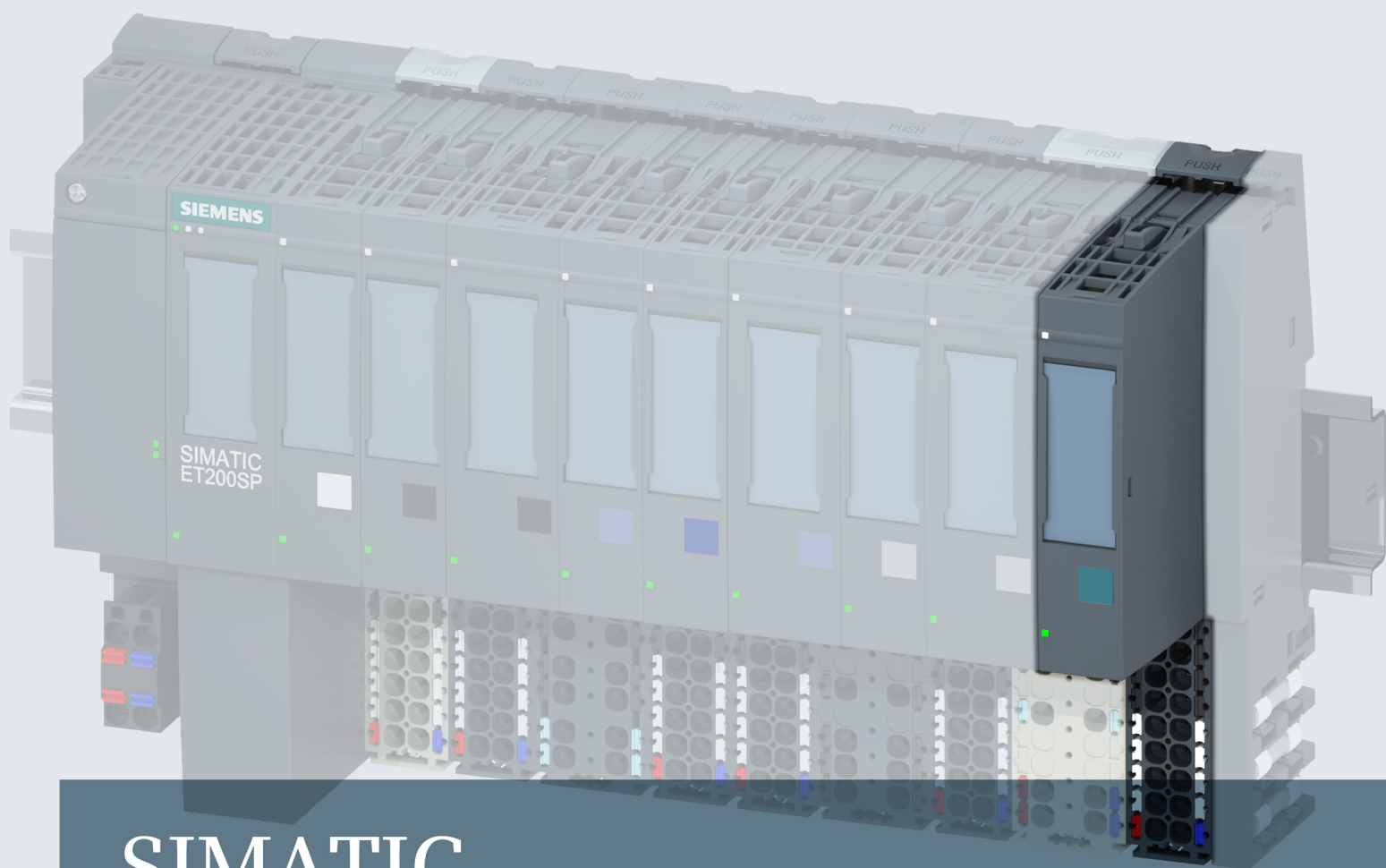


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SIMATIC

ET 200SP

Technology Module TM Count 1x24V (6ES7138-6AA00-0BA0)

Edition

02 2017

SIEMENS

SIMATIC

ET 200SP Technology Module TM Count 1x24V (6ES7138-6AA00-0BA0)

Manual

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Preface

Purpose of the documentation

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

General information regarding design and commissioning of the ET 200SP is available in the ET 200SP system manual.

The counting and measuring functions of the TM Count 1x24V technology module are described in more detail in the Counting, Measurement and Position Detection (<http://support.automation.siemens.com/WW/view/en/59709820>) function manual.

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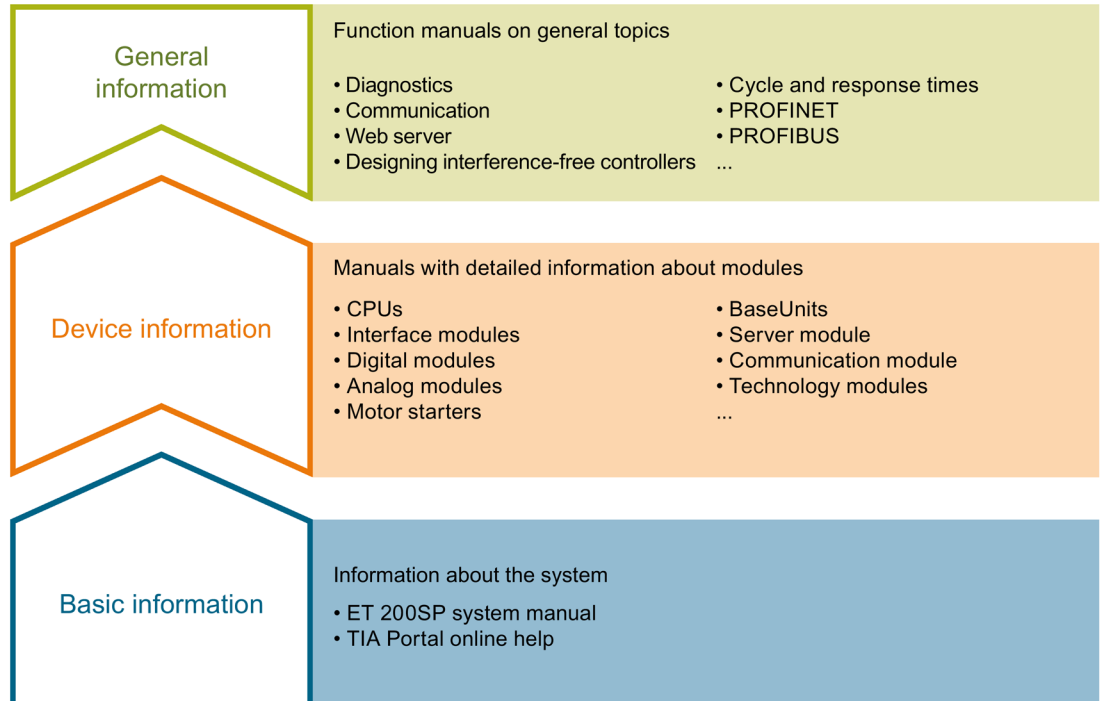
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Documentation guide

The documentation for the SIMATIC ET 200SP distributed I/O system is arranged into three areas.

This arrangement enables you to access the specific content you require.



Basic information

The system manual describes in detail the configuration, installation, wiring and commissioning of the SIMATIC ET 200SP. distributed I/O system. The STEP 7 online help supports you in the configuration and programming.

Device information

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

General information

The function manuals contain detailed descriptions on general topics regarding the SIMATIC ET 200SP distributed I/O system, e.g. diagnostics, communication, Web server, motion control and OPC UA.

You can download the documentation free of charge from the Internet (<http://w3.siemens.com/mcms/industrial-automation-systems-simatic/en/manual-overview/tech-doc-et200/Pages/Default.aspx>).

Changes and supplements to the manuals are documented in a Product Information.

You can download the product information free of charge from the Internet (<https://support.industry.siemens.com/cs/us/en/view/73021864>).

Manual Collection ET 200SP

The Manual Collection contains the complete documentation on the SIMATIC ET 200SP 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/84133942>).

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- Manuals, characteristics, operating manuals, certificates
- Product master data

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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 in individual products.

You can find the application examples on the Internet (<https://support.industry.siemens.com/sc/ww/en/sc/2054>).

TIA Selection Tool

With the TIA Selection Tool, you can select, configure and order devices for Totally Integrated Automation (TIA).

This tool is the successor of the SIMATIC Selection Tool and combines the known configurators for automation technology into one 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 (<http://w3.siemens.com/mcms/topics/en/simatic/tia-selection-tool>).

SIMATIC Automation Tool

You can use the SIMATIC Automation Tool to run commissioning and maintenance activities simultaneously on various SIMATIC S7 stations as a bulk operation independently of the TIA Portal.

The SIMATIC Automation Tool provides a multitude of functions:

- Scanning of a PROFINET/Ethernet network and identification of all connected CPUs
- Address assignment (IP, subnet, gateway) and station name (PROFINET device) to a CPU
- Transfer of the data and the programming device/PC time converted to UTC time to the module
- Program download to CPU
- Operating mode switchover RUN/STOP
- Localization of the CPU by means of LED flashing
- Reading out CPU error information
- Reading the CPU diagnostic buffer
- Reset to factory settings
- Updating the firmware 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

With SIEMENS PRONETA (PROFINET network analysis), you analyze the plant network during commissioning. PRONETA features two core functions:

- The topology overview independently scans PROFINET and all connected components.
- The IO check is a fast test of the wiring and the module configuration of a system.

You can find SIEMENS PRONETA on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/67460624>).

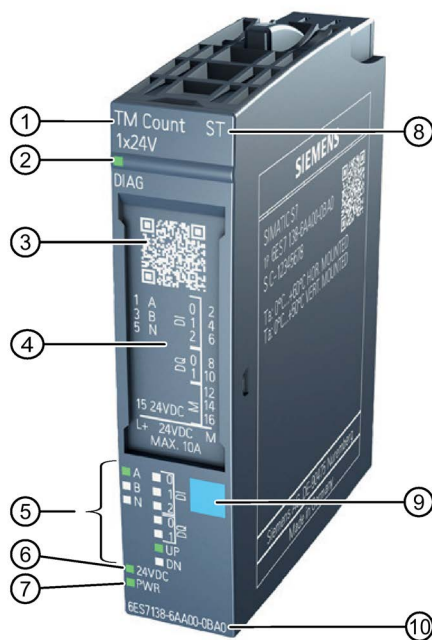
Product overview

2.1 Properties

Article number

6ES7138-6AA00-0BA0

View of the module



- | | |
|-------------------------------|----------------------------|
| ① Module type and designation | ⑥ LED for encoder supply |
| ② LED for diagnostics | ⑦ LED for supply voltage |
| ③ 2D matrix code | ⑧ Function class |
| ④ Terminal connection diagram | ⑨ Module type color coding |
| ⑤ LEDs for channel status | ⑩ Article number |

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

Properties

The TM Count 1x24V technology module has the following properties:

- Technical properties
 - One channel
 - Interfaces:
 - 24 V encoder signals A, B and N from sourcing, sinking or push pull encoders and sensors
 - 24 V encoder supply output, short-circuit proof
 - DI0, DI1 and DI2 digital input signals
 - DQ0 and DQ1 digital output signals
 - L+ supply voltage
 - Count range: 32 bits
 - Fast Mode configurable
 - Monitoring of encoder signals for wire break
 - Hardware interrupts configurable
 - Input filters for suppression of interferences at encoder inputs and digital inputs can be configured
- Supported encoder/signal types
 - 24 V incremental encoder with and without N signal
 - 24 V pulse encoder with direction signal
 - 24 V pulse encoder without direction signal
 - 24 V pulse encoders for up & down pulses
- Supported system functions
 - Isochronous mode
 - Firmware Update
 - Identification data I&M

The module supports the following functions:

Table 2- 1 Version dependencies of module functions

Function	Firmware version of the module	Configurable as of			
		STEP 7 (TIA Portal)	STEP 7	GSD	
				PROFINET IO	PROFIBUS DP
Counting/measuring	V1.0 or higher	V13	V5.5 SP4 or V5.5 SP3 with HSP0240 V1.0	X	X
Operating with technology object "Counting and measurement"	V1.0 or higher	V13	—	—	—
Position input for technology object "Motion Control"	V1.0 or higher	V13	—	—	—
Centralized operation on CPU 151xSP	V1.1 or higher	V13 SP1	—	—	—
Fast Mode	V1.2 or higher	V14 SP1 or V14 with HSP0199	V5.6 or V5.5 SP4 with HSP0240 V5.0	X	X

Accessories

The following accessories can be used with the module and are not included in the scope of delivery:

- Labeling strip
- Color identification labels
- Reference identification labels
- Shield connector

A BaseUnit of the A0 type is required to operate the technology module. For an overview of the BaseUnits that you can use with the technology module, please refer to the product information on the documentation for the ET 200SP Distributed I/O System (<http://support.automation.siemens.com/WW/view/en/73021864>).

For detailed information on the installation procedure, refer to the ET 200SP Distributed I/O System (<http://support.automation.siemens.com/WW/view/en/58649293>) system manual.

2.2 Functions

2.2.1 Detection of counting signals

Counting refers to the detection and summation 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.

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.

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

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

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

Start value

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

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

Gate control

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

The control of the hardware gate takes place externally via the digital inputs of the technology module. Control of the software gate takes place via the user program. The hardware gate can be enabled through parameter assignment. The software gate (bit in the control interface (Page 53) of the cyclic I/O data) cannot be deactivated.

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

When using a digital input, you can specify whether counting is to continue from the current counter value or from the start value after the Capture function. When the rising edge of the N signal at the encoder input is used, counting is to continue from the current counter value after the Capture function.

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 (Page 64) are to trigger a hardware interrupt during operation.

2.2.2 Measured value determination

The following measuring functions are available:

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

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

Update time

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

Gate control

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

Measuring ranges

The measuring functions have the following measuring range limits:

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

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

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

2.2.3 Switching the outputs at comparison values

You define two comparison values that can control the two digital outputs independent of the user program. The comparison values are configurable and can be modified during runtime with the user program.

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.

2.2.4 Position input for Motion Control

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

The range of functions of the technology module has the following limitations in this case:

- Counter behavior not configurable
- No functions for digital inputs available
- No comparison functions for digital outputs available
- No hysteresis available
- No hardware interrupts available

In the device configuration of the technology module in STEP 7 (TIA Portal), select "Position input for technology object "Motion Control"".

Additional information

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

2.2.5 Fast Mode

You can use the technology module in Fast Mode for very fast detection of the counter value in case of compressed functionality. In Fast Mode, you have access to a reduced feedback interface but not to a control interface. This means you can use a shorter send clock for the CPU.

The range of functions of the technology module has the following additional 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

To do this, select "Fast Mode" operating mode in the device configuration of the technology module in STEP 7 (TIA Portal).

You can specify the behavior of the counter using the functions described below.

Counting limits

The counting limits define the counter value range used. The counter limits are configurable and can be modified during runtime using data record 128 but not through the control interface.

The maximum possible counting limit is 33554431 ($2^{25}-1$). The minimum possible counting limit is 0.

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

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

Start value

You can configure a start value within the counting limits. The start value can only be modified during runtime with data record 128.

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

Gate control

Opening and closing the hardware gate (HW gate) defines the period of time during which the counting signals are recorded.

The control of the hardware gate takes place externally via the digital inputs of the technology module. The hardware gate can be enabled through parameter assignment. All count signals are recorded when you do not configure a hardware gate. A software gate is not available.

2.2.6 Additional functions

Synchronization

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

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

Hysteresis

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

Diagnostic interrupt

The technology module can trigger a diagnostic interrupt in the event of a missing supply voltage or an error at the digital outputs, for example. You enable the diagnostic interrupts (Page 60) 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 in distributed operation. 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 and changes the status bit of the digital input in the feedback interface (Page 55).

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. The counter value and the measured value as well as status bits are captured at time T_i and made available in the feedback interface for retrieval in the current bus cycle.

Additional information

A detailed description of isochronous mode can be found in the PROFINET with STEP 7 function manual, which is available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/49948856>).

Wiring

3.1 Pin assignment

The TM Count 1x24V is used with a BaseUnit of the A0 type.

The encoder signals, the digital input and output signals and the encoder supply are connected to the BaseUnit of the technology module. The supply voltage feed on the light BaseUnit BU...D of the associated potential group supplies the module and the digital outputs, and generates the encoder supply voltage.

BaseUnit

The BaseUnit is not included in the scope of delivery of the module and must be ordered separately.

For an overview of the BaseUnits to be used with the technology module, refer to the product information on the documentation for the ET 200SP Distributed I/O System (<http://support.automation.siemens.com/WW/view/en/73021864>).

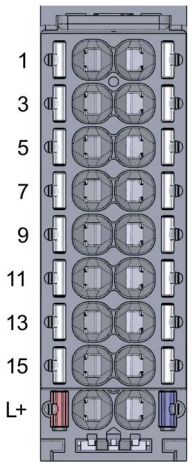
You can find information about selecting a suitable BaseUnit in the ET 200SP Distributed I/O System (<http://support.automation.siemens.com/WW/view/en/58649293>) system manual and ET 200SP BaseUnits (<http://support.automation.siemens.com/WW/view/en/58532597/133300>) device manual.

You can find information on wiring the BaseUnit, connecting cable shields, etc. in the Connecting section of the ET 200SP Distributed I/O System (<http://support.automation.siemens.com/WW/view/en/58649293>) system manual.

Terminal assignment of the BaseUnit

The table below shows the pin assignment, using the BaseUnit BU15-P16+A0+2B as an example.

Table 3- 1 Pin assignment of the BaseUnit BU15-P16+A0+2B

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	
	1	A	Encoder signal A		Counting signal A		Up counting signal A	
	3	B	Encoder signal B		Direction signal B	—	Down counting signal B	
	5	N	Encoder signal N	—				
	2	DI0	Digital input DI0					
	4	DI1	Digital input DI1					
	6	DI2	Digital input DI2					
	8	DQ0	Digital output DQ0					
	10	DQ1	Digital output DQ1					
	7	—	—					
	9	—	—					
	11	—	—					
	13	—	—					
	Supply voltage, encoder supply and ground							
	15	24V DC	24 V encoder supply					
	12	M	Ground for encoder supply, digital inputs and digital outputs					
	14	M						
	16	M						
	L+	DC 24V Supply voltage						
	M	Ground for supply voltage						

Block diagram

The figure below shows the block diagram of the technology module.

You must ground the shields of the cables between encoder and technology module both through the shield terminal on the BaseUnit (shield bracket and terminal) and also on the encoder.

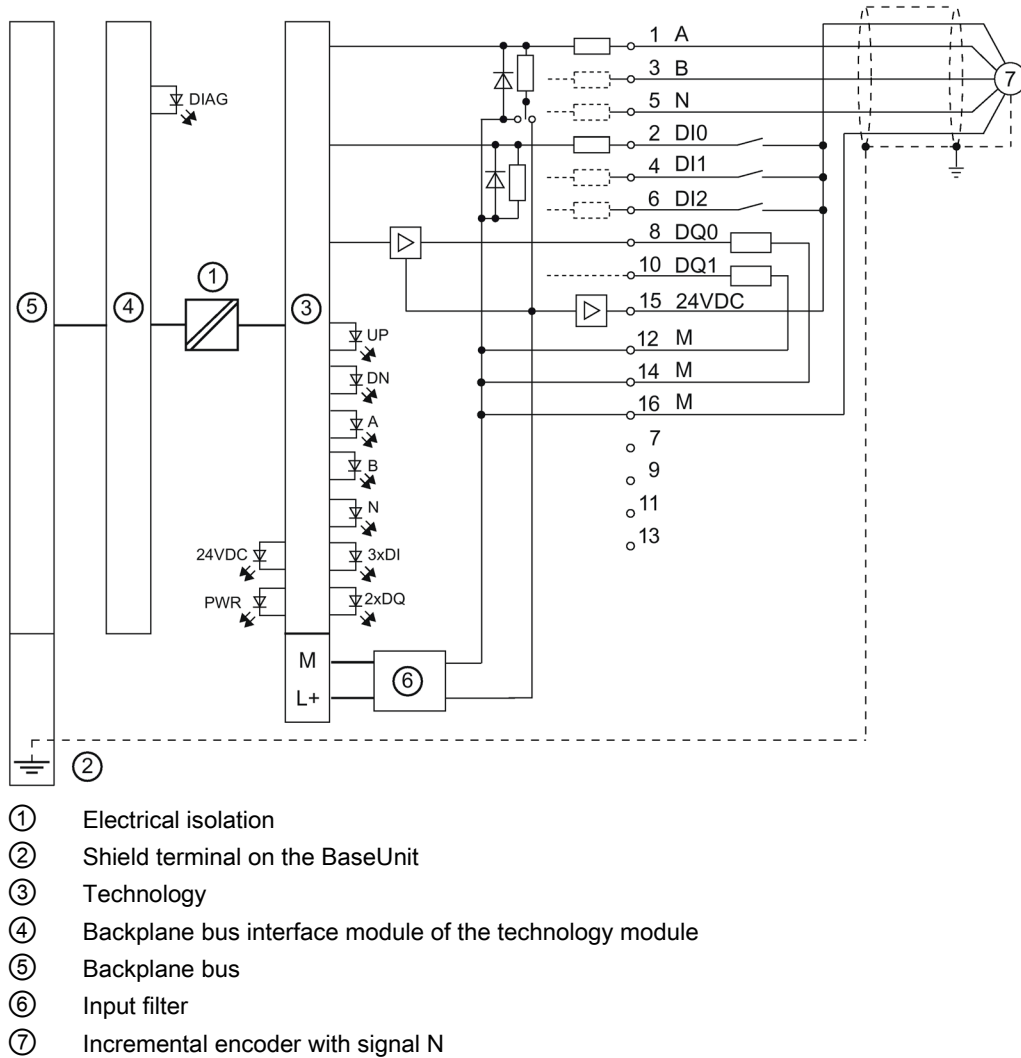


Figure 3-1 Block diagram with incremental encoder

L+/M supply voltage

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

24VDC encoder supply

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

24 V encoder signals/count signals

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

- Incremental encoder with signal N:

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

- Incremental encoder without signal N:

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

- Pulse encoders without direction signal:

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

- Pulse encoders with direction signal:

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

- Pulse encoders with counting signal up/down:

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

The inputs are not electrically isolated from each other. The inputs are isolated against the backplane bus.

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

- Sourcing output:

The inputs A, B and N are switched by the encoder or sensor after 24VDC .

- Sinking output:

The inputs A, B and N are switched by the encoder or sensor after ground M .

- Push pull:

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

Input filter for 24 V encoder signals

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

You can specify the following values for the filter frequency:

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

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

Digital inputs DI0, DI1 and DI2

There are three digital inputs. The digital inputs are used for gate control, synchronization and the Capture function. Alternatively, you can use one or more digital inputs without the mentioned functions and read the signal state of the respective digital input via the feedback interface.

The digital inputs are not electrically isolated from each other.

Input delay for digital inputs

This parameter can be used to suppress signal noise at the digital inputs of a channel. Changes to the signal are only detected if they remain stable for longer than the configured input delay time.

You can specify the following values for the input delay:

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

- 12.8 ms
- 20 ms

Note

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

Digital outputs DQ0 and DQ1

There are two digital outputs. The two digital outputs DQ0 and DQ1 can be activated/switched directly by the specified comparison values or by the user program.

The digital outputs are not isolated from each other.

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

Note

Relays and contactors can be connected direct without external circuitry. You can find information on the maximum possible operating frequencies and the inductive loads at the digital outputs in the section Technical specifications (Page 66).

Configuring/address space

4.1 Configuring

Introduction

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

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

System environment

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

Applications	Components required	Configuration software	In the user program
Centralized operation with a CPU 151xSP	<ul style="list-style-type: none"> • S7-1500 automation system • TM Count 1x24V 	STEP 7 (TIA Portal): Operating with technology object "Counting and measurement" <ul style="list-style-type: none"> • Device configuration with hardware configuration • Parameter setting with High_Speed_Counter technology object 	High_Speed_Counter instruction
		STEP 7 (TIA Portal): Position input for technology object "Motion Control" <ul style="list-style-type: none"> • Device configuration with hardware configuration • Parameter setting with axis technology object 	Motion Control instructions
		STEP 7 (TIA Portal): Manual operation (without technology object) <ul style="list-style-type: none"> • Device configuration and parameter setting with hardware configuration 	Direct access to the control and feedback interface (Page 52) in the I/O data
		STEP 7 (TIA Portal): Fast Mode <ul style="list-style-type: none"> • Device configuration and parameter setting with hardware configuration 	Direct access to the feedback interface (Page 56) in the I/O data

Applications	Components required	Configuration software	In the user program
Distributed operation with an S7-1500 CPU	<ul style="list-style-type: none"> • S7-1500 automation system • ET 200SP distributed I/O system • TM Count 1x24V 	STEP 7 (TIA Portal): Operating with technology object "Counting and measurement" <ul style="list-style-type: none"> • Device configuration with hardware configuration • Parameter setting with High_Speed_Counter technology object 	High_Speed_Counter instruction
		STEP 7 (TIA Portal): Position input for technology object "Motion Control" <ul style="list-style-type: none"> • Device configuration with hardware configuration • Parameter setting with axis technology object 	Motion Control instructions
		STEP 7 (TIA Portal): Manual operation (without technology object) <ul style="list-style-type: none"> • Device configuration and parameter setting with hardware configuration 	Direct access to the control and feedback interface in the I/O data
		STEP 7 (TIA Portal): Fast Mode <ul style="list-style-type: none"> • Device configuration and parameter setting with hardware configuration 	Direct access to the feedback interface (Page 56) in the I/O data
Distributed operation with a CPU S7-300/400 or S7-1200	<ul style="list-style-type: none"> • S7-300/400 or S7-1200 automation system • ET 200SP distributed I/O system • TM Count 1x24V 	STEP 7 (TIA Portal): Device configuration and parameter setting with hardware configuration STEP 7: Device configuration and parameter setting	Direct access to the control and feedback interface (Page 52) in the I/O data
Distributed operation in a third-party system	<ul style="list-style-type: none"> • Third-party automation system • ET 200SP distributed I/O system • TM Count 1x24V 	Third-party configuration software: Device configuration and parameter settings with GSD file	

Additional information

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

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

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

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

Hardware Support Packages (HSP)

STEP 7 (TIA Portal)

If the "Fast Mode" operating mode of the technology module is not yet integrated in the TIA Portal version you are using, you can integrate a corresponding module with HSP0199.

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

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

STEP 7

The Hardware Support Packages (HSP) are available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/23183356>).

GSD file

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

- GSD file PROFINET IO (<http://support.automation.siemens.com/WW/view/en/57138621>)
- GSD file PROFIBUS DP (<http://support.automation.siemens.com/WW/view/en/73016883>)

4.2 Reaction to CPU STOP

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

Table 4- 1 Response 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 function "At comparison value for a pulse duration" 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.

4.3 Address space

Address space of the technology module

Table 4- 2 Range of the input addresses and output addresses of the TM Count 1x24V

	Inputs	Outputs
Range	16 bytes	12 bytes

Table 4- 3 Range of the input addresses and output addresses of the TM Count 1x24V in "Position input for technology object "Motion Control"" operating mode.

	Inputs	Outputs
Range	16 bytes	4 bytes

Table 4- 4 Range of the input and output addresses of the TM Count 1x24V in "Fast Mode" operating mode

	Inputs	Outputs
Range	4 bytes	0 bytes

Additional information

A description on how to use the control and feedback interface of TM Count 1x24V can be found in the section Control and feedback interface (Page 52).

4.4 Parameters

4.4.1 Parameter setting

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 73).

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

Parameter setting via ...	Basic procedure
Hardware configuration in STEP 7 (TIA Portal) in centralized operation with an ET 200SP CPU	<ol style="list-style-type: none"> 1. Select an appropriate CPU under "Add new device > Controller > SIMATIC ET 200 CPU". 2. Select the module in the hardware catalog under "Technology modules". 3. Set the device configuration and the parameters of the module in the hardware configuration. 4. Set the parameters of the technology object. 5. Download the parameter assignment to the module.
Hardware configuration and technology object High_Speed_Counter in STEP 7 (TIA Portal) in "Operating with technology object "Counting and measurement"" operating mode	<ol style="list-style-type: none"> 1. Select an appropriate CPU under "Add new device > Controller > SIMATIC S7-1500 / SIMATIC ET 200 CPU". 2. For distributed operation, select an interface module in the hardware catalog under "Distributed I/O > ET 200SP > Interface modules". 3. Select the module in the hardware catalog under "Technology modules". 4. Set the device configuration and the parameters of the module (Page 36) in the hardware configuration. "Operating with technology object "Counting and measurement"" must be set as the operating mode. 5. Set the parameters (Page 36) of the High_Speed_Counter technology object. 6. Download the parameter assignment to the module.
Hardware configuration and technology object in STEP 7 (TIA Portal) in "Position input for technology object "Motion Control"" operating mode	<ol style="list-style-type: none"> 1. Select an appropriate CPU under "Add new device > Controller > SIMATIC S7-1500 / SIMATIC ET 200 CPU". 2. For distributed operation, select an interface module in the hardware catalog under "Distributed I/O > ET 200SP > Interface modules". 3. Select the module in the hardware catalog under "Technology modules". 4. Set the device configuration and the parameters of the module (Page 41) in the hardware configuration. "Position input for technology object "Motion Control"" must be set as the operating mode. 5. Set the parameters of the axis technology object. 6. Download the parameter assignment to the module.

4.4 Parameters

Parameter setting via ...	Basic procedure
Hardware configuration in STEP 7 (TIA Portal) in "Manual operation (without technology object)" operating mode	<ol style="list-style-type: none"> 1. Select an appropriate CPU under "Add new device > Controller > SIMATIC S7-1500 / SIMATIC ET 200 CPU". 2. For distributed operation, select an interface module in the hardware catalog under "Distributed I/O > ET 200SP > Interface modules". 3. Select the module in the hardware catalog under "Technology modules". 4. Set the device configuration and the parameters of the module (Page 43) in the hardware configuration. "Manual operation (without technology object)" must be set as the operating mode. 5. Download the parameter assignment to the module.
Hardware configuration in STEP 7 (TIA Portal) in "Fast Mode" operating mode	<ol style="list-style-type: none"> 1. If the technology module is not yet integrated in your TIA Portal version, install the corresponding HSP file. 2. Select an appropriate CPU under "Add new device > Controller > SIMATIC S7-1500 / SIMATIC ET 200 CPU". 3. For distributed operation, select an interface module in the hardware catalog under "Distributed I/O > ET 200SP > Interface modules". 4. Select the module in the hardware catalog under "Technology modules". 5. Set the device configuration and the parameters of the module (Page 48) in the hardware configuration. "Fast Mode" must be set as the operating mode. 6. Download the parameter assignment to the module.
Hardware configuration in STEP 7 (TIA Portal) with HSP	<ol style="list-style-type: none"> 1. Install the appropriate HSP file. 2. Select an appropriate CPU under "Add new device > Controller > SIMATIC S7-1500". 3. Select an interface module in the hardware catalog under "Distributed I/O > ET 200SP > Interface modules". 4. Select the module in the hardware catalog under "Technology modules". 5. Set the device configuration and the parameters of the module in the hardware configuration. 6. Download the parameter assignment to the module.
Hardware configuration in STEP 7 with HSP	<ol style="list-style-type: none"> 1. Install the corresponding HSP file. You will then find the module in the Hardware catalog under "ET 200SP". 2. Set the device configuration and the parameters in the hardware configuration. 3. Download the parameter assignment to the module.

Parameter setting via ...	Basic procedure
Hardware configuration using GSD file for distributed operation on the PROFINET IO	<ol style="list-style-type: none"> 1. Install the latest PROFINET GSD file. You will then find the module in the hardware catalog under "Additional Field Devices > PROFINET IO > I/O". 2. Set the parameters in the hardware configuration. 3. Download the parameter assignment to the module.
Hardware configuration using GSD file for distributed operation on the PROFIBUS DP	<ol style="list-style-type: none"> 1. Install the latest PROFIBUS GSD file. You will then find the module in the hardware catalog under "Additional Field Devices > PROFINET IO > I/O". 2. Set the parameters in the hardware configuration. The parameters marked with ¹ in the following tables cannot be set in the PROFIBUS GSD file. 3. Download the parameter assignment to the module. This will download the parameters marked with ¹ in the following tables with the default setting. You can change these parameters in the user program using data record 128 (Page 73).

You will find the parameters in the following sections according to operating mode.

4.4.2 Parameters for operating with technology object "Counting and measurement"

Parameters of the TM Count 1x24V

The following parameter settings are possible:

Table 4- 5 Settable parameters and their default setting in "Operating with technology object "Counting and measurement"" operating mode

Parameter	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software
				HSP for STEP 7 (TIA Portal)
Operating mode	<ul style="list-style-type: none"> Use counter value as reference Use measured value as reference 	Use counter value as reference	No	Channel
Sensor type	<ul style="list-style-type: none"> Sourcing output Sinking output Push-pull (sinking and sourcing output) 	Sourcing output	Yes	Channel
Reaction to CPU STOP	<ul style="list-style-type: none"> Output substitute value Keep last value Continue operation 	Output substitute value	Yes	Channel
Enable diagnostic interrupt on wire break	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel
Enable additional diagnostic interrupts	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel
Signal type	<ul style="list-style-type: none"> Pulse (A) Pulse (A) and direction (B) Count up (A), count down (B) Incremental encoder (A, B phase-shifted) Incremental encoder (A, B, N) 	Pulse (A) and direction (B)	Yes	Channel
Signal evaluation for counter inputs	<ul style="list-style-type: none"> Single Double Quadruple 	Single	Yes	Channel

Parameter	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software
				HSP for STEP 7 (TIA Portal)
Filter frequency for counter inputs	<ul style="list-style-type: none"> • 100 Hz • 200 Hz • 500 Hz • 1 kHz • 2 kHz • 5 kHz • 10 kHz • 20 kHz • 50 kHz • 100 kHz • 200 kHz 	200 kHz	Yes	Channel
Invert direction (counter inputs) ¹	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel
Reaction to signal N	<ul style="list-style-type: none"> • No reaction to signal N • Synchronization at signal N • Capture at signal N 	No reaction to signal N	Yes	Channel
Hardware interrupt: Gate start	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel
Hardware interrupt: Gate stop	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel
Hardware interrupt: Overflow (high counting limit violated)	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel
Hardware interrupt: Underflow (low counting limit violated)	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel
Hardware interrupt: Direction reversal	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel
Hardware interrupt: Comparison event for DQ0 occurred	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel
Hardware interrupt: Comparison event for DQ1 occurred	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel
Hardware interrupt: Zero crossing	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel

4.4 Parameters

Parameter	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software
				HSP for STEP 7 (TIA Portal)
Hardware interrupt: New Capture value available	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel
Hardware interrupt: Synchronization of the counter by an external signal	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel
Set output	<ul style="list-style-type: none"> Use by user program Between comparison value and high limit / measured value \geq comparison value Between comparison value and low limit / measured value \leq 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 	DQ0, DQ1: Between comparison value and high limit	Yes	Channel
Substitute value for DQ	<ul style="list-style-type: none"> 0 1 	DQ0, DQ1: 0	Yes	Channel
Count direction of the DQ function	<ul style="list-style-type: none"> Forward Backward In both directions 	In both directions	Yes	Channel
Pulse duration [ms/10]	0...65535	5000 (corresponds to 0.5 s)	Yes	Channel
Set function of DI	<ul style="list-style-type: none"> Gate start/stop (level-triggered) Gate start (edge-triggered) Gate stop (edge-triggered) Synchronization Enable synchronization at signal N Capture Digital input without function 	<ul style="list-style-type: none"> DI0: Gate start/stop (level-triggered) DI1: Digital input without function DI2: Digital input without function 	Yes	Channel
Select level for DI	<ul style="list-style-type: none"> Active with high level Active with low level 	Active with high level	Yes	Channel

Parameter	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software
				HSP for STEP 7 (TIA Portal)
Edge selection for DI	<ul style="list-style-type: none"> At rising edge At falling edge At rising and falling edge 	At rising edge	Yes	Channel
Behavior of counter value after Capture with DI	<ul style="list-style-type: none"> Continue counting Set to start value and continue counting 	Continue counting	Yes	Channel
Input delay for digital inputs	<ul style="list-style-type: none"> None 0.05 ms 0.1 ms 0.4 ms 0.8 ms 1.6 ms 3.2 ms 12.8 ms 20 ms 	0.1 ms	Yes	Channel
Frequency of synchronization	<ul style="list-style-type: none"> Once Periodic 	Once	Yes	Channel
High counting limit	-2147483648...2147483647	2147483647	Yes	Channel
Comparison value 0	-2147483648...2147483647	0	Yes	Channel
Comparison value 1	-2147483648...2147483647	10	Yes	Channel
Start value	-2147483648...2147483647	0	Yes	Channel
Low counting limit	-2147483648...2147483647	-2147483648	Yes	Channel
Reset when counting limit is violated	<ul style="list-style-type: none"> To other counting limit To start value 	To other counting limit	Yes	Channel
Reaction to violation of a counting limit	<ul style="list-style-type: none"> Stop counting Continue counting 	Continue counting	Yes	Channel
Reaction to gate start	<ul style="list-style-type: none"> Set to start value Continue with current value 	Continue with current value	Yes	Channel
Measured variable	<ul style="list-style-type: none"> Frequency Period Velocity 	Frequency	Yes	Channel
Update time [ms] of the measuring function ¹	0...25000	10	Yes	Channel

4.4 Parameters

Parameter	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software
				HSP for STEP 7 (TIA Portal)
Time base for velocity measurement	<ul style="list-style-type: none"> • 1 ms • 10 ms • 100 ms • 1 s • 60 s/1 min 	60 s/1 min	Yes	Channel
Increments per unit	1...65535	1	Yes	Channel
Hysteresis	0...255	0	Yes	Channel
Potential group	<ul style="list-style-type: none"> • Use the potential group of the left module (dark BaseUnit) • Enable new potential group (light BaseUnit) 	Use the potential group of the left module (dark BaseUnit)	No	Module

4.4.3 Parameters for position input for "Motion Control" technology object

Parameters of the TM Count 1x24V

The following parameter settings are possible:

Table 4- 6 Settable parameters and their default setting in "Position input for technology object "Motion Control"" operating mode

Parameters	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software
				HSP for STEP 7 (TIA Portal)
Enable diagnostic interrupt on wire break	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel
Enable additional diagnostic interrupts	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel
Signal type	<ul style="list-style-type: none"> Pulse (A) Pulse (A) and direction (B) Count up (A), count down (B) Incremental encoder (A, B phase-shifted) Incremental encoder (A, B, N) 	Pulse (A) and direction (B)	Yes	Channel
Signal evaluation for counter inputs	<ul style="list-style-type: none"> Single Double Quadruple 	Single	Yes	Channel
Filter frequency for counter inputs	<ul style="list-style-type: none"> 100 Hz 200 Hz 500 Hz 1 kHz 2 kHz 5 kHz 10 kHz 20 kHz 50 kHz 100 kHz 200 kHz 	200 kHz	Yes	Channel
Invert direction (counter inputs)	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel

4.4 Parameters

Parameters	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software
				HSP for STEP 7 (TIA Portal)
Sensor type	<ul style="list-style-type: none"> Sourcing output Sinking output Push-pull (sinking and sourcing output) 	Sourcing output	Yes	Channel
Signal selection for reference mark 0	<ul style="list-style-type: none"> DI0 Signal N of incremental encoder 	DI0	Yes	Channel
Steps per revolution	1...65535	1	Yes	Channel
Reference speed [10^{-2} rpm]	600...21000000	300000 (corresponds to 3000 rpm)	Yes	Channel
Potential group	<ul style="list-style-type: none"> Use the potential group of the left module (dark BaseUnit) Enable new potential group (light BaseUnit) 	Use the potential group of the left module (dark BaseUnit)	No	Module

4.4.4 Parameters for manual operation (without technology object)

Parameters of the TM Count 1x24V

The following parameter settings are possible:

Table 4- 7 Settable parameters and their default setting in "Manual operation (without technology object)" operating mode

Parameter	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software	
				HSP for STEP 7 (TIA Portal)	HSP for STEP 7; GSD file
Operating mode ³	<ul style="list-style-type: none"> Counting Measuring 	Counting	No	Channel	Channel
Sensor type	<ul style="list-style-type: none"> Sourcing output Sinking output Push-pull (sinking and sourcing output) 	Sourcing output	Yes	Channel	Channel
Reaction to CPU STOP ¹	<ul style="list-style-type: none"> Output substitute value Keep last value Continue operation 	Output substitute value	Yes	Channel	Channel
Enabling diagnostic interrupts for wire break ²	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel	Channel
Enable additional diagnostic interrupts	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel	Channel
Signal type	<ul style="list-style-type: none"> Pulse (A) Pulse (A) and direction (B) Count up (A), count down (B) Incremental encoder (A, B phase-shifted) Incremental encoder (A, B, N) 	Pulse (A) and direction (B)	Yes	Channel	Channel
Signal evaluation for counter inputs	<ul style="list-style-type: none"> Single Double Quadruple 	Single	Yes	Channel	Channel

4.4 Parameters

Parameter	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software	
				HSP for STEP 7 (TIA Portal)	HSP for STEP 7; GSD file
Filter frequency for counter inputs ¹	<ul style="list-style-type: none"> • 100 Hz • 200 Hz • 500 Hz • 1 kHz • 2 kHz • 5 kHz • 10 kHz • 20 kHz • 50 kHz • 100 kHz • 200 kHz 	200 kHz	Yes	Channel	Channel
Invert direction (counter inputs) ¹	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel	Channel
Reaction to signal N ¹	<ul style="list-style-type: none"> • No reaction to signal N • Synchronization at signal N • Capture at signal N 	No reaction to signal N	Yes	Channel	Channel
Hardware interrupt: Gate start ¹	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel	Channel
Hardware interrupt: Gate stop ¹	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel	Channel
Hardware interrupt: Overflow (high counting limit violated) ¹	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel	Channel
Hardware interrupt: Underflow (low counting limit violated) ¹	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel	Channel
Hardware interrupt: Direction reversal ¹	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel	Channel
Hardware interrupt: Comparison event for DQ0 occurred ¹	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel	Channel
Hardware interrupt: Comparison event for DQ1 occurred ¹	<ul style="list-style-type: none"> • Deactivated • Activated 	Deactivated	Yes	Channel	Channel

Parameter	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software	
				HSP for STEP 7 (TIA Portal)	HSP for STEP 7; GSD file
Hardware interrupt: Zero crossing ¹	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel	Channel
Hardware interrupt: New Capture value available ¹	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel	Channel
Hardware interrupt: Synchronization of the counter by an external signal ¹	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel	Channel
Set output	<ul style="list-style-type: none"> Use by user program Between comparison value and high limit / measured value \geq comparison value Between comparison value and low limit / measured value \leq 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 	DQ0, DQ1: Between comparison value and high limit	Yes	Channel	Channel
Substitute value for DQ ¹	<ul style="list-style-type: none"> 0 1 	DQ0, DQ1: 0	Yes	Channel	Channel
Count direction of the DQ function ¹	<ul style="list-style-type: none"> Forward Backward In both directions 	In both directions	Yes	Channel	Channel
Pulse duration [ms/10] ¹	0...65535	5000 (corresponds to 0.5 s)	Yes	Channel	Channel

4.4 Parameters

Parameter	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software	
				HSP for STEP 7 (TIA Portal)	HSP for STEP 7; GSD file
Set function of DI	<ul style="list-style-type: none"> Gate start/stop (level-triggered) Gate start (edge-triggered) Gate stop (edge-triggered) Synchronization Enable synchronization at signal N Capture Digital input without function 	<ul style="list-style-type: none"> DI0: Gate start/stop (level-triggered) DI1: Digital input without function DI2: Digital input without function 	Yes	Channel	Channel
Select level for DI ¹	<ul style="list-style-type: none"> Active with high level Active with low level 	Active with high level	Yes	Channel	Channel
Edge selection for DI ¹	<ul style="list-style-type: none"> At rising edge At falling edge At rising and falling edge 	At rising edge	Yes	Channel	Channel
Behavior of counter value after Capture with DI ¹	<ul style="list-style-type: none"> Continue counting Set to start value and continue counting 	Continue counting	Yes	Channel	Channel
Input delay for digital inputs ¹	<ul style="list-style-type: none"> None 0.05 ms 0.1 ms 0.4 ms 0.8 ms 1.6 ms 3.2 ms 12.8 ms 20 ms 	0.1 ms	Yes	Channel	Channel
Frequency of synchronization ¹	<ul style="list-style-type: none"> Once Periodic 	Once	Yes	Channel	Channel
High counting limit ¹	-2147483648...2147483647	2147483647	Yes	Channel	Channel
Comparison value 0 ¹	-2147483648...2147483647	0	Yes	Channel	Channel
Comparison value 1 ¹	-2147483648...2147483647	10	Yes	Channel	Channel
Start value ¹	-2147483648...2147483647	0	Yes	Channel	Channel
Low counting limit ¹	-2147483648...2147483647	-2147483648	Yes	Channel	Channel
Reset when counting limit is violated	<ul style="list-style-type: none"> To other counting limit To start value 	To other counting limit	Yes	Channel	Channel

Parameter	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software	
				HSP for STEP 7 (TIA Portal)	HSP for STEP 7; GSD file
Reaction to violation of a counting limit	<ul style="list-style-type: none"> Stop counting Continue counting 	Continue counting	Yes	Channel	Channel
Reaction to gate start	<ul style="list-style-type: none"> Set to start value Continue with current value 	Continue with current value	Yes	Channel	Channel
Measured variable	<ul style="list-style-type: none"> Frequency Period Velocity 	Frequency	Yes	Channel	Channel
Update time [ms] of the measuring function ¹	0...25000	10	Yes	Channel	Channel
Time base for velocity measurement ¹	<ul style="list-style-type: none"> 1 ms 10 ms 100 ms 1 s 60 s/1 min 	60 s/1 min	Yes	Channel	Channel
Increments per unit ¹	1...65535	1	Yes	Channel	Channel
Hysteresis ¹	0...255	0	Yes	Channel	Channel
Potential group	<ul style="list-style-type: none"> Use the potential group of the left module (dark BaseUnit) Enable new potential group (light BaseUnit) 	Use the potential group of the left module (dark BaseUnit)	No	Module	Module

¹ Due to the limited number of parameters at a maximum of 244 bytes per ET 200SP station with a PROFIBUS GSD configuration, the possible parameter settings are restricted. The parameter is downloaded to the module with the default setting. If your PROFIBUS master supports the "Read/write data record" function, you can set these parameters using data record 128.

² When a GSD file is used, this diagnostic interrupt is activated via the "Enable additional diagnostic interrupts" parameter and cannot be set separately.

³ When configuring with HSP for STEP 7 or with a GSD file, you define the operating mode by the selection of the module name.

4.4.5 Parameters for operating in Fast Mode

Parameters of the TM Count 1x24V

The following parameter settings are possible:

Table 4- 8 Settable parameters and their default setting in "Fast Mode" operating mode

Parameters	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software	
				HSP for STEP 7 (TIA Portal)	HSP for STEP 7; GSD file
Reaction to CPU STOP ¹	<ul style="list-style-type: none"> Output substitute value Keep last value Continue operation 	Output substitute value	Yes	Channel	Channel
Enable diagnostic interrupt on wire break ²	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel	Channel
Enable additional diagnostic interrupts	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel	Channel
Signal type	<ul style="list-style-type: none"> Pulse (A) Pulse (A) and direction (B) Count up (A), count down (B) Incremental encoder (A, B phase-shifted) Incremental encoder (A, B, N) 	Pulse (A) and direction (B)	Yes	Channel	Channel
Signal evaluation for counter inputs	<ul style="list-style-type: none"> Single Double Quadruple 	Single	Yes	Channel	Channel
Filter frequency for counter inputs ¹	<ul style="list-style-type: none"> 100 Hz 200 Hz 500 Hz 1 kHz 2 kHz 5 kHz 10 kHz 20 kHz 50 kHz 100 kHz 200 kHz 	200 kHz	Yes	Channel	Channel

Parameters	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software	
				HSP for STEP 7 (TIA Portal)	HSP for STEP 7; GSD file
Invert direction (counter inputs) ¹	<ul style="list-style-type: none"> Deactivated Activated 	Deactivated	Yes	Channel	Channel
Reaction to signal N ¹	<ul style="list-style-type: none"> No reaction to signal N Synchronization at signal N 	No reaction to signal N	Yes	Channel	Channel
Sensor type	<ul style="list-style-type: none"> Sourcing output Sinking output Push-pull (sinking and sourcing output) 	Sourcing output	Yes	Channel	Channel
Set output	<ul style="list-style-type: none"> Use by user program Between comparison value and high counting limit Between comparison value and low counter limit At comparison value for a pulse duration After set command from CPU until comparison value Between comparison value 0 and 1 	DQ0, DQ1: Digital output without function	Yes	Channel	Channel
Substitute value for DQ ¹	<ul style="list-style-type: none"> 0 1 	DQ0, DQ1: 0	Yes	Channel	Channel
Count direction of the DQ function ¹	<ul style="list-style-type: none"> Forward Backward In both directions 	In both directions	Yes	Channel	Channel
Pulse duration [ms/10] ¹	0...65535	5000 (corresponds to 0.5 s)	Yes	Channel	Channel
Set function of DI	<ul style="list-style-type: none"> Gate start/stop (level-triggered) Gate start (edge-triggered) Gate stop (edge-triggered) Synchronization Enable synchronization at signal N Digital input without function 	Digital input without function	Yes	Channel	Channel
Select level for DI ¹	<ul style="list-style-type: none"> Active with high level Active with low level 	Active with high level	Yes	Channel	Channel

4.4 Parameters

Parameters	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software	
				HSP for STEP 7 (TIA Portal)	HSP for STEP 7; GSD file
Edge selection for DI ¹	<ul style="list-style-type: none"> At rising edge At falling edge 	At rising edge	Yes	Channel	Channel
Input delay for digital inputs ¹	<ul style="list-style-type: none"> None 0.05 ms 0.1 ms 0.4 ms 0.8 ms 1.6 ms 3.2 ms 12.8 ms 20 ms 	0.1 ms	Yes	Channel	Channel
Frequency of synchronization ¹	<ul style="list-style-type: none"> Once Periodic 	Once	Yes	Channel	Channel
Count direction for synchronization	<ul style="list-style-type: none"> Up Down In both directions 	Up	Yes	Channel	Channel
High counting limit ¹	1...33554431	33554431	Yes	Channel	Channel
Comparison value 0 ¹	0...33554430	0	Yes	Channel	Channel
Comparison value 1 ¹	0...33554431	10	Yes	Channel	Channel
Start value ¹	0...33554431	0	Yes	Channel	Channel
Low counting limit ¹	0...33554430	0	Yes	Channel	Channel
Reset when counting limit is violated	<ul style="list-style-type: none"> To other counting limit To start value 	To other counting limit	Yes	Channel	Channel
Reaction to violation of a counting limit	<ul style="list-style-type: none"> Stop counting Continue counting 	Continue counting	Yes	Channel	Channel
Reaction to gate start	<ul style="list-style-type: none"> Set to start value Continue with current value 	Continue with current value	Yes	Channel	Channel

Parameters	Value range	Default setting	Re-configuration in RUN	Effective range with configuring software	
				HSP for STEP 7 (TIA Portal)	HSP for STEP 7; GSD file
Hysteresis ¹	0...255	0	Yes	Channel	Channel
Potential group	<ul style="list-style-type: none"> Use the potential group of the left module (dark BaseUnit) Enable new potential group (light BaseUnit) 	Use the potential group of the left module (dark BaseUnit)	No	Module	Module

- ¹ Due to the limited number of parameters at a maximum of 244 bytes per ET 200SP station with a PROFIBUS GSD configuration, the possible parameter settings are restricted. The parameter is downloaded to the module with the default setting. If your PROFIBUS master supports the "Read/write data record" function, you can set these parameters using data record 128.
- ² When a GSD file is used, this diagnostic interrupt is activated via the "Enable additional diagnostic interrupts" parameter and cannot be set separately.

4.5 Control and feedback interface

Information on using the control and feedback interface can be found in the section Configuring (Page 28).

A detailed description of the control and feedback bits is available in the Counting, Measurement and Position Detection function manual, which can be downloaded on the Internet (<http://support.automation.siemens.com/WWW/view/en/59709820>).

Note

Except in "Fast Mode" operating mode, the control and feedback interface is compatible with the control and feedback interface of the TM Count 2x24V technology module of the S7-1500 automation system.

Note

Operating with technology object

If you are using a technology object, the control and feedback interface is operated by the technology object.

Fast Mode

If you are using the "Fast Mode" operating mode, a control interface is not available. The feedback interface (Page 56) has an adapted assignment in Fast Mode. In addition, you can find explanations about the feedback bits (Page 56).

4.5.1 Assignment of the control interface

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

Control interface

The following table shows control interface assignment:

Byte offset from start address	Parameter	Meaning																																																										
0 ... 3	Slot 0	DINT or REAL: Load value (the significance of the value is specified in LD_SLOT_0)																																																										
4 ... 7	Slot 1	DINT or REAL: Load value (the significance of the value is specified in LD_SLOT_1)																																																										
8	LD_SLOT_0*	Specifies the significance of the value in Slot 0																																																										
		<table border="1"> <thead> <tr> <th>Bit 3</th> <th>Bit 2</th> <th>Bit 1</th> <th>Bit 0</th> <th></th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>No action, idle</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>Load counter value</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>Invalid</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>Load start value</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>Load comparison value 0</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>1</td> <td>Load comparison value 1</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>Load low counting limit</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>1</td> <td>Load high counting limit</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td rowspan="3">Invalid</td> </tr> <tr> <td colspan="4">to</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	Bit 3	Bit 2	Bit 1	Bit 0		0	0	0	0	No action, idle	0	0	0	1	Load counter value	0	0	1	0	Invalid	0	0	1	1	Load start value	0	1	0	0	Load comparison value 0	0	1	0	1	Load comparison value 1	0	1	1	0	Load low counting limit	0	1	1	1	Load high counting limit	1	0	0	0	Invalid	to				1	1	1	1
		Bit 3	Bit 2	Bit 1	Bit 0																																																							
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		0	0	1	1	Load start value																																																						
		0	1	0	0	Load comparison value 0																																																						
		0	1	0	1	Load comparison value 1																																																						
		0	1	1	0	Load low counting limit																																																						
		0	1	1	1	Load high counting limit																																																						
		1	0	0	0	Invalid																																																						
		to																																																										
		1	1	1	1																																																							
	LD_SLOT_1*	Specifies the significance of the value in Slot 1																																																										
		<table border="1"> <thead> <tr> <th>Bit 7</th> <th>Bit 6</th> <th>Bit 5</th> <th>Bit 4</th> <th></th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>No action, idle</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>Load counter value</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>Invalid</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>Load start value</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>Load comparison value 0</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>1</td> <td>Load comparison value 1</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>Load low counting limit</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>1</td> <td>Load high counting limit</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td rowspan="3">Invalid</td> </tr> <tr> <td colspan="4">to</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	Bit 7	Bit 6	Bit 5	Bit 4		0	0	0	0	No action, idle	0	0	0	1	Load counter value	0	0	1	0	Invalid	0	0	1	1	Load start value	0	1	0	0	Load comparison value 0	0	1	0	1	Load comparison value 1	0	1	1	0	Load low counting limit	0	1	1	1	Load high counting limit	1	0	0	0	Invalid	to				1	1	1	1
		Bit 7	Bit 6	Bit 5	Bit 4																																																							
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		0	0	1	1	Load start value																																																						
		0	1	0	0	Load comparison value 0																																																						
		0	1	0	1	Load comparison value 1																																																						
		0	1	1	0	Load low counting limit																																																						
		0	1	1	1	Load high counting limit																																																						
		1	0	0	0	Invalid																																																						
to																																																												
1	1	1	1																																																									

4.5 Control and feedback interface

Byte offset from start address	Parameter	Meaning
9	EN_CAPTURE	Bit 7: Capture function enable
	EN_SYNC_DN	Bit 6: Enable synchronization down
	EN_SYNC_UP	Bit 5: Enable synchronization up
	SET_DQ1	Bit 4: Set DQ1
	SET_DQ0	Bit 3: Set DQ0
	TM_CTRL_DQ1	Bit 2: Enable technological function DQ1
	TM_CTRL_DQ0	Bit 1: Enable technological function DQ0
	SW_GATE	Bit 0: Software gate
10	SET_DIR	Bit 7: Count direction (for encoders without direction signal)
	–	Bits 2 to 6: Reserve; bits must be set to 0
	RES_EVENT	Bit 1: Reset of saved events
	RES_ERROR	Bit 0: Reset of saved error states
11	–	Bits 0 to 7: Reserve; bits must be set to 0

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

4.5.2 Assignment of the feedback interface

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

Feedback interface

The following table shows the assignment of the feedback interface:

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

4.5.3 Assignment of the feedback interface in Fast Mode

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 in Fast Mode:

Byte offset from start address	Parameter	Meaning
0 ... 3	LS	Bit 31: In isochronous mode: Sign of life (toggling); without isochronous mode: set to 0
	STS_READY	Bit 30: Technology module started up and configured
	STS_DI2	Bit 29: Status DI2
	EXT_F	Bit 28: Group error
	STS_DI0	Bit 27: Status DI0
	STS_DIR	Bit 26: Direction of last counter value change
	STS_DI1	Bit 25: Status DI1
	COUNT_VALUE	Bits 0 to 24: Current counter value

Explanation of feedback bits

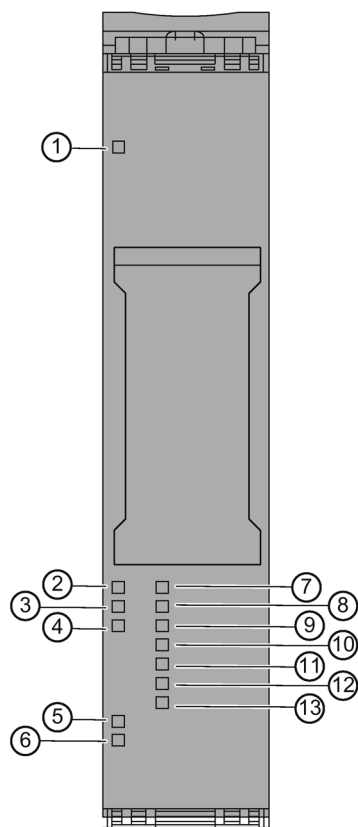
Feedback bit	Notes
COUNT_VALUE	This value returns the current counter value in the first 25 bits of a DINT value.
EXT_F	<p>This bit indicates that one of the following errors has occurred at the encoder signals for the technology module:</p> <ul style="list-style-type: none"> • Wire break of digital input A, B or N (with push-pull encoder) • Illegal transition of A/B signals (with incremental encoder) <p>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 section Diagnostic messages (Page 61).</p> <p>The bit is reset automatically as soon as an error no longer exists.</p>
LS	<p>As a life sign, 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.</p> <p>This bit is set to 0 in non-isochronous mode.</p>
STS_DI0	This bit indicates the status of digital input DI0.
STS_DI1	This bit indicates the status of digital input DI1.
STS_DI2	This bit indicates the status of digital input DI2.
STS_DIR	<p>This bit indicates the count direction of the last count pulse.</p> <p>0 means: Down 1 means: Up</p>
STS_READY	This bit indicates that the technology module supplies valid user data. The technology module has been started up and configured.

Interrupts/diagnostic messages

5.1 Status and error displays

LEDs

The figure below shows you the LED displays (status and error displays) of TM Count 1x24V.



- | | | | |
|---|-----------------------|---|-----------------------|
| ① | DIAG (green/red) | ⑧ | Status of DI1 (green) |
| ② | Status A (green) | ⑨ | Status of DI2 (green) |
| ③ | Status B (green) | ⑩ | Status of DQ0 (green) |
| ④ | Status N (green) | ⑪ | Status of DQ1 (green) |
| ⑤ | 24 VDC (green) | ⑫ | Status UP (green) |
| ⑥ | PWR (green) | ⑬ | Status DN (green) |
| ⑦ | Status of DI0 (green) | | |

Figure 5-1 LEDs of the TM Count 1x24V

5.1 Status and error displays

Meaning of the LED displays

The following tables explain the meaning of the status and error displays. Remedial measures for diagnostic messages can be found in the section Diagnostic messages (Page 60).

Table 5- 1 Status and error displays DIAG











LED DIAG	Meaning	To correct or avoid errors
 Off	Backplane bus supply of the ET 200SP not OK	Check or switch on the supply voltage on the CPU or on the interface module.
 Flashes	Technology module not configured	---
 On	Technology module configured but no module diagnostics	---
 Flashes	Technology module configured and module diagnostics (at least one error pending)	Evaluate the diagnostic messages and eliminate the error.

Table 5- 2 PWR/24VDC status displays

LEDs		Meaning	To correct or avoid errors
PWR	24VDC		
 Off	 Off	Supply voltage missing	<ul style="list-style-type: none"> • Check the supply voltage. • Check the BaseUnit type and the wiring of the BaseUnit.
 On	 On	Supply voltage is present and OK	---
 On	 Off	Short-circuit or overload at the encoder supply or supply voltage too low	<ul style="list-style-type: none"> • Check the encoder wiring. • Check the loads connected to the encoder supply. • Check the supply voltage.

ChannelLEDs

The A, B, N and DIm LEDs indicate the current level of the associated signals. The LEDs of the digital outputs DQm indicate the desired state.

The LEDs UP and DN indicate the logical counting direction.

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

Table 5- 3 A/B/N/DIm/DQm status displays

A/B/N/DIm/DQm LEDs	Meaning
□ Off	Counter input / digital input / digital output at 0 level
■ On	Counter input / digital input / digital output at 1 level

Table 5- 4 Status displays UP/DN

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

5.2 Diagnostic messages

Enabling the diagnostic interrupts

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

The technology module can trigger the following diagnostic interrupts:

Table 5- 5 Possible diagnostic interrupts

Diagnostic interrupt	Monitoring
<ul style="list-style-type: none"> • Parameter assignment error • Hardware interrupt lost • Module temporarily unavailable • Internal error • Watchdog tripped. Module is defective. 	<p>Monitoring is always active. A diagnostic interrupt is triggered each time an error is detected.</p>
<ul style="list-style-type: none"> • Wire break at digital input A, B or N 	<p>Monitoring is active if a push-pull switching encoder has been configured. A detected error only triggers a diagnostic interrupt if "Enable diagnostic interrupt for wire break" has been enabled in the device configuration.</p>
<ul style="list-style-type: none"> • Error • Load voltage missing • Short circuit or overload at external encoder supply • Error at the digital outputs • Supply voltage error¹ • Illegal A/B signal ratio • Overheating 	<p>Monitoring is always active. A detected error only triggers a diagnostic interrupt if "Enable additional diagnostic interrupts" has been enabled in the device configuration.</p>

¹ No longer available as of module version V1.2. This case is then taken into account by diagnostic interrupt "Load voltage missing".

Reactions to a diagnostic interrupt

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

- The DIAG LED flashes red.

When you have eliminated all errors, the DIAG LED stops flashing red and turns green.

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

Detailed information on the error event can be obtained in the error organization block with instruction "RALRM" (read additional interrupt information), in the information system of STEP 7 and in the Diagnostics function manual

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

If the module is being operated as a distributed module in an ET 200SP system with PROFIBUS DP, you have the option of reading out diagnostic data with the RDREC or RD_REC instruction using data record 0 and 1. For the structure of the data records, refer to the product 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 messages

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 following diagnostics can be signaled:

Table 5- 6 Diagnostic alarms, their meaning and remedies

Diagnostic alarm	Error code	Meaning	Remedy
Error	9H	<ul style="list-style-type: none"> • Internal module error occurred • Possible cause: Technology module defective 	Replace technology module
Parameter assignment error	10H	<ul style="list-style-type: none"> • The received parameter data record is invalid • The configured BaseUnit is not the used BaseUnit 	<ul style="list-style-type: none"> • Check parameter data record • Check BaseUnit
Load voltage missing	11H	<ul style="list-style-type: none"> • Undervoltage • Supply voltage L+ of technology module missing • Wiring of supply voltage L+ faulty 	<ul style="list-style-type: none"> • Check BaseUnit type • Check supply voltage L+ on the BaseUnit • Check wiring of supply voltage L+ • Check total consumption of the load group

5.2 Diagnostic messages

Diagnostic alarm	Error code	Meaning	Remedy
Hardware interrupt lost	16 _H	<ul style="list-style-type: none"> Module cannot send an interrupt because a previous interrupt has not been processed Possible cause: Too many hardware interrupts in too short a time 	<ul style="list-style-type: none"> Change interrupt processing in the CPU and re-assign technology module parameters correspondingly Check frequency of interrupts from the process
Channel/component temporarily unavailable	1F _H	<ul style="list-style-type: none"> Firmware update in progress or update has been canceled. The module reads no process values in this state. 	<ul style="list-style-type: none"> Wait for firmware update If firmware update aborts: <ul style="list-style-type: none"> Check minimum firmware version required Check supply voltage Repeat firmware update
Internal error	100 _H	Technology module defective	Replace technology module
Watchdog tripped. Module is defective.	103 _H	Firmware error	Run firmware update
		Technology module defective	Replace technology module
Short circuit or overload at external encoder supply	10E _H	<ul style="list-style-type: none"> Error at encoder supply Possible causes: <ul style="list-style-type: none"> Short circuit Overload 	<ul style="list-style-type: none"> Check encoder wiring Check consumers connected to encoder supply
Error at the digital outputs	10F _H	<ul style="list-style-type: none"> Error at the digital outputs Possible causes: <ul style="list-style-type: none"> Short circuit Overload 	<ul style="list-style-type: none"> Check wiring at the digital outputs Check consumers connected to the digital outputs
Supply voltage error ¹	110 _H	<ul style="list-style-type: none"> Error at supply voltage L+ Possible causes: <ul style="list-style-type: none"> Low voltage Wiring of L+ supply voltage defective 	<ul style="list-style-type: none"> Check supply voltage L+ on the BaseUnit Check wiring of supply voltage L+ Check total consumption of the load group
Illegal A/B signal ratio	500 _H	<ul style="list-style-type: none"> Time profile of signals A and B of the incremental encoder does not meet certain specifications Possible causes: <ul style="list-style-type: none"> Signal frequency too high Encoder faulty Process wiring faulty 	<ul style="list-style-type: none"> Check process wiring Check encoder/sensor Check parameter assignment

Diagnostic alarm	Error code	Meaning	Remedy
Wire break at digital input A, B or N	505 _H	Channel not connected	Connect the channel
		Resistance of encoder circuit too high	<ul style="list-style-type: none"> • Use a different encoder type or modify the wiring, for example, use shorter cables with larger cross-sections • Check encoders
		Interruption of the line between technology module and encoder	Check process wiring
		Sensor used is sourcing output or sinking output only	Correct parameter assignment
Overheating	506 _H	Possible causes: <ul style="list-style-type: none"> • Short circuit or overload at the digital outputs or output of the encoder supply • Ambient temperature outside specifications 	<ul style="list-style-type: none"> • Check process wiring • Improve cooling • Check connected loads

¹ No longer available as of module version V1.2. This case is then taken into account by diagnostic interrupt "Load voltage missing".

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

Enabling the hardware interrupts

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

The EventType tag, among others, is entered in the start information of the assigned hardware interrupt OB when a hardware interrupt is triggered. The EventType tag specifies the number of the event type to which the event triggering the interrupt belongs.

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

Table 5- 7 Possible hardware interrupts

Hardware interrupt	EventType number
Internal gate opening (Gate start)	1
Internal gate closing (Gate stop)	2
Overflow (high counting limit violated)	3
Underflow (low counting limit violated)	4
Compare event for DQ0 has occurred	5
Compare event for DQ1 has occurred	6
Zero pass	7
New Capture value available ¹⁾	8

Hardware interrupt	EventType number
Synchronization of the counter by an external signal	9
Direction reversal ²⁾	10

1) Can only be configured in Counting mode

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

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

6ES7138-6AA00-0BA0	
Product type designation	TM Count 1x24V
General information	
BaseUnits that can be used	BU type A0
Product function	
I&M data	Yes; I&M0 to I&M3
Engineering with	
STEP 7 TIA Portal can be configured/integrated as of version	V13 / –
STEP 7 can be configured/integrated as of version	V5.5 SP3 / –
PROFIBUS as of GSD version/GSD revision	GSD revision 5
PROFINET as of GSD version/GSD revision	GSDML V2.3
Supply voltage	
Load voltage L+	
Rated value (DC)	24 V
Low limit of valid range (DC)	19.2 V
High limit of valid range (DC)	28.8 V
Reverse polarity protection	Yes
Input current	
Current consumption, max.	60 mA; without load
Encoder supply	
Number of outputs	1
24 V encoder supply	
24 V	Yes; L+ (-0.8 V)
Short-circuit protection	Yes; electronic/thermal
Output current, max.	300 mA
Power loss	
Power loss, typ.	1 W
Address area	
Occupied address area	
Inputs	16 bytes; 4 bytes with Fast Mode
Outputs	12 bytes; 4 bytes with Motion Control; 0 bytes with Fast Mode

6ES7138-6AA00-0BA0	
Digital inputs	
Number of inputs	3
Digital inputs, configurable	Yes
Input characteristics to IEC 61131, Type 3	Yes
Digital input functions, configurable	
Gate start/stop	Yes
Capture	Yes; not available with Fast Mode
Synchronization	Yes
Freely assignable digital input	Yes
Input voltage	
Rated value, DC	24 V
For signal "0"	-30 V to +5 V
For signal "1"	+11 V to +30 V
Permitted voltage at input, min.	-30 V
Permitted voltage at input, max.	30 V
Input current	
for signal "1", typ.	2,5 mA
Input delay (at rated value of input voltage)	
For standard inputs	
<ul style="list-style-type: none"> • Configurable 	Yes; none / 0.05 / 0.1 / 0.4 / 0.8 / 1.6 / 3.2 / 12.8 / 20 ms
<ul style="list-style-type: none"> • at "0" to "1", min. 	6 μs; with parameter assignment "none"
<ul style="list-style-type: none"> • at "1" to "0", min. 	6 μs; with parameter assignment "none"
For counters/technological functions	
<ul style="list-style-type: none"> • Configurable 	Yes
Cable length	
Cable length shielded, max.	1000 m
Cable length unshielded, max.	600 m
Digital outputs	
Type of digital output	Transistor
Number of outputs	2
Digital outputs, configurable	Yes
Short-circuit protection	Yes; electronic/thermal
<ul style="list-style-type: none"> • Response threshold, typ. 	1 A
Limiting of inductive shutdown voltage to	L+ (-33 V)
Control of a digital input	Yes
Digital output functions, configurable	
Switch at comparison values	Yes
Freely assignable digital output	Yes; not available with Fast Mode
Output switching capacity	
With resistive load, max.	0.5 A; per digital output
With lamp load, max.	5 W

	6ES7138-6AA00-0BA0
Load resistance range	
Low limit	48 Ω
High limit	12 kΩ
Output voltage	
for signal "1", min.	23.2 V; L+ (-0.8 V)
Output current	
for signal "1" rated value	0.5 A; per digital output
for signal "1" permissible range, max.	0.6 A; per digital output
for signal "1" minimum load current	2 mA
for signal "0" residual current, max.	0.5 mA
Output delay with resistive load	
"0" to "1", max.	50 μs
"1" to "0", max.	50 μs
Switching frequency	
With resistive load, max.	10 kHz
With inductive load, max.	0.5 Hz; acc. to IEC 60947-5-1, DC-13; observe derating curve
With lamp load, max.	10 Hz
Total current of outputs	
Max. current per module	1 A
Cable length	
Cable length shielded, max.	1000 m
Cable length unshielded, max.	600 m
Encoders	
Supported encoders	
2-wire sensor	Yes
• Permitted quiescent current (2-wire sensor), max.	1.5 mA
Encoder signals, incremental encoders (asymmetrical)	
Input voltage	24 V
Input frequency, max.	200 kHz
Counting frequency, max.	800 kHz; with quadruple evaluation
Cable length shielded, max.	600 m; depends on input frequency, encoder and cable quality; max. 50 m with 200 kHz
Signal filter, configurable	Yes
Incremental encoder with A/B tracks, phase-shifted by 90°	Yes
Incremental encoder with A/B tracks, phase-shifted by 90°, and zero track	Yes
Pulse encoder	Yes
Pulse encoder with direction	Yes
Pulse encoder with one pulse signal per count direction	Yes

	6ES7138-6AA00-0BA0
24 V encoder signal	
<ul style="list-style-type: none"> Permitted voltage at input, min. 	-30 V
<ul style="list-style-type: none"> Permitted voltage at input, max. 	30 V
Interface hardware	
Input characteristics to IEC 61131, Type 3	Yes
Sinking/sourcing input	Yes
Isochronous mode	
Isochronous mode (application synchronized until terminal)	Yes
Bus cycle time (TDP), min.	250 μ s, 125 μ s with Fast Mode
Interrupts/diagnostics/status information	
Activation of substitute values	Yes; configurable
Interrupts	
Diagnostic interrupt	Yes
Hardware interrupt	Yes; not available with Fast Mode
Diagnostic messages	
Monitoring of supply voltage	Yes
Wire break	Yes
Short circuit	Yes
A/B transition error with incremental encoder	Yes
Group error	Yes
LED diagnostics display	
Monitoring of supply voltage	Yes, green PWR LED
For module diagnostics	Yes; green / red DIAG LED
Count down status display (green)	Yes
Count up status display (green)	Yes
Integrated functions	
Number of counters	1
Counting frequency (counters), max.	800 kHz; with quadruple evaluation
Counting functions	
Can be used with TO High_Speed_Counter	Yes
Continuous counting	Yes
Counter response configurable	Yes
Hardware gate by means of digital input	Yes
Software gate	Yes; not available with Fast Mode
Event-triggered stop	Yes
Synchronization by means of digital input	Yes
Counting range, configurable	Yes
Comparator	
<ul style="list-style-type: none"> Number of comparators 	2
<ul style="list-style-type: none"> Direction-dependent 	Yes
<ul style="list-style-type: none"> Can be changed from user program 	Yes

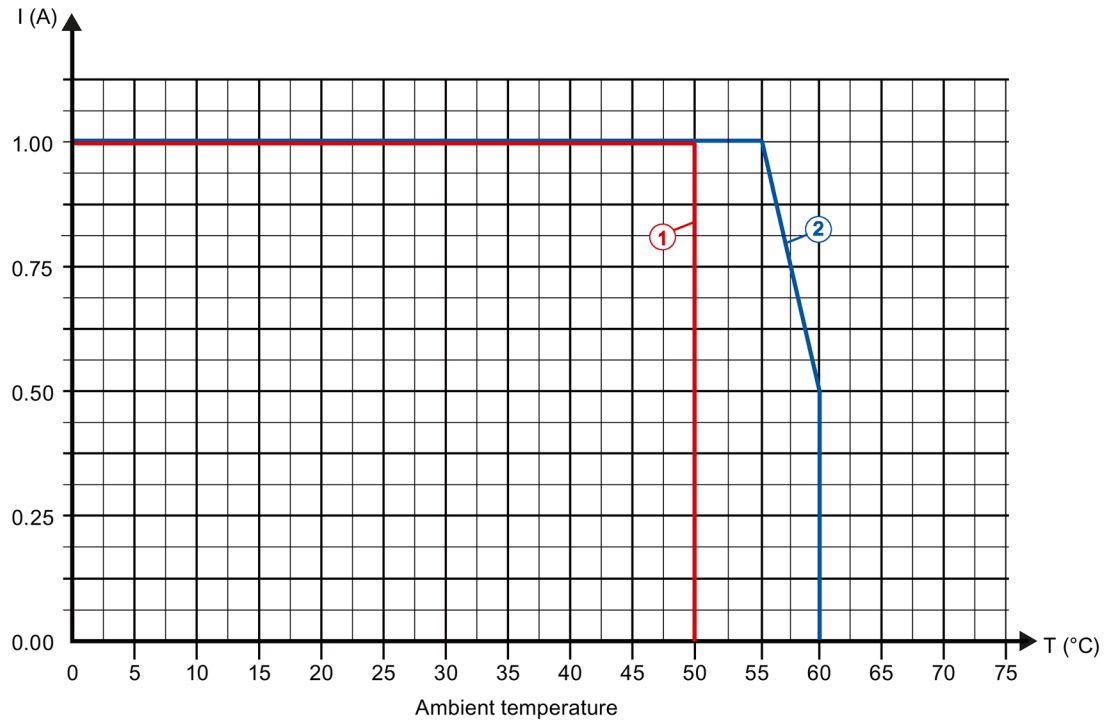
6ES7138-6AA00-0BA0	
Position detection	
Suitable for S7-1500 Motion Control	Yes
Measuring functions	
Measuring time, configurable	Yes
Dyn. measuring time adjustment	Yes
Number of threshold values, configurable	2
Measuring range	
• Frequency measurement, min.	0.04 Hz
• Frequency measurement, max.	800 kHz
• Period measurement, min.	1.25 µs
• Period measurement, max.	25 s
Accuracy	
• Frequency measurement	100 ppm; depends on measuring interval and signal evaluation
• Velocity measurement	100 ppm; depends on measuring interval and signal evaluation
• Period measurement	100 ppm; depends on measuring interval and signal evaluation
Electrical isolation	
Electrical isolation channels	
Between the channels and the backplane bus	Yes
Permitted potential difference	
Between the different circuits	75 V DC / 60 V AC (basic insulation)
Insulation	
Insulation tested with	707 V DC (type test)
Ambient conditions	
Operating temperature	
Horizontal installation, min.	0 °C
Horizontal installation, max.	60 °C; note derating
Vertical installation, min.	0 °C
Vertical installation, max.	50 °C; note derating
Dimensions	
Width	15 mm
Weights	
Weight, approx.	45 g

Derating information for total current of outputs

If the digital outputs of the TM Count 1x24V are operated with resistive or 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 (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:

- Load resistance: 48 Ω (IEC 947-5-1)

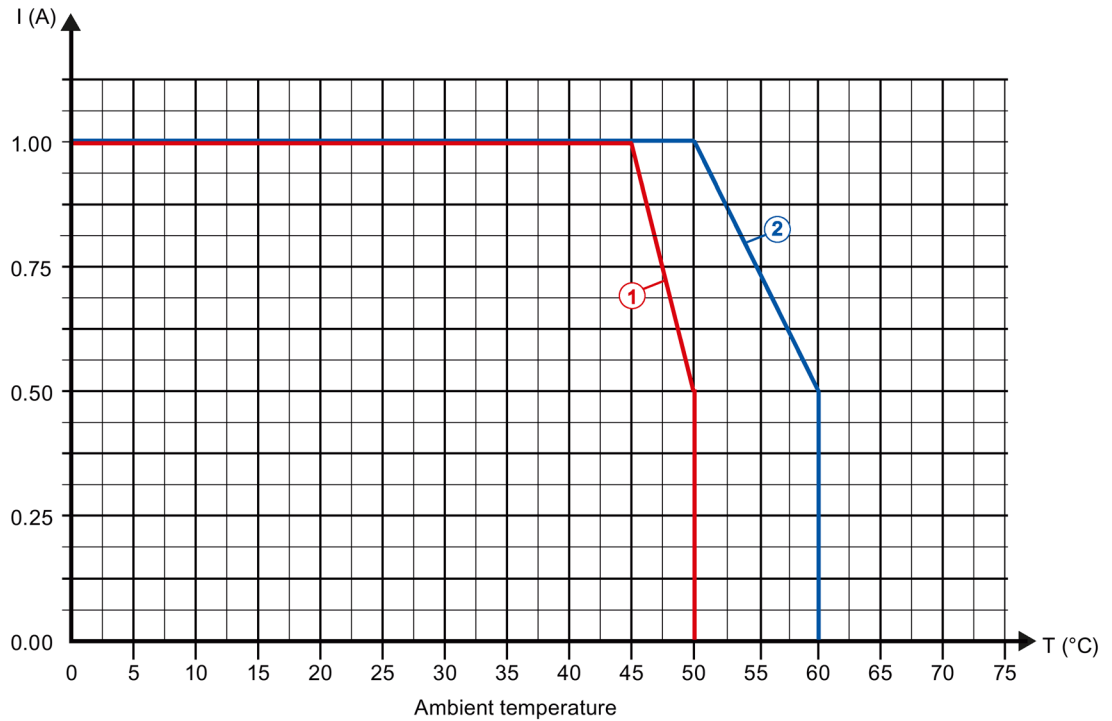


- ① Vertical installation of the system
- ② Horizontal installation of the system

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

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

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



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

Figure 6-2 Total current by ambient temperature and mounting position for inductive loads

Note

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

Dimensional drawing

See ET 200SP BaseUnits
<http://support.automation.siemens.com/WW/view/en/58532597/133300> manual

Parameter data record

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

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

If errors occur during the transfer or validation of parameters with the WRREC instruction, the module continues operation with the previous parameter assignment. A corresponding error code is then written to the STATUS output parameter. If no errors occur, the STATUS output parameter contains the length of the actually transferred data.

The description of the WRREC instruction and the error codes is available in section Parameter validation error (Page 81) or in the online help of STEP 7 (TIA Portal).

Structure of data record 128

The table below shows you the structure of data record 128 for TM Count 1x24V with 1 channel. The values in byte 0 to byte 3 are fixed and may not be changed. The value in byte 4 can only be changed by means of new parameter assignment and not in RUN mode.

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 Reaction to CPU STOP "Continue operation" is set, the module is only set to its startup state when data record 128 has been changed.

Table A- 1 Parameter data record 128

Bit →	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte ↓								
0...3	Header							
0	Major Version = 0				Minor Version = 1			
1	Length of the parameter data = 48							
2	Reserved ²⁾							
3	Reserved ²⁾							

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

Bit →	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4...51	Counting channel							
4	Operating mode							
4	Reserved ²⁾			Operating mode:				
				0000 _B : Reserved				
				0001 _B : Counting				
				0010 _B : Measuring				
						0011 to 1111 _B : Invalid		
5	Basic parameters							
5	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	Counter inputs							
6	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	Reaction to signal N:		Invert direction ¹⁾	Enable diagnostics interrupt at wire break ¹⁾	Filter frequency:			
	00 _B : No reaction to signal N				0000 _B : 100 Hz			
	01 _B : Synchronization at signal N				0001 _B : 200 Hz			
	10 _B : Capture at signal N				0010 _B : 500 Hz			
	11 _B : Invalid				0011 _B : 1 kHz			
			0100 _B : 2 kHz					
			0101 _B : 5 kHz					
			0110 _B : 10 kHz					
			0111 _B : 20 kHz					
			1000 _B : 50 kHz					
			1001 _B : 100 kHz					
		1010 _B : 200 kHz						
		1011 to 1111 _B : Invalid						

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

Bit →								
Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
8...9	Hardware interrupts¹⁾							
8	Reserved ²⁾			Change of direction	Underflow (low counting limit violated)	Overflow (high counting limit violated)	Gate stop	Gate start
9	Synchronization of the counter by an external signal	New Capture value available	Reserved ²⁾	Zero pass	Reserved ²⁾	Comparison event for DQ1 has occurred	Reserved ²⁾	Comparison event for DQ0 has occurred
10...15	Behavior of DQ0/1							
10	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; measuring: measured value >= comparison value				0001 _B : Between comparison value and high limit; measuring: measured value >= comparison value			
	0010 _B : Between comparison value and low limit; measuring: measured value <= comparison value				0010 _B : Between comparison value and low limit; measuring: measured value <= comparison value			
	0011 _B : At comparison value for a pulse duration				0011 _B : At comparison value for a pulse duration			
	0100 _B : Between comparison value 0 and 1				0100 _B : Invalid			
	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 : Invalid			
	0111 to 1111 _B : Invalid							
11	Count direction (DQ1):		Count direction (DQ0):		Reserved ²⁾		Substitute value for DQ1	Substitute value for DQ0
	00 _B : Invalid		00 _B : Invalid					
	01 _B : Forward		01 _B : Forward					
	10 _B : Backward		10 _B : Backward					
	11 _B : In both directions		11 _B : In both directions					
12	Pulse duration (DQ0):							
13	WORD: Value range in ms/10: 0 to 65535 _D							
14	Pulse duration (DQ1):							
15	WORD: Value range in ms/10: 0 to 65535 _D							

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

Bit →								
Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
16	Behavior of DI0							
16	Behavior of counter value after Capture (DI0):	Edge selection (DI0):		Select level (DI0):	Reserved ²⁾	Set function of DI (DI0):		
		00 _B : Invalid				0 _B : Active with high level	000 _B : Gate start/stop (level-triggered)	
		01 _B : At rising edge		001 _B : Gate start (edge-triggered)				
	10 _B : At falling edge		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 : Invalid						
17	Behavior of DI1: See Byte 16							
18	Behavior of DI2: See Byte 16							
19	Frequency:	Reserved ²⁾			Input delay:			
	0 _B : Once				0000 _B : None			
	1 _B : Periodic				0001 _B : 0.05 ms			
					0010 _B : 0.1 ms			
	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	Values							
20...23	High counting limit: DWORD: Value range: -2147483648 to 2147483647 _D or 80000000 to 7FFFFFFF _H							
24...27	Comparison value 0: Counting mode: DWORD: Value range: -2147483648 to 2147483647 _D or 80000000 to 7FFFFFFF _H ; Measuring mode: REAL: Floating point number in the configured unit of the measured variable							
28...31	Comparison value 1: Counting mode: DWORD: Value range: -2147483648 to 2147483647 _D or 80000000 to 7FFFFFFF _H ; Measuring mode: REAL: Floating point number in the configured unit of the measured variable							
32...35	Start value: DWORD: Value range: -2147483648 to 2147483647 _D or 80000000 to 7FFFFFFF _H							
36...39	Low counting limit: DWORD: Value range: -2147483648 to 2147483647 _D or 80000000 to 7FFFFFFF _H							
40...43	Update time: DWORD: Value range in μs: 0 to 25000000 _D							

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

Bit →	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
44	Counter behavior at limits and gate start							
44	Reaction to gate start:		Reaction to violation of a counting limit:			Reset when counting limit is violated:		
	00 _B : Set to start value		000 _B : Stop counting			000 _B : To other counting limit		
	01 _B : Continue with current value		001 _B : Continue counting			001 _B : To start value		
	10 to 11 _B : Reserved		010 to 111 _B : Reserved			010 to 111 _B : Reserved		
45	Specify measured value							
45	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 : Invalid	
				100 _B : 60 s/1 min				
101 to 111 _B : Invalid								
46	Increments per unit:							
47	WORD: Value range: 1 to 65535 _D							
48	Set the hysteresis range: Value range: 0 to 255 _D							
49...51	Reserved ²⁾							

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

2) Reserved bits must be set to 0.

Note

DQ functions

In counting mode, you can select the "Between comparison value 0 and 1" function only for digital output DQ1 and only if you have selected the "Use by user program" function for digital output DQ0.

In measuring mode, you can select the "Between comparison value 0 and 1" and "Not between comparison value 0 and 1" functions only for digital output DQ1 and only if you have selected the "Use by user program" function for digital output DQ0.

Structure of data record 128 in Fast Mode

The following table shows you the structure of data record 128 for TM Count 1x24V for "Fast Mode" operating mode. The values in byte 0 to byte 3 are fixed and must not be changed.

Table A- 2 Parameter data record 128: "Fast Mode" operating mode

Bit →	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
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 = 48							
2	Reserved ²⁾							
3	Reserved ²⁾							
4	Operating mode							
4	Reserved ²⁾				Operating mode:			
					0000 _B : Invalid			
					0001 _B : Counting / Position input			
					0010 to 1111 _B : Invalid			
5	Basic parameters							
5	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	Counter inputs (parameters for incremental encoders and pulse encoders)							
6	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	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	
	01 _B : Synchronization at signal N						0001 _B : 200 Hz	
	10 to 11 _B : Invalid						0010 _B : 500 Hz	
					0011 _B : 1 kHz			
					0100 _B : 2 kHz			
					0101 _B : 5 kHz			
					0110 _B : 10 kHz			
					0111 _B : 20 kHz			
					1000 _B : 50 kHz			
					1001 _B : 100 kHz			
					1010 _B : 200 kHz			
					1011 to 1111 _B : Invalid			
8...9	Reserved ²⁾							

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

Bit →									
Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
10...15	Behavior of a DQ								
10	Set output (DQ1):				Set output (DQ0):				
	0000 _B : Digital output without function				0000 _B : Digital output without function				
	0001 _B : Between comparison value and high limit				0001 _B : Between comparison value and high limit				
	0010 _B : Between comparison value and low limit				0010 _B : Between comparison value and 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	Count direction (DQ1):		Count direction (DQ0):		Reserved ²⁾	Reserved ²⁾	Substitute value for DQ1	Substitute value for DQ0	
	00 _B : Reserved		00 _B : Reserved						
	01 _B : Up		01 _B : Up						
	10 _B : Down		10 _B : Down						
	11 _B : In both directions		11 _B : In both directions						
12	Pulse duration (DQ0):								
13	UINT: Value range in ms/10: 0 to 65535 _D								
14	Pulse duration (DQ1):								
15	UINT: Value range in ms/10: 0 to 65535 _D								
16	Behavior of DI0								
16	Reserved ²⁾	Edge selection (DI0):		Select level (DI0):	Reserved ²⁾	Set function of DI (DI0):			
		00 _B : Invalid				0 _B : Active with high level	000 _B : Gate start/stop (level-triggered)		
		01 _B : At rising edge		1 _B : Active with low level			001 _B : Gate start (edge-triggered)		
		10 _B : At falling edge					010 _B : Gate stop (edge-triggered)		
		11 _B : Invalid		011 _B : Synchronization ³⁾					
				100 _B : Enable synchronization at signal N					
				101 _B : Invalid					
		110 _B : Digital input without function							
		111 _B : Invalid							
17	Behavior of DI1: See Byte 16								
18	Behavior of DI2: See Byte 16								
19	Frequency:	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						

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

Bit →	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte ↓								
20...43	Values							
20...23	High counting limit: DWORD: Value range: 1 to 33554431 _D or 1 to 01FFFFFF _H							
24...27	Comparison value 0: DWORD: Value range: 0 to 33554430 _D or 0 to 01FFFFFFE _H							
28...31	Comparison value 1 DWORD: Value range: 1 to 33554431 _D or 1 to 01FFFFFF _H							
32...35	Start value: DWORD: Value range: 0 to 33554431 _D or 0 to 01FFFFFF _H							
36...39	Low counting limit: DWORD: Value range: 0 to 33554430 _D or 0 to 01FFFFFFE _H							
40...43	Reserved ²⁾							
44	Counter behavior at limits and gate start							
44	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	Reserved ²⁾							
48	Set hysteresis range: Value range: 0 to 255 _D :							
49...51	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, overflows can occur. You prevent overflows by selecting the option with the greatest time demand during offline parameter assignment.

Note

DQ functions

You can select the "Between comparison value 0 and 1" function only for digital output DQ1 and only if you have selected the "Use by user program" function for digital output DQ0.

A.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 A- 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	<ul style="list-style-type: none"> Check whether module is inserted or removed. Check assigned values for parameters of the WRREC instruction.
DF	80	E0	01	Wrong version	<ul style="list-style-type: none"> Check byte 0. Enter valid values.
DF	80	E0	02	Error in the header information	<ul style="list-style-type: none"> Check byte 1. Correct the length of 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	<ul style="list-style-type: none"> "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" 	<ul style="list-style-type: none"> 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.

Error code in STATUS parameter (hexadecimal)				Meaning	Remedy
Byte 0	Byte 1	Byte 2	Byte 3		
DF	80	E1	21 ¹	<ul style="list-style-type: none"> Low counting limit > comparison value 0 Low counting limit > comparison value 1 	<ul style="list-style-type: none"> Low counting limit < comparison value 0 Low counting limit < comparison value 1
DF	80	E1	22 ¹	<ul style="list-style-type: none"> High counting limit > comparison value 0 High counting limit > comparison value 1 	<ul style="list-style-type: none"> High counting limit < comparison value 0 High counting limit < comparison value 1
DF	80	E1	23	<ul style="list-style-type: none"> "Start value" parameter invalid "Low counting limit" parameter invalid 	Enter valid parameter value: Start value > low counting limit
DF	80	E1	24	<ul style="list-style-type: none"> "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 _b .
DF	80	E1	26 ²	"Reference speed" parameter invalid	Enter parameter value from range 6.00 to 210000.00 _b .
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	<ul style="list-style-type: none"> "High counting limit" parameter invalid "Low counting limit" parameter invalid 	Enter valid parameter value: Low counting limit < high counting limit
DF	80	E1	2B	<ul style="list-style-type: none"> "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	<ul style="list-style-type: none"> "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 	<ul style="list-style-type: none"> Configure "Between comparison value 0 and 1" only for DQn.1 Configure "Not between comparison value 0 and 1" 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 DIn.m in "Measuring" operating mode	Do not configure "Capture" for DIn.m in "Measuring" operating mode.
DF	80	E1	3A ³	"Count direction for synchronization" parameter invalid	Enter valid parameter value.

1 Only for "Counting" operating mode

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

3 Only for "Fast Mode" operating mode