

Documentation | EN

# EP1111-0000

EtherCAT Box with ID switch





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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
1.1	<ul style="list-style-type: none"><li>Commissioning updated</li></ul>
1.0	<ul style="list-style-type: none"><li>First release</li></ul>

### 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](#) [► 36].

## 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.

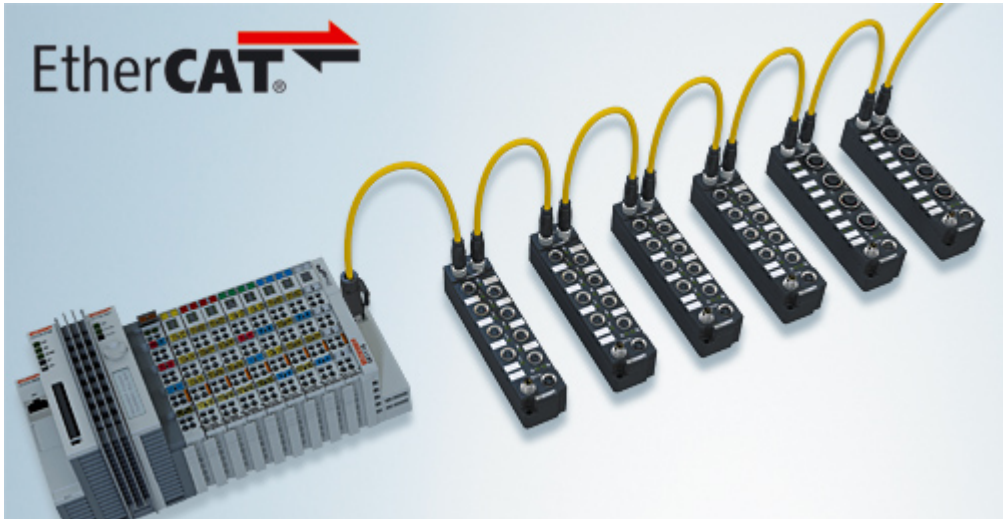


Fig. 1: EtherCAT Box Modules within an EtherCAT network

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  $\mu$ 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

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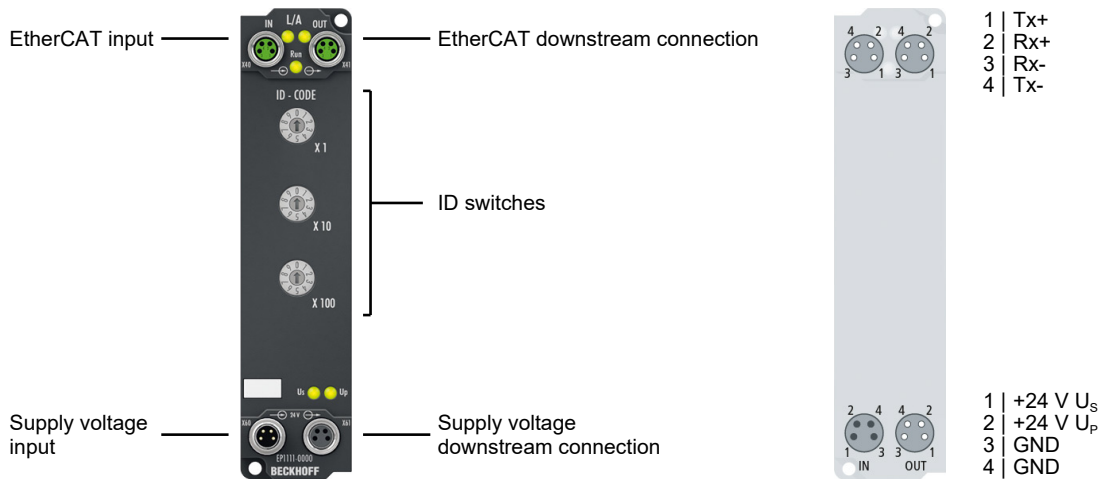
### **i Basic EtherCAT documentation**

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](http://www.beckhoff.com)) under Downloads.

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## 3 Product overview

### 3.1 Introduction



#### EtherCAT Box with ID switch

The EP1111-0000 EtherCAT Box has three decimal ID switches that are used to assign an ID to groups of EtherCAT components. This group can be present in any position in the EtherCAT network, thus allowing variable topologies to be executed in a simple manner.

The EtherCAT connection is established via shielded M8 connectors. The link and activity statuses are displayed directly on the connectors. The Run LED shows the status of the EP1111-0000.

#### Quick links

Basics for Hot Connect: See [EtherCAT system documentation](#)

[Technical data](#) [► 11]

[Process image](#) [► 14]

[Dimensions](#) [► 15]

## 3.2 Technical data

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

Supply voltages	
Connection	Input: M8 connector, 4-pin, A-coded Downstream connection: M8 socket, 4-pin, A-coded
U <sub>S</sub> nominal voltage	24 V <sub>DC</sub> (-15 % / +20 %)
U <sub>S</sub> sum current: I <sub>S,sum</sub>	max. 4 A
Current consumption from U <sub>S</sub>	120 mA
Rated voltage U <sub>P</sub>	24 V <sub>DC</sub> (-15 % / +20 %)
U <sub>P</sub> sum current: I <sub>P,sum</sub>	max. 4 A
Current consumption from U <sub>P</sub>	None. U <sub>P</sub> is only forwarded.

ID switches	
Number system	Decimal
Value range	0 ... 999 <sub>dec</sub> (3 ID switches with a value range of 0 ... 9 <sub>dec</sub> )

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 <a href="#">Additional tests [► 11]</a>
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 [ <a href="#">► 22</a> ]

\*) 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 Scope of supply

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

- 1x EP1111-0000
- 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**

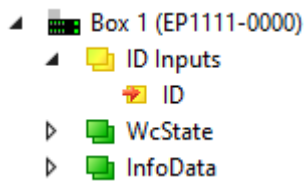
Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

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

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## 3.4 Process image

TwinCAT displays the process image in a tree structure.



### ID

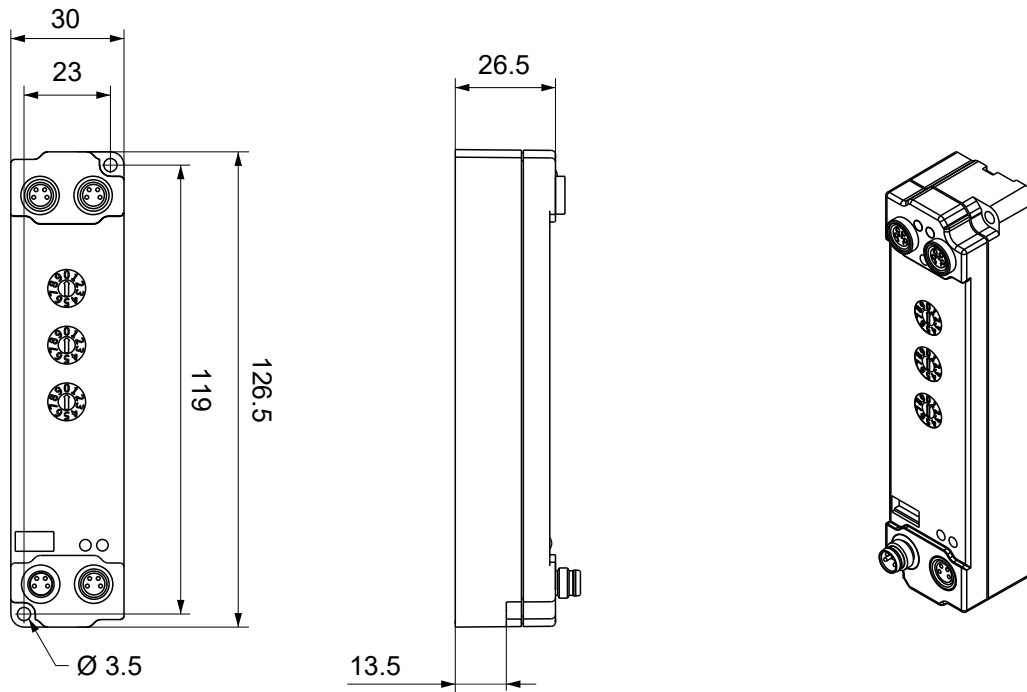
Data type: UINT

The input variable ID contains the value that is set via the ID switches.

## 4 Mounting and connection

### 4.1 Mounting

#### 4.1.1 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)

## 4.1.2 Fixing

### 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 M3 screws on the mounting holes in the corners of the module. The mounting holes have no thread.

## 4.1.3 Tightening torques for plug connectors

Screw M8 connectors tight with a torque wrench. (e.g. ZB8801 from Beckhoff)

Torque: 0.4 Nm.



4.2 EtherCAT

4.2.1 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 sockets for the incoming and downstream EtherCAT connections.



Connection

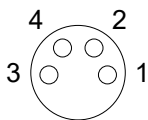


Fig. 4: M8 socket

EtherCAT	M8 socket	Core colors		
Signal	Contact	ZB9010, ZB9020, ZB9030, ZB9032, ZK1090-6292, ZK1090-3xxx-xxxx	ZB9031 and old versions of ZB9030, ZB9032, ZK1090-3xxx-xxxx	TIA-568B
Tx +	1	yellow <sup>1)</sup>	orange/white	white/orange
Tx -	4	orange <sup>1)</sup>	orange	orange
Rx +	2	white <sup>1)</sup>	blue/white	white/green
Rx -	3	blue <sup>1)</sup>	blue	green
Shield	Housing	Shield	Shield	Shield

<sup>1)</sup> Core colors according to EN 61918

**i** **Adaptation of core colors for cables ZB9030, ZB9032 and ZK1090-3xxxx-xxxx**  
For standardization, the core colors of the ZB9030, ZB9032 and ZK1090-3xxx-xxxx cables have been changed to the EN61918 core colors: yellow, orange, white, blue. So there are different color codes in circulation. The electrical properties of the cables have been retained when the core colors were changed.

## 4.2.2 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

## 4.2.3 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

## 4.3 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](#) [► 22].

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.

4.3.1 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

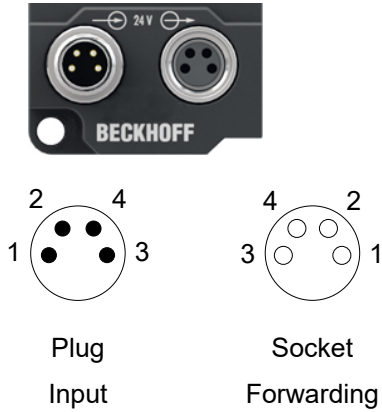


Fig. 5: M8 connector

Contact	Function	Description	Core color <sup>1)</sup>
1	U <sub>S</sub>	Control voltage	Brown
2	U <sub>P</sub>	Peripheral voltage	White
3	GND <sub>S</sub>	GND to U <sub>S</sub>	Blue
4	GND <sub>P</sub>	GND to U <sub>P</sub>	Black

<sup>1)</sup> The core colors apply to cables of the type: Beckhoff ZK2020-3xxx-xxxx

4.3.2 Status LEDs

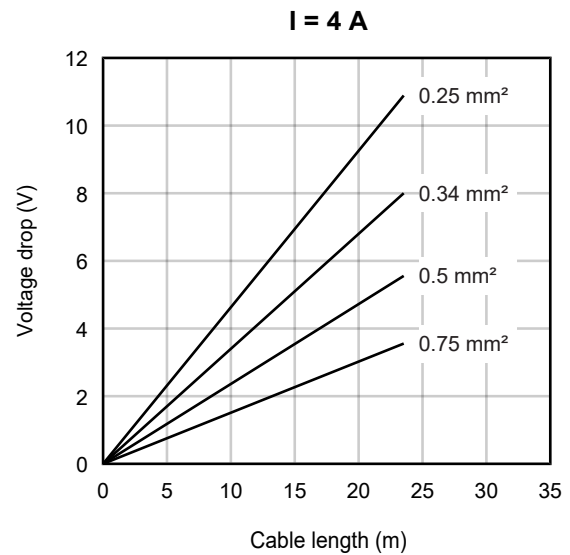
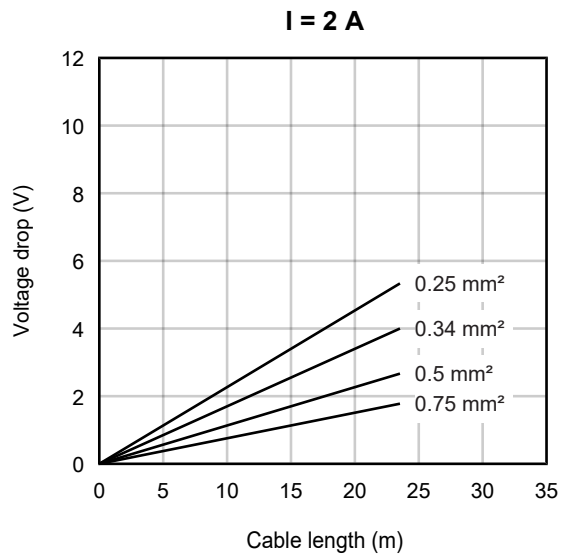


LED	Display	Meaning
U <sub>S</sub> (control voltage)	off	The supply voltage U <sub>S</sub> is not available.
	green illuminated	The supply voltage U <sub>S</sub> is available.
U <sub>P</sub> (peripheral voltage)	off	The supply voltage U <sub>P</sub> is not available.
	green illuminated	The supply voltage U <sub>P</sub> is available.

### 4.3.3 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 the supply line



## 4.4 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<sub>DC</sub> 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<sub>DC</sub> 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. 6: UL label

## 4.5 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.

## 5 Commissioning

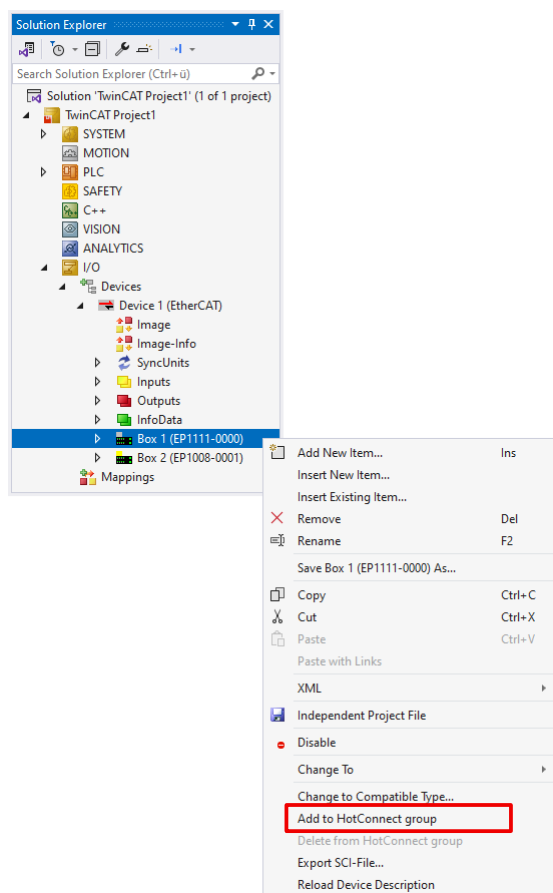
### 5.1 Integrating into a TwinCAT project

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

### 5.2 Creating a Hot Connect group

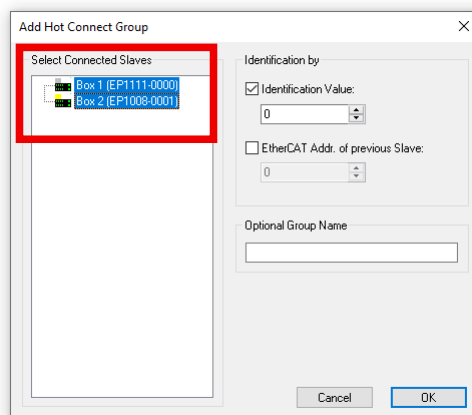
Proceed as follows to create a hot connect group with the EP1111-0000:

1. Arrange the EtherCAT devices so that the EP1111-0000 is the first EtherCAT device in the planned hot connect group.
2. In Solution Explorer, right-click on EP1111-0000 and select "Add to HotConnect group" in the context menu.

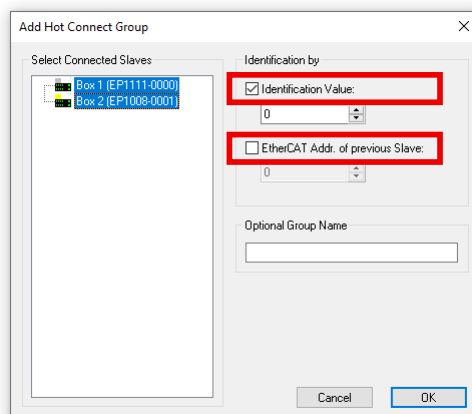




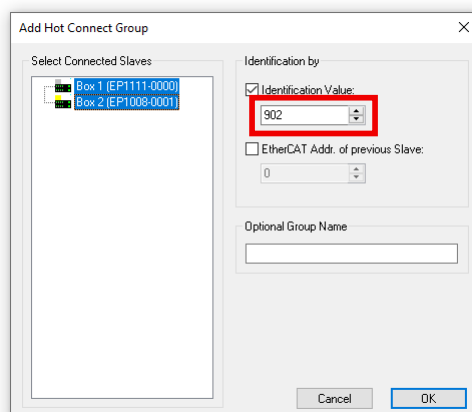
3. Select the EtherCAT devices for the hot connect group in the "Select Connected Slaves" left-hand field.



4. Ensure that the checkboxes are set correctly:
  - check in "Identification Value".
  - check removed in "EtherCAT Addr. of previous Slave".



5. Set the desired ID under "Identification Value" (0 ... 999).

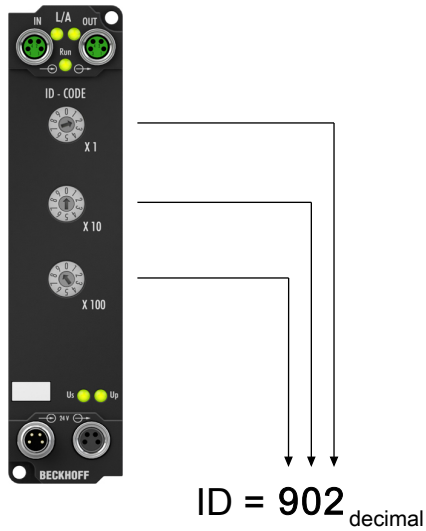


## 5.3 Set hot connect ID

The units, tens and hundreds digits of the ID each have their own ID switch. The ID switches are labelled accordingly:

- X 1
- X 10
- X 100

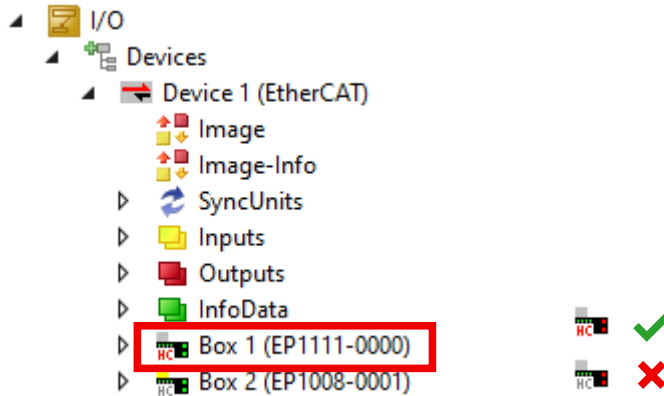
### Sample



## 5.4 Troubleshooting

### Check the structure of the hot connect group

The EP1111-0000 must be the first device in the hot connect group.  
The first EtherCAT device in a hot connect group is marked with a red "HC" symbol.

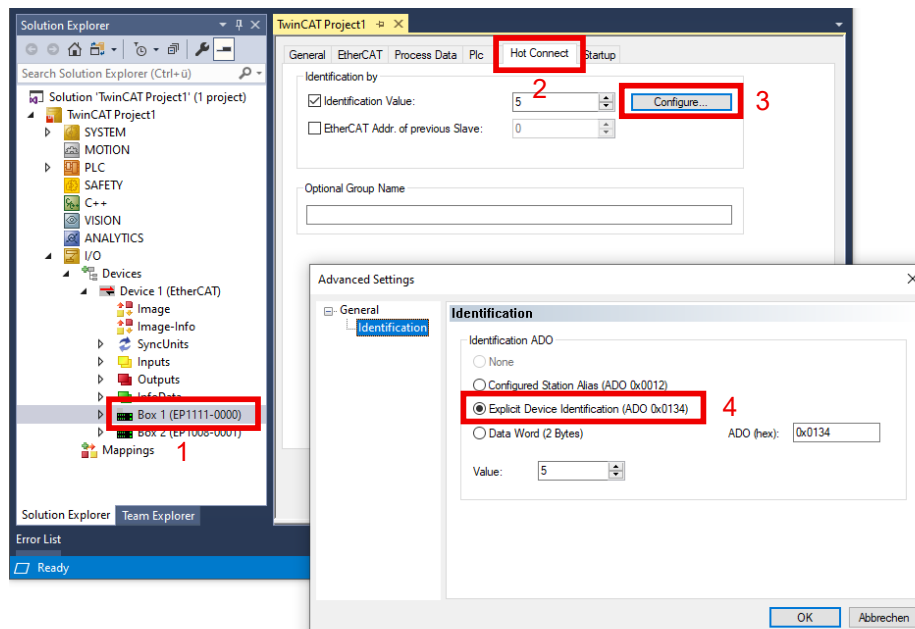


If an EtherCAT device other than the EP1111-0000 is marked with a red "HC" symbol, proceed as follows:

1. Right-click on the EtherCAT device with the red "HC" symbol in the Solution Explorer.
2. Click on "Delete from Hotconnect group" in the context menu.
3. Create the hot connect group correctly. See chapter [Creating a Hot Connect group](#) [► 24].

### Check the addressing method

1. Go to Solution Explorer and click on EP1111-0000.
2. Select the "Hot Connect" tab.
3. Click the "Configure" button.
4. Ensure that "Explicit Device Identification" is selected.



## 5.5 Decommissioning

### **WARNING**

#### **Risk of electric shock!**

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

## 6 CoE parameters

### 6.1 Directory

Index (hex)	Name
1000	<a href="#">Device type [► 30]</a>
1008	<a href="#">Device name [► 30]</a>
1009	<a href="#">Hardware version [► 30]</a>
100A	<a href="#">Software version [► 30]</a>
1018	<a href="#">Identity [► 30]</a>
1A00	<a href="#">ID TxPDO-Map Inputs [► 30]</a>
1C00	<a href="#">Sync manager type [► 30]</a>
1C12	<a href="#">RxPDO assign [► 31]</a>
1C13	<a href="#">TxPDO assign [► 31]</a>
1C33	<a href="#">SM input parameter [► 32]</a>
F000	<a href="#">Modular device profile [► 33]</a>
F008	<a href="#">Code word [► 33]</a>
F600	<a href="#">DIG Inputs Ch.1 [► 33]</a>

## 6.2 Object description and parameterization

### 6.2.1 Standard objects

#### 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 CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	0x00001389 (5001 <sub>dec</sub> )

#### Index 1008 Device name

Index (hex)	Name	Meaning	Data type	Flags	Default
1008:0	Device name	Device name of the EtherCAT slave	STRING	RO	EP1111-0000

#### 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 <sub>dec</sub> )
1018:01	Vendor ID	Vendor ID of the EtherCAT slave	UINT32	RO	0x00000002 (2 <sub>dec</sub> )
1018:02	Product code	Product code of the EtherCAT slave	UINT32	RO	0x04574052 (72826962 <sub>dec</sub> )
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	-
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 <sub>dec</sub> )

#### Index 1A00 ID TxPDO-Map Inputs

Index (hex)	Name	Meaning	Data type	Flags	Default
1A00:0	ID TxPDO-Map Inputs	PDO Mapping TxPDO 1	UINT8	RO	0x01 (1 <sub>dec</sub> )
1A00:01	SubIndex 001	1. PDO Mapping entry (object 0xF600 (DIG Inputs Ch.1), entry 0x01 (ID))	UINT32	RO	0xF600:01, 16

#### Index 1C00 Sync manager type

Index (hex)	Name	Meaning	Data type	Flags	Default
1C00:0	Sync manager type	Using the Sync Managers	UINT8	RO	0x04 (4 <sub>dec</sub> )
1C00:01	SubIndex 001	Sync-Manager Type Channel 1: Mailbox Write	UINT8	RO	0x01 (1 <sub>dec</sub> )
1C00:02	SubIndex 002	Sync-Manager Type Channel 2: Mailbox Read	UINT8	RO	0x02 (2 <sub>dec</sub> )
1C00:03	SubIndex 003	Sync-Manager Type Channel 3: Process Data Write (Outputs)	UINT8	RO	0x03 (3 <sub>dec</sub> )
1C00:04	SubIndex 004	Sync-Manager Type Channel 4: Process Data Read (Inputs)	UINT8	RO	0x04 (4 <sub>dec</sub> )

**Index 1C12 RxPDO assign**

Index (hex)	Name	Meaning	Data type	Flags	Default
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RW	0

**Index 1C13 TxPDO assign**

Index (hex)	Name	Meaning	Data type	Flags	Default
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x02 (2 <sub>dec</sub> )
1C13:01	Subindex 001	1. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A00 (6656 <sub>dec</sub> )

## Index 1C33 SM input parameter

Index (hex)	Name	Meaning	Data type	Flags	Default
1C33:0	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20 (32 <sub>dec</sub> )
1C33:01	Sync mode	Current synchronization mode: <ul style="list-style-type: none"> <li>0: Free Run</li> <li>1: Synchron with SM 3 Event (no outputs available)</li> <li>2: DC - Synchron with SYNC0 Event</li> <li>3: DC - Synchron with SYNC1 Event</li> <li>34: Synchron with SM 2 Event (outputs available)</li> </ul>	UINT16	RW	0x0000 (0 <sub>dec</sub> )
1C33:02	Cycle time	Cycle time (in ns): <ul style="list-style-type: none"> <li>Free Run: Cycle time for the local timer</li> <li>Synchron with SM 2 Event: Cycle time for the master</li> <li>DC-Mode: SYNC0/SYNC1 Cycle Time</li> </ul>	UINT32	RW	0x000186A0 (100000 <sub>dec</sub> )
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, DC mode only)	UINT32	RO	0
1C33:04	Sync modes supported	Supported synchronization modes: <ul style="list-style-type: none"> <li>Bit 0: Free Run is supported</li> <li>Bit 1: Synchron with SM 2 Event is supported (outputs available)</li> <li>Bit 1: Synchron with SM 3 Event is supported (no outputs available)</li> <li>Bit 2-3 = 01: DC-Mode is supported</li> <li>Bit 4-5 = 01: Input shift through local event (outputs available)</li> <li>Bit 4-5 = 10: Input shift with SYNC1 event (no outputs available)</li> <li>Bit 14 = 1: Dynamic times (measurement through writing of 1C33:08)</li> </ul>	UINT16	RO	0x0001 (1 <sub>dec</sub> )
1C33:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x000124F8 (75000 <sub>dec</sub> )
1C33:06	Calc and copy time	Time between reading of the inputs and the inputs being available for the master (in ns, only DC mode)	UINT32	RO	0
1C33:07	Minimum delay time		UINT32	RO	0
1C33:08	Command	<ul style="list-style-type: none"> <li>0: Measurement of the local cycle time is stopped</li> <li>1: Measurement of the local cycle time is started</li> </ul> <p>The entries 1C33:03, 1C33:06, and 1C33:09 are updated with the maximum measured values. If remeasurement is carried out, the measured values are reset</p>	UINT16	RW	0
1C33:09	Maximum Delay time	Time between SYNC1 event and reading of the inputs (in ns, DC mode only)	UINT32	RO	0
1C33:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC mode only)	UINT16	RO	0
1C33:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0
1C33:0D	Shift too short counter	Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)	UINT16	RO	0
1C33:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)	BOOLEAN	RO	0



## 6.2.2 Profile-specific objects

### Index F000 Modular device profile

Index (hex)	Name	Meaning	Data type	Flags	Default
F000:0	Modular device profile	General information for the modular device profile	UINT8	RO	0x02 (2 <sub>dec</sub> )
F000:01	Module index distance	Index distance of the objects of the individual channels	UINT16	RO	0x0010 (16 <sub>dec</sub> )
F000:02	Maximum number of modules	Number of channels	UINT16	RO	0x0002 (2 <sub>dec</sub> )

### Index F008 Code word

Index (hex)	Name	Meaning	Data type	Flags	Default
F008:0	Code word		UINT32	RW	0x00000000 (0 <sub>dec</sub> )

### Index F600 DIG Inputs CH.1

Index (hex)	Name	Meaning	Data type	Flags	Default
F600:0	DIG Inputs Ch.1		UINT8	RO	0x01 (1 <sub>dec</sub> )
F600:01	ID	The value that is set by the ID switches.	UINT16	RO	0x0000 (0 <sub>dec</sub> )

## 7 Appendix

### 7.1 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

## 7.2 Accessories

### Mounting

Ordering information	Description	Link
ZS5300-0011	Mounting rail	<a href="#">Website</a>

### Labeling material, protective caps

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

### 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	<a href="#">Website</a>
ZK1093-3xxx-xxxx	EtherCAT cable M8, yellow	<a href="#">Website</a>
ZK2020-3xxx-xxxx	Power cable M8, 4-pin	<a href="#">Website</a>

### 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



### Further accessories

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

## 7.3 Version identification of EtherCAT devices

### 7.3.1 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.

### 7.3.2 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

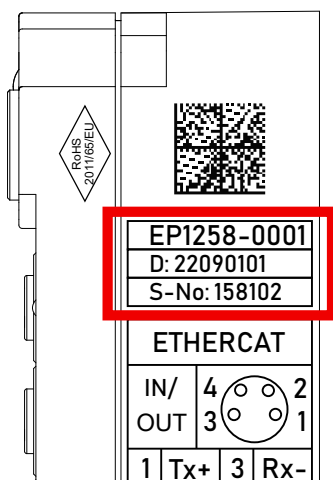


Fig. 7: EP1258-00001 IP67 EtherCAT Box with batch number/DateCode 22090101 and unique serial number 158102

### 7.3.3 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.

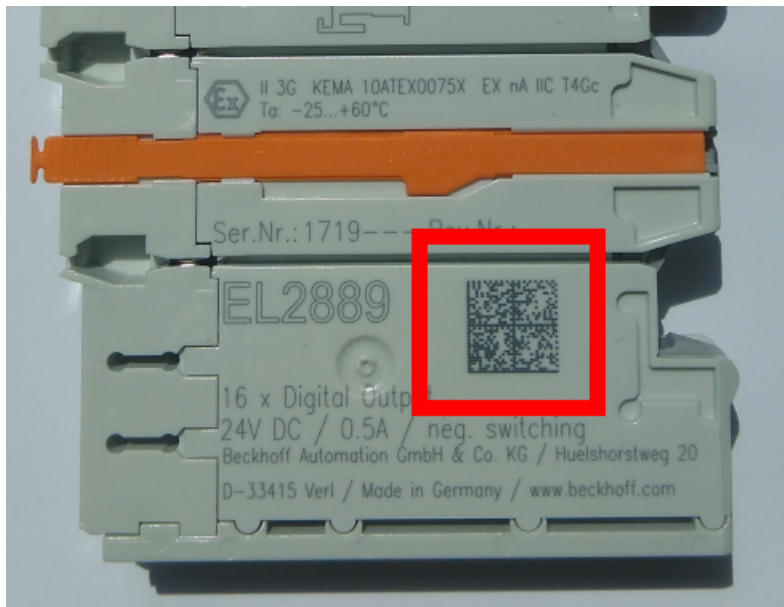


Fig. 8: BIC as data matrix code (DMC, code scheme ECC200)

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

**1P**072222**SBTN**k4p562d7**1K**EL1809 **Q1** **51S**678294

Accordingly as DMC:



Fig. 9: 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.

## 7.3.4 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.

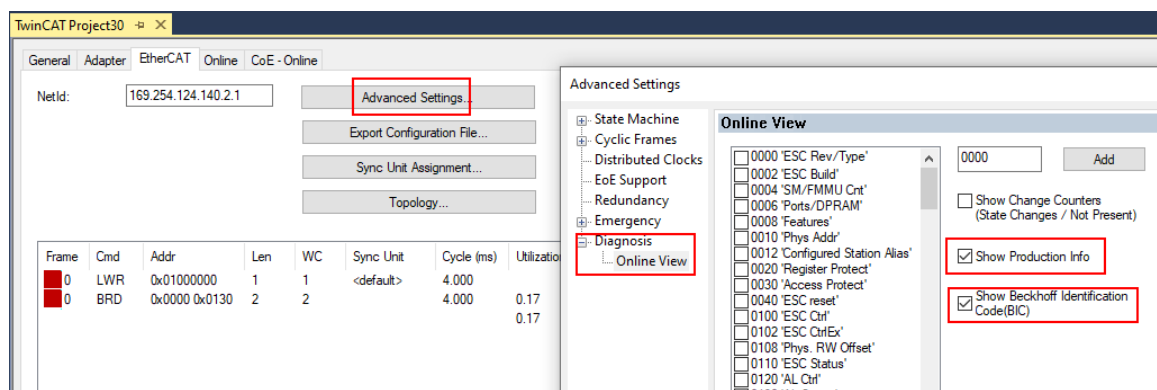
### EtherCAT devices (IP20, IP67)

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	0x170fb277e

- 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.

## 7.4 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](http://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:

- support
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- and extensive training program for Beckhoff system components

Hotline: +49 5246 963 157  
e-mail: [support@beckhoff.com](mailto:support@beckhoff.com)  
web: [www.beckhoff.com/support](http://www.beckhoff.com/support)

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- hotline service

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