

Documentation | EN

EP6224 and EP6228

IO-Link Master with protection class IP67



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1 Foreword

1.1 Notes on the documentation

Intended audience

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.

It is essential that the documentation and the following notes and explanations are followed when installing and commissioning these components.

The qualified personnel is obliged to always use the currently valid documentation.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.

We reserve the right to revise and change the documentation at any time and without prior announcement.

No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

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1.2 Safety instructions

Safety regulations

Please note the following safety instructions and explanations!

Product-specific safety instructions can be found on following pages or in the areas mounting, wiring, commissioning etc.

Exclusion of liability

All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

Personnel qualification

This description is only intended for trained specialists in control, automation and drive engineering who are familiar with the applicable national standards.

Signal words

The signal words used in the documentation are classified below. In order to prevent injury and damage to persons and property, read and follow the safety and warning notices.

Personal injury warnings

DANGER

Hazard with high risk of death or serious injury.

WARNING

Hazard with medium risk of death or serious injury.

CAUTION

There is a low-risk hazard that could result in medium or minor injury.

Warning of damage to property or environment

NOTICE

The environment, equipment, or data may be damaged.

Information on handling the product



This information includes, for example:
recommendations for action, assistance or further information on the product.

1.3 Documentation issue status

Version	Comment
2.5	• Product overview updated • Technical data updated
2.4	• EP6224-0092 added • Chapter "TwinSAFE SC" added
2.3	• Chapters updated: ◦ "IO-Link basics" ◦ "Connections" ◦ "Access to IO-Link data"
2.2	• EP6224-0002 added • EP6224-3002 added • Commissioning updated • Structure update
2.1	• UL Requirements updated • Module overview updated
2.0	• EP6224-0042 added • EP6228-0042 added • EP6228-3142 added • <i>Technical data</i> updated • Structure update
1.5	• <i>IO-Link master principles</i> updated • <i>IO-Link configuration</i> updated
1.4	• Update <i>Technical data</i> • EP6228-3132 added
1.3.0	• Update <i>Technical data</i> • Safety instructions – new layout
1.2.5	• <i>EP6228-x0x2 - Technical Data</i> updated • Safety instructions adapted to IEC 82079-1.
1.2.4	• EP6228-3032 added • <i>EP6224-x022 - Technical Data</i> updated • <i>EP6228-x0x2 - Technical Data</i> updated • <i>EP6228-x0x2 – Introduction</i> updated • <i>EP622x Module overview</i> updated • <i>Conductor losses 7/8"</i> added • <i>Configuration with TwinCAT – explanation of tab and IO-Link master</i> updated
1.2.3	• <i>Object description and parameterization</i> updated • <i>IO-Link basics</i> updated
1.2.2	• <i>Object description and parameterization</i> updated
1.2.1	• <i>Tightening torques for plug connectors</i> updated
1.2.0	• EP6228-0022 added • <i>Object description and parameterization</i> updated • <i>EP6224-x022 process image</i> updated • Images for IO-Link and sensor cable updated
1.1.0	• <i>Power connection</i> updated
1.0.0	• First release

Version	Changes
0.6	• Corrections
0.5	• First preliminary version

Firmware and hardware versions

This documentation refers to the firmware and hardware version that was applicable at the time the documentation was written.

The module features are continuously improved and developed further. Modules having earlier production statuses cannot have the same properties as modules with the latest status. However, existing properties are retained and are not changed, so that older modules can always be replaced with new ones.

The firmware and hardware version (delivery state) can be found in the batch number (D-number) printed on the side of the EtherCAT Box.

Syntax of the batch number (D-number)

D: WW YY FF HH

WW - week of production (calendar week)

YY - year of production

FF - firmware version

HH - hardware version

Example with D no. 29 10 02 01:

29 - week of production 29

10 - year of production 2010

02 - firmware version 02

01 - hardware version 01

Further information on this topic: [Version identification of EtherCAT devices](#) [► 152].

2 EtherCAT Box - Introduction

The EtherCAT system has been extended with EtherCAT Box modules with protection class IP67. Through the integrated EtherCAT interface the modules can be connected directly to an EtherCAT network without an additional Coupler Box. The high-performance of EtherCAT is thus maintained into each module.

The extremely low dimensions of only 126 x 30 x 26.5 mm (h x w x d) are identical to those of the Fieldbus Box extension modules. They are thus particularly suitable for use where space is at a premium. The small mass of the EtherCAT modules facilitates applications with mobile I/O interface (e.g. on a robot arm). The EtherCAT connection is established via screened M8 connectors.

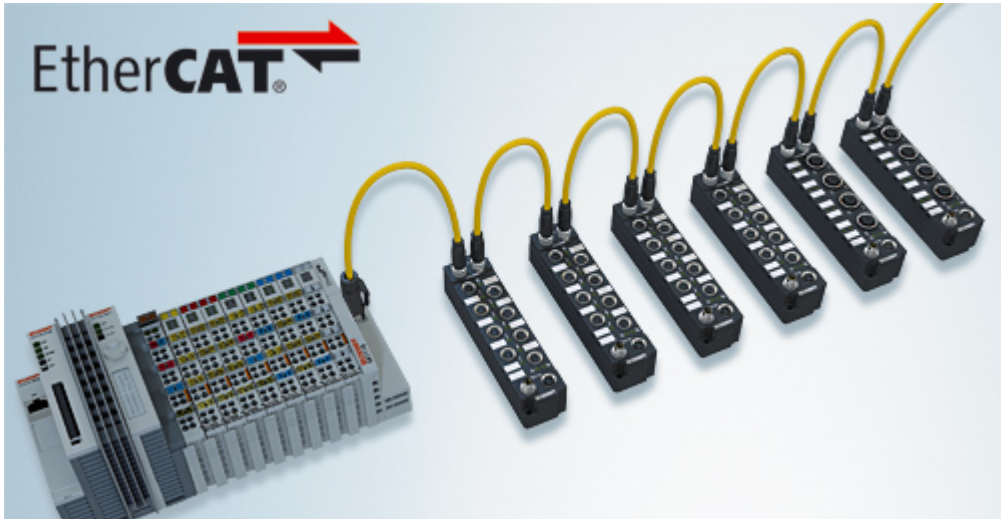


Fig. 1: EtherCAT Box Modules within an EtherCAT network

The robust design of the EtherCAT Box modules enables them to be used directly at the machine. Control cabinets and terminal boxes are now no longer required. The modules are fully sealed and therefore ideally prepared for wet, dirty or dusty conditions.

Pre-assembled cables significantly simplify EtherCAT and signal wiring. Very few wiring errors are made, so that commissioning is optimized. In addition to pre-assembled EtherCAT, power and sensor cables, field-configurable connectors and cables are available for maximum flexibility. Depending on the application, the sensors and actuators are connected through M8 or M12 connectors.

The EtherCAT modules cover the typical range of requirements for I/O signals with protection class IP67:

- digital inputs with different filters (3.0 ms or 10 μ s)
- digital outputs with 0.5 or 2 A output current
- analog inputs and outputs with 16 bit resolution
- Thermocouple and RTD inputs
- Stepper motor modules

XFC (eXtreme Fast Control Technology) modules, including inputs with time stamp, are also available.



Fig. 2: EtherCAT Box with M8 connections for sensors/actuators



Fig. 3: EtherCAT Box with M12 connections for sensors/actuators

i Basic EtherCAT documentation

You will find a detailed description of the EtherCAT system in the Basic System Documentation for EtherCAT, which is available for download from our website (www.beckhoff.com) under Downloads.

3 Product overview

The following table shows the products described in this documentation and the main distinguishing features.

Product	Number of ports Class A	Number of ports Class B	Digital I/O	EtherCAT connections	Maximum supply current for IO-Link devices			
					L+ ¹⁾ per port	L+ ¹⁾ in total	P24 ¹⁾ per port	P24 ¹⁾ in total
EP6224-0002 ▶ 14	4	-	4 x DI + max. 4 x DI/DO ²⁾	M8	1.4 A	4 A	-	-
EP6224-0042 ▶ 18	4	-	8 x DI + max. 4 x DI/DO ²⁾	M12	1.4 A	5.6 A	-	-
EP6224-0092 ▶ 22	4	-	4 x DI + max. 4 x DI/DO ²⁾	M8	1.4 A	4 A	-	-
EP6224-2022 ▶ 26	4	-	max. 4 x DI/DO ²⁾	M8	1.4 A	4 A	-	-
EP6224-3002 ▶ 30	-	4	-	M8	1.4 A	4 A	2 A	4 A
EP6224-3022 ▶ 34	-	4	-	M8	1.4 A	4 A	2 A	4 A
EP6228-0022 ▶ 38	8	-	max. 8 x DI/DO ²⁾	M8	1.4 A	4 A	-	-
EP6228-0042 ▶ 43	8	-	8 x DI + max. 8 x DI/DO ²⁾	M12	1.4 A	11.2 A	-	-
EP6228-3032 ▶ 48	-	8	-	M8	1.4 A	11.2 A	4 A ³⁾	16 A
EP6228-3132 ▶ 53	4	4	4 x DI + max. 4 x DI/DO ²⁾	M8	1.4 A	11.2 A	4 A ³⁾	8 A
EP6228-3142 ▶ 59	4	4	4 x DI + max. 4 x DI/DO ²⁾	M12	1.4 A	11.2 A	4 A ³⁾	8 A

¹⁾ Supply voltages for IO-Link devices:

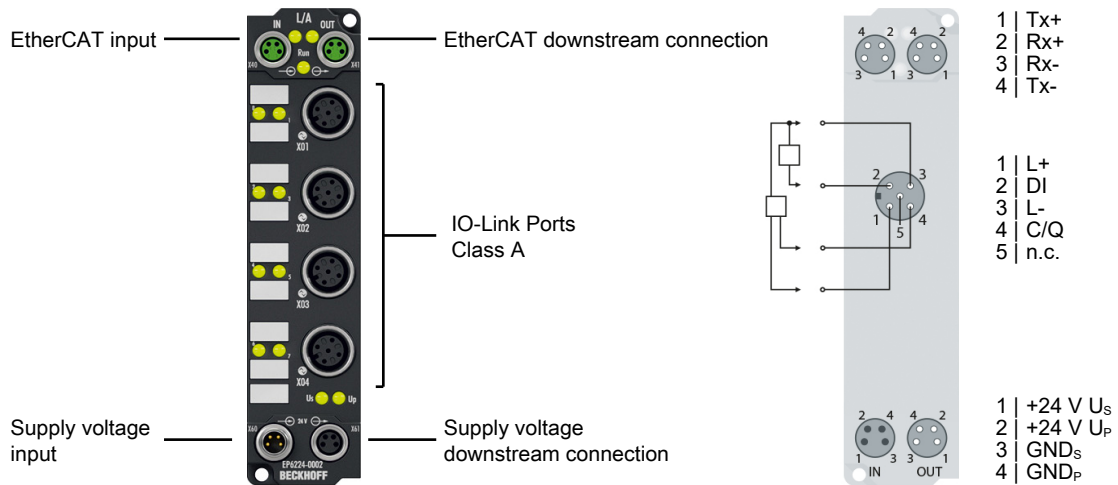
- L+ : Supply voltage for sensors and logic.
- P24: Supply voltage for actuators. Only available on Class B ports.

²⁾ Each unused IO-Link port Class A can be configured as either a DI or a DO.

³⁾ This value is also the maximum sum current for a port pair. The port pairs are specified in the Technical Data.

3.1 EP6224-0002

3.1.1 Introduction EP6224-0002



4-channel IO-Link master Class A, 4 x digital input

The EP6224-0002 IO-Link module enables the connection of up to four IO-Link devices. These can be actuators, sensors or a combination of both. In addition, the EP6224-0002 offers four further digital inputs on the free pins of the M12 ports. Point-to-point connection between the box and the device. The EtherCAT Box is parameterized via the EtherCAT Master. IO-Link is designed as an intelligent link between the fieldbus level and the sensor, wherein parameterization information can be exchanged bidirectionally via the IO-Link connection. The parameterization of the IO-Link devices with service data can take place from TwinCAT via ADS or, very conveniently, via the integrated IO-Link configuration tool.

In the default setting, the four IO-Link channels of the EP6224-0002 operate as a 4-channel input module, 24 V_{DC}, which if necessary communicates with connected IO-Link devices, parameterizes them and, if required, changes their operation mode. Each IO-Link port can also optionally be used just as an input or output. The slim design also enables use where space is cramped.

Quick links

[Technical data \[► 15\]](#)

[Process image \[► 17\]](#)

[Dimensions \[► 68\]](#)

[Connections: IO-Link \[► 81\]](#)

[Commissioning and configuration \[► 87\]](#)

3.1.2 Technical data EP6224-0002

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, A-coded, shielded
Electrical isolation	500 V
Distributed Clocks	yes

Supply voltages	
Power supply connection	M8 connector, 4-pin
Downstream connection	M8 socket, 4-pin
U_s nominal voltage	24 V _{DC} (-15 % / +20 %)
U_s sum current	max. 4 A
Current consumption from U_s	100 mA + Current consumption of the IO-Link devices from L+
U_s nominal voltage	24 V _{DC} (-15 % / +20 %)
U_s sum current	max. 4 A
Current consumption from U_p	None. U_p is only forwarded.

IO-Link	
Number of ports Class A	4
Connection	4x M12 socket, 4-pin
Cable length	max. 20 m
Specification	IO-Link V1.1
Data rates	COM1: 4.8 kbit/s COM2: 38.4 kbit/s COM3: 230.4 kbit/s
Sensor power supply L+	24 V _{DC} from U_s
L+ output current	max. 1.4 A per port, short-circuit proof max. 4.0 A in total
Extra power P24	-
C/Q input filter	none (when configured as digital input, see 2. Assigning IO-Link device to port n [► 93])
C/Q output current	max. 200 mA, not short-circuit proof (when configured as digital output, see 2. Assigning IO-Link device to port n [► 93])

Digital inputs	
Number	4
Connection	4x M12 socket ¹⁾
Cable length	max. 30 m
Characteristics	Type 3 according to EN61131-2, compatible with type 1
Input filter	10 µs
Signal voltage "0"	-3 ... +5 V
Signal voltage "1"	+11 ... +30 V
Input current	3 mA

¹⁾ These digital inputs are located at pin 2 of the IO-Link ports.

Housing data	
Dimensions W x H x D	30 mm x 126 mm x 26.5 mm (without connectors)
Weight	approx. 165 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25 ... +60 °C -25 ... +55 °C according to cURus
Ambient temperature during storage	-40 ... +85 °C
Vibration resistance, shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 Additional tests [► 16]
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 (conforms to EN 60529)

Approvals/markings	
Approvals/markings *)	CE, cURus [► 85]

*) Real applicable approvals/markings see type plate on the side (product marking).

Additional tests

The devices have undergone the following additional tests:

Test	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.1.3 Scope of supply EP6224-0002

Make sure that the following components are included in the scope of delivery:

- 1x EP6224-0002
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 10x labels, blank (1 strip of 10)



Pre-assembled protective caps do not ensure IP67 protection

Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.1.4 Process image EP6224-0002

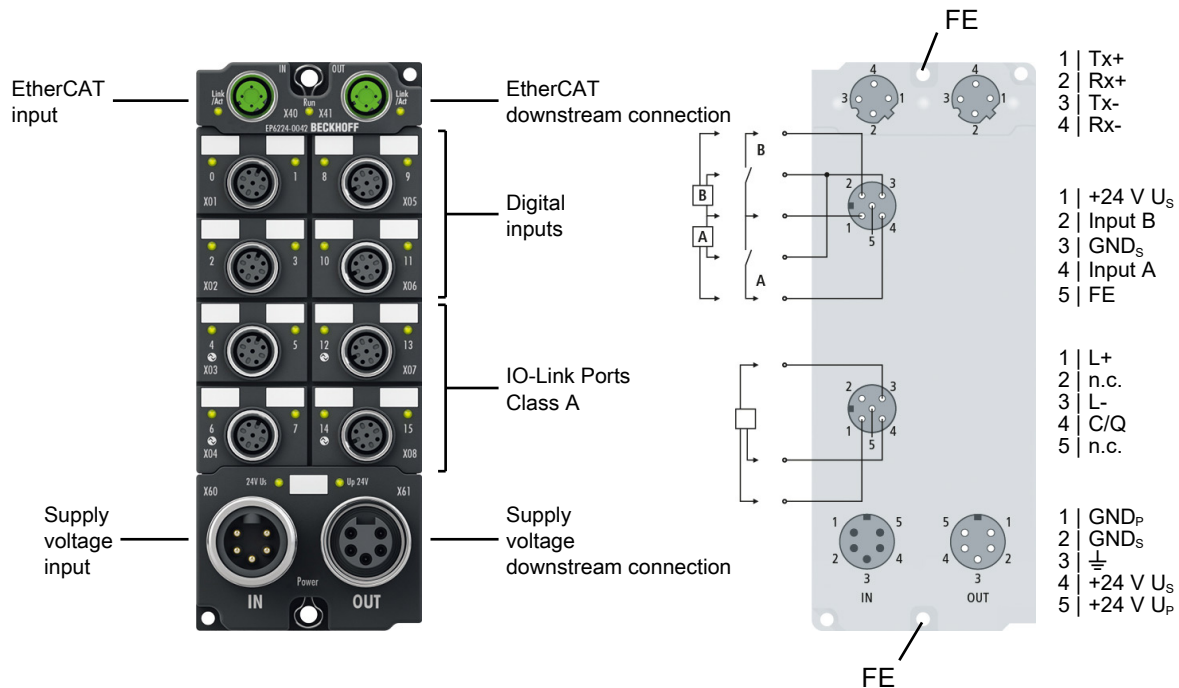
- ▲  Box 1 (EP6224-0002)
 - ▲  Module 1 (DeviceState Inputs Device)
 - ▲  DeviceState Inputs Device
 -  Device Diag
 -  Device State
 - ▲  Module 2 (DeviceState Inputs)
 - ▲  DeviceState Inputs
 -  State Ch1
 -  State Ch2
 -  State Ch3
 -  State Ch4
 - ▶  Module 3 (IO-Link Slave)
 - ▶  Module 4 (IO-Link Slave)
 - ▶  Module 5 (IO-Link Slave)
 - ▶  Module 6 (IO-Link Slave)
 - ▲  Module 7 (Digital Inputs)
 - ▲  Digital Inputs
 -  DI X01 Pin2
 -  DI X02 Pin2
 -  DI X03 Pin2
 -  DI X04 Pin2
 - ▶  WcState
 - ▶  InfoData

-  Module 1
Diagnosis.
See chapter [Further error diagnosis](#) [▶ 134].
-  Module 2
Status variables of the IO-Link ports.
See chapter [Status of the IO-Link ports](#) [▶ 129].
-  Module 3 ¹⁾
Process data of the IO-Link device at port X01
-  Module 4 ¹⁾
Process data of the IO-Link device at port X02
-  Module 5 ¹⁾
Process data of the IO-Link device at port X03
-  Module 6 ¹⁾
Process data of the IO-Link device at port X04
-  Module 7
Digital inputs.

¹⁾ The modules "Module 3" to "Module 6" only exist in the process data if the corresponding IO-Link ports have been configured.

3.2 EP6224-0042

3.2.1 Introduction EP6224-0042



4-channel IO-Link master, Class A, 8 x digital input

The EP6224-0042 IO-Link module enables connection of up to four IO-Link devices, e.g. actuators, sensors or combinations of both. In addition, the EP6224-0042 offers further digital inputs on the four upper free M12 ports. A point-to-point connection is used between the box and the IO-Link device. The terminal is parameterized via the EtherCAT master. IO-Link is designed as an intelligent link between the fieldbus level and the sensor, wherein parameterization information can be exchanged bidirectionally via the IO-Link connection. The parameterization of the IO-Link devices with service data can be done from TwinCAT via ADS or very conveniently via the integrated IO-Link configuration tool.

In the standard setting, the four IO-Link channels of the EP6224-0042 operate as a 4-channel input module, 24 V DC, which communicates with connected IO-Link devices, parameterizes them and, if necessary, changes their operating mode. Each IO-Link port can optionally be used only as input or output.

Quick links

[Technical data \[► 19\]](#)

[Process image \[► 21\]](#)

[Dimensions \[► 73\]](#)

[Connections: IO-Link \[► 81\]](#)

[Connections: digital inputs \[► 84\]](#)

[Commissioning and configuration \[► 87\]](#)

3.2.2 Technical data EP6224-0042

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M12 socket, 4-pin, D-coded, shielded
Electrical isolation	500 V
Distributed Clocks	yes

Supply voltages	
Connection	Input: 7/8" plug, 5-pin, 16-UN thread Downstream connection: 7/8" socket, 5-pin, 16-UN thread
U _S nominal voltage	24 V _{DC} (-15 % / +20 %)
U _S sum current	max. 16 A
Current consumption from U _S	130 mA + Current consumption of the IO-Link devices from L+
U _S nominal voltage	24 V _{DC} (-15 % / +20 %)
U _S sum current	max. 16 A
Current consumption from U _P	None. U _P is only forwarded.

IO-Link	
Number of ports Class A	4
Connection	4x M12 socket, 4-pin
Cable length	max. 20 m
Specification	IO-Link V1.1
Data rates	COM1: 4.8 kbit/s COM2: 38.4 kbit/s COM3: 230.4 kbit/s
Sensor power supply L+	24 V _{DC} from U _S
L+ output current	max. 1.4 A per port, short-circuit proof
Extra power P24	-
C/Q input filter	none (when configured as digital input, see 2. Assigning IO-Link device to port n [► 93])
C/Q output current	max. 200 mA, not short-circuit proof (when configured as digital output, see 2. Assigning IO-Link device to port n [► 93])

Digital inputs	
Number	8
Connection	4 x M12 socket
Cable length	max. 30 m
Characteristics	Type 3 according to EN61131-2, compatible with type 1
Input filter	10 µs
Signal voltage "0"	-3 ... +5 V
Signal voltage "1"	+11 ... +30 V
Input current	3 mA

Housing data	
Dimensions W x H x D	60 mm x 150 mm x 26,5 mm (without connectors)
Weight	approx. 440 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25 ... +60 °C
Ambient temperature during storage	-40 ... +85 °C
Vibration / shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 conforms to EN 60529

Approvals / markings	
Approvals / markings *)	CE, UL under preparation

*) Real applicable approvals/markings see type plate on the side (product marking).

Additional tests

The devices have undergone the following additional tests:

Test	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.2.3 Scope of supply EP6224-0042

Make sure that the following components are included in the scope of delivery:

- 1x EP6224-0042 EtherCAT Box
- 1x Protective cap for supply voltage output, 7/8", black (pre-fitted)
- 2x protective cap for EtherCAT socket, M12 (pre-assembled)
- 10x labels, blank (1 strip of 10)



Pre-assembled protective caps do not ensure IP67 protection

Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.2.4 Process image EP6224-0042

- Box 1 (EP6224-0042)
 - Module 1 (DeviceState Inputs Device)
 - DeviceState Inputs Device
 - Device Diag
 - Device State
 - Module 2 (DeviceState Inputs)
 - DeviceState Inputs
 - State Ch1
 - State Ch2
 - State Ch3
 - State Ch4
 - Module 3 (IO-Link Slave)
 - Module 4 (IO-Link Slave)
 - Module 5 (IO-Link Slave)
 - Module 6 (IO-Link Slave)
 - Module 7 (Digital Inputs)
 - Digital Inputs
 - DI X01 Pin2
 - DI X01 Pin4
 - DI X02 Pin2
 - DI X02 Pin4
 - DI X05 Pin2
 - DI X05 Pin4
 - DI X06 Pin2
 - DI X06 Pin4
 - WcState
 - InfoData

- Module 1

Diagnosis.

See chapter [Further error diagnosis](#) [► 134].
- Module 2

Status bytes of the IO-Link ports.

See chapter [Status of the IO-Link ports](#) [► 129].
- Module 3 ¹⁾

Process data of the IO-Link device at port 1 (connector X03)
- Module 4 ¹⁾

Process data of the IO-Link device at port 2 (connector X04)
- Module 5 ¹⁾

Process data of the IO-Link device at port 3 (connector X07)
- Module 6 ¹⁾

Process data of the IO-Link device at port 4 (connector X08)
- Module 7

Digital inputs.

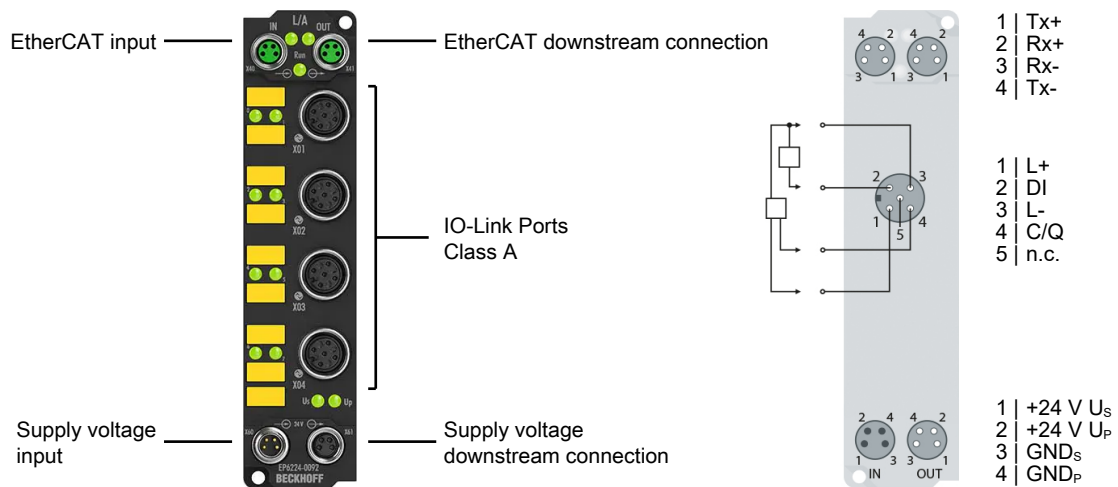
Assignment of connectors, ports and process data

Connector	IO-Link port	Process data of the IO-Link device	Status variable of the IO-Link port
X03	1	Module 3 ¹⁾	State Ch1
X04	2	Module 4 ¹⁾	State Ch2
X07	3	Module 5 ¹⁾	State Ch3
X08	4	Module 6 ¹⁾	State Ch4

¹⁾ The modules "Module 3" to "Module 6" only exist in the process data if the corresponding IO-Link ports have been configured.

3.3 EP6224-0092

3.3.1 Introduction EP6224-0092



The EP6224-0092 IO-Link module enables the connection of up to four IO-Link devices. These can be actuators, sensors or a combination of both. In addition, the EP6224-0092 offers four further digital inputs on the free pins of the M12 ports. Point-to-point connection between the box and the device.

The EP6224-0092 also supports TwinSAFE SC (TwinSAFE Single Channel). This enables the use of IO-Link data for safety-related tasks via EtherCAT.

The EtherCAT Box is parameterized via the EtherCAT Master. IO-Link is designed as an intelligent link between the fieldbus level and the sensor, wherein parameterization information can be exchanged bidirectionally via the IO-Link connection. The parameterization of the IO-Link devices with service data can take place from TwinCAT via ADS or, very conveniently, via the integrated IO-Link configuration tool. In the default setting, the four IO-Link channels of the EP6224-0092 operate as a 4-channel input module, 24 V_{DC}, which if necessary communicates with connected IO-Link devices, parameterizes them and, if required, changes their operation mode. Each IO-Link port can also optionally be used just as an input or output. The slim design also enables use where space is cramped.

TwinSAFE SC

The TwinSAFE SC technology [► 123] (TwinSAFE Single Channel) enables the use of standard signals for safety tasks in any networks of fieldbuses. The standard functionalities and features of the I/Os are retained. The data of the TwinSAFE SC I/Os are routed to the TwinSAFE logic and processed there in a multi-channel safety-related manner. In the Safety Logic the data originating from different sources are analyzed, checked for plausibility and submitted to a 'voting'. This is done using certified function blocks such as Scale, Compare/Voting (1oo2, 2oo3, 3oo5), Limit, etc. For safety reasons, at least one of the data sources must be a TwinSAFE SC component. The remainder of the data can originate from other standard Bus Terminals, drive controllers or measuring transducers.

With the aid of the TwinSAFE SC technology it is typically possible to achieve a safety level equivalent to PL d/Cat. 3 in accordance with EN ISO 13849-1 or SIL 2 in accordance with EN 62061.

Quick links

[Technical data \[► 23\]](#)

[Process image \[► 25\]](#)

[Dimensions \[► 70\]](#)

[Connections: IO-Link \[► 81\]](#)

[Commissioning and configuration \[► 87\]](#)

3.3.2 Technical data EP6224-0092

All values are typical values over the entire temperature range, unless stated otherwise.

MTBF	
MTBF (55 °C)	> 1,050,000 h

EtherCAT	
Connection	2 x M8 socket, 4-pin, A-coded, shielded
Electrical isolation	500 V
Distributed Clocks	yes

Supply voltages	
Power supply connection	M8 connector, 4-pin
Downstream connection	M8 socket, 4-pin
U _s nominal voltage	24 V _{DC} (-15 % / +20 %)
U _s sum current	max. 4 A
Current consumption from U _s	100 mA + Current consumption of the IO-Link devices from L+
U _s nominal voltage	24 V _{DC} (-15 % / +20 %)
U _s sum current	max. 4 A
Current consumption from U _p	None. U _p is only forwarded.

IO-Link	
Number of ports Class A	4
Connection	4x M12 socket, 4-pin
Cable length	max. 20 m
Specification	IO-Link V1.1
Data rates	COM1: 4.8 kbit/s COM2: 38.4 kbit/s COM3: 230.4 kbit/s
Sensor power supply L+	24 V _{DC} from U _s
L+ output current	max. 1.4 A per port, short-circuit proof max. 4.0 A in total
Extra power P24	-
C/Q input filter	none (when configured as digital input, see 2. Assigning IO-Link device to port n [► 93])
C/Q output current	max. 200 mA, not short-circuit proof (when configured as digital output, see 2. Assigning IO-Link device to port n [► 93])

Digital inputs	
Number	4
Connection	4x M12 socket ¹⁾
Cable length	max. 30 m
Characteristics	Type 3 according to EN61131-2, compatible with type 1
Input filter	10 µs
Signal voltage "0"	-3 ... +5 V
Signal voltage "1"	+11 ... +30 V
Input current	3 mA

¹⁾ These digital inputs are located at pin 2 of the IO-Link ports.

Housing data	
Dimensions W x H x D	30 mm x 126 mm x 26.5 mm (without connectors)
Weight	approx. 165 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25 ... +60 °C -25 ... +55 °C according to cURus
Ambient temperature during storage	-40 ... +85 °C
Vibration resistance, shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 Additional tests [► 24]
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 (conforms to EN 60529)

Approvals/markings	
Approvals/markings ^{*)}	CE, cURus [► 85]

^{*)} Real applicable approvals/markings see type plate on the side (product marking).

Additional tests

The devices have undergone the following additional tests:

Test	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.3.3 Scope of supply EP6224-0092

Make sure that the following components are included in the scope of delivery:

- 1x EP6224-0092
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 10x labels, blank (1 strip of 10)



Pre-assembled protective caps do not ensure IP67 protection

Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.3.4 Process image EP6224-0092

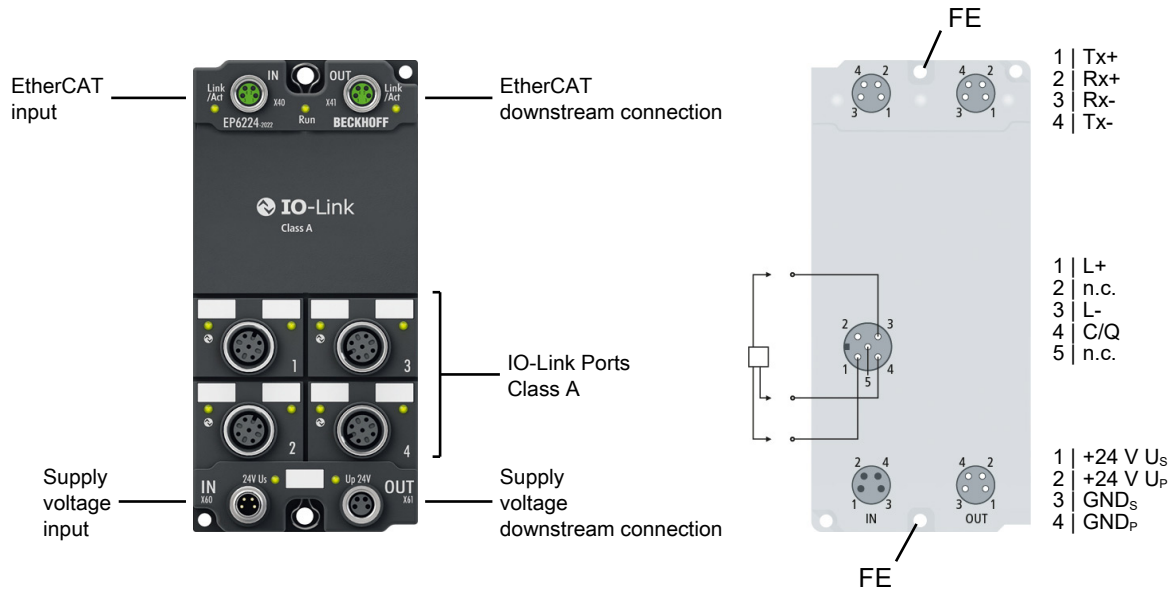
- ▲  Box 1 (EP6224-0092)
 - ▲  Module 1 (DeviceState Inputs Device)
 - ▲  DeviceState Inputs Device
 -  Device Diag
 -  Device State
 - ▲  Module 2 (DeviceState Inputs)
 - ▲  DeviceState Inputs
 -  State Ch1
 -  State Ch2
 -  State Ch3
 -  State Ch4
 - ▲  Module 3 (IO-Link Slave)
 - ▶  IO-Link Port1
 - ▲  Module 4 (IO-Link Slave)
 - ▶  IO-Link Port2
 - ▲  Module 5 (IO-Link Slave)
 - ▶  IO-Link Port3
 - ▲  Module 6 (IO-Link Slave)
 - ▶  IO-Link Port4
 - ▲  Module 7 (Digital Inputs)
 - ▶  Digital Inputs
 - ▶  WcState
 - ▶  InfoData

-  Module 1
Diagnosis.
See chapter [Further error diagnosis](#) [► 134].
-  Module 2
Status variables of the IO-Link ports.
See chapter [Status of the IO-Link ports](#) [► 129].
-  Module 3 ¹⁾
Process data of the IO-Link device at port X01
-  Module 4 ¹⁾
Process data of the IO-Link device at port X02
-  Module 5 ¹⁾
Process data of the IO-Link device at port X03
-  Module 6 ¹⁾
Process data of the IO-Link device at port X04
-  Module 7
Digital inputs.

¹⁾ The modules "Module 3" to "Module 6" only exist in the process data if the corresponding IO-Link ports have been configured.

3.4 EP6224-2022

3.4.1 Introduction EP6224-2022



4-channel IO-Link master

The EP6224-2022 IO-Link module enables connection of up to four IO-Link devices, e.g. actuators, sensors or combinations of both. A point-to-point connection is used between the box and the device. The terminal is parameterised via the EtherCAT master. IO-Link is designed as an intelligent link between the fieldbus level and the sensor, wherein parameterisation information can be exchanged bidirectionally via the IO-Link connection. The parameterisation of the IO-Link devices with service data can be done from TwinCAT via ADS or very conveniently via the integrated IO-Link configuration tool.

In the standard setting, the EP6224-2022 functions as a 4-channel input terminal, 24 V DC, which communicates with connected IO-Link devices, parameterises them and, if necessary, changes their operating mode.

Quick links

[Technical data \[► 27\]](#)

[Process image \[► 29\]](#)

[Dimensions \[► 71\]](#)

[Connections: IO-Link \[► 81\]](#)

[Commissioning and configuration \[► 87\]](#)

3.4.2 Technical data EP6224-2022

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, A-coded, shielded
Electrical isolation	500 V
Distributed Clocks	yes

Supply voltages	
Power supply connection	M8 connector, 4-pin
Downstream connection	M8 socket, 4-pin
U_s nominal voltage	24 V _{DC} (-15 % / +20 %)
U_s sum current	max. 4 A
Current consumption from U_s	130 mA + Current consumption of the IO-Link devices from L+
U_s nominal voltage	24 V _{DC} (-15 % / +20 %)
U_s sum current	max. 4 A
Current consumption from U_p	None. U_p is only forwarded.

IO-Link	
Number of ports Class A	4
Connection	4x M12 socket, 4-pin
Cable length	max. 20 m
Specification	IO-Link V1.1
Data rates	COM1: 4.8 kbit/s COM2: 38.4 kbit/s COM3: 230.4 kbit/s
Sensor power supply L+	24 V _{DC} from U_s
L+ output current	max. 1.4 A per port, short-circuit proof max. 4.0 A in total
Extra power P24	-
C/Q input filter	none (when configured as digital input, see 2. Assigning IO-Link device to port n [► 93])
C/Q output current	max. 200 mA, not short-circuit proof (when configured as digital output, see 2. Assigning IO-Link device to port n [► 93])

Housing data	
Dimensions W x H x D	60 mm x 126 mm x 26.5 mm (without plug connectors)
Weight	approx. 250 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25 ... +60 °C -25 ... +55 °C according to cURus
Ambient temperature during storage	-40 ... +85 °C
Vibration resistance, shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 Additional tests [► 28]
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 (conforms to EN 60529)

Approvals/markings	
Approvals/markings *)	CE, cURus [► 85]

*) Real applicable approvals/markings see type plate on the side (product marking).

Additional tests

The devices have undergone the following additional tests:

Test	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.4.3 Scope of supply EP6224-2022

Make sure that the following components are included in the scope of delivery:

- 1x EP6224-2022 EtherCAT Box
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 10x labels, blank (1 strip of 10)

i Pre-assembled protective caps do not ensure IP67 protection

Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.4.4 Process image EP6224-2022

- ▲  Box 1 (EP6224-2022)
 - ▲  Module 1 (DeviceState Inputs Device)
 - ▲  DeviceState Inputs Device
 -  Device Diag
 -  Device State
 - ▲  Module 2 (DeviceState Inputs)
 - ▲  DeviceState Inputs
 -  State Ch1
 -  State Ch2
 -  State Ch3
 -  State Ch4
 - ▶  Module 3 (IO-Link Slave)
 - ▶  Module 4 (IO-Link Slave)
 - ▶  Module 5 (IO-Link Slave)
 - ▶  Module 6 (IO-Link Slave)
 - ▶  WcState
 - ▶  InfoData

-  Module 1
Diagnosis.
See chapter [Further error diagnosis](#) [► 134].
-  Module 2
Status bytes of the IO-Link ports.
See chapter [Status of the IO-Link ports](#) [► 129].
-  Module 3 ¹⁾
Process data of the IO-Link device at port 1
-  Module 4 ¹⁾
Process data of the IO-Link device at port 2
-  Module 5 ¹⁾
Process data of the IO-Link device at port 3
-  Module 6 ¹⁾
Process data of the IO-Link device at port 4

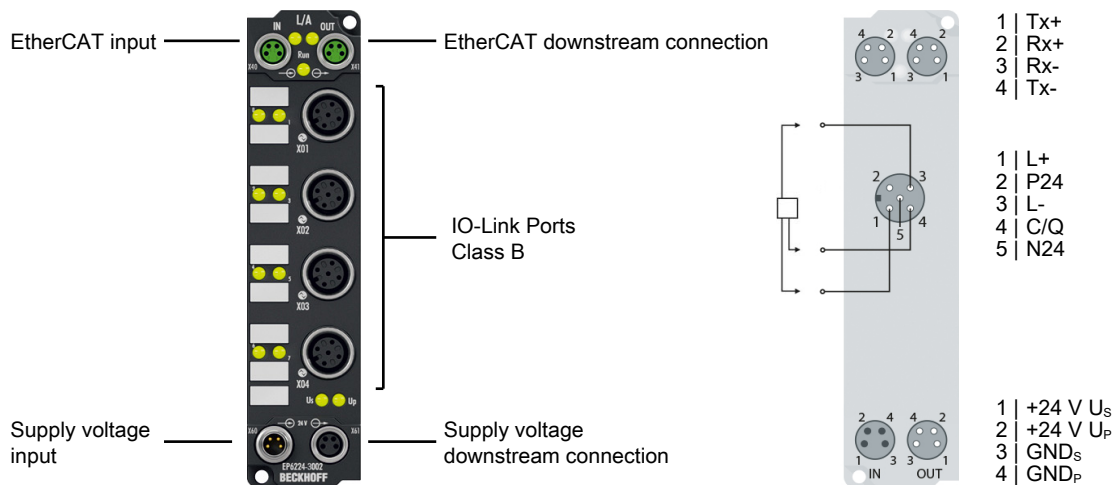
Assignment of connectors, ports and process data

Connector	IO-Link port	Process data of the IO-Link device	Status variable of the IO-Link port
1	1	 Module 3 ¹⁾	 State Ch1
2	2	 Module 4 ¹⁾	 State Ch2
3	3	 Module 5 ¹⁾	 State Ch3
4	4	 Module 6 ¹⁾	 State Ch4

¹⁾ The modules "Module 3" to "Module 6" only exist in the process data if the corresponding IO-Link ports have been configured.

3.5 EP6224-3002

3.5.1 Introduction EP6224-3002



EtherCAT Box, 4-channel communication interface, IO-Link, master, Class B, M12

The EP6224-3002 IO-Link module enables the connection of up to four IO-Link devices. These can be actuators, sensors or a combination of both. An additional supply voltage is available on the Class B ports for IO-Link devices with higher power requirements. Point-to-point connection between the box and the device. The EtherCAT Box is parameterized via the EtherCAT Master. IO-Link is designed as an intelligent link between the fieldbus level and the sensor, wherein parameterization information can be exchanged bidirectionally via the IO-Link connection. The parameterization of the IO-Link devices with service data can take place from TwinCAT via ADS or, very conveniently, via the integrated IO-Link configuration tool.

In the default setting, the EP6224-3002 operates as a 4-channel input module, 24 V_{DC}, which if necessary communicates with connected IO-Link devices, parameterizes them and, if required, changes their operation mode. Each IO-Link port can also optionally be used just as an input or output. The slim design also enables use where space is cramped.

Special features:

- IO-Link V1.1
- convenient sensor parameterization in TwinCAT
- additional supply P24
- very slim design

Quick links

[Technical data \[► 31\]](#)

[Process image \[► 33\]](#)

[Dimensions \[► 68\]](#)

[Connections: IO-Link \[► 81\]](#)

[Commissioning and configuration \[► 87\]](#)

3.5.2 Technical data EP6224-3002

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, A-coded, shielded
Electrical isolation	500 V
Distributed Clocks	yes

Supply voltages	
Power supply connection	M8 connector, 4-pin
Downstream connection	M8 socket, 4-pin
U_s nominal voltage	24 V _{DC} (-15 % / +20 %)
U_s sum current	max. 4 A
Current consumption from U_s	100 mA + Current consumption of the IO-Link devices from L+
U_p nominal voltage	24 V _{DC} (-15 % / +20 %)
U_p sum current	max. 4 A
Current consumption from U_p	= Current consumption of the IO-Link devices from P24

IO-Link	
Number of ports Class B	4
Connection	4x M12 socket, 5-pin
Cable length	max. 20 m
Specification	IO-Link V1.1
Data rate	COM1: 4.8 kbit/s COM2: 38.4 kbit/s COM3: 230.4 kbit/s
Sensor power supply L+	24 V _{DC} from the control voltage U_s
L+ output current	max. 1.4 A per port, short-circuit proof max. 4.0 A in total
Extra power P24	24 V _{DC} from U_p
P24 output current	max. 2.0 A per port max. 4.0 A in total, short-circuit proof
C/Q input filter	none (when configured as digital input, see 2. Assigning IO-Link device to port n [► 93])
C/Q output current	max. 200 mA, not short-circuit proof (when configured as digital output, see 2. Assigning IO-Link device to port n [► 93])

Housing data	
Dimensions W x H x D	30 mm x 126 mm x 26.5 mm (without connectors)
Weight	approx. 165 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25 ... +60 °C -25 ... +55 °C according to cURus
Ambient temperature during storage	-40 ... +85 °C
Vibration resistance, shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 Additional tests [► 32]
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 (conforms to EN 60529)

Approvals/markings	
Approvals/markings *)	CE, cURus [► 85]

*) Real applicable approvals/markings see type plate on the side (product marking).

Additional tests

The devices have undergone the following additional tests:

Test	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.5.3 Scope of supply EP6224-3002

Make sure that the following components are included in the scope of delivery:

- 1x EP6224-3002
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 10x labels, blank (1 strip of 10)

i Pre-assembled protective caps do not ensure IP67 protection

Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.5.4 Process image EP6224-3002

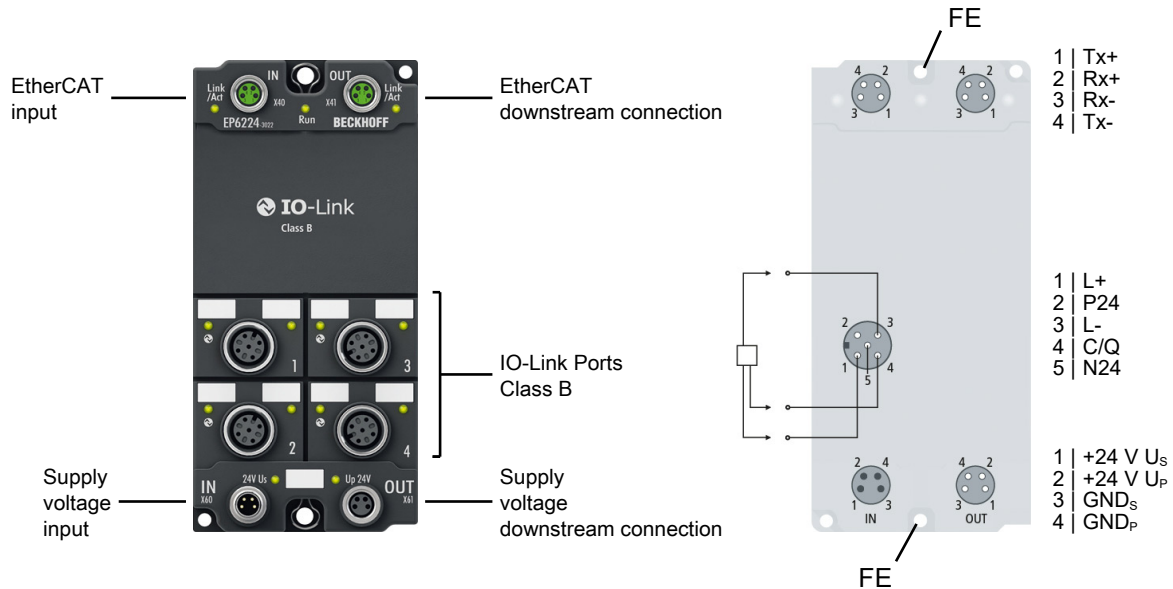
- ▲  Box 1 (EP6224-3002)
 - ▲  Module 1 (DeviceState Inputs Device)
 - ▲  DeviceState Inputs Device
 -  Device Diag
 -  Device State
 - ▲  Module 2 (DeviceState Inputs)
 - ▲  DeviceState Inputs
 -  State Ch1
 -  State Ch2
 -  State Ch3
 -  State Ch4
 - ▲  Module 3 (IO-Link Slave)
 - ▷  IO-Link Port1
 - ▲  Module 4 (IO-Link Slave)
 - ▷  IO-Link Port2
 - ▲  Module 5 (IO-Link Slave)
 - ▷  IO-Link Port3
 - ▲  Module 6 (IO-Link Slave)
 - ▷  IO-Link Port4
 - ▷  WcState
 - ▷  InfoData

-  Module 1
Diagnosis.
See chapter [Further error diagnosis](#) [► 134].
-  Module 2
Status variables of the IO-Link ports
-  Module 3 ¹⁾
Process data of the IO-Link device at port X01
-  Module 4 ¹⁾
Process data of the IO-Link device at port X02
-  Module 5 ¹⁾
Process data of the IO-Link device at port X03
-  Module 6 ¹⁾
Process data of the IO-Link device at port X04
-  Module 7
Digital inputs.

¹⁾ The modules "Module 3" to "Module 6" only exist in the process data if the corresponding IO-Link ports have been configured.

3.6 EP6224-3022

3.6.1 Introduction EP6224-3022



4-channel IO-Link master

The EP6224-3022 IO-Link module enables connection of up to four IO-Link devices, e.g. actuators, sensors or combinations of both. A point-to-point connection is used between the box and the device. The terminal is parameterised via the EtherCAT master. IO-Link is designed as an intelligent link between the fieldbus level and the sensor, wherein parameterisation information can be exchanged bidirectionally via the IO-Link connection. The parameterisation of the IO-Link devices with service data can be done from TwinCAT via ADS or very conveniently via the integrated IO-Link configuration tool.

In the standard setting, the EP6224-3022 functions as a 4-channel input terminal, 24 V DC, which communicates with connected IO-Link devices, parameterises them and, if necessary, changes their operating mode.

Quick links

[Technical data \[► 35\]](#)

[Process image \[► 37\]](#)

[Dimensions \[► 71\]](#)

[Connections: IO-Link \[► 81\]](#)

[Commissioning and configuration \[► 87\]](#)

3.6.2 Technical data EP6224-3022

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, A-coded, shielded
Electrical isolation	500 V
Distributed Clocks	yes

Supply voltages	
Power supply connection	M8 connector, 4-pin
Downstream connection	M8 socket, 4-pin
U_s nominal voltage	24 V _{DC} (-15 % / +20 %)
U_s sum current	max. 4 A
Current consumption from U_s	130 mA + Current consumption of the IO-Link devices from L+
U_p nominal voltage	24 V _{DC} (-15 % / +20 %)
U_p sum current	max. 4 A
Current consumption from U_p	= Current consumption of the IO-Link devices from P24

IO-Link	
Number of ports Class B	4
Connection	4x M12 socket, 5-pin
Cable length	max. 20 m
Specification	IO-Link V1.1
Data rate	COM1: 4.8 kbit/s COM2: 38.4 kbit/s COM3: 230.4 kbit/s
Sensor power supply L+	24 V _{DC} from the control voltage U_s
L+ output current	max. 1.4 A per port, short-circuit proof max. 4.0 A in total
Extra power P24	24 V _{DC} from U_p
P24 output current	max. 2.0 A per port max. 4.0 A in total, short-circuit proof
C/Q input filter	none (when configured as digital input, see 2. Assigning IO-Link device to port n [► 93])
C/Q output current	max. 200 mA, not short-circuit proof (when configured as digital output, see 2. Assigning IO-Link device to port n [► 93])

Housing data	
Dimensions W x H x D	60 mm x 126 mm x 26.5 mm (without plug connectors)
Weight	approx. 250 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25 ... +60 °C -25 ... +55 °C according to cURus
Ambient temperature during storage	-40 ... +85 °C
Vibration resistance, shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 Additional tests [► 36]
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 (conforms to EN 60529)

Approvals/markings	
Approvals/markings *)	CE, cURus [► 85]

*) Real applicable approvals/markings see type plate on the side (product marking).

Additional tests

The devices have undergone the following additional tests:

Test	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.6.3 Scope of supply EP6224-3022

Make sure that the following components are included in the scope of delivery:

- 1x EP6224-3022 EtherCAT Box
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 10x labels, blank (1 strip of 10)



Pre-assembled protective caps do not ensure IP67 protection

Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.6.4 Process image EP6224-3022

- ▲  Box 1 (EP6224-3022)
 - ▲  Module 1 (DeviceState Inputs Device)
 - ▲  DeviceState Inputs Device
 -  Device Diag
 -  Device State
 - ▲  Module 2 (DeviceState Inputs)
 - ▲  DeviceState Inputs
 -  State Ch1
 -  State Ch2
 -  State Ch3
 -  State Ch4
 - ▶  Module 3 (IO-Link Slave)
 - ▶  Module 4 (IO-Link Slave)
 - ▶  Module 5 (IO-Link Slave)
 - ▶  Module 6 (IO-Link Slave)
 - ▶  WcState
 - ▶  InfoData

-  Module 1
Diagnosis.
See chapter [Further error diagnosis](#) [► 134].
-  Module 2
Status bytes of the IO-Link ports.
See chapter [Status of the IO-Link ports](#) [► 129].
-  Module 3 ¹⁾
Process data of the IO-Link device at port 1
-  Module 4 ¹⁾
Process data of the IO-Link device at port 2
-  Module 5 ¹⁾
Process data of the IO-Link device at port 3
-  Module 6 ¹⁾
Process data of the IO-Link device at port 4

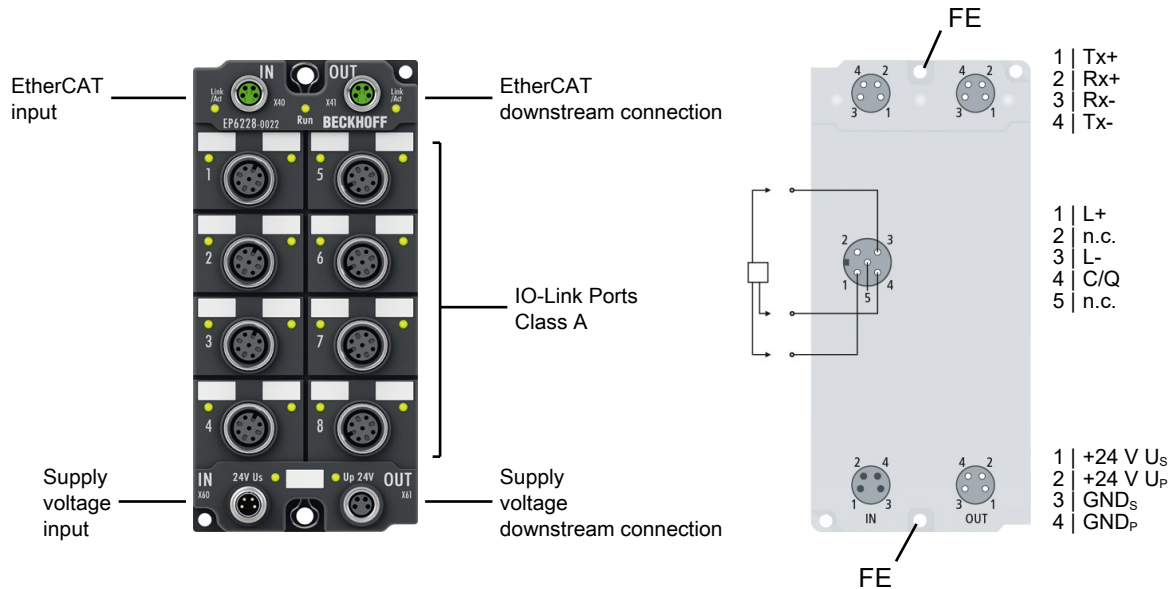
Assignment of connectors, ports and process data

Connector	IO-Link port	Process data of the IO-Link device	Status variable of the IO-Link port
1	1	 Module 3 ¹⁾	 State Ch1
2	2	 Module 4 ¹⁾	 State Ch2
3	3	 Module 5 ¹⁾	 State Ch3
4	4	 Module 6 ¹⁾	 State Ch4

¹⁾ The modules "Module 3" to "Module 6" only exist in the process data if the corresponding IO-Link ports have been configured.

3.7 EP6228-0022

3.7.1 Introduction EP6228-0022



8-channel IO-Link master

The EP6228-0022 IO-Link module enables connection of up to eight IO-Link devices, e.g. IO-Link box modules, actuators, sensors or combinations thereof. A point-to-point connection is used between the module and the device. The terminal is parameterised via the EtherCAT master. IO-Link is designed as an intelligent link between the fieldbus level and the sensor, wherein parameterisation information can be exchanged bidirectionally via the IO-Link connection. The parameterisation of the IO-Link devices with service data can be done from TwinCAT via ADS or very conveniently via the integrated IO-Link configuration tool.

In the standard setting, the EP6228-0022 functions as a 8-channel input terminal, 24 V DC, which communicates with connected IO-Link devices, parameterises them and, if necessary, changes their operating mode.

Quick links

[Technical data \[► 39\]](#)

[Process image \[► 41\]](#)

[Dimensions \[► 69\]](#)

[Connections: IO-Link \[► 81\]](#)

[Commissioning and configuration \[► 87\]](#)

3.7.2 Technical data EP6228-0022

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, A-coded, shielded
Electrical isolation	500 V
Distributed Clocks	yes

Supply voltages	
Power supply connection	M8 connector, 4-pin
Downstream connection	M8 socket, 4-pin
U_s nominal voltage	24 V _{DC} (-15 % / +20 %)
U_s sum current	max. 4 A
Current consumption from U_s	130 mA + Current consumption of the IO-Link devices from L+
U_s nominal voltage	24 V _{DC} (-15 % / +20 %)
U_s sum current	max. 4 A
Current consumption from U_p	None. U_p is only forwarded.

IO-Link	
Number of ports Class A	8
Connection	8x M12 socket, 4-pin
Cable length	max. 20 m
Specification	IO-Link V1.1
Data rates	COM1: 4.8 kbit/s COM2: 38.4 kbit/s COM3: 230.4 kbit/s
Sensor power supply L+	24 V _{DC} from U_s
L+ output current	max. 1.4 A per port, short-circuit proof max. 4.0 A in total
Extra power P24	-
C/Q input filter	none (when configured as digital input, see 2. Assigning IO-Link device to port n [► 93])
C/Q output current	max. 200 mA, not short-circuit proof (when configured as digital output, see 2. Assigning IO-Link device to port n [► 93])

Housing data	
Dimensions W x H x D	60 mm x 126 mm x 26.5 mm (without plug connectors)
Weight	approx. 250 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25 ... +60 °C -25 ... +55 °C according to cURus
Ambient temperature during storage	-40 ... +85 °C
Vibration resistance, shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 Additional tests [► 40]
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 (conforms to EN 60529)

Approvals/markings	
Approvals/markings *)	CE, cURus [► 85]

*) Real applicable approvals/markings see type plate on the side (product marking).

Additional tests

The devices have undergone the following additional tests:

Test	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.7.3 Scope of supply EP6228-0022

Make sure that the following components are included in the scope of delivery:

- 1x EP6228-0022 EtherCAT Box
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 10x labels, blank (1 strip of 10)

i Pre-assembled protective caps do not ensure IP67 protection

Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.7.4 Process image EP6228-0022

- ▲  Box 1 (EP6228-0022)
 - ▲  Module 1 (DeviceState Inputs Device)
 - ▲  DeviceState Inputs Device
 -  Device Diag
 -  Device State
 - ▲  Module 2 (DeviceState Inputs)
 - ▲  DeviceState Inputs
 -  State Ch1
 -  State Ch2
 -  State Ch3
 -  State Ch4
 -  State Ch5
 -  State Ch6
 -  State Ch7
 -  State Ch8
 - ▶  Module 3 (IO-Link Slave)
 - ▶  Module 4 (IO-Link Slave)
 - ▶  Module 5 (IO-Link Slave)
 - ▶  Module 6 (IO-Link Slave)
 - ▶  Module 7 (IO-Link Slave)
 - ▶  Module 8 (IO-Link Slave)
 - ▶  Module 9 (IO-Link Slave)
 - ▶  Module 10 (IO-Link Slave)
 - ▶  WcState
 - ▶  InfoData

-  Module 1
Diagnosis.
See chapter [Further error diagnosis](#) [► 134].
-  Module 2
Status bytes of the IO-Link ports.
See chapter [Status of the IO-Link ports](#) [► 129].
-  Module 3 ¹⁾
Process data of the IO-Link device at port 1
-  Module 4 ¹⁾
Process data of the IO-Link device at port 2
-  Module 5 ¹⁾
Process data of the IO-Link device at port 3
-  Module 6 ¹⁾
Process data of the IO-Link device at port 4
-  Module 7 ¹⁾
Process data of the IO-Link device at port 5
-  Module 8 ¹⁾
Process data of the IO-Link device at port 6
-  Module 9 ¹⁾
Process data of the IO-Link device at port 7
-  Module 10 ¹⁾
Process data of the IO-Link device at port 8

¹⁾ The modules "Module 3" to "Module 6" only exist in the process data if the corresponding IO-Link ports have been configured.

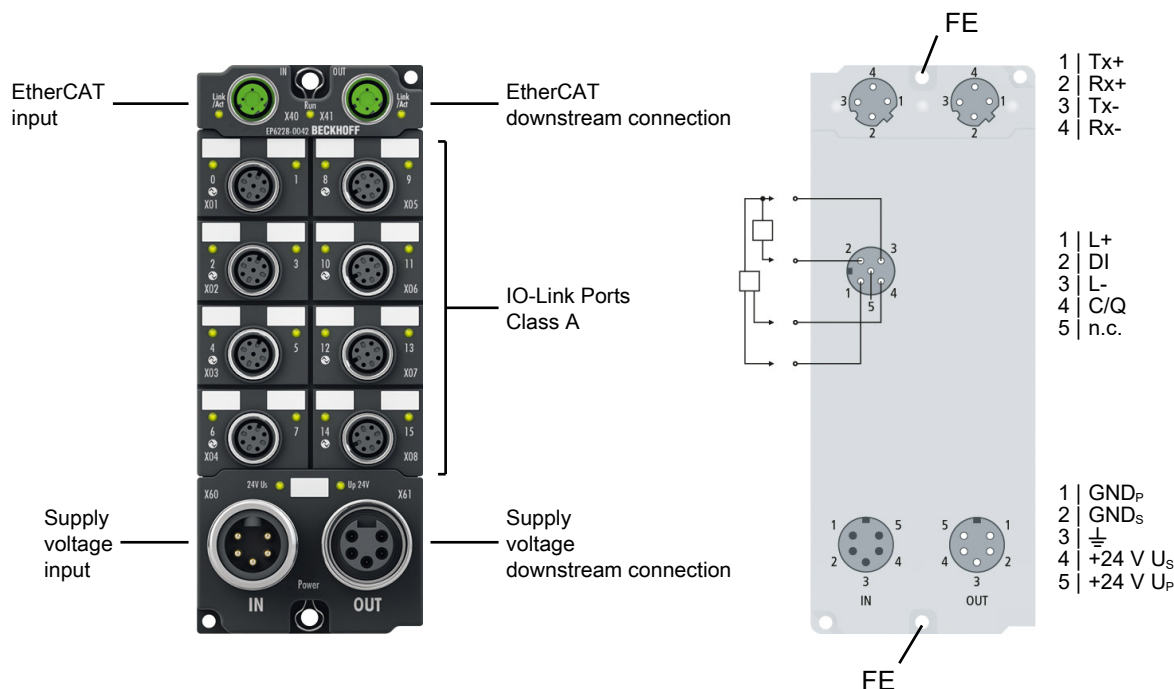
Assignment of connectors, ports and process data

Connector	IO-Link port	Process data of the IO-Link device	Status variable of the IO-Link port
1	1	 Module 3 ¹⁾	 State Ch1
2	2	 Module 4 ¹⁾	 State Ch2
3	3	 Module 5 ¹⁾	 State Ch3
4	4	 Module 6 ¹⁾	 State Ch4
5	5	 Module 7 ¹⁾	 State Ch5
6	6	 Module 8 ¹⁾	 State Ch6
7	7	 Module 9 ¹⁾	 State Ch7
8	8	 Module 10 ¹⁾	 State Ch8

¹⁾ The modules "Module 3" to "Module 10" only exist in the process data if the corresponding IO-Link ports have been configured.

3.8 EP6228-0042

3.8.1 Introduction EP6228-0042



8-channel IO-Link master, Class A, 8 x digital input

The EP6228-0042 IO-Link module enables connection of up to eight IO-Link devices, e.g. IO-Link box modules, actuators, sensors or combinations thereof. In addition, the EP6228-0042 offers additional digital inputs on the eight Class A master ports. A point-to-point connection is used between the module and the device. The terminal is parameterized via the EtherCAT master. IO-Link is designed as an intelligent link between the fieldbus level and the sensor, wherein parameterization information can be exchanged bidirectionally via the IO-Link connection. The parameterization of the IO-Link devices with service data can be done from TwinCAT via ADS or very conveniently via the integrated IO-Link configuration tool.

In the standard setting, the EP6228-0042 functions as a 8-channel input terminal, 24 V_{DC}, which communicates with connected IO-Link devices, parameterizes them and, if necessary, changes their operating mode.

Quick links

[Technical data \[► 44\]](#)

[Process image \[► 46\]](#)

[Dimensions \[► 73\]](#)

[Connections: IO-Link \[► 81\]](#)

[Commissioning and configuration \[► 87\]](#)

3.8.2 Technical data EP6228-0042

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M12 socket, 4-pin, D-coded, shielded
Electrical isolation	500 V
Distributed Clocks	yes

Supply voltages	
Connection	Input: 7/8" plug, 5-pin, 16-UN thread Downstream connection: 7/8" socket, 5-pin, 16-UN thread
U _S nominal voltage	24 V _{DC} (-15 % / +20 %)
U _S sum current	max. 16 A
Current consumption from U _S	130 mA + Current consumption of the IO-Link devices from L+
U _S nominal voltage	24 V _{DC} (-15 % / +20 %)
U _S sum current	max. 16 A
Current consumption from U _P	None. U _P is only forwarded.

IO-Link	
Number of ports Class A	8
Connection	8x M12 socket, 4-pin
Cable length	max. 20 m
Specification	IO-Link V1.1
Data rates	COM1: 4.8 kbit/s COM2: 38.4 kbit/s COM3: 230.4 kbit/s
Sensor power supply L+	24 V _{DC} from U _S
L+ output current	max. 1.4 A per port, short-circuit proof
Extra power P24	-
C/Q input filter	none (when configured as digital input, see 2. Assigning IO-Link device to port n [► 93])
C/Q output current	max. 200 mA, not short-circuit proof (when configured as digital output, see 2. Assigning IO-Link device to port n [► 93])

Digital inputs	
Number	8
Connection	8x M12 socket ¹⁾
Cable length	max. 30 m
Characteristics	Type 3 according to EN61131-2, compatible with type 1
Input filter	10 µs
Signal voltage "0"	-3 ... +5 V
Signal voltage "1"	+11 ... +30 V
Input current	3 mA

¹⁾ These digital inputs are located at pin 2 of the IO-Link ports.

Housing data	
Dimensions W x H x D	60 mm x 150 mm x 26,5 mm (without connectors)
Weight	approx. 440 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25 ... +60 °C
Ambient temperature during storage	-40 ... +85 °C
Vibration / shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 conforms to EN 60529

Approvals / markings	
Approvals / markings *)	CE, UL under preparation

*) Real applicable approvals/markings see type plate on the side (product marking).

Additional tests

The devices have undergone the following additional tests:

Test	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.8.3 Scope of supply EP6228-0042

Make sure that the following components are included in the scope of delivery:

- 1x EP6228-0042 EtherCAT Box
- 1x Protective cap for supply voltage output, 7/8", black (pre-fitted)
- 2x protective cap for EtherCAT socket, M12 (pre-assembled)
- 10x labels, blank (1 strip of 10)



Pre-assembled protective caps do not ensure IP67 protection

Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.8.4 Process image EP6228-0042

- ▲  Box 1 (EP6228-0042)
 - ▲  Module 1 (DeviceState Inputs Device)
 - ▲  DeviceState Inputs Device
 -  Device Diag
 -  Device State
 - ▲  Module 2 (DeviceState Inputs)
 - ▲  DeviceState Inputs
 -  State Ch1
 -  State Ch2
 -  State Ch3
 -  State Ch4
 -  State Ch5
 -  State Ch6
 -  State Ch7
 -  State Ch8
 - ▶  Module 3 (IO-Link Slave)
 - ▶  Module 4 (IO-Link Slave)
 - ▶  Module 5 (IO-Link Slave)
 - ▶  Module 6 (IO-Link Slave)
 - ▶  Module 7 (IO-Link Slave)
 - ▶  Module 8 (IO-Link Slave)
 - ▶  Module 9 (IO-Link Slave)
 - ▶  Module 10 (IO-Link Slave)
 - ▲  Module 11 (Digital Inputs)
 - ▲  Digital Inputs
 -  Pin2 Ch1
 -  Pin2 Ch2
 -  Pin2 Ch3
 -  Pin2 Ch4
 -  Pin2 Ch5
 -  Pin2 Ch6
 -  Pin2 Ch7
 -  Pin2 Ch8
 - ▶  WcState
 - ▶  InfoData

-  Module 1
Diagnosis.
See chapter [Further error diagnosis](#) [► 134].
-  Module 2
Status bytes of the IO-Link ports.
See chapter [Status of the IO-Link ports](#) [► 129].
-  Module 3 ¹⁾
Process data of the IO-Link device at port 1
-  Module 4 ¹⁾
Process data of the IO-Link device at port 2
-  Module 5 ¹⁾
Process data of the IO-Link device at port 3
-  Module 6 ¹⁾
Process data of the IO-Link device at port 4
-  Module 7 ¹⁾
Process data of the IO-Link device at port 5
-  Module 8 ¹⁾
Process data of the IO-Link device at port 6
-  Module 9 ¹⁾
Process data of the IO-Link device at port 7
-  Module 10 ¹⁾
Process data of the IO-Link device at port 8
-  Module 11
Digital inputs.

¹⁾ The modules "Module 3" to "Module 10" only exist in the process data if the corresponding IO-Link ports have been configured.

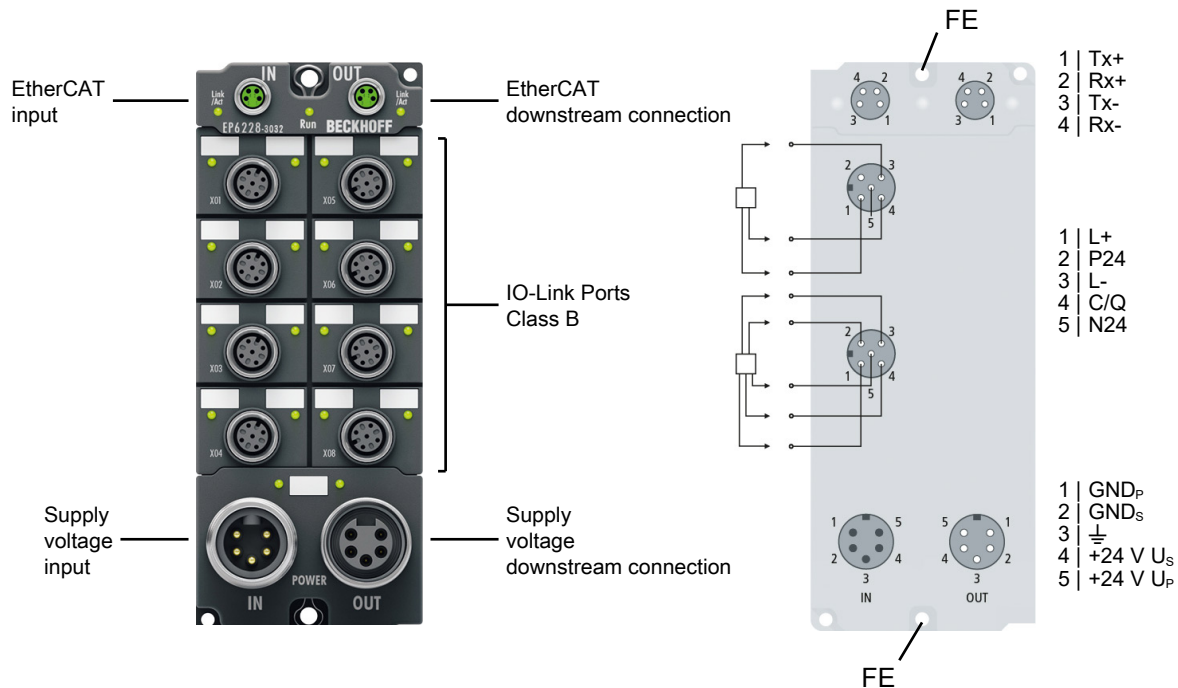
Assignment of connectors, ports and process data

Connector	IO-Link port	Process data of the IO-Link device	Status variable of the IO-Link port	Digital input
X01	1	 Module 3 ¹⁾	 State Ch1	 Pin 2 Ch1
X02	2	 Module 4 ¹⁾	 State Ch2	 Pin 2 Ch2
X03	3	 Module 5 ¹⁾	 State Ch3	 Pin 2 Ch3
X04	4	 Module 6 ¹⁾	 State Ch4	 Pin 2 Ch4
X05	5	 Module 7 ¹⁾	 State Ch5	 Pin 2 Ch5
X06	6	 Module 8 ¹⁾	 State Ch6	 Pin 2 Ch6
X07	7	 Module 9 ¹⁾	 State Ch7	 Pin 2 Ch7
X08	8	 Module 10 ¹⁾	 State Ch8	 Pin 2 Ch8

¹⁾ The modules "Module 3" to "Module 10" only exist in the process data if the corresponding IO-Link ports have been configured.

3.9 EP6228-3032

3.9.1 Introduction EP6228-3032



8-channel IO-Link master

The EP6228-3032 IO-Link module enables the connection of up to eight IO-Link devices according to specification V1.1 Class B. These can be IO-Link Box modules, actuators, sensors or a combination of both. A point-to-point connection is used between the module and the device. The EtherCAT Box is parameterised via the EtherCAT master. IO-Link is designed as an intelligent link between the fieldbus level and connected sensors, enabling the bidirectional exchange of parameterisation data via the IO-Link connection. The IO-Link device can be parameterised with service data from TwinCAT via ADS and also very conveniently using the integrated IO-Link configuration tool.

In the standard setting, the eight IO-Link channels of the EP6228-3032 operate as an 8-channel input module, 24 V DC, which communicates with connected IO-Link devices as required, parameterises them and, if necessary, changes their operating mode. Each IO-Link port can optionally be used as a pure input or output.

The 7/8" power supply connectors offer an increased total current of the EtherCAT Box so that all IO-Link ports can be operated with maximum current.

Quick links

[Technical data \[► 49\]](#)

[Process image \[► 51\]](#)

[Dimensions \[► 72\]](#)

[Connections: IO-Link \[► 81\]](#)

[Commissioning and configuration \[► 87\]](#)

3.9.2 Technical data EP6228-3032

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, A-coded, shielded
Electrical isolation	500 V
Distributed Clocks	yes

Supply voltages	
Connection	Input: 7/8" plug, 5-pin, 16-UN thread Downstream connection: 7/8" socket, 5-pin, 16-UN thread
U _s nominal voltage	24 V _{DC} (-15 % / +20 %)
U _s sum current	max. 16 A at 40 °C
Current consumption from U _s	130 mA + Current consumption of the IO-Link devices from L+
U _p nominal voltage	24 V _{DC} (-15 % / +20 %)
U _p sum current	max. 16 A at 40 °C
Current consumption from U _p	= Current consumption of the IO-Link devices from P24

IO-Link	
Number of ports Class B	8
Connection	8x M12 socket, 5-pin
Cable length	max. 20 m
Specification	IO-Link V1.1
Data rate	COM1: 4.8 kbit/s COM2: 38.4 kbit/s COM3: 230.4 kbit/s
Sensor power supply L+	24 V _{DC} from U _s
L+ output current	max. 1.4 A per port, short-circuit proof
Extra power P24	24 V _{DC} from U _p
P24 output current	max. 4.0 A per port pair ¹⁾ , short-circuit proof
C/Q input filter	none (when configured as digital input, see 2. Assigning IO-Link device to port n [► 93])
C/Q output current	max. 200 mA, not short-circuit proof (when configured as digital output, see 2. Assigning IO-Link device to port n [► 93])

¹⁾ Port pairs with common limitation of P24:

- 1 + 5
- 2 + 6
- 3 + 7
- 4 + 8

Housing data	
Dimensions W x H x D	60 mm x 150 mm x 26,5 mm (without connectors)
Weight	approx. 440 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25 ... +60 °C
Ambient temperature during storage	-40 ... +85 °C
Vibration / shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 conforms to EN 60529

Approvals / markings	
Approvals / markings *)	CE, UL under preparation

*) Real applicable approvals/markings see type plate on the side (product marking).

Additional tests

The devices have undergone the following additional tests:

Test	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.9.3 Scope of supply EP6228-3032

Make sure that the following components are included in the scope of delivery:

- 1x EP6228-3032 EtherCAT Box
- 1x Protective cap for supply voltage output, 7/8", black (pre-fitted)
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 10x labels, blank (1 strip of 10)

i Pre-assembled protective caps do not ensure IP67 protection

Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.9.4 Process image EP6228-3032

- ▲  Box 1 (EP6228-3032)
 - ▲  Module 1 (DeviceState Inputs Device)
 - ▲  DeviceState Inputs Device
 -  Device Diag
 -  Device State
 - ▲  Module 2 (DeviceState Inputs)
 - ▲  DeviceState Inputs
 -  State Ch1
 -  State Ch2
 -  State Ch3
 -  State Ch4
 -  State Ch5
 -  State Ch6
 -  State Ch7
 -  State Ch8
 - ▶  Module 3 (IO-Link Slave)
 - ▶  Module 4 (IO-Link Slave)
 - ▶  Module 5 (IO-Link Slave)
 - ▶  Module 6 (IO-Link Slave)
 - ▶  Module 7 (IO-Link Slave)
 - ▶  Module 8 (IO-Link Slave)
 - ▶  Module 9 (IO-Link Slave)
 - ▶  Module 10 (IO-Link Slave)
 - ▶  WcState
 - ▶  InfoData

-  Module 1
Diagnosis.
See chapter [Further error diagnosis](#) [► 134].
-  Module 2
Status bytes of the IO-Link ports.
See chapter [Status of the IO-Link ports](#) [► 129].
-  Module 3 ¹⁾
Process data of the IO-Link device at port 1
-  Module 4 ¹⁾
Process data of the IO-Link device at port 2
-  Module 5 ¹⁾
Process data of the IO-Link device at port 3
-  Module 6 ¹⁾
Process data of the IO-Link device at port 4
-  Module 7 ¹⁾
Process data of the IO-Link device at port 5
-  Module 8 ¹⁾
Process data of the IO-Link device at port 6
-  Module 9 ¹⁾
Process data of the IO-Link device at port 7
-  Module 10 ¹⁾
Process data of the IO-Link device at port 8

¹⁾ The modules "Module 3" to "Module 10" only exist in the process data if the corresponding IO-Link ports have been configured.

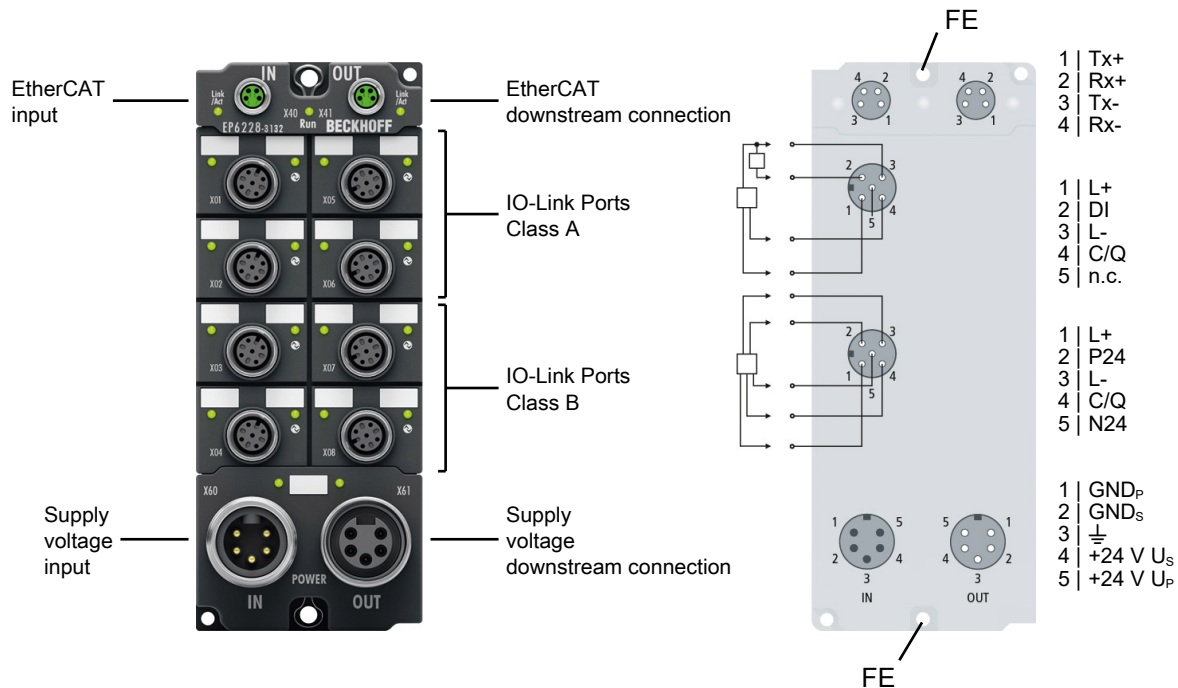
Assignment of connectors, ports and process data

Connector	IO-Link port	Process data of the IO-Link device	Status variable of the IO-Link port
X01	1	 Module 3 ¹⁾	 State Ch1
X02	2	 Module 4 ¹⁾	 State Ch2
X03	3	 Module 5 ¹⁾	 State Ch3
X04	4	 Module 6 ¹⁾	 State Ch4
X05	5	 Module 7 ¹⁾	 State Ch5
X06	6	 Module 8 ¹⁾	 State Ch6
X07	7	 Module 9 ¹⁾	 State Ch7
X08	8	 Module 10 ¹⁾	 State Ch8

¹⁾ The modules "Module 3" to "Module 10" only exist in the process data if the corresponding IO-Link ports have been configured.

3.10 EP6228-3132

3.10.1 Introduction EP6228-3132



8-channel IO-Link master, 4 x Class A, 4 x Class B, 4 x digital input

The EP6228-3132 IO-Link module enables connection of up to eight IO-Link devices, e.g. IO-Link box modules, actuators, sensors or combinations thereof. The EP6228-3132 additionally offers further digital inputs on the four Class A master ports. A point-to-point connection is used between the module and the device. The terminal is parameterized via the EtherCAT master. IO-Link is designed as an intelligent link between the fieldbus level and the sensor, wherein parameterization information can be exchanged bidirectionally via the IO-Link connection. The parameterization of the IO-Link devices can be done from TwinCAT via ADS or very conveniently via the integrated IO-Link configuration tool.

In the standard setting, the EP6228-3132 functions as a 8-channel input terminal, 24 V DC, which communicates with connected IO-Link devices, parameterizes them and, if necessary, changes their operating mode.

Quick links

[Technical data \[► 54\]](#)

[Process image \[► 57\]](#)

[Dimensions \[► 72\]](#)

[Connections: IO-Link \[► 82\]](#)

[Commissioning and configuration \[► 87\]](#)

3.10.2 Technical data EP6228-3132

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, A-coded, shielded
Electrical isolation	500 V
Distributed Clocks	yes

Supply voltages	
Connection	Input: 7/8" plug, 5-pin, 16-UN thread Downstream connection: 7/8" socket, 5-pin, 16-UN thread
U _S nominal voltage	24 V _{DC} (-15 % / +20 %)
U _S sum current	max. 16 A at 40 °C
Current consumption from U _S	130 mA + Current consumption of the IO-Link devices from L+
U _P nominal voltage	24 V _{DC} (-15 % / +20 %)
U _P sum current	max. 16 A at 40 °C
Current consumption from U _P	= Current consumption of the IO-Link devices from P24

IO-Link	
Number of ports Class A	4
Number of ports Class B	4
Connection	Ports Class A: 4x M12 socket, 4-pin Ports Class B: 4x M12 socket, 5-pin
Cable length	max. 20 m
Specification	IO-Link V1.1
Data rate	COM1: 4.8 kbit/s COM2: 38.4 kbit/s COM3: 230.4 kbit/s
Sensor power supply L+	24 V _{DC} from U _S max. 1.4 A per port, short-circuit proof
Extra power P24	24 V _{DC} from U _P max. 4.0 A per port pair ¹⁾ , short-circuit proof
C/Q input filter	none (when configured as digital input, see 2. Assigning IO-Link device to port n [► 93])
C/Q output current	max. 200 mA, not short-circuit proof (when configured as digital output, see 2. Assigning IO-Link device to port n [► 93])

¹⁾ Port pairs with common limitation of P24:

- Port 3 and 7
- Port 4 and 8

Digital inputs	
Number	4
Connection	4 x M12 socket ²⁾
Cable length	max. 30 m
Characteristics	Type 3 according to EN61131-2, compatible with type 1
Input filter	10 µs
Signal voltage "0"	-3 ... +5 V
Signal voltage "1"	+11 ... +30 V
Input current	3 mA

²⁾ These digital inputs are located at pin 2 of the IO-Link Class A ports.

Housing data	
Dimensions W x H x D	60 mm x 150 mm x 26,5 mm (without connectors)
Weight	approx. 440 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25 ... +60 °C
Ambient temperature during storage	-40 ... +85 °C
Vibration / shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 conforms to EN 60529

Approvals / markings	
Approvals / markings ^{*)}	CE, UL under preparation

^{*)} Real applicable approvals/markings see type plate on the side (product marking).

Additional tests

The devices have undergone the following additional tests:

Test	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.10.3 Scope of supply EP6228-3132

Make sure that the following components are included in the scope of delivery:

- 1x EP6228-3132 EtherCAT Box
- 1x Protective cap for supply voltage output, 7/8", black (pre-fitted)
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 10x labels, blank (1 strip of 10)



Pre-assembled protective caps do not ensure IP67 protection

Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.10.4 Process image EP6228-3132

- ▲  Box 1 (EP6228-3132)
 - ▲  Module 1 (DeviceState Inputs Device)
 - ▲  DeviceState Inputs Device
 -  Device Diag
 -  Device State
 - ▲  Module 2 (DeviceState Inputs)
 - ▲  DeviceState Inputs
 -  State Ch1
 -  State Ch2
 -  State Ch3
 -  State Ch4
 -  State Ch5
 -  State Ch6
 -  State Ch7
 -  State Ch8
 - ▶  Module 3 (IO-Link Slave)
 - ▶  Module 4 (IO-Link Slave)
 - ▶  Module 5 (IO-Link Slave)
 - ▶  Module 6 (IO-Link Slave)
 - ▶  Module 7 (IO-Link Slave)
 - ▶  Module 8 (IO-Link Slave)
 - ▶  Module 9 (IO-Link Slave)
 - ▶  Module 10 (IO-Link Slave)
 - ▲  Module 11 (Digital Inputs)
 - ▲  Digital Inputs
 -  Pin2 Ch1
 -  Pin2 Ch2
 -  Pin2 Ch5
 -  Pin2 Ch6
 - ▶  WcState
 - ▶  InfoData

-  Module 1
Diagnosis.
See chapter [Further error diagnosis](#) [► 134].
-  Module 2
Status bytes of the IO-Link ports.
See chapter [Status of the IO-Link ports](#) [► 129].
-  Module 3 ¹⁾
Process data of the IO-Link device at port 1
-  Module 4 ¹⁾
Process data of the IO-Link device at port 2
-  Module 5 ¹⁾
Process data of the IO-Link device at port 3
-  Module 6 ¹⁾
Process data of the IO-Link device at port 4
-  Module 7 ¹⁾
Process data of the IO-Link device at port 5
-  Module 8 ¹⁾
Process data of the IO-Link device at port 6
-  Module 9 ¹⁾
Process data of the IO-Link device at port 7
-  Module 10 ¹⁾
Process data of the IO-Link device at port 8
-  Module 11
Digital inputs of ports 1, 2, 5, 6 (Class A ports)

¹⁾ The modules "Module 3" to "Module 10" only exist in the process data if the corresponding IO-Link ports have been configured.

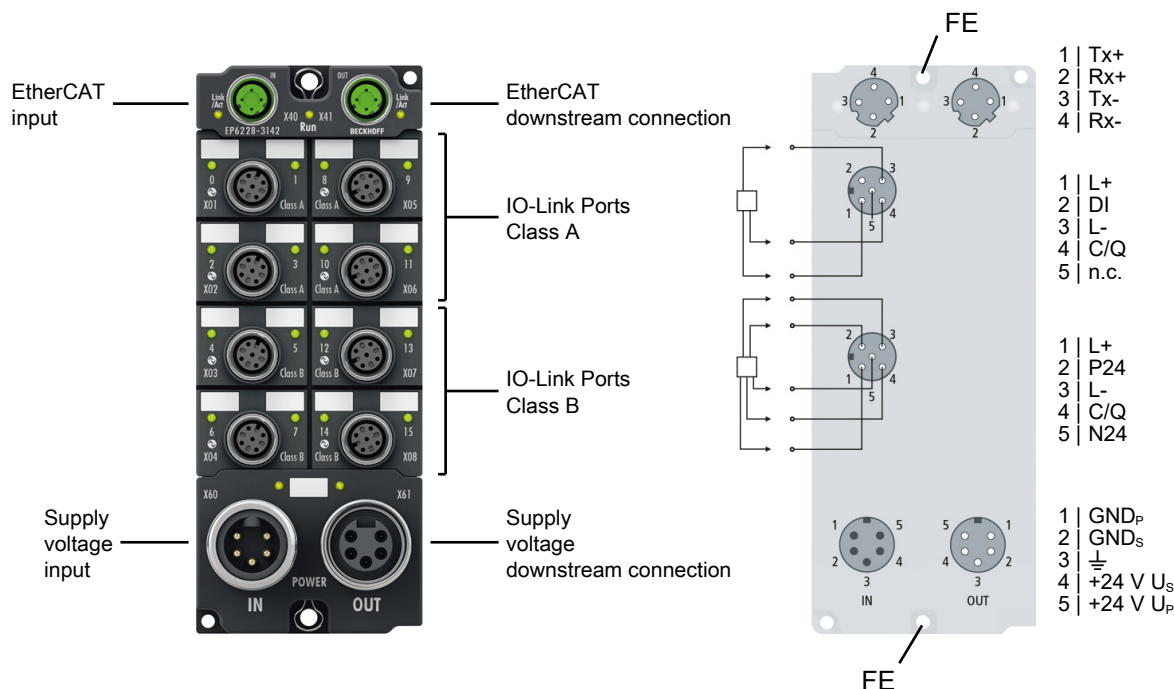
Assignment of connectors, ports and process data

Connector	IO-Link port	Process data of the IO-Link device	Status variable of the IO-Link port	Digital input
X01	1	 Module 3 ¹⁾	 State Ch1	 Pin 2 Ch1
X02	2	 Module 4 ¹⁾	 State Ch2	 Pin 2 Ch2
X03	3	 Module 5 ¹⁾	 State Ch3	-
X04	4	 Module 6 ¹⁾	 State Ch4	-
X05	5	 Module 7 ¹⁾	 State Ch5	 Pin 2 Ch5
X06	6	 Module 8 ¹⁾	 State Ch6	 Pin 2 Ch6
X07	7	 Module 9 ¹⁾	 State Ch7	-
X08	8	 Module 10 ¹⁾	 State Ch8	-

¹⁾ The modules "Module 3" to "Module 10" only exist in the process data if the corresponding IO-Link ports have been configured.

3.11 EP6228-3142

3.11.1 Introduction EP6228-3142



8-channel IO-Link master, 4 x Class A, 4 x Class B, 4 x digital input

The EP6228-3142 IO-Link module enables connection of up to eight IO-Link devices, e.g. IO-Link box modules, actuators, sensors or combinations thereof. The EP6228-3142 additionally offers further digital inputs on the four Class A master ports. A point-to-point connection is used between the module and the device. The terminal is parameterized via the EtherCAT master. IO-Link is designed as an intelligent link between the fieldbus level and the sensor, wherein parameterization information can be exchanged bidirectionally via the IO-Link connection. The parameterization of the IO-Link devices can be done from TwinCAT via ADS or very conveniently via the integrated IO-Link configuration tool.

In the standard setting, the EP6228-3142 functions as a 8-channel input terminal, 24 V DC, which communicates with connected IO-Link devices, parameterizes them and, if necessary, changes their operating mode.

Quick links

[Technical data \[► 60\]](#)

[Process image \[► 63\]](#)

[Dimensions \[► 73\]](#)

[Connections: IO-Link \[► 82\]](#)

[Commissioning and configuration \[► 87\]](#)

3.11.2 Technical data EP6228-3142

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M12 socket, 4-pin, D-coded, shielded
Electrical isolation	500 V
Distributed Clocks	yes

Supply voltages	
Connection	Input: 7/8" plug, 5-pin, 16-UN thread Downstream connection: 7/8" socket, 5-pin, 16-UN thread
U _S nominal voltage	24 V _{DC} (-15 % / +20 %)
U _S sum current	max. 16 A at 40 °C
Current consumption from U _S	130 mA + Current consumption of the IO-Link devices from L+
U _P nominal voltage	24 V _{DC} (-15 % / +20 %)
U _P sum current	max. 16 A at 40 °C
Current consumption from U _P	= Current consumption of the IO-Link devices from P24

IO-Link	
Number of ports Class A	4
Number of ports Class B	4
Connection	Ports Class A: 4x M12 socket, 4-pin Ports Class B: 4x M12 socket, 5-pin
Cable length	max. 20 m
Specification	IO-Link V1.1
Data rate	COM1: 4.8 kbit/s COM2: 38.4 kbit/s COM3: 230.4 kbit/s
Sensor power supply L+	24 V _{DC} from U _S max. 1.4 A per port, short-circuit proof
Extra power P24	24 V _{DC} from U _P max. 4.0 A per port pair ¹⁾ , short-circuit proof
C/Q input filter	none (when configured as digital input, see 2. Assigning IO-Link device to port n [► 93])
C/Q output current	max. 200 mA, not short-circuit proof (when configured as digital output, see 2. Assigning IO-Link device to port n [► 93])

¹⁾ Port pairs with common limitation of P24:

- Port 3 and 7
- Port 4 and 8

Digital inputs	
Number	4
Connection	4 x M12 socket ²⁾
Cable length	max. 30 m
Characteristics	Type 3 according to EN61131-2, compatible with type 1
Input filter	10 µs
Signal voltage "0"	-3 ... +5 V
Signal voltage "1"	+11 ... +30 V
Input current	3 mA

²⁾ These digital inputs are located at pin 2 of the IO-Link Class A ports.

Housing data	
Dimensions W x H x D	60 mm x 150 mm x 26,5 mm (without connectors)
Weight	approx. 440 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25 ... +60 °C
Ambient temperature during storage	-40 ... +85 °C
Vibration / shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 conforms to EN 60529

Approvals / markings	
Approvals / markings ^{*)}	CE, UL under preparation

^{*)} Real applicable approvals/markings see type plate on the side (product marking).

Additional tests

The devices have undergone the following additional tests:

Test	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.11.3 Scope of supply EP6228-3142

Make sure that the following components are included in the scope of delivery:

- 1x EP6228-3142 EtherCAT Box
- 1x Protective cap for supply voltage output, 7/8", black (pre-fitted)
- 2x protective cap for EtherCAT socket, M12 (pre-assembled)
- 10x labels, blank (1 strip of 10)



Pre-assembled protective caps do not ensure IP67 protection

Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.11.4 Process image EP6228-3142

- ▲  Box 1 (EP6228-3142)
 - ▲  Module 1 (DeviceState Inputs Device)
 - ▲  DeviceState Inputs Device
 -  Device Diag
 -  Device State
 - ▲  Module 2 (DeviceState Inputs)
 - ▲  DeviceState Inputs
 -  State Ch1
 -  State Ch2
 -  State Ch3
 -  State Ch4
 -  State Ch5
 -  State Ch6
 -  State Ch7
 -  State Ch8
 - ▶  Module 3 (IO-Link Slave)
 - ▶  Module 4 (IO-Link Slave)
 - ▶  Module 5 (IO-Link Slave)
 - ▶  Module 6 (IO-Link Slave)
 - ▶  Module 7 (IO-Link Slave)
 - ▶  Module 8 (IO-Link Slave)
 - ▶  Module 9 (IO-Link Slave)
 - ▶  Module 10 (IO-Link Slave)
 - ▲  Module 11 (Digital Inputs)
 - ▲  Digital Inputs
 -  Pin2 Ch1
 -  Pin2 Ch2
 -  Pin2 Ch5
 -  Pin2 Ch6
 - ▶  WcState
 - ▶  InfoData

-  Module 1
Diagnosis.
See chapter [Further error diagnosis](#) [► 134].
-  Module 2
Status bytes of the IO-Link ports.
See chapter [Status of the IO-Link ports](#) [► 129].
-  Module 3 ¹⁾
Process data of the IO-Link device at port 1 (Port Class A)
-  Module 4 ¹⁾
Process data of the IO-Link device at port 2 (Port Class A)
-  Module 5 ¹⁾
Process data of the IO-Link device at port 3 (Port Class B)
-  Module 6 ¹⁾
Process data of the IO-Link device at port 4 (Port Class B)
-  Module 7 ¹⁾
Process data of the IO-Link device at port 5 (Port Class A)
-  Module 8 ¹⁾
Process data of the IO-Link device at port 6 (Port Class A)
-  Module 9 ¹⁾
Process data of the IO-Link device at port 7 (Port Class B)
-  Module 10 ¹⁾
Process data of the IO-Link device at port 8 (Port Class B)
-  Module 11
Digital inputs of ports 1, 2, 5, 6 (Class A ports)

¹⁾ The modules "Module 3" to "Module 10" only exist in the process data if the corresponding IO-Link ports have been configured.

Assignment of connectors, ports and process data

Connector	IO-Link port	Process data of the IO-Link device	Status variable of the IO-Link port	Digital input
X01	1	 Module 3 ¹⁾	 State Ch1	 Pin 2 Ch1
X02	2	 Module 4 ¹⁾	 State Ch2	 Pin 2 Ch2
X03	3	 Module 5 ¹⁾	 State Ch3	-
X04	4	 Module 6 ¹⁾	 State Ch4	-
X05	5	 Module 7 ¹⁾	 State Ch5	 Pin 2 Ch5
X06	6	 Module 8 ¹⁾	 State Ch6	 Pin 2 Ch6
X07	7	 Module 9 ¹⁾	 State Ch7	-
X08	8	 Module 10 ¹⁾	 State Ch8	-

¹⁾ The modules "Module 3" to "Module 10" only exist in the process data if the corresponding IO-Link ports have been configured.

4 IO-Link basics

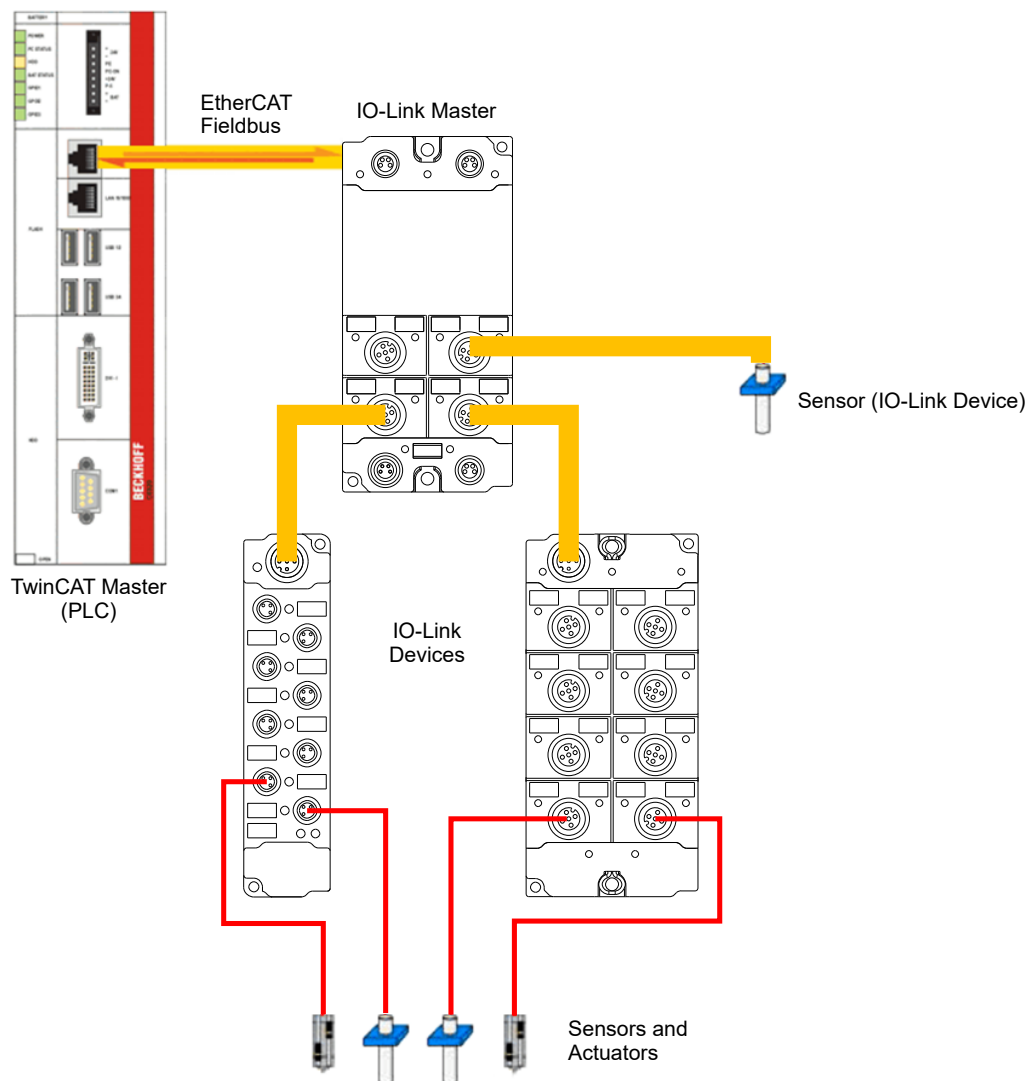
IO-Link is a communication system for connecting intelligent sensors and actuators to an automation system. The IEC 61131-9 standard specifies IO-Link under the designation "Single-drop digital communication interface for small sensors and actuators" (SDCI).

Both the electrical connection data and the communication protocol are standardized and summarized in the IO-Link Spec.

4.1 IO-Link system layout

An IO-Link system consists of an IO-Link master and one or more IO-Link devices, i.e. sensors or actuators. The IO-Link master provides the interface to the higher-level controller and controls communication with the connected IO-Link devices.

The IO-Link masters from Beckhoff have several IO-Link ports, to each of which one IO-Link device can be connected. IO-Link is not a fieldbus, but rather a point-to-point connection.



⚠ CAUTION

Risk of device damage

The IO-Link devices must be supplied from the 24 V power supply of the IO-Link master provided for this purpose. Otherwise, damage to the IO-Link port is possible.

4.2 Establishment of IO Link communication

The establishment of the IO-Link communication is illustrated in Fig. *Establishment of IO-Link communication*. This illustrates in particular the sequence when automatically scanning [► 94] the IO-Link port.

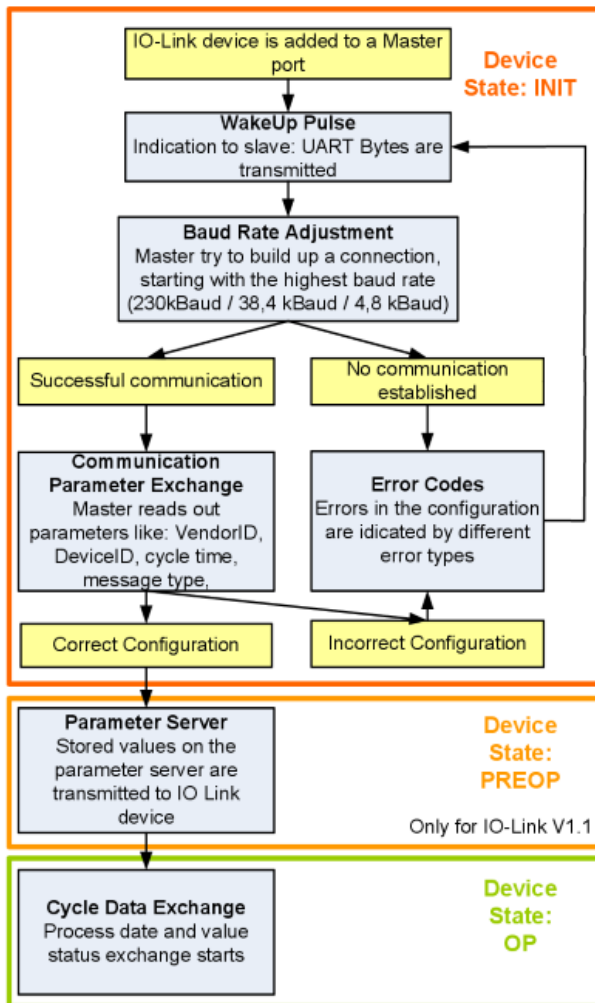


Fig. 4: Establishment of IO Link communication

- If an IO-Link device is connected to a master port, the master attempts to establish communication. A defined signal level, the **wake-up pulse**, signals to the device that UART bytes are to be sent from now on.
From this point on, all data will be interpreted by the IO-Link device as UART bytes.
- The master runs through all baud rates [► 67], starting with the fastest baud rate (COM3 = 230 kbaud). A successful connection has been established when the slave responds to the wake-up pulse.
- First of all the master reads the **basic parameters** (Vendor ID, Device ID, process data length, telegram type and cycle time) and compares them with the existing configuration.
- If no connection could be established to the device, or if the saved parameters differ from those read, the corresponding error is output.
- If the saved parameters differ from those read, the IO-Link device changes to the PREOP state.
If the IO-Link device specification is V1.1, the parameter server [► 67] is now executed. If the IO-Link device specification is V1.0, this step is omitted and the device changes directly to OP.
- Finally the cycle time is written and the device changes to OP. After that the master cyclically exchanges data with the device.

4.3 Device description IODD

IO-Link devices possess individual system information in the form of an IO device description (IODD), which contains:

- Communication features
- Device parameters with value range and default values
- Identification, process and diagnostic data
- Device data
- Text description
- Picture of the device
- Vendor's logo

If the IODD is imported, then the device data are automatically detected during [automatic scanning \[► 94\]](#) with TwinCAT and adopted in the System Manager.

4.4 Parameter server

In order to be able to use the functionality of the parameter server, both the IO-Link master and the IO-Link device must be specified to V1.1. The IO-Link revision of the device can be read for the individual port under [Settings \[► 101\]](#). All IO-Link masters from Beckhoff with current firmware support the IO-Link specification V1.1.

- The parameter server in the IO-Link master contains parameter data that are saved in the IO-Link device. The memory capacity is max. 2 kbyte (including header).
If the IO-Link device is exchanged, then the data are loaded from the parameter server into the new device. The requirement for this is that the device is of the same type (VendorID and DeviceID must be the same).
- If a new IO-Link device is configured, then the IO-Link master loads the parameters from the IO-Link device into the parameter server when starting for the first time.
Data from other IO-Link devices that are already configured (VendorID and DeviceID do not correspond to the configured device) are overwritten.
- At each further start the IO-Link master uses a checksum to check whether the data in the parameter server correspond to those on the IO-Link device and if necessary downloads them to the device.
- If the parameters change during the device runtime, this can be reported to the Master via the [store button \[► 109\]](#) ([ParamDownloadStore \[► 110\]](#)). The master then starts the parameter server with an upload.
- By default the event is not set each time the parameters are written, therefore the end of the parameterization procedure has to be reported to the IO-Link device via the [store button \[► 109\]](#) ([ParamDownloadStore \[► 110\]](#)).
The IO-Link device then sends the corresponding event to the master. The data are loaded into the parameter server.
- In the case of a pre-programmed IO-Link device, no download takes place from the parameter server to the device.

4.5 Data transfer rate

An IO-Link master according to specification V1.1 supports all three transmission methods and automatically adjusts the baud rate to that of the IO-Link device.

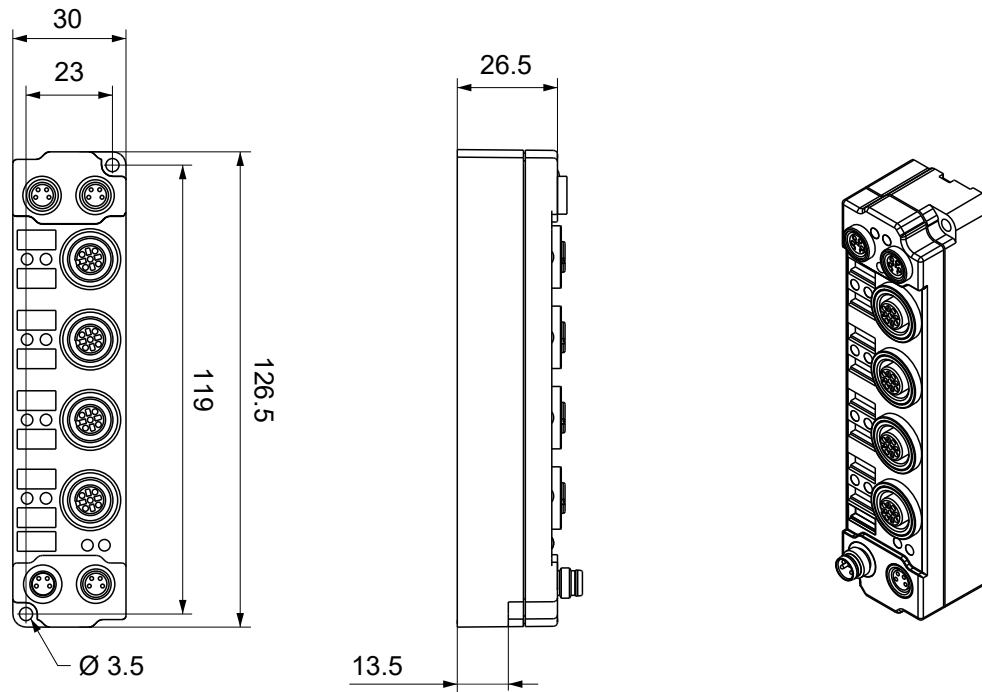
An IO-Link device usually supports only one baud rate. IO-Link devices with different baud rates can be connected to the various ports of the master.

- COM1 = 4.8 kbaud
- COM2 = 38.4 kbaud
- COM3 = 230.4 kbaud

5 Mounting and connections

5.1 Mounting

5.1.1 EPxxxx-x002 dimensions

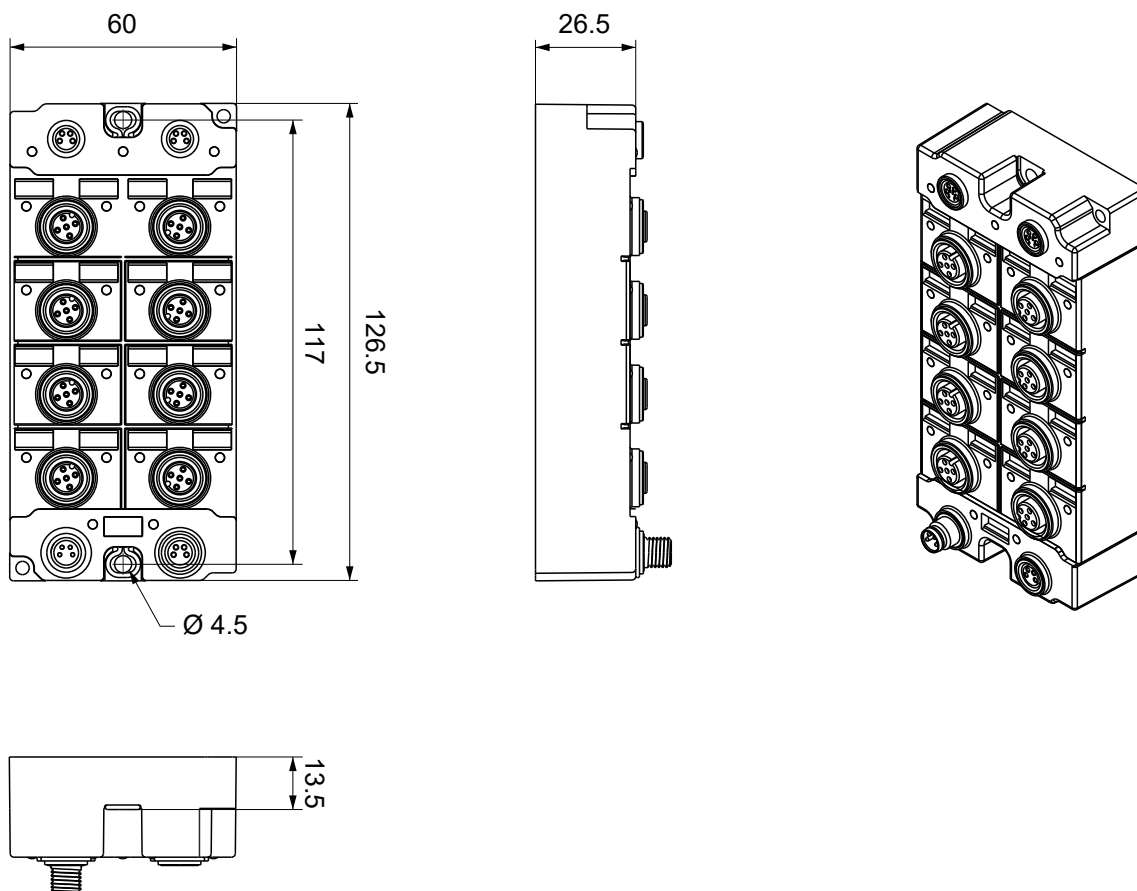


All dimensions are given in millimeters.
The drawing is not true to scale.

Housing features

Housing material	PA6 (polyamide)
Sealing compound	polyurethane
Mounting	two mounting holes Ø 3.5 mm for M3
Metal parts	brass, nickel-plated
Contacts	CuZn, gold-plated
Installation position	variable
Protection class	IP65, IP66, IP67 (conforms to EN 60529) when screwed together
Dimensions (H x W x D)	approx. 126 x 30 x 26.5 mm (without connectors)

5.1.2 EPxxxx-0022 dimensions

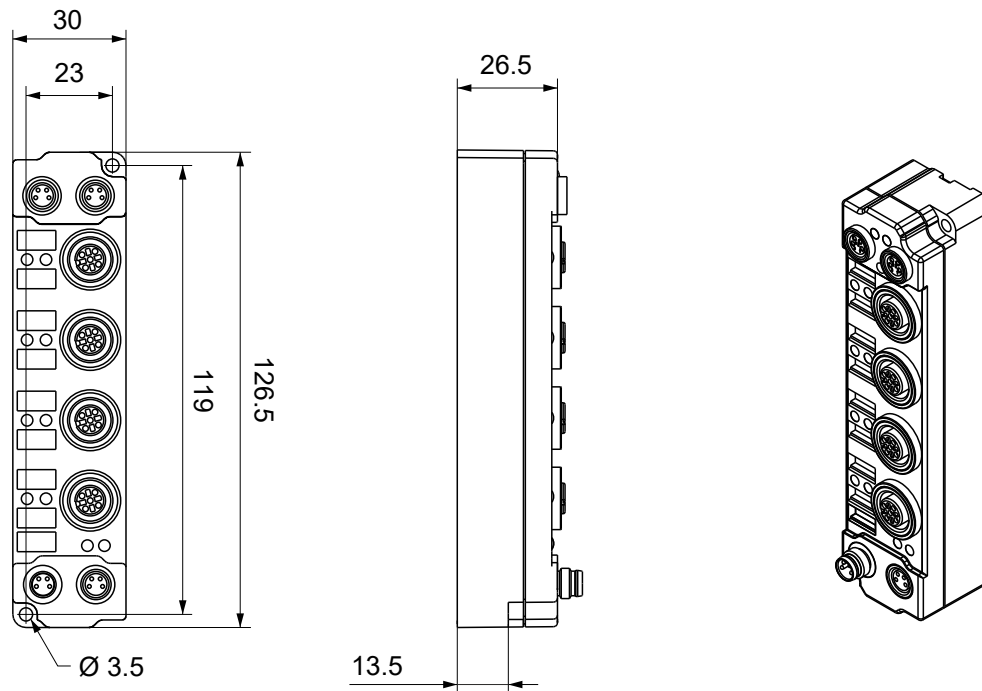


All dimensions are given in millimeters.
The drawing is not true to scale.

Housing features

Housing material	PA6 (polyamide)
Sealing compound	polyurethane
Mounting	two mounting holes $\varnothing 4.5$ mm for M4
Metal parts	brass, nickel-plated
Contacts	CuZn, gold-plated
Installation position	variable
Protection class	IP65, IP66, IP67 (conforms to EN 60529) when screwed together
Dimensions (H x W x D)	approx. 126 x 60 x 26.5 mm (without connectors)

5.1.3 Dimensions EPxxxx-0092

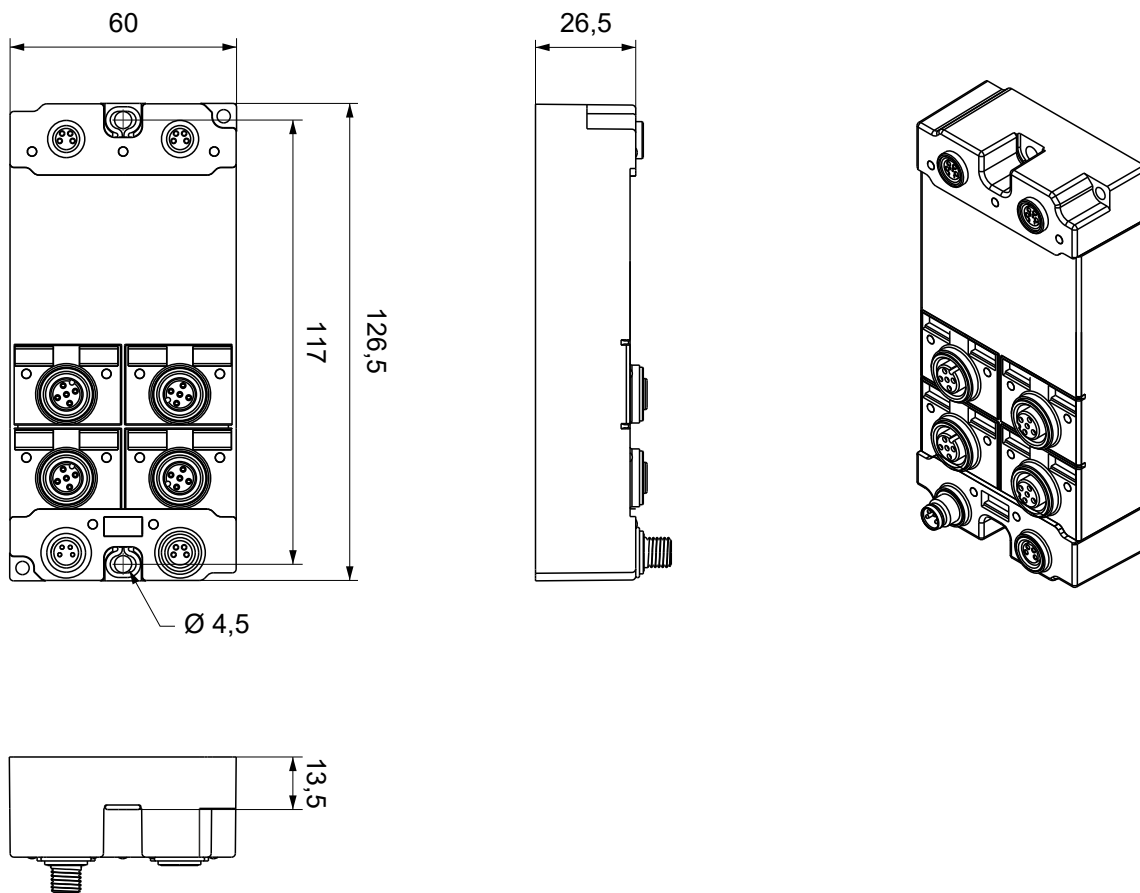


All dimensions are given in millimeters.
The drawing is not true to scale.

Housing features

Housing material	PA6 (polyamide)
Sealing compound	polyurethane
Mounting	two mounting holes $\varnothing 3.5$ mm for M3
Metal parts	brass, nickel-plated
Contacts	CuZn, gold-plated
Installation position	variable
Protection class	IP65, IP66, IP67 (conforms to EN 60529) when screwed together
Dimensions (H x W x D)	approx. 126 x 30 x 26.5 mm (without connectors)

5.1.4 Dimensions EPxxxx-2022, -3022

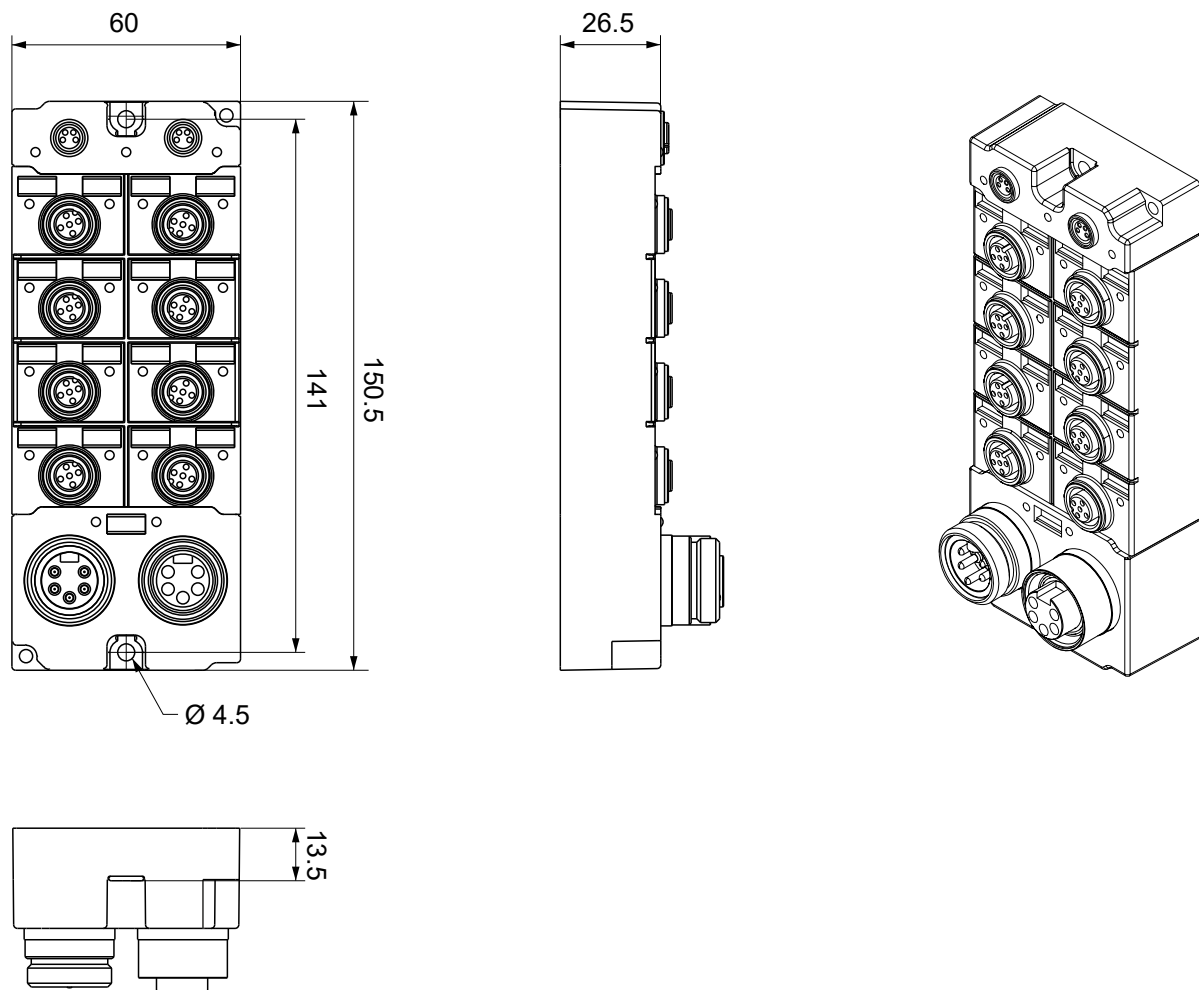


All dimensions are given in millimeters.
The drawing is not true to scale.

Housing features

Housing material	PA6 (polyamide)
Sealing compound	polyurethane
Mounting	two mounting holes Ø 4.5 mm for M4
Metal parts	brass, nickel-plated
Contacts	CuZn, gold-plated
Installation position	variable
Protection class	IP65, IP66, IP67 (conforms to EN 60529) when screwed together
Dimensions (H x W x D)	approx. 126 x 60 x 26.5 mm (without connectors)

5.1.5 Dimensions EPxxxx-xx32

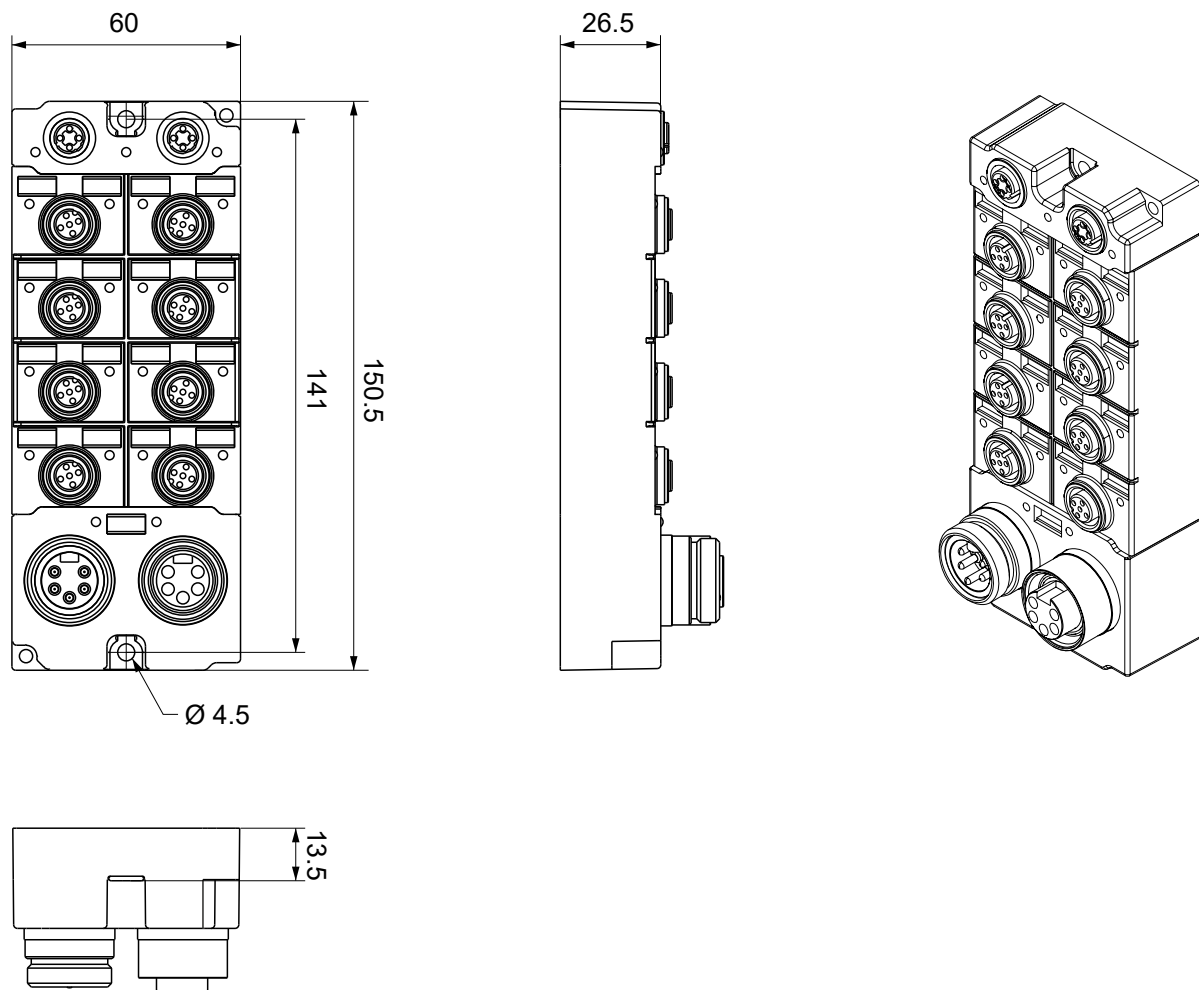


All dimensions are given in millimeters.
The drawing is not true to scale.

Housing features

Housing material	PA6 (polyamide)
Sealing compound	polyurethane
Mounting	two mounting holes $\varnothing 4.5$ mm for M4
Metal parts	brass, nickel-plated
Contacts	CuZn, gold-plated
Installation position	variable
Protection class	IP65, IP66, IP67 (conforms to EN 60529) when screwed together
Dimensions (H x W x D)	approx. 150 x 60 x 26.5 mm (without connectors)

5.1.6 Dimensions EPxxxx-xx42



All dimensions are given in millimeters.
The drawing is not true to scale.

Housing features

Housing material	PA6 (polyamide)
Sealing compound	polyurethane
Mounting	two mounting holes Ø 4.5 mm for M4
Metal parts	brass, nickel-plated
Contacts	CuZn, gold-plated
Installation position	variable
Protection class	IP65, IP66, IP67 (conforms to EN 60529) when screwed together
Dimensions (H x W x D)	approx. 150 x 60 x 26.5 mm (without connectors)

5.1.7 Mounting

NOTICE

Dirt during assembly

Dirty connectors can lead to malfunctions. Protection class IP67 can only be guaranteed if all cables and connectors are connected.

- Protect the plug connectors against dirt during the assembly.

Mount the module with two M4 screws in the centrally located mounting holes.

5.1.8 Tightening torques for plug connectors

Screw connectors tight with a torque wrench. (e.g. ZB8801 from Beckhoff)

Connector diameter	Tightening torque
M8	0.4 Nm
M12	0.6 Nm
7/8"	1.5 Nm

5.1.9 Functional earth (FE)

The [fastening holes](#) [► 74] also serve as connections for the functional earth (FE).

Make sure that the box is earthed with low impedance via both fastening screws. You can achieve this, for example, by mounting the box on a grounded machine bed.

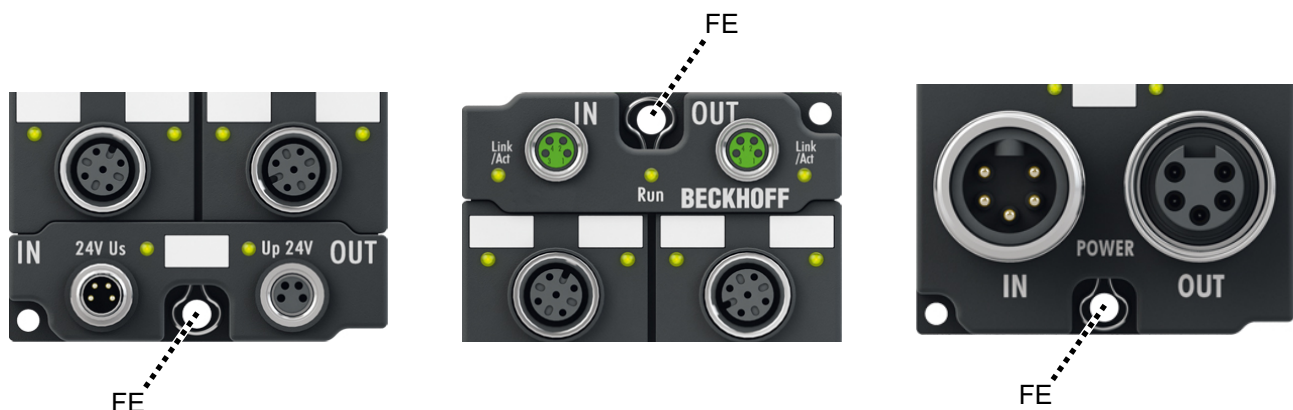


Fig. 5: Functional earth via the fastening holes

5.2 Connections

Guidelines

Follow these guidelines to ensure IP67 protection:

- Mount connectors with the specified torque [► 74]. Use a torque wrench, e.g. Beckhoff ZB8801.
- Seal unused connectors with protective caps.
- Ensure the correct seating of pre-assembled protective caps.
Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

5.2.1 Supply voltages

⚠ WARNING

Power supply from SELV / PELV power supply unit!

SELV / PELV circuits (safety extra-low voltage / protective extra-low voltage) according to IEC 61010-2-201 must be used to supply this device.

Notes:

- SELV / PELV circuits may give rise to further requirements from standards such as IEC 60204-1 et al, for example with regard to cable spacing and insulation.
- A SELV supply provides safe electrical isolation and limitation of the voltage without a connection to the protective conductor, a PELV supply also requires a safe connection to the protective conductor.

⚠ CAUTION

Observe the UL requirements

- When operating under UL conditions, observe the warnings in the chapter [UL Requirements](#) [► 85].

The EtherCAT Box has one input for two supply voltages:

- **Control voltage U_s**
The following sub-functions are supplied from the control voltage U_s :
 - the fieldbus
 - the processor logic
 - typically the inputs and the sensors if the EtherCAT Box has inputs.
- **Peripheral voltage U_p**
For EtherCAT Box modules with digital outputs the digital outputs are typically supplied from the peripheral voltage U_p . U_p can be supplied separately. If U_p is switched off, the fieldbus function, the function of the inputs and the supply of the sensors are maintained.

The exact assignment of U_s and U_p can be found in the pin assignment of the I/O connections.

Redirection of the supply voltages

The power IN and OUT connections are bridged in the module. Hence, the supply voltages U_s and U_p can be passed from EtherCAT Box to EtherCAT Box in a simple manner.

NOTICE

Note the maximum current!

Ensure that the permitted current for the connectors is not exceeded when routing the supply voltages U_s and U_p :

M8 connector: max. 4 A
7/8" connector: max 16 A

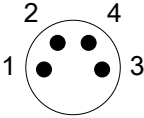
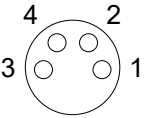
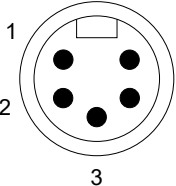
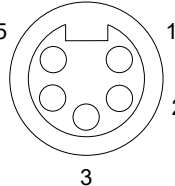
NOTICE

Unintentional cancellation of the electrical isolation possible

In some types of EtherCAT Box modules the ground potentials GND_s and GND_p are connected.

- If several EtherCAT Box modules are supplied with the same electrically isolated voltages, check whether there is an EtherCAT Box among them in which the ground potentials are connected.

5.2.1.1 Connectors

M8 connector		7/8" connector	
			
			
Plug Input	Socket Forwarding	Plug Feed-in	Socket Forwarding

Function	M8	7/8"	Description	Core color ¹⁾
U _S	1	4	Control voltage	Brown
U _P	2	5	Peripheral voltage	White
GND _S	3	2	GND to U _S	Blue
GND _P	4	1	GND to U _P	Black
FE	-	3	Functional earth	Grey

¹⁾ The core colors apply to cables of the type: Beckhoff ZK2020-xxxx-xxxx

5.2.1.2 Status LEDs



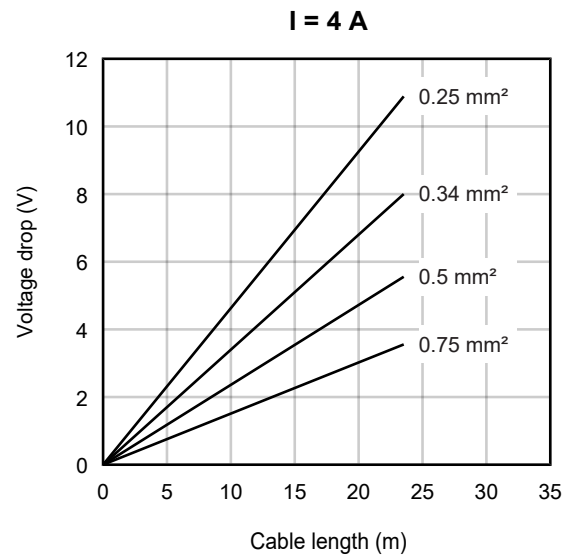
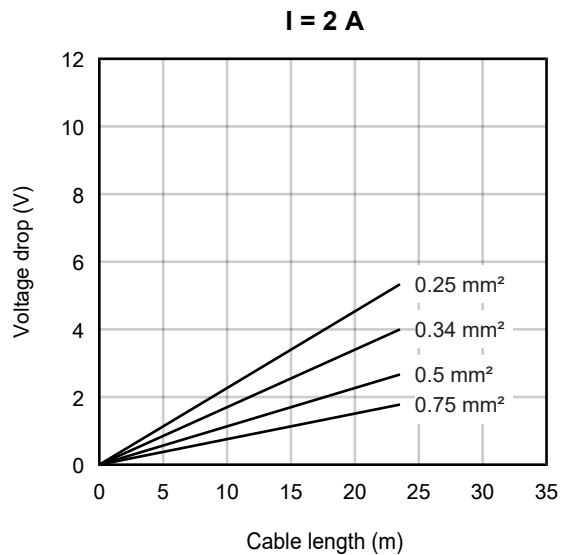
Fig. 6: Status LEDs for the supply voltages

LED	Display	Meaning
U _S (control voltage)	off	The supply voltage U _S is not available.
	green illuminated	The supply voltage U _S is available.
U _P (peripheral voltage)	off	The supply voltage U _P is not available
	green illuminated	The supply voltage U _P is available

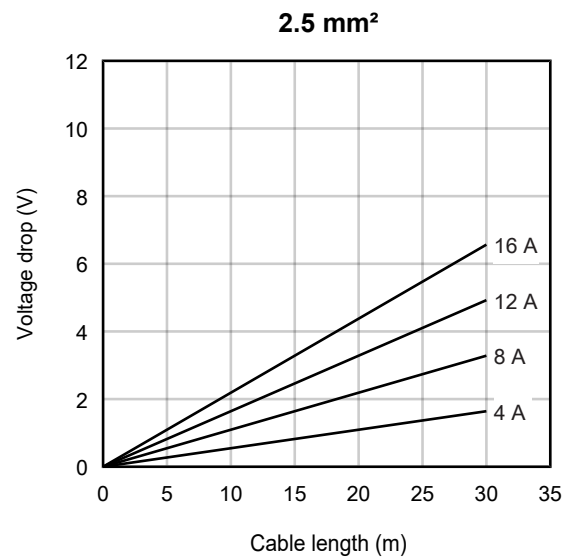
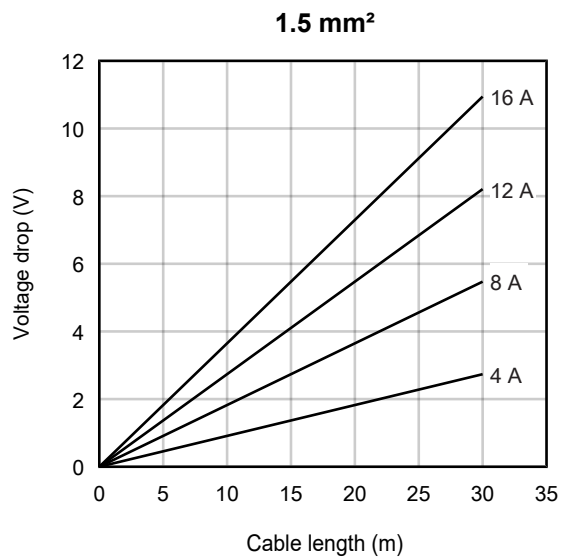
5.2.1.3 Conductor losses

Take into account the voltage drop on the supply line when planning a system. Avoid the voltage drop being so high that the supply voltage at the box lies below the minimum nominal voltage. Variations in the voltage of the power supply unit must also be taken into account.

Voltage drop on cables with M8 connectors



Voltage drop on cables with 7/8" connectors



5.2.2 EtherCAT

5.2.2.1 Connectors

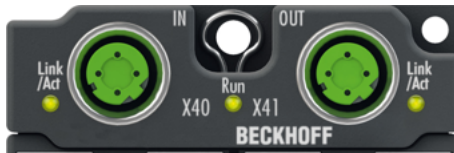
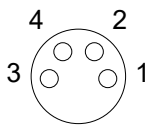
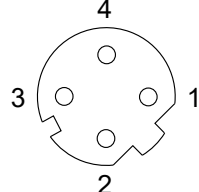
NOTICE

Risk of confusion: supply voltages and EtherCAT

Defect possible through incorrect insertion.

- Observe the color coding of the connectors:
black: Supply voltages
green: EtherCAT

EtherCAT Box modules have two green M8 or M12 sockets for the incoming and outgoing EtherCAT connections.

M8 sockets		M12 sockets
 		
		

Assignment

There are various different standards for the assignment and colors of connectors and cables for EtherCAT.

EtherCAT	Plug connector			Cable		Standard
Signal	M8	M12	RJ45 ¹	ZB9010, ZB9020, ZB9030, ZB9032, ZK1090-6292, ZK1090-3xxx-xxxx	ZB9031 and old versions of ZB9030, ZB9032, ZK1090-3xxx-xxxx	TIA-568B
Tx +	Pin 1	Pin 1	Pin 1	yellow ²	orange/white ³	white/orange
Tx -	Pin 4	Pin 3	Pin 2	orange ²	orange ³	orange
Rx +	Pin 2	Pin 2	Pin 3	white ²	blue/white ³	white/green
Rx -	Pin 3	Pin 4	Pin 6	blue ²	blue ³	green
Shield	Housing		Shroud	Shield	Shield	Shield

¹) colored markings according to EN 61918 in the four-pin RJ45 connector ZS1090-0003

²) wire colors according to EN 61918

³) wire colors



Assimilation of color coding for cable ZB9030, ZB9032 and ZK1090-3xxxx-xxxx (with M8 connectors)

For unification, the prevalent cables ZB9030, ZB9032 and ZK1090-3xxx-xxxx were changed to the colors of EN61918 (yellow, orange, white, blue). So different color coding exists. But the electrical properties are absolutely identical.

5.2.2.2 Status LEDs



L/A (Link/Act)

A green LED labelled "L/A" is located next to each EtherCAT socket. The LED indicates the communication state of the respective socket:

LED	Meaning
off	no connection to the connected EtherCAT device
lit	LINK: connection to the connected EtherCAT device
flashes	ACT: communication with the connected EtherCAT device

Run

Each EtherCAT slave has a green LED labelled "Run". The LED signals the status of the slave in the EtherCAT network:

LED	Meaning
off	Slave is in "Init" state
flashes uniformly	Slave is in "Pre-Operational" state
flashes sporadically	Slave is in "Safe-Operational" state
lit	Slave is in "Operational" state

Description of the EtherCAT slave states

5.2.2.3 Cables

For connecting EtherCAT devices only shielded Ethernet cables that meet the requirements of at least category 5 (CAT5) according to EN 50173 or ISO/IEC 11801 should be used.

EtherCAT uses four wires for signal transmission.
Thanks to automatic line detection ("Auto MDI-X"), both symmetrical (1:1) or cross-over cables can be used between Beckhoff EtherCAT.

Detailed recommendations for the cabling of EtherCAT devices

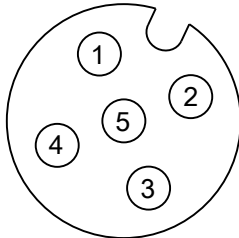
5.2.3 IO-Link

Guidelines for connecting IO-Link cables

- Only connect or disconnect IO-Link cables when they are de-energized.
- When used in a hazardous EMC environment: ideally, use cable with plastic union nut.

5.2.3.1 Connector

The IO-Link ports are implemented as M12 sockets.



EP6224-0042 - X03, X04, X07, X08
EP6224-2022
EP6228-0022

Pin	Function	Description	Wire color ¹⁾
1	L+	Supply voltage (from U _S)	brown
2	-	-	white
3	L-	GND	blue
4	C/Q	IO-Link data cable	black
5	-	-	gray

EP6224-0002
EP6224-0092
EP6228-0042

Pin	Function	Description	Wire color ¹⁾
1	L+	Supply voltage (from U _S)	brown
2	DI	Digital input	white
3	L-	GND	blue
4	C/Q	IO-Link data cable	black
5	-	-	gray

EP6224-3002
EP6224-3022
EP6228-3032

Pin	Function	Description	Wire color ¹⁾
1	L+	Sensor/logic supply (from U _S)	brown
2	P24	Actuator supply (from U _P)	white
3	L-	GND to L+	blue
4	C/Q	IO-Link data cable	black
5	N24	GND to P24	gray

¹⁾ The core colors apply to M12 cables from Beckhoff: ZK2000-5xxx, ZK2000-6xxx, ZK2000-7xxx

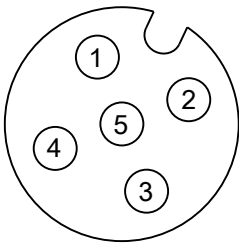


Fig. 7: M12 socket

EP6228-3132
EP6228-3142

Contact	X01, X02, X05, X06:		X03, X04, X07, X08:		Core color ¹⁾
	Class A ports		Class B ports		
	Function	Description	Function	Description	
1	L+	Supply voltage (U _{S1})	L+	Sensor/logic supply (U _{S1})	brown
2	DI	Digital input	P24	Actuator supply (U _{P1})	white
3	L-	GND	L-	GND to L+	blue
4	C/Q	IO-Link data	C/Q	IO-Link data	black
5	-	-	N24	GND to P24	grey

¹⁾The core colors apply to M12 cables from Beckhoff: ZK2000-5xxx, ZK2000-6xxx, ZK2000-7xxx

5.2.3.2 Status LEDs



Fig. 8: Status LEDs of an IO-Link port

1 - IO-Link

LED signal	Meaning
off	Possibilities: • Port not configured • Logic level low ¹⁾
red illuminated flashes sporadically green	Possibilities: • IO-Link connection attempt • No IO-Link device connected • Incorrect IO-Link device connected • IO-Link device defective
flashing green	IO-Link communication active
green illuminated	Logic level high ¹⁾

¹⁾ Port configured as digital input or output

2 - Digital input DI (EP6228-0042, EP6228-3132, EP6228-3142)

The LED lights up when a high level is present on the digital input DI.

5.2.4 Digital inputs: EP6224-0042 - X01, X02, X05, X06

Pin assignment

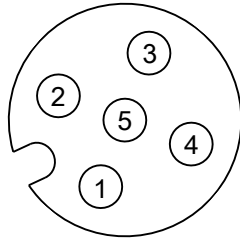
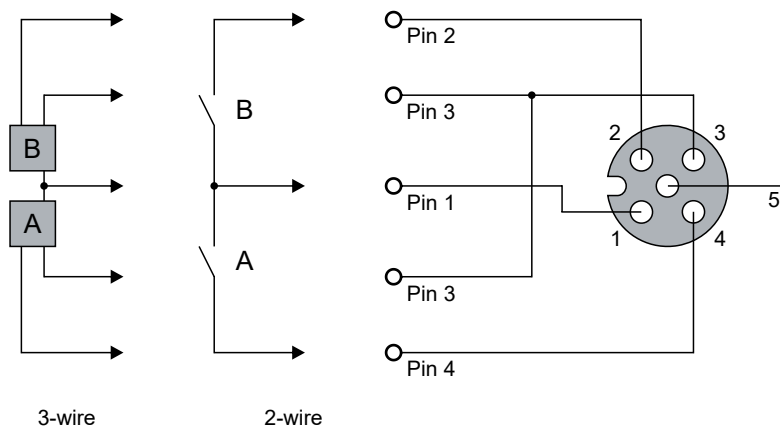


Fig. 9: M12 socket

Pin	Function	Wire color
1	U_s	brown
2	Input B	white
3	GND_s	blue
4	Input A	black
5	Functional earth FE	gray

The wire colors apply to M12 cables from Beckhoff. See chapter [Accessories](#) [► 151].

Connection examples



Status LEDs

Each M12 socket with digital inputs has two green LEDs. An LED lights up when a high level is detected at the respective input.



Fig. 10: Status LEDs at M12 sockets

5.3 UL Requirements

The installation of the EtherCAT Box Modules certified by UL has to meet the following requirements.

Supply voltage

⚠ CAUTION

CAUTION!

This UL requirements are valid for all supply voltages of all marked EtherCAT Box Modules!
For the compliance of the UL requirements the EtherCAT Box Modules should only be supplied

- by a 24 V_{DC} supply voltage, supplied by an isolating source and protected by means of a fuse (in accordance with UL248), rated maximum 4 Amp, or
- by a 24 V_{DC} power source, that has to satisfy *NEC class 2*.
A *NEC class 2* power supply shall not be connected in series or parallel with another (class 2) power source!

⚠ CAUTION

CAUTION!

To meet the UL requirements, the EtherCAT Box Modules must not be connected to unlimited power sources!

Networks

⚠ CAUTION

CAUTION!

To meet the UL requirements, EtherCAT Box Modules must not be connected to telecommunication networks!

Ambient temperature range

⚠ CAUTION

CAUTION!

To meet the UL requirements, EtherCAT Box Modules has to be operated only at an ambient temperature range of -25 °C to +55 °C!

Marking for UL

All EtherCAT Box Modules certified by UL (Underwriters Laboratories) are marked with the following label.



Fig. 11: UL label

5.4 Disposal



Products marked with a crossed-out wheeled bin shall not be discarded with the normal waste stream. The device is considered as waste electrical and electronic equipment. The national regulations for the disposal of waste electrical and electronic equipment must be observed.

6 Commissioning and configuration

6.1 Integrating into a TwinCAT project

The procedure for integration in a TwinCAT project is described in these [Quick start guide](#).

6.2 Configuration of the IO link master

i EtherCAT XML device description and configuration files

The display matches that of the CoE objects from the EtherCAT XML Device Description. We recommend downloading the latest XML file from the download area of the [Beckhoff website](#) and installing it according to installation instructions.

When adding the IO-Link master (see chapter [Integrating into a TwinCAT project](#) [► 87]) in the TwinCAT System Manager, an additional tab called "IO-Link" is created (fig. *IO-Link tab*). A detailed description can be found in chapter [Configuration of the IO-Link devices](#) [► 89]

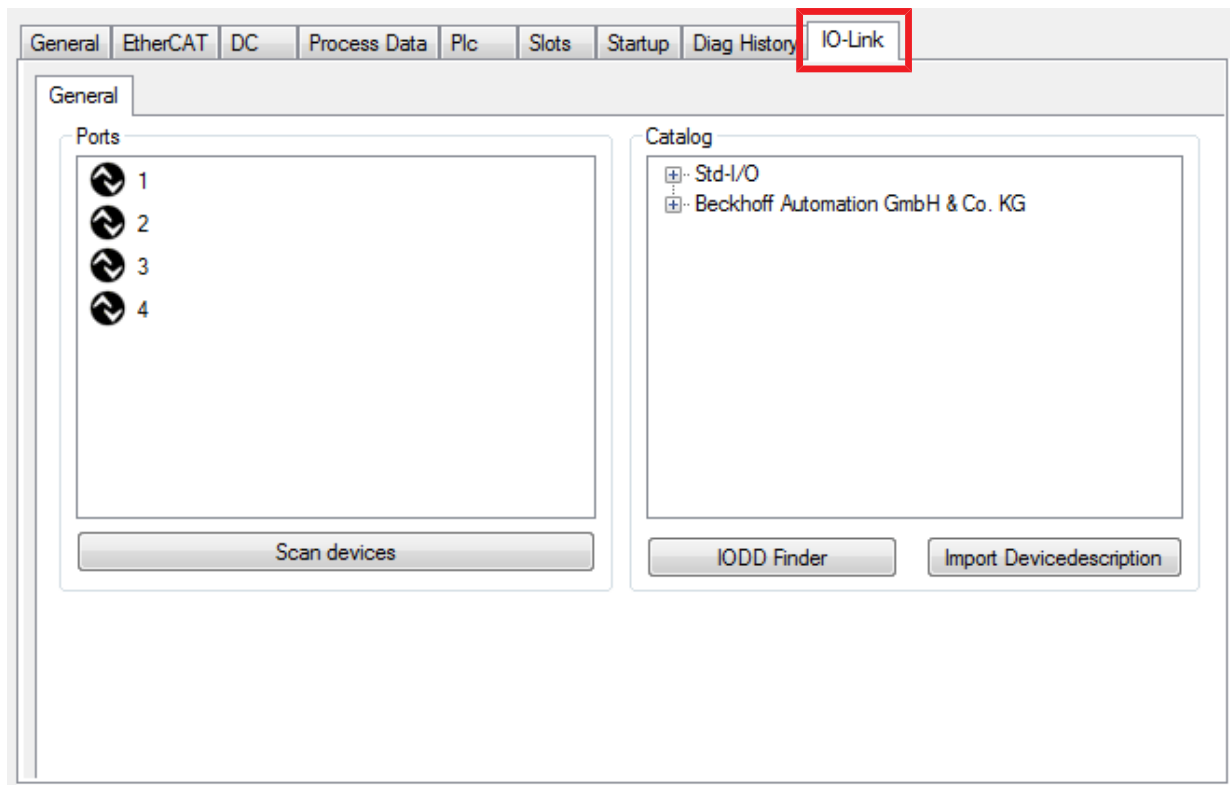


Fig. 12: "IO Link" tab

i IO-Link Extension

If the tab "IO-Link" is not displayed, the associated System Manager extension is missing. The System Manager extension is required for TwinCAT version 2.10, build 1325 to 1330.

- If your System Manager version or TwinCAT 3 does not yet provide this support, it can be installed later if necessary. Please contact our [Support](#) [► 158].

6.3 Configuration of the IO-Link devices

The configuration of the IO link devices is carried out in the IO link configuration tool. Configure the IO link device as described below.

✓ Requirement: an IO-Link master has been added in the Solution Explorer under the "I/O" entry.

1. Open the IO link configuration tool [► 89].
2. Import the IODD file of the IO link device [► 93].
3. Assign devices to ports.
 - ⇒ Assign a device to a port [► 90].
 - ⇒ Configure a port as digital in- or output [► 93].
4. Remove a device from a port [► 99].
5. Activate the IO link configuration [► 100], so that changes become effective.

6.3.1 Open the IO link configuration tool

✓ Requirement: an IO-Link master has been added in the Solution Explorer under the "I/O" entry.

1. Double-click on the IO-Link master.
 - ⇒ A device editor for the IO-Link master opens.
 2. Click on the "IO-Link" tab.
 - ⇒ The IO-Link configuration tool opens. The configuration tool contains two fields:
- „Ports“
The left-hand field "Ports" shows a list of the ports of the IO-Link master. If a device has been assigned to a port, the device designation is shown next to the port.
 - „Catalog“
The right-hand field "Catalog" shows the device catalog.
The device catalog contains an alphabetically sorted list of the IO-Link devices for which a device description (IODD) exists in the local TwinCAT installation.
The IODDs for the EPIxxxx, ERIxxxx IO-Link Box modules from Beckhoff can be downloaded via the [Download finder](#). The downloaded zip file contains the IODD device description files for the Beckhoff EPIxxxx, ERIxxxx IO-Link Box modules.

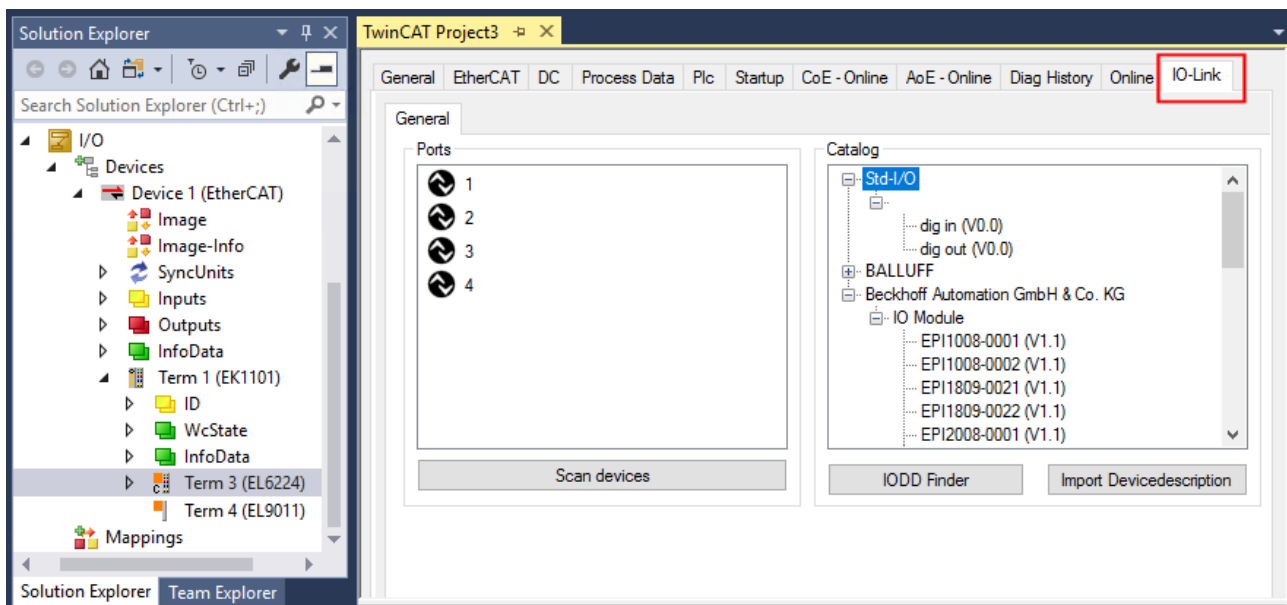


Fig. 13: IO-Link configuration tool

6.3.2 Integrating IO-Link devices

The integration of the IODD file should always be the first step, since this enables the breakdown of the individual process data of the IO-Link devices as well as the display of the parameters.

There are several ways of integrating an IO-Link device:

1. Importing the IODD file (offline and online) via
 - ⇒ button Import Devicedescription [► 91] (A) or
 - ⇒ button IODD Finder [► 91] (B)
2. Select the device in the "Catalog" field and assign it to a port [► 93].
3. Automatic scanning of the IO-Link ports (online) via
 - ⇒ button Scan devices [► 94] (C)
4. Manual insertion (offline and online) via
 - ⇒ menu Create Device [► 98] (D)



Application note

- If the IODD is not available, the IO-Link device should be integrated online by scanning.
- Manual integration of the IO-Link devices via "Create Device" should only be carried out if the IODD of the vendor and the IO-Link device are not available at the time of project creation.

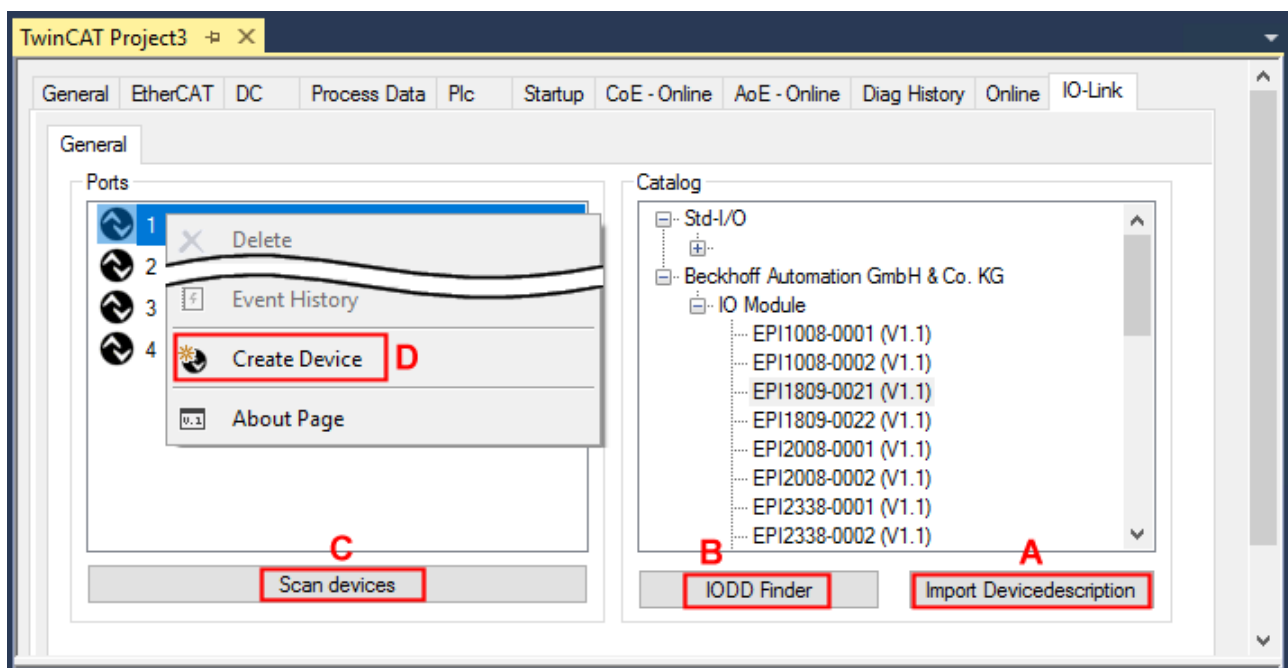


Fig. 14: Creating IO-Link devices

6.3.2.1 1. Importing the device description IODD

Importing the device description simplifies the integration of the IO-Link devices. The individual process data are broken down, enabling simple parameterization of the sensor. The IODD only needs to be imported during the initial commissioning of a new IO-Link device. The import is port-independent. Proceed as follows to import the IODD:

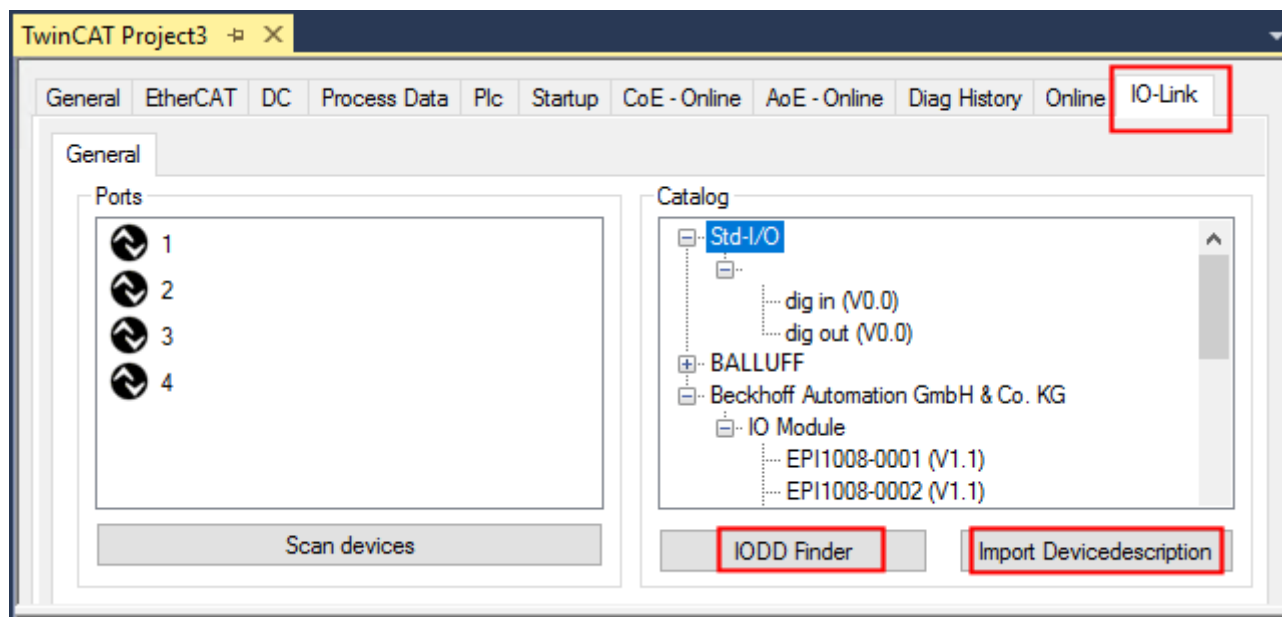


Fig. 15: Import of the IODD device description via "IODD Finder" or "Import Devicedescription"

Button "Import Devicedescription"

1. Press the "Import Devicedescription" button in the "IO-Link" tab
 2. Select the .xml file of the desired sensor.
 3. After pressing the Open button, the imported files are stored in the following folder:
 - for TwinCAT 2.x: \TwinCAT\IO\IOLink
 - for TwinCAT 3.x: \TwinCAT\3.X\Config\IO\IOLink.
- ⇒ The imported device descriptions are listed in a tree structure in the "Catalog" field, sorted by vendor.



No manual copying of the XML files

Do not copy the files directly into the folder; read them in via *Import Devicedescription* instead! Important checks will otherwise be bypassed!

Button "IODD Finder"

1. Press the "IODD Finder" button in the "IO-Link" tab
2. Searching for the desired IO-Link sensor/device by entering them in the search mask; see the figure below (1)
3. Selecting the desired IO-Link sensor/device. Move the mouse pointer over the figure of the desired IO-Link sensor/device. A blue download icon appears, see the following figure (2).

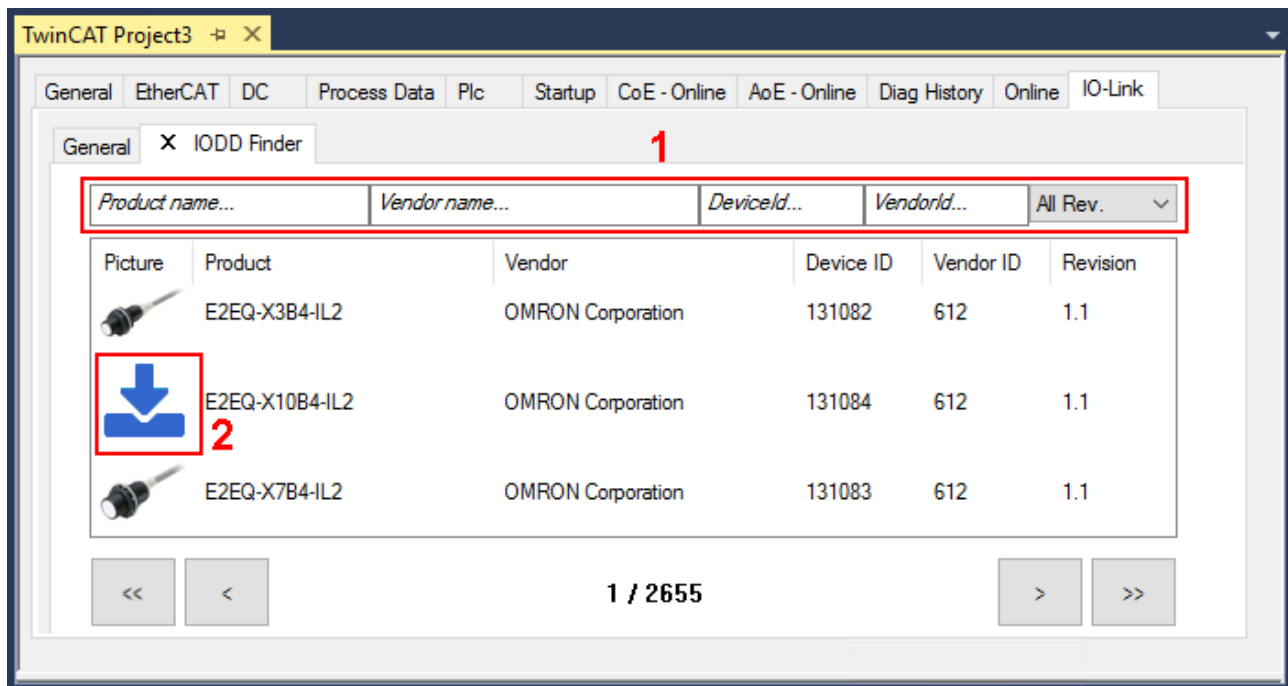


Fig. 16: IODD Finder, selection and import of the .xml-file

4. After clicking the download symbol, the .xml file of the selected IO-Link sensor/device is imported and stored in the following folder:
 - for TwinCAT 2.x: \TwinCAT\IO\IOLink
 - for TwinCAT 3.x: \TwinCAT\3.X\Config\IO\IOLink
5. When moving the mouse pointer over the IO-Link sensor/device, a green icon now indicates (see the following figure (3)) that the .xml file already exists.

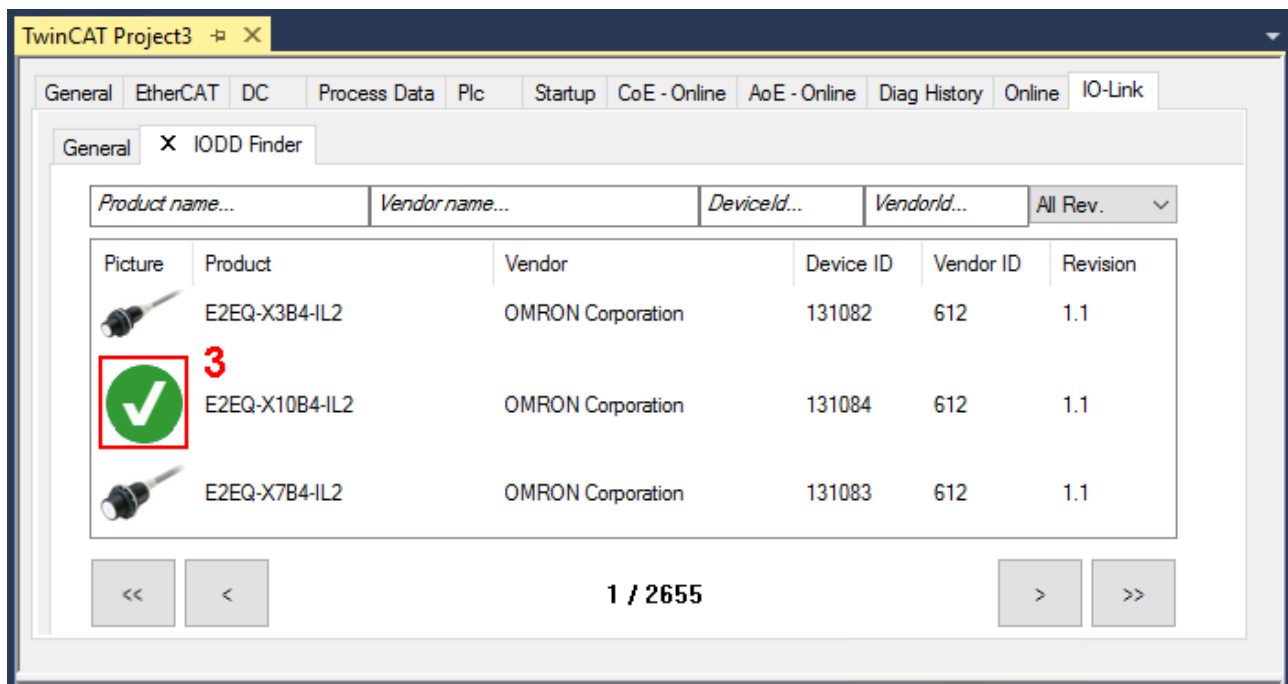


Fig. 17: IODD Finder, display of an already imported device description

- ⇒ The imported device descriptions are listed in a tree structure in the “Catalog” field of the IO-Link tab, sorted by vendor.

6.3.2.2 2. Assigning IO-Link device to port n

Online configuration

✓ Requirement: The IO-Link device is connected.

1. Press the button Scan devices (see chapter [Automatic scanning](#) [[▶ 94](#)])

⇒ The device is automatically detected and created with the corresponding parameters. If several devices are stored in the IODD file, the first entry is always selected here. Grouping in the IODD is usually carried out by the vendor if the process data are the same and there are only mechanical differences (e.g. other material).

Offline configuration

The *Catalog* field shows the IO-Link device catalog, which lists the already imported device descriptions in a tree structure, sorted by vendor.

1. Select the desired IO-Link device from the *Catalog* field
 - via drag and drop or
 - by right-clicking on the product with "Add to Port n".

Activating the configuration

2. [Activate the IO link configuration](#) [[▶ 100](#)], so that changes become effective.

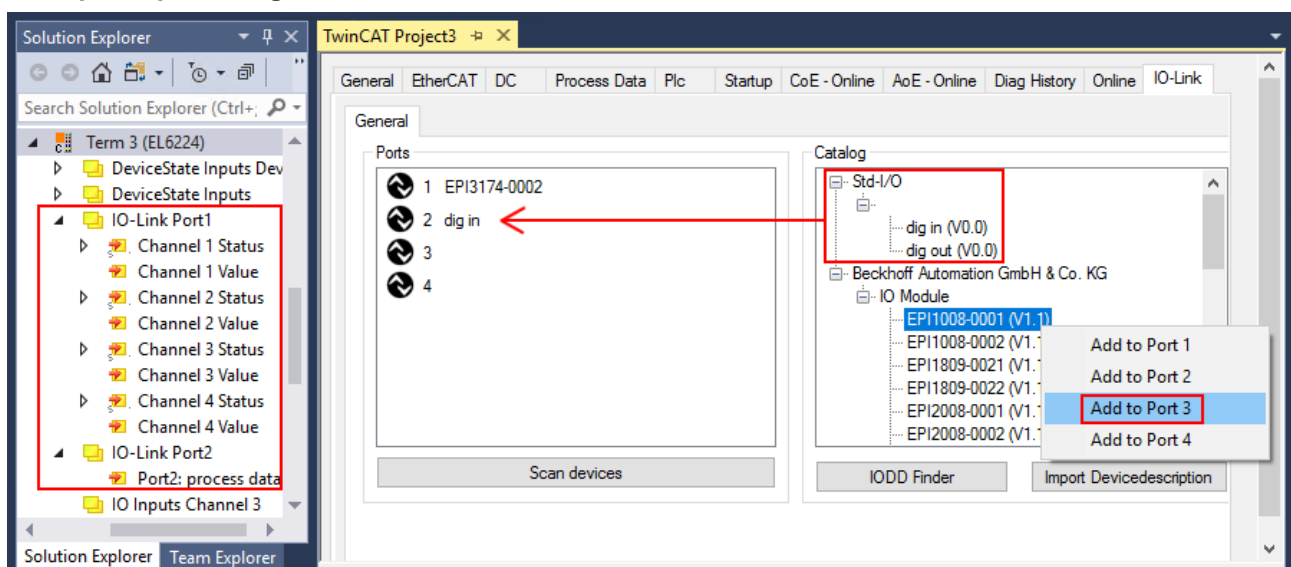
⇒ The IO-Link devices are displayed, and the process data are created. If an error is found when integrating the IO-Link device, e.g. wrong VendorID or no device connected, then this is indicated via the status of the port (object state Ch.n 0xF100:0n).

Configuration of the IO-Link ports as digital in- or output

IO-Link ports can also be configured as digital inputs or digital outputs. This allows digital sensors and actuators having no IO-Link functionality to be connected to IO-Link ports.

1. Expand the "Std-I/O" tree node in the "Catalog" field.
 - ⇒ The operating modes "dig in" and "dig out" appear.
2. Configure the desired port. There are two ways to do this:
 - Drag-and-drop: pull "dig in" or "dig out" onto the port in the "Ports" field or
 - Right-click on "dig in" or "dig out" and click on "Add to Port n".

Example of port assignment on the IO link master EL6224



Port1:
EPI3174-0002 is assigned
Process data of Port1 and Port2 are displayed in the Solution Explorer.

Port2:
is configured as digital input

Port3:
EPI1008-0001 will be assigned

6.3.2.3 3. Automatic scanning of the IO-Link ports

This part of the documentation describes the configuration of the physically available IO-Link devices in TwinCAT.

During automatic scanning of the IO-Link ports, the steps “WakeUp pulse”, “Baud rate setting”, “Reading of the communication parameters”, plus “Parameter server” and “Cyclic data exchange”, if applicable, are performed, see [Establishing the IO-Link communication](#) [► 66]. The corresponding IO-Link device must be connected to the IO-Link port for this.

The connected devices are automatically detected, configured and a search is performed for the associated IODD.

Finding connected IO-Link devices

✓ Requirement: the master and the devices are cabled and supplied with voltage.

1. Click on the “Scan devices” button (see the following figure).

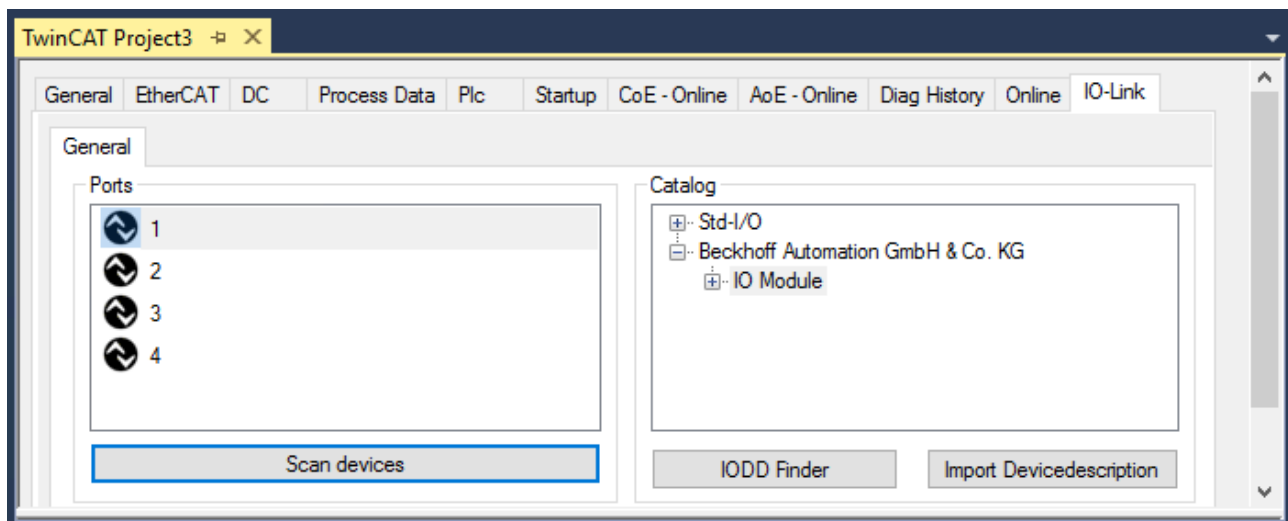


Fig. 18: Scan devices

- ⇒ The connected IO-Link devices can be found.
- ⇒ The information window lists the connected device for each of the four ports. Only port2 of the master is assigned an IO-Link device.
- ⇒ Confirm with the OK button.

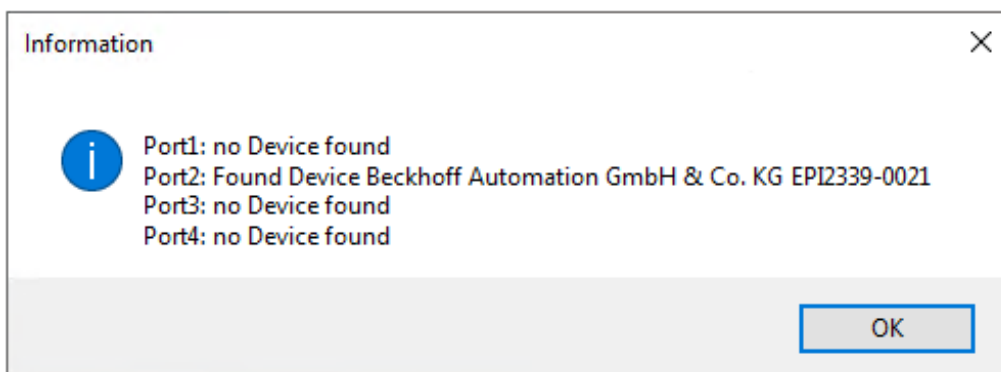


Fig. 19: Information “Scan devices”

1. To be able to work with the devices, the button “Reload Devices” must be clicked. 

The IO-Link devices are now entered in the *General* display. The Port2 “Details” field displays information about the connected device. Additionally the tabs Settings [► 96] and Parameter [► 97] can be opened.

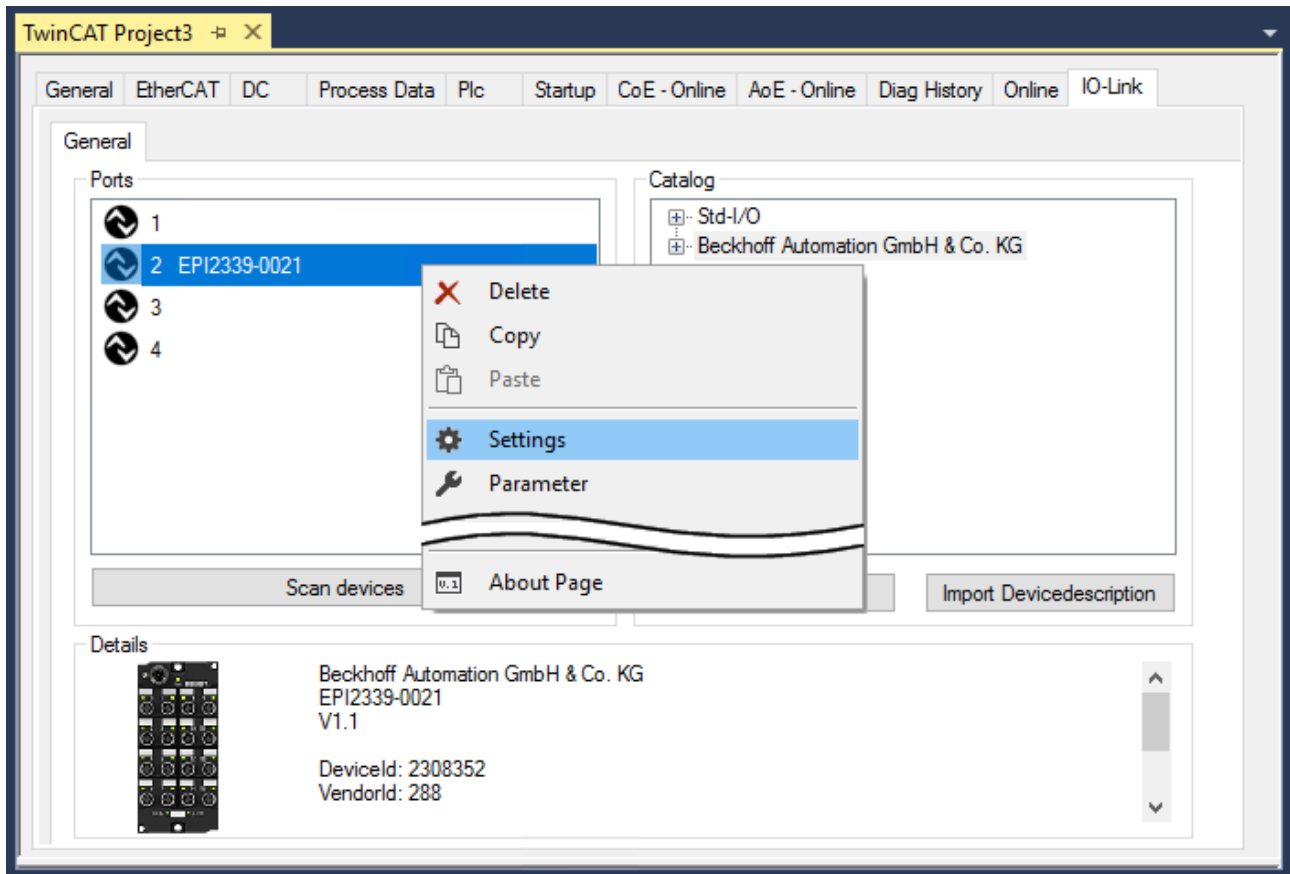


Fig. 20: Device at Port2, Display “Details”, open tabs “Settings” and “Parameter”

Show settings of the device

1. Right-click on port2, to display more details in dialog “Settings”.
2. If necessary, change the settings as described in chapter [Settings of the IO-Link devices](#) [► 101].

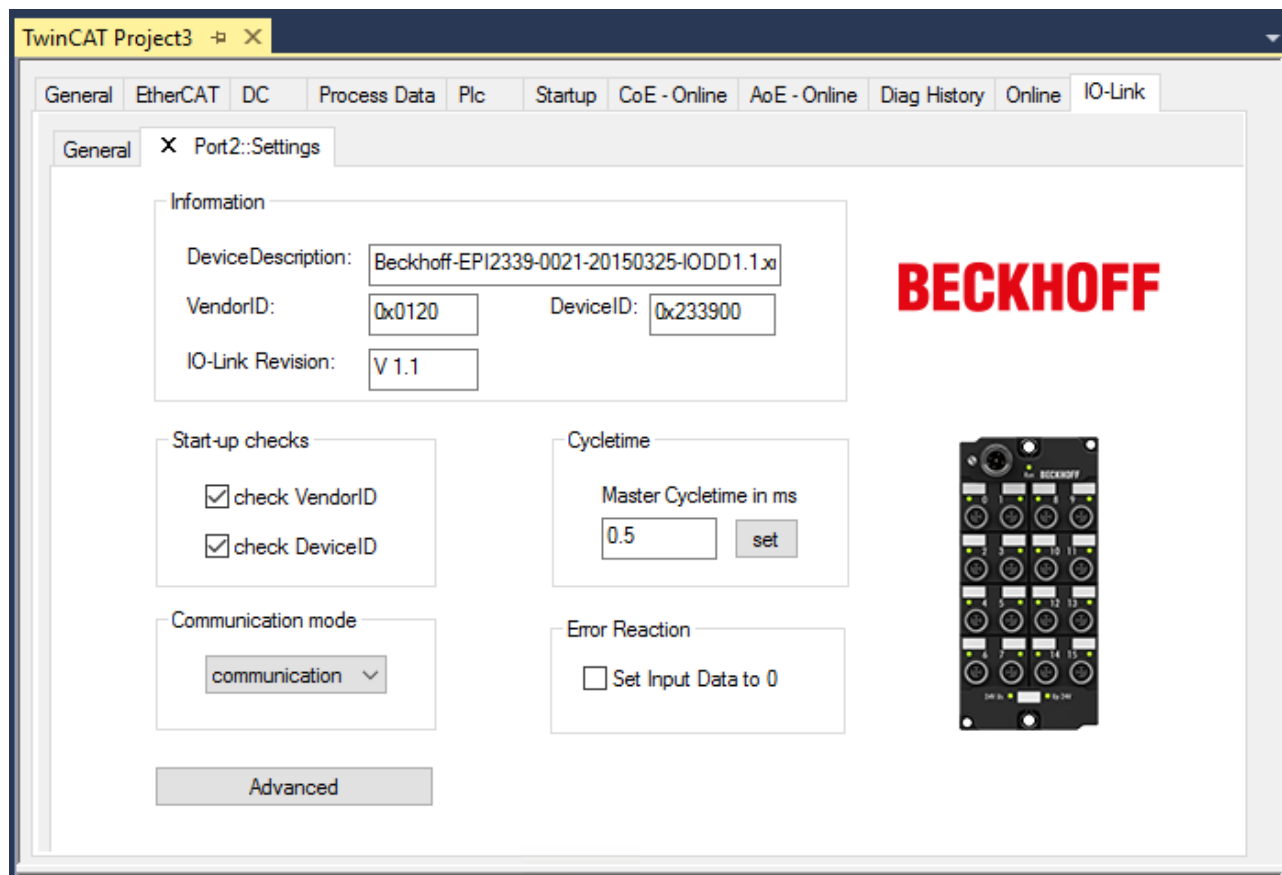


Fig. 21: Settings of the device assigned to port2

Show parameters of the device

1. Open the Parameter tab via
 - double-click on Port2 or
 - right-click on Port2 and select "Parameter" in the menu.
 ⇒ The Parameters of of the respective IO link device are listed.
2. Parameterize the device as described in chapter [EPIxxxx, ERIxxxx - Setting of the IO-Link device parameters](#) [[▶ 103](#)].

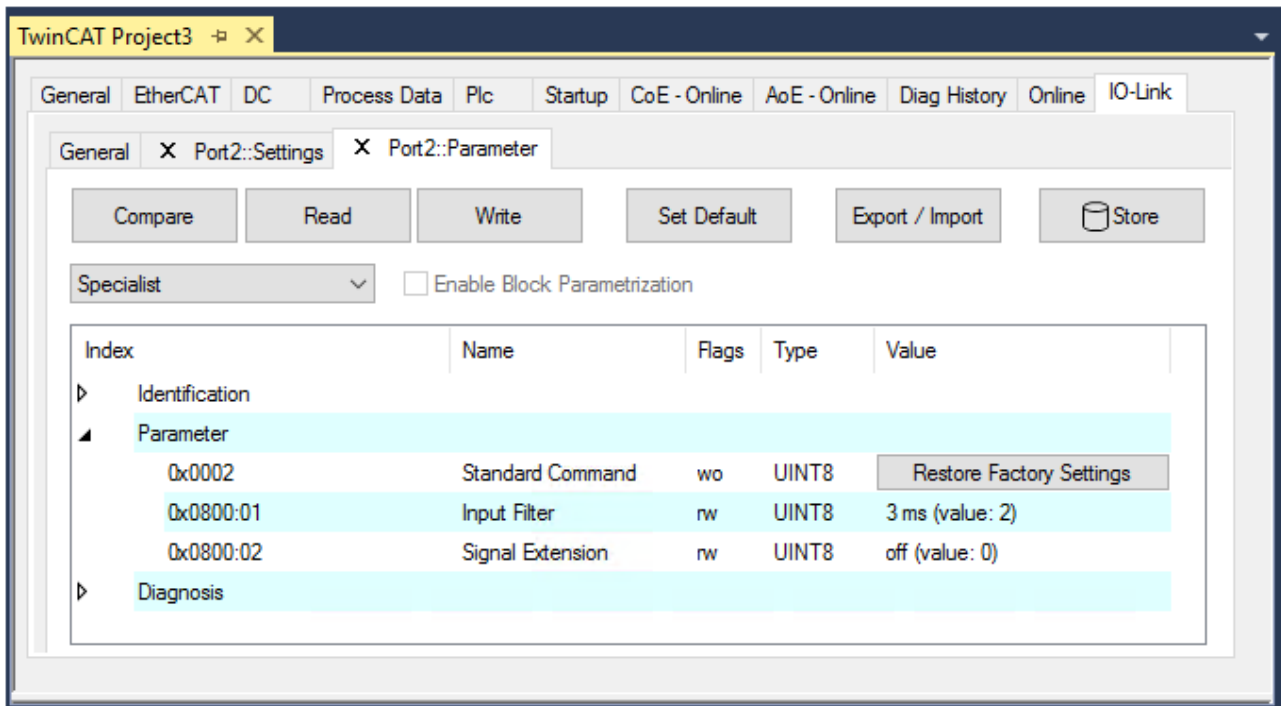


Fig. 22: Parameter of the device assigned to port2

6.3.2.4 4. Manual insertion via Create Device

This part of the documentation describes the manual configuration of the IO-Link devices in TwinCAT.

The manual insertion of the IO-Link device should only be carried out if the IODD from the vendor and the IO-Link device are not available. By saving the project, the settings for the individual ports are saved. The devices that were created are **not** stored in the "Catalog" (see the figure below (A)). To insert the IO-Link devices manually via "Create Device", proceed as follows:

1. The IODD of the IO link device is already available:
Select the respective device from the "Catalog" field sorted by manufacturer (see following figure (A)).
2. No IODD is available:
Add the device can be manually via "Create Device". These data are **not** saved in the "Catalog" field and must be manually entered for each port.
3. Right-click on the port to open the context menu (see the figure below (B)) and select "Create Device".
4. In the "Create Device" dialog an IO-Link device with the basic communication parameters can be created. The mandatory fields here are: For Vendor ID, Device ID and process data length see the figure below (C). The values VendorID and DeviceID can be entered both in hexadecimal notation (input format: 0xnnnn) and as decimal numbers (nnnn).
The communication parameters to be entered can be found in the information provided by the device vendor.
5. If the IO-Link device version is 1.1, then the parameter server is activated by the selection of the check box "Revision V1.1" (see following figure (D)).
6. Activate the IO link configuration [► 100], so that changes become effective.

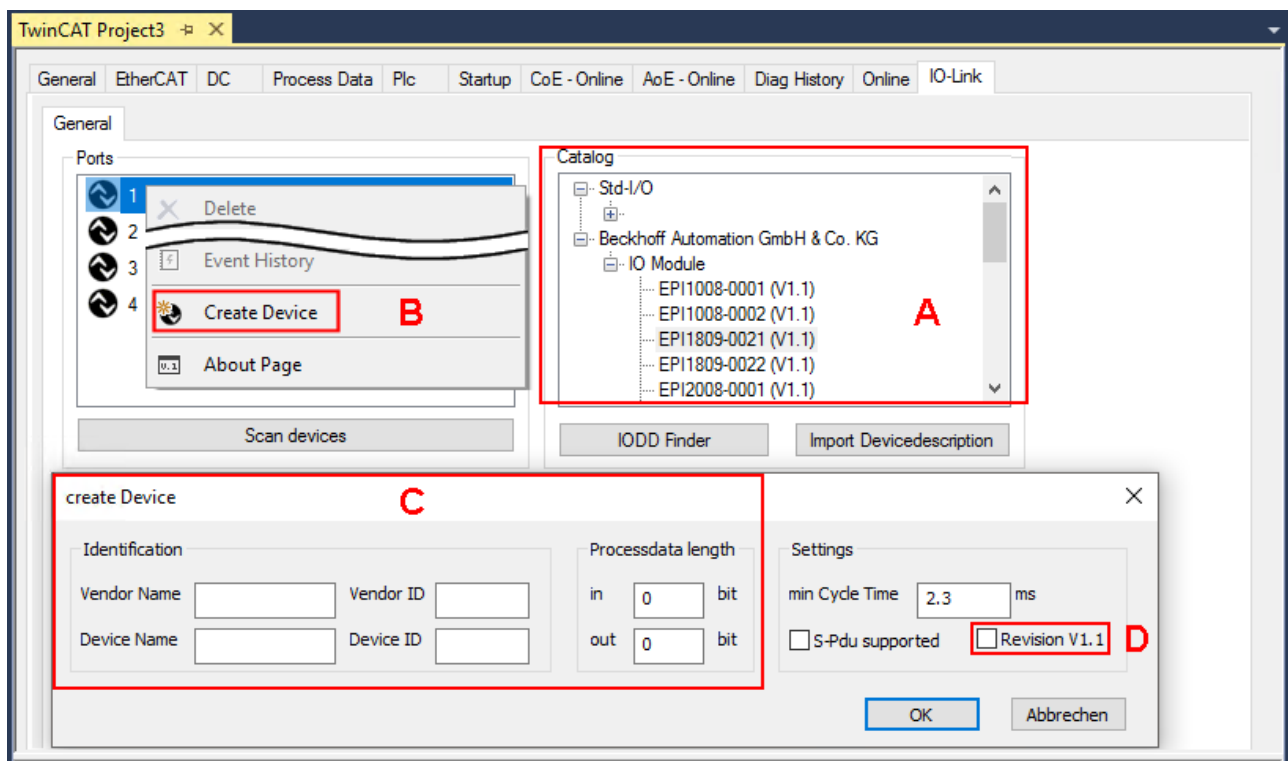


Fig. 23: Manual creation of an IO-Link device via the "Create Device" dialog (C)



Reading the IODD

Even when manually creating and scanning, the IODD should always be read in as well in order to display further sensor-specific information.

7. In the "Settings" tab of the IO link devices further settings can be made as described in chapter [Settings of the IO-Link devices \[► 101\]](#).

6.3.3 Removal of IO-Link devices

To remove a device that has already been inserted, proceed as follows.

1. Right-click on the port to open the context menu and select "Delete".

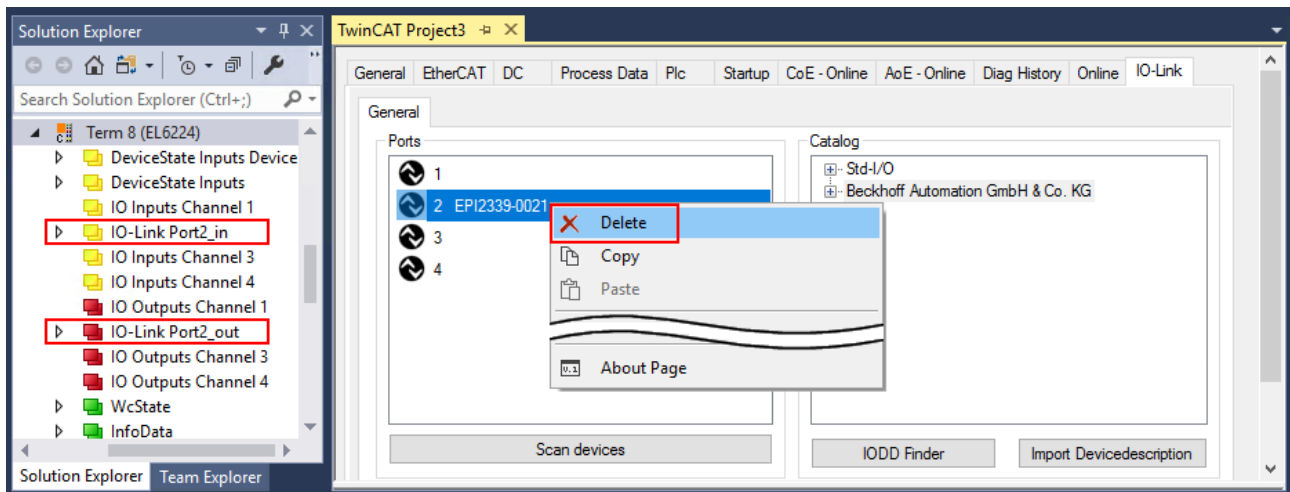


Fig. 24: Remove the device from port2

2. Activate the IO link configuration [▶ 100], so that changes become effective.

⇒ The already create process data are removed.

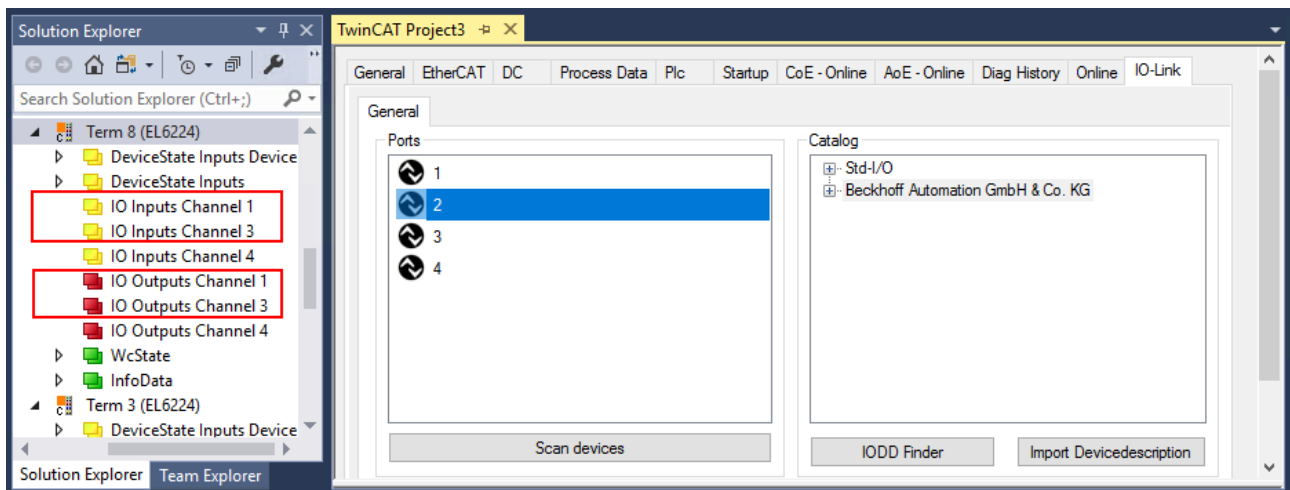


Fig. 25: The device was removed from the port2, the process data no longer displayed in the tree.

6.3.4 Activating the configuration

Changes in the IO-Link configuration tool only become effective when you activate the IO-Link configuration.

There are two ways to activate the IO-Link configuration:

- Click on the "Reload Devices" button



- Activate the TwinCAT configuration:
Click on the "Activate Configuration" button



6.4 Settings of the IO-Link devices

To find the basic settings of the devices for each port, proceed as follows.

1. right-click on the port to open the context menu and select "Settings".

⇒ A new tab "Portx:: Settings" opens where the settings described below can be made.

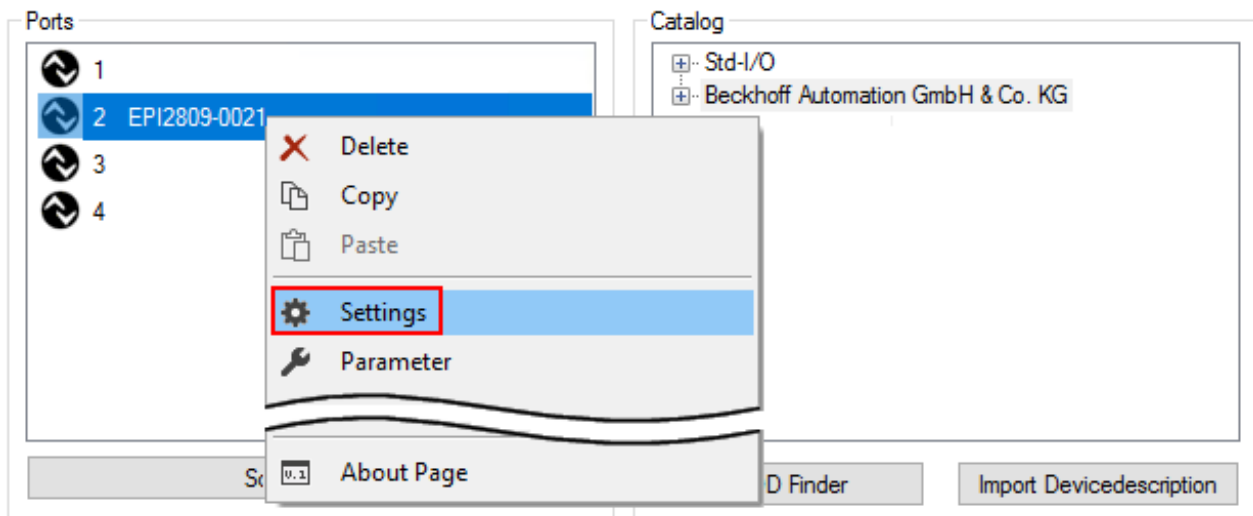


Fig. 26: Context menu - Settings

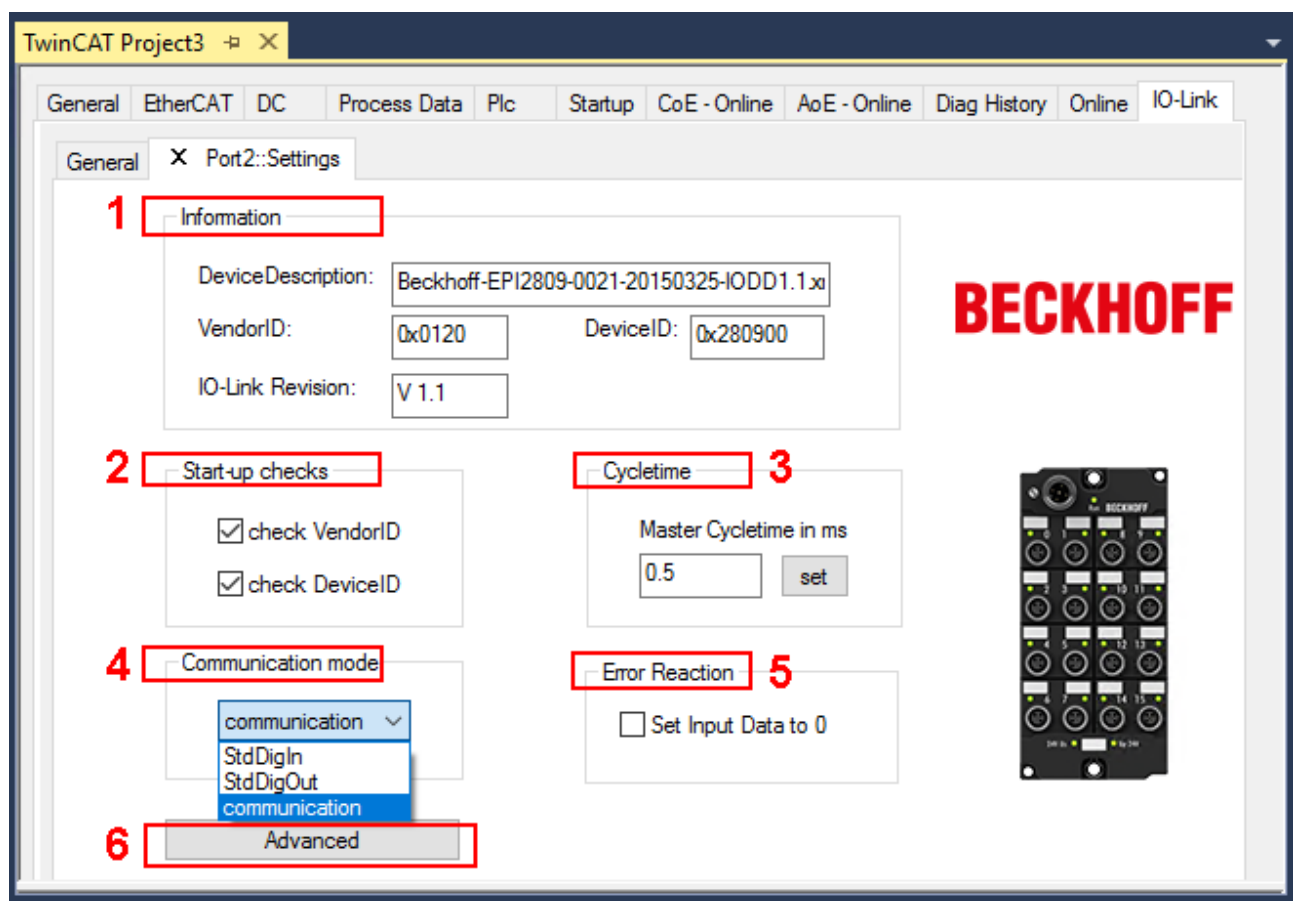


Fig. 27: Settings of the IO-Link devices

1. Information

This field is for information only; the IODD that was read in is displayed under Device Description. Furthermore, the VendorID, DeviceID and the IO-Link revision (V1.0 or V1.1) of the IO-Link devices are displayed. If the device is an IO-Link device V1.1, then the parameter server [► 67] function is supported.

The following settings can be made in the settings for the IO-Link devices (see figure above):

2. Start-up checks

This parameter can be used to specify that the Vendor ID and Device ID should be checked when the IO-Link device starts up.

⇒ This avoids errors when exchanging IO-Link devices.

3. CycleTime

Specifies the cycle time for the IO-Link master

4. Communication mode

Selection of the mode in which the IO-Link port is to be operated.

⇒ "Communication": Default mode for IO-Link devices

⇒ "StdDigIn / StdDigOut": Mode for non-IO-Link devices, automatically selected if the port is configured as a digital input or output [► 93].

5. Error Reaction

If the "Set Input Data to 0" field is activated:

⇒ input data are set to 0 in case of error

⇒ Status display: "Error"

6. Button "Advanced"**7. Data Storage**

Pay attention to the sensor version:

⇒ V1.0 -> data storage is not supported

⇒ V1.1 -> data are stored in the parameter server (preset)

8. Process Data Format

Adaptation of the process data format

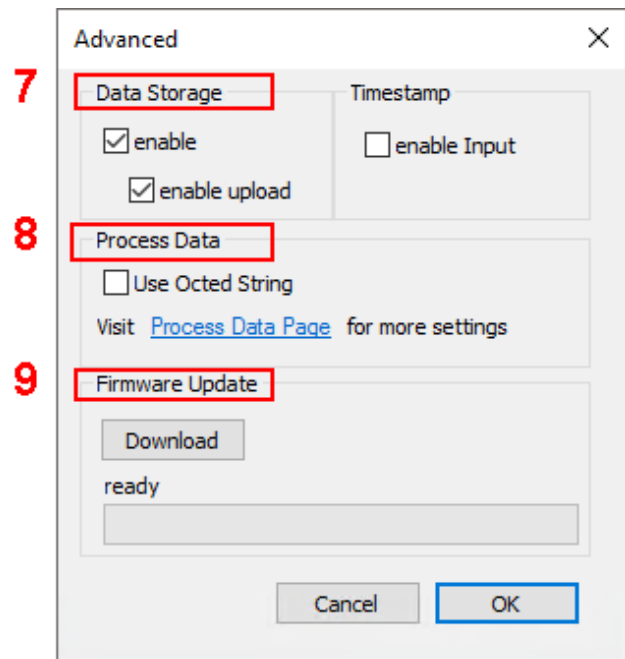
If Field "Use Octet String" is selected

⇒ complex data types (process data) are created as octet strings.

Advantage: simple further processing in the PLC

9. Firmware Update of the Beckhoff IO-Link devices

For a firmware update use the "Download" button. Observe the description in the documentation of EPIxxx boxes in chapter Firmware Update des IO-Link Devices.



6.5 EPIxxxx, ERIxxxx - Setting of the IO-Link device parameters

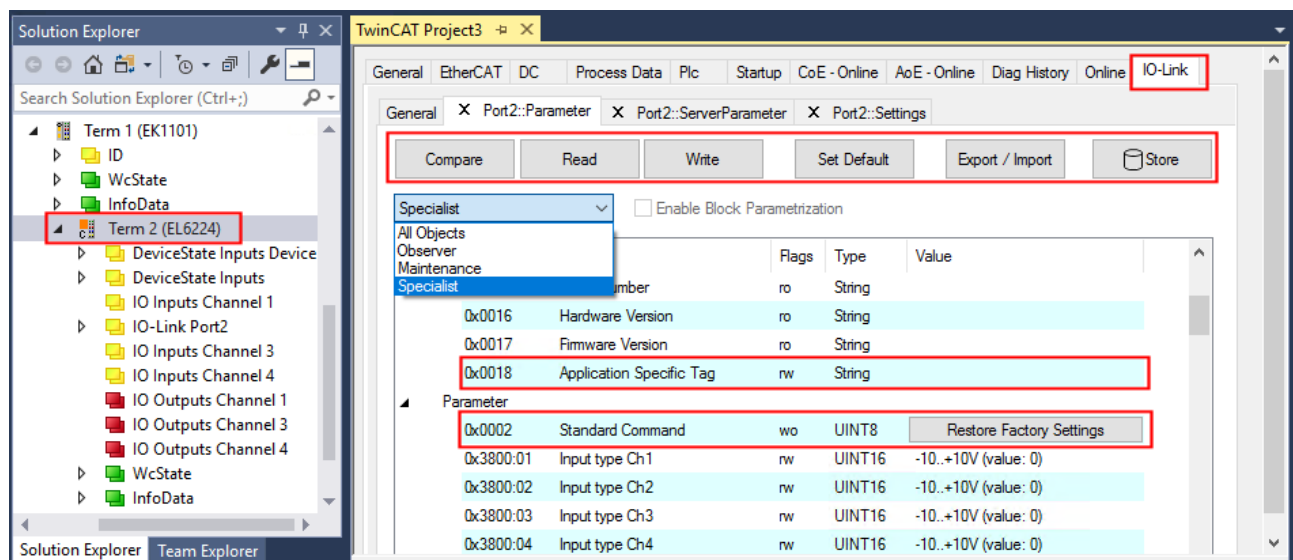
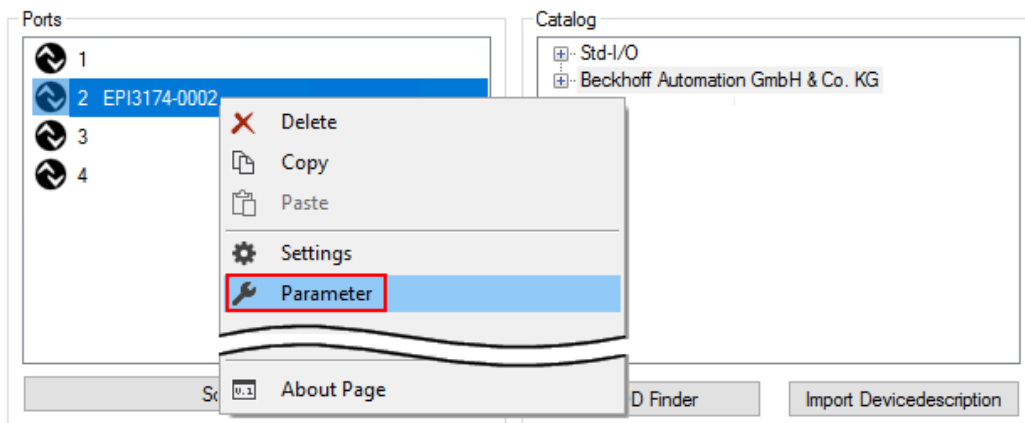
This chapter explains how to read out and set the IO-Link device parameters.

The number and type of the objects shown on the “Parameters” tab vary according to the type of sensor. The default settings as stored in the IODD can initially be seen.

To open the “Parameter” tab

1. Click the IO-Link master in the TwinCAT tree structure.
2. Click the “IO-Link” tab.
3. Select the port to which the IO-Link device is connected,
4. Double-click or by right-click to the port and select “Parameter”.

⇒ The “Parameter” tab is opened.



The device parameters are listed in the tab. The buttons [Compare](#) [► 104], [Read](#), [Write](#) [► 106], [Set Default](#) [► 107], [Export/Import](#) [► 108] and [Store](#) [► 109] are located at the top of the tab. The “Read”, “Write” and “Store” buttons are used to read out the parameters stored in the IO-Link device, load them and store them in the parameter server of the master.

Different user roles can be selected from the drop-down menu. The default user role is “Specialist”. The parameters are displayed in different representations and scopes.

Restarting the IO link device or restoring of the application parameters is possible via the parameter [Standard Command](#) [► 112].

Application specific information can be specified in parameter (0x0018) [Application Specific Tag](#) [► 113].

“Compare” button

1. Press the “Compare” button.
 - ⇒ the parameter data of the configuration are compared with the parameter sets in the sensor.
 - ⇒ The result is displayed in the “Parameter” tab see following figures.

Conformity of configuration and sensor data

The match is confirmed by a green tick in front of the index. Matching values are displayed in the “Value” field (see index 0x0018 “Application Specific Tag”).

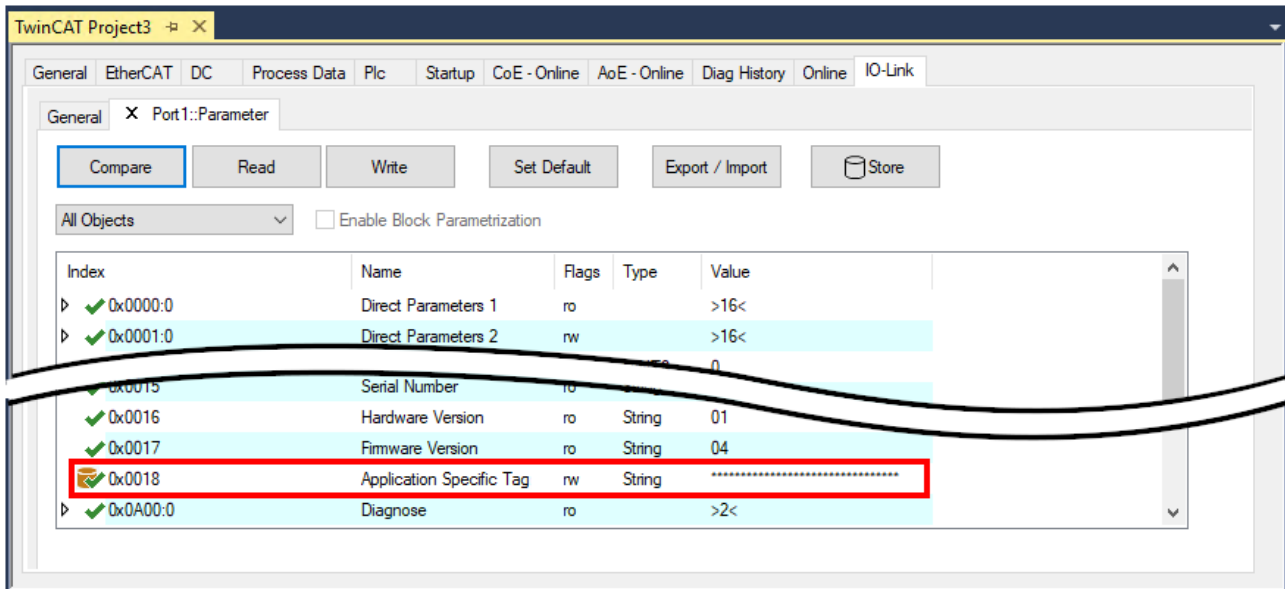


Fig. 28: Display of matching data in the “Parameter” tab

Deviations between configuration and sensor data

Deviations are indicated by a pen-symbol in front of the index. If there are different values in the “Value” field, the value “Compare” is displayed (see Index 0x0018 “Application Specific Tag”).

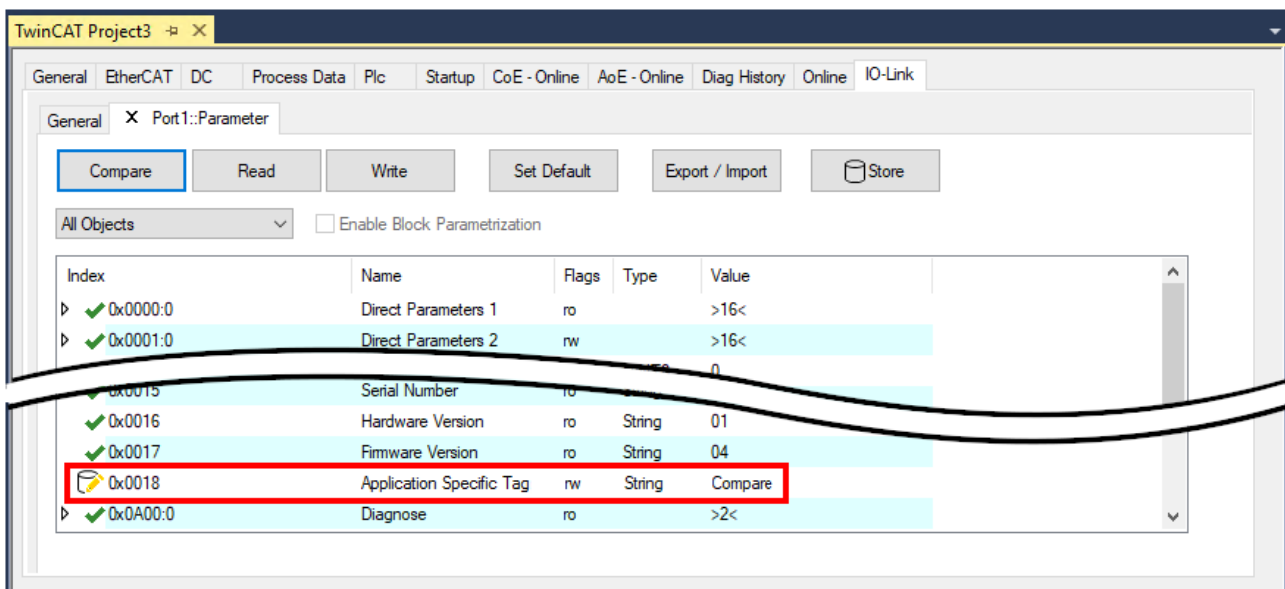


Fig. 29: Display of deviating data in the “Parameter” tab

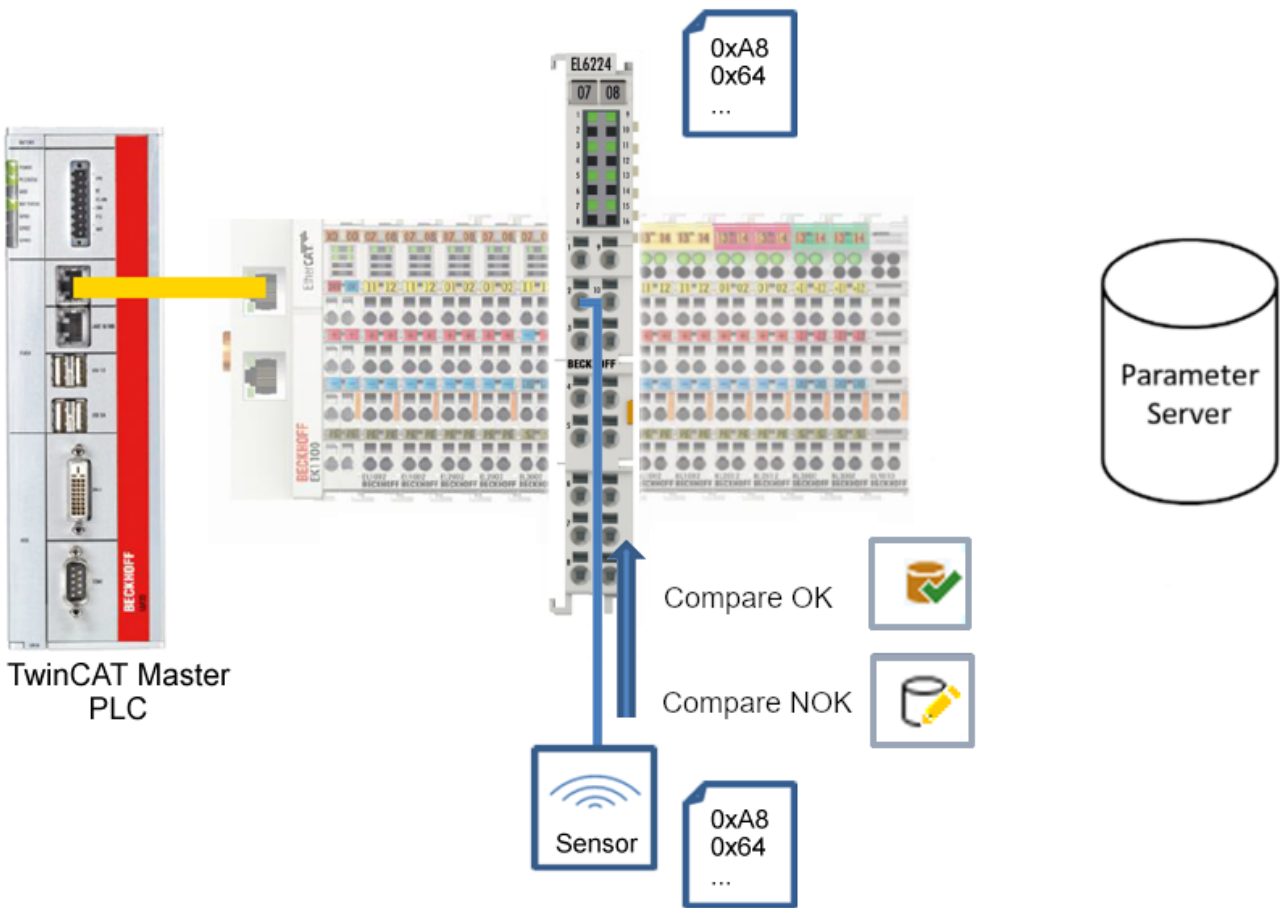


Fig. 30: Compare configuration and sensor data

“Read” button

The default values from the IODD file are always preset

1. Press the “Read” button
⇒ The current parameter values of the sensor are read. The successful reading of the data is confirmed with a green tick in front of the index.

“Write” button

The default values from the IODD file are always preset

1. Enter the desired value under “Value”.
2. Press the Enter key.
⇒ The values are accepted.
3. Press the “Write” button.
⇒ The data is written to the device (offline configuration is possible). The successful writing process is confirmed via a storing symbol in front of the index.

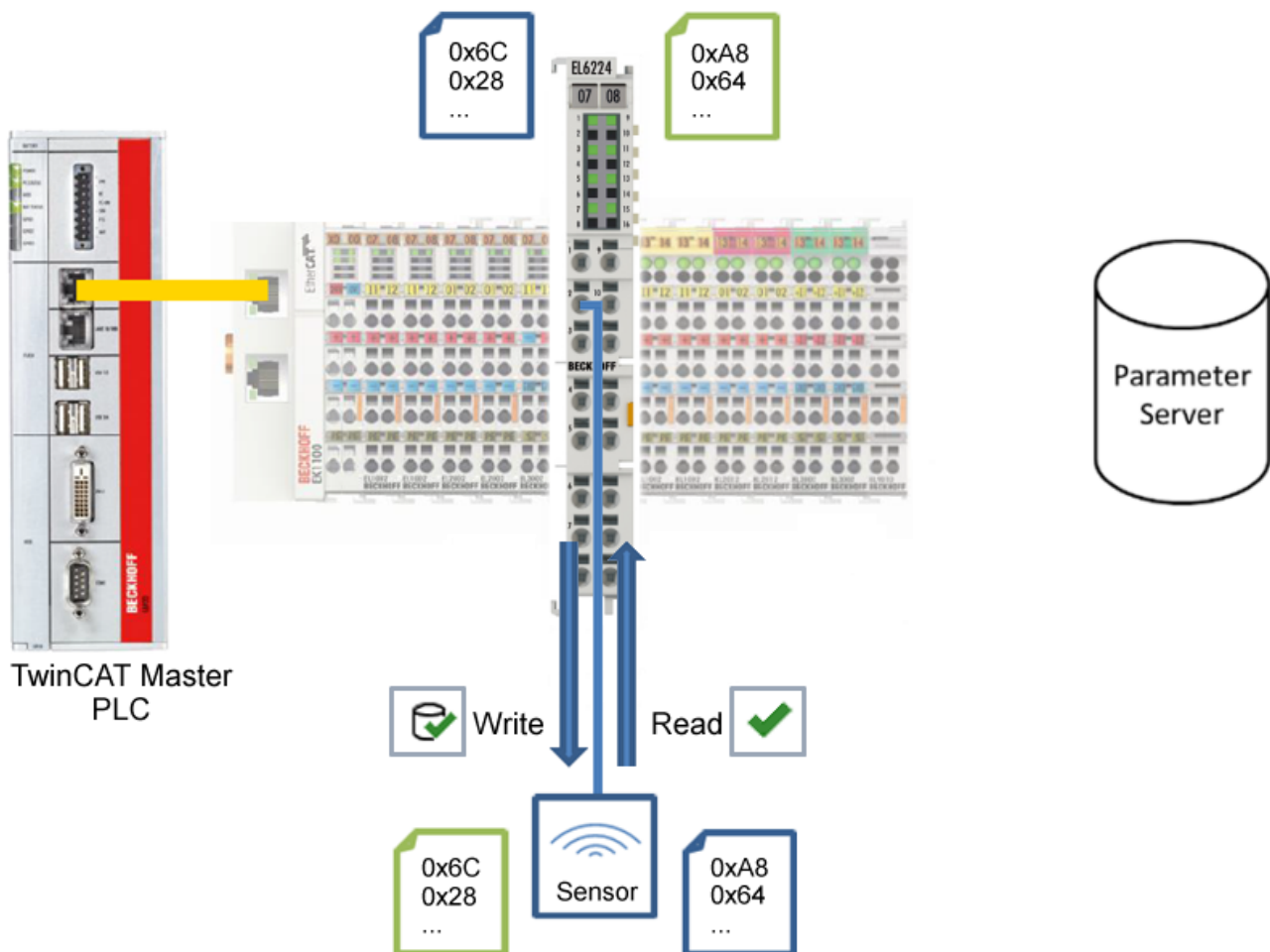


Fig. 31: Write parameter data to the sensor, read parameter data from the sensor.

“Set Default” button

1. Press the “Set Default” button.

⇒ All parameter values are set to the default settings.

Write default-values to the sensor

Note that the default-values must also be written to the device via the “Write” button.

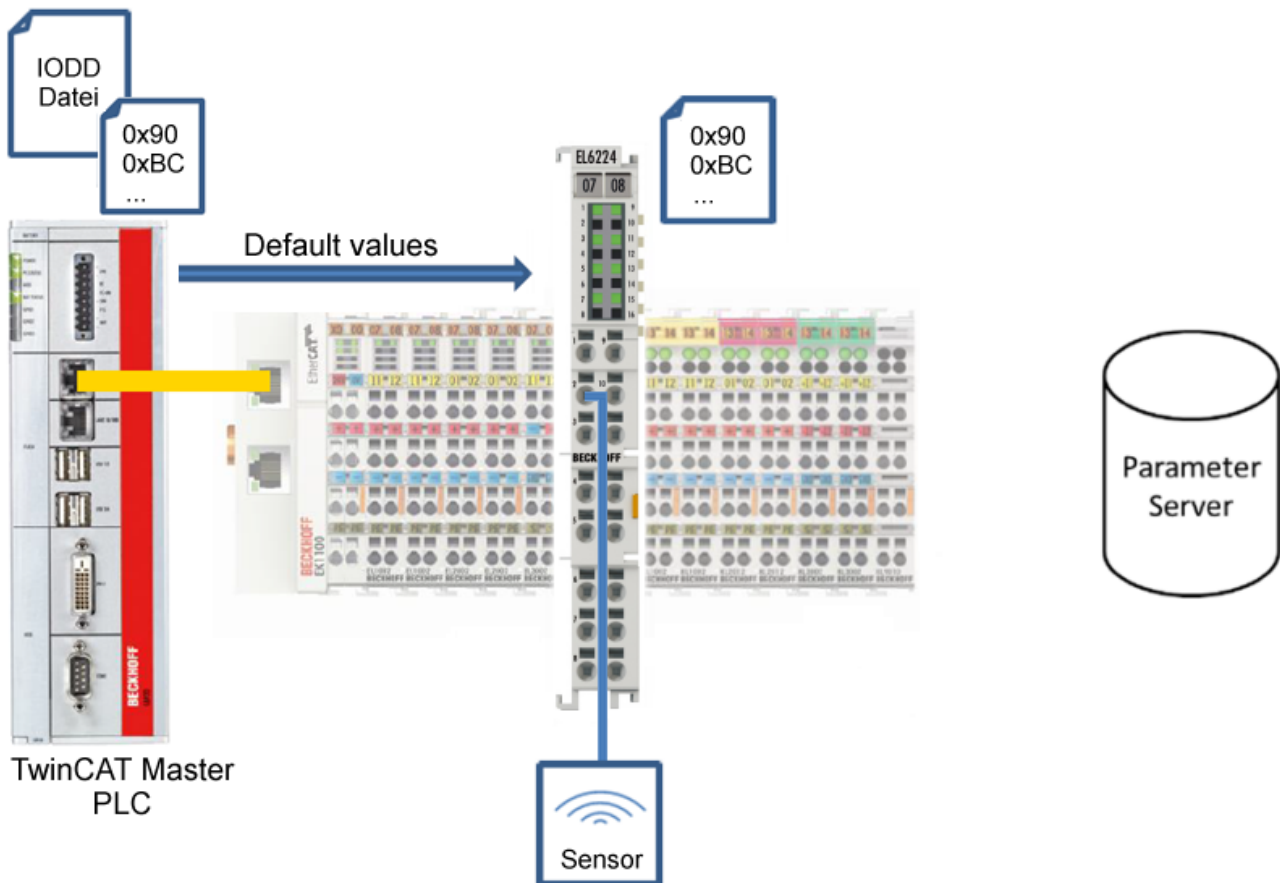


Fig. 32: Reset parameter values to default

“Export / Import” button

The set parameter values can be exported as a .vbs file and restored later via Import.

1. Press the “Export / Import” button (see the diagram below (1)).
⇒ The Import / Export dialog is opened
2. Specify the path under which you want to export or import the .vbs file, see fig. (2) below and confirm with the “Open” button, see fig. (4) below.
3. In addition, the export options “Attach Store Command” and “Enable Block Parametrization” can be selected as shown in fig. (3) below.
⇒ “Attach Store Command”: The parameters are loaded into the parameter server after the script has written all values.
⇒ “Enable Block Parametrization”: Block parameterization is enabled. For some sensors, writing is only possible when block parameterization is enabled.
4. Press the “Export” or “Import” button
⇒ The parameters are adopted from the imported file. The change of parameters is marked with a pencil symbol.
5. Write the new parameter values to the sensor via “Write” button.
⇒ The data is written to the device (offline configuration is possible). The successful writing process is confirmed via a storing symbol in front of the index.

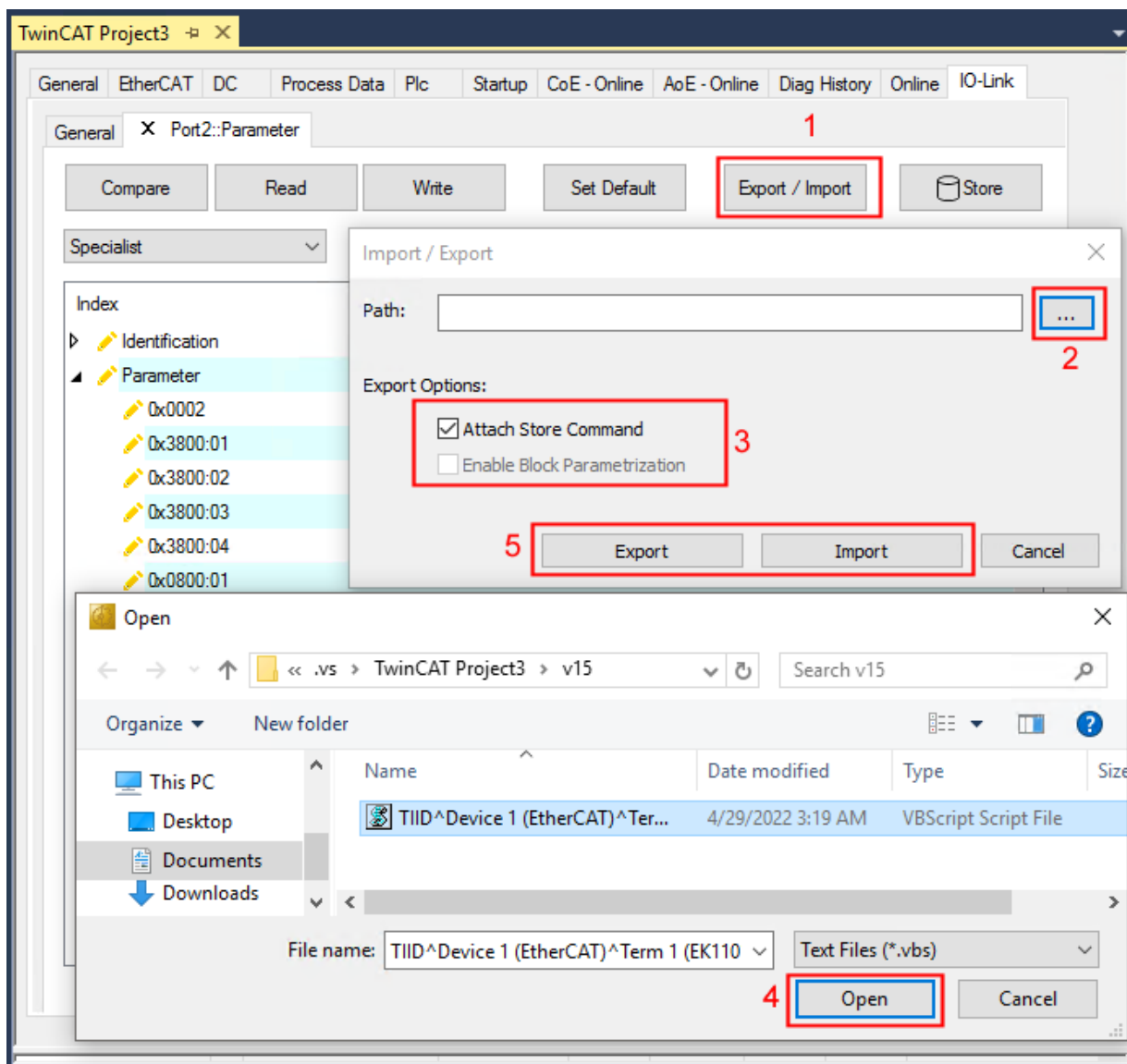


Fig. 33: Parameterization IO-Link device - Export / Import

“Store” button

1. Click “Store” (data storage):

- ⇒ The Beckhoff IO-Link master stores sensor-dependent-data, e. g. the following parameters (0x0018) “Application-Specific Tag”, (0x08n0) “Settings” and 0x3800 “Range Settings”.

The success of storing process is marked with the storing symbol.

- ⇒ If the IO-Link device is exchanged for a similar module, the device can be restored.

The stored values are displayed in the “ServerParameter” tab

1. Right-click on the device and select “Parameter Server” from the menu.

- ⇒ The stored values are displayed.

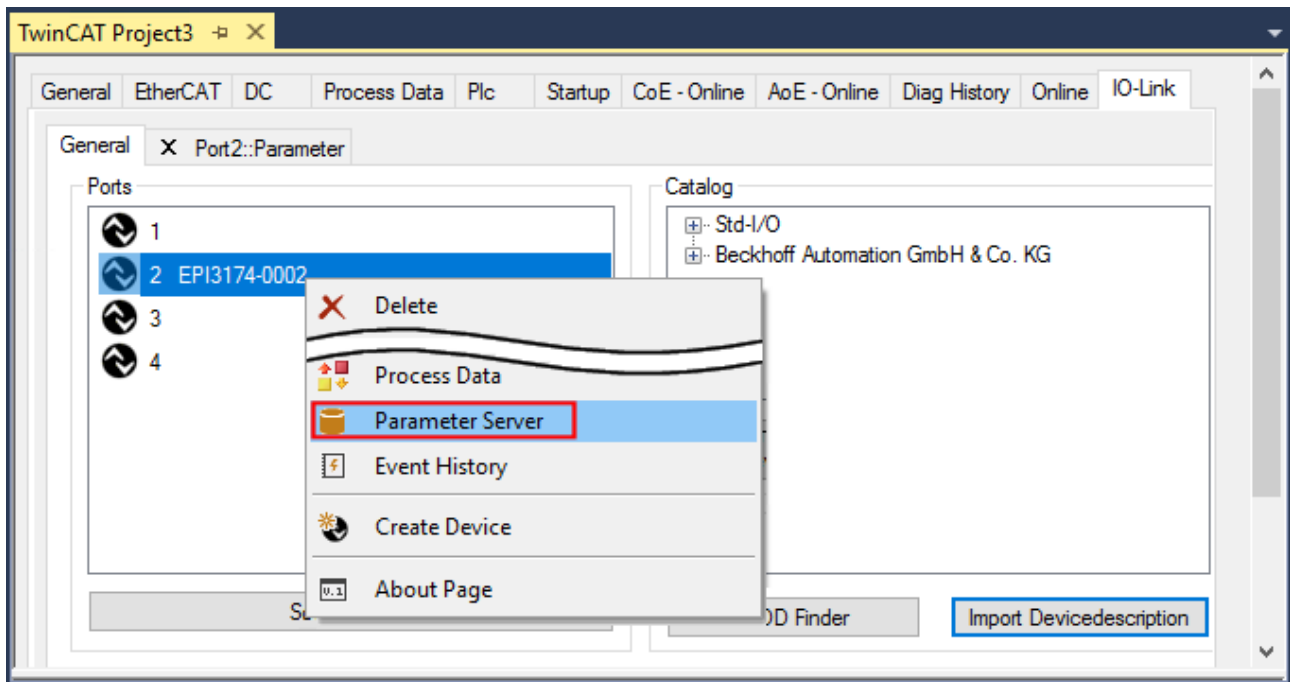


Fig. 34: Open the “ServerParameter” tab

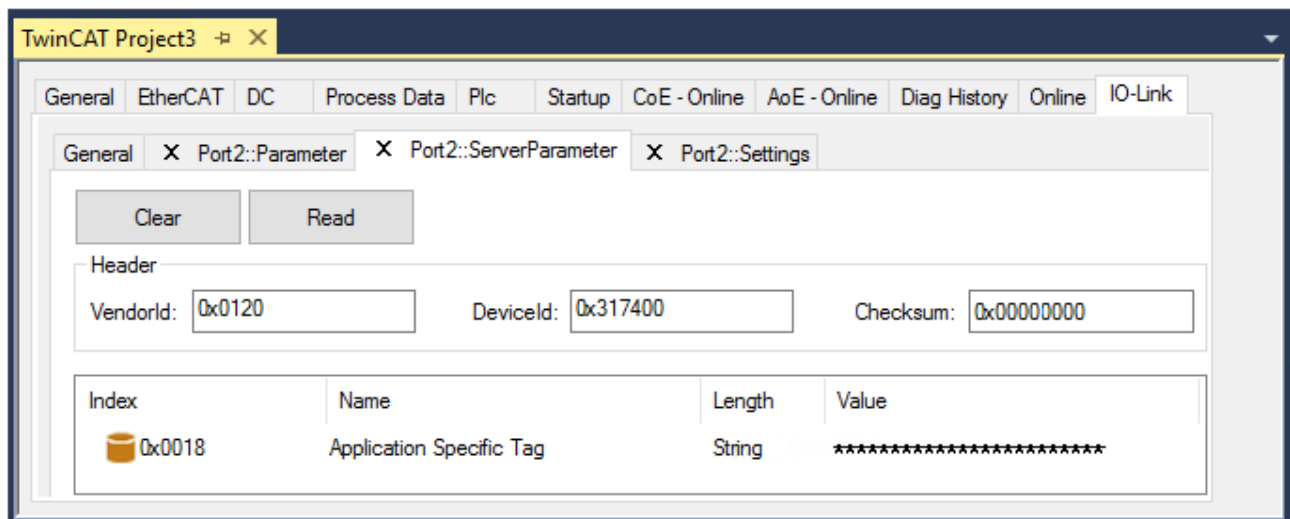


Fig. 35: „ServerParameter“ tab

Activate store button via PLC

As for CoE, the Indexgroup of an ADS command is specified as **0xF302** for the IO link data channel.

According to the IO-Link specification devices with ISDU support shall use index **0x0002** to receive the SystemCommand. The following list displays coding examples for system commands (ISDU), the complete table "Coding of SystemCommand (ISDU)" can be found in the [IO-Link specification](#).

Command (hex)	Command (dec)	Name of the command	Definition
....			
0x01	1	ParamUploadStart	Start Parameter Upload
0x02	2	ParamUploadEnd	Stop Parameter Upload
0x03	3	ParamDownloadStart	Start Parameter Download
0x04	4	ParamDownloadEnd	Stop Parameter Download
0x05	5	ParamDownloadStore	Finalize parameterization and start Data Storage
0x06	6	ParamBreak	Cancel all Param commands
....			

Use an ADS Write function block for activating the store-function via the plc. The following figure shows a sample code for activation of the store-Button (command 0x05 "ParamDownloadStore")

```

Case_Write:
  AdsWrite_EL6224( WRITE := FALSE );
  AdsWrite_EL6224.IDXGRP   := EL6224_Ch_iGrp;
  AdsWrite_EL6224.IDXOFFS  := EL6224_Ch_iOffWri;
  AdsWrite_EL6224.LEN      := SIZEOF(EL6224_bywrite);
  AdsWrite_EL6224.SRCADDR  := ADR(EL6224_bywrite);
  AdsWrite_EL6224( Write := TRUE );
  eSwitch1 := Case_WriBu;

EL6224_AoePortCh  : UINT  := 16#1001;
EL6224_Ch_iGrp    : UDINT := 16#F302;
EL6224_Ch_iOffManu : UDINT := 16#00100000;
EL6224_Ch_iOffPro  : UDINT := 16#00140000;
EL6224_Ch_iOffWri  : UDINT := 16#00020000;
EL6224_sManu       : STRING;
EL6224_sPro        : STRING;
EL6224_bywrite     : BYTE  := 16#5;

```

Fig. 36: Sample code for activation of the store-function via the plc

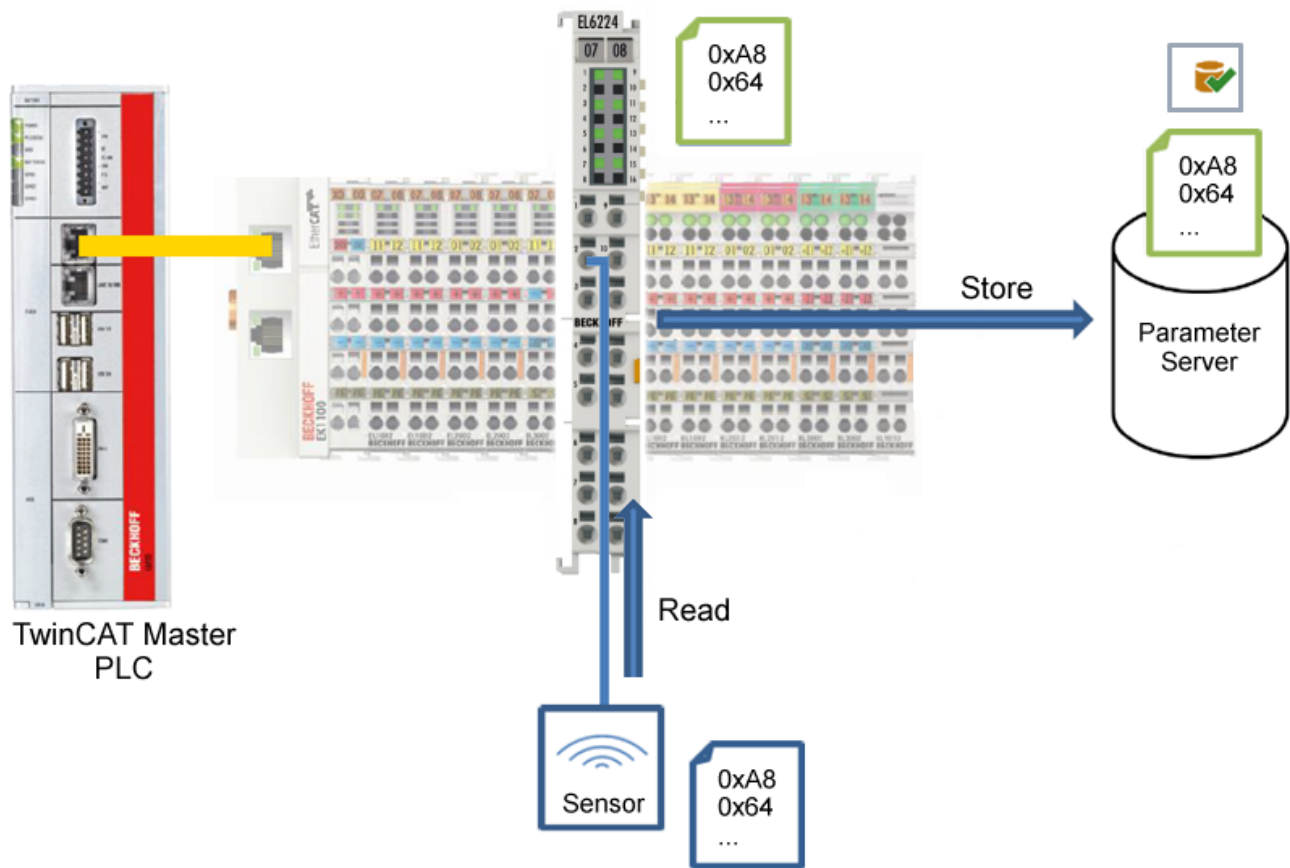


Fig. 37: Store parameters

Standard Command (Index 0x0002)

The IO-Link master writes various IO-Link-specific commands to the “Standard Command” during startup. Some of these commands are available in the TwinCAT interface (see figure below).

1. Click “Standard Command” in the parameter list of the “All Objects” user role, then double-click “Standard Command” in the right-hand field.
 2. Select the desired value from the list of different options and
 - “Device Reset”: Restarts the IO-Link device.
 - “Application Reset”: No function.
 - “Restore Factory Settings”: Restoring the application parameters, i.e. the Settings parameter (0x0800).
 3. Use the “Write” button (as described above [► 106]).
- ⇒ The data is written to the device (offline configuration is possible). The successful writing process is confirmed via a storing symbol in front of the index.

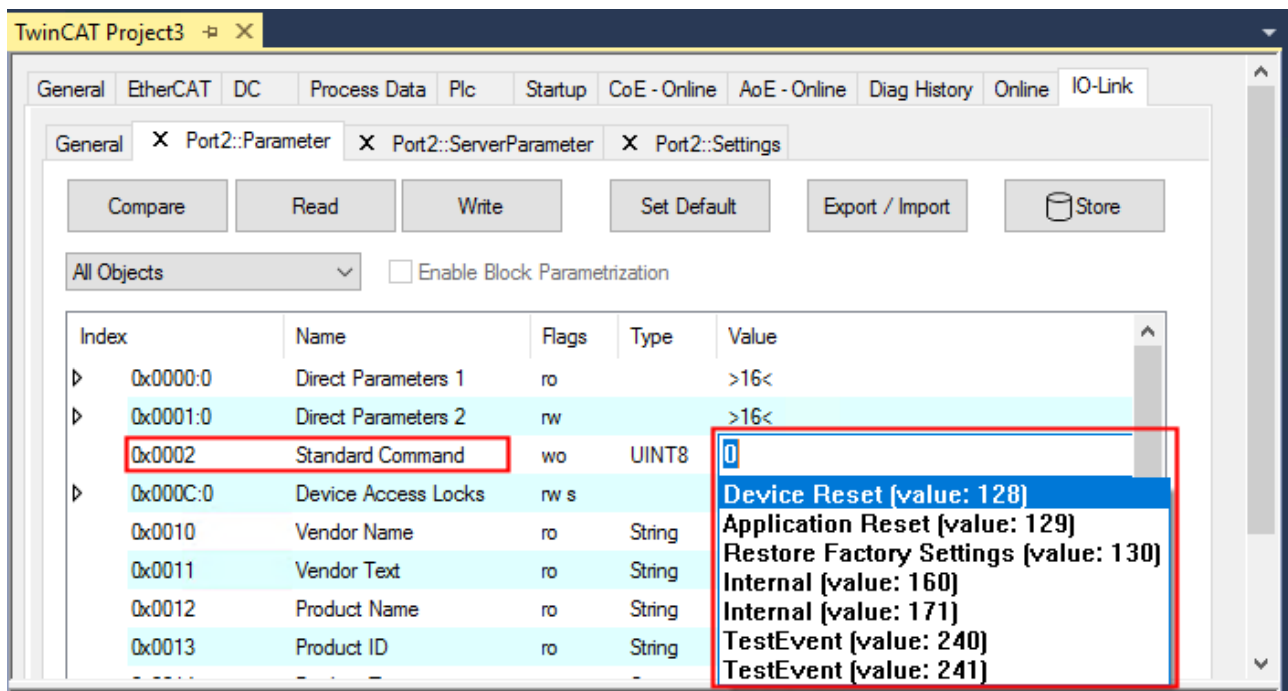


Fig. 38: Parameters IO-Link device “Standard Command”

“Application Specific Tag” (Index 0x0018)

Application-specific information can be entered and stored here.

1. Click “Application-Specific Tag” in the parameter list, then double-click “Application-Specific Tag” in the right-hand field.
2. Enter application-specific information and confirm with the Enter key.
3. Use the Write [►_106] button and the Store [►_109] button, if required (as described above).

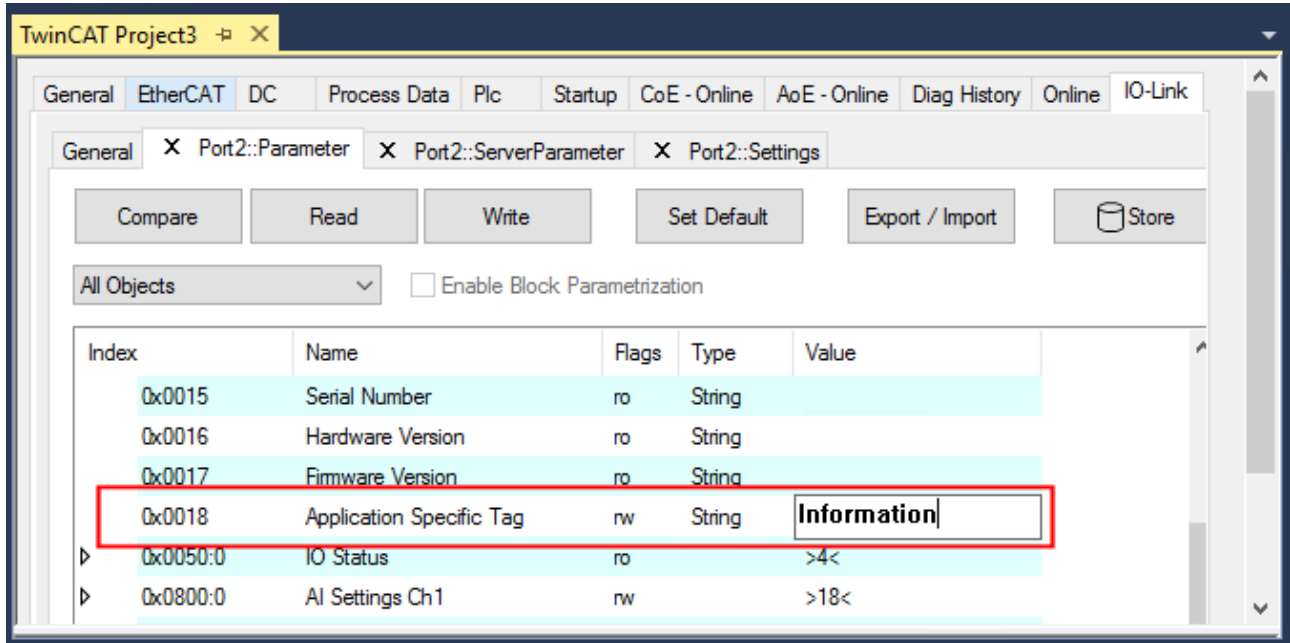


Fig. 39: Parameters IO-Link device: “Application Specific Tag”

6.6 Access to IO-Link data

6.6.1 IO-Link system communication

The EP622x IO-Link master is divided into two services. On the one hand it represents an IO-Link master in relation to the connected IO-Link devices, while on the other it is an EtherCAT slave in relation to the PLC TwinCAT master. The system communication is illustrated in Fig. *Illustration of the system communication of an EtherCAT master*.

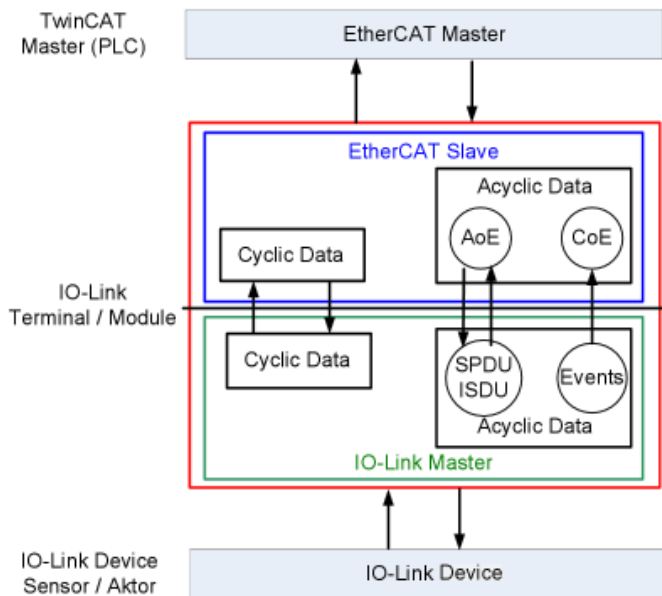


Fig. 40: Illustration of the system communication of an EtherCAT master

In principle cyclic and acyclic data are exchanged. The cyclic process data can be accessed via the PDOs, the acyclic data via [AoE](#) [► 116]. The events are additionally displayed under [Diag History](#) [► 119] in the System Manager.

- **Cyclic data:**
 - Process data
 - Value status
- **Acyclic data:**
 - Device data
 - Events

6.6.2 PDO Assignment

The scope of the process data offered varies depending on the configured IO-Link ports.

DeviceState Inputs Device and *DeviceState Inputs* are selected by default. Device-specific PDOs (*0x1A0n Port (n-1) Process Data*) are only displayed after configuring on the respective port and restarting the EtherCAT system or reloading the configuration in Config mode (F4); see Configuration of the IO-Link master.

Fig. 41: Illustration of the EP6224-2022 process data allocation, SM3 inputs

SM3, PDO Assignment 0x1C13			
Index	Size (byte.bit)	Name	PDO Content
0x1A05	2.0	DeviceState Inputs Device	Index 0xF101:0D - Device Diag Index 0xF101:10 - Device State
0x1A04	4.0	DeviceState Inputs	Index 0xF100:01 - State Ch1 Index 0xF100:02 - State Ch2 Index 0xF100:03 - State Ch3 Index 0xF100:04 - State Ch4
0x1A00	0.0 - 32.0	Port 1 Process Data	IO-Link device-specific / only active after configuration
0x1A01	0.0 - 32.0	Port 2 Process Data	IO-Link device-specific / only active after configuration
0x1A02	0.0 - 32.0	Port 3 Process Data	IO-Link device-specific / only active after configuration
0x1A03	0.0 - 32.0	Port 4 Process Data	IO-Link device-specific / only active after configuration



Process data representation

If data types are used that don't conform to IEC61131-3, they are represented as octed strings.

The state of the IO-Link ports 1 to 4 is displayed via index 0xF100:0n.

The indices 0xF101:xx provide general diagnosis data.

Index	Size (byte.bit)	Name	Meaning
0xF101:0D	0.1	Device Diag	Occurrence of events (on the slave side) is reported via a status bit
0xF101:10	0.1	Device State	Interruption of communication with one of the slaves is reported via a status bit
0xF100:01	1.0	State Ch.1	0x_0 = Port disabled 0x_1 = Port in std dig in 0x_2 = Port in std dig out 0x_3 = Port in communication OP 0x_4 = Port in communication COMSTOP / dig in Bit (only in the std. IO Mode) 0x_8 = Process Data Invalid Bit 0x1_ = Watchdog detected 0x2_ = internal Error 0x3_ = invalid Device ID 0x4_ = invalid Vendor ID 0x5_ = invalid IO-Link Version 0x6_ = invalid Frame Capability 0x7_ = invalid Cycle Time 0x8_ = invalid PD in length 0x9_ = invalid PD out length 0xA_ = no Device detected 0xB_ = error PreOP/Data storage (error in IO-Link State PreOP)
0xF100:02	1.0	State Ch.2	
0xF100:03	1.0	State Ch.3	
0xF100:04	1.0	State Ch.4	

6.6.3 Accessing IO-Link parameters

The exchange of the acyclic data takes place via a specified index and subindex range that is device-specific and can be read about in the corresponding vendor documentation.

6.6.4 Parameter data exchange

An intelligent IO-Link sensor/actuator can support parameterization by ISDUs (Indexed Service Data Unit). The PLC must explicitly query or, when marked as such, send these acyclic service data.



ISDU access

TwinCAT supports access via ADS and via the CoE directory.

The respective parameter is addressed via the so-called ISDU index. The following ranges are available:

Designation	Index range
System	0x00..0x0F
Identification	0x10..0x1F
Diagnostic	0x20..0x2F
Communication	0x30..0x3F
Preferred Index	0x40..0xFE
Extended Index	0x0100..0x3FFF
	The range 0x4000 to 0xFFFF is reserved

The use and implementation of these ranges is the responsibility of the sensor/actuator manufacturer. For clarification, just a few of the possible indices are listed here. Please take a look at the relevant chapter "Object description and parameterization".

Index	Name
0010	Vendor Name
0011	Vendor Text
0012	Product Name
0013	Product ID
0015	Serial Number
0016	Hardware Revision
0017	Firmware Revision
...	...

IO-Link operating modes

The IO-Link ports on the IO-Link master can be operated in the following nine modes (see Object description and parameterization - IO-Link State, Index 0xA0n0:01):

- INACTIVE: Statemachine is inactive
- DIGINPUT: The port behaves like a digital input
- DIGOUTPUT: The port behaves like a digital output
- ESTABLISHCOMM: The IO-Link wakeup sequence is running
- INITMASTER: Readout the IO-Link device and check the communication parameters
- INITDEVICE: Initialization of the IO-Link device
- PREOPERATE: Parameter server is running
- OPERATE: The port is used for IO-Link communication
- STOP: Communication is stopped (COM-stop)

6.6.5 ADS

Communication relating to IO link demand data is initiated via an ADS command. An ADS address always consists of a NetID and PortNo. TwinCAT relays ADS commands to the EP622x via AoE (ADS over EtherCAT), from where the command is relayed to the IO link master section and therefore the data channel.

AoE NetID

The EP622x is assigned a dedicated AoE-NetID for communication with the IO-Link master section. This is assigned by the configuration tool (Fig. *Assignment AoE-NetID*).

NetID at EP622x -> "EtherCAT"-> "Advanced Settings" -> "Mailbox" -> "AoE"

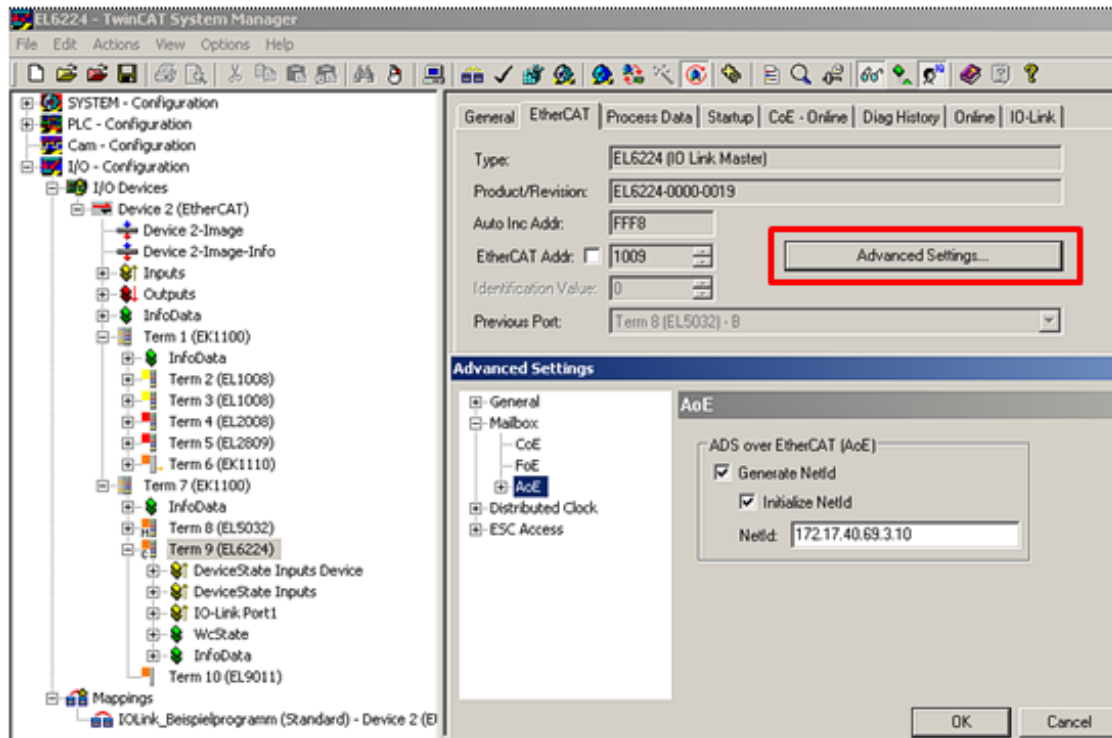


Fig. 42: AoE-NetID allocation

PortNo

The individual IO-Link ports for the master are allocated via the port number. The port numbers are allocated in ascending order from 0x1000. I.e. IO-Link Port1 corresponds to PortNo 0x1000 and IO-Link Portn corresponds to PortNo 0x1000 + n-1.

The following specification applies for the EP6224 (4-port IO-Link master):

- IO-Link Port1 corresponds to PortNo 0x1000
- IO-Link Port2 corresponds to PortNo 0x1001
- IO-Link Port3 corresponds to PortNo 0x1002
- IO-Link Port4 corresponds to PortNo 0x1003

ADS Indexgroup

As for CoE, the Indexgroup of an ADS command is specified as 0xF302 for the IO link data channel.

ADS Indexoffset

The IO link addressing with index and subindex is coded in the Indexoffset. The Indexoffset has a size of 4 bytes and is subdivided as follows: 2-byte index, 1-byte reserve, 1-byte subindex.

- Example: Indexoffset 0x12340056 corresponds to index 0x1234 and subindex 56

6.6.6 Access to events

Some of the IO-Link sensors forward events that occur to the master. These events may be items of information, warnings or error messages, e.g. short circuit or overheating.

The IO-Link master reports these events by setting the Device Diag bit. Further information on the events can be read via the CoE directory or the DiagHistory tab.

General EtherCAT DC Process Data Startup CoE - Online Diag History Online IO-Link				
Update History ☒ Auto Update Ack. Messages Export Diag History Advanced... ☐ only new Messages				
Type	Flags	Timestamp	Message	
Warning	N	13.10.2014 10:11:18 433 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00A4 (0xFFFF8CB0) Unknown TextId	
Warning	N	13.10.2014 10:11:18 355 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00E4 (0xFFFF8CB0) Unknown TextId	
Error	N	13.10.2014 10:11:16 47 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00B4 (0xFFFF8CB4) Unknown TextId	
Error	N	13.10.2014 10:11:15 963 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00F4 (0xFFFF8CB4) Unknown TextId	
Error	N	13.10.2014 10:11:12 661 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00B4 (0xFFFF8CB5) Unknown TextId	
Error	N	13.10.2014 10:11:12 576 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00F4 (0xFFFF8CB5) Unknown TextId	
Warning	N	13.10.2014 10:11:07 500 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00E4 (0xFFFF8CA4) Unknown TextId	
Warning	N	13.10.2014 10:10:52 889 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00A4 (0xFFFF8CB1) Unknown TextId	
Warning	N	13.10.2014 10:10:52 811 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00E4 (0xFFFF8CB1) Unknown TextId	
Error	N	13.10.2014 10:10:51 758 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00B4 (0xFFFF8CB4) Unknown TextId	
Error	N	13.10.2014 10:10:51 673 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00F4 (0xFFFF8CB4) Unknown TextId	
Warning	N	13.10.2014 10:10:50 471 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00A4 (0xFFFF8CA4) Unknown TextId	
Warning	N	13.10.2014 10:10:50 393 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00E4 (0xFFFF8CA4) Unknown TextId	
Warning	N	13.10.2014 10:10:04 93 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00A4 (0xFFFF8CB0) Unknown TextId	
Warning	N	13.10.2014 10:10:04 9 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00E4 (0xFFFF8CB0) Unknown TextId	
Error	N	13.10.2014 10:10:01 194 ms	(0x0001) IO-Link Master Port 1: Eventqualifier = 0x00F4 (0xFFFF8CB5) Unknown TextId	

Fig. 43: DiagHistory tab

The events are arranged according to type (information, warning, error), flag, occurrence of the event (time stamp) and message (port number & event code).

The meaning of the individual messages can be taken from the vendor documentation. The IO-Link device can be directly allocated on the basis of the port number. The events occurring can be managed using the various buttons.

- **Update History:** if the "Auto Update" field is not selected, then the current events can be displayed via the "Update History" button
- **Auto Update:** if this field is selected, then the list of events occurring is automatically updated
- **Only new Messages:** if this field is selected, then only those messages that have not yet been confirmed are displayed.
- **Ack. Messages:** an event that occurs is reported via the Device Diag. Confirming the message will reset the bit to 0.
- **Export Diag History:** the events that have occurred can be exported as a "txt" file and thus archived.
- **Advanced:** this field currently (as at 3rd quarter 2015) has no function.

6.6.7 PLC library: Tc3_IoLink

The PLC library "Tc3_IoLink" is used for communication with IoLink devices.

Function blocks are available for this purpose that support the "Common Profile" and "Smart Sensor Profile" and enable parameters to be read and written.

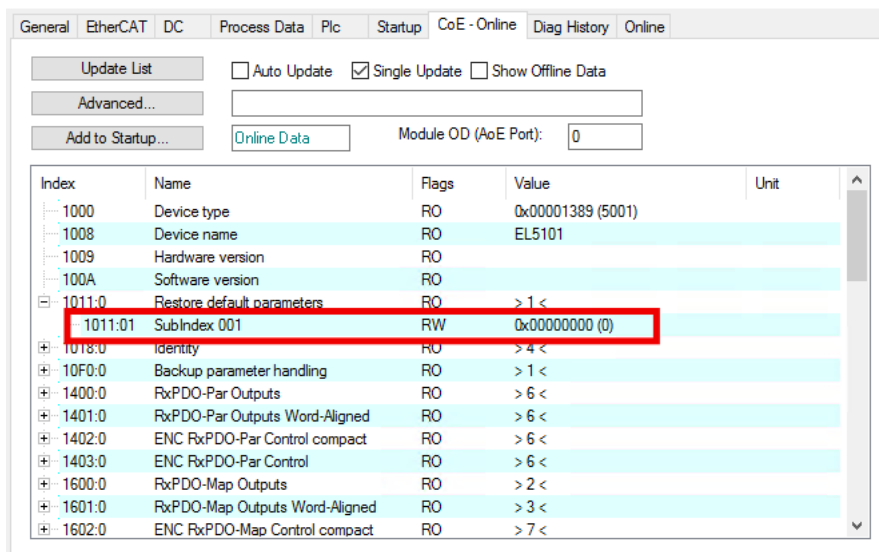
See software documentation in the Beckhoff Information System:

[TwinCAT 3 | PLC Library: Tc3_IoLink](#)

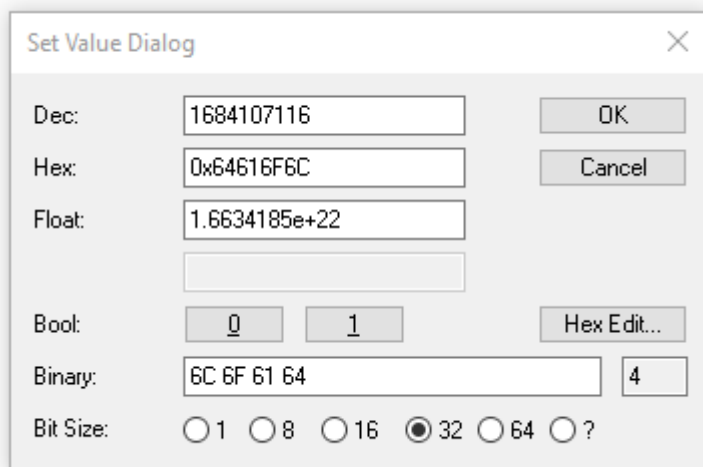
6.7 Restore the delivery state

You can restore the delivery state of the backup objects as follows:

1. Ensure that TwinCAT is running in Config mode.
2. In CoE object 1011:0 "Restore default parameters" select parameter 1011:01 "Subindex 001".



3. Double-click on "Subindex 001".
⇒ The "Set Value Dialog" dialog box opens.
4. Enter the value 1684107116 in the "Dec" field.
Alternatively: enter the value 0x64616F6C in the "Hex" field.



5. Confirm with "OK".
⇒ All backup objects are reset to the delivery state.

Alternative restore value

With some older modules the backup objects can be changed with an alternative restore value:

Decimal value: 1819238756

Hexadecimal value: 0x6C6F6164

An incorrect entry for the restore value has no effect.

6.8 Decommissioning

WARNING

Risk of electric shock!

Bring the bus system into a safe, de-energized state before starting disassembly of the devices!

7 TwinSAFE SC (only EP6224-0092)

7.1 TwinSAFE SC

7.1.1 TwinSAFE SC - operating principle

The TwinSAFE SC (Single Channel) technology enables the use of standard signals for safety tasks in any networks of fieldbuses. To do this, EtherCAT Terminals from the areas of analog input, angle/displacement measurement or communication (4...20 mA, incremental encoder, IO-Link, etc.) are extended by the TwinSAFE SC function. The typical signal characteristics and standard functionalities of the I/O components are retained. TwinSAFE SC I/Os have a yellow strip at the front of the housing to distinguish them from standard I/Os.

The TwinSAFE SC technology enables communication via a TwinSAFE protocol. These connections can be distinguished from the usual safe communication via Safety over EtherCAT.

The data of the TwinSAFE SC components are transferred via a TwinSAFE protocol to the TwinSAFE logic, where they can be used in the context of safety-relevant applications. Detailed examples for the correct application of the TwinSAFE SC components and the respective normative classification, which were confirmed/calculated by TÜV SÜD, can be found in the [TwinSAFE application manual](#).

7.1.2 TwinSAFE SC - configuration

The TwinSAFE SC technology enables communication with standard EtherCAT terminals via the Safety over EtherCAT protocol. These connections use another checksum, in order to be able to distinguish between TwinSAFE SC and TwinSAFE. Eight fixed CRCs can be selected, or a free CRC can be entered by the user.

By default the TwinSAFE SC communication channel of the respective TwinSAFE SC component is not enabled. In order to be able to use the data transfer, the corresponding TwinSAFE SC module must first be added under the Slots tab. Only then is it possible to link to a corresponding alias device.

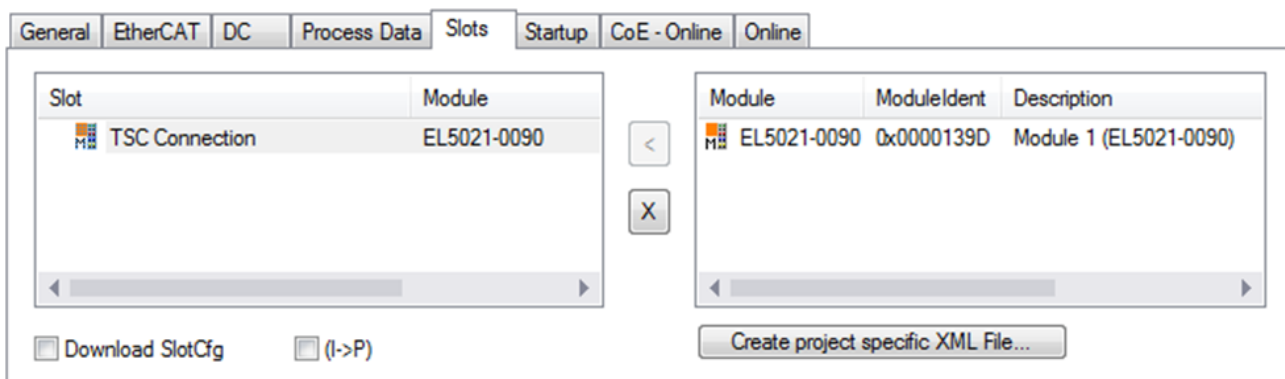


Fig. 44: Adding the TwinSAFE SC process data under the component, e.g. EL5021-0090

Additional process data with the ID TSC Inputs, TSC Outputs are generated (TSC - TwinSAFE Single Channel).

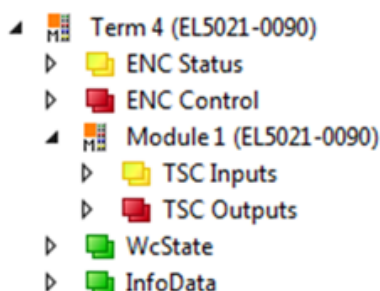


Fig. 45: TwinSAFE SC component process data, example EL5021-0090

A TwinSAFE SC connection is added by adding an alias devices in the safety project and selecting TSC (TwinSAFE Single Channel)

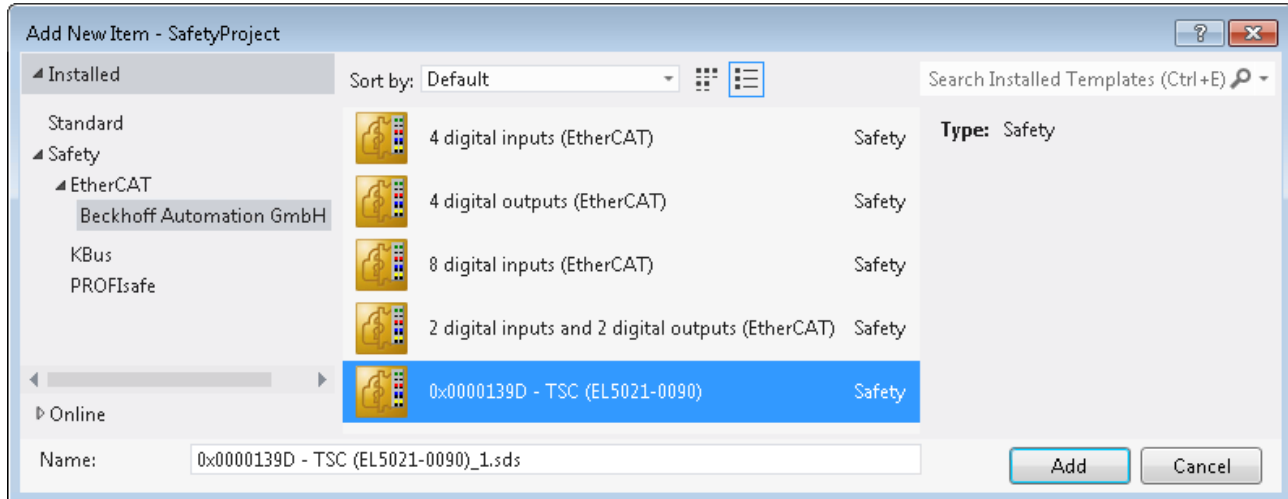


Fig. 46: Adding a TwinSAFE SC connection

After opening the alias device by double-clicking, select the Link button  next to *Physical Device*, in order to create the link to a TwinSAFE SC terminal. Only suitable TwinSAFE SC terminals are offered in the selection dialog.

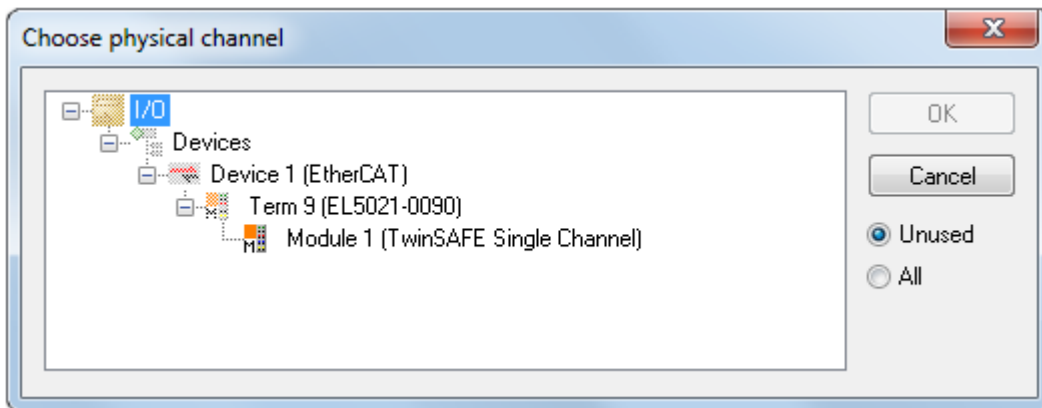


Fig. 47: Creating a link to TwinSAFE SC terminal

The CRC to be used can be selected or a free CRC can be entered under the Connection tab of the alias device.

Entry Mode	Used CRCs
TwinSAFE SC CRC 1 master	0x17B0F
TwinSAFE SC CRC 2 master	0x1571F
TwinSAFE SC CRC 3 master	0x11F95
TwinSAFE SC CRC 4 master	0x153F1
TwinSAFE SC CRC 5 master	0x1F1D5
TwinSAFE SC CRC 6 master	0x1663B
TwinSAFE SC CRC 7 master	0x1B8CD
TwinSAFE SC CRC 8 master	0x1E1BD

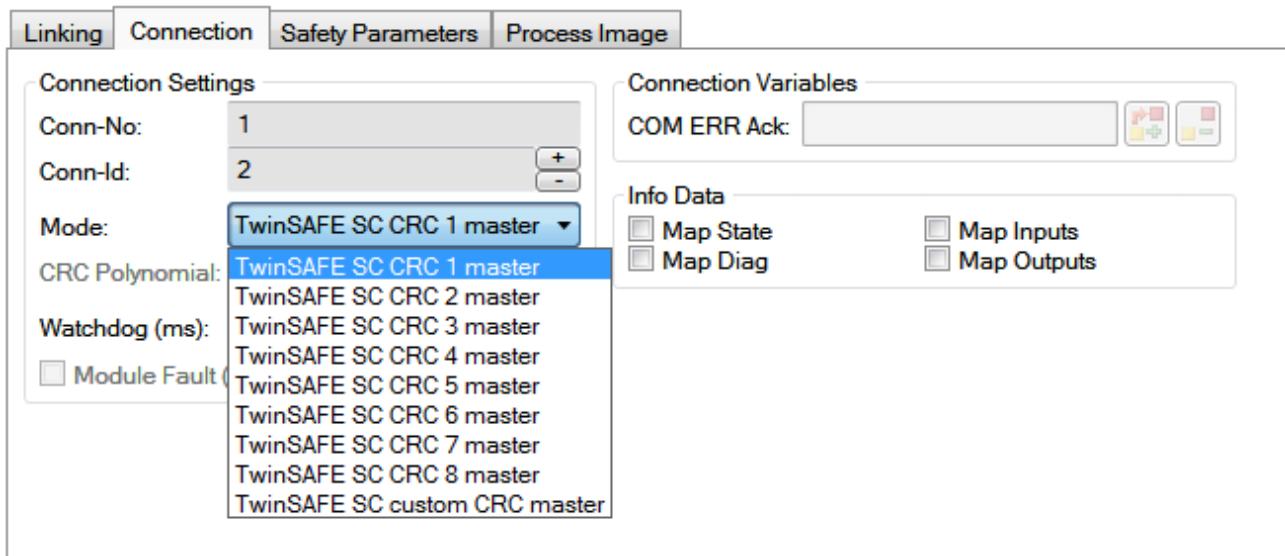


Fig. 48: Selecting a free CRC

These settings must match the settings in the CoE objects of the TwinSAFE SC component. The TwinSAFE SC component initially makes all available process data available. The *Safety Parameters* tab typically contains no parameters. The process data size and the process data themselves can be selected under the *Process Image* tab.

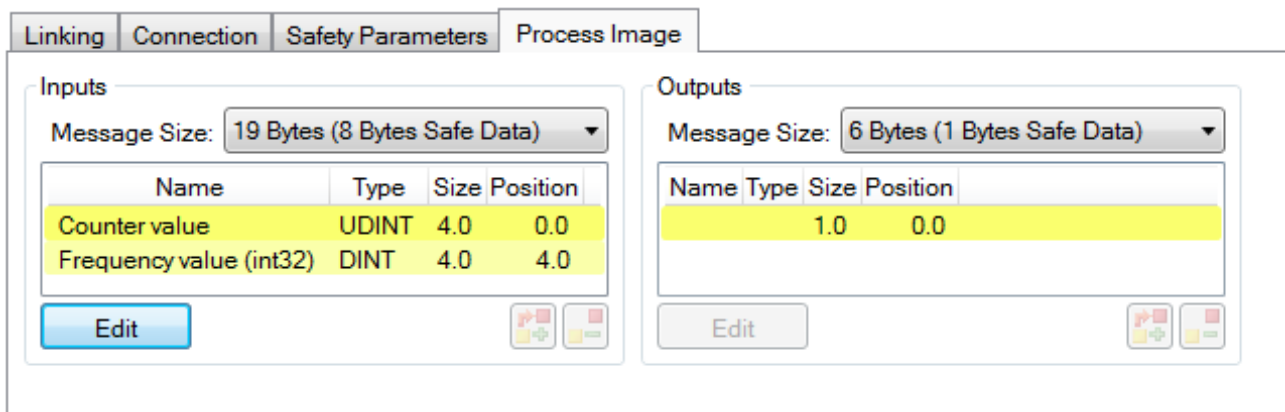


Fig. 49: Selecting the process data size and the process data

The process data (defined in the ESI file) can be adjusted to user requirements by selecting the *Edit* button in the dialog *Configure I/O element(s)*.

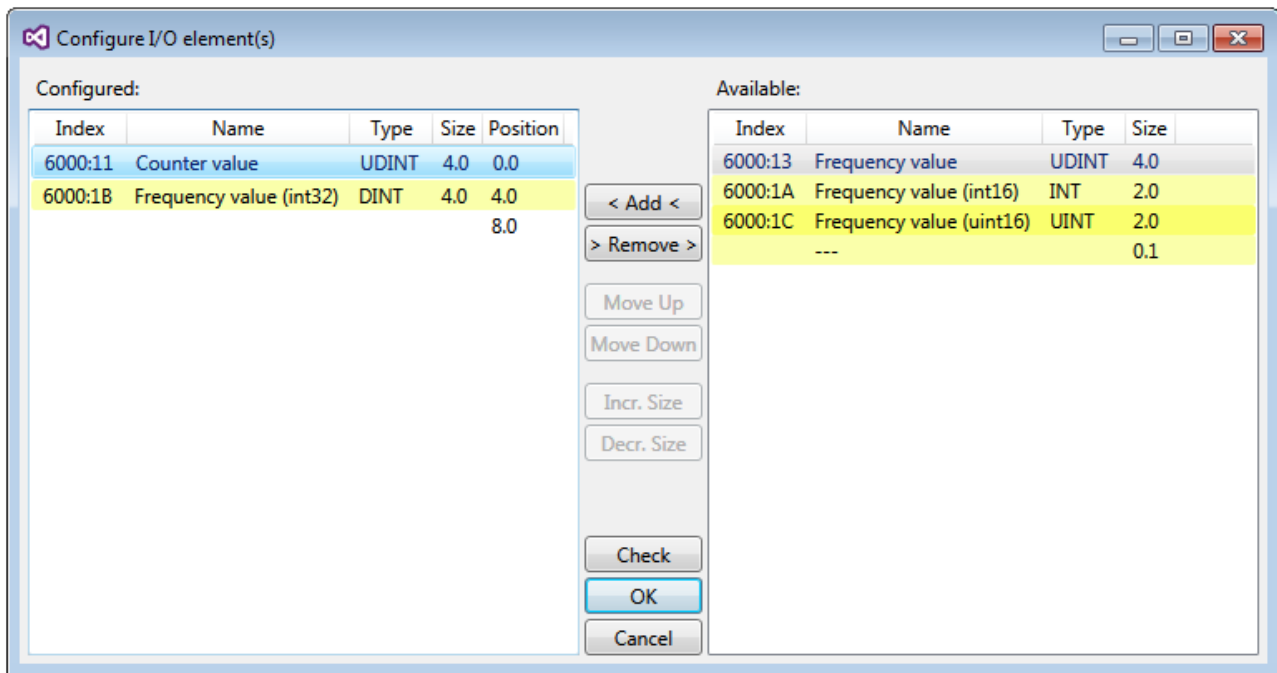


Fig. 50: Selection of the process data

The safety address together with the CRC must be entered on the TwinSAFE SC slave side. This is done via the CoE objects under *TSC settings* of the corresponding TwinSAFE SC component (here, for example, EL5021-0090, 0x8010: 01 and 0x8010: 02). The address set here must also be set in the *alias device* as *FSoE* address under the *Linking* tab.

Under the object 0x80n0:02 Connection Mode the CRC to be used is selected or a free CRC is entered. A total of 8 CRCs are available. A free CRC must start with 0x00ff in the high word.

8010:0	TSC Settings	RW	> 2 <
8010:01	Address	RW	0x0000 (0)
8010:02	Connection Mode	RW	TwinSAFE SC CRC1 master (97039)

Fig. 51: CoE objects 0x8010:01 and 0x8010:02

Object *TSC Settings*

Depending on the terminal, the index designation of the configuration object *TSC Settings* can vary. Example:

- EL3214-0090 and EL3314-0090, TSC Settings, Index 8040
- EL5021-0090, TSC Settings, Index 8010
- EL6224-0090, TSC Settings, Index 800F

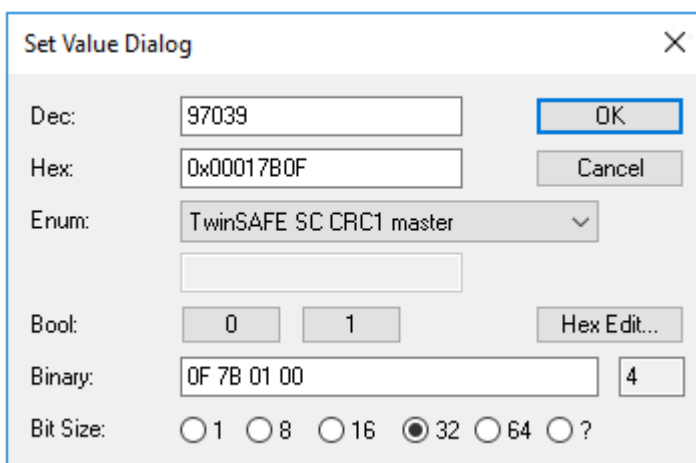


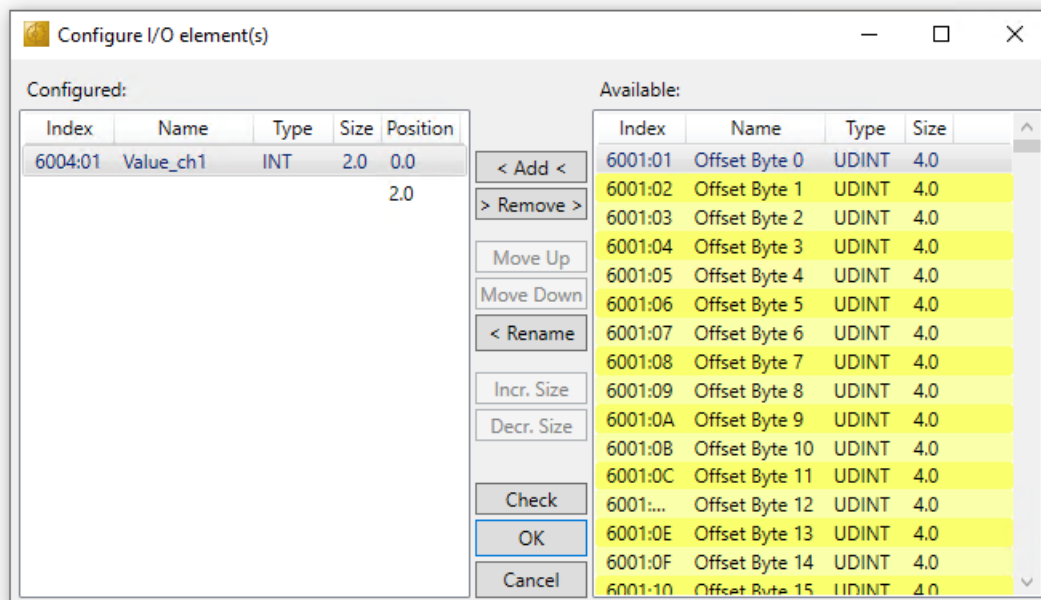
Fig. 52: Entering the safety address and the CRC

**TwinSAFE SC connections**

If several TwinSAFE SC connections are used within a configuration, a different CRC must be selected for each TwinSAFE SC connection.

7.2 TwinSAFE SC process data EL6224-0092

The process data size and the process data themselves can be selected under the "Process Image" tab in TwinCAT. The process data depend on the connected IO-Link device and have to be adjusted accordingly. The corresponding information can be found in the sensor-specific data sheet. By default, a 16-bit unsigned integer is mapped with byte offset 0 from IO-Link channel 1.



The process data can be adjusted to user requirements by selecting the *Edit* button in the dialog Configure I/O element(s).

The following rule applies for process data mapping:

0x60ab:0c		
a = IO-Link port	b = data type integer	c = byte offset
0 = IO-Link port 1	0 = data type bit	01 = Offset Byte 0
1 = IO-Link port 2	1 = UDINT	02 = Offset Byte 1
2 = IO-Link port 3	2 = DINT	03 = Offset Byte 2
3 = IO-Link port 4	3 = UINT	
	4 = INT	0p = offset byte p-1

Examples for index mapping:

0x6004:01 => IO-Link port 1, data type INT, offset byte 0

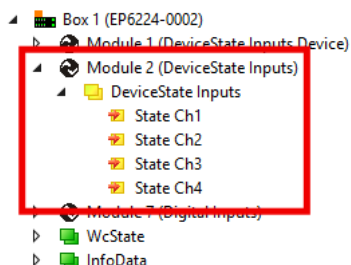
0x6011:01 => IO-Link port 2, data type UDINT, offset byte 0

8 Diagnosis

8.1 Status of the IO-Link ports

There is a status byte for each IO-Link port. You can find the status bytes at the following locations:

- In the process data object "Module 2 (DeviceState Inputs)"



(example for EP6224-0002)

- In the CoE object F100 [► 146]

8.1.1 Interpretation of the status bytes

The status bytes are divided into two nibbles.

Low nibble

Value	Meaning
0x_0	Port disabled
0x_1	Port in std dig in
0x_2	Port in std dig out
0x_3	Port in communication OP
0x_4	Port in communication COMSTOP / dig in Bit (only in std. IO Mode)
0x_5	not defined
0x_6	not defined
0x_7	not defined
0x_8	Process Data Invalid Bit

Combinations are possible and are output as an addition of the values (see note below).

Higher nibble

Value	Meaning
0x1_	Watchdog detected
0x2_	internal Error
0x3_	invalid Device ID
0x4_	invalid Vendor ID
0x5_	invalid IO-Link version
0x6_	invalid Frame Capability
0x7_	invalid Cycle Time
0x8_	invalid PD in length
0x9_	invalid PD out length
0xA_	no Device detected
0xB_	error PreOP/Data storage

Combinations are possible and are output as an addition of the values (see note below).



Addition of the values in case of simultaneously occurring diagnosis messages

If diagnosis messages occur simultaneously, the value is output as a sum in the status byte of the relevant channel.

- Often 0x03 "Port in communication OP" and 0x08 "Process Data Invalid Bit" occur simultaneously:

$$0x03 + 0x08 = 0x0B (11_{dec})$$

⇒ The value 0x0B (11_{dec}) is output in the status byte.

8.2 ADS Error Codes

Error codes are generated in the event of an error during ADS access to an IO-Link device.

The possible error codes are listed in tables C.1 and C.2.

Example of an AdsReturnCode

AdsReturnCode 0x**80110700**

- **80**: Device Application Error (IO-Link Spec),
- **11**: Index not Available (IO-Link Spec),
- **0700**: General ADS Error

ErrorTypes (IO-Link Spec)

Incident	Error Code	Additional Code	Name	Definition
Device application error – no details	0x80	0x00	APP_DEV	This ErrorType shall be used if the requested service has been refused by the Device application and no detailed
Index not available	0x80	0x11	IDX_NOTAVAIL	This ErrorType shall be used whenever a read or write access occurs to a not existing Index.
Subindex not available	0x80	0x12	SUBIDX_NOTAVAIL	This ErrorType shall be used whenever a read or write access occurs to a not existing Subindex.
Service temporarily not available	0x80	0x20	SERV_NOTAVAIL	This ErrorType shall be used if a parameter is not accessible for a read or write service due to the current state of the Device application.
Service temporarily not available – local control	0x80	0x21	SERV_NOTAVAIL_LOCTRL	This ErrorType shall be used if a parameter is not accessible for a read or write service due to an ongoing local operation at the Device (for example operation or parameterization via an on-board Device control panel).
Service temporarily not available – Device control	0x80	0x22	SERV_NOTAVAIL_DEVCTRL	This ErrorType shall be used if a read or write service is not accessible due to a remote triggered state of the device application (for example parameterization during a remote triggered teach-in operation or calibration).
Access denied	0x80	0x23	IDX_NOT_WRITEABLE	This ErrorType shall be used if a write service tries to access a read-only parameter.
Parameter value out of range	0x80	0x30	PAR_VALOUTOFRNG	This ErrorType shall be used for a write service to a parameter outside its permitted range of values.
Parameter value above limit	0x80	0x31	PAR_VALGTLM	This ErrorType shall be used for a write service to a parameter above its specified value range.
Parameter value below limit	0x80	0x32	PAR_VALLTLM	This ErrorType shall be used for a write service to a parameter below its specified value range.
Parameter length overrun	0x80	0x33	VAL_LENVERRUN	This ErrorType shall be used when the content of a write service to a parameter is greater than the parameter specified length. This ErrorType shall also be used, if a data object is too large to be processed by the Device application (for example ISDU buffer restriction).
Parameter length underrun	0x80	0x34	VAL_LENUNDRUN	This ErrorType shall be used when the content of a write service to a parameter is less than the parameter specified length (for example write access of an Unsigned16 value to an Unsigned32 parameter).
Function not available	0x80	0x35	FUNC_NOTAVAIL	This ErrorType shall be used for a write service with a command value not supported by the Device application (for example a SystemCommand with a value not implemented).
Function temporarily unavailable	0x80	0x36	FUNC_UNAVAILTEMP	This ErrorType shall be used for a write service with a command value calling a Device function not available due to the current state of the Device application (for example a SystemCommand).
Invalid parameter set	0x80	0x40	PAR_SETINVALID	This ErrorType shall be used if values sent via single parameter transfer are not consistent with other actual parameter settings (for example overlapping set points for a binary data setting)
Inconsistent parameter set	0x80	0x41	PAR_SETINCONSIST	This ErrorType shall be used at the termination of a block parameter transfer with ParamDownloadEnd or ParamDownloadStore if the plausibility check shows inconsistencies
Application not ready	0x80	0x82	APP_DEVNOTRDY	This ErrorType shall be used if a read or write service is refused due to a temporarily unavailable application (for example peripheral controllers during startup).
Vendor specific	0x81	0x00	UNSPECIFIC	This ErrorType will be propagated directly to higher level processing elements as an error (no warning) by the Master.
Vendor specific	0x81	0x01 to 0xFF	VENDOR_SPECIFIC	

Table C.1 ErrorTypes, IO-Link Spec

Derived ErrorTypes (IO-Link Spec)

Incident	Error Code	Additional Code	Name	Definition
Master – Communication error	0x10	0x00	COM_ERR	The Master generates a negative service response with this ErrorType if a communication error occurred during a read or write service, for example the SDCI connection is interrupted.
Master – ISDU timeout	0x11	0x00	I-SERVICE_TIMEOUT	The Master generates a negative service response with this ErrorType, if a Read or Write service is pending longer than the specified I-Service timeout in the Master.
Device Event – ISDU error (DL, Error, single shot, 0x5600)	0x11	0x00	I-SERVICE_TIMEOUT	If the Master received an Event with the EventQualifier and the EventCode 0x5600, a negative service response indicating a service timeout is generated and returned to the requester (Master – ISDU timeout).
Device Event – ISDU illegal service primitive (AL, Error, single shot, 0x5800)	0x11	0x00	I-SERVICE_TIMEOUT	If the Master received an Event with the EventQualifier and the EventCode 0x5800, a negative service response indicating a service timeout is generated and returned to the requester (Master – ISDU timeout).
Master – ISDU checksum error	0x56	0x00	M_ISDU_CHECKSUM	The Master generates a negative service response with this ErrorType, if its data link layer detects an ISDU checksum error.
Master – ISDU illegal service primitive	0x57	0x00	M_ISDU_ILLEGAL	The Master generates a negative service response with this ErrorType, if its data link layer detects an ISDU illegal service primitive.
Device Event – ISDU buffer overflow (DL, Error, single shot, 0x5200)	0x80	0x33	VAL_LEN_OVRUN	If the Master received an Event with the EventQualifier and the EventCode 0x5200, a negative service response indicating a parameter length overrun is generated and returned to the requester (see parameter length overrun) Events from legacy Devices shall be redirected in compatibility mode to this derived ErrorType

Table C.2 Derived ErrorTypes, IO-Link Spec

8.3 Further error diagnosis

Device State Inputs Device (0x1A05)

It is indicated in the PDO "Device Diag" (0xF101:0D) that at least one event has occurred in the "Diag History".

"Device State" is the standard status bit for EtherCAT slaves and shows, for example, that communication with one of the slaves has been interrupted.

DeviceState Inputs (0x1A04)

The status of the IO-Link ports is mapped as a status byte in the "DeviceState Inputs" process data object. See chapter [Status of the IO-Link ports \[► 129\]](#).

Nominal/actual comparison of the parameter objects

The indices 0x90n0 (Info data) can be referred to for validation of the configuration indices 0x80n0 of the connected IO-Link device.

In case of error these objects can be used to compare the configuration with the actual state.

Lost Frame Counter

The Lost Frame counter in object 0xA0n0:02 is for the diagnosis of the transmission quality. TwinCAT provides the possibility here to diagnose problems, e. g. with the wiring, EMC or power supply.

9 CoE parameters

9.1 Objects for commissioning

Index 1011 Restore default parameters

Index (hex)	Name	Meaning	Data type	Flags	Default
1011:0	Restore default parameters	Restore default parameters	UINT8	RO	0x01 (1 _{dec})
1011:01	SubIndex 001	If this object is set to " 0x64616F6C " in the set value dialog, all backup objects are reset to their delivery state.	UINT32	RW	0x00000000 (0 _{dec})

Index 80n0 IO Settings Ch.[1, 2, 3, ...]

- Index 8000 IO Settings Ch.1
- Index 8010 IO Settings Ch.2
- Index 8020 IO Settings Ch.3
- ...

i Recommendation: Configuration via configuration tool

TwinCAT includes a graphical configuration tool for IO-Link masters and IO-Link devices. With this tool the configuration is easier and clearer than via the CoE parameters.

See chapter [Configuration of the IO link master](#) [► 88].

Index (hex)	Name	Meaning	Data type	Flags	Default																				
80n0:0	IO Settings	IO Settings Ch.[1 ... 8]	UINT8	RW	0x28 (40 _{dec})																				
80n0:04	Device ID	The Device ID is used for validating the IO-Link device.	UINT32	RW	0x00000000 (0 _{dec})																				
80n0:05	Vendor ID	The Vendor ID is used for validating the vendor of the IO-Link device.	UINT32	RW	0x00000000 (0 _{dec})																				
80n0:20	IO-Link Revision	The version of the IO-Link specification according to which the IO-Link device communicates. Bit 0-3: MinorRev Bit 4-7: MajorRev	UNIT8	RW	0x00 (0 _{dec})																				
80n0:21	Frame capability	The Frame capability indicates certain functionalities of the IO-Link device (e.g. SPDU supported). Bit 0: SPDU Bit 1: Type1 Bit 7: PHY1	UINT8	RW	0x00 (0 _{dec})																				
80n0:22	Min cycle time	The cycle time refers to the communication between the IO-Link master and the IO-Link device. This value is transferred in the IO-Link format for Min Cycle Time. Bit 6 and 7: Time Base Bit 0 to 5: Multiplier 0x00: The IO-Link master automatically uses the smallest possible update time of the IO-Link device. <table><tr><th>Time Base</th><th>Meaning Time base</th><th>Calculation</th><th>Min. Cycle Time</th></tr><tr><td>00_{bin}</td><td>0.1ms</td><td>Multiplier x Time Base</td><td>0.4- 6.3 ms</td></tr><tr><td>01_{bin}</td><td>0.4ms</td><td>6.4 ms + Multiplier x Time Base</td><td>6.4- 31.6 ms</td></tr><tr><td>10_{bin}</td><td>1.6ms</td><td>32.0 ms + Multiplier x Time Base</td><td>32.0 - 132.8 ms</td></tr><tr><td>11_{bin}</td><td>6.4 ms</td><td>134.4 ms + Multiplier x Time Base</td><td>134.4- 537.6 ms</td></tr></table>	Time Base	Meaning Time base	Calculation	Min. Cycle Time	00 _{bin}	0.1ms	Multiplier x Time Base	0.4- 6.3 ms	01 _{bin}	0.4ms	6.4 ms + Multiplier x Time Base	6.4- 31.6 ms	10 _{bin}	1.6ms	32.0 ms + Multiplier x Time Base	32.0 - 132.8 ms	11 _{bin}	6.4 ms	134.4 ms + Multiplier x Time Base	134.4- 537.6 ms	UINT8	RW	0x00 (0 _{dec})
Time Base	Meaning Time base	Calculation	Min. Cycle Time																						
00 _{bin}	0.1ms	Multiplier x Time Base	0.4- 6.3 ms																						
01 _{bin}	0.4ms	6.4 ms + Multiplier x Time Base	6.4- 31.6 ms																						
10 _{bin}	1.6ms	32.0 ms + Multiplier x Time Base	32.0 - 132.8 ms																						
11 _{bin}	6.4 ms	134.4 ms + Multiplier x Time Base	134.4- 537.6 ms																						

Index (hex)	Name	Meaning	Data type	Flags	Default
80n0:23	Offset time	reserved	UINT8	RW	0x00 (0 _{dec})
80n0:24	Process data in length	These parameters are transferred in the IO-Link format for "Process data in length". Bit 7: BYTE (indicates whether the value in LENGTH interpreted as bit length [bit not set] or as byte length + 1 [bit set]) Bit 6: SIO (indicates whether the device supports the standard IO mode [bit set]) Bit 0 to 4: LENGTH (Length of the process data)	UINT8	RW	0x00 (0 _{dec})
80n0:25	Process data out length	These parameters are transferred in the IO-Link format for "Process data out length". Bit 7: BYTE (indicates whether the value in LENGTH interpreted as bit length [bit not set] or as byte length + 1 [bit set]) Bit 6: SIO (indicates whether the device supports the standard IO mode [bit set]) Bit 0 to 4: LENGTH (Length of the process data)	UINT8	RW	0x00 (0 _{dec})
80n0:26	Compatible ID	reserved	UINT16	RW	0x0000 (0 _{dec})
80n0:27	Reserved	reserved	UINT16	RW	0x0000 (0 _{dec})
80n0:28	Master Control	Possible values: • 0: IO-Link port inactive • 1: IO-Link port as digital input • 2: IO-Link port as digital output • 3: IO-Link port in communication via the IO-Link protocol. • 4: IO-Link port in communication via the IO-Link protocol. The IO-Link state is ComStop (no cyclic communication, data is only exchanged when required).	UINT16	RW	0x0000 (0 _{dec})

9.2 Standard objects (0x1000-0x1FFF)

Index 1000 Device type

Index (hex)	Name	Meaning	Data type	Flags	Default
1000:0	Device type	Device Type of the EtherCAT slave: The Lo-Word contains the supported CoE Profile (5001). The Hi-Word contains the Module Profile corresponding to the Modular Device Profile.	UINT32	RO	0x184C1389 (407638921 _{dez})

Index 1008 Device name

Index (hex)	Name	Meaning	Data type	Flags	Default
1008:0	Device name	Device name of the EtherCAT slave	STRING	RO	(Product name, e.g. EP6224-0002)

Index 1009 Hardware version

Index (hex)	Name	Meaning	Data type	Flags	Default
1009:0	Hardware version	Hardware version of the EtherCAT slave	STRING	RO	-

Index 100A Software version

Index (hex)	Name	Meaning	Data type	Flags	Default
100A:0	Software version	Firmware version of the EtherCAT slave	STRING	RO	-

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default
1018:0	Identity	Information for identifying the slave	UINT8	RO	0x04 (4 _{dec})
1018:01	Vendor ID	Vendor ID of the EtherCAT slave	UINT32	RO	0x00000002 (2 _{dec})
1018:02	Product code	Product code of the EtherCAT slave	UINT32	RO	¹⁾
1018:03	Revision	Revision number of the EtherCAT slave; the Low Word (bit 0-15) indicates the special terminal number, the High Word (bit 16-31) refers to the device description	UINT32	RO	0x00100000 (1048576 _{dec})
1018:04	Serial number	Serial number of the EtherCAT slave; the Low Byte (bit 0-7) of the Low Word contains the year of production, the High Byte (bit 8-15) of the Low Word contains the week of production, the High Word (bit 16-31) is 0	UINT32	RO	0x00000000 (0 _{dec})

¹⁾ Product code:

- EP6224-0002:
- EP6224-0042
- EP6224-0092
- EP6224-2022
- EP6224-3002
- EP6224-3022
- EP6228-0022
- EP6228-0042
- EP6228-3032
- EP6228-3132
- EP6228-3142

Index 10F0 Backup parameter handling

Index (hex)	Name	Meaning	Data type	Flags	Default
10F0:0	Backup parameter handling	contains informations for the standardized Upload and Download of the Backup Entries	UINT8	RO	0x01 (1 _{dez})
10F0:01	Checksum	Checksum over all backup entries	UINT32	RO	0x00000000 (0 _{dez})

Index 1600 IO RxPDO-Map Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
1600:0	IO RxPDO-Map Ch.1	PDO Mapping RxPDO 1	UINT8	RW	0x01 (1 _{dec})
1600:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1601 IO RxPDO-Map Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
1601:0	IO RxPDO-Map Ch.2	PDO Mapping RxPDO 2	UINT8	RW	0x01 (1 _{dec})
1601:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1602 IO RxPDO-Map Ch.3

Index (hex)	Name	Meaning	Data type	Flags	Default
1602:0	IO RxPDO-Map Ch.3	PDO Mapping RxPDO 3	UINT8	RW	0x01 (1 _{dec})
1602:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1603 IO RxPDO-Map Ch.4

Index (hex)	Name	Meaning	Data type	Flags	Default
1603:0	IO RxPDO-Map Ch.4	PDO Mapping RxPDO 4	UINT8	RW	0x01 (1 _{dec})
1603:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1604 IO RxPDO-Map Ch.5 (EP6228-xxxx only)

Index (hex)	Name	Meaning	Data type	Flags	Default
1604:0	IO RxPDO-Map Ch.5	PDO Mapping RxPDO 5	UINT8	RW	0x01 (1 _{dec})
1604:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1605 IO RxPDO-Map Ch.6 (EP6228-xxxx only)

Index (hex)	Name	Meaning	Data type	Flags	Default
1605:0	IO RxPDO-Map Ch.6	PDO Mapping RxPDO 6	UINT8	RW	0x01 (1 _{dec})
1605:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1606 IO RxPDO-Map Ch.7 (EP6228-xxxx only)

Index (hex)	Name	Meaning	Data type	Flags	Default
1606:0	IO RxPDO-Map Ch.7	PDO Mapping RxPDO 7	UINT8	RW	0x01 (1 _{dec})
1606:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1607 IO RxPDO-Map Ch.8 (EP6228-xxxx only)

Index (hex)	Name	Meaning	Data type	Flags	Default
1607:0	IO RxPDO-Map Ch.8	PDO Mapping RxPDO 8	UINT8	RW	0x01 (1 _{dec})
1607:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1A00 IO TxPDO-Map Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
1A00:0	IO TxPDO-Map Ch.1	PDO Mapping TxPDO 1	UINT8	RW	0x01 (1 _{dec})
1A00:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1A01 IO TxPDO-Map Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
1A01:0	IO TxPDO-Map Ch.2	PDO Mapping TxPDO 2	UINT8	RW	0x01 (1 _{dec})
1A01:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1A02 IO TxPDO-Map Ch.3

Index (hex)	Name	Meaning	Data type	Flags	Default
1A02:0	IO TxPDO-Map Ch.3	PDO Mapping TxPDO 3	UINT8	RW	0x01 (1 _{dec})
1A02:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1A03 IO TxPDO-Map Ch.4

Index (hex)	Name	Meaning	Data type	Flags	Default
1A03:0	IO TxPDO-Map Ch.4	PDO Mapping TxPDO 4	UINT8	RW	0x01 (1 _{dec})
1A03:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1A04 IO TxPDO-Map Ch.5 (EP6228-xxxx only)

Index (hex)	Name	Meaning	Data type	Flags	Default
1A04:0	IO TxPDO-Map Ch.5	PDO Mapping TxPDO 5	UINT8	RW	0x01 (1 _{dec})
1A04:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1A05 IO TxPDO-Map Ch.6 (EP6228-xxxx only)

Index (hex)	Name	Meaning	Data type	Flags	Default
1A05:0	IO TxPDO-Map Ch.6	PDO Mapping TxPDO 6	UINT8	RW	0x01 (1 _{dec})
1A05:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1A06 IO TxPDO-Map Ch.7 (EP6228-xxxx only)

Index (hex)	Name	Meaning	Data type	Flags	Default
1A06:0	IO TxPDO-Map Ch.7	PDO Mapping TxPDO 7	UINT8	RW	0x01 (1 _{dec})
1A06:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1A07 IO TxPDO-Map Ch.8 (EP6228-xxxx only)

Index (hex)	Name	Meaning	Data type	Flags	Default
1A07:0	IO TxPDO-Map Ch.8	PDO Mapping TxPDO 8	UINT8	RW	0x01 (1 _{dec})
1A07:01	SubIndex 001	1. PDO Mapping entry (8 bits align)	UINT32	RW	0x0000:00, 8

Index 1A80 DeviceState TxPDO-Map Inputs

Index (hex)	Name	Meaning	Data type	Flags	Default
1A80:0	DeviceState TxPDO-Map Inputs	PDO Mapping	UINT8	RW	0x04 (4 _{dec})
1A80:01	SubIndex 001	1. PDO Mapping entry (object 0xF100 (Diagnosis Status data), entry 0x01 (State Ch1))	UINT32	RW	0xF100:01, 8
1A80:02	SubIndex 002	2. PDO Mapping entry (object 0xF100 (Diagnosis Status data), entry 0x02 (State Ch2))	UINT32	RW	0xF100:02, 8
1A80:03	SubIndex 003	3. PDO Mapping entry (object 0xF100 (Diagnosis Status data), entry 0x03 (State Ch3))	UINT32	RW	0xF100:03, 8
...	...	...	...	...	...

Index 1C00Sync manager type

Index (hex)	Name	Meaning	Data type	Flags	Default
1C00:0	Sync manager type	Usage of the Sync Manager channels	UINT8	RO	0x04 (4 _{dez})
1C00:01	SubIndex 001	Sync-Manager Type Channel 1: Mailbox Write	UINT8	RO	0x01 (1 _{dez})
1C00:02	SubIndex 002	Sync-Manager Type Channel 2: Mailbox Read	UINT8	RO	0x02 (2 _{dez})
1C00:03	SubIndex 003	Sync-Manager Type Channel 3: Process Data Write (Outputs)	UINT8	RO	0x03 (3 _{dez})
1C00:04	SubIndex 004	Sync-Manager Type Channel 4: Process Data Read (Inputs)	UINT8	RO	0x04 (4 _{dez})

Index 1C12 RxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RW	0x04 (4 _{dec})
1C12:01	SubIndex 001	1. allocated RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x1600 (5632 _{dec})
1C12:02	SubIndex 002	2. allocated RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x1601 (5633 _{dec})
1C12:03	SubIndex 003	3. allocated RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x1602 (5634 _{dec})
...	...	...	UINT16	RW	...

Index 1C13 TxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x05 (5 _{dec})
1C13:01	SubIndex 001	1. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A00 (6656 _{dec})
1C13:02	SubIndex 002	2. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A01 (6657 _{dec})
1C13:03	SubIndex 003	3. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A02 (6658 _{dec})
...	...	...	...	...	...

Index 1C32 SM output parameter

Index (hex)	Name	Meaning	Data type	Flags	Default
1C32:0	SM output parameter	Synchronization parameter of the outputs	UINT8	RO	0x20 (32 _{dez})
1C32:01	Sync mode	actual synchronization mode: 0: Free Run 1: Synchron with SM 2 Event 2: DC-Mode - Synchron with SYNC0 Event 3: DC-Mode - Synchron with SYNC1 Event	UINT16	RW	0x0000 (0 _{dez})
1C32:02	Cycle time	Cycle time (in ns): Free Run: cycle time of the local timer Synchron with SM 2 Event: Cycle time of the master DC-Mode: SYNC0/SYNC1 Cycle time	UINT32	RW	0x000186A0 (100000 _{dez})
1C32:03	Shift time	Time between SYNC0 Event and Outputs Valid (in ns, only in DC-Mode)	UINT32	RO	0x00000000 (0 _{dez})
1C32:04	Sync modes supported	Supported synchronization modes: Bit 0 = 1: Free Run is supported Bit 1 = 1: Synchron with SM 2 Event is supported Bit 2-3 = 01: DC-Mode is supported Bit 4-5 = 10: Output Shift with SYNC1 Event (only DC-Mode) Bit 14 = 1: dynamic times (could be measured Messen by writing 1C32:08)	UINT16	RO	0xC007 (49159 _{dez})
1C32:05	Minimum cycle time	Minimum cycle time supported (in ns)	UINT32	RO	0x000186A0 (100000 _{dez})
1C32:06	Calc and copy time	Minimal time between SYNC0 and SYNC1 Event (in ns, only in DC-Mode)	UINT32	RO	0x00000000 (0 _{dez})
1C32:08	Command	0: Measurement of the times will be stopped 1: Measurement of the times will be started The Entries 1C32:03, 1C32:05, 1C32:06, 1C32:09, 1C33:03, 1C33:06, 1C33:09 will be updated with the maximum measured values.	UINT16	RW	0x0000 (0 _{dez})
1C32:09	Delay time	Time between SYNC1 Event and Outputs Valid (in ns, only in DC-Mode)	UINT32	RO	0x00000000 (0 _{dez})
1C32:0B	SM event missed counter	Number of the missed SM-Events in state OPERATIONAL (only in DC Mode)	UINT16	RO	0x0000 (0 _{dez})
1C32:0C	Cycle exceeded counter	Number of the exceeded cycles in state OPERATIONAL	UINT16	RO	0x0000 (0 _{dez})
1C32:0D	Shift too short counter	Number of the too short distances between SYNC0 and SYNC1 Event (only in DC Mode)	UINT16	RO	0x0000 (0 _{dez})
1C32:20	Sync error	TRUE: In the last cycle the synchronization was not correct (only in DC Mode)	BOOLEAN	RO	0x00 (0 _{dez})

Index 1C33 SM input parameter

Index (hex)	Name	Meaning	Data type	Flags	Default
1C33:0	SM input parameter	Synchronization parameter of the inputs	UINT8	RO	0x20 (32 _{dez})
1C33:01	Sync mode	actual synchronization mode: 0: Free Run 1: Synchron with SM 3 Event (no Outputs available) 2: DC - Synchron with SYNC0 Event 3: DC - Synchron with SYNC1 Event 34: Synchron with SM 2 Event (Outputs available)	UINT16	RW	0x0000 (0 _{dez})
1C33:02	Cycle time	same as 1C32:02	UINT32	RW	0x000186A0 (100000 _{dez})
1C33:03	Shift time	time between SYNC0-Event and Input Latch (in ns, only in DC-Mode)	UINT32	RO	0x00000000 (0 _{dez})
1C33:04	Sync modes supported	Supported synchronization modes: Bit 0: Free Run is supported Bit 1: Synchron with SM 2 Event is supported (Outputs available) Bit 1: Synchron with SM 3 Event is supported (no Outputs available) Bit 2-3 = 01: DC-Mode is supported Bit 4-5 = 01: Input Shift with local event (Outputs available) Bit 4-5 = 10: Input Shift with SYNC1 Event (no Outputs available) Bit 14 = 1: dynamic times (could be measured Messen by writing 1C32:08 or 1C33:08)	UINT16	RO	0xC007 (49159 _{dez})
1C33:05	Minimum cycle time	same as 1C32:05	UINT32	RO	0x000186A0 (100000 _{dez})
1C33:06	Calc and copy time	time between Input Latch and the availability of the inputs for the master (in ns, only in DC-Mode)	UINT32	RO	0x00000000 (0 _{dez})
1C33:08	Command	same as 1C32:08	UINT16	RW	0x0000 (0 _{dez})
1C33:09	Delay time	time between SYNC1-Event and Input Latch (in ns, only in DC-Mode)	UINT32	RO	0x00000000 (0 _{dez})
1C33:0B	SM event missed counter	same as 1C32:11	UINT16	RO	0x0000 (0 _{dez})
1C33:0C	Cycle exceeded counter	same as 1C32:12	UINT16	RO	0x0000 (0 _{dez})
1C33:0D	Shift too short counter	same as 1C32:13	UINT16	RO	0x0000 (0 _{dez})
1C33:20	Sync error	same as 1C32:32	BOOLEAN	RO	0x00 (0 _{dez})

9.3 Profile specific objects (0x6000-0xFFFF)

Index 90n0 IO Info data Ch.[1, 2, 3, ...]

- Index 9000 IO Info data Ch.1
- Index 9010 IO Info data Ch.2
- Index 9020 IO Info data Ch.3
- ...

Index (hex)	Name	Meaning	Data type	Flags	Default																				
90n0:0	IO Info data	Max. Subindex	UINT8	RO	0x27 (39 _{dec})																				
90n0:04	Device ID	The device ID is used for validating the IO-Link device.	UINT32	RO	0x00000000 (0 _{dec})																				
90n0:05	VendorID	The vendor ID is used for validating the manufacturer of the IO-Link device.	UINT32	RO	0x00000000 (0 _{dec})																				
90n0:07	IO-Link revision	ID of the specification version based on which the IO-Link device communicates. Bit 0-3: MinorRev Bit 4-7: MajorRev	UINT8	RO	0x00 (0 _{dec})																				
90n0:20	FrameCapability	The Frame Capability indicates certain functionalities of the IO-Link device (e.g. SPDU supported). Bit 0: SPDU Bit 1: Type1 Bit 7: PHY1	UINT8	RO	0x00 (0 _{dec})																				
90n0:21	Min cycle time	The cycle time refers to the communication between the IO-Link master and the IO-Link device. This value is transferred in the IO-Link format for Min Cycle Time. Bit 6 and 7: Time Base Bit 0 to 5: Multiplier <table><thead><tr><th>Time Base</th><th>Meaning Time base</th><th>Calculation</th><th>Min. Cycle Time</th></tr></thead><tbody><tr><td>00b</td><td>0,100 ms</td><td>Multiplier x Time Base</td><td>0,000 - 6,300 ms</td></tr><tr><td>01b</td><td>0,400 ms</td><td>6,400 ms + Multiplier x Time Base</td><td>6,400 - 31,600 ms</td></tr><tr><td>10b</td><td>1,600 ms</td><td>32,000 ms + Multiplier x Time Base</td><td>32,000 - 132,800 ms</td></tr><tr><td>11b</td><td>6,400 ms</td><td>134,400 ms + Multiplier x Time Base</td><td>134,400 - 537,600 ms</td></tr></tbody></table>	Time Base	Meaning Time base	Calculation	Min. Cycle Time	00b	0,100 ms	Multiplier x Time Base	0,000 - 6,300 ms	01b	0,400 ms	6,400 ms + Multiplier x Time Base	6,400 - 31,600 ms	10b	1,600 ms	32,000 ms + Multiplier x Time Base	32,000 - 132,800 ms	11b	6,400 ms	134,400 ms + Multiplier x Time Base	134,400 - 537,600 ms	UINT8	RO	0x00 (0 _{dec})
Time Base	Meaning Time base	Calculation	Min. Cycle Time																						
00b	0,100 ms	Multiplier x Time Base	0,000 - 6,300 ms																						
01b	0,400 ms	6,400 ms + Multiplier x Time Base	6,400 - 31,600 ms																						
10b	1,600 ms	32,000 ms + Multiplier x Time Base	32,000 - 132,800 ms																						
11b	6,400 ms	134,400 ms + Multiplier x Time Base	134,400 - 537,600 ms																						

Index (hex)	Name	Meaning	Data type	Flags	Default
90n0:22	Offset time	reserved	UINT8	RO	0x00 (0 _{dec})
90n0:23	Process data in length	These parameters are transferred in the IO-Link format for "Process data in length". Bit 7: BYTE (indicates whether the value in LENGTH interpreted as bit length [bit not set] or as byte length + 1 [bit set]) Bit 6: SIO (indicates whether the device supports the standard IO mode [bit set]) Bit 0 to 4: LENGTH (Length of the process data)	UINT8	RO	0x00 (0 _{dec})
90n0:24	Process data out length	These parameters are transferred in the IO-Link format for "Process data out length". Bit 7: BYTE (indicates whether the value in LENGTH interpreted as bit length [bit not set] or as byte length + 1 [bit set]) Bit 6: SIO (indicates whether the device supports the standard IO mode [bit set]) Bit 0 to 4: LENGTH (Length of the process data)	UINT8	RO	0x00 (0 _{dec})
90n0:26	Reserved	reserved	UINT16	RO	0x0000 (0 _{dec})
90n0:27	Reserved2	reserved	UINT16	RO	0x0000 (0 _{dec})

Index A0n0 IO Diag data Ch.[1, 2, 3, ...]

- Index A000 IO Diag data Ch.1
- Index A010 IO Diag data Ch.2
- Index A020 IO Diag data Ch.3
- ...

Index (hex)	Name	Meaning	Data type	Flags	Default
A0n0:0	IO Diag data Ch.[1, 2, 3, ...]	Max. Subindex	UINT8	RO	0x02 (2 _{dec})
A0n00:01	IO-Link State	The value of the IO-Link state corresponds to a state from the IO-Link master state machine 0: INACTIVE 1: DIGINPUT 2: DIGOUTPUT 3: ESTABLISHCOMM 4: INITMASTER 5: INITDEVICE 7: PREOPERATE 8: OPERATE 9: STOP	UINT8	RO	0x00 (0 _{dec})
A0n00:02	Lost Frames	This parameter counts the number of lost IO-Link telegrams. This value is deleted whenever IO-Link starts up, otherwise it is incremented continuously.	UINT8	RO	0x00 (0 _{dec})

Index F000 Modular device profile

Index (hex)	Name	Meaning	Data type	Flags	Default
F000:0	Modular device profile	General information about the Modular Device Profile	UINT8	RO	0x02 (2 _{dez})
F000:01	Module index distance	Index distance between the objects of two channels	UINT16	RO	0x0010 (16 _{dez})
F000:02	Maximum number of modules	Number of channels	UINT16	RO	0x0004 (4 _{dez})

Index F008 Code word

Index (hex)	Name	Meaning	Data type	Flags	Default
F008:0	Code word	reserved	UINT32	RW	0x00000000 (0 _{dez})

Index F010 Module list

Index (hex)	Name	Meaning	Data type	Flags	Default
F010:0	Module list	Max. Subindex	UINT8	RW	0x04 (4 _{dez})
F010:01	SubIndex 001	-	UINT32	RW	0x0000184C (6220 _{dez})
F010:02	SubIndex 002	-	UINT32	RW	0x0000184C (6220 _{dez})
F010:03	SubIndex 003	-	UINT32	RW	0x0000184C (6220 _{dez})
F010:04	SubIndex 004	-	UINT32	RW	0x0000184C (6220 _{dez})

Index F100 Diagnosis Status data

See chapter [Status of the IO-Link ports \[► 129\]](#).

Index (hex)	Name	Meaning	Data type	Flags	Default
F100:0	Diagnosis Status data	Max. Subindex	UINT8	RO	0x04 (4 _{dec})
F100:01	State Ch1	Status byte Ch. 1	UINT8	RO	0x00 (0 _{dec})
F100:02	State Ch2	Status byte Ch. 2	UINT8	RO	0x00 (0 _{dec})
F100:03	State Ch3	Status byte Ch. 3	UINT8	RO	0x00 (0 _{dec})
...	...	...	...	...	...

Index F900 Info data

Index (hex)	Name	Meaning	Data type	Flags	Default
F900:0	Info data	Max. Subindex	UINT8	RO	0x09 (9 _{dez})
F900:01	IO-Link Version	-	UINT8	RO	0x10 (16 _{dez})

9.4 Objects for TwinSAFE SC (EP6224-0092)

Index 1690 TSC RxPDO-Map Master Message

Index (hex)	Name	Meaning	Data type	Flags	Default
1690:0	TSC RxPDO-Map Master Message	PDO Mapping RxPDO	UINT8	RO	0x04 (4 _{dec})
1690:01	SubIndex 001	1. PDO Mapping entry (object 0x700F (TSC Master Frame Elements), entry 0x01 (TSC__Master Cmd))	UINT32	RO	0x700F:01, 8
1690:02	SubIndex 002	2. PDO Mapping entry (8 bits align)	UINT32	RO	0x0000:00, 8
1690:03	SubIndex 003	3. PDO Mapping entry (object 0x700F (TSC Master Frame Elements), entry 0x03 (TSC__Master CRC_0))	UINT32	RO	0x700F:03, 16
1690:04	SubIndex 004	4. PDO Mapping entry (object 0x700F (TSC Master Frame Elements), entry 0x02 (TSC__Master ConnID))	UINT32	RO	0x700F:02, 16

Index 1A90 TSC TxPDO-Map Slave Message

Index (hex)	Name	Meaning	Data type	Flags	Default
1A90:0	TSC TxPDO-Map Slave Message	PDO Mapping TxPDO	UINT8	RW	0x04 (4 _{dez})
1A90:01	SubIndex 001	1. PDO Mapping entry (object 0x600F (TSC Slave Frame Elements), entry 0x01 (TSC__Slave Cmd))	USINT8	RW	0x600F:01, 8
1A90:02	SubIndex 002	2. PDO Mapping entry (object 0x6004 (unsigned Word Inputs Ch. 1), entry 0x01 (Offset Byte 0))	INT16	RW	0x6004:01, 16
1A90:03	SubIndex 003	3. PDO Mapping entry (object 0x600F (TSC Slave Frame Elements), entry 0x03 (TSC__Slave CRC_0))	UINT16	RW	0x600F:03, 16
...	...	...	...	...	...

Index 600F TSC Slave Frame Elements

Index (hex)	Name	Meaning	Data type	Flags	Default
600F:0	TSC Slave Frame Elements	Max. subindex	UINT8	RO	0x0A (10 _{dec})
600F:01	TSC__Slave Cmd	reserved	UINT8	RO	0x00 (0 _{dec})
600F:02	TSC__Slave ConnID	reserved	UINT16	RO	0x0000 (0 _{dec})
600F:03	TSC__Slave CRC_0	reserved	UINT16	RO	0x0000 (0 _{dec})
600F:04	TSC__Slave CRC_1	reserved	UINT16	RO	0x0000 (0 _{dec})
600F:05	TSC__Slave CRC_2	reserved	UINT16	RO	0x0000 (0 _{dec})
600F:06	TSC__Slave CRC_3	reserved	UINT16	RO	0x0000 (0 _{dec})
600F:07	TSC__Slave CRC_4	reserved	UINT16	RO	0x0000 (0 _{dec})
600F:08	TSC__Slave CRC_5	reserved	UINT16	RO	0x0000 (0 _{dec})
600F:09	TSC__Slave CRC_6	reserved	UINT16	RO	0x0000 (0 _{dec})
600F:0A	TSC__Slave CRC_7	reserved	UINT16	RO	0x0000 (0 _{dec})

Index 60a1 DWord Inputs Ch. a+1 (a = 0, 1, 2, 3)

Index (hex)	Name	Meaning	Data type	Flags	Default
60a1:0	DWord Inputs Ch. a+1	Max. subindex	UINT8	RO	0x1D (29 _{dec})
60a1:01	Offset Byte 0	Offset Byte 0	()	RO	()
60a1:02	Offset Byte 1	Offset Byte 1	()	RO	()
...	...	...	...	...	...
60a1:1D	Offset Byte 28	Offset Byte 28	()	RO	()

Index 60b2 unsigned DWord Inputs Ch. b+1 (b = 0, 1, 2, 3)

Index (hex)	Name	Meaning	Data type	Flags	Default
60b2:0	Unsigned DWord Inputs Ch. b+1	Max. subindex	UINT8	RO	0x1D (29 _{dec})
60b2:01	Offset Byte 0	Offset Byte 0	()	RO	()
60b2:02	Offset Byte 1	Offset Byte 1	()	RO	()
...	...	...	...	...	...
60b2:1D	Offset Byte 28	Offset Byte 28	()	RO	()

Index 60c3 Word Inputs Ch. c+1 (c = 0, 1, 2, 3)

Index (hex)	Name	Meaning	Data type	Flags	Default
60c3:0	Word Inputs Ch. c+1	Max. subindex	UINT8	RO	0x1F (31 _{dec})
60c3:01	Offset Byte 0	Offset Byte 0	()	RO	()
60c3:02	Offset Byte 1	Offset Byte 1	()	RO	()
...	...	...	...	...	...
60c3:1F	Offset Byte 30	Offset Byte 30	()	RO	()

Index 60d4 unsigned Word Inputs Ch. d+1 (d = 0, 1, 2, 3)

Index (hex)	Name	Meaning	Data type	Flags	Default
60d4:0	Unsigned Word Inputs Ch. d+1	Max. subindex	UINT8	RO	0x1F (31 _{dec})
60d4:01	Offset Byte 0	Offset Byte 0	()	RO	()
60d4:02	Offset Byte 1	Offset Byte 1	()	RO	()
...	...	...	...	...	...
60d4:1F	Offset Byte 30	Offset Byte 30	()	RO	()

Index 61e0 Bool Inputs Ch. e+1 (e = 0, 1, 2, 3)

Index (hex)	Name	Meaning	Data type	Flags	Default
61e0:0	Bool Inputs Ch. e+1	Max. subindex	UINT8	RO	0x40 (64 _{dec})
61e0:01	Offset Byte 0 Bit 0	Offset Byte 0 Bit 0	()	RO	()
61e0:02	Offset Byte 0 Bit 1	Offset Byte 0 Bit 1	()	RO	()
...	...	...	...	...	...
61e0:08	Offset Byte 0 Bit 7	Offset Byte 0 Bit 7	()	RO	()
61e0:09	Offset Byte 1 Bit 0	Offset Byte 1 Bit 0	()	RO	()
61e0:0A	Offset Byte 1 Bit 1	Offset Byte 1 Bit 1	()	RO	()
...	...	...	...	...	...
61e0:10	Offset Byte 1 Bit 7	Offset Byte 1 Bit 7	()	RO	()
...	...	...	...	...	...
...	...	...	...	...	...
61e0:39	Offset Byte 7 Bit 0	Offset Byte 7 Bit 0	()	RO	()
61e0:3A	Offset Byte 7 Bit 1	Offset Byte 7 Bit 1	()	RO	()
...	...	...	...	...	...
61e0:40	Offset Byte 7 Bit 7	Offset Byte 7 Bit 7	()	RO	()

Index 700F TSC Master Frame Elements

Index (hex)	Name	Meaning	Data type	Flags	Default
700F:0	TSC Master Frame Elements	Max. subindex	UINT8	RO	0x03 (3 _{dec})
700F:01	TSC __Master Cmd	reserved	UINT8	RO	0x00 (0 _{dec})
700F:02	TSC __Master ConnID	reserved	UINT16	RO	0x0000 (0 _{dec})
700F:03	TSC __Master CRC_0	reserved	UINT16	RO	0x0000 (0 _{dec})

Index 800F TSC Settings

Index (hex)	Name	Meaning	Data type	Flags	Default
800F:0	TSC Settings	Max. subindex	UINT8	RO	0x02 (2 _{dez})
800F:01	Address	TwinSAFE SC Adresse	UINT16	RW	0x0000 (0 _{dez})
800F:02	Connection Mode	Auswahl der TwinSAFE SC CRC	UINT32	RO	0x00000000 (0 _{dez})

9.5 Objects for digital inputs

These objects are only available in products that have a digital input at pin 2 of their IO-Link ports:

- EP6224-0002
- EP6224-0092
- EP6228-0042
- EP6228-3132
- EP6228-3142

Index 1A20 Digital TxPDO-Map Inputs

Index (hex)	Name	Meaning	Data type	Flags	Default
1A20:0	DeviceState TxPDO-Map Inputs	PDO Mapping	UINT8	RW	0x04 (4 _{dec})
1A20:01	SubIndex 001	1. PDO Mapping entry (object 0xF100 (Diagnosis Status data), entry 0x01 (State Ch1))	UINT32	RW	0xF102:01, 1
1A20:02	SubIndex 002	2. PDO Mapping entry (object 0xF100 (Diagnosis Status data), entry 0x02 (State Ch2))	UINT32	RW	0xF102:02, 1
1A20:03	SubIndex 003	3. PDO Mapping entry (object 0xF100 (Diagnosis Status data), entry 0x03 (State Ch3))	UINT32	RW	0xF102:03, 1
...	...	...	...	...	...

10 Appendix

10.1 General operating conditions

Protection rating according to IP code

The degrees of protection are defined and divided into different classes in the IEC 60529 standard (EN 60529). Degrees of protection are designated by the letters "IP" and two numerals: **IPxy**

- Numeral x: Dust protection and contact protection
- Numeral y: Protection against water

x	Meaning
0	Not protected
1	Protected against access to dangerous parts with the back of the hand. Protected against solid foreign objects of 50 mm Ø
2	Protected against access to dangerous parts with a finger. Protected against solid foreign objects of 12.5 mm Ø
3	Protected against access to dangerous parts with a tool. Protected against solid foreign objects of 2.5 mm Ø
4	Protected against access to dangerous parts with a wire. Protected against solid foreign objects of 1 mm Ø
5	Protection against access to dangerous parts with a wire. Dust-protected. Ingress of dust is not prevented completely, although the quantity of dust able to penetrate is limited to such an extent that the proper function of the device and safety are not impaired
6	Protection against access to dangerous parts with a wire. Dust-tight. No ingress of dust

y	Meaning
0	Not protected
1	Protection against vertically falling water drops
2	Protection against vertically falling water drops when enclosure tilted up to 15°
3	Protection against spraying water. Water sprayed at an angle of up to 60° on either side of the vertical shall have no harmful effects
4	Protection against splashing water. Water splashed against the enclosure from any direction shall have no harmful effects
5	Protection against water jets.
6	Protection against powerful water jets.
7	Protected against the effects of temporary immersion in water. Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is immersed in water at a depth of 1 m for 30 minutes

Chemical resistance

The resistance refers to the housing of the IP67 modules and the metal parts used. In the table below you will find some typical resistances.

Type	Resistance
Water vapor	unstable at temperatures > 100 °C
Sodium hydroxide solution (ph value > 12)	stable at room temperature unstable > 40 °C
Acetic acid	unstable
Argon (technically pure)	stable

Key

- resistant: Lifetime several months
- non inherently resistant: Lifetime several weeks
- not resistant: Lifetime several hours resp. early decomposition

10.2 Accessories

Mounting

Ordering information	Description	Link
ZS5300-0011	Mounting rail	Website

Cables

A complete overview of pre-assembled cables can be found on the Beckhoff website: [Link](#).

Ordering information	Description	Link
ZK1090-3xxx-xxxx	EtherCAT cable M8, green	Website
ZK1093-3xxx-xxxx	EtherCAT cable M8, yellow	Website
ZK1090-6xxx-xxxx	EtherCAT cable M12, green	Website
ZK2000-5xxx-xxxx	Sensor cable M12, 5-pin	Website
ZK2000-6xxx-xxxx	Sensor cable M12, 4-pin	Website
ZK2020-3xxx-xxxx	Power cable M8, 4-pin	Website
ZK203x-xxxx-xxxx	Power cable 7/8", 5-pin	Website

Labeling material, protective caps

Ordering information	Description
ZS5000-0010	Protective cap for M8 sockets, IP67 (50 pieces)
ZS5000-0020	Protective cap for M12 sockets, IP67 (50 pcs.)
ZS5100-0000	Inscription labels, unprinted, 4 strips of 10
ZS5000-xxxx	Printed inscription labels on enquiry

Tools

Ordering information	Description
ZB8801-0000	Torque wrench for plugs, 0.4...1.0 Nm
ZB8801-0001	Torque cable key for M8 / wrench size 9 for ZB8801-0000
ZB8801-0002	Torque cable key for M12 / wrench size 13 for ZB8801-0000
ZB8801-0003	Torque cable key for M12 field assembly / wrench size 18 for ZB8801-0000



Further accessories

Further accessories can be found in the price list for fieldbus components from Beckhoff and online at <https://www.beckhoff.com>.

10.3 Version identification of EtherCAT devices

10.3.1 General notes on marking

Designation

A Beckhoff EtherCAT device has a 14-digit designation, made up of

- family key
- type
- version
- revision

Example	Family	Type	Version	Revision
EL3314-0000-0016	EL terminal 12 mm, non-pluggable connection level	3314 4-channel thermocouple terminal	0000 basic type	0016
ES3602-0010-0017	ES terminal 12 mm, pluggable connection level	3602 2-channel voltage measurement	0010 high-precision version	0017
CU2008-0000-0000	CU device	2008 8-port fast ethernet switch	0000 basic type	0000

Notes

- The elements mentioned above result in the **technical designation**. EL3314-0000-0016 is used in the example below.
- EL3314-0000 is the order identifier, in the case of "-0000" usually abbreviated to EL3314. "-0016" is the EtherCAT revision.
- The **order identifier** is made up of
 - family key (EL, EP, CU, ES, KL, CX, etc.)
 - type (3314)
 - version (-0000)
- The **revision** -0016 shows the technical progress, such as the extension of features with regard to the EtherCAT communication, and is managed by Beckhoff.
In principle, a device with a higher revision can replace a device with a lower revision, unless specified otherwise, e.g. in the documentation.
Associated and synonymous with each revision there is usually a description (ESI, EtherCAT Slave Information) in the form of an XML file, which is available for download from the Beckhoff web site.
From 2014/01 the revision is shown on the outside of the IP20 terminals, see Fig. "EL2872 with revision 0022 and serial number 01200815".
- The type, version and revision are read as decimal numbers, even if they are technically saved in hexadecimal.

10.3.2 Version identification of IP67 modules

The serial number/ data code for Beckhoff IO devices is usually the 8-digit number printed on the device or on a sticker. The serial number indicates the configuration in delivery state and therefore refers to a whole production batch, without distinguishing the individual modules of a batch.

Structure of the serial number: **KK YY FF HH**

KK - week of production (CW, calendar week)

YY - year of production

FF - firmware version

HH - hardware version

Example with serial number 12 06 3A 02:

12 - production week 12

06 - production year 2006

3A - firmware version 3A

02 - hardware version 02

Exceptions can occur in the **IP67 area**, where the following syntax can be used (see respective device documentation):

Syntax: D ww yy x y z u

D - prefix designation

ww - calendar week

yy - year

x - firmware version of the bus PCB

y - hardware version of the bus PCB

z - firmware version of the I/O PCB

u - hardware version of the I/O PCB

Example: D.22081501 calendar week 22 of the year 2008 firmware version of bus PCB: 1 hardware version of bus PCB: 5 firmware version of I/O PCB: 0 (no firmware necessary for this PCB) hardware version of I/O PCB: 1

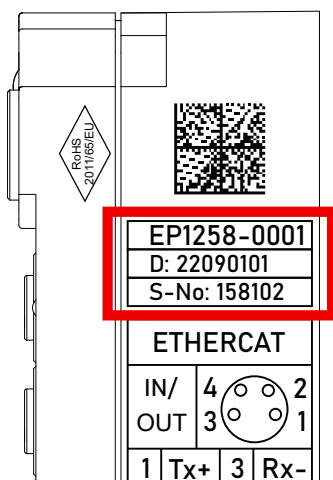


Fig. 53: EP1258-00001 IP67 EtherCAT Box with batch number/DateCode 22090101 and unique serial number 158102

10.3.3 Beckhoff Identification Code (BIC)

The Beckhoff Identification Code (BIC) is increasingly being applied to Beckhoff products to uniquely identify the product. The BIC is represented as a Data Matrix Code (DMC, code scheme ECC200), the content is based on the ANSI standard MH10.8.2-2016.

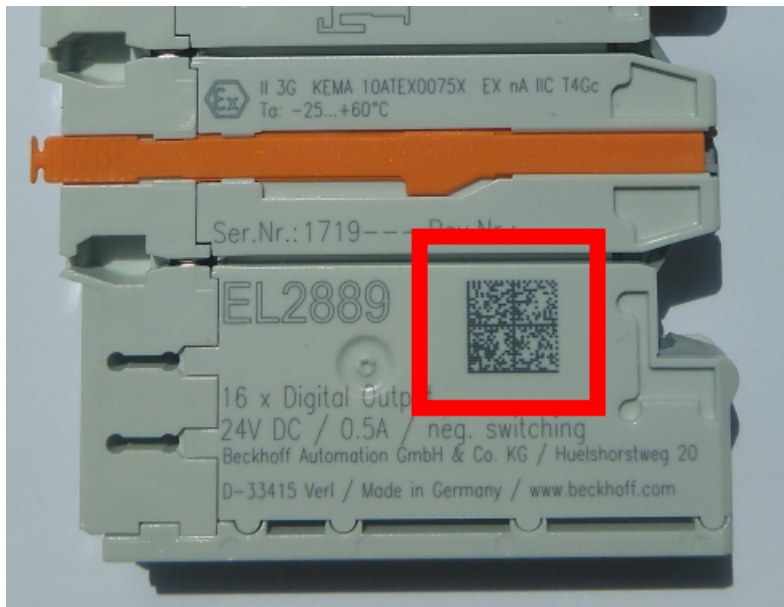


Fig. 54: BIC as data matrix code (DMC, code scheme ECC200)

The BIC will be introduced step by step across all product groups.

Depending on the product, it can be found in the following places:

- on the packaging unit
- directly on the product (if space suffices)
- on the packaging unit and the product

The BIC is machine-readable and contains information that can also be used by the customer for handling and product management.

Each piece of information can be uniquely identified using the so-called data identifier (ANSI MH10.8.2-2016). The data identifier is followed by a character string. Both together have a maximum length according to the table below. If the information is shorter, spaces are added to it.

Following information is possible, positions 1 to 4 are always present, the other according to need of production:

Position	Type of information	Explanation	Data identifier	Number of digits incl. data identifier	Example
1	Beckhoff order number	Beckhoff order number	1P	8	1P 072222
2	Beckhoff Traceability Number (BTN)	Unique serial number, see note below	SBTN	12	SBTN k4p562d7
3	Article description	Beckhoff article description, e.g. EL1008	1K	32	1K EL1809
4	Quantity	Quantity in packaging unit, e.g. 1, 10, etc.	Q	6	Q1
5	Batch number	Optional: Year and week of production	2P	14	2P 401503180016
6	ID/serial number	Optional: Present-day serial number system, e.g. with safety products	51S	12	51S 678294
7	Variant number	Optional: Product variant number on the basis of standard products	30P	12	30P F971, 2*K183
...					

Further types of information and data identifiers are used by Beckhoff and serve internal processes.

Structure of the BIC

Example of composite information from positions 1 to 4 and with the above given example value on position 6. The data identifiers are highlighted in bold font:

1P072222**SBTN**k4p562d7**1K**EL1809 **Q1** **51S**678294

Accordingly as DMC:



Fig. 55: Example DMC **1P**072222**SBTN**k4p562d7**1K**EL1809 **Q1** **51S**678294

BTN

An important component of the BIC is the Beckhoff Traceability Number (BTN, position 2). The BTN is a unique serial number consisting of eight characters that will replace all other serial number systems at Beckhoff in the long term (e.g. batch designations on IO components, previous serial number range for safety products, etc.). The BTN will also be introduced step by step, so it may happen that the BTN is not yet coded in the BIC.

NOTICE

This information has been carefully prepared. However, the procedure described is constantly being further developed. We reserve the right to revise and change procedures and documentation at any time and without prior notice. No claims for changes can be made from the information, illustrations and descriptions in this documentation.

10.3.4 Electronic access to the BIC (eBIC)

Electronic BIC (eBIC)

The Beckhoff Identification Code (BIC) is applied to the outside of Beckhoff products in a visible place. If possible, it should also be electronically readable.

The interface that the product can be electronically addressed by is crucial for the electronic readout.

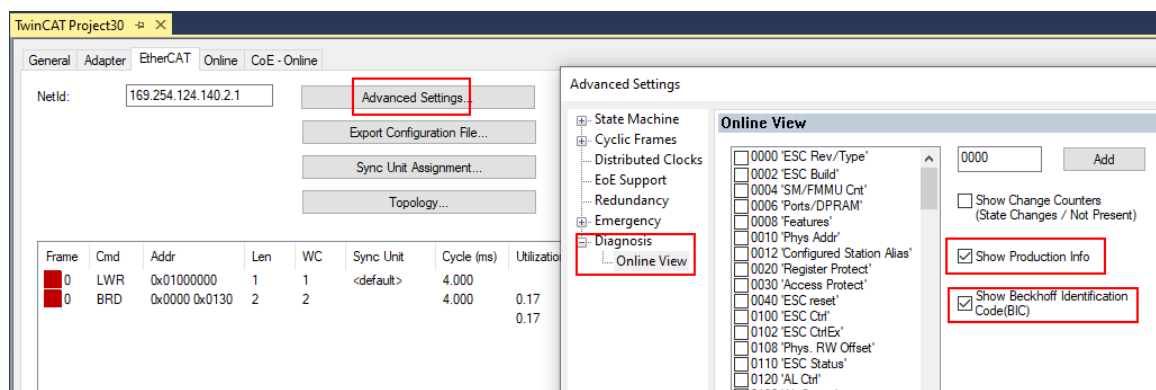
EtherCAT devices (IP20, IP67)

All Beckhoff EtherCAT devices have an ESI-EEPROM which contains the EtherCAT identity with the revision number. The EtherCAT slave information, also colloquially known as the ESI/XML configuration file for the EtherCAT master, is stored in it. See the corresponding chapter in the EtherCAT system manual ([Link](#)) for the relationships.

Beckhoff also stores the eBIC in the ESI-EEPROM. The eBIC was introduced into Beckhoff IO production (terminals, box modules) in 2020; as of 2023, implementation is largely complete.

The user can electronically access the eBIC (if present) as follows:

- With all EtherCAT devices, the EtherCAT master (TwinCAT) can read the eBIC from the ESI-EEPROM
 - From TwinCAT 3.1 build 4024.11, the eBIC can be displayed in the online view.
 - To do this, check the "Show Beckhoff Identification Code (BIC)" checkbox under EtherCAT → Advanced Settings → Diagnostics:



- The BTN and its contents are then displayed:

No	Addr	Name	State	CRC	Fw	Hw	Production Data	ItemNo	BTN	Description	Quantity	BatchNo	SerialNo
1	1001	Term 1 (EK1100)	OP	0, 0	0	0	—	—	—	—	—	—	—
2	1002	Term 2 (EL1018)	OP	0, 0	0	0	2020 KW36 Fr	072222	k4p562d7	EL1809	1	—	678294
3	1003	Term 3 (EL3204)	OP	0, 0	7	6	2012 KW24 Sa	—	—	—	—	—	—
4	1004	Term 4 (EL2004)	OP	0, 0	0	0	—	072223	k4p562d7	EL2004	1	—	678295
5	1005	Term 5 (EL1008)	OP	0, 0	0	0	—	—	—	—	—	—	—
6	1006	Term 6 (EL2008)	OP	0, 0	0	12	2014 KW14 Mo	—	—	—	—	—	—
7	1007	Term 7 (EK1110)	OP	0	1	8	2012 KW25 Mo	—	—	—	—	—	—

- Note: As shown in the figure, the production data HW version, FW version, and production date, which have been programmed since 2012, can also be displayed with "Show production info".
- Access from the PLC: From TwinCAT 3.1. build 4024.24, the functions *FB_EcReadBIC* and *FB_EcReadBTN* for reading into the PLC are available in the Tc2_EtherCAT library from v3.3.19.0.
- EtherCAT devices with a CoE directory may also have the object 0x10E2:01 to display their own eBIC, which can also be easily accessed by the PLC:

- The device must be in PREOP/SAFEOP/OP for access:

Index	Name	Flags	Value
1000	Device type	RO	0x015E1389 (22942601)
1008	Device name	RO	ELM3704-0000
1009	Hardware version	RO	00
100A	Software version	RO	01
100B	Bootloader version	RO	J0.1.27.0
1011:0	Restore default parameters	RO	> 1 <
1018:0	Identity	RO	> 4 <
10E2:0	Manufacturer-specific Identification C...	RO	> 1 <
10E2:01	SubIndex 001	RO	1P158442SBTN0008jckp1KELM3704 Q1 2P482001000016
10F0:0	Backup parameter handling	RO	> 1 <
10F3:0	Diagnosis History	RO	> 21 <
10F8	Actual Time Stamp	RO	0x170bf6277e

- The object 0x10E2 will be preferentially introduced into stock products in the course of necessary firmware revision.
- From TwinCAT 3.1. build 4024.24, the functions *FB_EcCoEReadBIC* and *FB_EcCoEReadBTN* for reading into the PLC are available in the Tc2_EtherCAT library from v3.3.19.0
- The following auxiliary functions are available for processing the BIC/BTN data in the PLC in *Tc2_Uilities* as of TwinCAT 3.1 build 4024.24
 - *F_SplitBIC*: The function splits the Beckhoff Identification Code (BIC) sBICValue into its components using known identifiers and returns the recognized substrings in the ST_SplittedBIC structure as a return value
 - *BIC_TO_BTN*: The function extracts the BTN from the BIC and returns it as a return value
- Note: If there is further electronic processing, the BTN is to be handled as a string(8); the identifier "SBTN" is not part of the BTN.
- Technical background
The new BIC information is written as an additional category in the ESI-EEPROM during device production. The structure of the ESI content is largely dictated by the ETG specifications, therefore the additional vendor-specific content is stored using a category in accordance with the ETG.2010. ID 03 tells all EtherCAT masters that they may not overwrite these data in the event of an update or restore the data after an ESI update.
The structure follows the content of the BIC, see here. The EEPROM therefore requires approx. 50..200 bytes of memory.
- Special cases
 - If multiple hierarchically arranged ESCs are installed in a device, only the top-level ESC carries the eBIC information.
 - If multiple non-hierarchically arranged ESCs are installed in a device, all ESCs carry the eBIC information.
 - If the device consists of several sub-devices which each have their own identity, but only the top-level device is accessible via EtherCAT, the eBIC of the top-level device is located in the CoE object directory 0x10E2:01 and the eBICs of the sub-devices follow in 0x10E2:nn.

10.4 Support and Service

Beckhoff and their partners around the world offer comprehensive support and service, making available fast and competent assistance with all questions related to Beckhoff products and system solutions.

Beckhoff's branch offices and representatives

Please contact your Beckhoff branch office or representative for local support and service on Beckhoff products!

The addresses of Beckhoff's branch offices and representatives round the world can be found on her internet pages: www.beckhoff.com

You will also find further documentation for Beckhoff components there.

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The Beckhoff Support offers you comprehensive technical assistance, helping you not only with the application of individual Beckhoff products, but also with other, wide-ranging services:

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