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Manual

SIMATIC

S7-1500/ET 200MP

Technology module
TM PosInput 2 (6ES7551-1AB01-0AB0)

Edition 06/2022

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SIMATIC

S7-1500/ET 200MP Technology module TM PosInput 2 (6ES7551-1AB01-0AB0)

Equipment 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.

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

The counting and measuring functions and position input of the TM PosInput 2 technology module are described in more detail in the Counting, measurement and position input (http://support.automation.siemens.com/WW/view/en/59709820) Function Manual.

Conventions

Please observe notes marked as follows:

Note

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

Document history

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

Manual edition	Comments
06/2022	The following sections have been revised: • Product overview (Page 10) • Wiring (Page 19) • Configuring/address space (Page 31) • Interrupts/diagnostic messages (Page 82) • Technical specifications (Page 90)
06/2018	The following sections have been revised: • Product overview (Page 10) • Configuring/address space (Page 31) • Interrupts/diagnostic messages (Page 82) • Technical specifications (Page 90) • Parameter data record (Page 100)
06/2013	First edition

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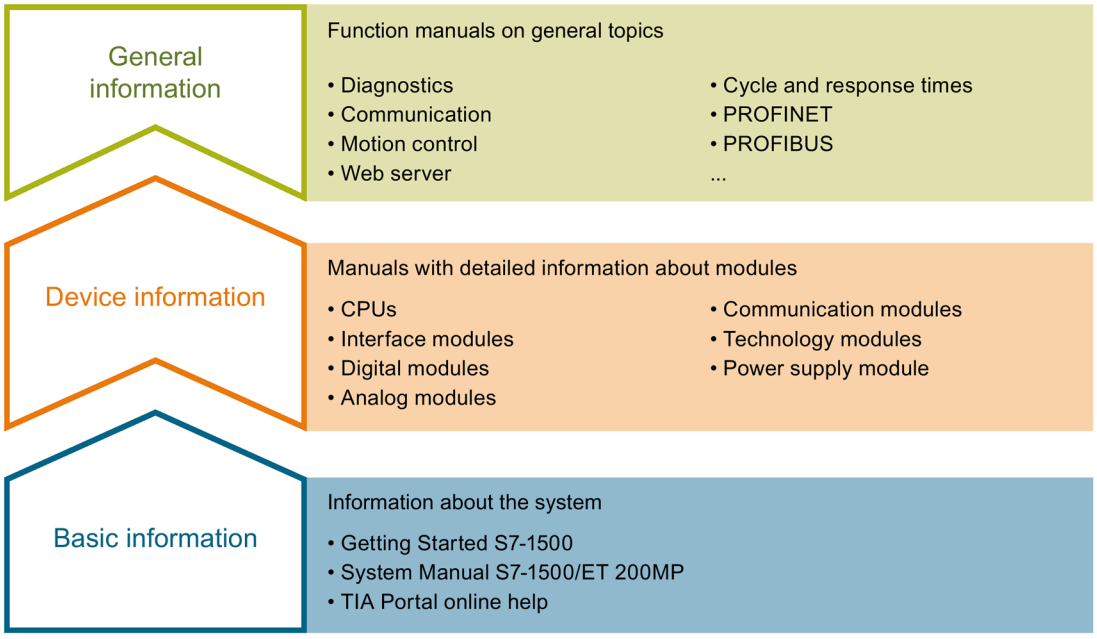
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Documentation guide

1

The documentation for the SIMATIC S7-1500 automation system and the SIMATIC ET 200MP 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 and Getting Started describe in detail the configuration, installation, wiring and commissioning of the SIMATIC S7-1500 and ET 200MP systems. The STEP 7 online help supports you in the configuration and programming.

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 S7-1500 and ET 200MP systems, e.g. diagnostics, communication, motion control, Web server, OPC UA.

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

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/68052815).

Manual Collection S7-1500/ET 200MP

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

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

SIMATIC S7-1500 comparison list for programming languages

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

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

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Application examples

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

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

Product overview

2

2.1 Properties

Article number

6ES7551-1AB01-0AB0

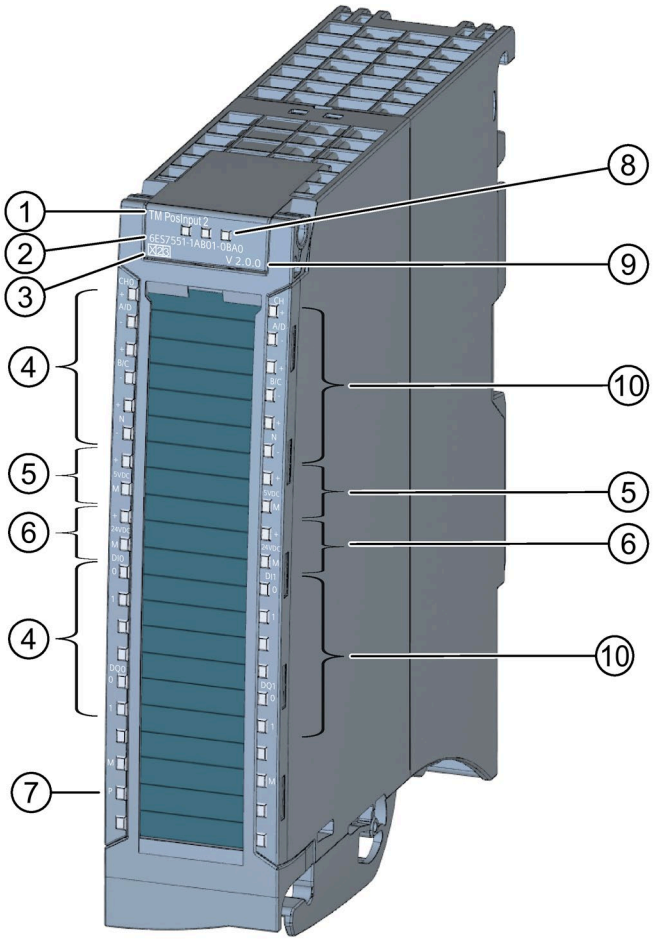
The TM PosInput 2 technology module with article number 6ES7551-1AB01-0AB0 and firmware version V2.0 is a compatible replacement for the TM PosInput 2 with article number 6ES7551-1AB00-0AB0.

The TM PosInput 2 with article number 6ES7551-1AB01-0AB0 can be used in configurations in which the TM PosInput 2 with article number 6ES7551-1AB00-0AB0 is configured. It then has the functional scope of the TM PosInput 2 with article number 6ES7551-1AB00-0AB0.

Firmware version

This manual describes the properties of firmware version V2.0 of the module.

View of the module



① Module type and designation
② Article number
③ Release number
④ LEDs for status channel 0
⑤ LED for 5 V encoder supply
⑥ LED for 24 V encoder supply
⑦ LED for supply voltage
⑧ LEDs for diagnostics
⑨ Firmware version
⑩ LEDs for status channel 1

Figure 2-1 View of the TM PosInput 2 module

Properties

The TM PosInput 2 technology module has the following properties:

- Technical properties
  - Two channels
  - Interfaces:

    SSI encoder signals D (SSI data) and C (SSI clock) or RS422/TTL encoder signals A, B and N

    5 V and 24 V encoder supply, short-circuit proof

    DI0 and DI1 digital input signals (per channel)

    DQ0 and DQ1 digital output signals (per channel, short-circuit proof)

    Supply voltage L+
  - Count range: 32 bits
  - Channel-by-channel monitoring of encoder signals for wire break
  - Channel-by-channel monitoring of digital outputs for short-circuit
  - Monitoring for faulty supply voltage
  - Hardware interrupts can be configured channel by channel
  - Input filters for suppression of interferences at encoder inputs and digital inputs can be configured
- Supported encoder/signal types
  - SSI absolute encoder
  - RS422/TTL incremental encoder with N signal
  - RS422/TTL incremental encoder without N signal
  - RS422/TTL pulse encoder with direction signal
  - RS422/TTL pulse encoder without direction signal
  - RS422/TTL pulse encoder with up/down count signal

The module supports the following functions:

Table 2- 1 Version dependencies of the functions

Function	Firmware version of module	Configurable as of		
		STEP 7 (TIA Portal)	GSD	
			PROFINET IO	PROFIBUS DP
Firmware update	V1.0 or higher	V13	X	—
I&M identification data	V1.0 or higher	V13	X	X
Parameter reassignment in RUN	V1.0 or higher	V13	X	X
Isochronous mode	V1.0 or higher	V13	—	—
Counting/measuring	V1.0 or higher	V13	X	X
Operating with "Counting and measurement" technology object	V1.0 or higher	V13	—	—
Position input for "Motion Control" technology object	V1.0 or higher	V13	—	—
Operating with "Measuring input" technology object	V1.3 or higher	V15 with HSP0256	—	—
Use SSI absolute encoder with position value range of 32 bits	V1.3 or higher	V15 with HSP0256	X	X
Fast Mode	V2.0 or higher	V17 with HSP0355	X	X
Display of digital input states in the process image for position detection for "Motion Control" technology object	V2.0 or higher	V17 with HSP0355	—	—

Firmware versions V1.x are available for the article number 6ES7551-1AB00-0AB0. Firmware version V2.0 is available for article number 6ES7551-1AB01-0AB0.
You can configure the module with the article number 6ES7551-1AB01-0AB0 as **replacement part compatible** with the article number 6ES7551-1AB00-0AB0.

Accessories

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

- Shield bracket
- Shield terminal
- Power supply element
- Labeling strip
- U-connector

Other components

The following component needs to be ordered separately:

- Front connectors, including potential jumpers and cable ties

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

2.2 Functions

2.2.1 Acquisition of encoder signals

2.2.1.1 Position input with SSI absolute encoder

You can use the TM PosInput 2 technology module per channel with one SSI absolute encoder for position detection. The technology module reads the position value via a synchronous serial interface from the SSI absolute encoder and makes it available to the controller.

You can switch the digital outputs of the technology module exactly at defined position values, independently of the user program. Position input with an SSI absolute encoder does not involve gate control.

Gray-code and dual-code

Gray-code and dual-code SSI absolute encoders are supported.

Range for position value

You can specify a frame length of 10 bits to 40 bits for the SSI absolute encoder. The configurable bit numbers of the LSB and the MSB of the position value in the frame define the value range. The technology module can read in a position value with a maximum length of 32 bits and transfer it to the controller.

Complete SSI frame

Instead of having a measured variable returned, you can choose to have the least significant 32 bit of the current unprocessed SSI frame returned. This provides you with encoder-specific additional bits, such as error bits, in addition to the position value. If the SSI frame is shorter than 32 bits, the complete SSI frame is returned right-aligned and the top unused bits are returned with "0" in the feedback interface.

Capture (Latch)

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

- Rising or falling edge of a digital input
- Both edges of a digital input

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

Measuring input

If you use Position input for Motion Control (Page 17), you can use the "Measuring input" technology object to execute a measuring input function with a hardware digital input.

Hardware interrupts

The technology module can trigger a hardware interrupt in the CPU when a comparison event, zero crossing and/or direction reversal occurs. You can specify which events during operation are to trigger a hardware interrupt.

2.2.1.2 Counting with incremental or pulse encoder

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

You can control the counting processes with the digital inputs. In addition, you can read the signal state of the respective digital input via the feedback interface.

You can specify the counter characteristics using the functions described below.

Counting limits

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

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

Start value

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

Gate control

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

Capture (Latch)

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

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

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

Measuring input

If you use Position input for Motion Control (Page 17), you can use the "Measuring input" technology object to execute a measuring input function with a hardware digital input.

Hardware interrupts

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

2.2.2 Measured value determination

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

- Frequency measurement with the unit of hertz
- Period measurement with the unit of seconds
- Velocity measurement with a flexibly adaptable unit
- Complete SSI frame instead of a measured quantity

Update time

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

Gate control for incremental and pulse encoders

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

2.2.3 Switching the outputs at comparison values

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

Comparison values in the Counting/Position input operating mode

In Counting/Position input operating mode you specify two position or counter values as comparison values depending on the encoder. If the current position or 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 for position detection for the following axis technology objects of S7-1500 Motion Control :

- TO_PositioningAxis
- TO_SynchronousAxis
- TO_ExternalEncoder

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

Additional information

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

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

2.2.5 Fast Mode

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

2.2.6 Additional functions

Synchronization for incremental and pulse encoder

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

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

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

Hysteresis

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

Diagnostic interrupt

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

Input filter

To suppress interference, you can configure an input filter for the RS422/TTL encoder inputs and for the digital inputs.

Isochronous mode

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

Wiring

3

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

You can find the pin assignment of the front connector and the power supply element in the following two sections.

You can find information on wiring the front connector, shielding the cable, etc., in system manual S7-1500 / ET 200MP Automation System (http://support.automation.siemens.com/WW/view/en/59191792), section Wiring.

Pin assignment for the power supply element

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

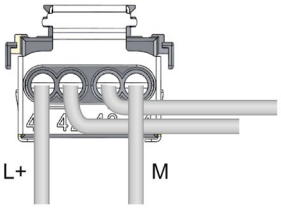


Figure 3-1 Connection of power supply element

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

An internal protective circuit protects the technology module from polarity reversal of the supply voltage. The technology module monitors the connection of the supply voltage.

Encoder supplies

For supplying the encoders and sensors connected to the digital inputs, the technology module provides supply voltages of 24 V DC (terminal 9/29) and 5 V DC (terminal 7/27) with reference to ground (terminals 8/28 and 10/30). Both voltages are monitored for short-circuit and overload.

Digital inputs DI0 and DI1

The digital inputs are used for gate control, synchronization and the Capture function.

The digital inputs of the two channels are not isolated from one another.

Input delay for digital inputs

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

Note

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

Digital outputs DQ0 and DQ1

The digital outputs of the two channels are not isolated from one another.

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

Relays and contactors can be directly connected without an external protective circuit. You can find information on the maximum possible operating frequencies and the inductive loads at the digital outputs in the section Technical specifications (Page 90).

3.1 SSI encoder signals

SSI encoder signals

The TM PosInput 2 can process SSI encoder signals. These are designated with data and clock and use the RS422 signal standard.

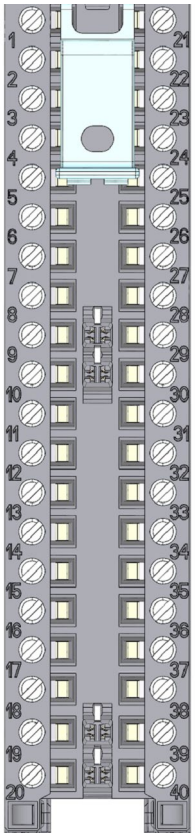
An RS422 encoder signal uses a pair of wires and the information is transmitted as differential voltage. This ensures interference-free transmission of RS422 encoder signals even with high frequencies over long distances. The RS422 wire pairs must each be twisted in the cable as well as outside the cable up to the terminal.

The SSI encoder signals data and clock are connected via the D and C terminals. The N terminals remain unconnected. The inputs are not isolated from each other. The inputs are isolated from the backplane bus.

Pin assignment for the front connector

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

Table 3- 1 Pin assignment of the front connector

Designation	Signal name		View	Signal name		Designation
Channel 0				**Channel 1**		
SSI data signal +D	+CH0.A/**D**	1		21	+CH1.A/**D**	SSI data signal +D
SSI data signal -D	-CH0.A/**D**	2		22	-CH1.A/**D**	SSI data signal -D
SSI clock signal +C	+CH0.B/**C**	3		23	+CH1.B/**C**	SSI clock signal +C
SSI clock signal -C	-CH0.B/**C**	4		24	-CH1.B/**C**	SSI clock signal -C
—	+CH0.N	5		25	+CH1.N	—
—	-CH0.N	6		26	-CH1.N	—
Encoder supply 5 V DC	5VDC	7		27	5VDC	Encoder supply 5 V DC
Ground[1]	M	8		28	M	Ground[1]
Encoder supply 24 V DC	24VDC	9		29	24VDC	Encoder supply 24 V DC
Ground[1]	M	10		30	M	Ground[1]
Digital input DI0	DI0.0	11		31	DI1.0	Digital input DI0
Digital input DI1	DI0.1	12		32	DI1.1	Digital input DI1
—	—	13		33	—	—
—	—	14		34	—	—
Digital output DQ0	DQ0.0	15		35	DQ1.0	Digital output DQ0
Digital output DQ1	DQ0.1	16		36	DQ1.1	Digital output DQ1
—	—	17		37	—	—
Ground[1]	M	18		38	M	Ground[1]
—	—	19		39	—	—
		20		40		

[1] Can be used for encoder supplies, digital inputs and digital outputs

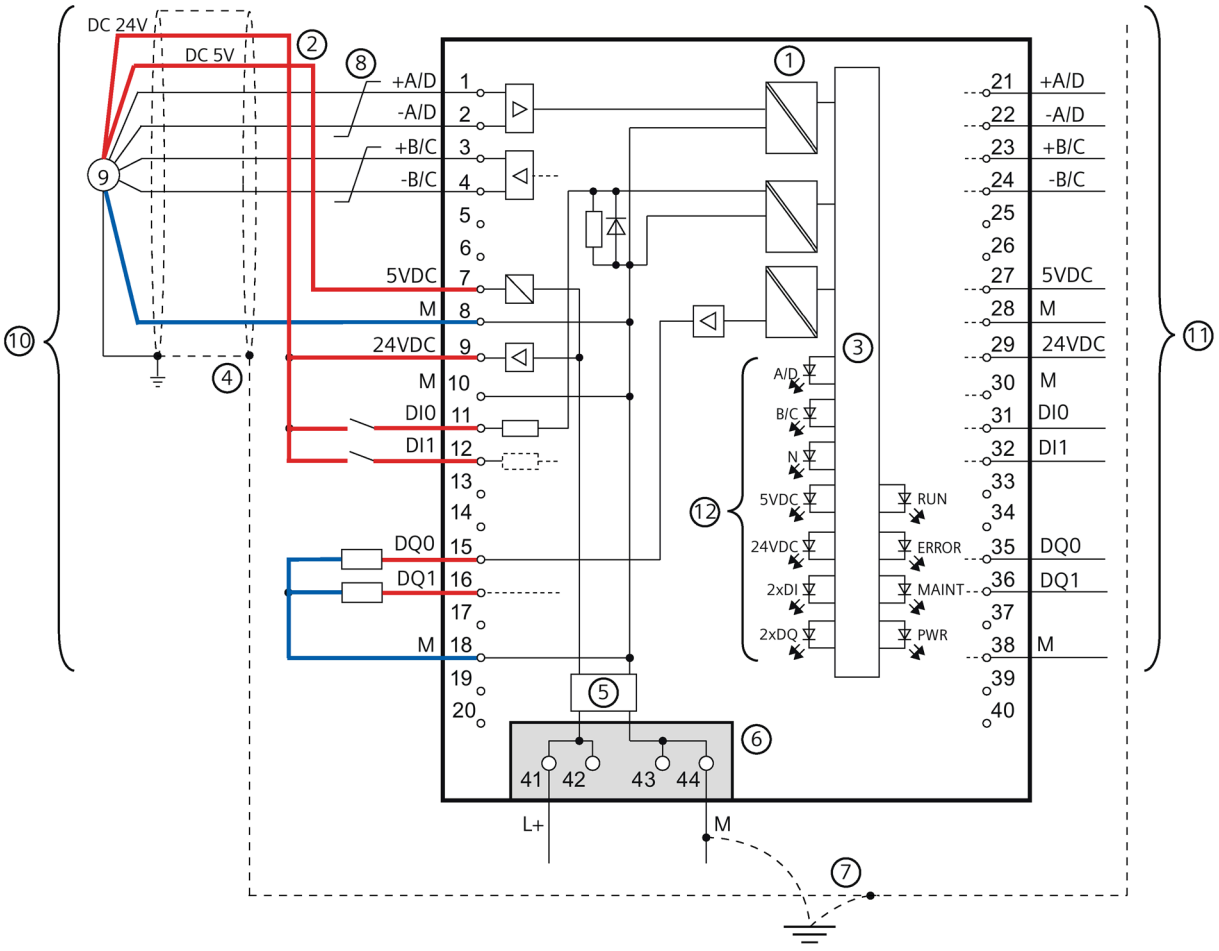
Note

Potential jumpers may not be inserted in the front connector.

Block diagram

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

The figure below shows the block diagram of the technology module with one connected SSI absolute encoder.



① Electrical isolation
② Encoder supply, optionally 5 V DC or 24 V DC, according to the specification of the encoder manufacturer
③ Technology and backplane bus interface
④ Shield support at the front connector
⑤ Input filter
⑥ Supply voltage via power supply element
⑦ Equipotential bonding
⑧ Twisted in pairs
⑨ SSI absolute encoder
⑩ Channel 0
⑪ Channel 1
⑫ Per channel

Figure 3-2 Block diagram with SSI absolute encoder

3.2 RS422 encoder signals

RS422 encoder signals/count signals

The TM PosInput 2 can process RS422 encoder signals. These counting encoder signals are designated with the letters A, B and N.

An RS422 encoder signal uses a pair of wires and the counter information is transmitted as differential voltage. This ensures interference-free transmission of RS422 encoder signals even with high frequencies over long distances. The RS422 wire pairs must each be twisted in the cable as well as outside the cable up to the terminal.

You can connect the following encoder types:

- RS422 incremental encoder with N signal:

  The encoder signals A, B and N are connected using the correspondingly marked terminals. A and B are the two incremental signals phase-shifted by 90°. N is the zero mark signal that supplies one pulse per revolution.

- RS422 incremental encoder without N signal:

  The encoder signals A and B are connected using the correspondingly marked terminals. A and B are the two incremental signals phase-shifted by 90°. The N terminals remain unconnected.

- RS422 pulse encoder without direction signal:

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

- RS422 pulse encoder with direction signal:

  The counting signal is connected to the A terminals. The direction signal is connected to the B terminals. Counting down takes place at a high level of the direction signal. The N terminals remain unconnected.

- RS422 pulse encoder with up/down count signal

  The up counting signal is connected to the A terminals. The down counting signal is connected to the B terminals. The N terminals remain unconnected.

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

Note

The RS422 signal standard offers greater interference immunity than the TTL signal standard. Therefore, if your incremental or pulse encoder supports the RS422 **and** the TTL signal standard, it is recommended to use the RS422 signal standard.

Pin assignment for the front connector

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

Table 3- 2 Pin assignment of the front connector: Channel 0

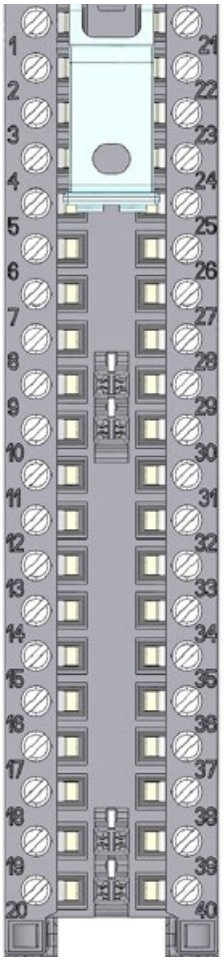
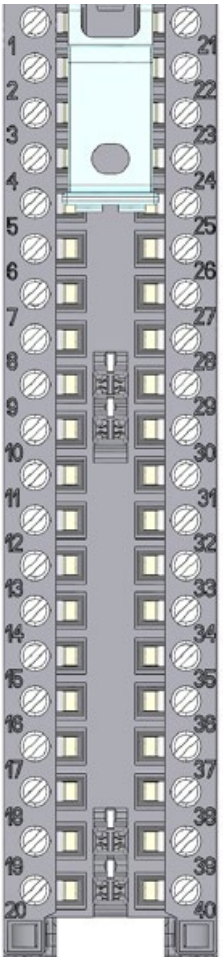
Designation					Signal name		View
RS422 incremental encoder		RS422 pulse encoder					
with signal N	without signal N	with direction signal	without direction signal	Up/ Down			
Encoder signal +A		Counting signal +A		Up counting signal +A	+CH0.**A**/D	1	
Encoder signal -A		Counting signal -A		Up counting signal -A	-CH0.**A**/D	2	
Encoder signal +B		Direction signal +B	—	Down counting signal +B	+CH0.**B**/C	3	
Encoder signal -B		Direction signal -B	—	Down counting signal -B	-CH0.**B**/C	4	
Encoder signal +N		—			+CH0.N	5	
Encoder signal -N		—			-CH0.N	6	
Encoder supply 5 V DC					5VDC	7	
Ground for encoder supplies and digital inputs					M	8	
Encoder supply 24 V DC					24VDC	9	
Ground for encoder supplies and digital inputs					M	10	
Digital input DI0					DI0.0	11	
Digital input DI1					DI0.1	12	
—					—	13	
—					—	14	
Digital output DQ0					DQ0.0	15	
Digital output DQ1					DQ0.1	16	
—					—	17	
Ground for digital outputs					M	18	
—					—	19	
						20	

Table 3- 3 Pin assignment of the front connector: Channel 1

View	Signal name		Designation					
			RS422 incremental encoder		RS422 pulse encoder			
			with signal N	without signal N	with direction signal	without direction signal	up/ down	
	21	+CH1.**A**/D	Encoder signal +A		Counting signal +A		Up counting signal +A	
	22	-CH1.**A**/D	Encoder signal -A		Counting signal -A		Up counting signal -A	
	23	+CH1.**B**/C	Encoder signal +B		Direction signal +B	—	Down counting signal +B	
	24	-CH1.**B**/C	Encoder signal -B		Direction signal -B	—	Down counting signal -B	
	25	+CH1.N	Encoder signal +N	—				
	26	-CH1.N	Encoder signal -N	—				
	27	5VDC	Encoder supply 5 V DC					
	28	M	Ground for encoder supplies and digital inputs					
	29	24VDC	Encoder supply 24 V DC					
	30	M	Ground for encoder supplies and digital inputs					
	31	DI1.0	Digital input DI0					
	32	DI1.1	Digital input DI1					
	33	—	—					
	34	—	—					
	35	DQ1.0	Digital output DQ0					
	36	DQ1.1	Digital output DQ1					
	37	—	—					
	38	M	Digital output ground					
	39	—	—					
	40							

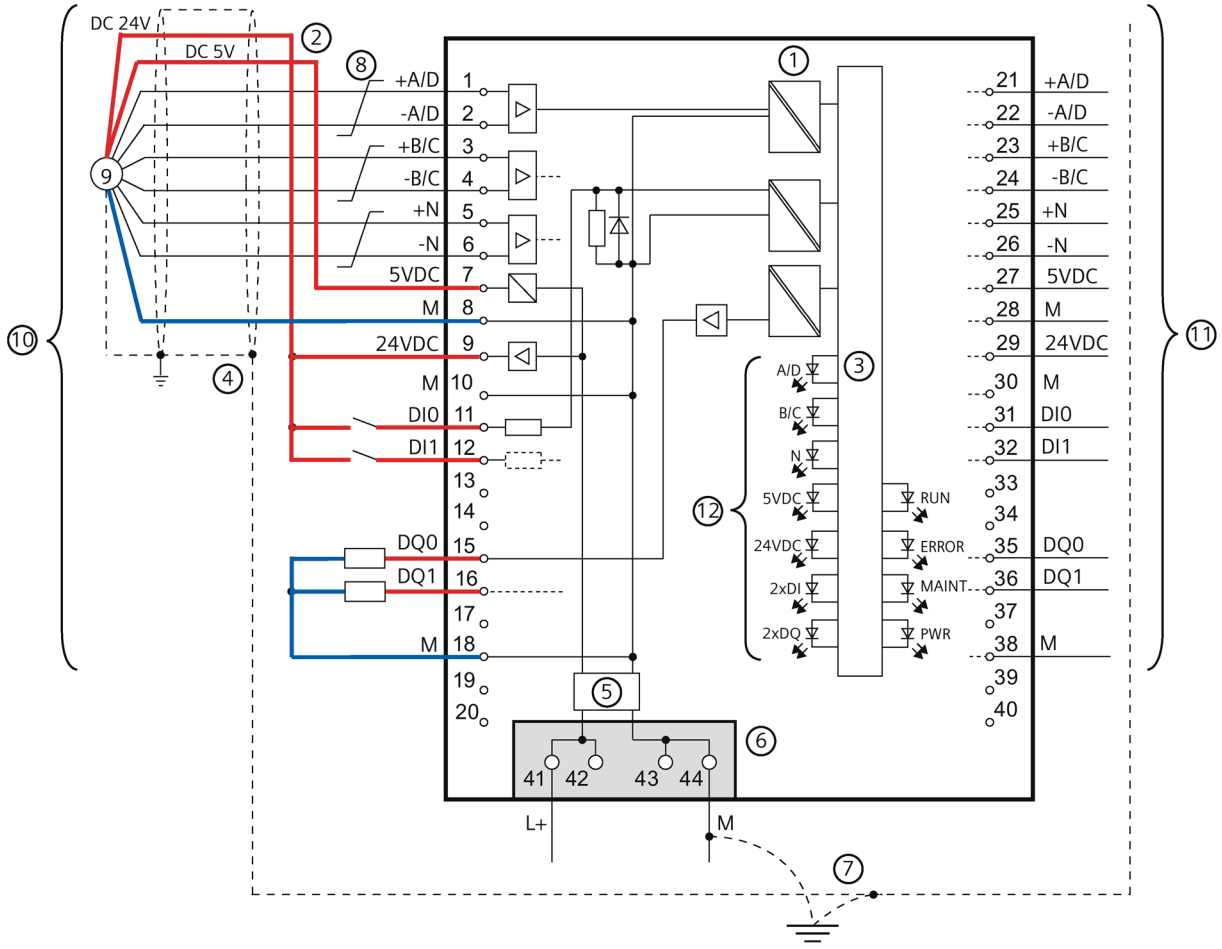
Note

Potential jumpers may not be inserted in the front connector.

Block diagram

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

The figure below shows the block diagram of the technology module with one connected RS422 incremental encoder.



① Electrical isolation
② Encoder supply, optionally 5 V DC or 24 V DC, according to the specification of the encoder manufacturer
③ Technology and backplane bus interface
④ Shield support at the front connector
⑤ Input filter
⑥ Supply voltage via power supply element
⑦ Equipotential bonding
⑧ Twisted in pairs
⑨ RS422 incremental encoder
⑩ Channel 0
⑪ Channel 1
⑫ Per channel

Figure 3-3 Block diagram with RS422 incremental encoder

3.3 TTL encoder signals

TTL encoder signals/counting signals

The TM PosInput 2 can process TTL encoder signals. The counting encoder signals are designated with the letters A, B and N. An encoder signal with TTL standard uses a single cable.

You can connect the following encoder types:

- TTL incremental encoder with N signal:

  The encoder signals A, B and N are connected using the correspondingly marked terminals. A and B are the two incremental signals phase-shifted by 90°. N is the zero mark signal that supplies one pulse per revolution.

- TTL incremental encoder without N signal:

  The encoder signals A and B are connected using the correspondingly marked terminals. A and B are the two incremental signals phase-shifted by 90°. The N terminal remains unconnected.

- TTL pulse encoder without direction signal:

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

- TTL pulse encoder with direction signal:

  The counting signal is connected to the A terminal. The direction signal is connected to the B terminal. Counting down takes place at a high level of the direction signal. The N terminal remains unconnected.

- TTL pulse encoder with up/down counting signal

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

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

Note

The RS422 signal standard offers greater interference immunity than the TTL signal standard. If your incremental encoder or pulse encoder supports the RS422 **and** the TTL signal standard, we recommend using the RS422 signal standard.

Pin assignment for the front connector

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

Table 3- 4 Pin assignment of the front connector: Channel 0

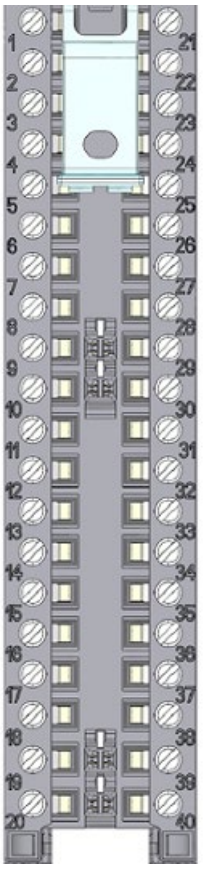
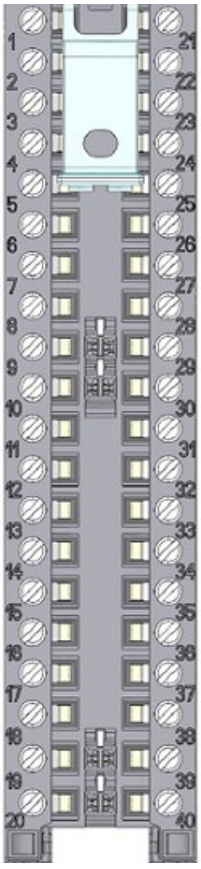
Designation					Signal name		View
TTL incremental encoder		TTL pulse encoder					
with signal N	without signal N	with direction signal	without direction signal	Up/ Down			
Encoder signal A		Counting signal A		Up counting signal A	+CH0.**A**/D	1	
—					-CH0.**A**/D	2	
Encoder signal B		Direction signal B	—	Down counting signal B	+CH0.**B**/C	3	
—					-CH0.**B**/C	4	
Encoder signal N	—				+CH0.N	5	
					-CH0.N	6	
Encoder supply 5 V DC					5VDC	7	
Ground for encoder supplies and digital inputs					M	8	
Encoder supply 24 V DC					24VDC	9	
Ground for encoder supplies and digital inputs					M	10	
Digital input DI0					DI0.0	11	
Digital input DI1					DI0.1	12	
—					—	13	
—					—	14	
Digital output DQ0					DQ0.0	15	
Digital output DQ1					DQ0.1	16	
—					—	17	
Ground for digital outputs					M	18	
—					—	19	
						20	

Table 3- 5 Pin assignment of the front connector: Channel 1

View	Signal name		Designation				
			TTL incremental encoder		TTL pulse encoder		
			with signal N	without signal N	with direction signal	without direction signal	up/ down
	21	+CH1.**A**/D	Encoder signal A		Counting signal A		Up counting signal A
	22	-CH1.**A**/D	—				
	23	+CH1.**B**/C	Encoder signal B		Direction signal B	—	Down counting signal B
	24	-CH1.**B**/C	—				
	25	+CH1.N	Encoder signal N	—			
	26	-CH1.N	—				
	27	5VDC	Encoder supply 5 V DC				
	28	M	Ground for encoder supplies and digital inputs				
	29	24VDC	Encoder supply 24 V DC				
	30	M	Ground for encoder supplies and digital inputs				
	31	DI1.0	Digital input DI0				
	32	DI1.1	Digital input DI1				
	33	—	—				
	34	—	—				
	35	DQ1.0	Digital output DQ0				
	36	DQ1.1	Digital output DQ1				
	37	—	—				
	38	M	Digital output ground				
	39	—	—				
	40						

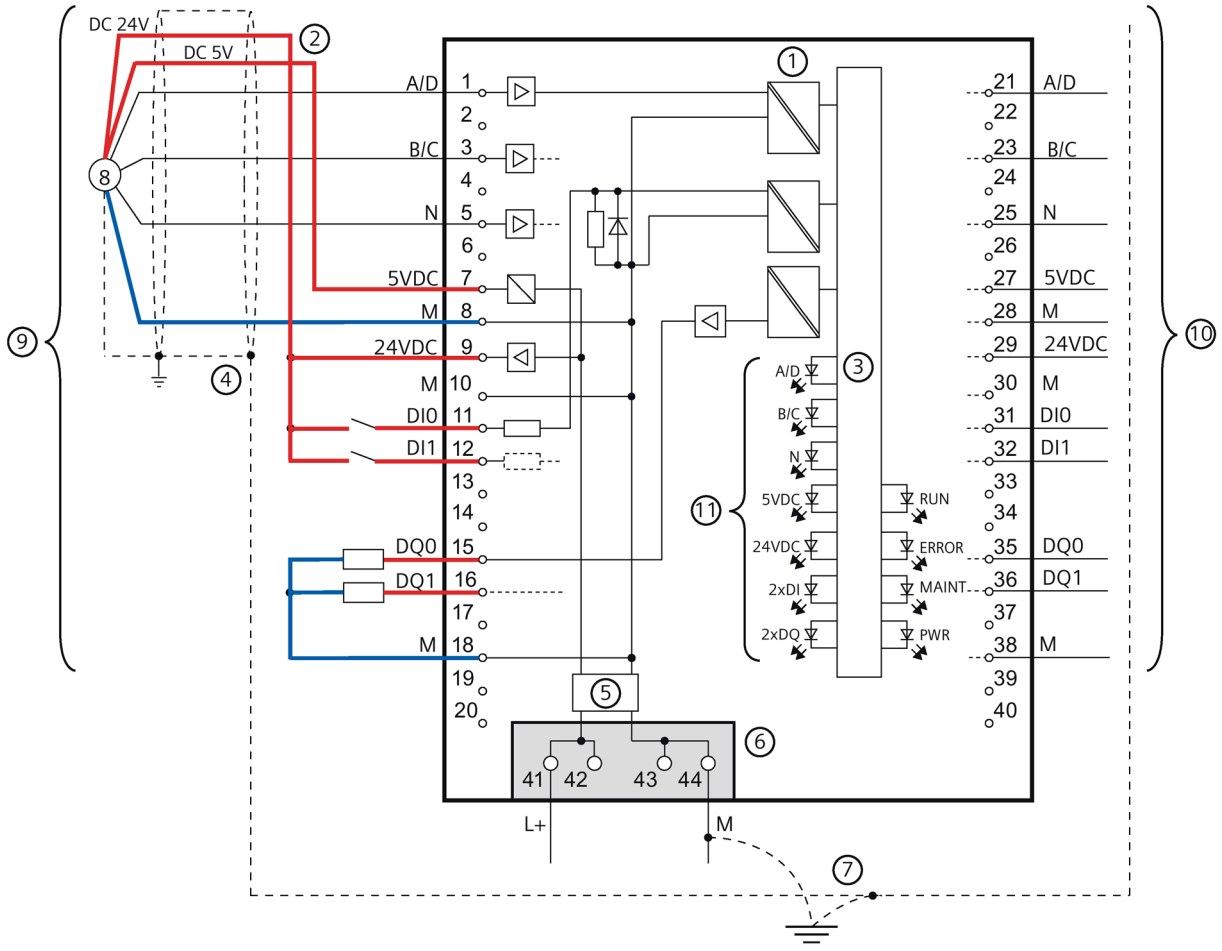
Note

Potential jumpers may not be inserted in the front connector.

Block diagram

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

The figure below shows the block diagram of the technology module with one connected TTL incremental encoder.



① Electrical isolation
② Encoder supply, optionally 5 V DC or 24 V DC, according to the specification of the encoder manufacturer
③ Technology and backplane bus interface
④ Shield support at the front connector
⑤ Input filter
⑥ Supply voltage via power supply element
⑦ Equipotential bonding
⑧ TTL incremental encoder
⑨ Channel 0
⑩ Channel 1
⑪ Per channel

Figure 3-4 Circuit diagram with TTL incremental encoder

Configuring/address space

4

4.1 Operating with "Counting and measurement" technology object

4.1.1 Configuring

Introduction

You configure the technology module and assign its parameters with STEP 7 (TIA Portal).

The technology object is used to control and monitor the functions of the technology module.

System environment

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

Applications	Components required	Configuration software	In the user program
Central operation with an S7-1500 CPU	• S7-1500 automation system • TM PosInput 2	STEP 7 (TIA Portal): • Device configuration with hardware configuration • Parameter setting with "Counting and measurement" technology object	For incremental / pulse encoders: High_Speed_Counter instruction For SSI absolute encoder: SSI_Absolute_Encoder instruction
Distributed operation with an S7-1500 CPU	• S7-1500 automation system • ET 200MP distributed I/O system • TM PosInput 2		

Additional information

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

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

Hardware Support Packages (HSP)

If you are using TIA Portal version V17, firmware versions ≤ V1.3 of the module (6ES7551-1AB00-0AB0) are integrated. You can configure the module with the article number 6ES7551-1AB01-0AB0 as replacement part compatible with the article number 6ES7551-1AB00-0AB0. You integrate the firmware version V2.0 of the module (6ES7551-1AB01-0AB0) using HSP0355. Firmware version V2.0 of the module is integrated into the following TIA Portal versions.

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

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

4.1.2 Parameter setting

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

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

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

Note

The "Operating with "Counting and measurement" technology object" and "Manual operation (without technology object)" operating modes apply to one channel in each case. As a result, you can also use a module with both operating modes.

4.1.2.1 Parameters (SSI absolute encoder)

Parameters of the TM PosInput 2 with SSI absolute encoder

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

Table 4- 1 Settable parameters and their default setting (SSI absolute encoder)

Parameter	Value range	Scope
Reaction to CPU STOP	• **Output substitute value** • Keep last value • Continue operation	Channel
Enable diagnostic interrupt on wire break	• **Deactivated** • Activated	Channel
Enable additional diagnostic interrupts	• **Deactivated** • Activated	Channel
Hardware interrupt: New Capture value available	• **Deactivated** • Activated	Channel
Hardware interrupt: Direction reversal	• **Deactivated** • Activated	Channel
Hardware interrupt: Zero crossing	• **Deactivated** • Activated	Channel
Hardware interrupt: Comparison event for DQ0 occurred	• **Deactivated** • Activated	Channel
Hardware interrupt: Comparison event for DQ1 occurred	• **Deactivated** • Activated	Channel

The following parameter settings are possible in the technology object:

Table 4- 2 Settable parameters and their default setting (SSI absolute encoder)

Parameter	Value range	Scope
Frame length	10 bits...**13 bits**...40 bits	Channel
Code type	• **Gray** • Dual	Channel
Transmission rate	• **125 kHz** • 250 kHz • 500 kHz • 1 MHz • 1.5 MHz • 2 MHz	Channel
Monoflop time	• **Automatically** • 16 µs • 32 µs • 48 µs • 64 µs	Channel
Parity	• **None** • Even • Odd	Channel
Bit number LSB of the position value	**0**...38	Channel
Bit number MSB of the position value	1...**12**...39	Channel
Invert direction (position value)	**Deactivated** Activated	Channel
Set function of DI	• Capture • **Digital input without function**	Channel
Input delay for digital inputs	• None • 0.05 ms • **0.1 ms** • 0.4 ms • 0.8 ms • 1.6 ms • 3.2 ms • 12.8 ms • 20 ms	Channel

Parameter	Value range	Scope
Edge selection for DI	• **At rising edge** • At falling edge • At rising and falling edge	Channel
Frequency of Capture function	• Once • **Periodic**	Channel
Comparison value 0	-2147483648...**0**...2147483647	Channel
Comparison value 1	-2147483648...**10**...2147483647	Channel
Operating mode	• **Use position value (SSI absolute value) as reference** • Use measured value as reference	Channel
Set output	• **Between comparison value and count high limit / measured value >= comparison value** • Between comparison value and low limit / measured value <= comparison value • At comparison value for a pulse duration • After set command from CPU until comparison value • Between comparison value 0 and 1 • Not between comparison value 0 and 1 • Use by user program	Channel
Count direction of DQ function	• Up • Down • **In both directions**	Channel
Pulse duration	0,0...**500,0**...6553,5 ms	Channel
Substitute value for DQ0	• **0** • 1	Channel
Substitute value for DQ1	• **0** • 1	Channel
Hysteresis (in increments)	**0**...255	Channel
Measured variable	• **Frequency** • Period • Velocity • Complete SSI frame	Channel

Parameter	Value range	Scope
Update time of the measuring function	0...**10**...25000 ms	Channel
Time base for velocity measurement	• 1 ms • 10 ms • 100 ms • 1 s • **60 s**	Channel
Increments per unit	**1**...65535	Channel

NOTICE

Excessive axis speed can provide wrong direction of rotation

If an axis connected to an SSI absolute encoder rotates so quickly that more than half of the value range is covered within one module cycle[1], the velocity and direction of rotation can no longer be determined correctly. As a result, the following may function incorrectly:

- DQ functions
- Feedback bits EVENT_OFLW, EVENT_UFLW, EVENT_ZERO, EVENT_CMP0, EVENT_CMP1 and STS_DIR

[1] Non-isochronous mode: 500 µs; isochronous mode: PROFINET cycle time

Note

If you use an SSI absolute encoder whose value range does not correspond to a power of 2, the calculated velocity measurement can be incorrect at the moment of the overflow.

Explanation of parameters

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

4.1.2.2 Parameters (incremental or pulse encoder)

Parameters of the TM PosInput 2 with incremental or pulse encoder

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

Table 4- 3 Settable parameters and their default setting (incremental or pulse encoder)

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

The following parameter settings are possible in the technology object:

Table 4- 4 Settable parameters and their default setting (incremental or pulse encoder)

Parameter	Value range	Scope
Signal type	• Pulse (A) • **Pulse (A) and direction (B)** • Count up (A), count down (B) • Incremental encoder (A, B phase-shifted) • Incremental encoder (A, B, N)	Channel
Signal evaluation for counter inputs	• **Single** • Double • Quadruple	Channel
Invert direction (counter inputs)	• **Deactivated** • Activated	Channel
Filter frequency for counter inputs	• 100 Hz • 200 Hz • 500 Hz • 1 kHz • 2 kHz • 5 kHz • 10 kHz • 20 kHz • 50 kHz • 100 kHz • 200 kHz • 500 kHz • **1 MHz**	Channel
Interface standard	• **RS422, symmetrical** • TTL (5 V), asymmetrical	Channel
Reaction to signal N	• **No reaction to signal N** • Synchronization at signal N • Capture at signal N	Channel
Frequency of synchronization	• **Once** • Periodic	Channel
Frequency of Capture function	• Once • **Periodic**	Channel

Parameter	Value range	Scope
Counting high limit	-2147483648...**2147483647**	Channel
Start value	-2147483648...**0**...2147483647	Channel
Counting low limit	**-2147483648**...2147483647	Channel
Reaction to violation of a counting limit	• Stop counting • **Continue counting**	Channel
Reset when counting limit is violated	• **To opposite counting limit** • To start value	Channel
Reaction to gate start	• Set to start value • **Continue with current value**	Channel
Set function of DI	• Gate start/stop (level-triggered) • Gate start (edge-triggered) • Gate stop (edge-triggered) • Synchronization • Enable synchronization at signal N • Capture • **Digital input without function**	Channel
Input delay for digital inputs	• None • 0.05 ms • **0.1 ms** • 0.4 ms • 0.8 ms • 1.6 ms • 3.2 ms • 12.8 ms • 20 ms	Channel
Edge selection for DI	• **At rising edge** • At falling edge • At rising and falling edge	Channel
Select level for DI	• **Active with high level** • Active with low level	Channel
Behavior of counter value after Capture with DI	• **Continue counting** • Set to start value and continue counting	Channel
Comparison value 0	-2147483648...**0**...2147483647	Channel
Comparison value 1	-2147483648...**10**...2147483647	Channel
Operating mode	• **Use counter value as reference** • Use measured value as reference	Channel

Parameter	Value range	Scope
Set output	• **Between comparison value and count high limit / measured value >= comparison value** • Between comparison value and low limit / measured value <= comparison value • At comparison value for a pulse duration • After set command from CPU until comparison value • Between comparison value 0 and 1 • Not between comparison value 0 and 1 • Use by user program	Channel
Count direction of DQ function	• Up • Down • **In both directions**	Channel
Pulse duration	0,0...**500,0**...6553,5 ms	Channel
Substitute value for DQ0	• **0** • 1	Channel
Substitute value for DQ1	• **0** • 1	Channel
Hysteresis (in increments)	**0**...255	Channel
Measured variable	• **Frequency** • Period • Velocity	Channel
Update time of the measuring function	0...**10**...25000 ms	Channel
Time base for velocity measurement	• 1 ms • 10 ms • 100 ms • 1 s • **60 s**	Channel
Increments per unit	**1**...65535	Channel

Explanation of parameters

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

4.1.3 Address space

Address space of the technology module

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

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

The control and feedback interface is compatible with manual operation (Page 50) and is operated by the instruction High_Speed_Counter or SSI_Absolute_Encoder.

4.1.4 Reaction to CPU STOP

Reaction to CPU STOP

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

Table 4- 6 Reaction of technology module to CPU STOP

Option	**Meaning**
Continue operation	The technology module remains fully functional. Incoming count pulses are processed or the position value is read in. 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 (with incremental encoders or pulse encoders) and the digital outputs switch according to the parameter assignment.
Keep last value	The technology module outputs the values at the digital outputs that were valid when the transition to STOP took place until the next CPU STOP-RUN transition. If a digital output with the "At comparison value for a pulse duration" function is set at CPU STOP, the digital output is reset after the pulse duration elapses. The technology module is returned to its startup state after a STOP-RUN transition: The counter value is set to the Start value (with incremental encoders or pulse encoders) and the digital outputs switch according to the parameter assignment.

4.1.5 Isochronous mode

The technology module supports the "Isochronous mode" system function. This system function enables position, counter 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 status change of a digital input immediately triggers the specified reaction of the technology module and the change of the status bit of the digital input in the feedback interface.

Use an OB of type "Synchronous Cycle" (e.g. OB61) in this operating mode. The High_Speed_Counter or SSI_Absolute_Encoder instruction is called in the assigned OB.

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

Data processing

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

Isochronous mode parameters

In isochronous mode, the following parameter can affect the isochronous mode parameters of the sync domain.

- Filter frequency
- Frame length
- Transmission rate
- Monoflop time
- Parity

Because the isochronous mode parameters are not checked in RUN, overflows can occur if you change one or more of the indicated parameters in RUN. To prevent overflows, select the option with the largest time required in the offline parameter assignment.

Additional information

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

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

4.2 Position input for "Motion Control" technology object

4.2.1 Configuring

Introduction

You configure the technology module and assign its parameters with STEP 7 (TIA Portal).

The technology object is used to control and monitor the functions of the technology module.

System environment

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

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

Additional information

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

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

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

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

Hardware Support Packages (HSP)

If you are using TIA Portal version V17, firmware versions ≤ V1.3 of the module (6ES7551-1AB00-0AB0) are integrated. You can configure the module with the article number 6ES7551-1AB01-0AB0 as replacement part compatible with the article number 6ES7551-1AB00-0AB0. You integrate the firmware version V2.0 of the module (6ES7551-1AB01-0AB0) using HSP0355. Firmware version V2.0 of the module is integrated into the following TIA Portal versions.

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

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

4.2.2 Parameter setting

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

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

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

Note

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

4.2.2.1 Parameters (SSI absolute encoder)

Parameters of the TM PosInput 2 with SSI absolute encoder

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

Table 4- 7 Settable parameters and their default setting (SSI absolute encoder)

Parameter	Value range	Scope
Invert direction (position value)	• **Deactivated** • Activated	Channel
Frame length	10 bits...**13 bits**...40 bits	Channel
Code type	• **Gray** • Dual	Channel
Transmission rate	• **125 kHz** • 250 kHz • 500 kHz • 1 MHz • 1.5 MHz • 2 MHz	Channel
Monoflop time	• **Automatically** • 16 µs • 32 µs • 48 µs • 64 µs	Channel
Parity	• **None** • Even • Odd	Channel
Bit number LSB of the position value	**0**...38	Channel
Bit number MSB of the position value	1...**12**...39	Channel
Measuring input	**DI1**	Channel
Encoder type	• Linear • **Rotary**	Channel
Steps per revolution	**1**...65535	Channel
Number of revolutions	is calculated automatically (read-only)	Channel
Reference speed	6.00...**3000.00**...210000.00 U/min	Channel
Distance between increments	**16000 nm**	Channel
Reference velocity	0,60...**16,00**...600,00 m/min	Channel

Parameter	Value range	Scope
Enable diagnostic interrupt on wire break	• **Deactivated** • Activated	Channel
Enable additional diagnostic interrupts	• **Deactivated** • Activated	Channel

NOTICE
Excessive axis speed can result in an incorrect position value The function of an axis technology object is based on the assumption that the axis position within a module cycle[1] never changes by more than half of the value range. Ensure that this condition is always met when configuring your system. [1] Non-isochronous mode: 500 µs; isochronous mode: PROFINET cycle time

Explanation of parameters

You can find a detailed description of the parameters in function manual Counting, Measurement and Position Detection, section Module parameters (position input for Motion Control) available for download on the Internet (http://support.automation.siemens.com/WW/view/en/59709820).

4.2.2.2 Parameters (incremental or pulse encoder)

Parameters of the TM PosInput 2 with incremental or pulse encoder

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

Table 4- 8 Settable parameters and their default setting (incremental or pulse encoder)

Parameter	Value range	Scope
Signal type	• Pulse (A) • **Pulse (A) and direction (B)** • Count up (A), count down (B) • Incremental encoder (A, B phase-shifted) • Incremental encoder (A, B, N)	Channel
Invert direction (counter inputs)	• **Deactivated** • Activated	Channel

Parameter	Value range	Scope
Signal evaluation for counter inputs	• **Single** • Double • Quadruple	Channel
Filter frequency for counter inputs	• 100 Hz • 200 Hz • 500 Hz • 1 kHz • 2 kHz • 5 kHz • 10 kHz • 20 kHz • 50 kHz • 100 kHz • 200 kHz • 500 kHz • **1 MHz**	Channel
Interface standard	• **RS422, symmetrical** • TTL (5 V), asymmetrical	Channel
Signal selection for reference mark 0	• DI0 • **Signal N of incremental encoder**	Channel
Measuring input	**DI1**	Channel
Encoder type	• Linear • **Rotary**	Channel
Increments per revolution / steps per revolution	**1**...65535	Channel
Reference speed	6.00...**3000.00**...210000.00 U/min	Channel
Distance between increments	1...**16000**...25000000 nm	Channel
Fine-resolution increment distance	is calculated automatically (read-only)	Channel
Reference velocity	0,60...**16,00**...600,00 m/min	Channel
Enable diagnostic interrupt on wire break	• **Deactivated** • Activated	Channel
Enable additional diagnostic interrupts	• **Deactivated** • Activated	Channel

Explanation of parameters

You can find a detailed description of the parameters in function manual Counting, Measurement and Position Detection, section Module parameters (position input for Motion Control) available for download on the Internet (http://support.automation.siemens.com/WW/view/en/59709820).

4.2.3 Address space

Address space of the technology module

Table 4- 9 Size of input and output addresses of the TM PosInput 2 with position input for "Motion Control" technology object

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

4.2.4 Control interface and feedback interface

4.2.4.1 Assignment of the control interface

The control interface is reserved for Motion Control instructions.

4.2.4.2 Assignment of the feedback interface

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

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

4.2.5 Isochronous mode

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

In isochronous mode, the cycle of the user program, the transmission of the input signals and processing in the technology module are synchronized. A status change of a digital input immediately triggers the specified reaction of the technology module and the change of the status bit of the digital input in the feedback interface.

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

Data processing

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

Isochronous mode parameters

In isochronous mode, the following parameter can affect the isochronous mode parameters of the sync domain.

- Filter frequency
- Frame length
- Transmission rate
- Monoflop time
- Parity

To prevent overflows, select the option with the largest time required in the offline parameter assignment.

Additional information

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

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

4.3 Manual operation (without technology object)

4.3.1 Configuring

Introduction

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

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

System environment

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

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

Additional information

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

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

Hardware Support Packages (HSP)

If you are using TIA Portal version V17, firmware versions ≤ V1.3 of the module (6ES7551-1AB00-0AB0) are integrated. You can configure the module with the article number 6ES7551-1AB01-0AB0 as replacement part compatible with the article number 6ES7551-1AB00-0AB0. You integrate the firmware version V2.0 of the module (6ES7551-1AB01-0AB0) using HSP0355. Firmware version V2.0 of the module is integrated into the following TIA Portal versions.

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

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

GSD file

You can find the respective GSD file for the ET 200MP distributed I/O system for download on the Internet:

- GSD file for PROFINET IO (http://support.automation.siemens.com/WW/view/en/68189683)
- GSD file for PROFIBUS DP (http://support.automation.siemens.com/WW/view/en/80206700)

4.3.2 Parameter setting

You specify the properties of the technology module using various parameters. Depending on the settings, not all parameters are available. When parameters are assigned in the user program, the parameters are transferred to the module with the "WRREC" instruction and data record 128 (Page 100).

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

Parameter setting using...	Basic procedure
Hardware configuration in STEP 7 (TIA Portal)	1. Insert the module from the hardware catalog under "Technology modules". 2. Set the operating mode "Manual operation (without technology object)" and the additional device configuration in the hardware configuration. 3. Download the project to the CPU.
Hardware configuration with GSD file for distributed operation on PROFINET IO	1. Install the current PROFINET GSD file. You will then find the module in the hardware catalog under "Other field devices > PROFINET IO > I/O". 2. Set the parameters in the hardware configuration. You can find information on the respective dependencies of the parameters in function manual Counting, Measurement and Position Detection (http://support.automation.siemens.com/WW/view/en/59709820). 3. Download the project to the CPU.
Hardware configuration with GSD file for distributed operation on PROFIBUS DP	1. Install the current PROFIBUS GSD file. You will then find the module in the hardware catalog under "Other field devices > PROFIBUS DP > I/O". 2. Set the parameters in the hardware configuration. You can find information on the respective dependencies of the parameters in function manual Counting, Measurement and Position Detection (http://support.automation.siemens.com/WW/view/en/59709820). The parameters marked with [1] in the following tables are not configurable in the PROFIBUS GSD file. 3. Download the project to the CPU. The parameters marked with [1] in the following tables are downloaded with their default setting. 4. If necessary, set the parameters marked with [1] in the user program using data record 128.

Note

The "Operating with "Counting and measurement" technology object" and "Manual operation (without technology object)" operating modes apply to one channel in each case. As a result, you can also use a module with both operating modes.

4.3.2.1 Parameters (SSI absolute encoder)

Parameters of the TM PosInput 2 with SSI absolute encoder

The following parameter settings are possible:

Table 4- 10 Settable parameters and their default setting (SSI absolute encoder)

Parameter	Value range	Scope
Operating mode[3]	• **Position input** • Measuring	Channel
Reaction to CPU STOP[1]	• **Output substitute value** • Keep last value • Continue operation	Channel
Substitute value for DQ0[1]	• **0** • 1	Channel
Substitute value for DQ1[1]	• **0** • 1	Channel
Enable diagnostic interrupt on wire break[2]	• **Deactivated** • Activated	Channel
Enable additional diagnostic interrupts	• **Deactivated** • Activated	Channel
Hardware interrupt: New Capture value available[1]	• **Deactivated** • Activated	Channel
Hardware interrupt: Direction reversal[1]	• **Deactivated** • Activated	Channel
Hardware interrupt: Zero crossing[1]	• **Deactivated** • Activated	Channel
Hardware interrupt: Comparison event for DQ0 occurred[1]	• **Deactivated** • Activated	Channel
Hardware interrupt: Comparison event for DQ1 occurred[1]	• **Deactivated** • Activated	Channel
Invert direction[1] (position value)	• **Deactivated** • Activated	Channel
Frame length	10 bits...**13 bits**...40 bits	Channel
Code type	• **Gray** • Dual	Channel

Parameter	Value range	Scope
Transmission rate	• **125 kHz** • 250 kHz • 500 kHz • 1 MHz • 1.5 MHz • 2 MHz	Channel
Monoflop time[1]	• **Automatically** • 16 µs • 32 µs • 48 µs • 64 µs	Channel
Parity	• **None** • Even • Odd	Channel
Bit number LSB of the position value	**0**...38	Channel
Bit number MSB of the position value	1...**12**...39	Channel
Set function of DI	• Capture • **Digital input without function**	Channel
Input delay for digital inputs[1]	• None • 0.05 ms • **0.1 ms** • 0.4 ms • 0.8 ms • 1.6 ms • 3.2 ms • 12.8 ms • 20 ms	Channel
Edge selection for DI[1]	• **At rising edge** • At falling edge • At rising and falling edge	Channel
Frequency of Capture function[1]	• Once • **Periodic**	Channel

Parameter	Value range	Scope
Set output	• **Between comparison value and count high limit / measured value >= comparison value** • Between comparison value and low limit / measured value <= comparison value • At comparison value for a pulse duration • After set command from CPU until comparison value • Between comparison value 0 and 1 • Not between comparison value 0 and 1 • Use by user program	Channel
Comparison value 0[1]	-2147483648...**0**...2147483647	Channel
Comparison value 1[1]	-2147483648...**10**...2147483647	Channel
Count direction of DQ function[1]	• Up • Down • **In both directions**	Channel
Pulse duration[1]	0,0...**500,0**...6553,5 ms	Channel
Hysteresis (in increments)[1]	**0**...255	Channel
Measured variable	• **Frequency** • Period • Velocity • Complete SSI frame	Channel
Update time of the measuring function[1]	0...**10**...25000 ms	Channel
Time base for velocity measurement[1]	• 1 ms • 10 ms • 100 ms • 1 s • **60 s**	Channel
Increments per unit[1]	**1**...65535	Channel

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

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

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

NOTICE
Excessive axis speed can provide wrong direction of rotation If an axis connected to an SSI absolute encoder rotates so quickly that more than half of the value range is covered within one module cycle[1], the velocity and direction of rotation can no longer be determined correctly. As a result, the following may function incorrectly: • DQ functions • Feedback bits EVENT_OFLW, EVENT_UFLW, EVENT_ZERO, EVENT_CMP0, EVENT_CMP1 and STS_DIR [1] Non-isochronous mode: 500 µs; isochronous mode: PROFINET cycle time

Note

If you use an SSI absolute encoder whose value range does not correspond to a power of 2, the calculated velocity measurement can be incorrect at the moment of the overflow.

Explanation of parameters

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

4.3.2.2 Parameters (incremental or pulse encoder)

Parameters of the TM PosInput 2 with incremental or pulse encoder

The following parameter settings are possible:

Table 4- 11 Settable parameters and their default setting (incremental or pulse encoder)

Parameter	Value range	Scope
Operating mode[3]	• **Counting** • Measuring	Channel
Reaction to CPU STOP[1]	• **Output substitute value** • Keep last value • Continue operation	Channel
Substitute value for DQ0[1]	• **0** • 1	Channel
Substitute value for DQ1[1]	• **0** • 1	Channel
Enable diagnostic interrupt on wire break[2]	• **Deactivated** • Activated	Channel
Enable additional diagnostic interrupts	• **Deactivated** • Activated	Channel
Hardware interrupt: New Capture value available[1]	• **Deactivated** • Activated	Channel
Hardware interrupt: Synchronization of the counter by an external signal[1]	• **Deactivated** • Activated	Channel
Hardware interrupt: Gate start[1]	• **Deactivated** • Activated	Channel
Hardware interrupt: Gate stop[1]	• **Deactivated** • Activated	Channel
Hardware interrupt: Overflow (high counting limit violated)[1]	• **Deactivated** • Activated	Channel
Hardware interrupt:Underflow (low counting limit violated)[1]	• **Deactivated** • Activated	Channel
Hardware interrupt: Direction reversal[1]	• **Deactivated** • Activated	Channel
Hardware interrupt: Zero crossing[1]	• **Deactivated** • Activated	Channel
Hardware interrupt: Comparison event for DQ0 occurred[1]	• **Deactivated** • Activated	Channel
Hardware interrupt: Comparison event for DQ1 occurred[1]	• **Deactivated** • Activated	Channel

Parameter	Value range	Scope
Signal type	• Pulse (A) • **Pulse (A) and direction (B)** • Count up (A), count down (B) • Incremental encoder (A, B phase-shifted) • Incremental encoder (A, B, N)	Channel
Signal evaluation for counter inputs	• **Single** • Double • Quadruple	Channel
Filter frequency for counter inputs[1]	• 100 Hz • 200 Hz • 500 Hz • 1 kHz • 2 kHz • 5 kHz • 10 kHz • 20 kHz • 50 kHz • 100 kHz • 200 kHz • 500 kHz • **1 MHz**	Channel
Invert direction[1] (counter inputs)	• **Deactivated** • Activated	Channel
Reaction to signal N[1]	• **No reaction to signal N** • Synchronization at signal N • Capture at signal N	Channel
Frequency of synchronization[1]	• **Once** • Periodic	Channel
Frequency of Capture function[1]	• Once • **Periodic**	Channel
Interface standard	• **RS422, symmetrical** • TTL (5 V), asymmetrical	Channel

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

Parameter	Value range	Scope
Comparison value 0[1]	-2147483648...**0**...2147483647	Channel
Comparison value 1[1]	-2147483648...**10**...2147483647	Channel
Count direction of DQ function[1]	• Up • Down • **In both directions**	Channel
Pulse duration[1]	0,0...**500,0**...6553,5 ms	Channel
Hysteresis (in increments)[1]	**0**...255	Channel
Measured variable	• **Frequency** • Period • Velocity	Channel
Update time of the measuring function[1]	0...**10**...25000 ms	Channel
Time base for velocity measurement[1]	• 1 ms • 10 ms • 100 ms • 1 s • **60 s**	Channel
Increments per unit[1]	**1**...65535	Channel

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

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

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

Explanation of parameters

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

4.3.3 Address space

Address space of the technology module

Table 4- 12 Size of input and output addresses of the TM PosInput 2 with manual operation

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

4.3.4 Control and feedback interface

Note

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

4.3.4.1 Assignment of the control interface

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

Control interface per channel

The following table shows the assignment of the control interface:

Byte offset from start address Channel 0/1 ↓ ↓		**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0 … 3	12 … 15	SLOT_0: DINT or REAL: Load value (meaning of the value is specified in LD_SLOT_0) Value range: –2147483648 to 2147483647$_D$ or 80000000 to 7FFFFFFF$_H$							
4 … 7	16 … 19	SLOT_1: DINT or REAL: Load value (meaning of the value is specified in LD_SLOT_1) Value range: –2147483648 to 2147483647$_D$ or 80000000 to 7FFFFFFF$_H$							

Byte offset from start address Channel 0/1 ↓ ↓		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
8	20	LD_SLOT_1				LD_SLOT_0			
9	21	EN_ CAPTURE	EN_ SYNC_DN	EN_ SYNC_UP	SET_DQ1	SET_DQ0	TM_ CTRL_DQ1	TM_ CTRL_DQ0	SW_GATE
10	22	SET_DIR	Reserved					RES_ EVENT	RES_ ERROR
11	23	Reserved							

Explanations

Control bit/value	Explanations
SLOT_m	You specify the load value with this value. You specify the meaning of the value in LD_SLOT_m. If you want to load a comparison value in the "Measuring" operating mode, specify the load value as floating-point number (REAL). In all other cases, you specify the load value as an integer (DINT). Value range: –2147483648 to 2147483647$_D$ or 80000000 to 7FFFFFFF$_H$
LD_SLOT_m	Use this load request to specify the meaning of the value in SLOT_m: • 0000 means: No action, idle • 0001 means: Load counter value (for incremental or pulse encoder) • 0010 not permitted • 0011 means: Load start value (for incremental or pulse encoder) • 0100 means: Load comparison value 0 • 0101 means: Load comparison value 1 • 0110 means: Load counting low limit (for incremental or pulse encoder) • 0111 means: Load counting high limit (for incremental or pulse encoder) • 1000 to 1111 not permitted The technology module executes the respective action as soon as LD_SLOT_m changes. If values are loaded simultaneously using LD_SLOT_0 and LD_SLOT_1, the value from SLOT_0 is internally applied first and then the value from SLOT_1 . This can produce unexpected intermediate states.
EN_CAPTURE	Use this bit to enable the Capture function. Resetting this bit resets a set EVENT_CAP in the feedback interface.
EN_SYNC_DN	Use this bit to enable the synchronization of the counter when counting down with an incremental encoder or pulse encoder. Resetting this bit resets a set EVENT_SYNC in the feedback interface.
EN_SYNC_UP	Use this bit to enable the synchronization of the counter when counting up with an incremental encoder or pulse encoder. Resetting this bit resets a set EVENT_SYNC in the feedback interface.
SET_DQ0	Use this bit to set digital output DQ0 when TM_CTRL_DQ0 is set to 0. In the case of the function "After set command from CPU until comparison value", SET_DQ0 is effective regardless of TM_CTRL_DQ0 as long as the counter value is not equal to the comparison value.

Control bit/value	Explanations
SET_DQ1	Use this bit to set digital output DQ1 when TM_CTRL_DQ1 is set to 0. In the case of the function "After set command from CPU until comparison value", SET_DQ1 is effective regardless of TM_CTRL_DQ1 as long as the counter value is not equal to the comparison value.
TM_CTRL_DQ0	Use this bit to enable the technological function of digital output DQ0. • 0 means: SET_DQ0 defines the state of DQ0 • 1 means: assigned function defines the state of DQ0
TM_CTRL_DQ1	Use this bit to enable the technological function of digital output DQ1. • 0 means: SET_DQ1 defines the state of DQ1 • 1 means: assigned function defines the state of DQ1
SW_GATE	Use this bit to open and close the software gate when using an incremental encoder or pulse encoder. Together, the software gate and the hardware gate form the internal gate. The technology module only counts when the internal gate is open. • 0 means: Software gate closed • 1 means: Software gate open The digital inputs of the technology module externally control the hardware gate. The hardware gate can be activated by parameter assignment. The software gate cannot be deactivated.
SET_DIR	Use this bit to specify the count direction for signal type "Pulse (A)". • 0 means: Up • 1 means: Down
RES_EVENT	Use this bit to trigger the reset of the saved events in the EVENT_ZERO, EVENT_OFLW, EVENT_UFLW, EVENT_CMP0, EVENT_CMP1 feedback bits.
RES_ERROR	Use this bit to trigger the reset of the saved error states LD_ERROR and ENC_ERROR .
Reserved	Reserved bits must be set to 0.

4.3.4.2 Assignment of the feedback interface

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

Feedback interface per channel

The following table shows the assignment of the feedback interface:

Byte offset from start address Channel 0/1 ↓ ↓		**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0 … 3	16 … 19	COUNT_VALUE: DINT: Current counter value or position value							
4 … 7	20 … 23	CAPTURED_VALUE: DINT: The last acquired Capture value							
8 … 11	24 … 27	MEASURED_VALUE: REAL: Current measured value or DWORD: Complete SSI frame							
12	28	Reserved					LD_ERROR	ENC_ ERROR	POWER_ ERROR
13	29	Reserved		STS_SW_ GATE	STS_ READY	LD_STS_ SLOT_1	LD_STS_ SLOT_0	RES_EVENT_ ACK	Reserved
14	30	Reserved	STS_DI1	STS_DI0	STS_DQ1	STS_DQ0	STS_GATE	STS_CNT	STS_DIR
15	31	STS_M_ INTERVAL	EVENT_ CAP	EVENT_ SYNC	EVENT_ CMP1	EVENT_ CMP0	EVENT_ OFLW	EVENT_ UFLW	EVENT_ ZERO

Note

Validity of the position value

The position value of an SSI absolute encoder is valid when STS_READY is set to 1 and ENC_ERROR is set to 0. STS_READY is set to 0 while the module starts up.

Explanations

Feedback bit/value	Explanations
COUNT_VALUE	This DINT value indicates the current counter value or position value. If you use an SSI absolute encoder with a position value length up to 31 bits, the position value is treated as unsigned and as a positive value and can assume values between 0 and $2^{(MSB-LSB+1)}$-1. If you use an SSI absolute encoder with a position value length of 32 bits, the MSB of the position value corresponds to the sign and the position value can assume values between –2147483648 and 2147483647. If you use a 32-bit position value for the comparison function, the position value is interpreted as DINT.
CAPTURED_VALUE	This DINT value indicates the last acquired Capture value. The following external signals can trigger the Capture function: • Rising or falling edge of a digital input • Both edges of a digital input The "Frequency of Capture function" parameter specifies whether the function is executed at each configured edge or only once after each enable.
MEASURED_VALUE	This value indicates the current measured value with data type REAL or the complete SSI frame with data type DWORD: • Frequency: The mean frequency is calculated from the time profile of the count pulses or position value changes in one measurement interval and returned as a floating-point number in the unit of hertz. • Period: The mean period is calculated from the time profile of the count pulses or position value changes in one measurement interval and returned as a floating-point number in the unit of seconds. • Velocity: The mean velocity is calculated from the time profile of the count pulses or position value changes in one measurement interval and returned as a floating-point number in the configured unit. • Complete SSI frame: Instead of a measured quantity, the least significant 32 bits of the unprocessed current SSI frame are returned. This provides you with encoder-specific additional bits, such as error bits, in addition to the position value. If the SSI frame is shorter than 32 bits, the complete SSI frame is returned right-aligned and the top unused bits are returned with "0" in the feedback interface. The measured values are returned as a signed value. The sign indicates whether the counter value or position value went up or down in the relevant time interval. The update time is asynchronous to the opening of the internal gate, i.e. the update time is not started when the gate opens. After the internal gate closes, the last calculated measured value continues to be returned.
LD_ERROR	This bit indicates that an error occurred (latching) during loading via the control interface. The loaded values were not applied. When using an incremental or pulse encoder, one of the following conditions is not fulfilled: • Low counting limit <= counter value <= high counting limit • Low counting limit <= start value <= high counting limit • Low counting limit <= comparison value 0/1 <= high counting limit When using an SSI absolute encoder (position value length 31 bits), the following condition is not met: • 0 <= comparison value 0/1 <= maximum position value When using an SSI absolute encoder (position value length 32 bits), the following condition is not met: • –2147483648 <= comparison value 0/1 <= maximum position value The bit is reset once you have acknowledged the error with RES_ERROR .

Feedback bit/value	Explanations
ENC_ERROR	This bit indicates that one of the following errors has occurred at the encoder signals (retentive) for the respective technology module: • Invalid transition of A/B signals (with incremental encoder) • RS422/TTL error • SSI encoder error or SSI frame error (with SSI absolute encoder) If you have enabled the diagnostic interrupts, the respective diagnostic interrupt is triggered in the event of encoder signal errors. For information on the meaning of the diagnostics interrupts, refer to the section Diagnostic interrupts (Page 85). The bit is reset once you have acknowledged the error with RES_ERROR .
POWER_ERROR	This bit indicates that supply voltage L+ is not present or is too low or the front connector is not inserted. If you have enabled the diagnostic interrupts (Page 85), the diagnostic interrupt "Load voltage missing" is triggered at a supply voltage error. When supply voltage L+ is available at a sufficient level once again, POWER_ERROR is automatically set to 0.
STS_SW_GATE	This bit indicates the status of the software gate. • 0 means: Gate closed • 1 means: Gate open
STS_READY	This bit indicates that the technology module supplies valid user data. The technology module has been started up and configured.
LD_STS_SLOT_0	This bit indicates by a status change (toggling) that the load request for SLOT_0 (LD_SLOT_0) was detected and performed.
LD_STS_SLOT_1	This bit indicates by a status change (toggling) that the load request for SLOT_1 (LD_SLOT_1) was detected and performed.
RES_EVENT_ACK	This bit indicates that the reset of event bit EVENT_SYNC, EVENT_CMP0, EVENT_CMP1, EVENT_OFLW, EVENT_UFLW, EVENT_ZERO is active.
STS_DI0	This bit indicates the status of digital input DI0.
STS_DI1	This bit indicates the status of digital input DI1.
STS_DQ0	This bit indicates the status of the digital output DQ0.
STS_DQ1	This bit indicates the status of the digital output DQ1.
STS_GATE	This bit indicates the status of the internal gate when using an incremental or pulse encoder. • 0 means: Gate closed • 1 means: Gate open Note: In order for the counting logic including the gate control to operate correctly, the startup of the technology module must finish correctly at least once with a connected incremental or pulse encoder (STS_READY auf 1). If a connected encoder is not yet ready during the startup, the function of feedback bit STS_GATE is delayed until the encoder for the technology module is available. When the technology module starts up without a connected encoder, the startup does not finish correctly and STS_READY as well as STS_GATE remain set to 0. As soon as an encoder is connected, the startup finishes and STS_GATE functions correctly. An encoder error after a finished startup has no effect on STS_GATE.
STS_CNT	This bit indicates that at least one count pulse or a position value change has been detected in the last approx. 0.5 s.
STS_DIR	This bit indicates the count direction of the last count pulse or the direction of the last position value change. • 0 means: Down • 1 means: Up
STS_M_INTERVAL	This bit indicates that at least one count pulse or a position value change was detected in the previous measurement interval.

Feedback bit/value	Explanations
EVENT_CAP	This bit indicates that a Capture event has occurred and a counter value has been saved in CAPTURED_VALUE . You reset the state by resetting EN_CAPTURE .
EVENT_SYNC	This bit indicates the saved state that the counter was loaded with the start value by an external reference signal (synchronization) when using an incremental or pulse encoder. You reset the state by resetting EN_SYNC_UP or EN_SYNC_DN .
EVENT_CMP0	This bit indicates the saved state that a comparison event (state change) has occurred for the digital output DQ0 based on the selected comparison condition. You reset the state by acknowledgment with RES_EVENT. If the counter value is set to the start value in counting operating mode, EVENT_CMP0 is not set.
EVENT_CMP1	This bit indicates the saved state that a comparison event (state change) has occurred for the digital output DQ1 based on the selected comparison condition. You reset the state by acknowledgment with RES_EVENT. If the counter value is set to the start value in counting operating mode, EVENT_CMP1 is not set.
EVENT_OFLW	This bit indicates the saved state which shows that there was a counter value overflow. You reset the state by acknowledgment with RES_EVENT.
EVENT_UFLW	This bit indicates the saved state which shows that there was a counter value underflow. You reset the state by acknowledgment with RES_EVENT.
EVENT_ZERO	This bit indicates the saved state that the counter value or position value experienced a zero crossing. You reset the state by acknowledgment with RES_EVENT. If the "Zero crossing" hardware interrupt is enabled, it can also be triggered by the system if "0" is outside the configured value range.
Reserved	Reserved bits are set to 0.

4.3.4.3 Reaction to CPU STOP

Reaction to CPU STOP

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

Table 4- 13 Reaction of technology module to CPU STOP

Option	Meaning
Continue operation	The technology module remains fully functional. Incoming count pulses are processed or the position value is read in. 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 (with incremental encoders or pulse encoders) and the digital outputs switch according to the parameter assignment.
Keep last value	The technology module outputs the values at the digital outputs that were valid when the transition to STOP took place until the next CPU STOP-RUN transition. If a digital output with the "At comparison value for a pulse duration" function is set at CPU STOP, the digital output is reset after the pulse duration elapses. The technology module is returned to its startup state after a STOP-RUN transition: The counter value is set to the Start value (with incremental encoders or pulse encoders) and the digital outputs switch according to the parameter assignment.

4.3.5 Isochronous mode

The technology module supports the "Isochronous mode" system function. This system function enables position, counter 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 status change of a digital input immediately triggers the specified reaction of the technology module and the change of the status bit of the digital input in the feedback interface.

Use an OB of type "Synchronous Cycle" (e.g. OB61) in this operating mode. The input and output data are processed in the assigned OB.

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

Data processing

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

Isochronous mode parameters

In isochronous mode, the following parameter can affect the isochronous mode parameters of the sync domain.

- Filter frequency
- Frame length
- Transmission rate
- Monoflop time
- Parity

Because the isochronous mode parameters are not checked in RUN, overflows can occur if you change one or more of the indicated parameters in RUN. To prevent overflows, select the option with the largest time required in the offline parameter assignment.

Additional information

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

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

4.4 Fast Mode

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

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

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

4.4.1 Configuring

Introduction

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

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

System environment

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

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

Additional information

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

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

Hardware Support Packages (HSP)

Fast Mode is available as of firmware version V2.0 of the module (6ES7551-1AB01-0AB0). In STEP 7 (TIA Portal) V17, you integrate the firmware version V2.0 using HSP0355. Firmware version V2.0 of the module is integrated into the following TIA Portal versions.

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

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

GSD file

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

- GSD file for PROFINET IO (http://support.automation.siemens.com/WW/view/en/68189683)
- GSD file for PROFIBUS DP (http://support.automation.siemens.com/WW/view/en/80206700)

4.4.2 Parameter setting

4.4.2.1 Parameter setting

You specify the properties of the technology module using various parameters. Depending on the settings, not all parameters are available. When parameters are assigned in the user program, the parameters are transferred to the module with the "WRREC" instruction and data record 128 (Page 100).

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

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

4.4.2.2 Parameters (SSI absolute encoder)

Parameters of the TM PosInput 2 with SSI absolute encoder

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

Table 4- 14 Adjustable parameters (SSI absolute encoder)

Parameter	Value range	Scope
Reaction to CPU STOP[1]	• **Output substitute value** • Keep last value • Continue operation	Channel
Substitute value for DQ0	• **0** • 1	Channel
Substitute value for DQ1	• **0** • 1	
Enable diagnostic interrupt on wire break[2]	• **Deactivated** • Activated	Channel
Enable additional diagnostic interrupts	• **Deactivated** • Activated	Channel
Invert direction[1] (position value)	• **Deactivated** • Activated	Channel
Frame length	10...**13**...40 bits	Channel
Code type	• **Gray** • Dual	Channel
Transmission rate	• **125 kHz** • 250 kHz • 500 kHz • 1 MHz • 1.5 MHz • 2 MHz	Channel
Monoflop time[1]	• **Automatically** • 16 µs • 32 µs • 48 µs • 64 µs	Channel
Parity	• **None** • Even • Odd	Channel
Bit number LSB of the position value	**0**...38	Channel
Bit number MSB of the position value	1...**12**...39	Channel
Set function of DI	**Digital input without function**	Channel

Parameter	Value range	Scope
Input delay for digital inputs[1]	• None • 0.05 ms • **0.1 ms** • 0.4 ms • 0.8 ms • 1.6 ms • 3.2 ms • 12.8 ms • 20 ms	Channel
Set output	• Between comparison value and count high limit • Between comparison value and count low limit • At comparison value for a pulse duration • **Digital output without function**	Channel
Comparison value 0[1]	**0**...33554431	Channel
Comparison value 1[1]	0...**10**...33554431	Channel
Count direction of DQ function[1]	• Up • Down • **In both directions**	Channel
Pulse duration[1]	0,1...**500,0**...6553,5 ms	Channel
Hysteresis (in increments)[1]	**0**...255	Channel

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

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

NOTICE

Excessive axis speed can provide wrong direction of rotation

If an axis connected to an SSI absolute encoder rotates so quickly that more than half of the value range is covered within one module cycle[1], the velocity and direction of rotation can no longer be determined correctly. As a result, the following may function incorrectly:

- DQ functions
- Feedback bit STS_DIR

[1] Non-isochronous mode: 500 µs; isochronous mode: PROFINET cycle time

Explanation of parameters

A detailed description of the parameters can be found in the Basic parameters and Fast Mode sections of the Counting, Measurement and Position Detection Function Manual which is available for downloaded on the Internet (http://support.automation.siemens.com/WW/view/en/59709820).

4.4.2.3 Parameters (incremental or pulse encoder)

Parameters of the TM PosInput 2 with incremental or pulse encoder

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

Table 4- 15 Adjustable parameters (incremental or pulse encoder)

Parameter	Value range	Scope
Reaction to CPU STOP[1]	• **Output substitute value** • Keep last value • Continue operation	Channel
Substitute value for DQ0[1]	• **0** • 1	Channel
Substitute value for DQ1[1]	• **0** • 1	Channel
Enable diagnostic interrupt on wire break[2]	• **Deactivated** • Activated	Channel
Enable additional diagnostic interrupts	• **Deactivated** • Activated	Channel
Signal type	• Pulse (A) • **Pulse (A) and direction (B)** • Count up (A), count down (B) • Incremental encoder (A, B phase-shifted) • Incremental encoder (A, B, N)	Channel
Invert direction[1] (counter inputs)	• **Deactivated** • Activated	Channel
Signal evaluation for counter inputs	• **Single** • Double • Quadruple	Channel
Filter frequency for counter inputs[1]	• 100 Hz • 200 Hz • 500 Hz • 1 kHz • 2 kHz • 5 kHz • 10 kHz • 20 kHz • 50 kHz • 100 kHz • 200 kHz • 500 kHz • **1 MHz**	Channel
Reaction to signal N[1]	• **No reaction to signal N** • Synchronization at signal N	Channel
Interface standard	• **RS422, symmetrical** • TTL (5 V), asymmetrical	Channel

Parameter	Value range	Scope
High counting limit[1]	1...**33554431**	Channel
Start value[1]	**0**...33554431	Channel
Counting low limit[1]	**0**...33554430	Channel
Reaction to violation of a counting limit	• Stop counting • **Continue counting**	Channel
Reset when counting limit is violated	• **To opposite counting limit** • To start value	Channel
Reaction to gate start	• Set to start value • **Continue with current value**	Channel
Set function of DI	• Gate start/stop (level-triggered) • Gate start (edge-triggered) • Gate stop (edge-triggered) • Synchronization • Enable synchronization at signal N • **Digital input without function**	Channel
Input delay for digital inputs[1]	• None • 0.05 ms • **0.1 ms** • 0.4 ms • 0.8 ms • 1.6 ms • 3.2 ms • 12.8 ms • 20 ms	Channel
Select level for DI[1]	• **Active with high level** • Active with low level	Channel
Edge selection for DI[1]	• **At rising edge** • At falling edge	Channel
Frequency of synchronization[1]	• **Once**[3] • Periodic	Channel
Count direction for synchronization	• **Up** • Down • In both directions	Channel
Set output	• Between comparison value and count high limit • Between comparison value and count low limit • At comparison value for a pulse duration • Between comparison value 0 and 1 • **Digital output without function**	Channel
Comparison value 0[1]	**0**...33554431	Channel
Comparison value 1[1]	0...**10**...33554431	Channel

Parameter	Value range	Scope
Count direction of DQ function[1]	• Up • Down • **In both directions**	Channel
Pulse duration[1]	0,0...**500,0**...6553,5 ms	Channel
Hysteresis (in increments)[1]	**0**...255	Channel

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

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

3 Note: in Fast Mode no control interface (bits EN_SYNC_UP/EN_SYNC_DN) is available to reset the function.

Explanation of parameters

A detailed description of the parameters can be found in the Basic parameters and Fast Mode sections of the Counting, Measurement and Position Detection Function Manual which is available for downloaded on the Internet (http://support.automation.siemens.com/WW/view/en/59709820).

4.4.3 Address space

Address space of the technology module

Table 4- 16 Range of the input addresses and output addresses of the TM PosInput 2 in Fast Mode

	Inputs	Outputs
Size per channel	4 bytes	0 bytes
Total size	8 bytes	0 bytes

4.4.4 Assignment of the feedback interface

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

Feedback interface

The following table shows the assignment of the feedback interface:

Byte offset relative to start address Channel 0/1 ↓ ↓		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	4	LS	STS_ READY	Reserved	EXT_F	STS_DI0	STS_DIR	STS_DI1	COUNT_ VALUE
1	5	COUNT_VALUE: DINT: Current counter value or position value							
2	6								
3	7								

Explanations

Feedback bit/value	Explanations
LS	As a sign of life, this bit indicates through a state change (toggling) that isochronous mode is functioning and that the module has updated the feedback interface in the respective bus cycle. This bit is set to 0 in non-isochronous mode.
STS_READY	This bit indicates that the technology module supplies valid user data. The technology module has been started up and configured.
EXT_F	This bit indicates that one of the following errors has occurred at the encoder signals for the technology module: • Load voltage missing • Invalid transition of A/B signals (with incremental encoder) • RS422/TTL error • SSI encoder error or SSI frame error (with SSI absolute encoder) If you have enabled the diagnostic interrupts, the respective diagnostic interrupt is triggered in the event of encoder signal errors. For information on the meaning of the diagnostic interrupts, refer to the section Diagnostic alarms (Page 85). The bit is reset automatically as soon as an error no longer exists.
STS_DI0	This bit indicates the status of digital input DI0.
STS_DIR	This bit indicates the count direction of the last count pulse or the direction of the last position value change. 0 means: Down 1 means: Up
STS_DI1	This bit indicates the status of digital input DI1.
COUNT_VALUE	This value returns the current counter value or position value in the first 25 bits of a DINT value.
Reserved	Reserved bits are set to 0.

4.4.5 Reaction to CPU STOP

Reaction to CPU STOP

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

Table 4- 17 Reaction of technology module to CPU STOP

Option	Meaning
Continue operation	The technology module remains fully functional. Incoming count pulses are processed or the position value is read in. 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 (with incremental encoders or pulse encoders) and the digital outputs switch according to the parameter assignment.
Keep last value	The technology module outputs the values at the digital outputs that were valid when the transition to STOP took place until the next CPU STOP-RUN transition. If a digital output with the "At comparison value for a pulse duration" function is set at CPU STOP, the digital output is reset after the pulse duration elapses. The technology module is returned to its startup state after a STOP-RUN transition: The counter value is set to the Start value (with incremental encoders or pulse encoders) and the digital outputs switch according to the parameter assignment.

4.4.6 Isochronous mode

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

In isochronous mode, the cycle of the user program, the transmission of the input signals and processing in the technology module are synchronized. The output signals switch immediately if the relevant comparison condition is met. A status change of a digital input immediately triggers the specified reaction of the technology module and the change of the status bit of the digital input in the feedback interface.

Since no control interface and a shortened feedback interface are used in the operating mode Fast Mode, particularly short transmission cycles can be realized. The smallest send clock supported by the module is 125 µs.

Use an OB of type "Synchronous Cycle" (e.g. OB61) in this operating mode.

Data processing

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

Isochronous mode parameters

In isochronous mode, the following parameter can affect the isochronous mode parameters of the sync domain.

- Filter frequency
- Frame length
- Transmission rate
- Monoflop time
- Parity

Because the isochronous mode parameters are not checked in RUN, overflows can occur if you change one or more of the indicated parameters in RUN. To prevent overflows, select the option with the largest time required in the offline parameter assignment.

Additional information

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

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

Interrupts/diagnostic messages

5

5.1 Status and error display

LEDs

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

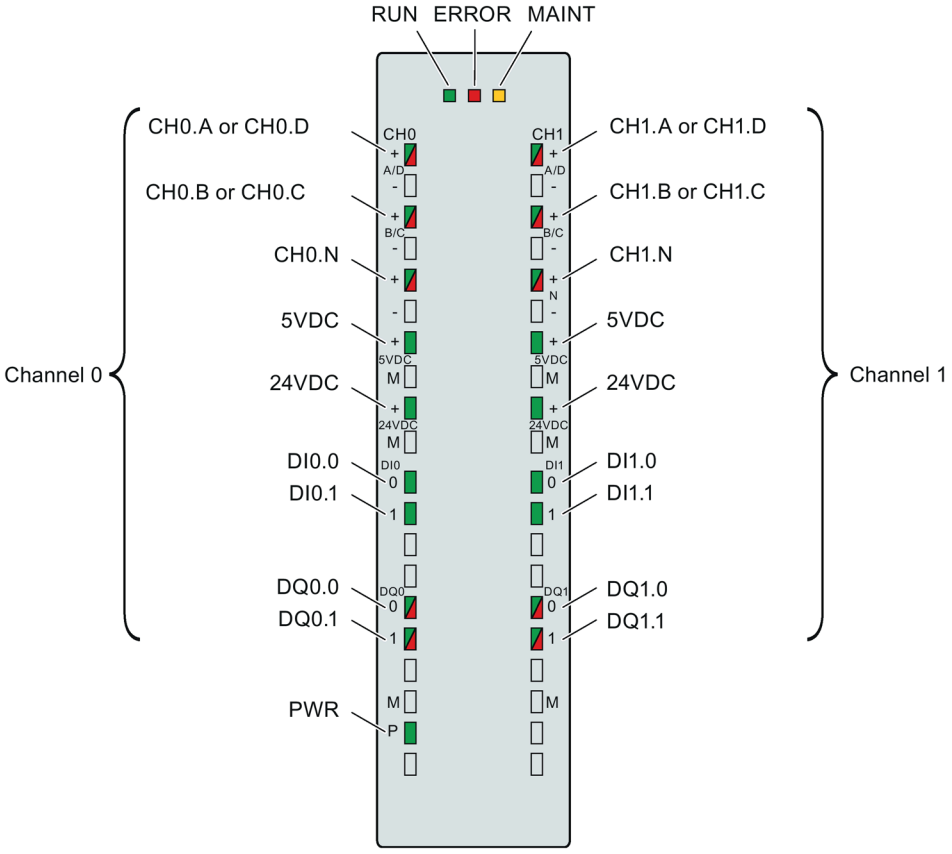


Figure 5-1 LED displays of the TM PosInput 2

Meaning of the LED displays

The following tables explain the meaning of the status and error displays. Remedial measures for diagnostic alarms can be found in section Diagnostic alarms (Page 85).

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

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

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

LEDs			Meaning	Remedy
PWR	24VDC/ 5VDC	ERROR		
Off	Off	Off	Supply voltage too low or missing *and* "Enable additional diagnostic interrupts" not enabled	• Check the supply voltage. • Make sure that the front connector is correctly inserted. • In the device configuration, enable "Enable additional diagnostic interrupts".
Off	Off	Flashes	Supply voltage too low or missing	• Check the supply voltage. • Make sure that the front connector is correctly inserted.
On	On	Off	Supply voltage is present and OK. Encoder supply is OK.	---

LEDs			Meaning	Remedy
PWR	**24VDC/ 5VDC**	**ERROR**		
■ On	□ Off	□ Off	Short circuit or overload at the encoder supply *and* "Enable additional diagnostic interrupts" not enabled	• Check the encoder wiring. • Check the loads connected to the encoder supply. • Check the supply voltage. • In the device configuration, enable "Enable additional diagnostic interrupts".
■ On	□ Off	☼ Flashes	Short-circuit or overload at the encoder supply	• Check the encoder wiring. • Check the loads connected to the encoder supply. • Check the supply voltage.

Channel LEDs

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

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

When an SSI absolute encoder is used, the CHn.D and CHn.C LEDs are lit green during transfer of the encoder frame and are lit red if an error occurred. The CHn.D and CHn.C LEDs are off when no encoder frame is being transferred or if an error has occurred for which the diagnostic interrupt is not enabled.

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

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

5.2 Diagnostic alarms

Enabling of diagnostic interrupts

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

The technology module can trigger the following diagnostic interrupts:

Table 5- 4 Possible diagnostic interrupts

Diagnostic interrupt	Monitoring
• Parameter error • Hardware interrupt lost[1] • Watchdog tripped. Module is defective.	Monitoring is always active. A diagnostic interrupt is triggered each time an error is detected.
• RS422/TTL error	Monitoring is always active. When an error is detected, a diagnostic interrupt is only triggered if "Enable diagnostic interrupt on wire break" is activated in the device configuration.
• Supply voltage missing • Short-circuit / overload at external encoder supply • Error at digital outputs • SSI encoder error • Invalid transition of A/B signals	Monitoring is always active. When an error is detected, a diagnostic interrupt is only triggered if "Enable additional diagnostic interrupts" is activated in the device configuration.

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

Reactions to a diagnostic interrupt

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

- The ERROR LED flashes red.

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

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

If the module is operated as a distributed module with PROFIBUS DP in an ET 200MP system, you have the option of reading out diagnostic data with the RDREC or RD_REC instruction using data record 0 and 1. You can find the structure of the data records in the manual for the IM 155-5 DP ST interface module available for download on the Internet (https://support.industry.siemens.com/cs/ww/de/view/78324181).

Diagnostic alarms

The display of diagnostics is in plain text in STEP 7 (TIA Portal) in the online and diagnostics view. You can evaluate the error codes with the user program.

The following diagnostics can be signaled:

Table 5- 5 Diagnostic alarms, their meaning and remedies

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

Diagnostic alarm	Error code	Meaning	Remedy
RS422/TTL error	502H	• Error at connection of the RS422 encoder, TTL encoder or SSI absolute encoder • Possible causes: – Wire break – No encoder connected – Cable too long – Short circuit – Overload – External voltage – Overtemperature – Parameter assignment error	• Check process wiring • Check encoder/sensor • Check parameter assignment
SSI encoder error	503H	• Error at SSI absolute encoder connection • Possible causes: – Wire break – Cable too long – Frame error (error of the start bit or stop bit) – Parity error – Parameter assignment error	• Check process wiring • Check SSI absolute encoder • Check parameter assignment

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

Enabling of hardware interrupts

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

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

- Opening of internal gate (gate start)[1]
- Closing of internal gate (gate stop)[1]
- Overflow (counting high limit violated)[1]
- Underflow (counting low limit violated)[1]
- Comparison event for DQ0 has occurred
- Comparison event for DQ1 has occurred
- Zero crossing[4]
- New Capture value available[2]
- Synchronization of the counter by an external signal[1]
- Direction reversal[3]

[1] Not for SSI absolute encoder

[2] Only configurable in the Counting/Position input operating mode

[3] Feedback bit STS_DIR is preassigned with "0". A hardware interrupt is not triggered when the first counter value or position value is changed immediately after switching on the technology module in *down direction*.

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

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

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

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

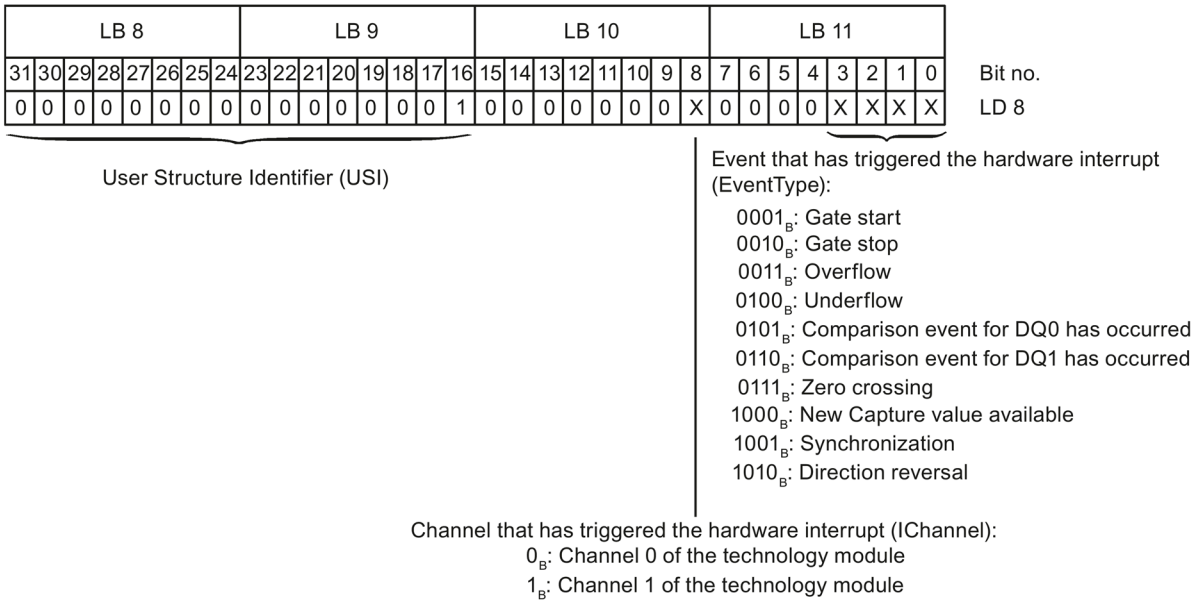


Figure 5-2 Start information of the organization block

Technical specifications

6

Article number	6ES7551-1AB01-0AB0
General information	
Product type designation	TM PosInput 2
Firmware version	V2.0
• FW update possible	Yes
Number of channels	2
Product function	
• I&M data	Yes; I&M0 to I&M3
• Isochronous mode	Yes
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	V17
• PROFIBUS from GSD version/GSD revision	GSD Revision 5
• PROFINET from GSD version/GSD revision	V2.3 / -
Installation type/mounting	
Rail mounting	Yes; S7-1500 mounting rail
Supply voltage	
Load voltage L+	
• Rated value (DC)	24 V
• permissible range, lower limit (DC)	19.2 V
• permissible range, upper limit (DC)	28.8 V
• Reverse polarity protection	Yes
Input current	
Current consumption, max.	75 mA; without load
Encoder supply	
Number of outputs	4; One 5V and 24V encoder supply per channel
5 V encoder supply	
• 5 V	Yes; 5.2 V ±2 %
• Short-circuit protection	Yes
• Output current, max.	300 mA; Per channel
24 V encoder supply	
• 24 V	Yes; L+ (-0.8 V)
• Short-circuit protection	Yes
• Output current, max.	300 mA; Per channel

Article number	6ES7551-1AB01-0AB0
Power	
Power available from the backplane bus	1.3 W
Power loss	
Power loss, typ.	5.5 W
Address area	
Address space per module	
• Inputs	32 byte; 16 bytes per channel; 4 bytes for fast mode
• Outputs	24 byte; 12 bytes per channel; 4 bytes for Motion Control, 0 bytes for fast mode
Digital inputs	
Number of digital inputs	4; 2 per channel
Digital inputs, parameterizable	Yes
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Digital input functions, parameterizable	
• Gate start/stop	Yes; only for pulse and incremental encoders
• Capture	Yes
• Synchronization	Yes; only for pulse and incremental encoders
• Freely usable digital input	Yes
Input voltage	
• Type of input voltage	DC
• Rated value (DC)	24 V
• for signal "0"	-5 ... +5 V
• for signal "1"	+11 to +30V
• permissible voltage at input, min.	-30 V; -5 V continuous, -30 V brief reverse polarity protection
• permissible voltage at input, max.	30 V
Input current	
• for signal "1", typ.	2.5 mA
Input delay (for rated value of input voltage)	
for standard inputs	
– parameterizable	Yes; none / 0.05 / 0.1 / 0.4 / 0.8 / 1.6 / 3.2 / 12.8 / 20 ms
– at "0" to "1", min.	6 µs; for parameterization "none"
– at "1" to "0", min.	6 µs; for parameterization "none"
for technological functions	
– parameterizable	Yes
Cable length	
• shielded, max.	1 000 m
• unshielded, max.	600 m

Article number	6ES7551-1AB01-0AB0
Digital outputs	
Type of digital output	Transistor
Number of digital outputs	4; 2 per channel
Digital outputs, parameterizable	Yes
Short-circuit protection	Yes; electronic/thermal
• Response threshold, typ.	1 A
Limitation of inductive shutdown voltage to	L+ (-33 V)
Controlling a digital input	Yes
Digital output functions, parameterizable	
• Switching tripped by comparison values	Yes
• Freely usable digital output	Yes
Switching capacity of the outputs	
• with resistive load, max.	0.5 A; Per digital output
• on lamp load, max.	5 W
Load resistance range	
• lower limit	48 Ω
• upper limit	12 kΩ
Output voltage	
• Type of output voltage	DC
• for signal "1", min.	23.2 V; L+ (-0.8 V)
Output current	
• for signal "1" rated value	0.5 A; Per digital output
• for signal "1" permissible range, max.	0.6 A; Per digital output
• for signal "1" minimum load current	2 mA
• for signal "0" residual current, max.	0.5 mA
Output delay with resistive load	
• "0" to "1", max.	50 µs
• "1" to "0", max.	50 µs
Switching frequency	
• with resistive load, max.	10 kHz
• with inductive load, max.	0.5 Hz; Acc. to IEC 60947-5-1, DC-13; observe derating curve
• on lamp load, max.	10 Hz
Total current of the outputs	
• Current per module, max.	2 A
Cable length	
• shielded, max.	1 000 m
• unshielded, max.	600 m

Article number	6ES7551-1AB01-0AB0
Encoder	
Encoder signals, incremental encoder (symmetrical)	
• Input voltage	RS 422
• Input frequency, max.	1 MHz
• Counting frequency, max.	4 MHz; with quadruple evaluation
• Cable length, shielded, max.	32 m; at 1 MHz
• Signal filter, parameterizable	Yes
• Incremental encoder with A/B tracks, 90° phase offset	Yes
• Incremental encoder with A/B tracks, 90° phase offset and zero track	Yes
• pulse encoder	Yes
• Pulse encoder with direction	Yes
• pulse encoder with one impulse signal per count direction	Yes
Encoder signals, incremental encoder (asymmetrical)	
• Input voltage	5 V TTL (push-pull encoders only)
• Input frequency, max.	1 MHz
• Counting frequency, max.	4 MHz; with quadruple evaluation
• Signal filter, parameterizable	Yes
• Incremental encoder with A/B tracks, 90° phase offset	Yes
• Incremental encoder with A/B tracks, 90° phase offset and zero track	Yes
• pulse encoder	Yes
• pulse encoder with direction	Yes
• pulse encoder with one impulse signal per count direction	Yes

Article number	6ES7551-1AB01-0AB0
Encoder signals, absolute encoder (SSI)	
• Input signal	to RS-422
• Telegram length, parameterizable	10 ... 40 bit
• Clock frequency, max.	2 MHz; 125 kHz, 250 kHz, 500 kHz, 1 MHz, 1.5 MHz or 2 MHz
• Binary code	Yes
• Gray code	Yes
• Cable length, shielded, max.	320 m; Cable length, RS-422 SSI absolute encoders, Siemens type 6FX2001-5, 24 V supply: 125 kHz, 320 meters shielded, max.; 250 kHz, 160 meters shielded, max.; 500 kHz, 60 meters shielded, max.; 1 MHz, 20 meters shielded, max. 1.5 MHz, 10 meters shielded, max.; 2 MHz, 8 meters shielded, max.
• Parity bit, parameterizable	Yes
• Monoflop time	16, 32, 48, 64 µs & automatic
• Multiturn	Yes
• Singleturn	Yes
Interface types	
• TTL 5 V	Yes; push-pull encoders only
• RS 422	Yes
Interrupts/diagnostics/status information	
Alarms	
• Diagnostic alarm	Yes
• Hardware interrupt	Yes
Diagnoses	
• Monitoring the supply voltage	Yes
• Wire-break	Yes
• Short-circuit	Yes
• A/B transition error at incremental encoder	Yes
• Telegram error at SSI encoder	Yes
Diagnostics indication LED	
• RUN LED	Yes; green LED
• ERROR LED	Yes; red LED
• MAINT LED	Yes; Yellow LED
• Monitoring of the supply voltage (PWR-LED)	Yes; green LED
• Channel status display	Yes; green LED
• for channel diagnostics	Yes; red LED

Article number	6ES7551-1AB01-0AB0
Integrated Functions	
Counter	Yes
• Number of counters	2
• Counting frequency, max.	4 MHz; with quadruple evaluation
Fast mode	Yes
Counting functions	
• Can be used with TO High_Speed_Counter	Yes; only for pulse and incremental encoders
• Continuous counting	Yes
• Counter response parameterizable	Yes
• Hardware gate via digital input	Yes
• Software gate	Yes
• Event-controlled stop	Yes
• Synchronization via digital input	Yes
• Counting range, parameterizable	Yes
Comparator	
– Number of comparators	2; Per channel
– Direction dependency	Yes
– Can be changed from user program	Yes
Position detection	
• Incremental acquisition	Yes
• Absolute acquisition	Yes
• Suitable for S7-1500 Motion Control	Yes
Measuring functions	
• Measuring time, parameterizable	Yes
• Dynamic measurement period adjustment	Yes
• Number of thresholds, parameterizable	2
Measuring range	
– Frequency measurement, min.	0.04 Hz
– Frequency measurement, max.	4 MHz
– Cycle duration measurement, min.	0.25 µs
– Cycle duration measurement, max.	25 s
Accuracy	
– Frequency measurement	100 ppm; depending on measuring interval and signal evaluation
– Cycle duration measurement	100 ppm; depending on measuring interval and signal evaluation
– Velocity measurement	100 ppm; depending on measuring interval and signal evaluation

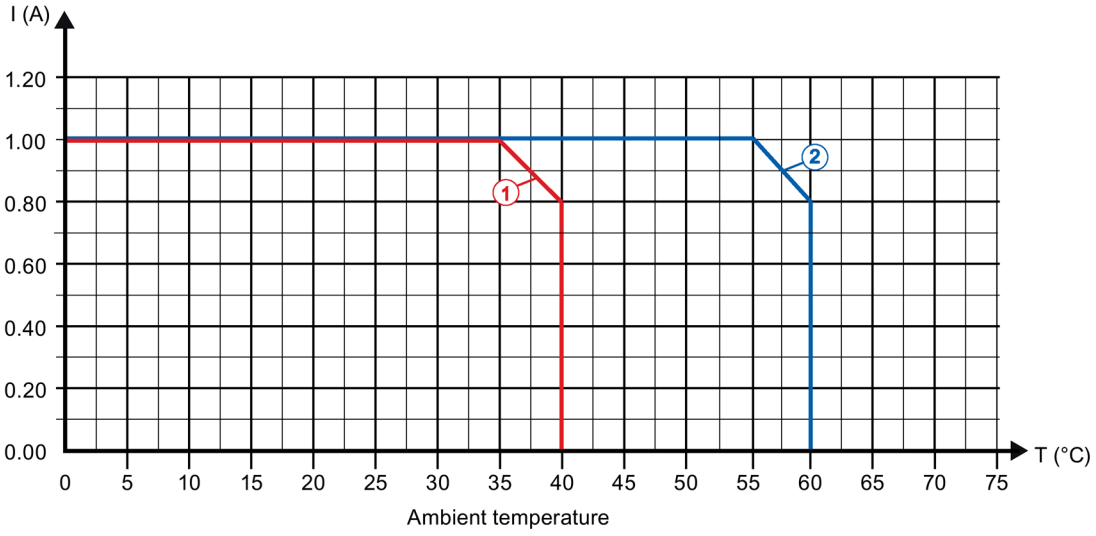
Article number	6ES7551-1AB01-0AB0
Potential separation	
Potential separation channels	
• between the channels	No
• between the channels and backplane bus	Yes
• Between the channels and load voltage L+	No
Isolation	
Isolation tested with	707 V DC (type test)
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-30 °C
• horizontal installation, max.	60 °C; Please note derating for inductive loads
• vertical installation, min.	-30 °C
• vertical installation, max.	40 °C; Please note derating for inductive loads
Ambient temperature during storage/transportation	
• min.	-40 °C
• max.	70 °C
Altitude during operation relating to sea level	
• Installation altitude above sea level, max.	5 000 m; restrictions for installation altitudes > 2 000 m, see ET 200MP system manual
Decentralized operation	
to SIMATIC S7-300	Yes
to SIMATIC S7-400	Yes
to SIMATIC S7-1200	Yes
to SIMATIC S7-1500	Yes
to standard PROFIBUS master	Yes
to standard PROFINET controller	Yes
Dimensions	
Width	35 mm
Height	147 mm
Depth	129 mm
Weights	
Weight, approx.	325 g

Derating information for total current of outputs

If the digital outputs of the TM PosInput 2 are operated with inductive loads, you should derate the total current of the loads at the digital outputs of the respective channel. The total current is the sum of the load currents at all digital outputs of a channel (without encoder supply).

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

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



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

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

Note

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

Note

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

Dimensional drawing

A

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

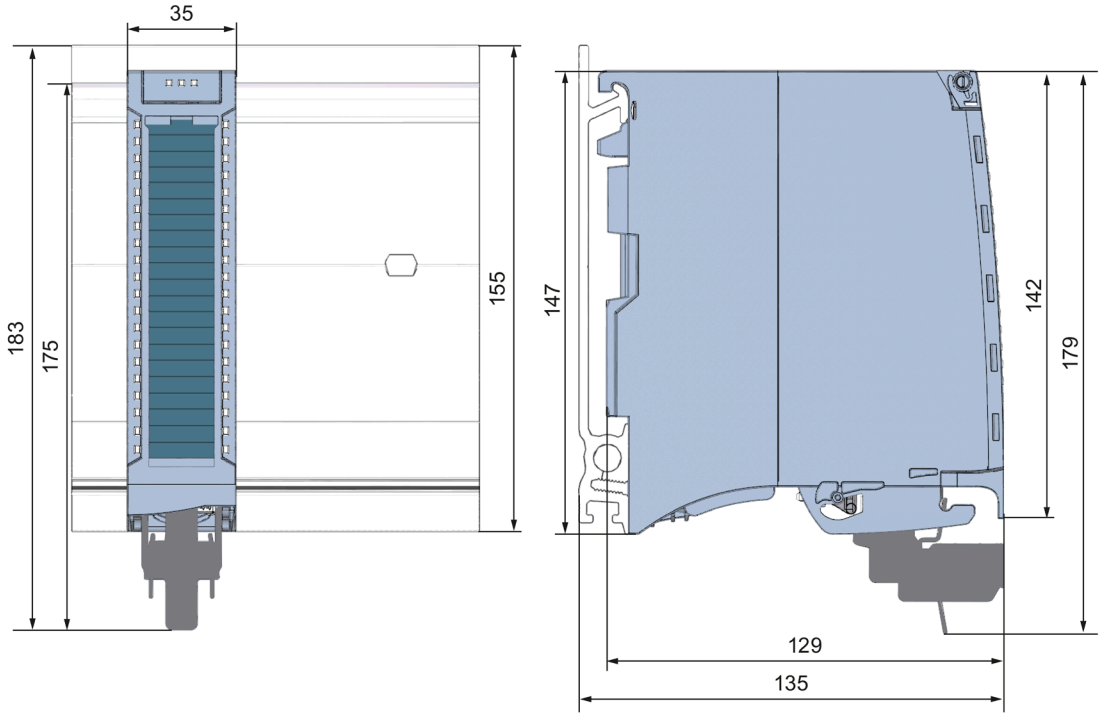


Figure A-1 Dimensional drawing of the TM PosInput 2 technology module

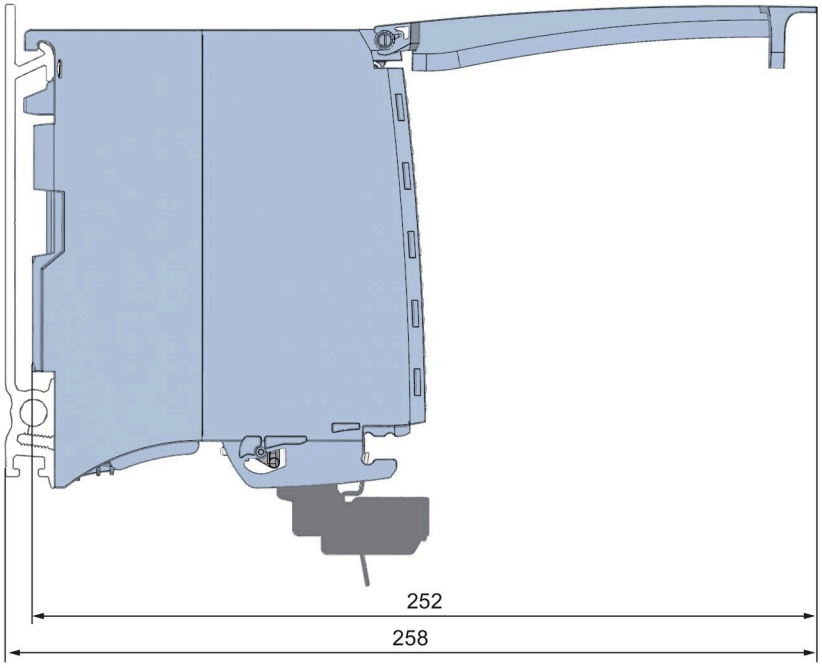


Figure A-2 Dimensional drawing of the TM PosInput 2 module, side view with open front panel

Parameter data record

B

B.1 Parameter assignment and structure of parameter data record

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

If an error occurs while transferring or validating parameters with the WRREC instruction, the module continues operating with the existing parameter assignment. A corresponding error code is then written to the STATUS output parameter. If no errors occur, the STATUS output parameter contains the length of the actually transferred data.

You can find a description of the WRREC instruction and the error codes in section Parameter validation error (Page 111) or in the online help of STEP 7 (TIA Portal).

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

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

Note

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

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

Bit → / Byte channel 0/1 ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0...3	**Header**							
0	Major Version = 0				Minor Version = 2			
1	Length of the parameter data per channel = 48							
2	Reserved[2]							
3								
4...51	**Channel 0**							
52...99	**Channel 1**							

Bit → / Byte channel 0/1 ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4/52	**Operating mode**							
4/52	Reserved[2]				Operating mode:			
					0000B: Not permitted			
					0001B: Counting / Position input			
					0010B: Measuring			
					0011 to 1111B: Not permitted			
5/53	**Basic parameters**							
5/53	Interface standard:	Reserved[2]				Enable additional diagnostic interrupts[1]	Reaction to CPU STOP:	
							00B: Output substitute value	
							01B: Keep last value	
	0B: RS422, symmetrical						10B: Continue operation	
	1B: TTL (5 V), asymmetrical						11B: Not permitted	
6...7/ 54...55	**Counter inputs** (parameters for incremental and pulse encoders)							
6/54	Reserved[2]		Signal evaluation:		Signal type:			
			00B: Single		0000B: Pulse (A)			
			01B: Double		0001B: Pulse (A) and direction (B)			
			10B: Quadruple		0010B: Count up (A), count down (B)			
			11B: Not permitted		0011B: Incremental encoder (A, B phase-shifted)			
					0100B: Incremental encoder (A, B, N)			
					0101B: Absolute encoder (SSI)			
					0110 to 1111B: Not permitted			
7/55	Reaction to signal N:		Invert direction[1]	Enable diagnostic interrupt on wire break[1]	Filter frequency[4]:			
	00B: No reaction to signal N				0000B: 100 Hz			
	01B: Synchronization at signal N				0001B: 200 Hz			
	10B: Capture at signal N				0010B: 500 Hz			
	11B: Not permitted				0011B: 1 kHz			
					0100B: 2 kHz			
					0101B: 5 kHz			
					0110B: 10 kHz			
					0111B: 20 kHz			
					1000B: 50 kHz			
					1001B: 100 kHz			
					1010B: 200 kHz			
					1011B: 500 kHz			
					1100B: 1 MHz			
					1101 to 1111B: Not permitted			

Bit → / Byte channel 0/1 ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
6…7/ 54…55	**Counter inputs** (parameters for SSI absolute encoder)							
6/54	Monoflop time[4]:			Code type:	Signal type:			
	000B: Automatically			0B: Gray	0000B: Pulse (A)			
	001B: 16 µs			1B: Dual	0001B: Pulse (A) and direction (B)			
	010B: 32 µs				0010B: Count up (A), count down (B)			
	011B: 48 µs				0011B: Incremental encoder (A, B phase-shifted)			
	100B: 64 µs				0100B: Incremental encoder (A, B, N)			
	101 to 111B: Not permitted				0101B: Absolute encoder (SSI)			
					0110 to 1111B: Not permitted			
7/55	Parity[4]:		Invert direction[1]	Enable diagnostic interrupt on wire break[1]	Reserved[2]	Transmission rate[4]:		
	00B: None					000B: 125 kHz		
	01B: Even					001B: 250 kHz		
	10B: Odd					010B: 500 kHz		
	11B: Not permitted					011B: 1 MHz		
						100B: 1.5 MHz		
						101B: 2 MHz		
						110 to 111B: Not permitted		
8…9/ 56…57	**Hardware interrupts**[1]							
8/56	Reserved[2]			Change of direction	Underflow (low counting limit violated)	Overflow (high counting limit violated)	Gate stop[3]	Gate start[3]
9/57	Synchronization of the counter by an external signal[3)]	New Capture value available	Reserved[2]	Zero crossing	Reserved[2]	Comparison event for DQ1 has occurred	Reserved[2]	Comparison event for DQ0 has occurred
10…15/ 58…63	**Behavior of a DQ**							
10/58	Set output (DQ1):				Set output (DQ0):			
	0000B: Use by user program				0000B: Use by user program			
	0001B: Between comparison value and high limit; Measuring: Measured value >= comparison value				0001B: Between comparison value and high limit; Measuring: Measured value >= comparison value			
	0010B: Between comparison value and low limit; Measuring: Measured value <= comparison value				0010B: Between comparison value and low limit; Measuring: Measured value <= comparison value			
	0011B: At comparison value for a pulse duration				0011B: At comparison value for a pulse duration			
	0100B: Between comparison value 0 and 1				0100B: Not permitted			
	0101B: After set command from CPU until comparison value				0101B: After set command from CPU until comparison value			
	0110B: Not between comparison value 0 and 1				0110 to 1111B: Not permitted			
	0111 to 1111B: Not permitted							

Bit → / Byte channel 0/1 ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
11/59	Count direction (DQ1):		Count direction (DQ0):		Reserved[2]		Substitute value for DQ1	Substitute value for DQ0
	00B: Not permitted		00B: Not permitted					
	01B: Up		01B: Up					
	10B: Down		10B: Down					
	11B: In both directions		11B: In both directions					
12/60	Pulse duration (DQ0):							
13/61	WORD: Value range in ms/10: 0 to 65535D							
14/62	Pulse duration (DQ1):							
15/63	WORD: Value range in ms/10: 0 to 65535D							
16/64	**Behavior of DI0**							
16/64	Behavior of counter value after Capture[3] (DI0):	Edge selection (DI0):		Select level (DI0):	Reserved[2]	Set function of DI (DI0):		
		00B: Not permitted[5]				000B: Gate start/stop (level-triggered)[3]		
		01B: At rising edge		0B: Active with high level		001B: Gate start (edge-triggered)[3]		
		10B: At falling edge				010B: Gate stop (edge-triggered)[3]		
	0B: Continue counting	11B: At rising and falling edge		1B: Active with low level		011B: Synchronization[3]		
						100B: Enable synchronization at signal N[3]		
	1B: Set to start value and continue counting					101B: Capture		
						110B: Digital input without function		
						111B: Not permitted		
17/65	**Behavior of DI1**: See Byte 16							
18/66	Reserved[2]							
19/67	Frequency of synchronization:4	Reserved[2]		Frequency of Capture function:	Input delay:			
					0B: Once			
	0B: Once			0B: Once	0001B: 0.05 ms			
					0010B: 0.1 ms			
	1B: Periodic			1B: Periodic	0011B: 0.4 ms			
					0100B: 0.8 ms			
					0101B: 1.6 ms			
					0110B: 3.2 ms			
					0111B: 12.8 ms			
					1000B: 20 ms			
					1001 to 1111B: Not permitted			

Bit → / Byte channel 0/1 ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
20...43/ 68...91	**Values**							
20...23/ 68...71	Counting high limit[3]: DWORD: Value range: –2147483648 to 2147483647D or 80000001 to 7FFFFFFFH							
24...27/ 72...75	Comparison value 0: Operating mode Counting: DWORD: Value range: –2147483648 to 2147483647D or 80000000 to 7FFFFFFFH; Measuring operating mode: REAL: Floating-point number in the configured unit of the measured quantity							
28...31/ 76...79	Comparison value 1: Operating mode Counting: DWORD: Value range: –2147483648 to 2147483647D or 80000000 to 7FFFFFFFH; Measuring operating mode: REAL: Floating-point number in the configured unit of the measured quantity							
32...35/ 80...83	Start value[3]: DWORD: Value range: –2147483648 to 2147483647D or 80000000 to 7FFFFFFFH							
36...39/ 84...87	Counting low limit[3] DWORD: Value range: –2147483648 to 2147483647D or 80000000 to 7FFFFFFFH							
40...43/ 88...91	Update time: DWORD: Value range in µs: 0 to 25000000D							
44/92	**Counter behavior at limits and gate start**							
44/92	Behavior at gate start[3]:		Reaction to violation of a counting limit[3]:			Reset when counting limit is violated[3]:		
	00B: Set to start value		000B: Stop counting			000B: To opposite counting limit		
	01B: Continue with current value		001B: Continue counting			001B: To start value		
	10 to 11B: Not permitted		010 to 111B: Not permitted			010 to 111B: Not permitted		
45/93	**Specify measured value**							
45/93	Reserved[2]			Time base for velocity measurement:			Measured variable:	
				000B: 1 ms			00B: Frequency	
				001B: 10 ms			01B: Period	
				010B: 100 ms			10B: Velocity	
				011B: 1 s			11B: Complete SSI frame	
				100B: 60 s/1 min				
				101 to 111B: Not permitted				
46/94 **47/95**	Increments per unit: WORD: Value range: 1 to 65535D							
48/96	Set hysteresis range: Value range: 0 to 255D							

Bit → Byte channel 0/1 ↓	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
49...51/ 97...99	**Parameters for SSI absolute encoder**							
49/97	Reserved[2]		Frame length[4]: Value range: 10 to 40D					
50/98			Bit number LSB of the position value: Value range: 0 to 38D					
51/99			Bit number MSB of the position value: Value range: 1 to 39D					

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

2 Reserved bits must be set to 0

3 For signal type "Absolute encoder (SSI)", the following applies: Reserved[2]

4 In isochronous mode, the parameter can affect the isochronous mode parameters of the sync domain. Because the isochronous mode parameters are not checked in RUN, overflows can occur if you change the parameter in RUN. To prevent overflows, select the option with the largest time required in the offline parameter assignment.

5 Applies to: Set function of DI = 001B; 010B; 011B; 101B

Structure of data record 128 in Fast Mode

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

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

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0...3	**Header**							
0	Major Version = 0				Minor Version = 2			
1	Length of the parameter data per channel = 48							
2	Reserved[2]							
3								
4...51	**Channel 0**							
52...99	**Channel 1**							
4/52	**Operating mode**							
4/52	Reserved[2]				Operating mode:			
					0000B: Not permitted			
					0001B: Counting / Position input			
					0010 to 1111B: Not permitted			
5/53	**Basic parameters**							
5/53	Interface standard:	Reserved[2]				Enable additional diagnostic interrupts[1)]	Reaction to CPU STOP:	
							00B: Output substitute value	
							01B: Keep last value	
	0B: RS422, symmetrical						10B: Continue operation	
	1B:TTL (5 V), asymmet-rical						11B: Not permitted	
6...7/ 54...55	**Counter inputs** (parameters for incremental and pulse encoders)							
6/54	Reserved[2]		Signal evaluation:		Signal type:			
			00B: Single		0000B: Pulse (A)			
			01B: Double		0001B: Pulse (A) and direction (B)			
			10B: Quadruple		0010B: Count up (A), count down (B)			
			11B: Not permitted		0011B: Incremental encoder (A, B phase-shifted)			
					0100B: Incremental encoder (A, B, N)			
					0101B: Absolute encoder (SSI)			
					0110 to 1111B: Not permitted			

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
7/55	Reaction to signal N:		Invert direction[1]	Enable diagnostic interrupt on wire break[1]	Filter frequency[4]:			
	00B: No reaction to signal N				0000B: 100 Hz			
	01B: Synchronization at signal N				0001B: 200 Hz			
	10 to 11B: Not permitted				0011B: 1 kHz			
					0100B: 2 kHz			
					0101B: 5 kHz			
					0110B: 10 kHz			
					0111B: 20 kHz			
					1000B: 50 kHz			
					1001B: 100 kHz			
					1010B: 200 kHz			
					1011B: 500 kHz			
					1100B: 1 MHz			
					1101 to 1111B: Not permitted			
6...7/ 54...55	**Counter inputs** (parameters for SSI absolute encoder)							
6/54	Monoflop time[4]:			Code type:	Signal type:			
	000B: Automatically			0B: Gray	0000B: Pulse (A)			
	001B: 16 µs			1B: Dual	0001B: Pulse (A) and direction (B)			
	010B: 32 µs				0010B: Count up (A), count down (B)			
	011B: 48 µs				0011B: Incremental encoder (A, B phase-shifted)			
	100B: 64 µs				0100B: Incremental encoder (A, B, N)			
	101 to 111B: Not permitted				0101B: Absolute encoder (SSI)			
					0110 to 1111B: Not permitted			
7/55	Parity[4]:		Invert direction[1]	Enable diagnostic interrupt on wire break[1]	Reserved[2]	Transmission rate[4]:		
	00B: None					000B: 125 kHz		
	01B:Even					001B: 250 kHz		
	10B:Odd					010B: 500 kHz		
	11B: Not permitted					011B: 1 MHz		
						100B: 1.5 MHz		
						101B: 2 MHz		
						110 to 111B: Not permitted		
8...9/ 56...57	Reserved[2]							

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
10...15/ 58...63	**Behavior of a DQ**							
10/58	Set output (DQ1):				Set output (DQ0):			
	0000B: Digital output without function				0000B: Digital output without function			
	0001B: Between comparison value and high counting limit				0001B: Between comparison value and high counting limit			
	0010B: Between comparison value and low counting limit				0010B: Between comparison value and low counting limit			
	0011B: At comparison value for a pulse duration				0011B: At comparison value for a pulse duration			
	0100B: Between comparison value 0 and 1				0100B to 1111B: Not permitted			
	0101 to 1111B: Not permitted							
11/59	Count direction (DQ1):		Count direction (DQ0):		Reserved[2]		Substitute value for DQ1	Substitute value for DQ0
	00B: Reserved		00B: Reserved					
	01B: Up		01B: Up					
	10B: Down		10B: Down					
	11B: In both directions		11B: In both directions					
12/60	Pulse duration (DQ0):							
13/61	Incremental and pulse encoder: UINT: Value range in ms/10: 0 to 65535D SSI absolute encoder: UINT: Value range in ms/10: 1 to 65535D							
14/62	Pulse duration (DQ1):							
15/63	Incremental and pulse encoder: UINT: Value range in ms/10: 0 to 65535D SSI absolute encoder: UINT: Value range in ms/10: 1 to 65535D							
16/64	**Behavior of DI0**							
16/64	Reserved[2)]	Edge selection (DI0):		Select level (DI0):	Reserved[2]	Set function of DI (DI0):		
		00B: Not permitted[5]				000B: Gate start/stop (level-triggered)[3]		
		01B: At rising edge		0B: Active with high level		001B: Gate start (edge-triggered)[3]		
		10B: At falling edge				010B:Gate stop (edge-triggered)[3]		
		11B: Not permitted		1B: Active with low level		011B:Synchronization[3]		
						100B: Enable synchronization at signal N[3]		
						101B: Not permitted		
						110B: Digital input without function		
						111B: Not permitted		

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
17/65	**Behavior of DI1**: See Byte 16							
18/66	Reserved[2]							
19/67	Frequency of synchronization:	Count direction for synchronization:		Reserved[2]	Input delay:			
	0_B: Once	00_B: Not permitted			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: Not permitted			
20...43/ 68...91	**Values**							
20...23/ 68...71	High counting limit[3]: Value range: 1 to 33554431_D or 1 to $01FFFFFF_H$							
24...27/ 72...75	Comparison value 0: Value range: 0 to 33554431_D or 0 to $01FFFFFF_H$							
28...31/ 76...79	Comparison value 1: Value range: 0 to 33554431_D or 0 to $01FFFFFF_H$							
32...35/ 80...83	Start value[3]: Value range: 0 to 33554431_D or 0 to $01FFFFFF_H$							
36...39/ 84...87	Counting low limit[3] Value range: 0 to 33554430_D or 0 to $01FFFFFE_H$							
40...43/ 88...91	Reserved[2]							

Bit → / Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
44/92	**Counter behavior at limits and gate start**							
44/92	Reaction to gate start[3]:		Reaction to violation of a counting limit[3]:			Reset when counting limit is violated[3]:		
	00_B: Set to start value		000_B: Stop counting			000_B: To opposite counting limit		
	01_B: Continue with current value		001_B: Continue counting			001_B: To start value		
	10 to 11_B: Not permitted		010 to 111_B: Not permitted			010 to 111_B: Not permitted		
45…47/ 93…95	Reserved[2]							
48/96	Set hysteresis range: Value range: 0 to 255_D:							
49…51/ 97…99	**Parameters for SSI absolute encoder**							
49/97	Reserved[2]		Frame length[4]: 10 to 40_D: Value range					
50/98			Bit number LSB of the position value: 0 to 38_D: Value range					
51/99			Bit number MSB of the position value: 1 to 39_D: Value range					

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

2 Reserved bits must be set to 0.

3 For signal type "Absolute encoder (SSI)", the following applies: Reserved[2]

4 In isochronous mode, the parameter can affect the isochronous mode parameters of the sync domain. Because the isochronous mode parameters are not checked in RUN, overflows can occur if you change the parameter in RUN. To prevent overflows, select the option with the largest time required in the offline parameter assignment.

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

B.2 Parameter validation error

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

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

WRREC

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

Example:

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

Example of WRREC STATUS data	Address	Meaning
DF_H	STATUS[1]	Error when writing a data record via PROFINET IO (IEC 61158-6)
80_H	STATUS[2]	Error when reading or writing a data record via PROFINET IO (IEC 61158-6)
$E1_H$	STATUS[3]	Module-specific error
11_H	STATUS[4]	Error code from the table below: The "Operating mode" parameter has an invalid value.

Error codes

The following table shows the module-specific error codes and their meaning for parameter data record 128 when using an incremental or pulse encoder.

Table B- 3 Error codes for parameter validation (incremental or pulse encoder)

Error code in STATUS parameter (hexadecimal)				Meaning	Remedy
Byte 0	Byte 1	Byte 2	Byte 3		
DF	80	B0	00	Data record number unknown	Enter valid number for data record.
DF	80	B1	01	Length of data record incorrect	Enter valid value for data record length.
DF	80	B2	00	Slot invalid or not accessible	• Check whether module is inserted or removed. • Check assigned values for parameters of the WRREC instruction.
DF	80	E0	01	Wrong version	• Check byte 0. • Enter valid values.
DF	80	E0	02	Error in the header information	• Check byte 1. • Correct the length of the parameter blocks.
DF	80	E1	00	Parameter invalid: No detailed information available	Check all parameter values.
DF	80	E1	11	"Operating mode" parameter invalid	Enter valid parameter value.
DF	80	E1	12	"Reaction to CPU STOP" parameter invalid	Enter valid parameter value.
DF	80	E1	13	"Signal type" parameter invalid	Enter valid parameter value.
DF	80	E1	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 DIn.0 and DIn.1.	Enter different parameter values for DIn.0 and DIn.1.
DF	80	E1	19	• "Edge selection" parameter invalid • "Gate start (edge-triggered)" configured as function for DIn.m and "At rising and falling edge" • "Gate stop (edge-triggered)" configured as function for DIn.m and "At rising and falling edge" • "Synchronization" configured as function for DIn.m and "At rising and falling edge"	• Enter valid parameter value. • Configure "Gate start (edge-triggered)" as function for DIn.m only together with "At rising edge" or "At falling edge" • Configure "Gate stop (edge-triggered)" as function for DIn.m only together with "At rising edge" or "At falling edge" • Configure "Synchronization" as function for DIn.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[1,4]	• Low counting limit > comparison value 0 • Low counting limit > comparison value 1	• Low counting limit < comparison value 0 • Low counting limit < comparison value 1
DF	80	E1	22[1,4]	• Counting high limit < comparison value 0 • Counting high limit < comparison value 1	• High counting limit > comparison value 0 • High counting limit > comparison value 1
DF	80	E1	23	• "Start value" parameter invalid • "Low counting limit" parameter invalid	Enter valid parameter value: Start value > low counting limit
DF	80	E1	24	• "Start value" parameter invalid • "High counting limit" parameter invalid	Enter valid parameter value: Start value < high counting limit
DF	80	E1	25	"Update time" parameter invalid	Enter parameter value from range 0 to 25000000D.
DF	80	E1	26[2]	"Reference speed" parameter invalid	Enter parameter value from range 6.00 to 210000.00D.
DF	80	E1	27	"Measured variable" parameter invalid	Enter valid parameter value.
DF	80	E1	28	"Time base for velocity measurement" parameter invalid	Enter valid parameter value.
DF	80	E1	29	"Increments per unit" parameter invalid	Enter valid parameter value.
DF	80	E1	2A	• "High counting limit" parameter invalid • "Low counting limit" parameter invalid	Enter valid parameter value: Low counting limit < high counting limit
DF	80	E1	2B[3]	• "Comparison value 0" parameter invalid • "Comparison value 1" parameter invalid	Enter valid parameter value: Comparison value 0 < comparison value 1
DF	80	E1	2C	"Signal evaluation" parameter invalid	Enter valid parameter value.
DF	80	E1	2D	• "Between comparison value 0 and 1" configured for DQn.0 • "Not between comparison value 0 and 1" configured for DQn.0 • "Between comparison value 0 and 1" configured for DQn.1, but "Use by user program" not configured for DQn.0 • "Not between comparison value 0 and 1" configured for DQn.1, but "Use by user program" not configured for DQn.0	• Configure "Between comparison value 0 and 1" only for DQn.1 • "Not between comparison value 0 and 1" configured only for DQn.1 • Only configure "Between comparison value 0 and 1" for DQn.1 when "Use by user program" is configured for DQn.0 • Only configure "Not between comparison value 0 and 1" for DQn.1 when "Use by user program" is configured for DQn.0
DF	80	E1	2E	"Capture" configured for DIn.m in "Measuring" operating mode	Do not configure "Capture" for DIn.m in "Measuring" operating mode.
DF	80	E1	36[5]	"High counting limit" parameter invalid	Enter valid parameter value.
DF	80	E1	37[4,5]	• "Comparison value 0" parameter invalid • "Comparison value 1" parameter invalid	Enter valid parameter value.
DF	80	E1	38[5]	"Start value" parameter invalid	Enter valid parameter value.
DF	80	E1	39[5]	"Low counting limit" parameter invalid	Enter valid parameter value.
DF	80	E1	3A[5]	"Count direction for synchronization" 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	F0	Reserved bit is not set to 0.	Set reserved bit to 0.
DF	80	E1	FF	Conflict with the isochronous times configured in the hardware configuration.	Enter suitable isochronous times in the hardware configuration.

1 Only for "Counting" operating mode

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

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

4 Not for DQn.m function "Use by user program"

5 Only with operating mode "Fast Mode"

The following table shows the module-specific error codes and their meaning for parameter data record 128 when using an SSI absolute encoder.

Table B- 4 Error codes for parameter validation (SSI absolute encoder)

Error code in STATUS parameter (hexadecimal)				**Meaning**	**Remedy**
Byte 0	**Byte 1**	**Byte 2**	**Byte 3**		
DF	80	B0	00	Data record number unknown	Enter valid number for data record.
DF	80	B1	01	Length of data record incorrect	Enter valid value for data record length.
DF	80	B2	00	Slot invalid or not accessible	• Check whether module is inserted or removed. • Check assigned values for parameters of the WRREC instruction.
DF	80	E0	01	Wrong version	• Check byte 0. • Enter valid values.
DF	80	E0	02	Error in the header information	• Check byte 1. • Correct the length of the parameter blocks.
DF	80	E1	00	Parameter invalid: No detailed information available	Check all parameter values.
DF	80	E1	11	"Operating mode" parameter invalid	Enter valid parameter value.
DF	80	E1	12	"Reaction to CPU STOP" parameter invalid	Enter valid parameter value.
DF	80	E1	13	"Signal type" parameter invalid	Enter valid parameter value.
DF	80	E1	18	"Set function of DI" parameter configured the same for DIn.0 and DIn.1.	Enter different parameter values for DIn.0 and DIn.1.
DF	80	E1	19	• "Edge selection" parameter invalid	Enter valid parameter value.
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	25	"Update time" parameter invalid	Enter parameter value from range 0 to 25000000$_D$.
DF	80	E1	26[1]	"Reference speed" parameter invalid	Enter parameter value from range 6.00 to 210000.00$_D$.
DF	80	E1	27	"Measured variable" parameter invalid	Enter valid parameter value.
DF	80	E1	28	"Time base for velocity measurement" parameter invalid	Enter valid parameter value.
DF	80	E1	29	"Increments per unit" parameter invalid	Enter valid parameter value.
DF	80	E1	2B[2]	• "Comparison value 0" parameter invalid • "Comparison value 1" parameter invalid	Enter valid parameter value: Comparison value 0 < comparison value 1
DF	80	E1	2D	• "Between comparison value 0 and 1" configured for DQn.0 • "Not between comparison value 0 and 1" configured for DQn.0 • "Between comparison value 0 and 1" configured for DQn.1, but "Use by user program" not configured for DQn.0 • "Not between comparison value 0 and 1" configured for DQn.1, but "Use by user program" not configured for DQn.0	• Configure "Between comparison value 0 and 1" only for DQn.1 • "Not between comparison value 0 and 1" configured only for DQn.1 • Only configure "Between comparison value 0 and 1" for DQn.1 when "Use by user program" is configured for DQn.0 • Only configure "Not between comparison value 0 and 1" for DQn.1 when "Use by user program" is configured for DQn.0

Error code in STATUS parameter (hexadecimal)				Meaning	Remedy
Byte 0	**Byte 1**	**Byte 2**	**Byte 3**		
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	2F	"Set function of DI" parameter invalid	Enter valid parameter value.
DF	80	E1	30	"Monoflop time" parameter invalid	Enter valid parameter value.
DF	80	E1	31	"Transmission rate" parameter invalid	Enter valid parameter value.
DF	80	E1	32	"Parity" parameter invalid	Enter valid parameter value.
DF	80	E1	33	"Frame length" parameter invalid	Enter valid parameter value.
DF	80	E1	34	• Bit number LSB of the position value < 0 • Bit number LSB of the position value > Bit number MSB of the position value • (Bit number MSB of the position value) – (Bit number LSB of the position value) >= 31 • Bit number MSB of the position value > Frame length	• Bit number LSB of the position value >= 0 • Bit number LSB of the position value < Bit number MSB of the position value • (Bit number MSB of the position value) – (Bit number LSB of the position value) < 32 • Bit number MSB of the position value <= Frame length
DF	80	E1	35	"0" configured for "Pulse duration" parameter	Enter valid parameter value.
DF	80	E1	37[3]	• "Comparison value 0" parameter invalid • "Comparison value 1" parameter invalid	Enter valid parameter value.
DF	80	E1	F0	Reserved bit is not set to 0.	Set reserved bit to 0.
DF	80	E1	FF	Conflict with the isochronous times configured in the hardware configuration.	Enter suitable isochronous times in the hardware configuration.

[1] Only for "Position input for "Motion Control"" technology object" operating mode

[2] Only for DQn.1 functions "Between comparison value 0 and 1" and "Not between comparison value 0 and 1"

[3] Only for "Fast Mode" operating mode; not with DQm function "Digital output without function"