SIEMENS



Manual

SIMATIC

S7-1500/ET 200MP

Technology module
TM PTO 4 (6ES7553-1AA01-0AB0)

Edition 12/2024

support.industry.siemens.com

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SIMATIC

S7-1500/ET 200MP TM PTO 4 Technology Module (6ES7553-1AA01-0AB0)

Equipment Manual

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Legal information

Warning notice system

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

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⚠ 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.

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Preface

Purpose of the documentation

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

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

Conventions

Please observe notes marked as follows:

Note

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

Document history

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

Manual edition	Comments
12/2024	Edition for article number 6ES7553-1AA01-0AB0, firmware version V2.0. All sections have been editorially revised.
12/2016	First edition

Open Source Software

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

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

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S7-1500/ET 200MP Documentation Guide

1

1.1 S7-1500/ET 200MP documentation guide



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

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

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

Basic information



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

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

Examples:

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

Device information



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

Examples:

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

General information



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

Examples:

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

Product Information

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

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

Manual Collection S7-1500/ET 200MP

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

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

Manual Collection fail-safe modules

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

You can find the Manual Collection on the Internet.

SIMATIC S7-1500 comparison list for programming languages

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

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

1.2 SIMATIC Technical Documentation

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

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

Overview of the SIMATIC Technical Documentation

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

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

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

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

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

Retention of the documentation

Retain the documentation for later use.

For documentation provided in digital form:

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

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

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

Updating the documentation

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

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

mySupport

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

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

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

Application examples

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

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

1.3 Tool support

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

TIA Selection Tool

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

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

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

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

SINETPLAN

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

The advantages at a glance

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

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

See also

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

Industrial Cybersecurity 2

2.1 Introduction to industrial cybersecurity

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

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

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

2.2 Cybersecurity information

Siemens provides products and solutions with industrial security 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 Cybersecurity-relevant information

Note all cybersecurity-relevant information.

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

Product overview

3

3.1 Properties

Article number

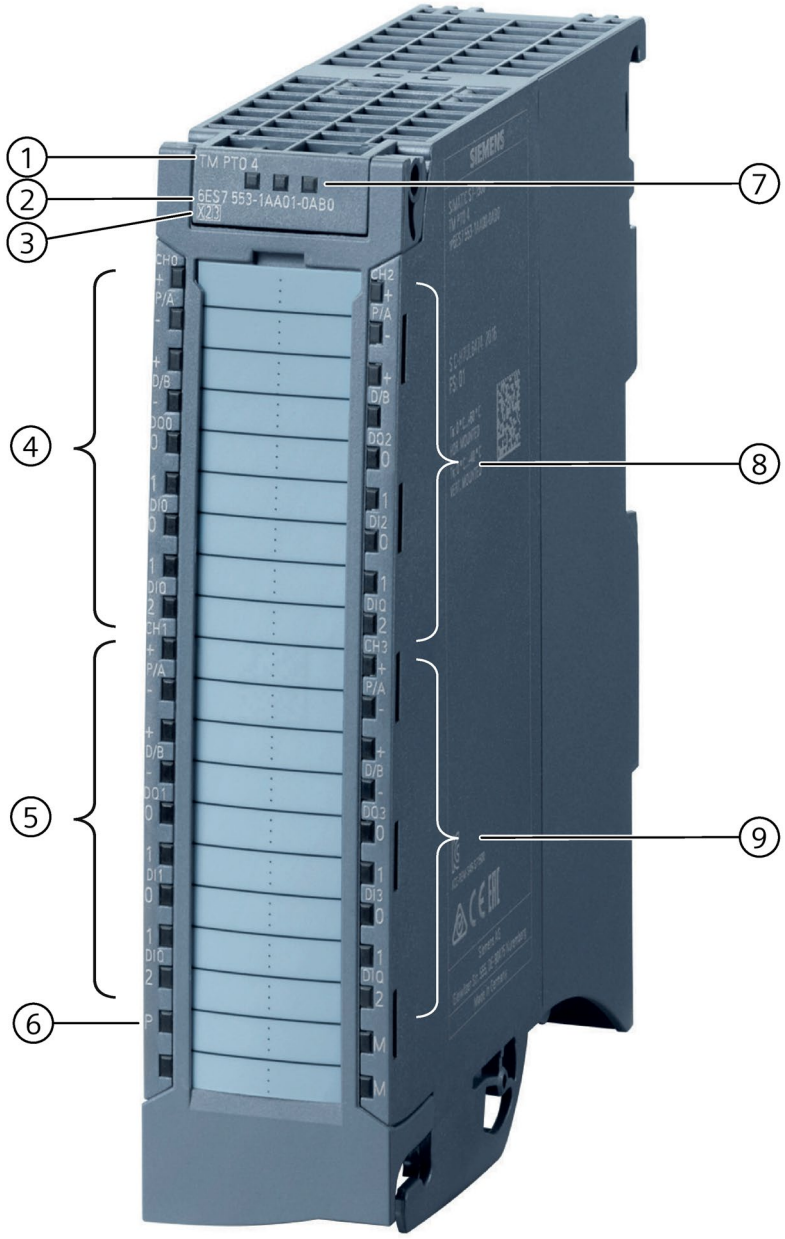
6ES7553-1AA01-0AB0

The TM PTO 4 with article number 6ES7553-1AA01-0AB0 is a compatible replacement for the TM PTO 4 with article number 6ES7553-1AA00-0AB0.

Firmware version

This Equipment Manual describes the properties of firmware version V2.0 of the module.

View of the module



① Module type and designation
② Article number
③ Release number
④ LEDs for status channel 0
⑤ LEDs for status channel 1
⑥ LED for supply voltage
⑦ LEDs for diagnostics
⑧ LEDs for status channel 2
⑨ LEDs for status channel 3

Figure 3-1 View of the TM PTO 4 module

Introduction

The technology module enables you to connect up to four stepper motor axes to an S7-1500 system. The module is linked to technology objects by means of an implementation of the PROFIdrive frame 3 and forms the interface to the drive. The number of steps that are output is returned as the actual position value.

Properties

The technology module has the following properties:

- Technical properties
  - 4 channels, quantity can be configured, channel-by-channel parameter assignment
  - Interfaces:

    RS422/TTL(5 V) or 24 V pulse output signals P/A and D/B for the PTO function (per channel, max. 1 MHz for RS422, max. 200 kHz for 24 V / TTL (5 V))

    Digital input signals DI0 and DI1 for the reference switch, measuring input, ready input functions (per channel)

    Digital output signal DQ0 for the PTO or drive enable function (per channel)

    Digital output signal DQ1 for the PTO function (per channel)

    Digital input/output signal DIQ2 for the drive enable or ready input function (per channel)

    Supply voltage L+
  - Configurable diagnostics (per channel)
  - Configurable interpulse period for direction reversal
  - Configurable input delay: none, 0.05 ms ... 20 ms
- Supported signal types for pulse output
  - Pulse encoder with direction signal
  - Pulse encoder with forward signal and backward signal
  - Incremental encoder with two signals with a 90° phase shift

The module supports the following functions:

Table 3- 1 Version dependencies of the functions

Function	Firmware version of the module	Configurable as of	
		STEP 7 (TIA Portal)	GSD PROFINET IO
Firmware update	V1.0 or higher	V14 with HSP0181	X
I&M identification data	V1.0 or higher	V14 with HSP0181	X
Parameter reassignment in RUN	V1.0 or higher	V14 with HSP0181	X
Isochronous mode	V1.0 or higher	V14 with HSP0181	—
Signed firmware update	As of V2.0	V20	X

Accessories

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

- Shielding bracket
- Shield connection clamp
- Infeed element
- Labeling strip
- U-connector

Other components

The following component needs to be ordered separately:

- Front connectors, including potential bridges and cable ties

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

3.2 Pulse Train Output (PTO)

Applications

Pulse Train Output is a simple and universal interface between a SIMATIC controller and a drive. PTO is supported worldwide by many stepper and servo drives and is used in many positioning applications, such as for adjustment axes and feed axes.

PTO is also referred to as the pulse/direction interface. The pulse/direction interface comprises two signals. The frequency of the pulse output represents the speed and the number of pulses that are output represents the distance to be traversed. The direction output defines the traversing direction. The position specification is thereby accurate to within one increment. The pulse/direction interface is especially well-suited for operation with the technology objects TO_SpeedAxis, TO_PositioningAxis and TO_SynchronousAxis.

Control

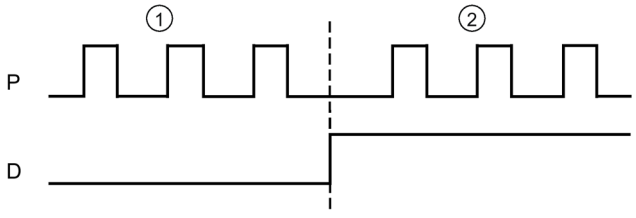
The control of the pulse output channels is provided above all with S7-1500 Motion Control by means of the technology objects TO_SpeedAxis, TO_PositioningAxis and TO_SynchronousAxis . The control and feedback interface (Page 34) of the channels is an implementation of the PROFIdrive interface with standard frame 3.

For a detailed description of configuring the technology module with the axis technology objects, see the S7-1500/S7-1500T Axis functions Function Manual, which is available for download on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109817884).

Signal types

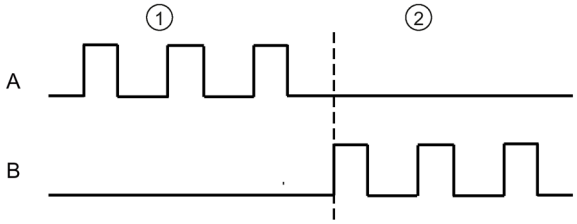
The technology module supports the following four signal types:

- PTO (pulse (P) and direction (D)):
  One output (P) controls the pulses and one output (D) controls the direction. D is 'high' (active) when pulses are generated in the negative direction. D is 'low' (inactive) when pulses are generated in the positive direction.



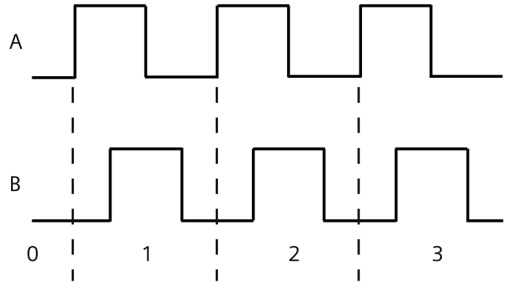
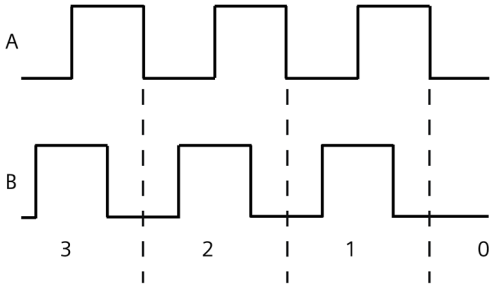
① Positive direction of rotation
② Negative direction of rotation

- PTO (count up (A), count down (B)):
  One output (A) outputs pulses for positive directions and another output (B) outputs pulses for negative directions.

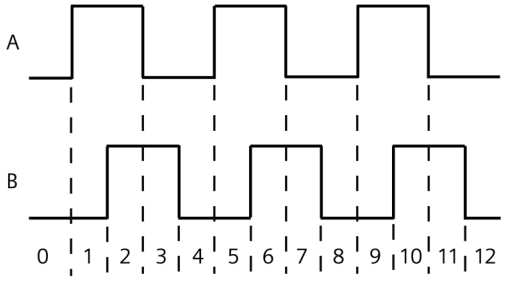
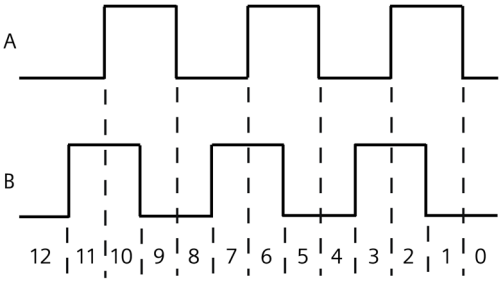


① Positive direction of rotation
② Negative direction of rotation

- PTO (A, B phase-shifted):
  Output pulses are output by both outputs at the specified velocity, but phase-shifted by 90 degrees. This involves a single pulse output in which the duration of the pulse is the time between two transitions of signal A while signal B is in low state.
  A positive direction of rotation is generated at a positive edge of signal A while signal B is in low state. A negative direction of rotation is generated at a negative edge of signal A while signal B is in low state.

A precedes B (positive direction of rotation)	A follows B (negative direction of rotation)
	
Position value	Position value

- PTO (A, B phase-shifted, quadruple)
  Output pulses are output by both outputs at the specified velocity, but phase-shifted by 90 degrees. This signal type involves a quadruple pulse output in which each edge transition corresponds to one increment. Therefore, a complete period of signal A contains four increments. In this way, it is possible, for example, to use two outputs, each with 100 kHz signal frequency, to output a control signal that supplies 400,000 increments per second.
  Whether count pulses are generated in the positive or negative direction of rotation depends on the edge direction of one signal and the logic state of the other signal in each case.

A precedes B (positive direction of rotation)	A follows B (negative direction of rotation)
	
Position value	Position value

4 Connecting

4.1 Pin assignment

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

For information on wiring the front connector, connecting the cable shield, etc., see System Manual S7-1500, ET 200MP Automation System (http://support.automation.siemens.com/WW/view/en/59191792), section Wiring.

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

Pin assignment for the front connector

The table below shows the pin assignment of the front connector for the respective signal interface.

Table 4- 1 Pin assignment of the front connector: Channel 0/1

Designation			Signal name		View
24 V, asymmetrical	**RS422, symmetrical**	**TTL (5 V), asymmetrical**			
Channel 0					
—	Pulse signal P/A	Pulse signal P/A	CH0.P/A	1	
	Inverted pulse signal P/A	—	/CH0.P/A	2	
	Pulse signal D/B	Pulse signal D/B	CH0.D/B	3	
	Inverted pulse signal D/B	—	/CH0.D/B	4	
Pulse signal P/A	Digital output DQ0	Digital output DQ0	DQ0.0	5	
Pulse signal D/B	—	—	DQ0.1	6	
Digital input DI0			DI0.0	7	
Digital input DI1			DI0.1	8	
Digital input/output DIQ2			DIQ0.2	9	
Channel 1					
—	Pulse signal P/A	Pulse signal P/A	CH1.P/A	10	
	Inverted pulse signal P/A	—	/CH1.P/A	11	
	Pulse signal D/B	Pulse signal D/B	CH1.D/B	12	
	Inverted pulse signal D/B	—	/CH1.D/B	13	
Pulse signal P/A	Digital output DQ0	Digital output DQ0	DQ1.0	14	
Pulse signal D/B	—	—	DQ1.1	15	
Digital input DI0			DI1.0	16	
Digital input DI1			DI1.1	17	
Digital input/output DIQ2			DIQ1.2	18	
—			—	19	
				20	

Table 4- 2 Pin assignment of the front connector: Channel 2/3

View	Signal name		Designation		
			24 V, asymmetrical	**RS422, symmetrical**	**TTL (5 V), asymmetrical**
	**Channel 2**				
	21	CH2.P/A	—	Pulse signal P/A	Pulse signal P/A
	22	/CH2.P/A		Inverted pulse signal P/A	—
	23	CH2.D/B		Pulse signal D/B	Pulse signal D/B
	24	/CH2.D/B		Inverted pulse signal D/B	—
	25	DQ2.0	Pulse signal P/A	Digital output DQ0	Digital output DQ0
	26	DQ2.1	Pulse signal D/B	—	—
	27	DI2.0	Digital input DI0		
	28	DI2.1	Digital input DI1		
	29	DIQ2.2	Digital input/output DIQ2		
	Channel 3				
	30	CH3.P/A	—	Pulse signal P/A	Pulse signal P/A
	31	/CH3.P/A		Inverted pulse signal P/A	—
	32	CH3.D/B		Pulse signal D/B	Pulse signal D/B
	33	/CH3.D/B		Inverted pulse signal D/B	—
	34	DQ3.0	Pulse signal P/A	Digital output DQ0	Digital output DQ0
	35	DQ3.1	Pulse signal D/B	—	—
	36	DI3.0	Digital input DI0		
	37	DI3.1	Digital input DI1		
	38	DIQ3.2	Digital input/output DIQ2		
	39	M	Ground for digital outputs, digital inputs, and pulse signals of the technology module		
	40	M			

Note

Use of potential bridges in the front connector is not permitted.

Pin assignment for the infeed element

The infeed element is inserted into the front connector and serves to supply power to the technology module. You must connect the supply voltage to terminal 41 (L+) and terminal 44 (M) for this.

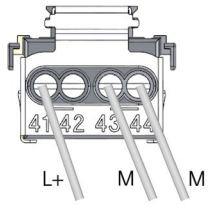


Figure 4-1 Infeed element wiring

L+ 24 V DC supply voltage
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.

The PWR LED (Page 46), next to terminal 19 of the front connector, indicates the presence of the supply voltage.

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

Due to the characteristics of the output driver used in the module, a wire break causes approximately 10 mA supply current to drain from the digital outputs via a parasitic diode. This behavior may lead to a high level, even at outputs that are not set. Depending on the nature of the load, 10 mA may be enough to activate a high-level load.

Double wiring to ground

To prevent inadvertent switching of outputs when a wire break occurs at a ground connection, follow these steps:

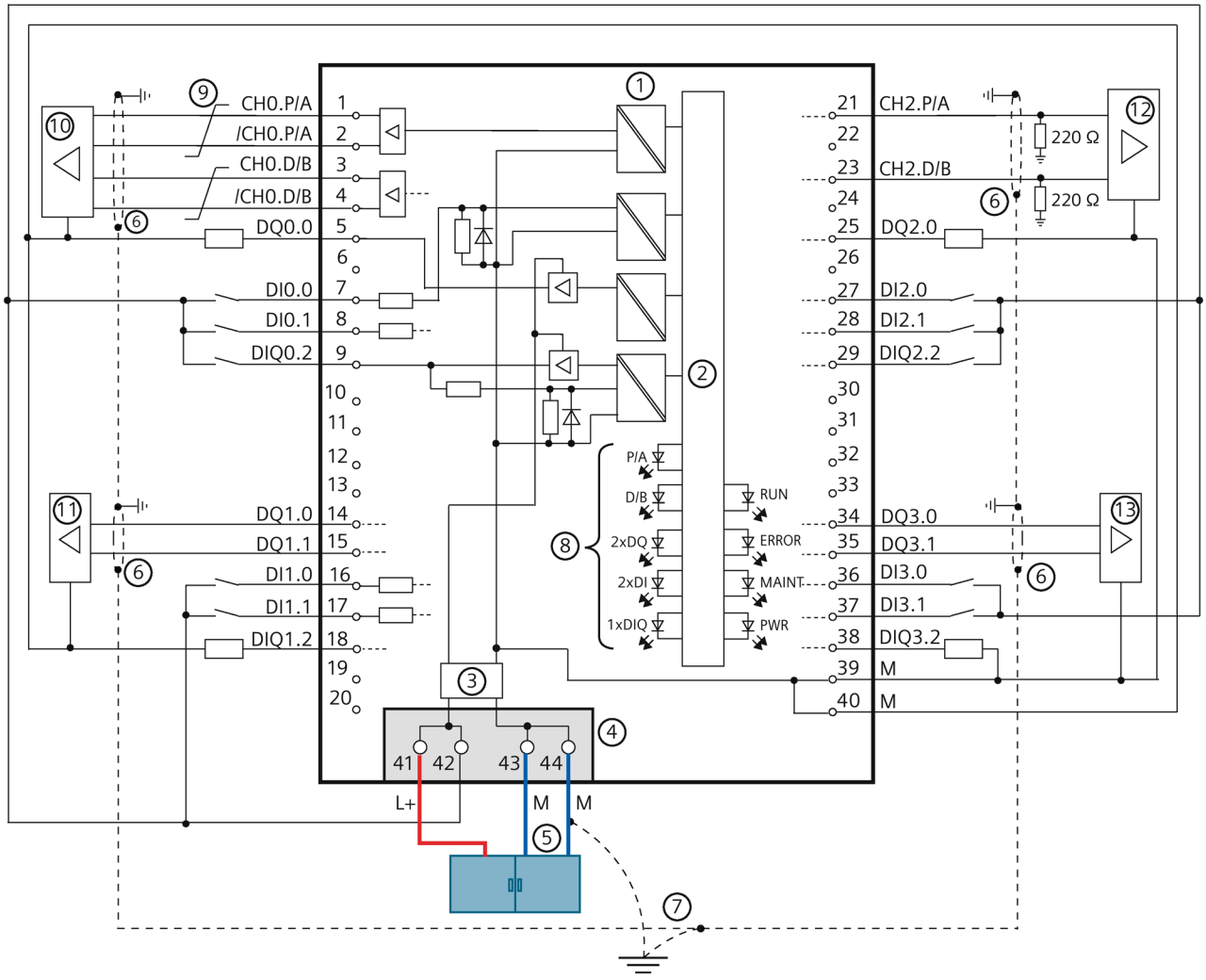
1. Route the first ground connection from terminal 44 to the ground connection of the central power supply of the system.
2. Route the second ground connection from terminal 43 to the ground connection of the central power supply of the system.

If one of the two ground connection cables is interrupted, the outputs are kept at the required potential by the remaining ground connection.

WARNING
Wire break at ground connection Always connect *two* cables to the ground connection of the central power supply of the system.

Circuit diagram

The figure below shows an example circuit diagram of the technology module. In this example, four channels are used with the RS422, 5 V-TTL and 24 V signal interfaces:



①	Galvanic isolation	⑦	Equipotential bonding (preferably via DIN rail)
②	Technology and backplane bus interface	⑧	LEDs per channel
③	Input filter for supply voltage	⑨	Twisted-pair cables
④	Supply voltage via infeed element	⑩	Motor with drive stage at RS422 signal interface
⑤	Duplicate wiring to the ground connection of the central power supply of the system	⑪, ⑬	Motor with drive stage at 24 V signal interface
⑥	Shield support on the front connector (clamp connection of the shields in the shield connection clamp)	⑫	Motor with drive stage at TTL signal interface

Circuit diagram when using RS422, 5 V-TTL and 24 V signal interfaces

RS422/TTL and 24 V pulse output signals

The technology module can output pulse signals either via the RS422/TTL or 24 V signal interface for each channel. The pulse signals are designated with P/A and D/B.

A TTL pulse signal and a 24 V pulse signal use a single wire. An RS422 pulse signal uses a pair of wires and the pulse information is transmitted as differential voltage. This ensures interference-free transmission of RS422 encoder signals, even of higher-frequency signals over longer distances. The RS422 wire pairs must be twisted in the cable and terminated with a 100 Ω resistance.

For an overview of the signal types you can output, see section Pulse Train Output (PTO) (Page 16).

When the RS422/TTL signal interface is used, you connect the P/A signal to the Chn.P/A connections and the D/B signal to the CHn.D/B connections. When the 24 V signal interface is used, you connect the P/A signal to digital output DQn.0 and the D/B signal to digital output DQn.1. When the 5 V TTL signal interface is used, you must provide a resistance of 220 Ω to 1 kΩ between connection CHn.P/A and ground M, as well as between connection CHn.D/B and ground M.

The outputs of the channels are not electrically isolated from each other. The outputs are electrically isolated from the backplane bus.

Digital inputs DI0, DI1 and DIQ2

Up to three digital inputs are available per channel. The digital inputs are used for additional functions for the respective drive control:

Function	Meaning
Reference switch input	You can use a reference switch at digital input DIn.0 to synchronize the reference mark with the current position of the drive axis.
Measuring input	You can use a measuring input at digital input DIn.1 to save the current position of the drive axis.
"Drive ready" input	You can use digital input DIn.0, DIn.1 or DIQn.2 as an input for the ready signal of the drive.

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

Interpulse period following direction reversal

You can configure the minimum amount of time the technology module must pause the pulse output following reversal of the direction of rotation. After the interpulse period elapses, the pulse output is resumed.

You can specify the following values for the interpulse period:

- 0 (default)
- 1 ms
- 4 ms
- 10 ms

Input delay for digital inputs

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

You can specify the following values for the input delay:

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

Note

If you set an input delay < 0.1 ms, you must use shielded cables to connect the digital inputs.

Digital outputs DQ0, DQ1 and DIQ2

Up to three digital outputs are available per channel. When you use the "RS422, symmetrical / TTL (5 V), asymmetrical" signal interface, you can use digital output DQn.0 to enable the drive. When the "24 V, asymmetrical" signal interface is used, you connect the P/A signal to digital output DQn.0 and the D/B signal to digital output DQn.1. In this case, you can use digital output DIQn.2 to enable the drive.

The digital outputs are:

- Not electrically isolated from one other
- Electrically isolated from the backplane bus
- Protected from overload and short-circuit

Relays and contactors can be connected direct without external circuitry. You can find information on the maximum possible operating frequencies at the digital outputs in the section Technical specifications (Page 51).

Possible combinations of the DI and DQ functions

The possible combinations of additional DI and DQ functions are dependent on the signal interface:

- Reference switch input (RS, Reference Switch)
- Measuring input (MI, Measuring Input)
- "Drive ready" input (DR, Drive Ready)
- Drive enable output (ED, Enable Drive)

When you use the "RS422, symmetrical / TTL (5 V), asymmetrical" signal interface, you have the following possible combinations for the named functions:

Table 4- 3 Possible combinations for "RS422, symmetrical / TTL (5 V), asymmetrical" signal interface

DIn.0	DIn.1	DIQn.2		DQn.0	DQn.1
		Input	Output		
—	—	—	—	—	Not supported
RS	—	—	—	—	
RS	—	DR	—	—	
RS	—	DR	—	ED	
RS	—	—	ED	—	
RS	MI	—	—	—	
RS	MI	DR	—	—	
RS	MI	DR	—	ED	
RS	MI	—	ED	—	
—	MI	—	—	—	
—	MI	DR	—	—	
—	MI	DR	—	ED	
—	MI	—	ED	—	
DR	—	—	—	—	
DR	—	—	—	ED	
DR	—	—	ED	—	
DR	MI	—	—	—	
DR	MI	—	—	ED	
DR	MI	—	ED	—	
—	DR	—	—	—	
—	DR	—	—	ED	
—	DR	—	ED	—	
RS	DR	—	—	—	
RS	DR	—	—	ED	
RS	DR	—	ED	—	

When you use the "24 V, asymmetrical" signal interface, you have the following possible combinations for the named functions:

Table 4- 4 Possible combinations for "24 V, asymmetrical" signal interface

DIn.0	DIn.1	DIQn.2		DQn.0	DQn.1
		Input	Output		
—	—	—	—	P/A signal	D/B signal
RS	—	—	—		
—	—	DR	—		
RS	—	DR	—		
—	—	—	ED		
RS	—	—	ED		
RS	MI	—	—		
RS	MI	DR	—		
RS	MI	—	ED		
—	MI	—	—		
—	MI	DR	—		
—	MI	—	ED		
DR	—	—	—		
DR	—	—	ED		
DR	MI	—	—		
DR	MI	—	ED		
—	DR	—	—		
—	DR	—	ED		
RS	DR	—	—		
RS	DR	—	ED		

Configuring/address space

5

5.1 Configuring

Introduction

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

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

System environment

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

Possible applications	Components required	Configuration software	In the user program
Central operation with an S7-1500 CPU	• S7-1500 automation system • TM PTO 4	STEP 7 (TIA Portal): • Device configuration and parameter setting with hardware configuration • Parameter setting with axis technology object for Motion Control	Motion Control instructions
Distributed operation with an S7-1500 CPU	• S7-1500 automation system • ET 200MP distributed I/O system • TM PTO 4	STEP 7 (TIA Portal): • Device configuration and parameter setting with hardware configuration • Parameter setting with axis technology object for Motion Control (PROFINET IO and PROFIBUS DP[1])	Motion Control instructions
Distributed operation with an S7-1200 CPU	• S7-1200 automation system • ET 200MP distributed I/O system • TM PTO 4	STEP 7 (TIA Portal): • Device configuration and parameter setting with hardware configuration • Parameter setting with TO_PositioningAxis technology object (PROFINET IO and PROFIBUS DP[1])	Motion Control instructions

Possible applications	Components required	Configuration software	In the user program
Distributed operation with an S7-300/400 CPU	• S7-300/400 automation system • ET 200MP distributed I/O system • TM PTO 4	STEP 7 (TIA Portal): Device configuration and parameter setting with hardware configuration (PROFINET IO and PROFIBUS DP[1]) STEP 7: Device configuration and parameter setting of the module with GSD file (PROFINET IO)	Direct access to the control and feedback interface (Page 34) in the I/O data
Distributed operation in a third-party system	• Third-party automation system • ET 200MP distributed I/O system • TM PTO 4	Third-party configuration software: Device configuration and parameter setting of the module with GSD file (PROFINET IO)	Direct access to the control and feedback interface (Page 34) in the I/O data

[1] When using the technology module on PROFIBUS DP, you can use a maximum of three channels.

Control using a technology object

For a detailed description of configuring the technology module with axis technology objects TO_SpeedAxis, TO_PositioningAxis and TO_SynchronousAxis, refer to the following:

- In the S7-1500/S7-1500T Axis functions Function Manual as a download from the Internet (https://support.industry.siemens.com/cs/ww/en/view/109817884)
- In the information system of STEP 7 (TIA Portal) under "Configuring technology modules for motion control (S7-1500, S7-1500T)"

Hardware Support Packages (HSP)

To use the technology module in TIA Portal V18 or V19, you need the HSP0181. The module is integrated in the subsequent TIA Portal versions.

The Hardware Support Packages (HSP) are available for download on the Internet (https://support.industry.siemens.com/cs/ww/en/view/72341852). In TIA Portal versions < V18, you can configure the module as 6ES7553-1AA00-0AB0 and use it with the corresponding range of functions.

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

GSD file for PROFINET IO

The GSD file for the ET 200MP distributed I/O system on PROFINET IO is available for download on the Internet (https://support.industry.siemens.com/cs/ww/en/view/68189683).

5.2 Parameters

You can use various parameters to define the properties of the technology module. 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 58).

You have the following options for setting the module's parameters:

Parameter setting via ...	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. 3. Set the parameters of the technology object. 4. Download the project to the CPU.
Hardware configuration using GSD file for distributed operation on the PROFINET IO	1. Install the latest 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 of the module in the hardware configuration. 3. Download the project to the CPU.

Parameters of the TM PTO 4

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

Table 5- 1 Configurable parameters and their defaults

Parameter	Value range	Scope
Channel configuration	• **4 channels** • 3 channels • 2 channels • 1 channel	Module
Operating mode		
Signal type	• **PTO (pulse (P) and direction (D))** • PTO (count up (A), count down (B)) • PTO (A, B phase-shifted) • PTO (A, B phase-shifted, quadruple)	Channel

Parameter	Value range	Scope
Signal interface	• **24 V, asymmetrical** • RS422, symmetrical / TTL (5 V), asymmetrical	Channel
Interpulse period following auto reverse	• **0 ms** • 1 ms • 4 ms • 10 ms	Channel
Diagnostic interrupts		
Enable diagnostic interrupts	• **Deactivated** • Enabled	Channel
Data exchange with the axis		
Increments per revolution	1...**200**...1000000	Channel
Reference speed	1,0...**3000,0**...20000,0 U/min	Channel
Maximum speed	Dependent on signal interface, signal evaluation, increments per revolution and reference speed (see following table): **3000,0**	Channel
Fine resolution		
Bits in incr. Actual value (G1_XIST1)	0 (read-only)	Channel
Stopping behavior		
Quick stop time (OFF3)	1...**1000**...65535 ms	Channel
Ramp stop time (OFF1)	1...**5000**...65535 ms	Channel
Hardware inputs/outputs		
Use drive enable	• **Deactivated** • Enabled	Channel
Drive enable output	• **DQ0** • DIQ2	Channel
Use DI0 as reference switch	• **Deactivated** • Enabled	Channel
Reference switch edge selection	• **At positive edge** • At negative edge	Channel
Use DI1 as measuring input	• **Deactivated** • Enabled	Channel
Use "Drive ready"	• **Deactivated** • Enabled	Channel
"Drive ready" input	• **DI0** • DI1 • DIQ2	Channel

Parameter	Value range	Scope
Input delay	• 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
Sign-of-life error		
Tolerated number of sign-of-life errors	0...**1**...65535	Channel

The following table shows the calculation of the value range of the maximum speed:

Table 5- 2 Value range of the maximum speed

Signal interface	Value range of the maximum speed			
	Low limit		High limit (the smaller of the two values applies)	
	Signal evaluation "Single"	Signal evaluation "Quadruple"	Signal evaluation "Single"	Signal evaluation "Quadruple"
24 V, asymmetrical	0.1 Hz * 60 / (increments per revolution)	0.1 Hz * 60 *4 / (increments per revolution)	• 2 * reference speed • 200000 Hz * 60 / (increments per revolution)	• 2 * reference speed • 200000 Hz * 60 *4 / (increments per revolution)
TTL (5 V), asymmetrical				
RS422, symmetrical			• 2 * reference speed • 1000000 Hz * 60 / (increments per revolution)	• 2 * reference speed • 1000000 Hz * 60 *4 / (increments per revolution)

Description of parameters

Parameter	Description
Channel configuration	Selection of the number of channels used. The channels are assigned in ascending order.
Signal type	Selection of the type of PTO pulse output (Page 16).
Signal interface	Selection of the interface used for the pulse output: • 24 V, asymmetrical: The channel outputs 24 V signals at terminals DQm.0 and DQm.1. • RS422, symmetrical / TTL (5 V), asymmetrical: The channel outputs either RS422 signals at terminals P/A and D/B and the respective inverted terminals or 5 V TTL signals at terminals P/A and D/B.

Parameter	Description
Interpulse period following auto reverse	Selection of the minimum time between a change in direction and the output of the first pulse in the new direction.
Enable diagnostic interrupts	Enables the following diagnostic interrupts (Page 49): • Supply voltage missing • Error at digital outputs The detected error is indicated for the respective channel with feedback bits (Page 39)Fault_Present and Sensor_Error.
Increments per revolution	Input of the number of steps (also micro steps) that correspond to one revolution of the drive. This parameter must match the "Increments per revolution" parameter in the "Data exchange with encoder" tab of the axis technology object.
Reference speed	Input of the speed at which the drive rotates with a speed setpoint of 100%. The permitted value range for the speed setpoint is -200% ... +200%. This parameter must match the "Reference speed" parameter in the "Data exchange with drive" tab of the axis technology object.
Maximum speed	Input of the maximum permitted speed for the application. The value must not exceed twice the reference speed. This parameter must match the "Maximum speed" parameter in the "Data exchange with drive" tab of the axis technology object.
Bits in incr. actual value (G1_XIST1)	Specifies the number of bits for the fine resolution coding in the incremental actual position value G1_XIST1. The value is always "0" for this module. This parameter must match the "Bits in incr. actual value (Gn_XIST1)" parameter in the "Data exchange with encoder" tab of the axis technology object.
Quick stop time (OFF3)	Input of the time taken to execute a fast stop from maximum speed to standstill.
Ramp stop time (OFF1)	Input of the time taken to execute a stop from maximum speed to standstill.
Use drive enable	Enables use of the drive enable signal at a hardware output (Page 19).
Drive enable output	Selection of the hardware output (Page 19) that is used to enable the drive. Only available for selection and effective if "Use drive enable" is enabled.
Use DI0 as reference switch	Enables use of the reference switch signal at the hardware input DI0 (Page 19). You can synchronize the reference mark with the current position of the drive axis using the reference switch signal.
Reference switch edge selection	Selection of the edge at DI0 that triggers detection of the reference mark. Only available for selection and effective if "Use DI0 as reference switch" is enabled.
Use DI1 as measuring input	Enables use of the measuring input signal at hardware input DI1 (Page 19). You can save the current position of the drive axis using the measuring input signal.
Use "Drive ready"	Enables use of the ready signal of the drive at a hardware input (Page 19).
"Drive ready" input	Selection of the hardware input (Page 19) to which the ready signal of the drive is connected and read in. Only available for selection and effective if "Use "Drive ready"" is enabled.

Parameter	Description
Input delay	Selection of the input delay for the signal at the respective digital input for noise suppression. Changes to the signal are only detected if they remain stable for longer than the configured input delay time. The input delay applies to all the used hardware inputs of the channel.
Tolerated number of sign-of-life errors	Input of how many Master Sign-Of-Life errors are tolerated by the module. If the number is exceeded, this triggers an error message via return bit (Page 39) Sensor_Error. 65535 means: No monitoring for sign-of-life errors

5.3 Address space

Address space of the technology module

Table 5- 3 Range of the input addresses and output addresses of the TM PTO 4

Channel configuration	Address space	
	Inputs	Outputs
1 channel	18 bytes	10 bytes
2 channels	36 bytes	20 bytes
3 channels	54 bytes	30 bytes
4 channels	72 bytes	40 bytes

5.4 Control and feedback interface

Direct access to the control and feedback interface is not needed for use of the module in an S7-1500 or S7-1200 system. For this case an S7-1500 system has the TO_SpeedAxis, TO_PositioningAxis and TO_SynchronousAxis technology objects, and an S7-1200 system has the TO_PositioningAxis technology object. For a detailed description of configuring the technology module with the axis technology objects, see the S7-1500/S7-1500T Axis functions Function Manual, which is available for download on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109817884).

The control and feedback interface of the channels is a partial implementation of the PROFIdrive interface "frame 3". More information on using the control and feedback interface is available in the Configuring (Page 28) section.

5.4.1 Assignment of the control interface

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

Control interface

The following table shows control interface assignment:

Byte offset from start address ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Channel 0							
0...1	STW1: Control word 1							
0	Reserved[1]					Control_ by_PLC	Reserved[1]	
1	Fault_ Acknow ledge	Enable_ Setpoint	Unfreeze_ Ramp_ Generator[6]	Enable_ Ramp_ Generator	Enable_ Operation	No_Quick_ Stop_OFF3	No_Coast_ Stop_OFF2	On_OFF1
2...5	NSOLL_B: DINT: Normalized speed setpoint in N4 format							
6...7	STW2: Control word 2							
6	Master_Sign-Of-Life				Reserved[1]			
7	Reserved[1]							
8...9	G1_STW: Encoder control word							
8	Acknow ledging_ Sensor_ Error	Activate_ Parking_ Sensor[7]	Request_ Absolute_ value_ Cyclically[3]	Request_ Set_Home_ Position[2]	Home_ Position_ Mode[2]	Reserved[1]		
9	Mode	Command _2_Request	Command _1_Request	Command _0_Request	Function_4 _Request [4,5]	Function_3 _Request [4,5]	Function_2 _Request [5]	Function_1 _Request
10...19	**Channel 1 (if used)**							
20...29	**Channel 2 (if used)**							
30...39	**Channel 3 (if used)**							

1 Must be set to 0.

2 This command is not supported by the module. If you set the bit, error code F01H is returned in G1_XIST2.

3 This command is not supported by the module. If you set the bit, error code 8H is returned in G1_XIST2.

4 This command is not supported for the "Acquire measuring input value" function. If you set the bit, error code 6H is returned in G1_XIST2.

5 This command is not supported for the "Detect reference mark" function. If you set the bit, error code 4H is returned in G1_XIST2.

6 This command is not supported by the module. The bit is not evaluated.

7 This command is not supported by the module. If you set the bit, error code 3H is returned in G1_XIST2.

Library with PLC data types (LPD)

A library of PLC data types (LPD) for STEP 7 (TIA Portal) is available for download on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109482396).

Description of control bits

Control bit/value	Description
STW1	
Control_by_PLC	0 means: Coast Stop (OFF2): Pulse output cannot be controlled by the user program on the CPU. 1 means: Valid values for control of the pulse output will be sent to the module from the user program on the CPU.
On_OFF1	0 means: OFF1: The pulse output returns to state S2 (Page 43). If you are using a drive enable, the corresponding digital output is reset as soon as the drive comes to a standstill. 1 means: Pulse output is switched on.
No_Coast_Stop_OFF2	0 means: Coast Stop (OFF2): The pulse output is stopped and returns to state S1 (Page 43). If you are using a drive enable, the corresponding digital output is reset immediately. 1 means: The "Coast Stop (OFF2)" command is withdrawn.
No_Quick_Stop_OFF3	0 means: Quick stop (OFF3): The drive stops within the configured quick stop time. The pulse output is stopped and returns to state S1 (Page 43). If you are using a drive enable, the corresponding digital output is reset as soon as the drive comes to a standstill. 1 means: The "Quick stop (OFF3)" command is withdrawn.
Enable_Operation	0 means: The pulse output returns to state S3 (Page 43). 1 means: Pulse output is enabled. The drive accelerates to the speed setpoint.
Enable_Ramp_Generator	0 means: The pulse output is stopped but remains in state S4 (Page 43). 1 means: Each speed change is controlled along on a ramp by the ramp generator.
Enable_Setpoint	0 means: The ramp generator stops the drive within the configured ramp stop time. State S4 (Page 43) is retained. 1 means: The speed setpoint is specified in NSOLL_B for the ramp generator.
Fault_Acknowledge	You use this bit to acknowledge an error.
NSOLL_B	You use this value to specify the setpoint for the drive axis velocity as a percentage in N4 format. The permitted value range for the speed setpoint is -200% ... +200%[1] of the reference speed. The DINT value maps the value range linearly. This means 100% corresponds to the value 40000000_H. The resolution is $9.3 * 10^{-8}$%.
STW2	
Master_Sign-Of-Life	When you control the module in isochronous mode using technology objects, this value is used by the technology object as the Master sign-of-life. When you control the module in non-isochronous mode without technology objects, you must set this value to 0. When you control the module in isochronous mode without a technology object, we recommend that you also set this value to 0.
G1_STW	
Acknowledging_Sensor_Error	You use this bit to acknowledge an error that occurred during feedback of the actual encoder value.
Function_1_Request	When you use the "Reference mark search" function, you use this bit to specify that the reference mark is to be detected using the configured edge (Page 58) of reference switch input DIn.0 and saved in G1_XIST2. When you use the "Measurement on the fly" function, you use this bit to specify that a measuring input value is to be acquired using the positive edge of digital input DIn.1 and saved in G1_XIST2.

Control bit/value	Description
Function_2_Request	You use this bit to specify that a measuring input value is to be acquired using the negative edge of digital input DIn.1.
Command_0_Request, Command_1_Request, Command_2_Request	You use this value to specify how the function selected with the Mode bit will be used: 000 means: Do nothing 001 means: Enable function 010 means: Read out value in G1_XIST2 011 means: Disable function 100 to 111 means: Invalid
Mode	0 means: Reference mark search: Detect reference mark using the configured edge of reference switch input DIn.0 1 means: Measurement on the fly: Acquire measuring input value using measuring input DIn.1

[1] The exact maximum speed setpoint is $+(200 - 2^{-30})\%$

Reference mark search

The following figure shows an example of the sequence of the detection and readout of the reference mark:

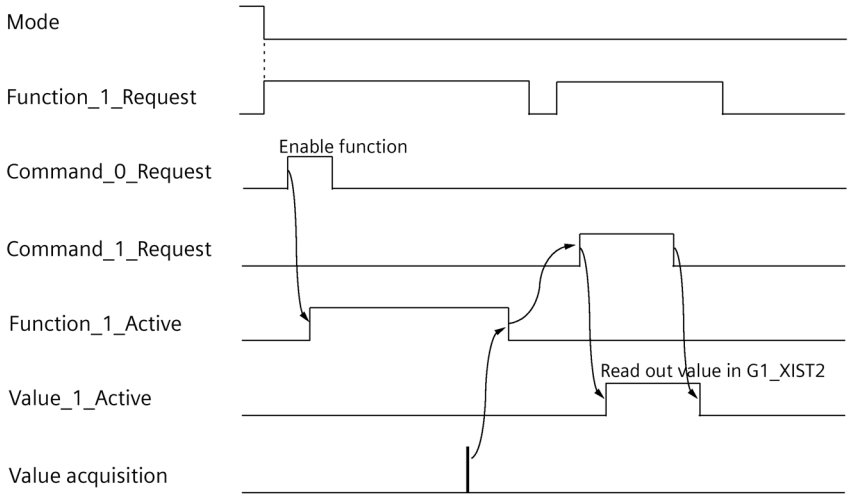


Figure 5-1 Detecting the reference mark

Measurement on the fly

The following figure shows an example of the sequence of the acquisition and the readout of the measuring input value:

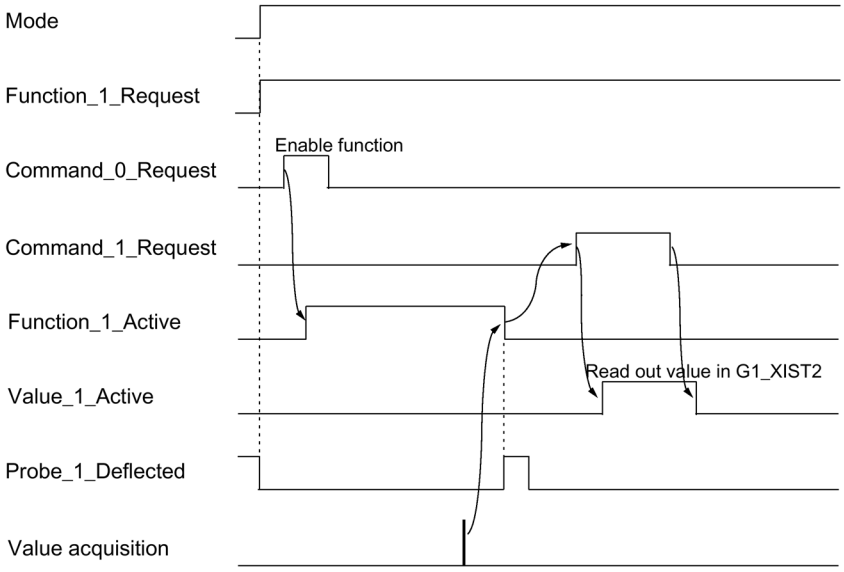


Figure 5-2 Acquiring the measuring input value

5.4.2 Assignment of the feedback interface

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

Feedback interface

The following table shows the assignment of the feedback interface:

Byte offset from start address ↓	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
	Channel 0							
0…1	ZSW1: Status word 1							
0	Reserved					f_or_n_ reached_or_ exceeded	Control_ Requested	Reserved
1	Reserved	Switching_ On_ Inhibited	Quick_Stop_ Not_ Activated_ OFF3	Coast_ Stop_Not_ Activated_ OFF2	Fault_ Present	Operation_ Enabled	Ready_To_ Operate	Ready_To_ Switch_On
2…5	NIST_B: DINT: Current normalized actual speed value in N4 format							
6…7	ZSW2: Status word 2							
6	Slave_Sign-Of-Life				Reserved			
7	Reserved							
8…9	G1_ZSW: Encoder status word							
8	Sensor_ Error	Parking_ Sensor_ Executed[1]	Transmit_ Absolute_ Value_ Cyclically[1]	Reserved	Require ment_of_ Acknow ledgement_ Detected	Reserved		Probe_1_ Deflected
9	Reserved		Value_2_ Active	Value_1_ Active	Reserved		Function_ 2_Active	Function_ 1_Active
10…13	G1_XIST1: DINT: Current actual encoder value							
14…17	G1_XIST2: DINT: Error code or measuring input value or reference mark							
18…35	**Channel 1 (if used)**							
36…53	**Channel 2 (if used)**							
54…71	**Channel 3 (if used)**							

[1] Not supported by the module.

Library with PLC data types (LPD)

A library of PLC data types (LPD) for STEP 7 (TIA Portal) is available for download on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109482396).

Description of feedback bits

Feedback bit/value	Description
ZSW1	
Control_Requested	This bit indicates that the module is ready to receive values from the user program for controlling the pulse output.
f_or_n_reached_or_exceeded	This bit indicates that the actual speed value has reached or exceeded the configured maximum speed.
Ready_To_Switch_On	This bit indicates that the pulse output is ready to switch on.
Ready_To_Operate	This bit indicates that the pulse output is ready to operate.
Operation_Enabled	This bit indicates that operation of the drive is enabled and the speed setpoint is being output.
Fault_Present	This bit indicates that a fault has occurred in the supply voltage or at a digital output. Error code 1H is returned.
Coast_Stop_Not_Activated_OFF2	This bit indicates that the drive will not perform a Coast Stop (OFF2).
Quick_Stop_Not_Activated_OFF3	This bit indicates that the drive will not perform a Quick Stop (OFF3)
Switching_On_Inhibited	This bit indicates that the pulse output is not yet ready to switch on.
NIST_B	This value indicates the actual value of the drive axis velocity as a percentage in N4 format relative to the reference speed.
ZSW2	
Slave_Sign-Of-Life	When you control the module in isochronous mode using technology objects, this value is used by the technology object as the Slave sign-of-life. When you control the module without technology objects, this bit is set to 0.
G1_ZSW	
Probe_1_Deflected	When you use the "Measurement on the fly" function, this bit indicates the state of digital input DIn.1.
Requirement_of_Acknowledgement_Detected	This bit indicates that the acknowledgement of an error is being processed.
Sensor_Error	This bit indicates that an error has occurred during feedback of position value G1_XIST1. The meaning of the returned error codes can be found in the following table.
Function_1_Active	If you use the "Reference mark search" function, this bit indicates that use of reference switch input DIn.0 is enabled. When you use the "Measurement on the fly" function, this bit indicates that use of the positive edge of measurement sensing input DIn.1 is enabled.
Function_2_Active	This bit indicates that use of the negative edge of measurement sensing input DIn.1 is enabled.
Value_1_Active	When you use the "Reference mark search" function, this bit indicates that the reference mark has been saved in G1_XIST2 using reference switch input DIn.0. When you use the "Measurement on the fly" function, this bit indicates that a measuring input value has been saved in G1_XIST2 using the positive edge of digital input DIn.1.
Value_2_Active	This bit indicates that a measuring input value has been saved in G1_XIST2 using the negative edge of digital input DIn.1.

Feedback bit/value	Description
G1_XIST1	This value is the incremental actual position value. G1_XIST1 corresponds to the number of output pulses, which control the speed of the drive.
G1_XIST2	If an error has occurred, G1_XIST2 indicates the associated error code. For the meaning of the error codes, see the table below. When you use the "Reference mark search" function, this value returns the detected reference mark. When you use the "Measurement on the fly" function, this value returns the acquired measuring input value.

Error codes

G1_XIST2 can contain the following error codes:

Error code	Name	Meaning
1H	Sensor group error	G1_XIST1 is invalid. One of the following errors occurred during feedback of the actual position value. • Missing supply voltage • Undervoltage • Short-circuit or overload at the digital output
3H	Sensor pause failed	A sensor pause (Sensor parking) is not supported.
4H	Reference mark detection aborted	• The Function_2_Request, Function_3_Request or Function_4_Request bit was set to 1 while the "Reference mark search" function was active. • The Mode bit was set to 1 while the "Reference mark search" function was active. • CPU STOP while the "Reference mark search" function was active.
5H	Read reference mark aborted	• G1_XIST2 does not contain a valid value for the reference mark. • The Mode bit was set to 1 while the reference mark was being read from G1_XIST2. • CPU STOP while the reference mark was being read from G1_XIST2.
6H	Measuring input value acquisition aborted	• The Function_3_Request or Function_4_Request bit was set to 1 while the "Measurement on the fly" function was active. • The Mode bit was set to 0 while the "Measurement on the fly" function was active. • CPU STOP while the "Measurement on the fly" function was active.

Error code	Name	Meaning
7H	Read measuring input value aborted	• G1_XIST2 does not contain a valid value of the measuring input. • The Mode bit was set to 0 while the measuring input value was being read from G1_XIST2. • CPU STOP while the measuring input value was being read from G1_XIST2.
8H	Absolute value acquisition aborted	The Request_Absolute_value_Cyclically bit is not supported by the module. The module returns only incremental encoder values.
F01H	Command not supported	The command is not supported by the module.
F02H	Sign-of-life error (Master Sign-Of-Life)	The number of tolerated errors of the Master sign-of-life (control value Master_Sign-Of-Life) was exceeded.

5.4.3 Enabling the pulse output

State diagram

The following figure shows the state diagram for enabling the pulse output:

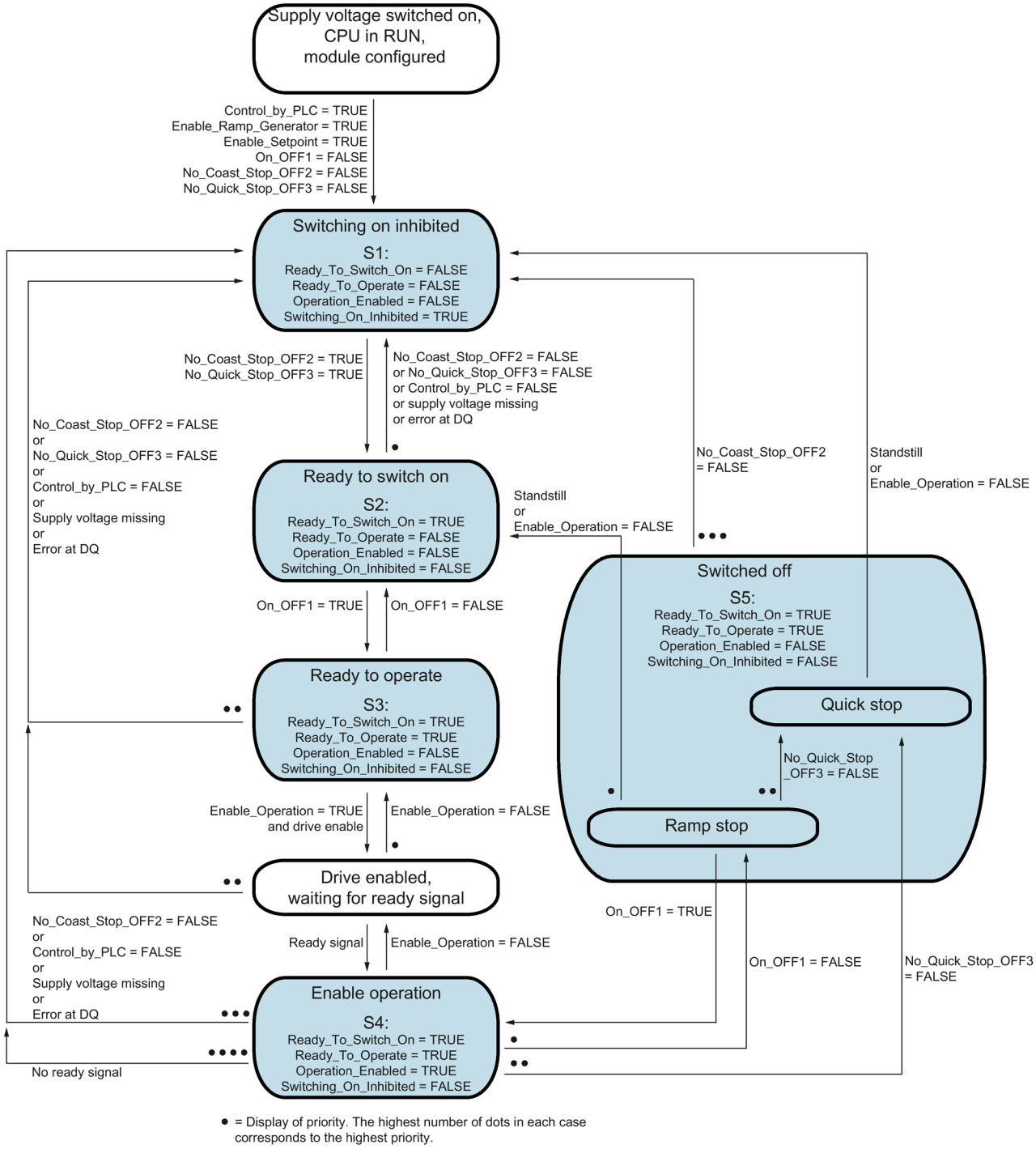


Figure 5-3 State diagram for the operation enable

Procedure

To enable the pulse output, proceed as follows:

1. Set the Control_by_PLC, Enable_Setpoint and Enable_Ramp_Generator control bits to TRUE and the On_OFF1, No_Coast_Stop_OFF2, No_Quick_Stop_OFF3 and Enable_Operation bits to FALSE.
   State S1 is reached: Switching on of the pulse output is still inhibited. The feedback bit Switching_On_Inhibited is set to TRUE.
2. Set the On_OFF1 and No_Quick_Stop_OFF3 control bits to TRUE.
   State S2 is reached: The pulse output is ready to switch on. The feedback bit Ready_To_Switch_On is set to TRUE. The feedback bit Switching_On_Inhibited is set to FALSE.
3. Set the On_OFF1 control bit to TRUE.
   State S3 is reached: The pulse output is ready to switch on. The feedback bit Ready_To_Operate is set to TRUE.
4. Set the Enable_Operation control bit to TRUE.
5. If you have configured a drive enable output, set it to high level.
   The drive is enabled.
6. If you have configured a ready input, wait for the ready signal of the drive.
   As soon as the ready input is at high level, state S4 is reached: Operation is enabled. The pulse output starts. The feedback bit Operation_Enabled is set to TRUE.

5.5 Reaction to CPU STOP

The following overview shows the reaction of the technology module to a transition of the CPU to STOP. The reaction is not configurable.

Table 5- 4 Reaction of technology module to CPU STOP

	Reaction of technology module
RUN-STOP transition	The technology module executes a Coast Stop (OFF2), which causes the pulse output to stop and the drive to coast down. If you are using a drive enable, the corresponding digital output is reset immediately. The control interface is no longer evaluated. The feedback interface continues returning the last acquired values. The feedback interface continues signaling diagnostic information using the Fault_Present and Sensor_Error bits. Active functions, such as for the reference switch, are aborted. **Note:** These outputs can retain a high level since no more pulses are output and the current status of the pulse output signals CHn.P/A and CHn.D/B is maintained depending on the signal type.
STOP-RUN transition	The configuration of the technology module is not reset. The feedback interface keeps the last acquired position value (G1_XIST1).

5.6 Isochronous mode

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

Data processing

At time T_i the current position value is acquired and made available in the feedback interface for retrieval in the current bus cycle. At time T_o the pulse output is adjusted to the current speed setpoint.

Additional information

You can find a detailed description of the isochronous mode:

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

Interrupts/diagnostic alarms

6

6.1 Status and error displays

LEDs

The figure below shows the LED displays (status and error displays) of the TM PTO 4.

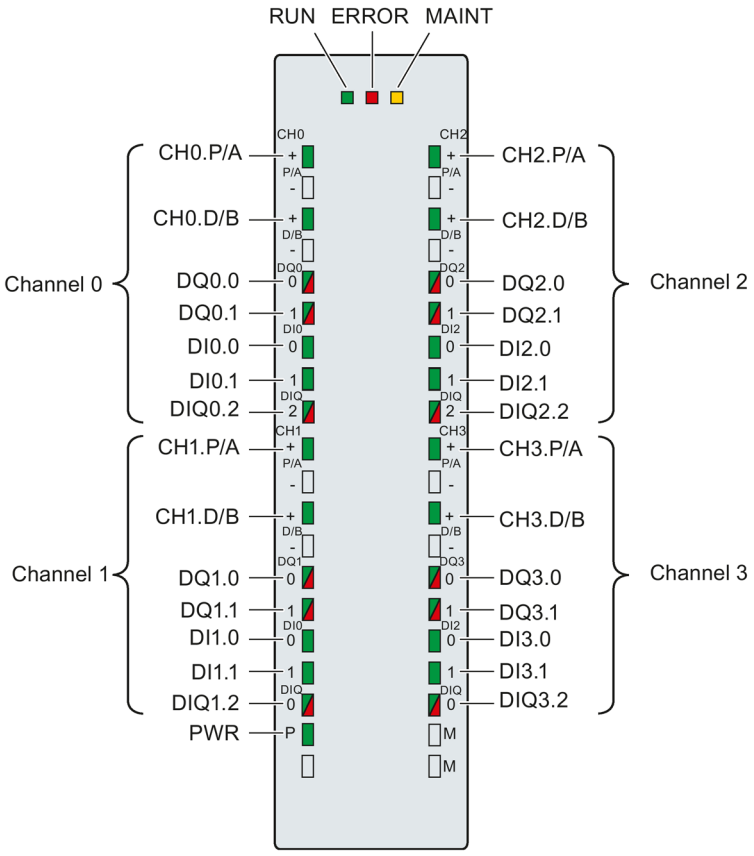


Figure 6-1 LED displays of the TM PTO 4

Meaning of the LED displays

The following tables explain the meaning of the status and error displays. Remedial measures for diagnostic alarms can be found in the section Diagnostic alarms (Page 49).

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

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

Table 6- 2 PWR/ERROR status displays

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

Channel LEDs

The CHn.P/A, CHn.D/B, and DIn.m LEDs and the LEDs of DIQn.2 used as digital inputs indicate the current level of the associated signals. The LEDs of digital outputs DQn.m and of DIQn.2 used as digital outputs indicate the desired state.

The flashing frequency of the channel LEDs is limited to approximately 24 Hz. If higher frequencies are present, the channel LEDs do not indicate the current status but instead flash at 24 Hz.

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

LEDs CHn.m/DIn.m	Meaning
□ Off	Pulse output/digital input at 0 level
■ On	Pulse output/digital input at 1 level

Table 6- 4 Status displays DQn.m/DIQn.2

LEDs DQn.m/DIQn.2	Meaning	Remedy
□ Off	Digital output at 0 level	—
■ On	Digital output at 1 level	—
■ On	Diagnostic alarm: e.g. "Error at digital outputs"	• Evaluate the diagnostic alarm. • Check the wiring or the connected load.

6.2 Diagnostic alarms

Enabling the diagnostic interrupts

You enable the diagnostic interrupts at the basic parameters.

The technology module can trigger the following diagnostic interrupts:

Table 6- 5 Possible diagnostic interrupts

Diagnostic interrupt	Monitoring
• Parameter assignment error • Internal error • Watchdog time tripped. Module is defective.	Monitoring is always active. A diagnostic interrupt is triggered each time an error is detected.
• Supply voltage missing • Error at the digital outputs	An error detected only triggers a diagnostic interrupt if "Enable diagnostic interrupts" has been enabled in the device configuration.

Reactions to a diagnostic interrupt

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

- The ERROR LED flashes red.

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

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

If the module is being operated as a distributed module in an ET 200MP system with PROFIBUS DP, you have the option of reading out diagnostics data with the RDREC or RD_REC instruction using data record 0 or 1. For the structure of the data records, refer to the Equipment Manual for the IM 155-5 DP ST interface module, which is available for download on the Internet (https://support.industry.siemens.com/cs/ww/en/view/78324181).

Diagnostic alarms

The diagnostics are displayed as plain text in STEP 7 (TIA Portal) in the online and diagnostics view. You can evaluate the error codes with the user program. The respective channel number is shown for each diagnostic information.

The following diagnostics can be signaled:

Table 6- 6 Diagnostic alarms, their meaning and remedies

Diagnostic alarm	Error code	Meaning	To correct or avoid errors
Parameter assignment error	10H	The received parameter data record is invalid	Check parameter data record
Supply voltage missing	11H	• No 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
Internal error	100H	Technology module defective	Replace technology module
Watchdog tripped. Module is defective.	103H	Firmware error	Run firmware update
		Technology module defective	Replace technology module
Error at the digital outputs[1,2]	10FH	• Error at the digital outputs (LED display DQn.m lights up red) • Possible causes: – Short-circuit – Overload	• Correct wiring at the digital outputs • Check consumers connected to the digital outputs

1 Digital outputs DQ0.0, DQ0.1, DQ1.0 and DQ1.1 have shared diagnostics. Digital outputs DQ2.0, DQ2.1, DQ3.0 and DQ3.1 have shared diagnostics.

2 Diagnostics for short-circuit and overload are effective only for 24 V outputs and only up to an output frequency of approximately 100 Hz. The module is otherwise protected from irrevocable damage caused by short-circuit at the outputs, and the diagnostic alarm is not displayed.

CAUTION

Cross-channel diagnostics of the digital outputs

The digital outputs of channels 0 and 1 as well as channels 2 and 3 have shared diagnostics. As a result, when there is an error at one digital output, faults are automatically signaled for *two* channels and the pulse output of both channels is stopped.

Ensure that this fault scenario is taken into consideration when using multiple channels.

Technical specifications

7

The following table shows the technical specifications of the module on the issue date. You can find a data sheet with up-to-date technical specifications on the Internet (https://support.industry.siemens.com/cs/de/en/pv/6ES7553-1AA01-0AB0/td?dl=en).

Article number	6ES7553-1AA01-0AB0
General information	
Product type designation	TM PTO 4
Number of channels	4; Axes
Product function	
• I&M data	Yes; I&M0 to I&M3
• Isochronous mode	Yes
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	STEP 7 V18 or higher
• STEP 7 configurable/integrated from version	V5.5 SP3 with GSD file / -
• PROFINET from GSD version/GSD revision	GSDML V2.43
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.	70 mA; without load
Power	
Power available from the backplane bus	1.3 W
Power loss	
Power loss, typ.	4 W
Address area	
Address space per module	
• Inputs	72 byte
• Outputs	40 byte

Article number	6ES7553-1AA01-0AB0
Digital inputs	
Number of digital inputs	12; 3 per channel, of which 1 DIQ
Digital inputs, parameterizable	Yes
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Digital input functions, parameterizable	
• Synchronization	Yes
• Probe	Yes
• Drive ready	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.	-5 V
• 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
– at "0" to "1", min.	4 µs; for parameterization "none"
– at "1" to "0", min.	4 µs; for parameterization "none"
for technological functions	
– parameterizable	Yes
Cable length	
• shielded, max.	1 000 m
• unshielded, max.	600 m
Digital outputs	
Number of digital outputs	12; 3 per channel, of which 1 DIQ
Current-sinking	Yes; For DQn.0 and DQn.1 push-pull outputs
Current-sourcing	Yes
Digital outputs, parameterizable	Yes
Short-circuit protection	Yes; electronic/thermal
• Response threshold, typ.	0.2 A for DQn.0 and DQn.1, 0.9 A for DIQn.2
Controlling a digital input	Yes

Article number	6ES7553-1AA01-0AB0
Digital output functions, parameterizable	
• PTO (pulse train output) signal interface	
– 24 V asymmetrical	Yes
– RS 422 symmetrical	Yes
– TTL (5 V) asymmetrical	Yes
• PTO (pulse train output) signal type	
– Pulse and direction	Yes
– Count up, count down	Yes
– Incremental encoder (A, B phase shift)	Yes
– Incremental encoder (A, B phase shift, quadruple)	Yes
Switching capacity of the outputs	
• with resistive load, max.	0.1 A; 0.5 A for DIQn.2
Load resistance range	
• lower limit	240 Ω; 48 ohms for DIQn.2
• upper limit	12 kΩ
Output voltage	
• Type of output voltage	DC
• for signal "1", min.	23.2 V; L+ (-0.8 V), L+ (-1.3 V) for DIQn.2
Output current	
• for signal "1" rated value	0.1 A; 0.5 A for DIQn.2
• for signal "1" permissible range, max.	0.12 A; 0.6 A for DIQn.2
• 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", typ.	1 µs; 28 µs for DIQn.2
• "1" to "0", typ.	1 µs; 25 µs for DIQn.2
Switching frequency	
• with resistive load, max.	1 kHz; For DIQn.2
• with inductive load, max.	0.5 Hz; According to IEC 60947-5-1, DC-13, for DIQn.2
• For signal interface 24 V asymmetrical	200 kHz; With DQn.0 and DQn.1
• For signal interface RS 422 symmetrical	1 MHz
• For signal interface TTL (5 V) asymmetrical	200 kHz
Cable length	
• shielded, max.	600 m; 600 m for technological functions; depending on output frequency, load, and cable quality

Article number	6ES7553-1AA01-0AB0
Isochronous mode	
Bus cycle time (TDP), min.	250 µs; 375 µs if all 4 channels are used
Interrupts/diagnostics/status information	
Diagnostics function	Yes
Alarms	
• Diagnostic alarm	Yes
Diagnoses	
• Monitoring the supply voltage	Yes
• Short-circuit	Yes; Thermal overload protection
• Group error	Yes
Diagnostics indication LED	
• RUN LED	Yes; green LED
• ERROR LED	Yes; red LED
• MAINT LED	Yes; Yellow LED
• Monitoring of the supply voltage (PWR-LED)	Yes; green LED
• Channel status display	Yes; green LED
• for channel diagnostics	Yes; red LED
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)
product functions / security / header	
signed firmware update	Yes
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-30 °C
• horizontal installation, max.	60 °C; Observe derating
• vertical installation, min.	-30 °C
• vertical installation, max.	40 °C; Observe derating
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

Article number	6ES7553-1AA01-0AB0
Decentralized operation	
to SIMATIC S7-300	Yes; Via control and feedback interface
to SIMATIC S7-400	Yes; Via control and feedback interface
to SIMATIC S7-1200	Yes
to SIMATIC S7-1500	Yes
to standard PROFINET controller	Yes; Via control and feedback interface
Dimensions	
Width	35 mm
Height	147 mm
Depth	129 mm
Weights	
Weight, approx.	300 g

Note

Derating information for output current

In the following cases, the maximum output current is reduced to 0.05 A for digital outputs DQn.m and 0.1 A for digital outputs DIQn.2:

- When the system is mounted vertically, as of an ambient temperature of 30 °C.
  In addition, you may only use channels 0 to 2 in this case.
- When the system is mounted horizontally, as of an ambient temperature of 50 °C.

Dimensional drawing

A

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

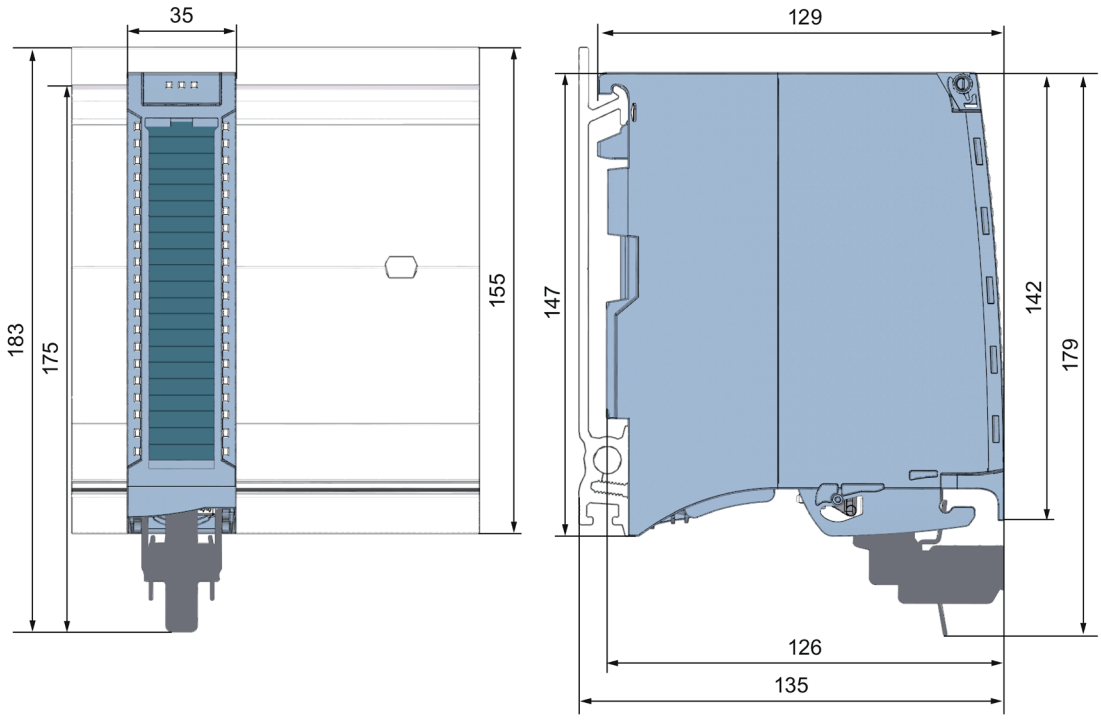


Figure A-1 Dimensional drawing of technology module TM PTO 4

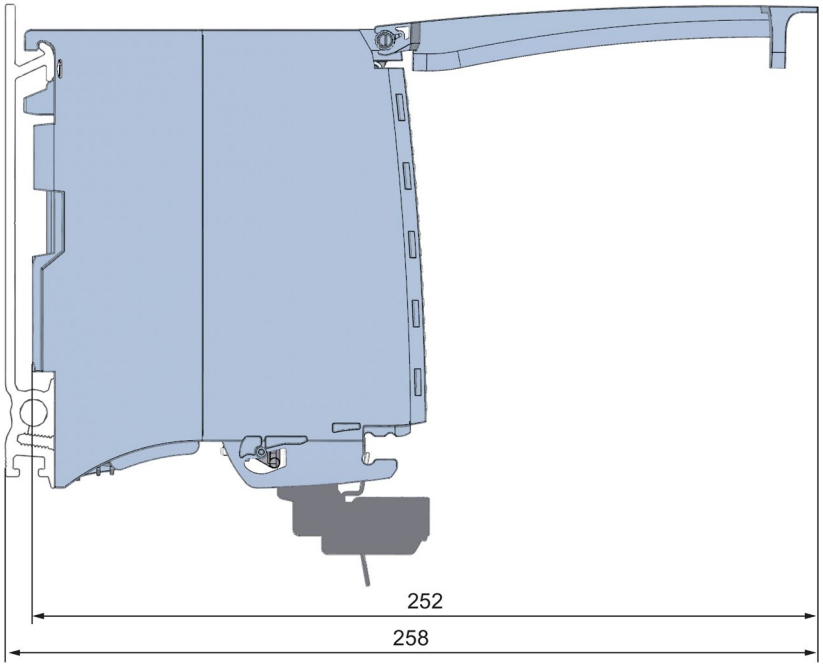


Figure A-2 Dimensional drawing of the TM PTO 4 module, side view with open front panel

Parameter data record

B

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

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

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

The description of the WRREC instruction and the error codes is available in the section Parameter validation error (Page 62) or in the online help of STEP 7 (TIA Portal).

Structure of data record 128

The following tables show you the structure of data record 128 for TM PTO 4. The values in byte 0 to byte 3 are fixed and may not be changed. The channels are assigned in ascending order.

Note

The module is reset during parameter reassignment, which also stops the pulse output. For this reason, only transfer the data record to the module when the drive is at a standstill.

Note

If you are using less than four channels, data record 128 is shortened accordingly.

When using the technology module on PROFIBUS DP, you can use a maximum of three channels.

Table B- 1 Parameter data record 128: Overall module

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 = 1			
1	Length of parameter data per channel = 28							
2	Reserved[2]							
3	Reserved[2]							
4...31	**Channel 0**							
32...59	**Channel 1 (if used)**							
60...87	**Channel 2 (if used)**							
88...115	**Channel 3 (if used)**							

[2] Reserved bits must be set to 0.

Table B- 2 Parameter data record 128: Channel parameters

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Basic parameters							
4/32/ 60/88	Reserved[2]				Enable diagnostic interrupts[1]	Reaction to CPU STOP:		
						000B: Coast Stop and reset drive enable		
						001 to 111B: Invalid		
	Operating mode							
5/33/ 61/89	Reserved[2]	Signal interface:	Signal evaluation[3]:		Signal type:			
			00B: Single		0000B: Invalid			
		0B: 24 V, asymmetrical	01B: Invalid		0001B: PTO (pulse (P) and direction (D))			
			10B: Quadruple		0010B: PTO (count up (A), count down (B))			
		1B: RS422, symmetrical / TTL (5 V), asymmetrical	11B: Invalid		0011B: PTO (A, B phase-shifted)			
					0100 to 1111B: Invalid			
	Digital inputs							
6/34/ 62/90	Reference switch edge selection:	Reserved[2]			Input delay:			
					0000B: None			
					0001B: 0.05 ms			
	0B: At positive edge				0010B: 0.1 ms			
					0011B: 0.4 ms			
	1B: At negative edge				0100B: 0.8 ms			
					0101B: 1.6 ms			
					0110B: 3.2 ms			
					0111B: 12.8 ms			
					1000B: 20 ms			
					1001 to 1111B: Invalid			

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Values							
7/35/ 63/91	Interpulse period: Value range in ms: 0 to 255D							
8...11/ 36...39/ 64...67/ 92...95	Reference speed: REAL: Value range in rpm: 1.0 to 20000.0D							
12...15/ 40...43/ 68...71/ 96...99	Increments per revolution: DINT: Value range in rpm: 1 to 1000000D							
16...19/ 44...47/ 72...75/ 100...103	Maximum speed: REAL: Value range is dependent on signal interface, signal evaluation, increments per revolution and reference speed, see following table							
20...21/ 48...49/ 76...77/ 104...105	Quick stop time (OFF3): UINT: Value range in ms: 1 to 65535D							
22...23/ 50...51/ 78...79/ 106...107	Ramp stop time (OFF1): UINT: Value range in ms: 1 to 65535D							
	Hardware inputs/outputs							
24...25/ 52...53/ 80...81/ 108...109	Reserved[2]							
26/54/ 82/110	Use drive enable[1]	Reserved[2]		Drive enable output:				
				00000B: DQn.0[4]				
				00001B: Invalid				
				00010B: DIQn.2				
				00011 to 11111B: Invalid				
27/55/ 83/111	Use DI0 as reference switch[1]	Reserved[2]		Reference switch input:				
				00000B: DIn.0				
				00001 to 11111B: Invalid				
28/56/ 84/112	Use DI1 as measuring input[1]	Reserved[2]		Measuring input:				
				00000B: Invalid				
				00001B: DIn.1				
				00010 to 11111B: Invalid				

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
29/57/ 85/113	Use "Drive ready"[1]	Reserved[2]		"Drive ready" input:				
				00000B: DIn.0				
				00001B: DIn.1				
				00010B: DIQn.2				
				00011 to 11111B: Invalid				
30...31/ 58...59/ 86...87/ 114...115	Tolerated number of sign-of-life errors: UINT: Value range: 0 to 65535D 65535D means: No monitoring for errors of Master sign-of-life							

1 Enable the respective parameter by setting the corresponding bit to 1.

2 Reserved bits must be set to 0.

3 Only available for signal type "Incremental encoder (A, B phase-shifted)"

4 Only available for "RS422, symmetrical / TTL (5 V), asymmetrical"signal interface

Maximum speed

The following table shows the calculation of the value range of the maximum speed:

Table B- 3 Value range of the maximum speed

Signal interface	Value range of the maximum speed			
	Low limit		High limit (the smaller of the two values applies)	
	Signal evaluation "Single"	Signal evaluation "Quadruple"	Signal evaluation "Single"	Signal evaluation "Quadruple"
24 V, asymmetrical TTL (5 V), asymmetrical	0.1 Hz * 60 / (increments per revolution)	0.1 Hz * 60 *4 / (increments per revolution)	• 2 * reference speed • 200000 Hz * 60 / (increments per revolution)	• 2 * reference speed • 200000 Hz * 60 *4 / (increments per revolution)
RS422, symmetrical			• 2 * reference speed • 1000000 Hz * 60 / (increments per revolution)	• 2 * reference speed • 1000000 Hz * 60 *4 / (increments per revolution)

Library with PLC data types (LPD)

A library of PLC data types (LPD) for STEP 7 (TIA Portal) is available for download on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109482396).

B.2 Parameter validation error

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

In other use cases, the technology module checks the transferred 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 when WRREC is executed, an invalid value, for example 9, is written to the module for the signal type. 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#DF80E113:

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
13_H	STATUS[4]	Error code from the table below: The "Signal type" 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- 4 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	00	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 length of parameter blocks.
DF	80	E1	00	Parameter invalid: No detailed information available	Check all parameter values.
DF	80	E1	12	"Reaction to CPU STOP" parameter invalid	Enter parameter value 000_B.
DF	80	E1	13	"Signal type" parameter invalid	Enter valid parameter value.
DF	80	E1	1A	"Input delay" parameter invalid	Enter valid parameter value.
DF	80	E1	26	"Reference speed" parameter invalid	Enter parameter value from range 1.0 to 20000.0_D taking into account the dependencies (Page 61).
DF	80	E1	29	"Increments per revolution" parameter invalid	Enter parameter value from range 1 to 1000000_D taking into account the dependencies (Page 61).
DF	80	E1	50	"Maximum speed" parameter invalid	Enter parameter value from the valid range (Page 61) in each case.
DF	80	E1	51	"Quick stop time (OFF3)" parameter invalid	Enter parameter value from range 1 to 65535_D.
DF	80	E1	52	"Ramp stop time (OFF1)" parameter invalid	Enter parameter value from range 1 to 65535_D.
DF	80	E1	2C	"Signal evaluation" parameter invalid	Enter valid parameter value.
DF	80	E1	40	"Reference switch input" parameter invalid	Enter valid parameter value.
DF	80	E1	41	"Measuring input" parameter invalid	Enter valid parameter value.
DF	80	E1	44	"Drive enable output" parameter invalid	Enter valid parameter value.
DF	80	E1	45	""Drive ready" input" parameter invalid	Enter valid parameter value.
DF	80	E1	46	DIQn.2 configured as ready input and drive enable output	Configure DIQn.2 either as ready input or as drive enable output.
DF	80	E1	47	• DIn.0 configured as reference switch input and ready input • DIn.1 configured as measuring input and ready input	• Configure DIQn.0 either as reference switch input or as ready input. • Configure DIQn.1 either as measuring input or as ready input.