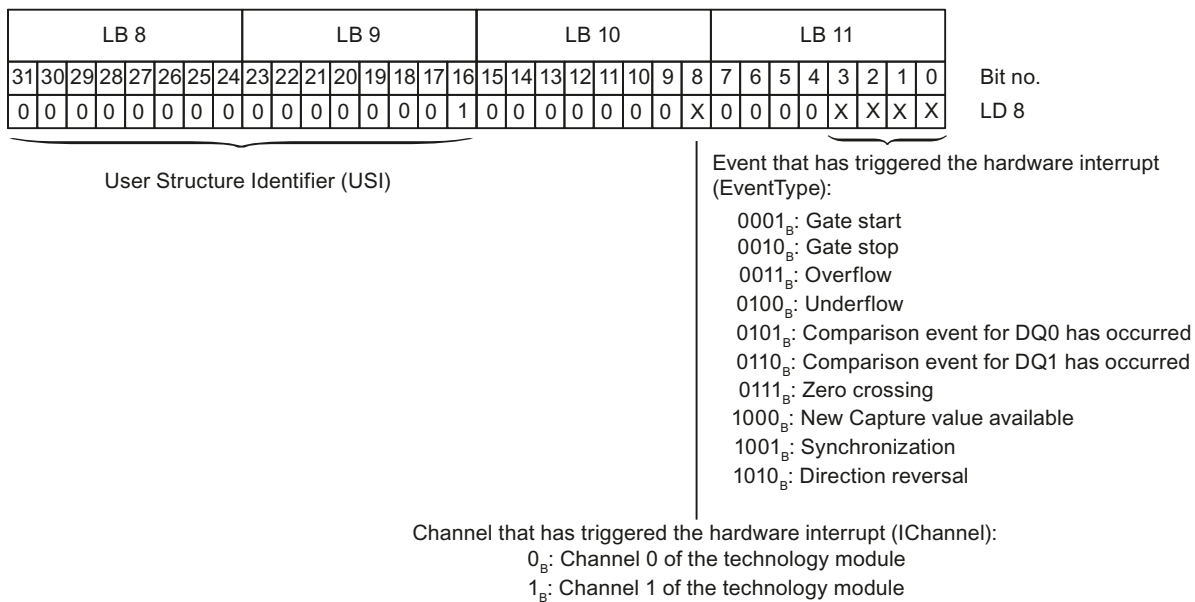


Figure 6-2 Start information of the organization block

Technical specifications

The following table shows the technical specifications as of the edition date. You can find a data sheet with up-to-date technical specifications on the Internet

(<https://support.industry.siemens.com/cs/ww/en/pv/6ES7550-1AA01-0AB0/td?dl=en>).

Article number	6ES7550-1AA01-0AB0
General information	
Product type designation	TM Count 2x24V
HW functional status	03
Firmware version	V3.0.0
• FW update possible	Yes
Product function	
• I&M data	Yes; I&M0 to I&M3
• Isochronous mode	Yes
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	V21.1; configurable with older TIA Portal versions as previous version
• PROFIBUS from GSD version/GSD revision	GSD Revision 5
• PROFINET from GSD version/GSD revision	V2.3 / -
Installation type/mounting	
Rail mounting	Yes; S7-1500 mounting rail
Supply voltage	
Load voltage L+	
• Rated value (DC)	24 V
• permissible range, lower limit (DC)	19.2 V
• permissible range, upper limit (DC)	28.8 V
• Reverse polarity protection	Yes
Input current	
Current consumption, max.	75 mA; without load
Encoder supply	
Number of outputs	1; A common 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 consumption from the backplane bus	1.3 W
Power loss	
Power loss, typ.	4 W

Article number	6ES7550-1AA01-0AB0
Address area	
Address space per module	
Inputs	32 byte; 16 bytes per channel; 4 bytes for fast mode
Outputs	24 byte; 12 bytes per channel; 4 bytes for Motion Control, 0 bytes for fast mode
Digital inputs	
Number of digital inputs	6; 3 per channel
Digital inputs, parameterizable	Yes
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Digital input functions, parameterizable	
Gate start/stop	Yes
Capture	Yes
Synchronization	Yes
Freely usable digital input	Yes
Probe	Yes
Input voltage	
Type of input voltage	DC
Rated value (DC)	24 V
for signal "0"	-5 ... +5 V
for signal "1"	+11 to +30V
permissible voltage at input, min.	-30 V; -5 V continuous, -30 V brief reverse polarity protection
permissible voltage at input, max.	30 V
Input current	
for signal "1", typ.	2.5 mA
Input delay (for rated value of input voltage)	
for standard inputs	
parameterizable	Yes; none / 0.05 / 0.1 / 0.4 / 0.8 / 1.6 / 3.2 / 12.8 / 20 ms
for technological functions	
Parameterizable	Yes
Cable length	
shielded, max.	1 000 m
unshielded, max.	600 m
Digital outputs	
Type of digital output	Transistor
Number of digital outputs	4; 2 per channel
Digital outputs, parameterizable	Yes
Short-circuit protection	Yes; electronic/thermal
Response threshold, typ.	1 A
Limitation of inductive shutdown voltage to	L+ (-53 V)
Controlling a digital input	Yes
Digital output functions, parameterizable	
Switching tripped by comparison values	Yes

Article number	6ES7550-1AA01-0AB0
Freely usable digital output	Yes
Switching capacity of the outputs	
with resistive load, max.	0.5 A; Per digital output
on lamp load, max.	5 W
Load resistance range	
lower limit	48 Ω
upper limit	12 k Ω
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 μ s
"1" to "0", max.	50 μ s
Switching frequency	
with resistive load, max.	10 kHz
with inductive load, max.	0.5 Hz; Acc. to IEC 60947-5-1, DC-13; observe derating curve
on lamp load, max.	10 Hz
Total current of the outputs	
Current per module, max.	2 A
Cable length	
shielded, max.	1 000 m
unshielded, max.	600 m
Encoder	
Connectable encoders	
2-wire sensor	Yes
— permissible quiescent current (2-wire sensor), max.	1.5 mA
Encoder signals, incremental encoder (asymmetrical)	
Input voltage	24 V
Input frequency, max.	200 kHz
Counting frequency, max.	800 kHz; with quadruple evaluation
Cable length, shielded, max.	600 m; depending on input frequency, encoder and cable quality; max. 50 m at 200 kHz
Signal filter, parameterizable	Yes
Incremental encoder with A/B tracks, 90° phase offset	Yes
Incremental encoder with A/B tracks, 90° phase offset and zero track	Yes
pulse encoder	Yes

Article number	6ES7550-1AA01-0AB0
- pulse encoder with direction - pulse encoder with one impulse signal per count direction	Yes Yes
Interface types	
- Sourcing/sinking input - Input characteristic curve in accordance with IEC 61131, type 3	Yes Yes
Interrupts/diagnostics/status information	
Alarms	
- Diagnostic alarm - Hardware interrupt	Yes Yes
Diagnoses	
- Monitoring the supply voltage - Wire break - Short-circuit - A/B transition error at incremental encoder	Yes Yes Yes Yes
Diagnostics indication LED	
- RUN LED - ERROR LED - MAINT LED - Monitoring of the supply voltage (PWR-LED) - Channel status display - for channel diagnostics	Yes; green LED Yes; red LED Yes; Yellow LED Yes; green LED Yes; green LED Yes; red LED
Integrated Functions	
Counter	Yes
- Number of counters - Counting frequency, max.	2 800 kHz; with quadruple evaluation
Fast mode	Yes
Counting functions	
- Can be used with TO High_Speed_Counter - Continuous counting - Counter response parameterizable - Hardware gate via digital input - Software gate - Event-controlled stop - Synchronization via digital input - Counting range, parameterizable	Yes Yes Yes Yes Yes Yes Yes Yes
Comparator	
- Number of comparators - Direction dependency - Can be changed from user program	2; Per channel Yes Yes
Position detection	
- Incremental acquisition - Suitable for S7-1500 Motion Control	Yes Yes

Article number	6ES7550-1AA01-0AB0
suitable for SIMOTION	Yes
Measuring functions	
Measuring time, parameterizable	Yes
Dynamic measurement period adjustment	Yes
Number of thresholds, parameterizable	2
Measuring range	
Frequency measurement, min.	0.04 Hz
Frequency measurement, max.	800 kHz
Cycle duration measurement, min.	1.25 µs
Cycle duration measurement, max.	25 s
Accuracy	
Frequency measurement	100 ppm; depending on measuring interval and signal evaluation
Cycle duration measurement	100 ppm; depending on measuring interval and signal evaluation
Velocity measurement	100 ppm; depending on measuring interval and signal evaluation
Potential separation	
Potential separation channels	
between the channels	No
between the channels and backplane bus	Yes
Between the channels and load voltage L+	No
Isolation	
Isolation tested with	707 V DC (type test)
Security	
signed firmware update	Yes; Firmware V3.0.0 or higher
data integrity	Yes; Firmware V3.0.0 or higher
Ambient conditions	
Ambient temperature during operation	
horizontal installation, min.	-30 °C
horizontal installation, max.	60 °C; Please note derating for inductive loads
vertical installation, min.	-30 °C
vertical installation, max.	40 °C; Please note derating for inductive loads
Altitude during operation relating to sea level	
Installation altitude above sea level, max.	5 000 m; restrictions for installation altitudes > 2 000 m, see ET 200MP system manual
Absolute humidity	
dew point, min.	-60 °C; suitable for dry room applications
Decentralized operation	
to SIMATIC S7-300	Yes
to SIMATIC S7-400	Yes
to SIMATIC S7-1200	Yes
to SIMATIC S7-1500	Yes
to standard PROFIBUS master	Yes
to standard PROFINET controller	Yes

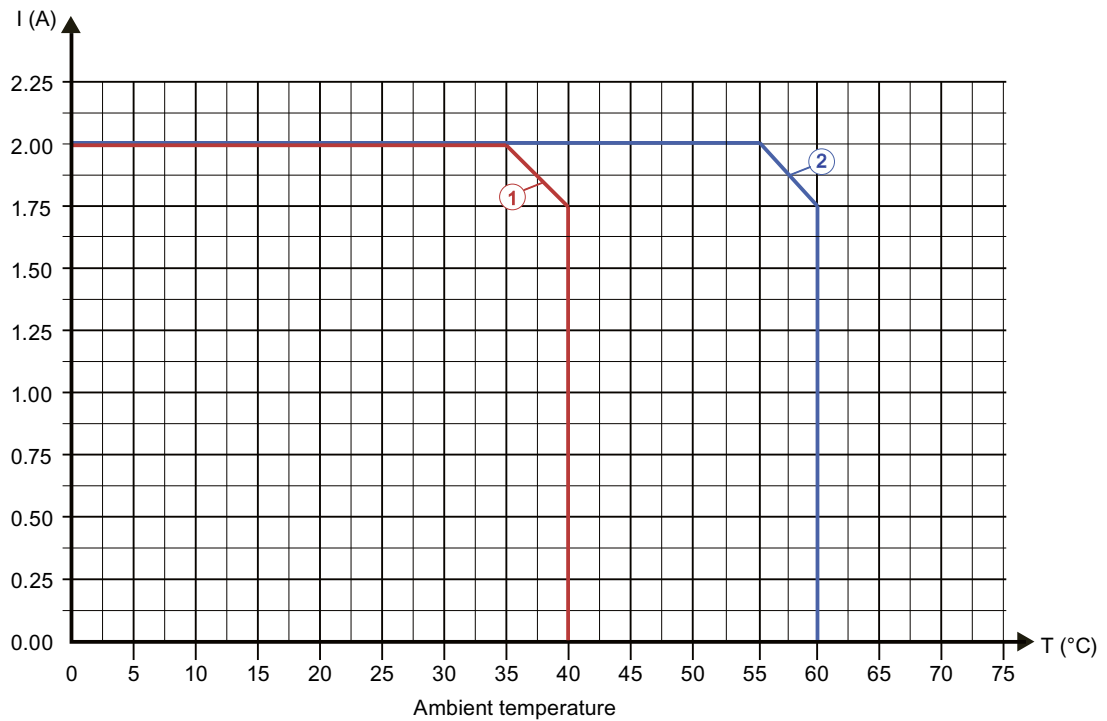
Article number	6ES7550-1AA01-0AB0
Dimensions	
Width	35 mm
Height	147 mm
Depth	129 mm
Weights	
Weight, approx.	250 g

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 7-1 Total current depending on ambient temperature and mounting position for inductive loads

NOTE

In the upper voltage range (28.8 V), the resistance of the load increases according to the total current, for example 57.6 Ω at 28.8 V and 0.5 A per digital output.

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

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.

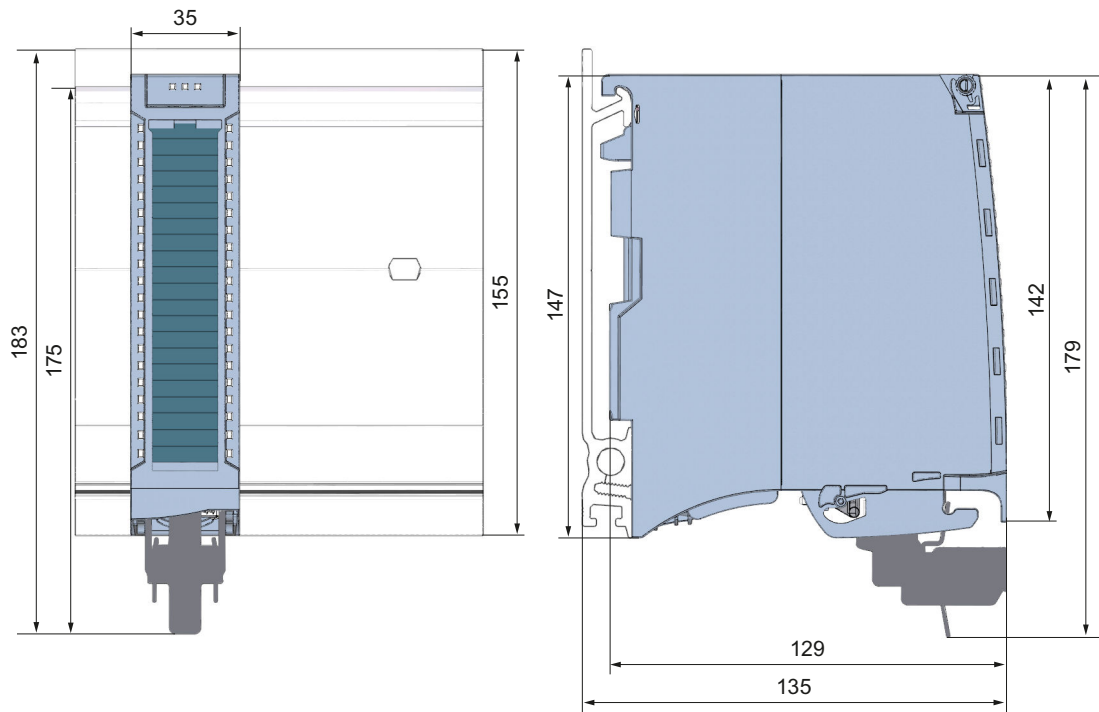


Figure A-1 Dimensional drawing of the TM Count 2x24V technology module

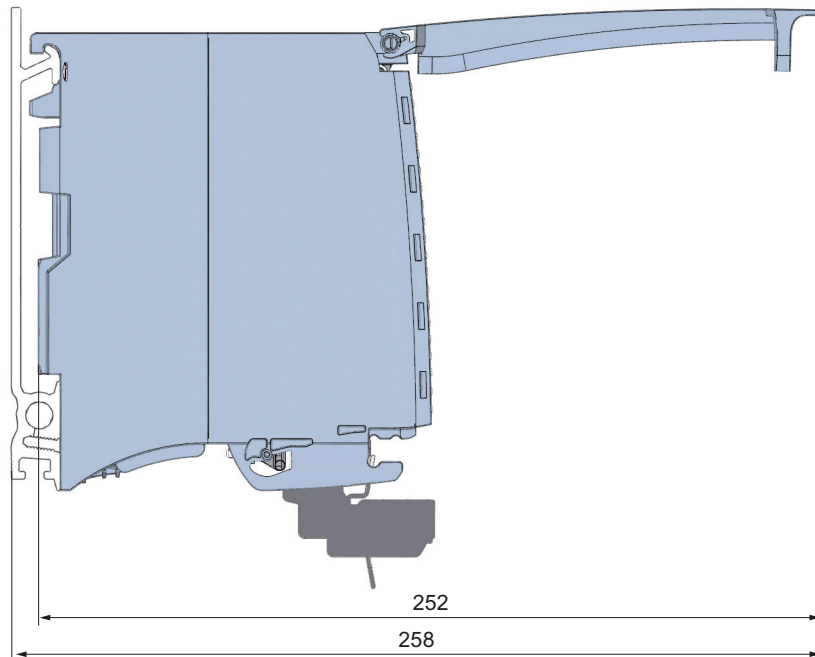


Figure A-2 Dimensional drawing of the TM Count 2x24V module, side view with open front panel

Parameter data record

B.1 Parameter assignment and structure of parameter data record

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

If an error occurs while transferring or validating parameters with the WRREC instruction, the module continues operating with the existing parameter assignment. A corresponding error code is then written to the STATUS output parameter.

You can find a description of the WRREC instruction and the error codes in section Parameter validation error (Page 92) or in the online help of STEP 7 (TIA Portal).

Structure of data record 128 for operation with technology object and manual operation

The following table shows you the structure of data record 128 for TM Count 2x24V with 2 channels for operation with technology object and manual operation without technology object. The values in byte 0 to byte 3 are fixed and must not be changed. The value in byte 4 can only be changed by means of new parameter assignment and not in RUN mode.

NOTE

After each writing of data record 128, the module is set to its startup state and the counter value is set to the start value. If "Continue operation" is set for Reaction to CPU STOP, the module is then only set to its startup state when data record 128 has been changed.

Table B-1 Data record 128: Operating modes "Operating with the 'Counting and measuring' technology object", "Manual operation (without technology object)"

Bit →	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte channel 0/1 ↓								
0...3	Header							
0	Major Version = 0				Minor Version = 2			
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							

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

² Reserved bits must be set to 0.

³ In isochronous mode, the parameter can affect the isochronous mode parameters of the sync domain. Because the isochronous parameters are not checked in RUN, changing the parameter in RUN can result in the technology module no longer processing the control and feedback interface correctly. You prevent this by selecting the option with the greatest time demand as early as during the offline parameter assignment.

⁴ Applies to: Set function of DI = 001_B; 010_B; 011_B; 101_B

B.1 Parameter assignment and structure of parameter data record

Bit → Byte channel 0/1 ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
4/52	Operating mode								
4/52	Reserved ²				Operating mode:				
					0000 _B : Not permitted				
					0001 _B : Counting				
					0010 _B : Measuring				
					0011 to 1111 _B : Not permitted				
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 : Not permitted		
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 : Not permitted		11 _B : Not permitted		0011 _B : Incremental encoder (A, B phase-shifted)				
					0100 _B : Incremental encoder (A, B, N)				
					0101 to 1111 _B : Not permitted				
7/55	Reaction to signal N:		Invert direction ¹	Enable diagnostic interrupt on wire break ¹	Filter frequency ³ :				
	00 _B : No reaction to signal N				0000 _B : 100 Hz				
					0001 _B : 200 Hz				
	01 _B : Synchronization at signal N				0010 _B : 500 Hz				
					0011 _B : 1 kHz				
	10 _B : Capture at signal N				0100 _B : 2 kHz				
	11 _B : Not permitted				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 : Not permitted				

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

² Reserved bits must be set to 0.

³ In isochronous mode, the parameter can affect the isochronous mode parameters of the sync domain. Because the isochronous parameters are not checked in RUN, changing the parameter in RUN can result in the technology module no longer processing the control and feedback interface correctly. You prevent this by selecting the option with the greatest time demand as early as during the offline parameter assignment.

⁴ Applies to: Set function of DI = 001_B; 010_B; 011_B; 101_B

B.1 Parameter assignment and structure of parameter data record

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			Change of direction	Underflow (low count- ing limit viol- ated)	Overflow (high count- ing limit viol- ated)	Gate stop	Gate start
9/57	Synchroniza- tion of the counter by an external sig- nal	New Capture value avail- able	Reserved ²	Zero crossing	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 limit; Meas- uring: Measured value >= comparison value				0001 _B : Between comparison value and high limit; Meas- uring: Measured value >= comparison value			
	0010 _B : Between comparison value and low limit; Measur- ing: Measured value <= comparison value				0010 _B : Between comparison value and low limit; Measur- ing: 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 : Not permitted			
	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 : Not permitted			
	0111 to 1111 _B : Not permitted							
11/59	Count direction (DQ1):		Count direction (DQ0):		Reserved ²		Substitute value for DQ1	Substitute value for DQ0
	00 _B : Not permitted		00 _B : Not permitted					
	01 _B : Up		01 _B : Up					
	10 _B : Down		10 _B : Down					
	11 _B : In both directions		11 _B : In both directions					
12/60	Pulse duration (DQ0): WORD: Value range in ms/10: 0 to 65535 _D							
13/61								
14/62	Pulse duration (DQ1): WORD: Value range in ms/10: 0 to 65535 _D							
15/63								
16/64	Behavior of DI0							
16/64	Behavior of counter value	Edge selection (DI0):		Select level (DI0):	Reserved ²	Set function of DI (DI0):		
		00 _B : Not permitted ⁴				000 _B : Gate start/stop (level-triggered)		
		01 _B : At rising edge		0 _B : Active		001 _B : Gate start (edge-triggered)		

¹ You activate the respective parameter by setting the associated bit to 1.² Reserved bits must be set to 0.³ In isochronous mode, the parameter can affect the isochronous mode parameters of the sync domain. Because the isochronous parameters are not checked in RUN, changing the parameter in RUN can result in the technology module no longer processing the control and feedback interface correctly. You prevent this by selecting the option with the greatest time demand as early as during the offline parameter assignment.⁴ Applies to: Set function of DI = 001_B; 010_B; 011_B; 101_B

B.1 Parameter assignment and structure of parameter data record

Bit → Byte channel 0/1 ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
16/64	after Capture (DI0):	10 _B : At falling edge		with high level	Reserved ²	010 _B : Gate stop (edge-triggered)		
	0 _B : Continue counting	11 _B : At rising and falling edge		1 _B : Active with low level		011 _B : Synchronization		
						100 _B : Enable synchronization at signal N		
	1 _B : Set to start value and continue counting					101 _B : Capture		
						110 _B : Digital input without function		
						111 _B : Not permitted		
17/65	Behavior of DI1: See Byte 16							
18/66	Behavior of DI2: See Byte 16							
19/67	Frequency of synchronization:	Reserved ²		Frequency of Capture function:	Input delay:			
				0000 _B : None				
				0001 _B : 0.05 ms				
	0 _B : Once			0010 _B : 0.1 ms				
				0011 _B : 0.4 ms				
	1 _B : Periodic			0100 _B : 0.8 ms				
				0101 _B : 1.6 ms				
				0110 _B : 3.2 ms				
				0111 _B : 12.8 ms				
				1000 _B : 20 ms				
	1001 to 1111 _B : Not permitted							
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 ; Measuring operating mode: REAL: Floating-point number in the configured unit of the measured quantity							
28...31/ 76...79	Comparison value 1: Operating mode Counting: DWORD: Value range: –2147483648 to 2147483647 _D ; or 80000000 to 7FFFFFFF _H ; Measuring operating mode: REAL: Floating-point number in the configured unit of the measured quantity							
32...35/ 80...83	Start value: DWORD: Value range: –2147483648 to 2147483647 _D or 80000000 to 7FFFFFFF _H							

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

² Reserved bits must be set to 0.

³ In isochronous mode, the parameter can affect the isochronous mode parameters of the sync domain. Because the isochronous parameters are not checked in RUN, changing the parameter in RUN can result in the technology module no longer processing the control and feedback interface correctly. You prevent this by selecting the option with the greatest time demand as early as during the offline parameter assignment.

⁴ Applies to: Set function of DI = 001_B; 010_B; 011_B; 101_B

B.1 Parameter assignment and structure of parameter data record

Bit → Byte channel 0/1 ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
36...39/ 84...87	Low counting limit: DWORD: Value range: −2147483648 to 2147483647 _D or 80000000 to 7FFFFFFF _H							
40...43/ 88...91	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 opposite counting limit		
	01 _B : Continue with current value		001 _B : Continue counting			001 _B : To start value		
	10 to 11 _B : Not permitted		010 to 111 _B : Not permitted			010 to 111 _B : Not permitted		
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 : Not permitted	
				100 _B : 60 s				
				101 to 111 _B : Not permitted				
46/94	Increments per unit: WORD: Value range: 1 to 65535 _D							
47/95								
48/96	Set hysteresis range: Value range: 0 to 255 _D							
49...51/ 97...99	Reserved ²							

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

² Reserved bits must be set to 0.

³ In isochronous mode, the parameter can affect the isochronous mode parameters of the sync domain. Because the isochronous parameters are not checked in RUN, changing the parameter in RUN can result in the technology module no longer processing the control and feedback interface correctly. You prevent this by selecting the option with the greatest time demand as early as during the offline parameter assignment.

⁴ Applies to: Set function of DI = 001_B; 010_B; 011_B; 101_B

Structure of data record 128 in Fast Mode

The following table shows you the structure of data record 128 for TM Count 2x24V in Fast Mode. The values in byte 0 to byte 3 are fixed and may not be changed.

Table B-2 Parameter data record 128: Operating mode "Fast Mode"

Bit → Byte ↓	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 = 2			
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 : Invalid			
					0001 _B : Counting			
					0010 to 1111 _B : Invalid			
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 : Invalid	
6...7/ 54...55	Counter inputs (parameters for incremental encoders and pulse encoders)							
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 : Invalid		11 _B : Invalid		0011 _B : Incremental encoder (A, B phase-shifted)			
					0100 _B : Incremental encoder (A, B, N)			
					0101 to 1111 _B : Invalid			
7/55	Reaction to signal N:		Invert direction ¹⁾	Enable diagnostic interrupt on wire break ¹⁾	Filter frequency ³⁾ :			
	00 _B : No reaction to signal N				0000 _B : 100 Hz			
					0001 _B : 200 Hz			
	01 _B : Synchronization at signal N				0010 _B : 500 Hz			
					0011 _B : 1 kHz			

¹⁾ You enable the respective parameter by setting the associated bit to 1.

²⁾ Reserved bits must be set to 0.

³⁾ In isochronous mode, the parameter can have an effect on the isochronous parameters of the Sync domain. Because the isochronous parameters are not checked in RUN, changing the parameter in RUN can result in the technology module no longer processing the control and feedback interface correctly. You prevent this by selecting the option with the greatest time demand as early as during the offline parameter assignment.

⁴⁾ Applies to: Set function of DI = 001_B; 010_B; 011_B

B.1 Parameter assignment and structure of parameter data record

Bit → Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
7/55	10 to 11 _B : Invalid		Invert direction ¹	Enable diagnostic interrupt on wire break ¹	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 : Invalid			
8...9/ 56...57	Reserved ²⁾							
10...15/ 58...63	Behavior of a DQ							
10/58	Set output (DQ1):				Set output (DQ0):			
	0000 _B : Digital output without function				0000 _B : Digital output without function			
	0001 _B : Between comparison value and count high limit				0001 _B : Between comparison value and count high limit			
	0010 _B : Between comparison value and count low limit				0010 _B : Between comparison value and count low limit			
	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 to 1111 _B : Invalid			
	0101 to 1111 _B : Invalid							
11/59	Count direction (DQ1):		Count direction (DQ0):		Reserved ²⁾		Substitute value for DQ1	Substitute value for DQ0
	00 _B : Reserved		00 _B : Reserved					
	01 _B : Up		01 _B : Up					
	10 _B : Down		10 _B : Down					
	11 _B : In both directions		11 _B : In both directions					
12/60	Pulse duration (DQ0): UINT: Value range in ms/10: 0 to 65535 _D							
13/61								
14/62	Pulse duration (DQ1): UINT: Value range in ms/10: 0 to 65535 _D							
15/63								
16/64	Behavior of DIO							
16/64	Reserved ²⁾	Edge selection (DIO):		Select level (DIO):	Reserved ²⁾	Set function of DI (DIO):		
		00 _B : Not permitted ⁴				000 _B : Gate start/stop (level-triggered)		
		01 _B : At rising edge		0 _B : Active with high level		001 _B : Gate start (edge-triggered)		
		10 _B : At falling edge				010 _B : Gate stop (edge-triggered)		
		11 _B : Invalid		1 _B : Active with low level		011 _B : Synchronization		
						100 _B : Enable synchronization at signal N		
				101 _B : Invalid				

¹ You enable the respective parameter by setting the associated bit to 1.

² Reserved bits must be set to 0.

³ In isochronous mode, the parameter can have an effect on the isochronous parameters of the Sync domain. Because the isochronous parameters are not checked in RUN, changing the parameter in RUN can result in the technology module no longer processing the control and feedback interface correctly. You prevent this by selecting the option with the greatest time demand as early as during the offline parameter assignment.

⁴ Applies to: Set function of DI = 001_B; 010_B; 011_B

B.1 Parameter assignment and structure of parameter data record

Bit → Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
16/64	Reserved ²⁾				Reserved ²⁾	110 _B : Digital input without function		
						111 _B : Invalid		
17/65	Behavior of DI1: See Byte 16							
18/66	Behavior of DI2: See Byte 16							
19/67	Frequency of synchronization:	Count direction for synchronization:		Reserved ²⁾	Input delay:			
	0 _B : Once	00 _B : Invalid			0000 _B : None			
	1 _B : Periodic	01 _B : Up			0001 _B : 0.05 ms			
		10 _B : Down			0010 _B : 0.1 ms			
		11 _B : In both directions			0011 _B : 0.4 ms			
					0100 _B : 0.8 ms			
					0101 _B : 1.6 ms			
					0110 _B : 3.2 ms			
					0111 _B : 12.8 ms			
					1000 _B : 20 ms			
					1001 to 1111 _B : Invalid			
20...43/ 68...91	Values							
20...23/ 68...71	High counting limit: DWORD: Value range: 1 to 33554431 _D or 1 to 01FFFFFF _H							
24...27/ 72...75	Comparison value 0: DWORD: Value range: 0 to 33554431 _D or 0 to 01FFFFFF _H							
28...31/ 76...79	Comparison value 1: DWORD: Value range: 0 to 33554431 _D or 0 to 01FFFFFF _H							
32...35/ 80...83	Start value: DWORD: Value range: 0 to 33554431 _D or 0 to 01FFFFFF _H							
36...39/ 84...87	Low counting limit: DWORD: Value range: 0 to 33554430 _D or 0 to 01FFFFFF _H							
40...43/ 88...91	Reserved ²⁾							
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 opposite counting limit			
	01 _B : Continue with current value		001 _B : Continue counting		001 _B : To start value			
	10 to 11 _B : Invalid		010 to 111 _B : Invalid		010 to 111 _B : Invalid			
45...47/ 93...95	Reserved ²⁾							
48/96	Set hysteresis range: Value range: 0 to 255 _D :							

Bit →	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte ↓								
49...51/ 97...99	Reserved ²⁾							

¹ You enable the respective parameter by setting the associated bit to 1.

² Reserved bits must be set to 0.

³ In isochronous mode, the parameter can have an effect on the isochronous parameters of the Sync domain. Because the isochronous parameters are not checked in RUN, changing the parameter in RUN can result in the technology module no longer processing the control and feedback interface correctly. You prevent this by selecting the option with the greatest time demand as early as during the offline parameter assignment.

⁴ Applies to: Set function of DI = 001_B; 010_B; 011_B

B.2 Parameter validation error

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

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

WRREC

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

Example:

Let us assume that an invalid value, for example 9, is written to the module for the operating mode with WRREC. As a consequence, the module rejects the entire parameter data record. You can recognize this by evaluating the STATUS output parameter of the WRREC instruction. The STATUS output parameter is output as an ARRAY[1..4] of BYTE data with the value 16#DF80E111:

Example of WRREC STATUS data	Address	Meaning
DF _H	STATUS[1]	Error when writing a data record via PROFINET IO (IEC 61158-6)
80 _H	STATUS[2]	Error when reading or writing a data record via PROFINET IO (IEC 61158-6)
E1 _H	STATUS[3]	Module-specific error
11 _H	STATUS[4]	Error code from the table below: The "Operating mode" parameter has an invalid value.

Error codes

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

Table B-3 Error codes for parameter validation

Error code in STATUS parameter (hexadecimal)				Meaning	Remedy
Byte 0	Byte 1	Byte 2	Byte 3		
DF	80	B0	00	Data record number unknown	Enter valid number for data record.
DF	80	B1	01	Length of data record incorrect	Enter valid value for data record length.
DF	80	B2	00	Slot invalid or not accessible	- Check whether module is inserted or removed. - Check assigned values for parameters of the WRREC instruction.
DF	80	E0	01	Wrong version	- Check byte 0. - Enter valid values.
DF	80	E0	02	Error in the header information	- Check byte 1. - Correct the length of the parameter blocks.
DF	80	E1	00	Parameter invalid: No detailed information available	Check all parameter values.
DF	80	E1	11	"Operating mode" parameter invalid	Enter valid parameter value.
DF	80	E1	12	"Reaction to CPU STOP" parameter invalid	Enter valid parameter value.
DF	80	E1	13	"Signal type" parameter invalid	Enter valid parameter value.
DF	80	E1	14	"Sensor type" parameter invalid	Enter valid parameter value.
DF	80	E1	15	"Filter frequency" parameter invalid	Enter valid parameter value.
DF	80	E1	16	"Reaction to signal N" parameter invalid	Enter valid parameter value.
DF	80	E1	17	"Set function of DI" parameter invalid	Enter valid parameter value.
DF	80	E1	18	"Set function of DI" parameter configured the same for DI.n.0 and DI.n.1.	Enter different parameter values for DI.n.0 and DI.n.1.
DF	80	E1	19	"Edge selection" parameter invalid "Gate start (edge-triggered)" configured as function for DI.n.m and "At rising and falling edge" "Gate stop (edge-triggered)" configured as function for DI.n.m and "At rising and falling edge" "Synchronization" configured as function for DI.n.m and "At rising and falling edge"	- Enter valid parameter value. - Configure "Gate start (edge-triggered)" as function for DI.n.m only together with "At rising edge" or "At falling edge" - Configure "Gate stop (edge-triggered)" as function for DI.n.m only together with "At rising edge" or "At falling edge" - Configure "Synchronization" as function for DI.n.m only together with "At rising edge" or "At falling edge"
DF	80	E1	1A	"Input delay" parameter invalid	Enter valid parameter value.
DF	80	E1	1B	"Set output" parameter invalid	Enter valid parameter value.
DF	80	E1	1C	"Count direction" parameter invalid	Enter valid parameter value.
DF	80	E1	1D	"Reset when counting limit is violated" parameter invalid	Enter valid parameter value.
DF	80	E1	1E	"Reaction to violation of a counting limit" parameter invalid	Enter valid parameter value.
DF	80	E1	20	"Reaction to gate start" parameter invalid	Enter valid parameter value.
DF	80	E1	21 ^{1,5}	- Low counting limit > comparison value 0 - Low counting limit > comparison value 1	- Low counting limit < comparison value 0 - Low counting limit < comparison value 1
DF	80	E1	22 ^{1,5}	- Counting high limit < comparison value 0 - Counting high limit < comparison value 1	- High counting limit > comparison value 0 - High counting limit > comparison value 1
DF	80	E1	23	"Start value" parameter invalid "Low counting limit" parameter invalid	Enter valid parameter value; Start value > low counting limit

¹ Only for "Counting" operating mode

² Only for "Position input for technology object "Motion Control"" operating mode

³ Only for DQn.1 functions "Between comparison value 0 and 1" and "Not between comparison value 0 and 1"

⁴ Only for operating mode "Fast Mode"

⁵ Not for DQn.m function "Use by user program" or "Digital output without function"

B.2 Parameter validation error

Error code in STATUS parameter (hexadecimal)				Meaning	Remedy
Byte 0	Byte 1	Byte 2	Byte 3		
DF	80	E1	24	"Start value" parameter invalid "High counting limit" parameter invalid	Enter valid parameter value: Start value < high counting limit
DF	80	E1	25	"Update time" parameter invalid	Enter parameter value from range 0 to 25000000 _D .
DF	80	E1	26 ²	"Reference speed" parameter invalid	Enter parameter value from range 6.00 to 210000.00 _D .
DF	80	E1	27	"Measured variable" parameter invalid	Enter valid parameter value.
DF	80	E1	28	"Time base for velocity measurement" parameter invalid	Enter valid parameter value.
DF	80	E1	29	"Increments per unit" parameter invalid	Enter valid parameter value.
DF	80	E1	2A	"High counting limit" parameter invalid "Low counting limit" parameter invalid	Enter valid parameter value: Low counting limit < high counting limit
DF	80	E1	2B ³	"Comparison value 0" parameter invalid "Comparison value 1" parameter invalid	Enter valid parameter value: Comparison value 0 < comparison value 1
DF	80	E1	2C	"Signal evaluation" parameter invalid	Enter valid parameter value.
DF	80	E1	2D	"Between comparison value 0 and 1" configured for DQn.0 "Not between comparison value 0 and 1" configured for DQn.0 "Between comparison value 0 and 1" configured for DQn.1, but "Use by user program" not configured for DQn.0 "Not between comparison value 0 and 1" configured for DQn.1, but "Use by user program" not configured for DQn.0	- Configure "Between comparison value 0 and 1" only for DQn.1 "Not between comparison value 0 and 1" configured only for DQn.1 - Only configure "Between comparison value 0 and 1" for DQn.1 when "Use by user program" is configured for DQn.0 - Only configure "Not between comparison value 0 and 1" for DQn.1 when "Use by user program" is configured for DQn.0
DF	80	E1	2E	"Capture" configured for DI _n .m in "Measuring" operating mode	Do not configure "Capture" for DI _n .m in "Measuring" operating mode.
DF	80	E1	36 ⁴	"Counting high limit" parameter invalid	Enter valid parameter value.
DF	80	E1	37 ^{4,5}	"Comparison value 0" parameter invalid "Comparison value 1" parameter invalid	Enter valid parameter value.
DF	80	E1	38 ⁴	"Start value" parameter invalid	Enter valid parameter value.
DF	80	E1	39 ⁴	"Counting low limit" parameter invalid	Enter valid parameter value.
DF	80	E1	3A ⁴	"Count direction for synchronization" parameter invalid	Enter valid parameter value.
DF	80	E1	F0	Reserved bit is not set to 0.	Set reserved bit to 0.
DF	80	E1	FF	Conflict with the isochronous times configured in the hardware configuration.	Enter suitable isochronous times in the hardware configuration.

¹ Only for "Counting" operating mode

² Only for "Position input for technology object "Motion Control"" operating mode

³ Only for DQn.1 functions "Between comparison value 0 and 1" and "Not between comparison value 0 and 1"

⁴ Only for operating mode "Fast Mode"

⁵ Not for DQn.m function "Use by user program" or "Digital output without function"