Your Global Automation Partner

TURCK

TBIP-L...-4FDI-4FDX
Safety Block I/O Modules

Instructions for Use

Table of Contents

1 About these instructions

These operating instructions describe the structure, functions and the use of the product and will help you to operate the product as intended. These instructions contain rules for the use of the devices in Safety Instrumented Systems (SIS). The assessment of the safety related values is based on IEC 61508, ISO 13849-1 and IEC 62061.

Read these instructions carefully before using the product. This is to avoid possible damage to persons, property or the device. Retain the instructions for future use during the service life of the product. If the product is passed on, pass on these instructions as well.

1.1 Target groups

These instructions are directed to qualified personnel or technically trained personnel (planer, developer, design engineer, installer, electrical specialist, operator, maintenance personnel etc.) and must be carefully read by anyone anyone who assembles, commissions, operates, maintains, dismantles or disposes of the device.

When using the device in Ex circuits, the user must also have an additional knowledge of explosion protection (IEC/EN 60079-14 etc.).

1.2 Explanation of symbols used

The following symbols are used in these instructions:

	**DANGER** DANGER indicates a dangerous situation with high risk of death or severe injury if not avoided.
	**WARNING** WARNING indicates a dangerous situation with medium risk of death or severe injury if not avoided.
	**CAUTION** CAUTION indicates a dangerous situation of medium risk which may result in minor or moderate injury if not avoided.
	**NOTICE** NOTICE indicates a situation which may lead to property damage if not avoided.
	**NOTE** NOTE indicates tips, recommendations and useful information on specific actions and facts. The notes simplify your work and help you to avoid additional work.
▶	**CALL TO ACTION** This symbol denotes actions that the user must carry out.
⇨	**RESULTS OF ACTION** This symbol denotes relevant results of actions.

1.3 Additional documents

The following additional documents are available online at **www.turck.com**:

- Data sheet
- Safety Manual
- Declarations of conformity (current versions)
- Approvals
- Notes on Use in Ex zone 2 and 22 (100022986)

1.4 Feedback about these instructions

We make every effort to ensure that these instructions are as informative and as clear as possible. If you have any suggestions for improving the design or if some information is missing in the document, please send your suggestions to techdoc@turck.com.

2 Notes on the product

2.1 Product identification

These instructions apply for the following full safety modules with CIP Safety:

- TBIP-L4-4FDI-4FDX
- TBIP-L5-4FDI-4FDX
- TBIP-LL-4FDI-4FDX

2.2 Scope of delivery

The scope of delivery includes:

- TBIP-L…-4FDI-4FDX
- M12 closure caps
- 7/8'' blind caps (not suitable to guarantee IP67/IP69K)

2.3 Turck service

Turck supports you with your projects, from initial analysis to the commissioning of your application. The Turck product database under www.turck.com contains software tools for programming, configuration or commissioning, data sheets and CAD files in numerous export formats.

The contact details of Turck subsidiaries worldwide can be found on p. [▷ 99].

3 For your safety

The product is designed according to state-of-the-art technology. However, residual risks still exist. Observe the following warnings and safety notices to prevent damage to persons and property. Turck accepts no liability for damage caused by failure to observe these warning and safety notices.

3.1 Intended use

TBIP-L…-4FDI-4FDX is a decentralized safety module for CIP Safety. The module collects field signals and forwards them safely to a CIP Safety master. Due to the temperature range from -40…+70 °C and IP67/IP69K protection, the module can be used directly on the machine.

The module serves for controlling signal devices as for example emergency stop buttons, position switches or OSSDs which are used to ensure human, material or machine protection.

TBIP-L…-4FDI-4FDX can be used in the following applications:

- Applications up to SIL 3 (according to IEC 61508)
- Applications up to SIL CL3 (according to EN 62061)
- Applications up to Category 4 and Performance Level e (according to EN ISO 13849-1)

The devices may only be used as described in these instructions. Any other use is not in accordance with the intended use. Turck accepts no liability for any resulting damage.

3.1.1 Reasonably foreseeable misuse

The devices are not suitable for:

- Outdoor use
- The permanent use in liquids
- The use in Zone 0 and Zone 1

Modifications to the device

The device must not be modified either constructionally or technically.

3.2 General safety notes

- The device may only be assembled, installed, operated, parameterized and maintained by professionally-trained personnel.
- The device may only be used in accordance with applicable national and international regulations, standards and laws.
- The device meets the EMC requirements for industrial areas. When used in residential areas, take measures to avoid radio interference.
- The Performance Level as well as the safety category according to EN ISO 13849-1 depend on the external wiring, the application, the choice of the control devices as well as their arrangement on the machine.
- The user has to execute a risk assessment according to EN ISO 12100:2010.
- Based on the risk assessment a validation of the complete plant/machine has to be done in accordance with the relevant standards.
- Operating the device beyond the specification can lead to malfunctions or to the destruction of the device. The installation instructions must be observed.
- For trouble-free operation, the device must be properly transported, stored, installed and mounted.
- For the release of safety circuits in accordance with EN IEC 60204-1, EN ISO 13850 only use the output circuits of connectors C4… C7 or X4…X7.
- Change the default password of the integrated web server after the first login. Turck recommends using a secure password.

3.3 Residual risks (EN ISO 12100:2010)

The wiring proposals described in the following have been tested under operational conditions with the greatest care. Together with the connected periphery of safety related equipment and switching devices they fulfill relevant standards.

Residual risks remain, if

- the proposed wiring concept is is changed and connected safety related devices or protective devices are possibly not or insufficiently included in the safety circuit.
- the operator does not observe the relevant safety regulations specified for the operation, adjustment and maintenance of the machine. Observe intervals for inspection and maintenance of the machine.

Failure to follow these instructions can result in serious injury or equipment damage.

3.4 Warranty and liability

Any warranty and liability is excluded for:

- Improper application or not intended use of the product
- Non-observance of the user manual
- Mounting, installation, configuration or commissioning by unqualified persons

3.5 Notes on explosion protection

- When operating the device in a hazardous area, the user must have a working knowledge of explosion protection (IEC/EN 60079-14, etc.).
- Observe national and international regulations for explosion protection.
- Only use the device within the permitted operating and ambient conditions (see Certification data and conditions resulting from the Ex-approval).

3.6 Ex approval requirements for use in Ex area

- Only use the device in an area with no more than pollution degree 2.
- Only disconnect and connect circuits when no voltage is applied.
- Only operate the switches if no voltage is present.
- Connect the metal protective cover to the equipotential bonding in the Ex area.
- Ensure impact resistance in accordance with EN IEC 60079-0 — alternative measures:
  - Install the device in the TB-SG-L protective housing (available in the set with Ultem window: ID 100014865) and replace the service window with an Ultem window.
  - Install the device in an area offering impact protection (e.g. in robot arm) and attach a warning: "DANGER: Only connect and disconnect circuits when no voltage is present. Do not operate switches when energized."
- Do not install the device in areas critically exposed to UV light.
- Prevent risks caused by electrostatic charge.
- Protect unused connectors with dummy plugs to ensure protection class IP67.

4 Product description

The TBIP-L…-4FDI-4FDX is a safety block I/O module for CIP Safety via EtherNet/IP. The device has four 2-channel digital safety inputs (FDI) for the connection of different safety sensors as for example light barriers or emergency stop buttons. Four further safety channels (FDX) can be freely used as inputs (FDI) or outputs (FDO).

The configuration of the safe I/Os and their function is realized by means of a software tool the Turck Safety Configurator.

The device has eight M12 connectors for connecting safe sensors and actuators.

For connecting the supply voltage, 4-pin 7/8'' connectors (TBIP-L4), 5-pin 7/8'' connectors (TBIP-L5) or 5-pin L coded M12 connectors (TBIP-LL) are available.

4.1 Device overview

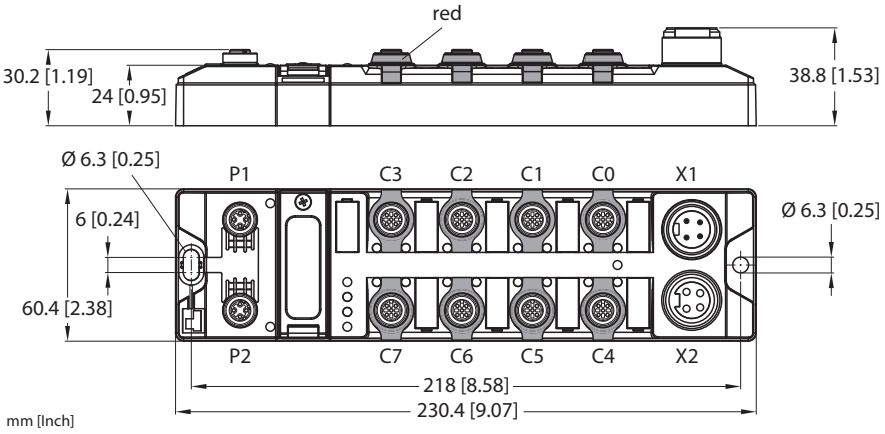


Fig. 1: TBIP-L4-4FDI-4FDX

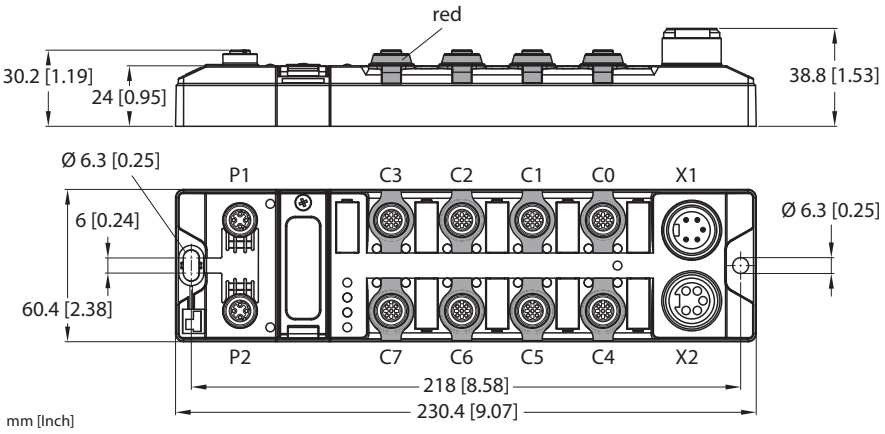


Fig. 2: TBIP-L5-4FDI-4FDX

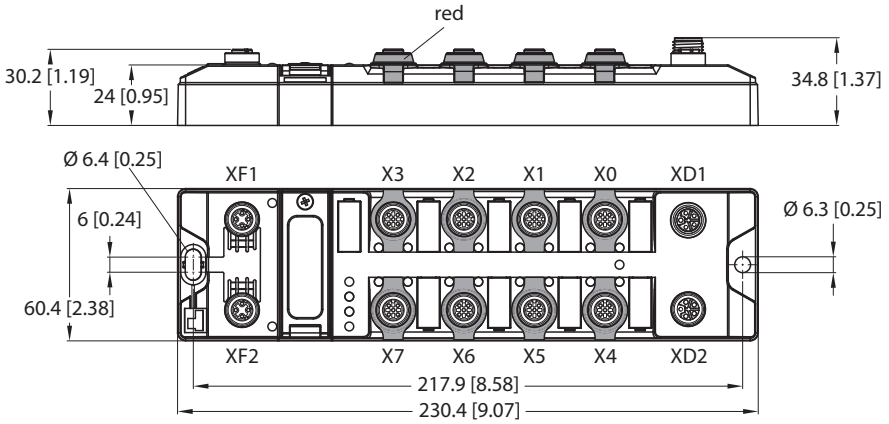


Fig. 3: TBIP-LL-4FDI-4FDX

4.1.1 Type label

TBIP-L4-4FDI-4FDX

Ident-No.:	100001827	Hans Turck GmbH & Co. KG
HW:		D-45466 Mülheim a. d. Ruhr
Charge code:		www.turck.com
YoC:		Made in Germany

Fig. 4: Type label BIP-L4-4FDI-4FDX

TBIP-L5-4FDI-4FDX

Ident-No.:	100001828	Hans Turck GmbH & Co. KG
HW:		D-45466 Mülheim a. d. Ruhr
Charge code:		www.turck.com
YoC:		Made in Germany

Fig. 5: Type label BIP-L5-4FDI-4FDX

TBIP-LL-4FDI-4FDX

Ident-No.:	100027259	Hans Turck GmbH & Co. KG
HW:		D-45466 Mülheim a. d. Ruhr
Charge code:		www.turck.com
YoC:		Made in Germany

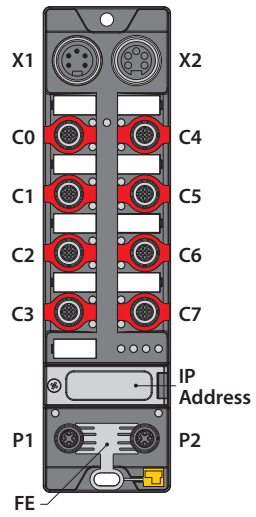
Fig. 6: Type label TBIP-LL-4FDI-4FDX

4.2 Properties and features

- Four safety-related SIL3 inputs FDI
- Four safety-related SIL3 in-/outputs FDX
- Safe PP/PM-switching of the actuator power supply
- Usable in SIL CL3 according to EN 62061 or PLe according to DIN EN ISO 13849-1
- Power supply
  - TB…- L4 and and TB…- L5: 7/8" connector
  - TB…-LL: M12 connector
- Two 4-pin M12-connectors for Ethernet
- Multiple LEDs for status indication
- Integrated Ethernet switch, allows line topology
- Integrated web server
- Transmission rate 10 Mbps and 100 Mbps
- Fiberglass reinforced housing
- Shock and vibration tested
- Fully potted module electronics
- Protection class IP65/IP67/IP69K

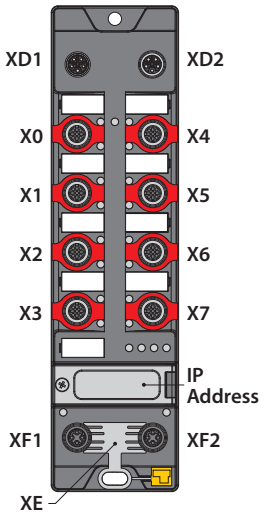
4.2.1 Switches and connectors

TBIP-L4-4FDI-4FDX/TBIP-L5-4FDI-4FDX



	Meaning
X1	Power IN TBIP-L4-4FDI-4FDX: 4-pin TBIP-L5-4FDI-4FDX: 5-pin
X2	Power OUT TBIP-L4-4FDI-4FDX: 4-pin TBIP-L5-4FDI-4FDX: 5-pin
C0	FDI0/1, safety-related input
C1	FDI2/3, safety-related input
C2	FDI4/5, safety-related input
C3	FDI6/7, safety-related input
C4	FDX8/9, safety-related in-/output
C5	FDX10/11, safety-related in-/output
C6	FDX12/13, safety-related in-/output
C7	FDX14/15, safety-related in-/output
IP address	Rotary coding switch for address setting (last byte of the IP address for the safe function unit)
P1	Ethernet 1
P2	Ethernet 2
FE	Functional earth

TBIP-LL-4FDI-4FDX



	Meaning
XD1	Power IN
XD2	Power OUT
X0	FDI0/1, safety-related input
X1	FDI2/3, safety-related input
X2	FDI4/5, safety-related input
X3	FDI6/7, safety-related input
X4	FDX8/9, safety-related in-/output
X5	FDX10/11, safety-related in-/output
X6	FDX12/13, safety-related in-/output
X7	FDX14/15, safety-related in-/output
IP address	Rotary coding switch for address setting (last byte of the IP address for the safe function unit)
XF1	Ethernet 1
XF2	Ethernet 2
FE	Functional earth

4.2.2 Block diagram

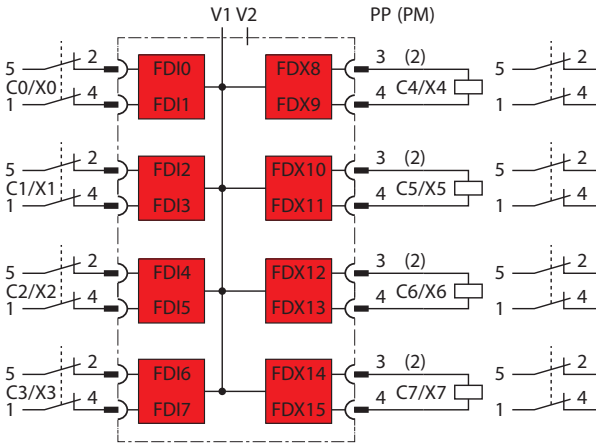


Fig. 7: Block diagram TBIP-L…-4FDI-4FDX

4.3 Functions and operating modes

4.3.1 Safety function

The TBIP-L…-4FDI-4FDX provide four safe digital SIL3 inputs (FDI) and four SIL3-connectors (FDX), configurable as in- or outputs.

The following devices can be connected to the safety inputs:

- 1- and 2-channel safety switches and sensors
- Contact based switches, e.g. emergency switches, protective door switches
- Sensors with OSSD switching outputs
- Antivalently switching OSSD sensors

The four safe SIL3 outputs can be used PP- or PM-switching.

Safe Status

In the safe state the device outputs are in LOW-state (0). The inputs report a LOW-state (0) to the logic.

Fatal Error

- Incorrect wiring at the output (i.e. capacitive load, energetic recovery)
- Short-circuit at the line control output T2
- Incorrect power supply
- Strong EMC disturbances
- Internal device error

4.3.2 Safety inputs (FDI)

The safe inputs are suitable for the connection of safety-related sensors:

- Max. eight 2-channel safety switches and sensors
- Contact based switches, e.g. emergency switches, protective door switches
- Sensors with OSSD switch outputs with test pulses
- Sensors with OSSD switch outputs without test pulses

Error detection and diagnostics

Internal:

- Device self test: Diagnosis of internal device errors

External:

- Cross connection diagnosis: The device detects a cross connection between the sensor supplies at the inputs or between one sensor supply to another potential (if the test pulses are activated)
- Discrepancy diagnosis: for 2-channel inputs
- Short-circuit diagnosis

Parameters

For each input the following types can be selected:

- Safe input for potential free contacts (NC/NC)
- Safe antivalent input for potential-free contacts (NC/NO)
- Safe electronic input at OSSD output with test pulses

4.3.3 Safety outputs (FDO)

The safe SIL3 outputs can be used PP- or PM-switching.

- Max. four 2-channel safety output (outputs are supplied via V1)

Error detection and diagnostics

Internal:

- Device self test: Diagnosis if an output can not change to the safe state due to an internal error.

External:

- Overload diagnosis
- Cross connection diagnosis
- Short-circuit diagnosis

Parameters

- Safe output PP-switching:
  Safe output, the load is connected between P-terminal and Ground-terminal.
- Safe output PM-switching:
  Safe output, the load is connected between P-terminal and M-terminal (mass), necessary for special loads which need a separation from Ground.

4.3.4 Configuration memory

A pluggable memory stick is included in the scope of delivery of TBIP-L…-4FDI-4FDX. It serves for storing the safety function configured via Turck Safety Configurator. It allows to transfer the configuration of one device to another device, e. g. for device exchange.

5 Installing

5.1 Installing the device in Zone 2 and Zone 22

In Zone 2 and Zone 22, the devices can be used in conjunction with the protective housing set TB-SG-L (ID 100014865).

DANGER
Potentially explosive atmosphere
Risk of explosion through spark ignition
For use in Zone 2 and Zone 22:
- ▶ Only install the device if there is no potentially explosive atmosphere present.
- ▶ Observe requirements for Ex approval.

- ▶ Unscrew the housing. Use Torx T8 screwdriver.
- ▶ Replace the service window with the enclosed Ultem window.
- ▶ Place the device on the base plate of the protective housing and fasten both together on the mounting plate, see [▷ 17].
- ▶ Connect the device, see [▷ 21].
- ▶ Mount and screw the housing cover according to the following figure. The tightening torque for the Torx T8 screw is 0.5 Nm.

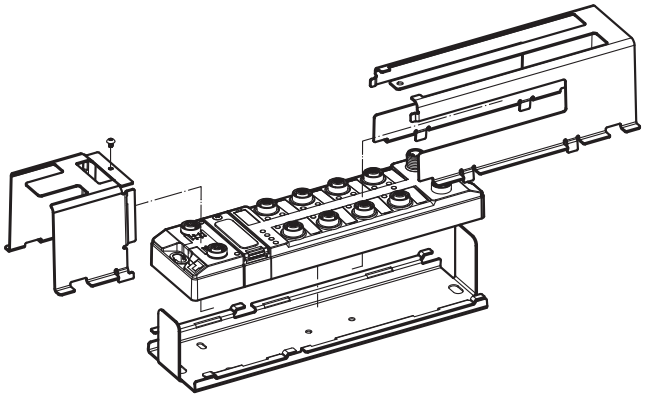


Fig. 8: Mounting the device in protection housing TB-SG-L

5.2 Mounting onto a mounting plate

NOTICE
Mounting on uneven surfaces
Device damage due to stresses in the housing
- ▶ Fix the device on a flat mounting surface.
- ▶ Use two M6 screws to mount the device.

The device can be screwed onto a flat mounting plate.

- ▶ Attach the module to the mounting surface with two M6 screws. The maximum tightening torque for the screws is 1.5 Nm.
- ▶ Avoid mechanical stresses.
- ▶ Optional: Ground the device.

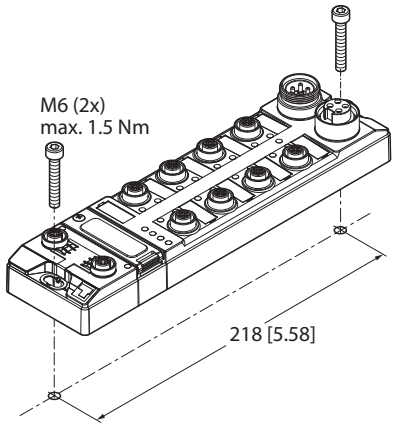


Fig. 9: Mounting the device onto a mounting plate

5.3 Grounding the device

5.3.1 Equivalent wiring diagram and shielding concept

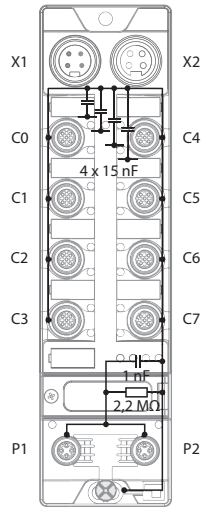


Fig. 10: Equivalent wiring diagram and shielding concept – TBIP-L4-4FDI-4FDX

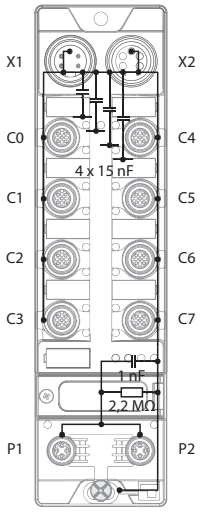


Fig. 11: Equivalent wiring diagram and shielding concept – TBIP-L5-4FDI-4FDX

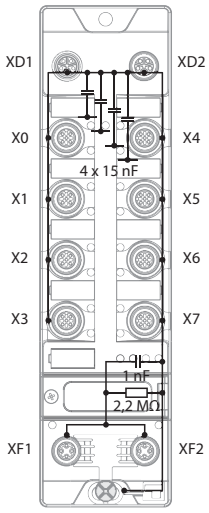


Fig. 12: Equivalent wiring diagram and shielding concept – TBIP-LL-4FDI-4FDX

5.3.2 Shielding of the fieldbus and I/O level

The fieldbus and the I/O level of the modules can be grounded separately.

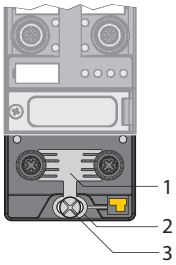


Fig. 13: Grounding clip (1), grounding ring (2) and metal screw (3)

The grounding ring (2) is the module grounding. The shielding of the I/O level is permanently connected to the module grounding. The module grounding is only connected to the reference potential of the installation when the module is mounted.

I/O level shielding

In the case of direct mounting on a mounting plate, the module grounding is connected to the reference potential of the system via the metal screw in the lower mounting hole (3). If module grounding is not desired, the electrical connection to the reference potential must be interrupted, e.g. by using a plastic screw.

Fieldbus level shielding

The grounding of the fieldbus level can either be connected directly via the grounding clip (1) or connected and routed indirectly via an RC element to the module grounding. If the grounding is to be routed via an RC element, the grounding clip must be removed.

In the delivery state, the grounding clip is mounted.

5.3.3 Disconnecting the direct grounding of the fieldbus level: removing the grounding clip

- ▶ Use a flat screwdriver to slide the grounding clip forward and remove it.

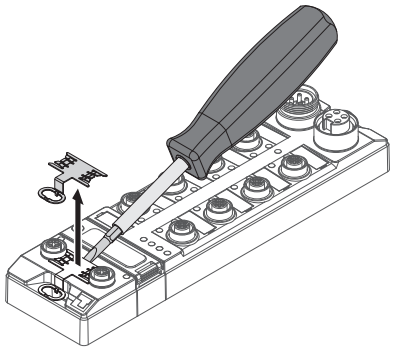


Fig. 14: Removing the grounding clamp

5.3.4 Grounding the fieldbus level directly: inserting the grounding clip

- ▶ Place the grounding clip between the fieldbus connectors by using a screwdriver in such way that the clip contacts the metal housing of the connectors.
- ▶ The shielding of the fieldbus cables is connected to the grounding clip.

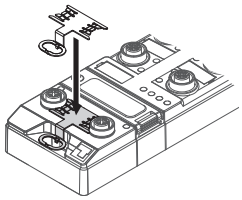


Fig. 15: Mounting the grounding clip

5.3.5 Grounding the device – mounting on a mounting plate

- ▶ For mounting onto a mounting plate: Fix the device with a metal screw through the lower mounting hole.
- ⇨ The module grounding is connected to the reference potential of the installation via the metal screw.
- ⇨ With mounted grounding clip: The shielding of the fieldbus and the module grounding are connected to the reference potential of the installation.

6 Connecting

WARNING
Intrusion of liquids or foreign bodies through leaking connections
Danger to life due to failure of the safety function

- Tighten M12 connectors with a tightening torque of 0.6 Nm.
- Tighten 7/8" connectors with a tightening torque of 0.8 Nm.
- Only use accessories that guarantee the protection class.
- Close unused M12 connectors with the supplied screw caps. The tightening torque for the screw caps is 0.5 Nm.
- Use appropriate 7/8" sealing caps, e.g. type RKMV-CCC. The caps not part of the scope of delivery.

6.1 Connecting the device in Zone 2 and Zone 22

DANGER
Potentially explosive atmosphere
Risk of explosion through spark ignition
When used in Zone 2 and Zone 22:

- Only disconnect and connect circuits when no voltage is applied.
- Only use connecting cables that are approved for use in potentially explosive atmospheres.
- Use all connectors or seal them with blind plugs.
- Observe requirements for Ex approval.

6.2 Connecting the M12 connectors

- When connecting the cables to the M12-connectors, use the torque screwdriver mentioned below.

Fig. 16: Torque screwdriver

Description	Type	ID
Torque screwdriver, torque range 0.4…1.0 Nm ▪ M8 (SW9) ▪ M12 for bus cables (SW13) ▪ M12 for sensor cables (SW14)	Torque-Wrench-Set Turck Line + BUS	6936171

6.3 Connecting the device to Ethernet

For the connection to Ethernet the device has an integrated auto-crossing switch with two 4-pin, D-coded M12 x 1-Ethernet-connectors. The maximum tightening torque is 0.6 Nm.

TBIP-L4 and TBIP-L5

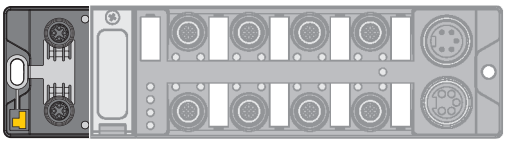


Fig. 17: M12 Ethernet connector

- ▶ Connect the device to Ethernet according to the pin assignment below.
- ▶ Always seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.

Fig. 18: Pin assignment Ethernet connectors

TBIP-LL

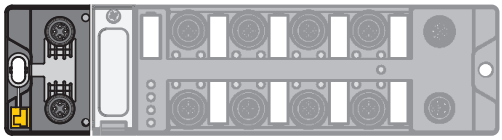


Fig. 19: M12 Ethernet connector

- ▶ Connect the device to Ethernet according to the pin assignment below.
- ▶ Always seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.

Fig. 20: Pin assignment Ethernet connectors

6.4 Connecting the power supply

NOTE
The device is supplied via V1. V2 is only fed through.

TBIP-L4 and TBIP-L5

NOTE
We recommend the use of pre-assembled 5-pole power supply cables,Turck type 52 (e.g. RKM52-1-RSM52). Suitable cables can be found on www.turck.com.

For the connection to the power supply, the device has two 5-pin 7/8" connectors. The power supply connectors are designed as 4-pin (TBIP-L4) or 5-pin (TBIP-L5) connectors. V1 and V2 are galvanically isolated. The maximum tightening torque is 0.8 Nm.

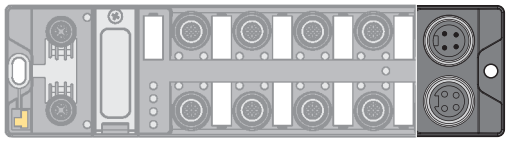


Fig. 21: TBIP-L4… – 7/8"
connector for connecting the supply voltage

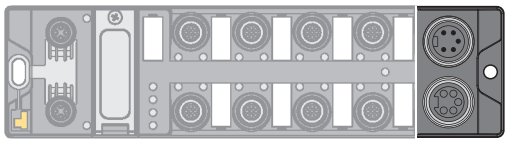


Fig. 22: TBIP-L5… – 7/8"
connector for connecting the supply voltage

▶ Connect the device to the power supply according to the pin assignment shown below.

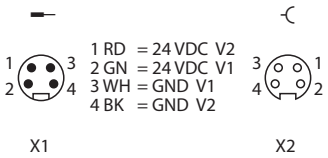


Fig. 23: TBIP-L4-… – pin assignment power supply connectors

Fig. 24: TBIP-L5-… – pin assignment power supply connectors

Connector	Function
X1	Power feed
X2	Continuation of the power to the next node

Voltage	Function
V1	System voltage: power supply 1 (incl. supply of electronics)
V2	Load voltage: power supply 2, fed through, not used in device

TBIP-LL

NOTE
We recommend the use of pre-assembled 5-pole power supply cables e.g. RKP56PLB-1-RSP56PLB/TXG (not suitable for Ex use). Suitable cables can be found on www.turck.com.

For the connection to the power supply, the device has two 5-pin, L coded M12 connectors. V1 and V2 are galvanically isolated. The maximum tightening torque is 0.6 Nm.

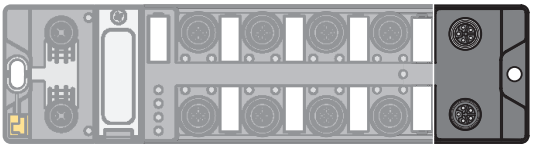


Fig. 25: M12 connector for connecting the supply voltage

- Connect the device to the power supply according to the pin assignment shown below.
- Always seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.

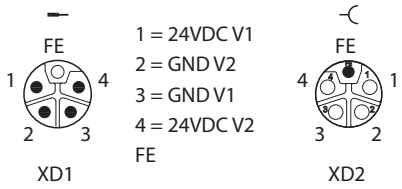


Fig. 26: Pin assignment power supply connectors

Connector	Function
XD1	Power feed
XD2	Continuation of the power to the next node

Voltage	Function
V1	System voltage: power supply 1 (incl. supply of electronics)
V2	Load voltage: power supply 2, fed through, not used in device

6.4.1 24 V supply (SELV/PELV)

WARNING
Incorrect or defective power supply unit
Danger to life due to dangerous voltages on touchable parts
- ▶ Only use for SELV or PELV power supplies in accordance with EN ISO 13849-2, which allow a maximum of 60 VDC or 25 VAC in the event of a fault.

External supply of sensors and actuators

Sensors and actuators with external power supply can also be connected to the device. The use of PELV power supplies must also be guaranteed for externally supplied sensors and actuators.

Decoupling of external electrical circuits

Decouple circuits that are not designed as SELV or PELV systems by means of optocouplers, or other measures.

WARNING
Potential differences
Dangerous additions of voltages
- ▶ Avoid potential differences between internal and external load voltage supplies (24 VDC).

6.5 Connecting safe sensors and actuators

NOTE
We recommend pre-assembled 5-pole sensor cables. Suitable cables can be found on www.turck.com.

DANGER
Wrong supply of sensors and actuators
Danger to life due to external supply
- ▶ Exclude external supply.
- ▶ Guarantee that the inputs are only supplied through the same 24 V source as the device itself.

The device has eight M12 connectors for connecting safe sensors and actuators. The maximum tightening torque is 0.6 Nm.

Safety inputs (FDI)

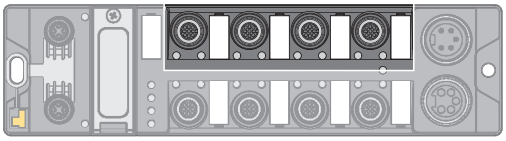


Fig. 27: M12 connector, safety inputs (FDI)

- ▶ Connect the sensors to the device according to the pin assignment.
- ▶ Always seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.

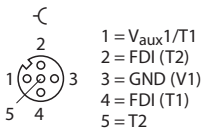


Fig. 28: Pin assignment FDI at C0…C3 or X0…X3

Signal	Meaning
VAUX1/T1	Sensor supply/test pulse 1
FDI (T2)	Digital input 2
GND (V1)	Ground V1
FDI (T1)	Digital input 1
T2	Test pulse 2
FE	FE is connected to the thread of the M12 connector.

Safe in- and outputs (FDX)

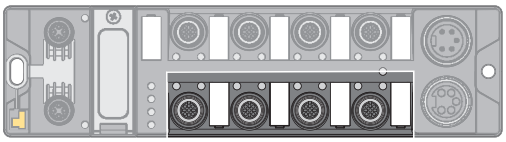


Fig. 29: M12 connector, safety in-/outputs (FDX)

- Connect the sensors and actuators to the device according to the pin assignment.
- Always seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.

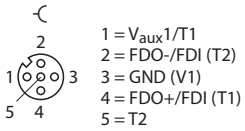


Fig. 30: Pin assignment FDX at C4…C7 or X4…X7

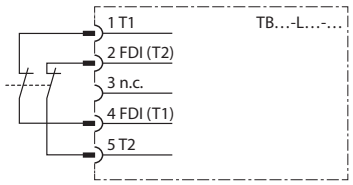
Signal	Meaning
VAUX1/T1	Sensor supply/test pulse 1
FDO-/FDI (T2)	Digital output (M)/digital input 2
GND (V1)	Ground V1
FDO+/FDI (T1)	Digital output (P)/digital input 1
T2	Test pulse 2
FE	FE is connected to the thread of the M12 connector.

DANGER
Connection of fast reacting loads
Danger to life due to connection failures
- Use loads with mechanical or electrical inertia. Positive and negative test pulses have to be tolerated.

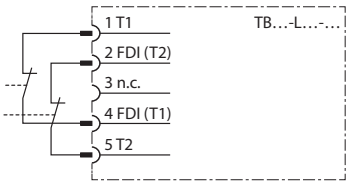
6.6 Switching examples

6.6.1 Inputs

Safe equivalent input for potential-free contacts (normally closed/normally closed)

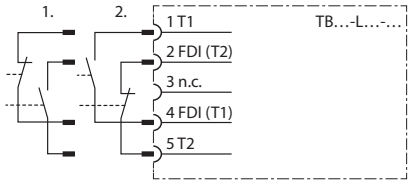


Connected in the switch



Two individual switches switching simultaneously via one application

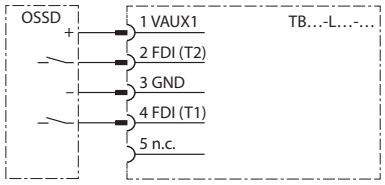
Safe antivalent input for potential-free contacts (normally closed/normally closed)



In the antivalent circuit, switches can be connected in different ways. The decisive factor for enabling is where the normally closed contact is connected.

- Example 1: The LEDs of the inputs are off when not actuated and light up when actuated. Use: e.g. for door monitoring with magnetic reed contacts
- Example 2: The LEDs of the inputs are off when actuated and light up when not actuated. Use: as programming for two-hand switches with two separate contacts

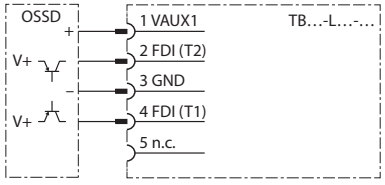
Safe electronic input (OSSD)



With this connection and corresponding parameterization, the pulsing of pins 1 and 5 is switched off. The supply voltage at pin 5 remains switched on.
Note:

▶ To avoid errors, do not use 5-pin cables to the sensor.

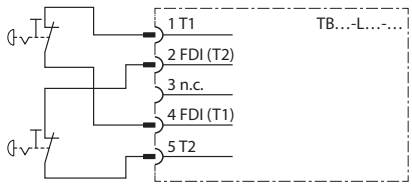
Safe electronic input (OSSD) antivalent switching



With this connection and corresponding parameterization, the pulsing of pins 1 and 5 is switched off. The supply voltage at pin 5 remains switched on. The NC contact is connected to pin 2 in order to receive a release when it is actuated. Connection example: Banner STB Touch
Note:

▶ To avoid errors, do not use 5-pin cables to the sensor.

Safe inputs with single-channel mechanical contacts



Inputs can be queried 1-channel.

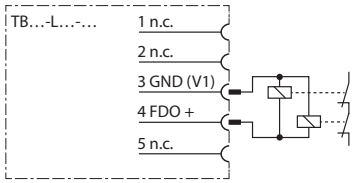
- Connect sensors via two connection cables and a Y-plug (i.e. ID: 6634405) to the M12 sockets of the modules.

Note:
Changes to the preset properties of the inputs directly affect the performance level to be achieved. For more information, see the online help of the Turck Safety Configurator.

6.6.2 Outputs

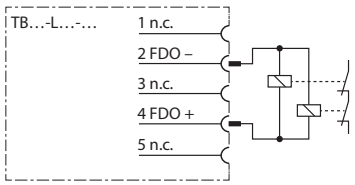
NOTE
Any change in the test pulse interval of the outputs will change the performance level. The software and the online help of the software contain further information.

Safe output PP-switching



- For PP-switching outputs, connect the negative pole of the load to the GND connector of the respective output (pin 3).
- Do not connect the negative pole of the load to the ground of the power supply at a different location.
- The wiring has to allow an exclusion of faults (e.g. cross connection to external potential).

Safe output PM switching



- For PM-switching outputs, connect the negative pole of the load to the M-connector of the respective output (pin 2).

7 Commissioning

7.1 Initial commissioning

7.1.1 Mounting and electrical installation

- IP address am Modul einstellen [▶ 32].
- Please assure the proper closing of the protective cover over the rotary coding switches [▶ 32].
- Mount the device according to the instructions [▶ 16].
- Connect Ethernet cables according to the instructions [▶ 22].
- Connect the power supply according to the instructions [▶ 23].
- Wire the in- and outputs depending on their use [▶ 26], [▶ 28].
- Seal unused connectors with the respective protection caps [▶ 21].

Connecting the supply voltage

- Before the operating voltage is applied, assure that:
  - no wiring or grounding errors exist
  - a safe grounding of the device or of the application is guaranteed
- Connect the supply voltage
- Check if all supply voltages as well as the output voltage are in the permitted range.
- Check if the device works properly or if errors are displayed by controlling the diagnostics an status displays.

7.1.2 Configuring in Turck Safety Configurator

- Configure the device as described in chapter “Configuring the device” [▶ 36].

7.1.3 Commissioning the device at the PLC

- Configure the device in the PLC.
- Configure the device in the PLC configuration software [▶ 63].
- Load parameterization and configuration data via the PLC into the device.
- Execute a functional test.
- Check if the device works according to the configuration and if all safety functions react as expected.

7.2 Safety planning

The operator is responsible for the safety planning.

7.2.1 Prerequisites

- Perform a hazard and risk analysis.
- Develop a safety concept for the machine or plant.
- Calculate the safety integrity for the complete machine or plant.
- Validate the complete system.

7.2.2 Reaction time

If the device is operated with higher availability, the max. reaction time is extended (see "Safety Characteristic Data" [▶ 31]).

In addition to the reaction time in the device, reaction times of the further Safety components have to be system considered eventually. Please find the respective information in the technical data of the respective devices.

Further information about the reaction time can be found in the online help for the Turck Safety Configurator.

7.2.3 Safety characteristic data

Characteristic data	Value	Standard
Performance Level (PL)	e	EN/ISO 13849-1:2015
Safety category	4	
$MTTF_D$	> 100 years (high)	
Permissible duration of use (TM)	20 years	
DC	99 %	
SIL (Safety Integrity Level)	3	EN 61508
PFH	3.85×10^{-9} 1/h	
Maximum on-time	12 months	
SIL CL	3	EN 62061:2005+ Cor.:2010+A1:2013+A2:2015
PFH_D	5.08×10^{-9} 1/h	
SFF	98.22 %	

Max. reaction time in case of shutdown	Value	Standard
CIP Safety > local output	25 ms	EN 61508
Local input > CIP Safety	20 ms	
Local input <> local output	35 ms	

7.3 Setting the IP address

The device supports two IP addresses. Whether the secondary IP address is required depends on the application and the CIP Safety Scanner used.

The first three bytes of the Main IP address can be set via the device's web server (IP address in delivery state: 192.168.1.254). The last byte of the IP address Main IP address can either be set via the rotary coding switches at the device, via the Turck Service Tool or via the web server.

NOTE
Turck recommends setting the IP address via the rotary coding switches (Static Rotary) on the device. The rotary mode supports easy device replacement.

- **Main IP Address:**
  IP address of the device to access the device with Turck Safety Configurator, PLC, web server, Turck Service Tool, etc.
- **Secondary IP Address:**
  depending on application possibly without function, must then be 0.0.0.0

NOTE
The Secondary IP address can only be set by using the web server of the device.

Setting the IP Address via rotary coding switches

- ▶ Open the cover above the switches.
- ▶ Set the last byte of the Main IP address via the three rotary coding switches under the cover at the device.
- ▶ Execute a power cycle.

DANGER
Intrusion of liquids or foreign bodies through open cover
Danger to life due to failure of the safety function
- ▶ Tightly close the cover above the switches.

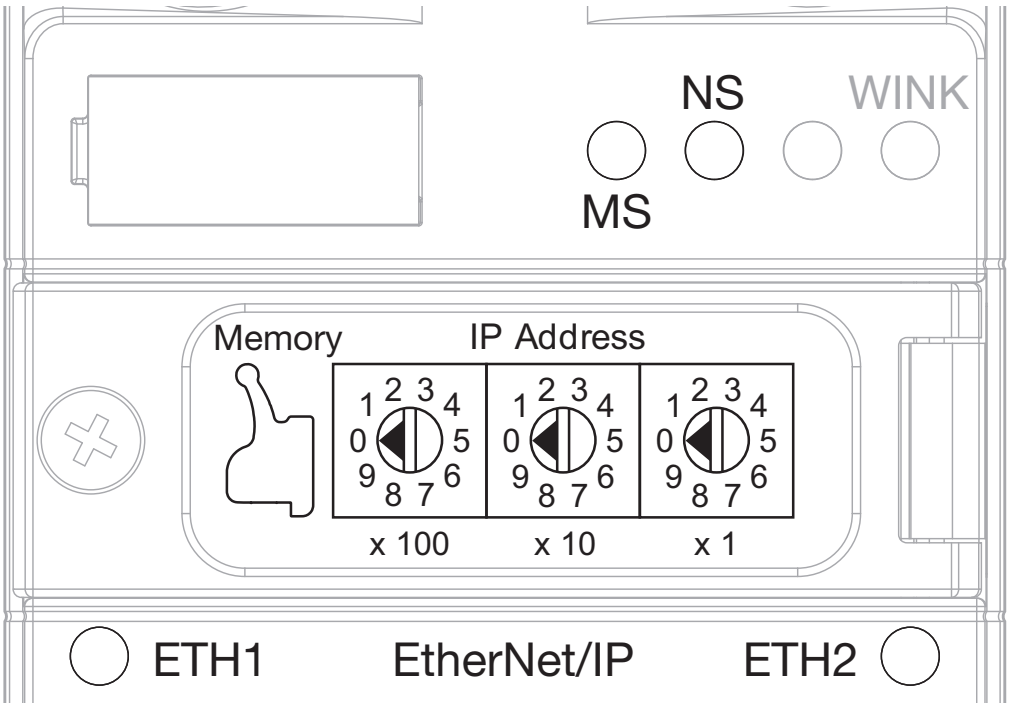


Fig. 31: Rotary coding switches at the device

In the delivery state, the rotary switches are set to 600 (6 - 0 - 0).

Switch position	Meaning
000	192.168.1.254
1…254	Rotary mode (Static rotary) Sets the last byte of the Main IP address, accept the setting with a device restart
300	BOOTP
400	DHCP
500	PGM
600	PGM-DHCP
900	Factory Reset: Resets device to factory settings
901	Erase Memory: Deletes the content of the memory chip

Setting the IP address via the web server

To set the IP address via the web server, the device must be in PGM mode.

- ▶ Open the web server.
- ▶ Log on to the device as administrator. The default password for the web server is “password”.

NOTE
The password is transmitted in plain text.

NOTICE
Inadequately secured devices
Unauthorized access to sensitive data
- ▶ Change password after first login. Turck recommends using a secure password.
- ▶ Adapt the password to the requirements of the network security concept of the system in which the devices are installed.

- ▶ Click **Station** → **Network Configuration**.
- ▶ Change the IP address and, if necessary, the subnet mask and the default gateway.
- ▶ Write the new IP address, the subnet mask and the default gateway via **Submit** into the device.

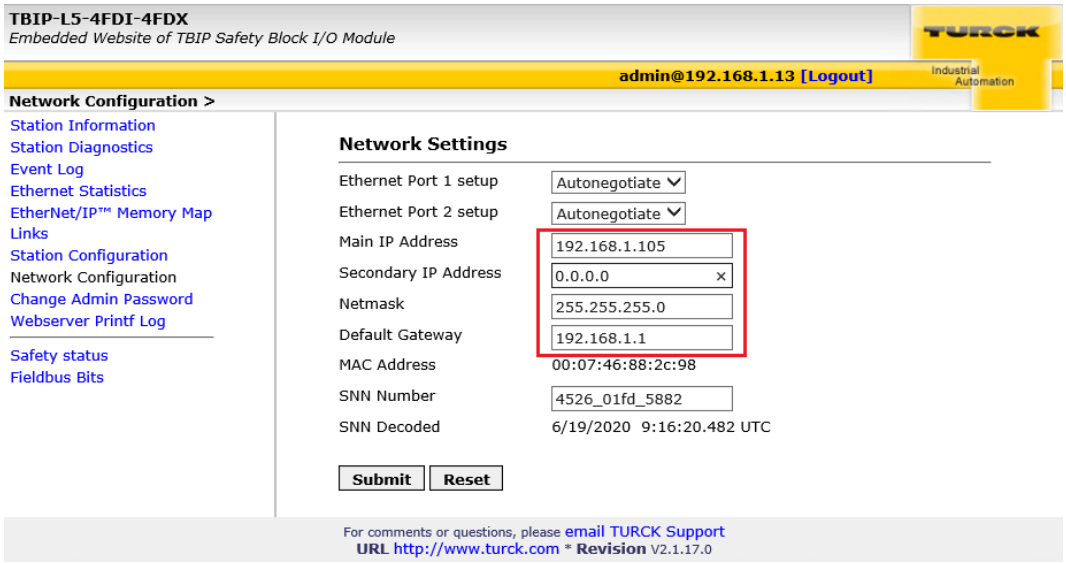


Fig. 32: Webserver — Network configuration TBIP-L…-4FDI-4FDX

Setting the Secondary IP Address via the web server

The Secondary IP Address is not used in the device and should always be set to 0.0.0.0.

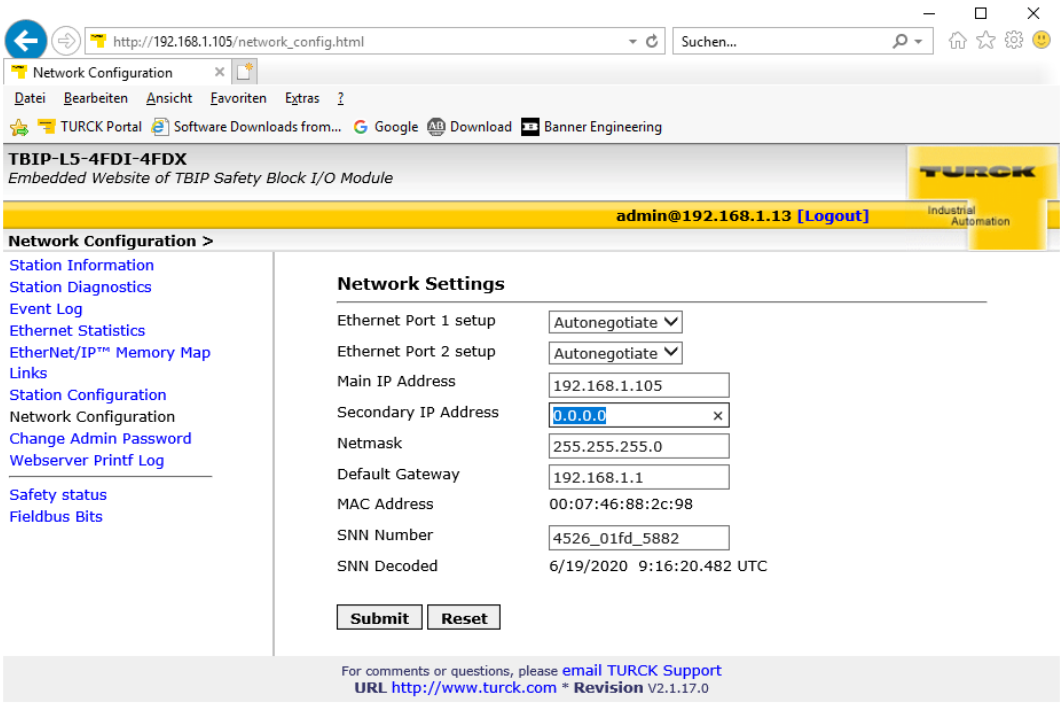


Fig. 33: Web server — setting the Secondary IP Address

8 Configuring

8.1 Installing Turck Safety Configurator

The Turck Safety Configurator is available for download as zip archive on www.turck.com.

NOTE
A coupon code is required to download the software. The coupon code can be requested from Turck customer service. Further information can be found on the product page of the software.

- ▶ Unpack the zip archive and install Turck Safety Configurator.

8.2 Licensing Turck Safety Configurator

The licensing is done via coupon code.

- ▶ Enter the coupon code on the Turck homepage following this link:

  https://www.turck.de/en/product/SW_Turck_Safety_Configurator.
- ▶ If the coupon code If missing, please order a coupon code via E-mail under the following E-mail address: **TM-BWSoftwareSupport@turck.com**

Software licensing for virtual machines (VM)

- ▶ Enter the coupon code on the Turck homepage following this link:

  https://www.turck.de/en/product/SW_Turck_Safety_Configurator.
- ▶ If the coupon code If missing, please order a coupon code via E-mail under the following E-mail address: **TM-BWSoftwareSupport@turck.com**

NOTE
The software can only be used on a virtual machine with Internet access.

8.3 Creating a configuration with the TSC commissioning wizard

- ▶ Start the software.
- ⇨ Turck Safety Configurator starts with the Start assistant, which will lead through the first steps after program start.

8.3.1 Creating a new workspace

▶ In the start assistant, select option **New workspace**, enter a name and a storage location and create the new workspace with **Create**.

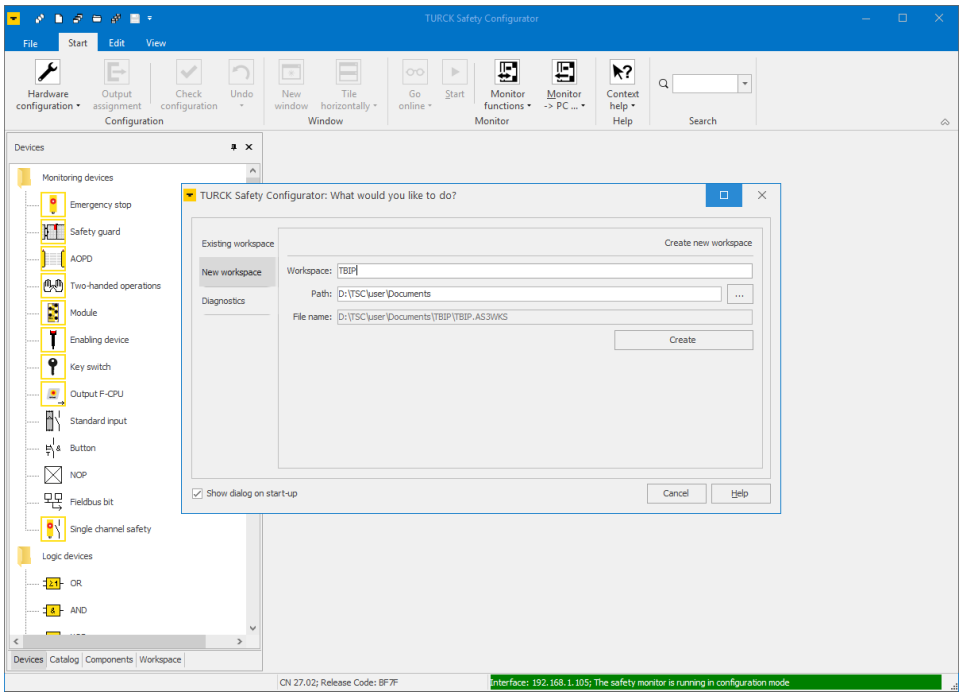


Fig. 34: Start assistant – new workspace

⇨ The new workspace is created.

8.3.2 Selecting a master and creating a basic configuration

▶ Select the TBIP-L…-4FDI-4FDX in the **Select master** dialog and confirm with **OK**.

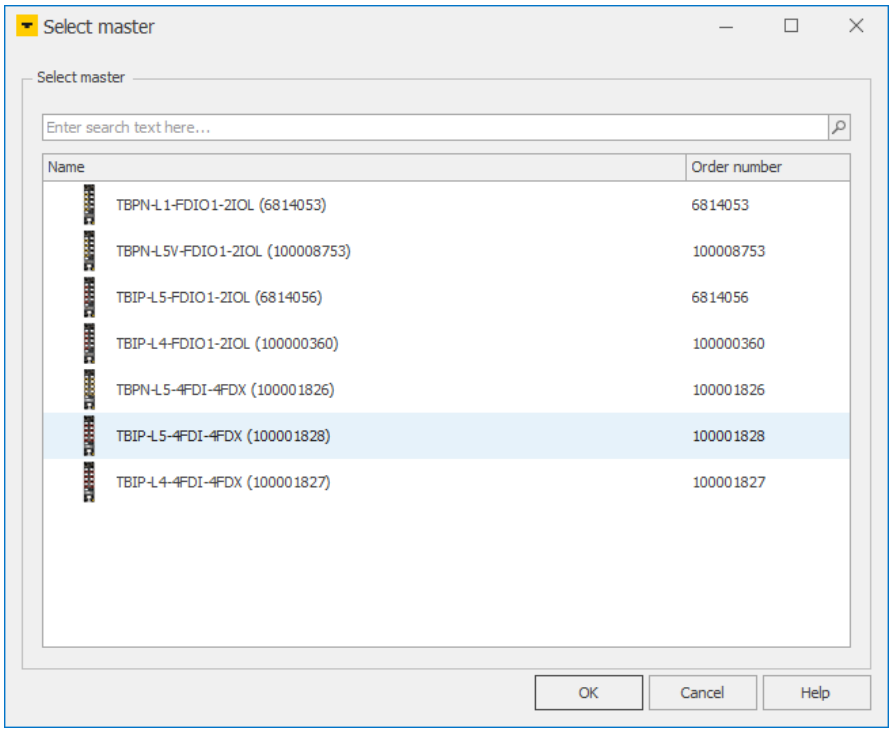


Fig. 35: TSC – selecting a master

⇨ The dialog box **Properties – TB…** is opened.

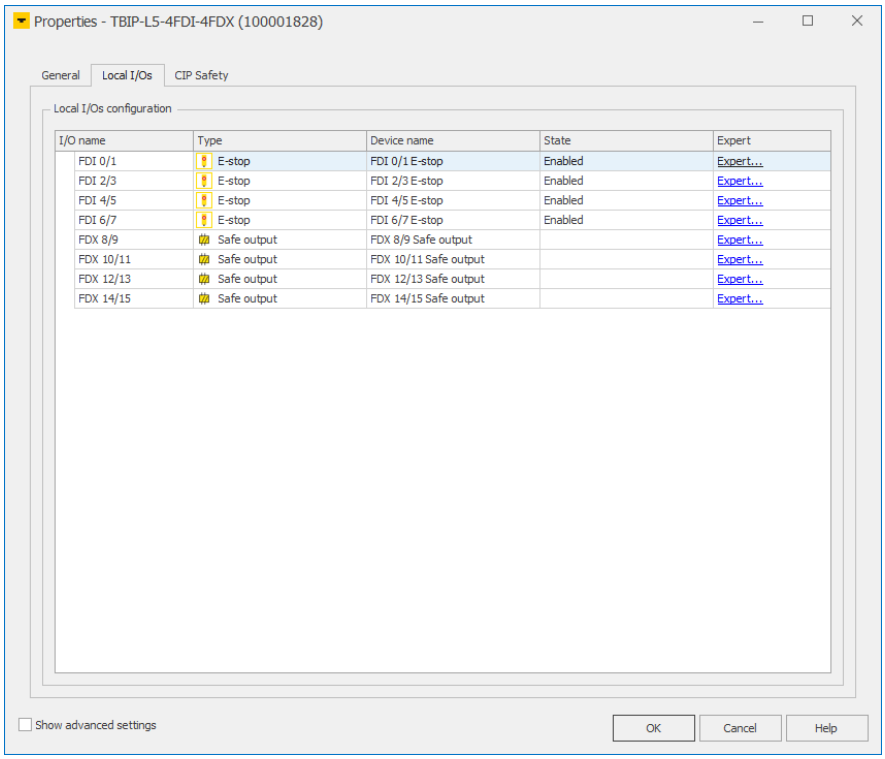


Fig. 36: TSC – hardware configuration

In the register tab Local I/Os, the safe slots of TBIP-L…-4FDI-4FDX are configured.

Basic configuration

In the basic configuration, the safe inputs (FDI) at C0…C3 are defined as double channel forced, safe inputs (dry contact). The safe in-/outputs (FDX) at C4…C7 are configured as safe outputs according to PLe.

Channel	Type designation	I/O name	Device name
FDI0/1	E-stop	Safe input (dry contact)	Double channel forced
FDI2/3	E-stop	Safe input (dry contact)	Double channel forced
FDI4/5	E-stop	Safe input (dry contact)	Double channel forced
FDI6/7	E-stop	Safe input (dry contact)	Double channel forced
FDX8/9	Safe output	Safe output	Safe output according to PLe (test pulse every 500 ms)
FDX10/11	Safe output	Safe output	Safe output according to PLe (test pulse every 500 ms)
FDX12/13	Safe output	Safe output	Safe output according to PLe (test pulse every 500 ms)
FDX14/15	Safe output	Safe output	Safe output according to PLe (test pulse every 500 ms)

- ▶ Complete the configuration with **OK**.
- ⇨ The basic configuration is applied.
- ⇨ The release circuits of the basic configuration are automatically created.

Release circuits (OSSDs) of the basic configuration

In the basic configuration, the release circuits OSSD1…OSSD4 and OSSD61…OSSD64 are predefined as follows:

Release circuit (OSSD)	Channels
OSSD 1	FDX8/9
OSSD 2	FDX10/11
OSSD 3	FDX12/13
OSSD 4	FDX14/15
OSSD 5	unused
…	…
OSSD 60	unused
OSSD 61	FDI6/7
OSSD 62	FDI4/5
OSSD 63	FDI2/3
OSSD 64	FDI0/1

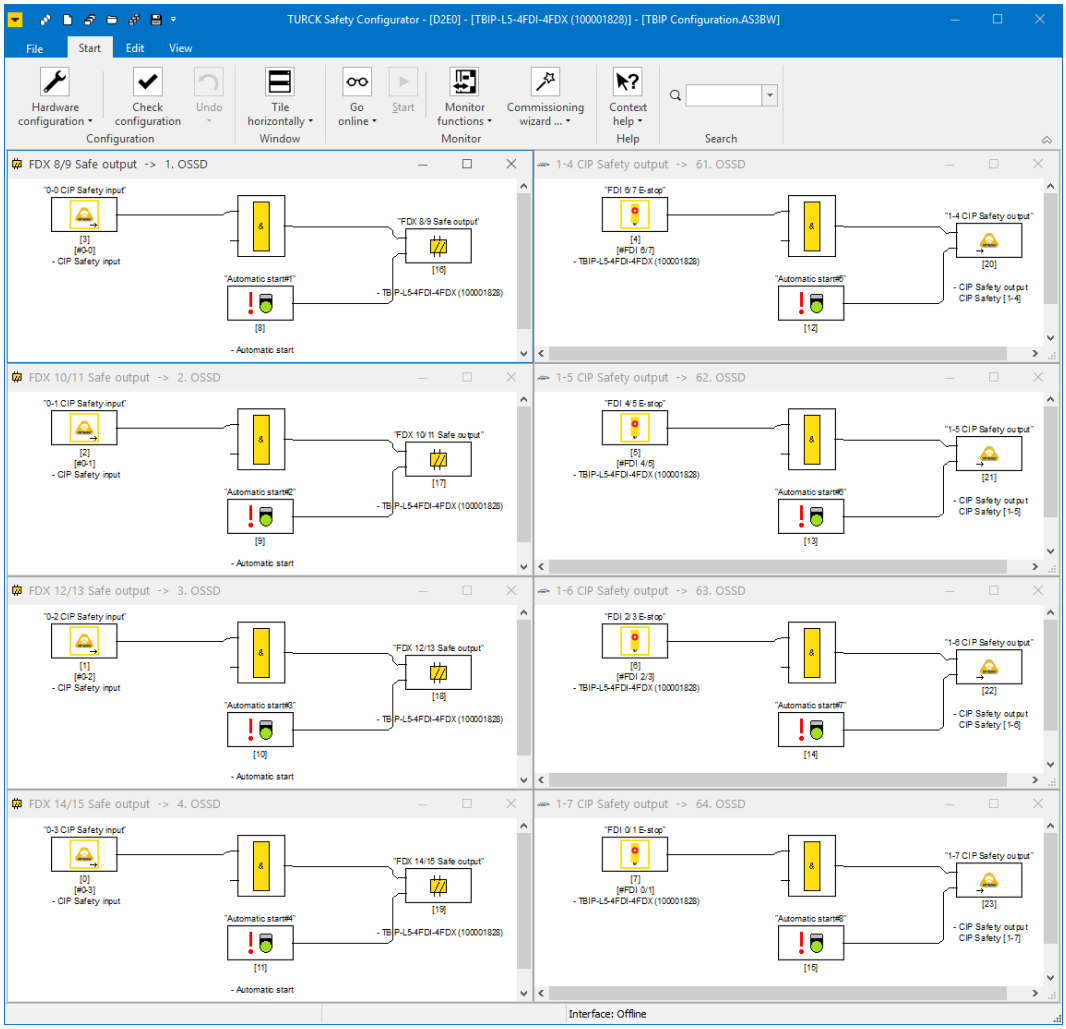


Fig. 37: TSC – release circuits (OSSDs) of the basic configuration

8.3.3 Adapting the configuration of the safe channels

The channels of TBIP-L…-4FDI-4FDX are adapted to requirements of the respective application in the register tab **Local I/Os** → **Expert**.

Configuration options

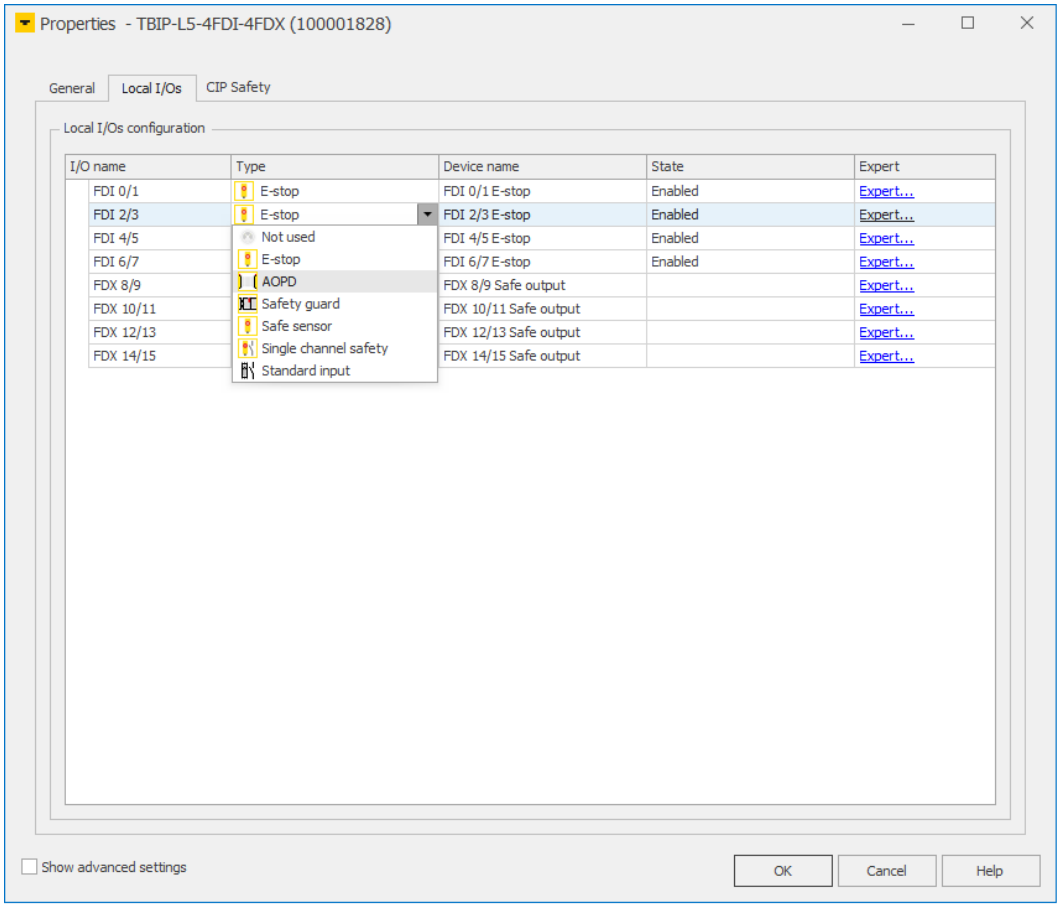


Fig. 38: TSC – Configuration of I/Os

Clicking **Expert** opens the expert settings for in- and outputs.

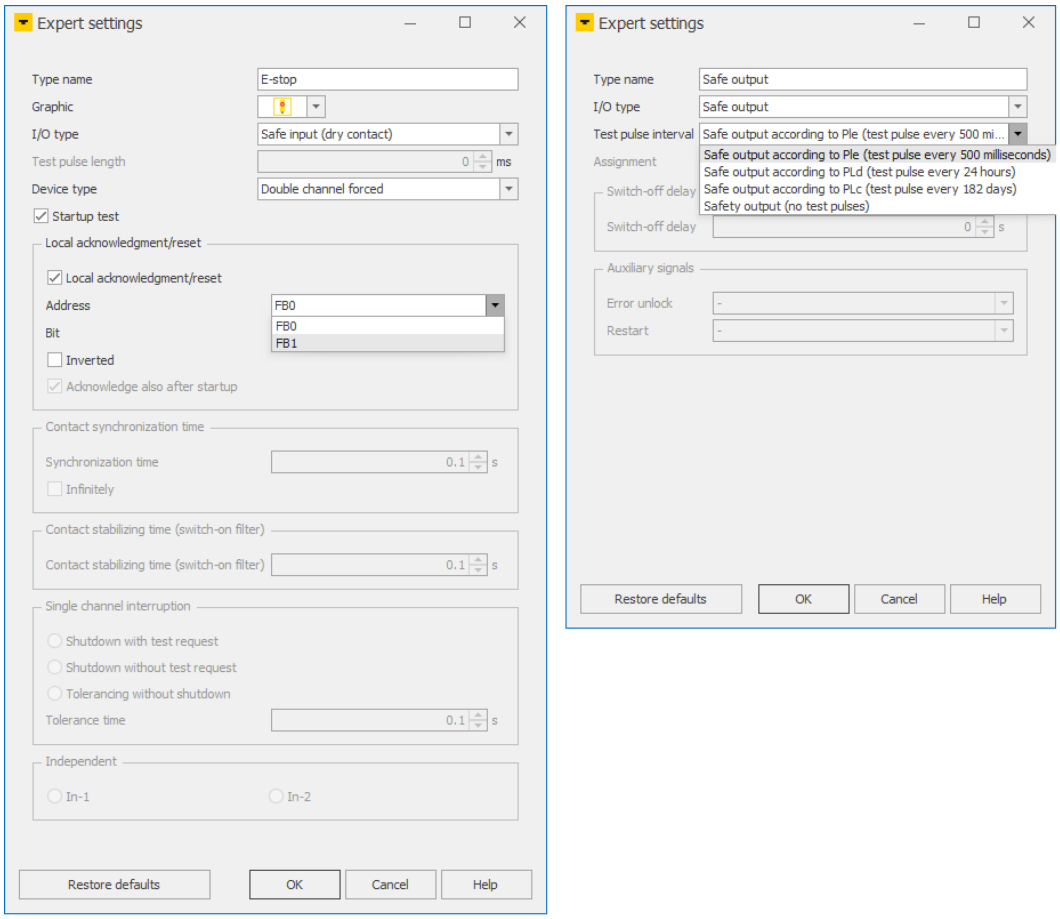


Fig. 39: TSC – Expert settings

NOTE
The description of the functions is part of the online help of the Turck Safety Configurator.

Example configuration

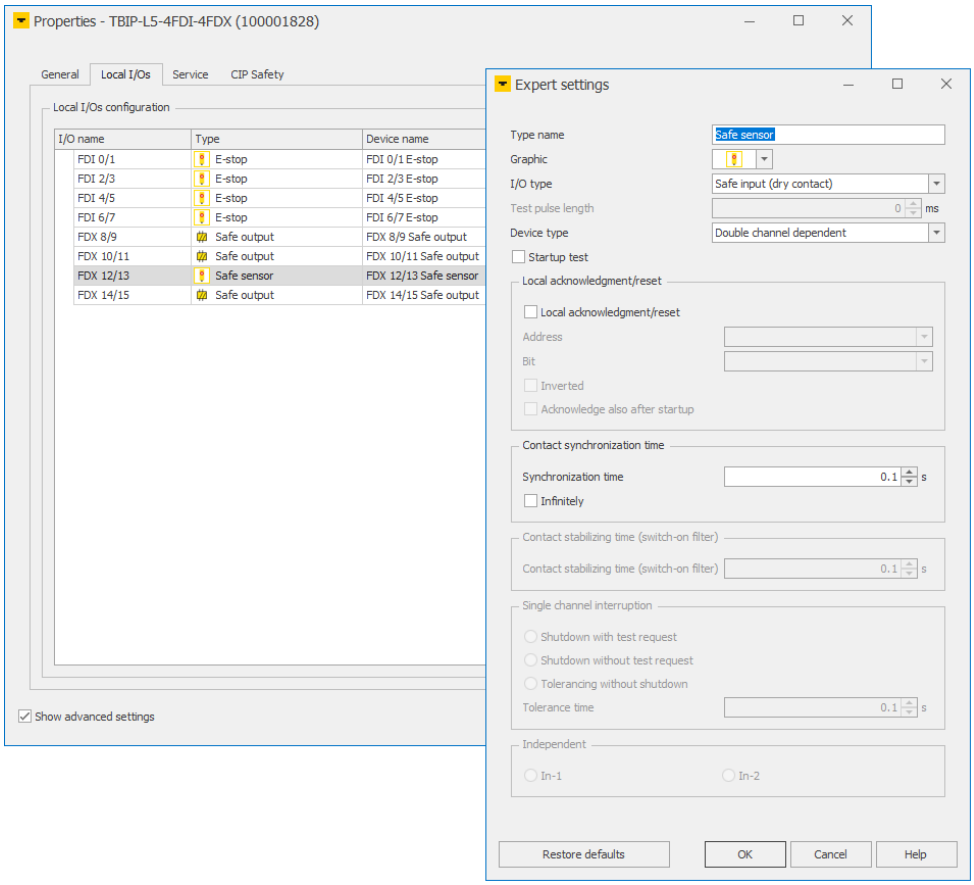


Fig. 40: TSC – Expert settings (example configuration)

Connector at device	Channels	Type	I/O type (Expert setting)	Later function (see application example [▶ 53])
C0	FDI0/1	E-stop	Safe input (dry contact), double channel forced	Safely switches off output at FDX8/9.
C1	FDI2/3	Light grid (AOPD)	Safe input (OSSD), double channel forced	Safely switches off output at FDX8/9.
C2	FDI4	Standard input		Used for the monitored start after switch-off of FDX8/9 and FDX10/11.
	FDI5	Standard input		-
C3	FDI6/7	E-stop	Safe input (dry contact)	No function, reserved
C4	FDX8/9	Safe output	Safe output according to PLe (test pulse every 500 ms)	Is switched off safely if the E-Stop (at FDI0/1) and/or the light grid at FDI2/3 are activated.
C5	FDX10/11	Safe output, switch-off delay	Safe output (plus and minus switching, no test pulses)	Is switched off safely, if the safety sensor at FDX12/13 is activated. Signal forwarding to F-CPU.
C6	FDX12/13	Safe sensor	Safe input (antivalent), double channel dependent with filtering	Safely switches off output at FDX10/11.
C7	FDX14/15	unused		

▶ Adapt the expert settings and close with **OK**.

Advanced settings – Global error unlock

If the **Advanced settings** are activated, a fieldbus bit for a global error unlock of the device can be configured in the **Service** register tab.

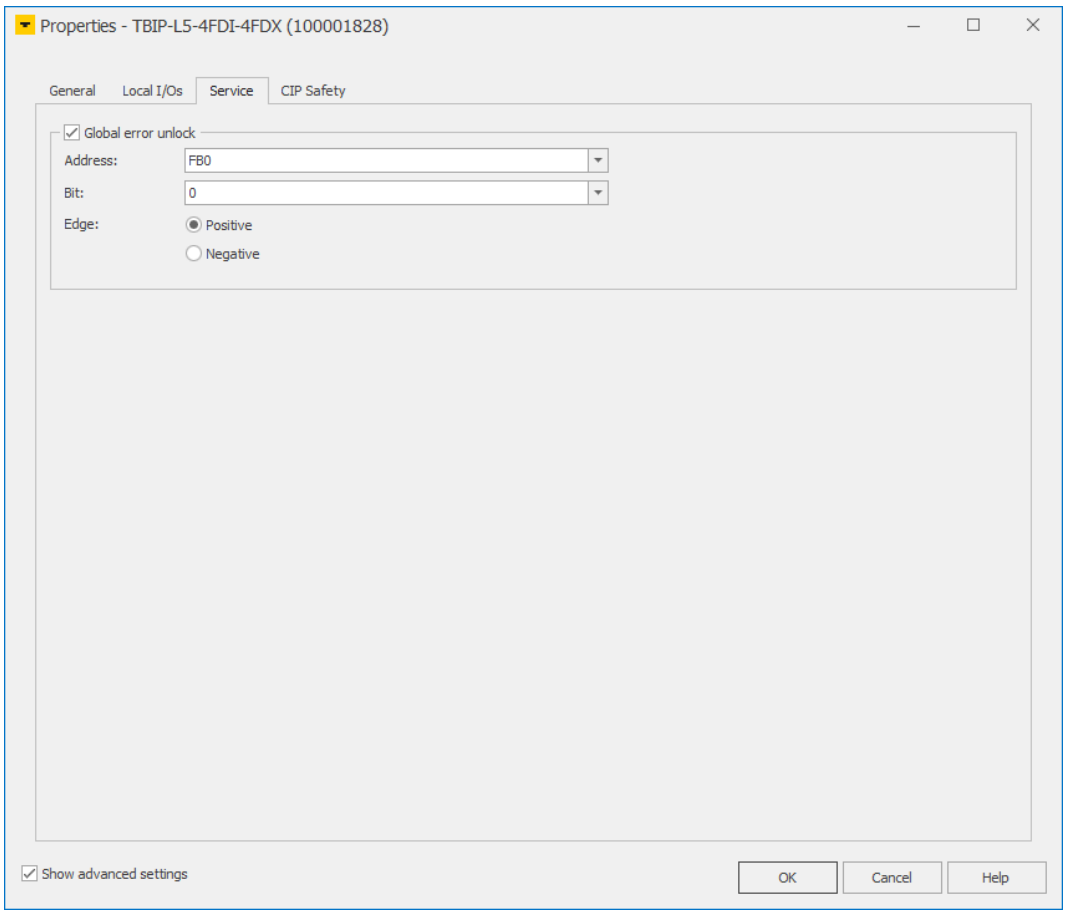


Fig. 41: TSC – Advanced settings, global error unlock

▶ Set the global error unlock and close the Properties dialog with **OK**.

NOTE
The global error unlock can also be executed via the process data bit "UNLK" in the module's process output data Process output data.

CIP Safety settings

The CIP Safety register defines whether the configuration is stored without SCID time stamp, with an automatically generated SCID time stamp or with a user-defined SCID time stamp.

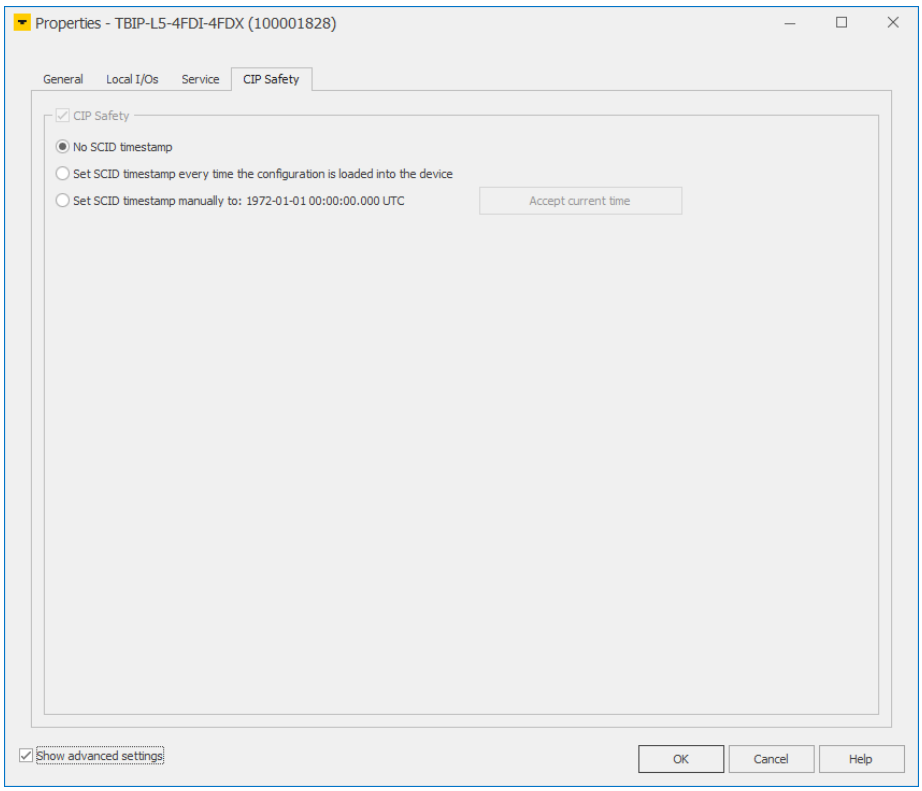


Fig. 42: TSC – CIP Safety options

Complete the hardware configuration in the start assistant

- ▶ Close the dialog box hardware configuration with **OK**.
- ⇨ The release circuits for the hardware configuration (example configuration) are created.

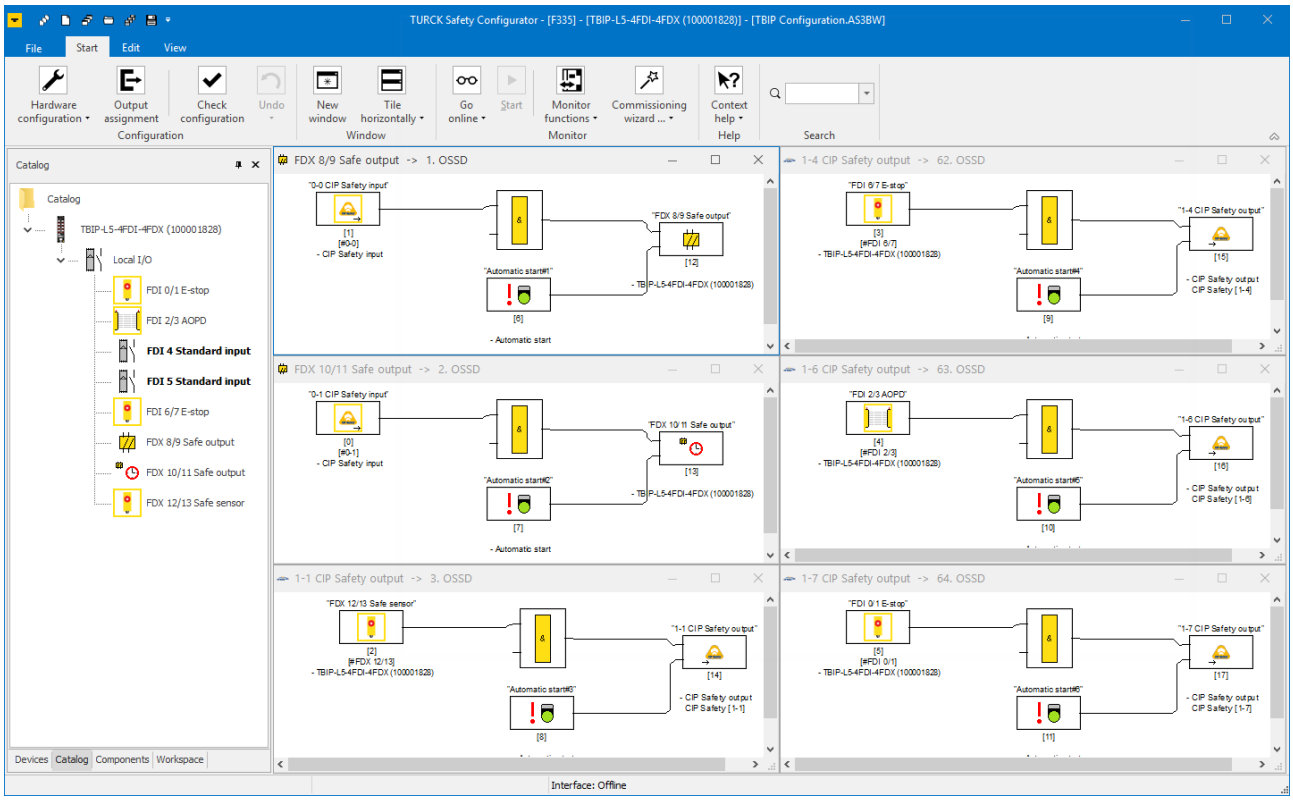


Fig. 43: TSC – release circuits (example configuration)

Channels	Type	OSSD	Adaptation
FDI0/1	E-stop	64. OSSD	unchanged
FDI2/3	Light grid (AOPD)	63. OSSD	unchanged
FDI4	Standard input	No OSSD created	
FDI5	Standard input		
FDI6/7	E-stop	62. OSSD	unchanged
FDX8/9	Safe output	1. OSSD	The state of OSSD 64 and 63 leads to switch-off this OSSD, monitored start via standard input FDI4 (see “Switch off FDX8/9 (1. OSSD)”)
FDX10/11	Safe output, switch-off delay	2. OSSD	State of OSSD 62 leads to switch-off this OSSD, monitored start via standard input FDI4 (see “Switch off FDX10/11 (2. OSSD)”)
FDX12/13	Safe sensor	3. OSSD	unchanged
FDX14/15	unused	No OSSD created	

8.4 Loading the configuration with the TSC commissioning wizard

- ▶ Start the commissioning wizard and click **Next >**.

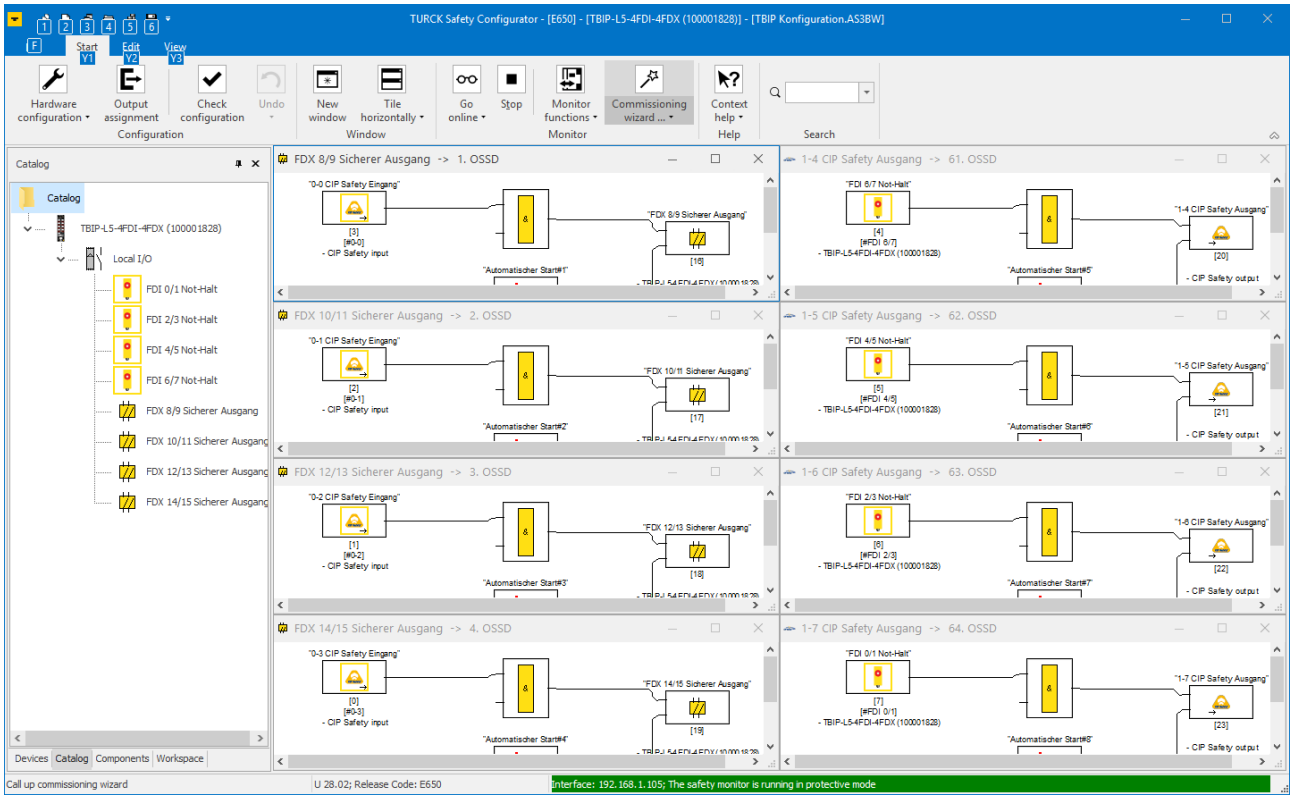


Fig. 44: TSC – Start the commissioning wizard

▶ In the dialog **Commissioning wizard settings**, enter the **Name of the validator** and the **Password for safety monitors** (release password) and confirm with **OK**.

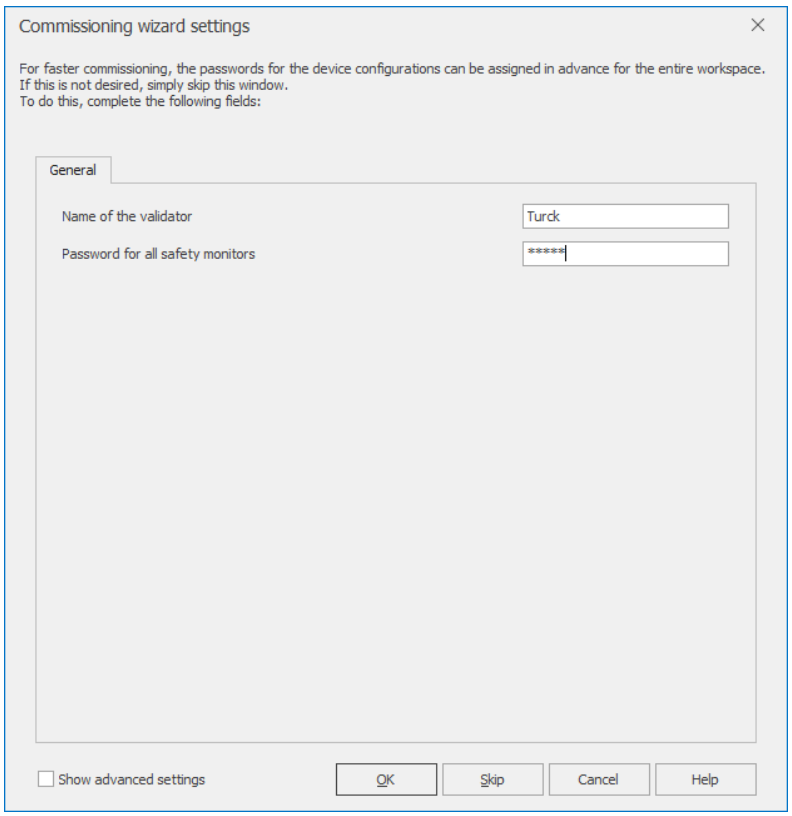


Fig. 45: TSC – Commissioning wizard, assigning a password

➪ The connected TBIP-L…-4FDI-4FDX is prepared for the configuration download.

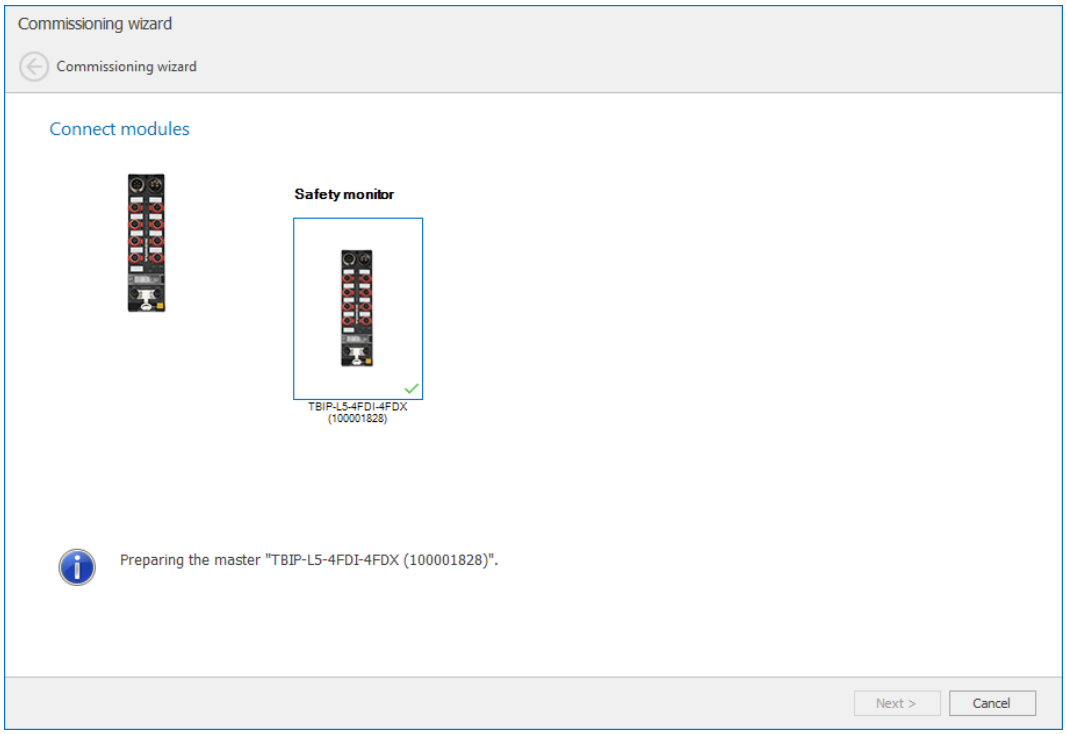


Fig. 46: TSC – Commissioning wizard, preparing the master

- ▶ **Optional:** If the TBIP-L…-4FDI-4FDX is not found, enter the device's IP address under **Ethernet** or search the connected device via the **…** button.

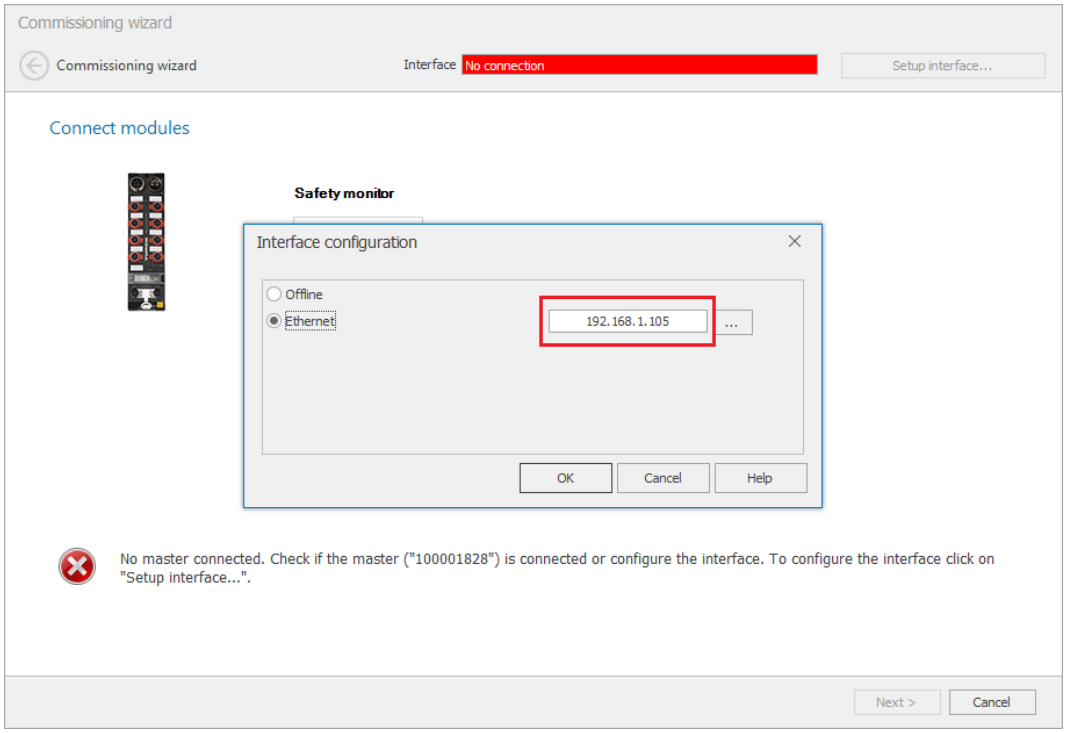


Fig. 47: TSC – interface configuration

- ▶ Confirm with OK and store the setting in the project (**store the interface in the workspace**).
- ⇨ The configuration is sent to the TBIP-L…-4FDI-4FDX. This process may take a few seconds.
- ⇨ The configuration protocol is created.

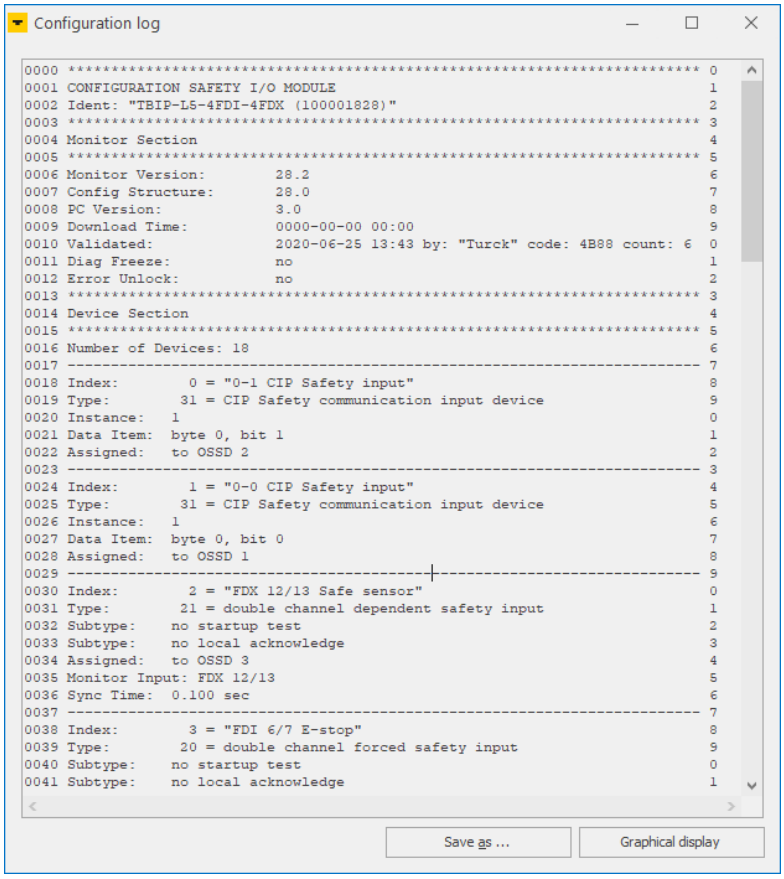


Fig. 48: TSC –Commissioning wizard configuration protocol

▶ Check the configuration using the configuration protocol and confirm the check.

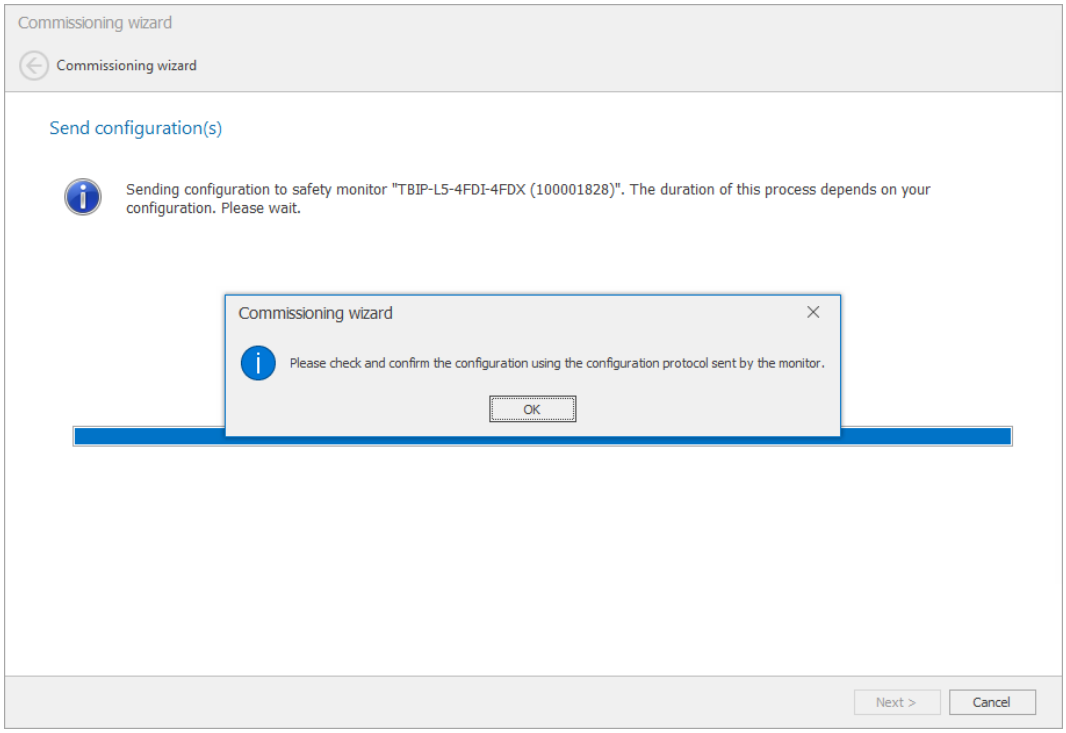


Fig. 49: TSC – confirming check of the configuration protocol

▶ Release the configuration in the **Validate configuration** dialog box with the data entered before (Name of the validator, Password).

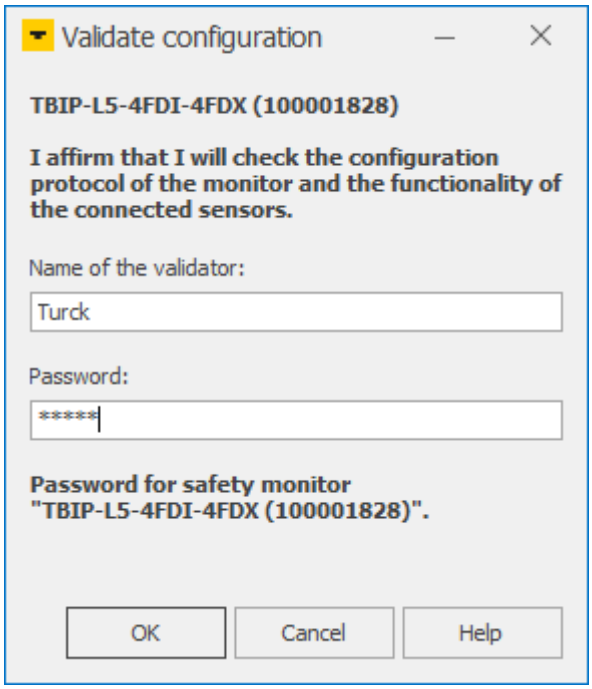


Fig. 50: TSC – release configuration

⇨ The configuration has been released.

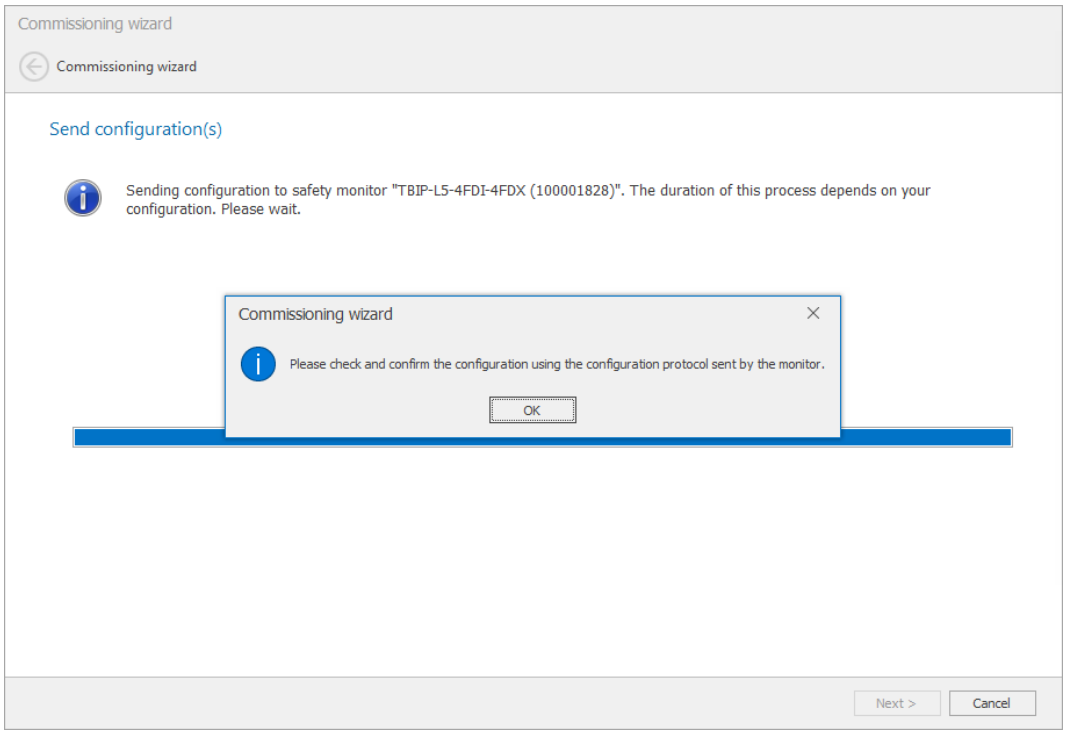


Fig. 51: TSC – release configuration

▶ Click **OK** and complete the commissioning with **Finish**.

➪ The Turck Safety Configurator changes to the online mode and opens the diagnostics configuration.

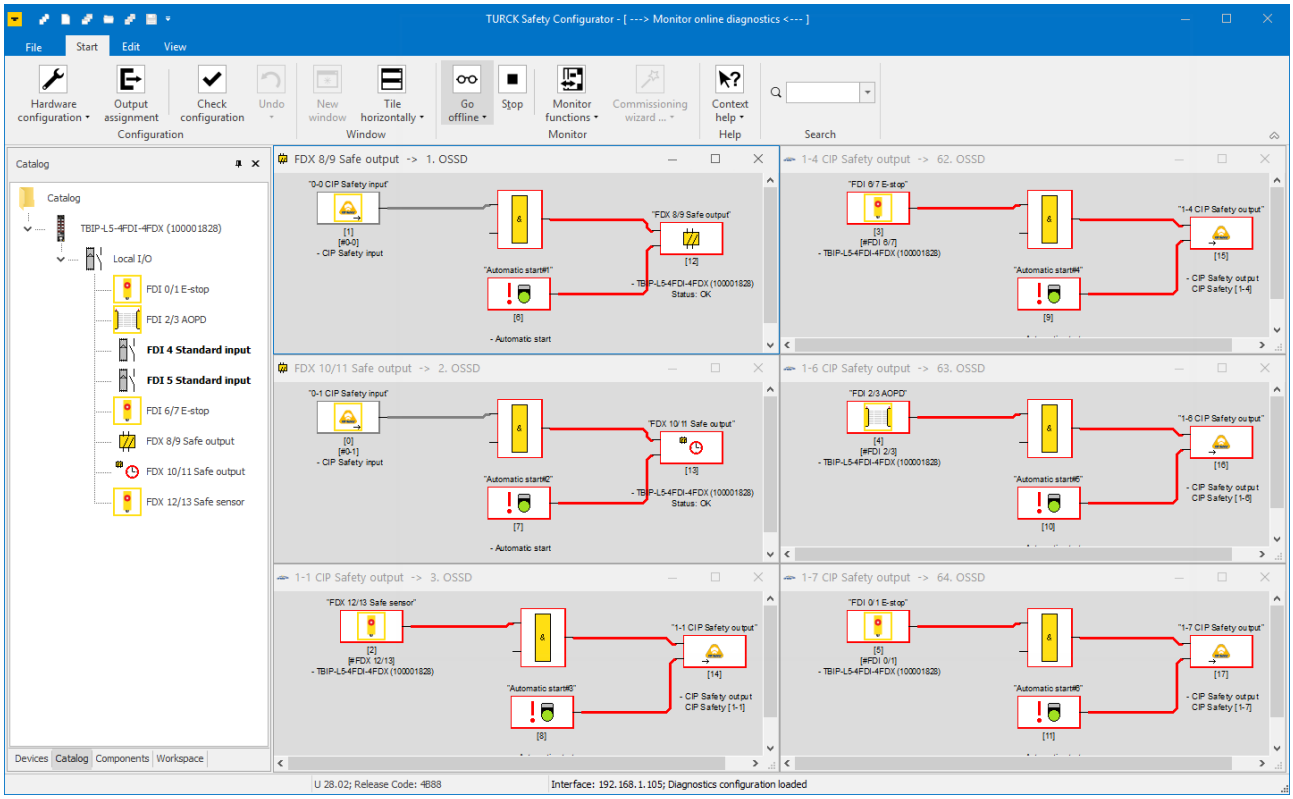


Fig. 52: TSC – Diagnostics configuration (online, no communication to safety PLC)

8.5 Application example – configuring a safety function in TSC

The following safety function is realized with the example configuration:

- The output FDX8/9 at C4 (1. OSSD) switches off when the emergency stop at FDI0/1 (64. OSSD) and/or the light grid at FDI2/3 (63. OSSD) are activated. The monitored start is done via the standard input FDI4.
- The output FDX10/11 at C5 (2. OSSD) switches off when the safe input at FDX12/13 (C5) switches. The monitored start is done via the standard input FDI4.
- The complete safety function is released via a release bit in the F-CPU (3. (OSSD).
- The state of output FDX8/9 is monitored via a CIP Safety bit in the F-CPU.

Safely switch off FDX8/9 (1. OSSD)

The output FDX8/9 at C4 (1. OSSD) has to be switched off as soon as the emergency shutdown at FDI0/1 (64. OSSD) or the light grid at FDI2/3 (63. OSSD) are activated. This means, the state of the OSSD 63 and 64 controls the state of FDX8/9.

- ▶ Delete **F-CPU output** in OSSD 1.
- ▶ Select the device **State of output switching element** from the device library and place it at the function input. In the dialog box **State of output switching element x** select OSSD 63 under **Assignment**.

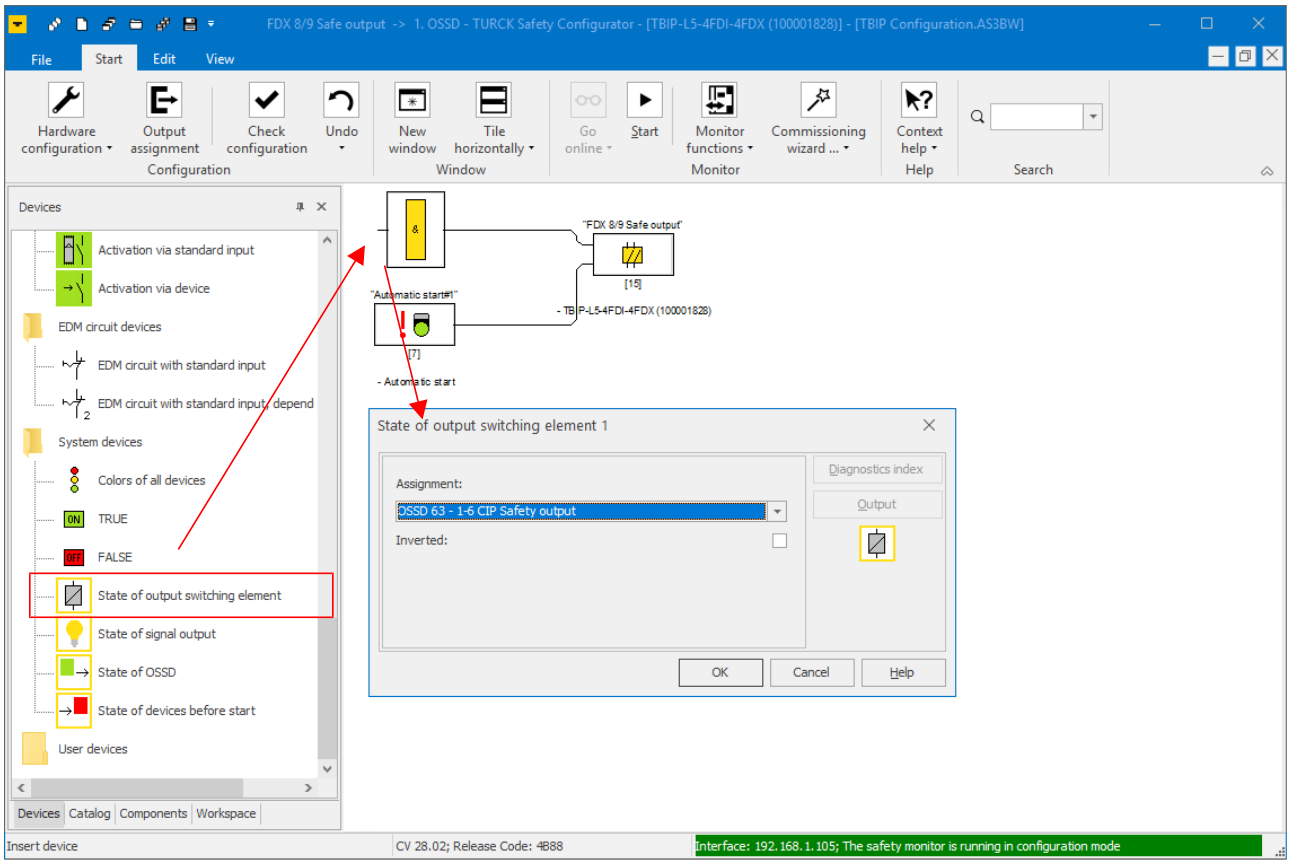


Fig. 53: TSC – 1. OSSD, state of output switching element OSSD 63

▶ Select the device **State of output switching element** from the device library and place it at the function input. In the dialog box **State of output switching element x** select OSSD 64 under **Assignment**.

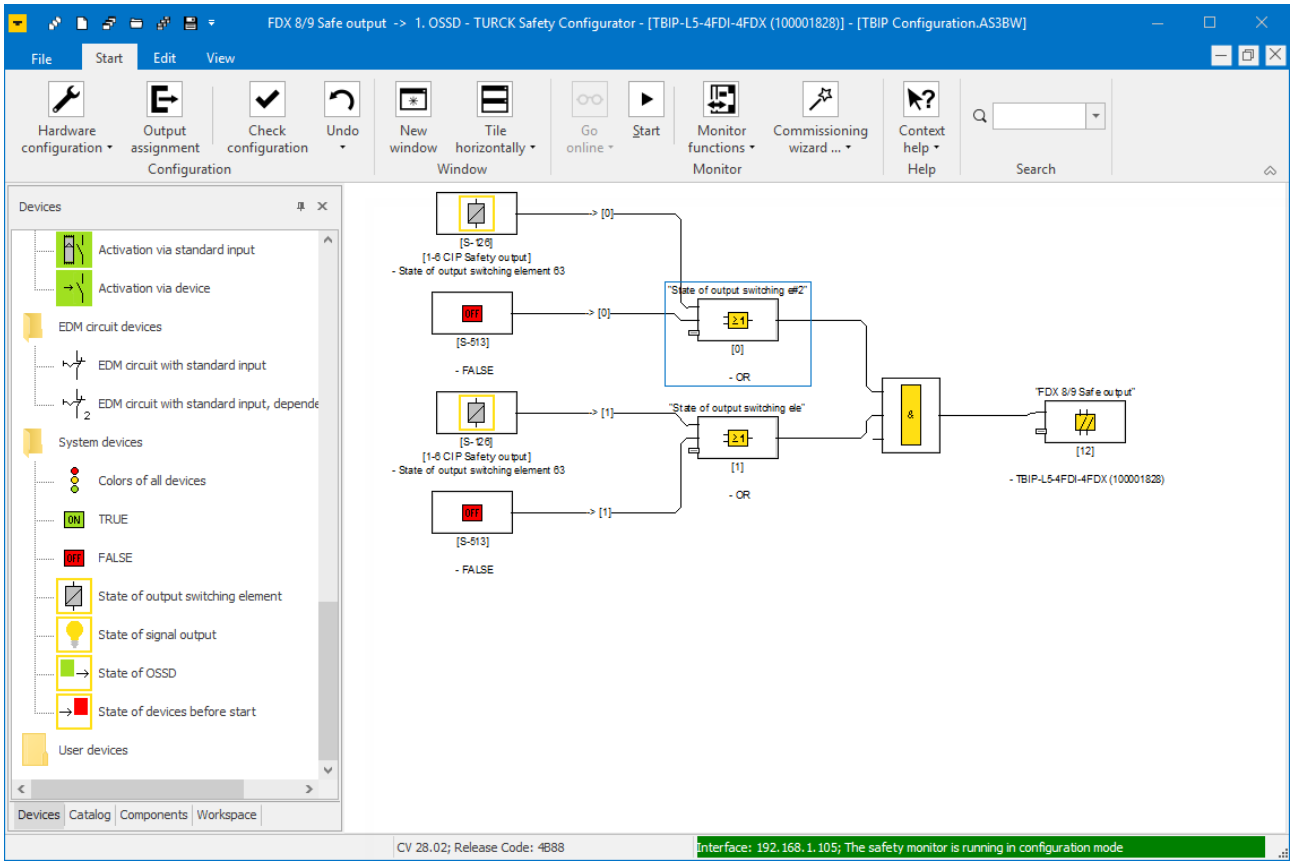


Fig. 54: TSC – 1. OSSD, state of output switching element OSSD 63 and OSSD 64

⇨ The activation of the emergency shutdown at FDI0/1 or the light grid at FDI2/3 switches off output FDX8/9.

Safely switch off FDX10/11 (2. OSSD)

The output FDX10/11 at C5 (2. OSSD) has to be switched off as soon as the safe input at FDX12/13 (62. OSSD) is activated. This means, the state of the OSSD 62 controls the state of output FDX10/11.

- Delete **F-CPU output** in OSSD 2.
- Select the device **State of output switching element** from the device library and place it at the function input. In the dialog box **State of output switching element x** select OSSD 62 under **Assignment**.

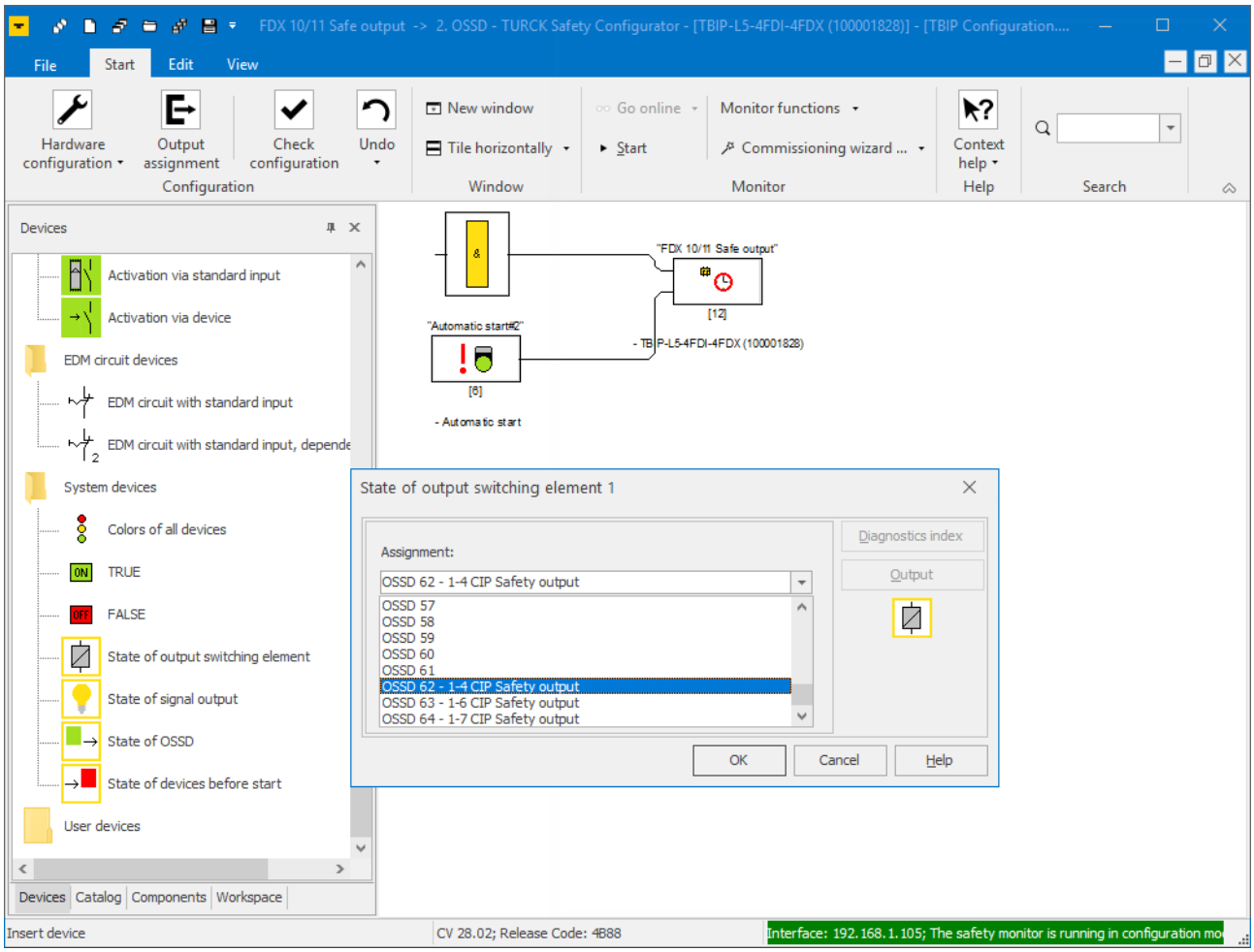


Fig. 55: TSC – 2. OSSD, state of output switching element OSSD 62

⇨ The activation of the emergency shutdown at FDI0/1 or the light grid at FDI2/3 switches off output FDX8/9.

Monitored start of FDX8/9 and FDX10/11

- ▶ Delete the device **Automatic start** in OSSD 1 and OSSD 2 and replace it with the device **Monitored start**.
- ▶ Select FDI4 under **Address**.

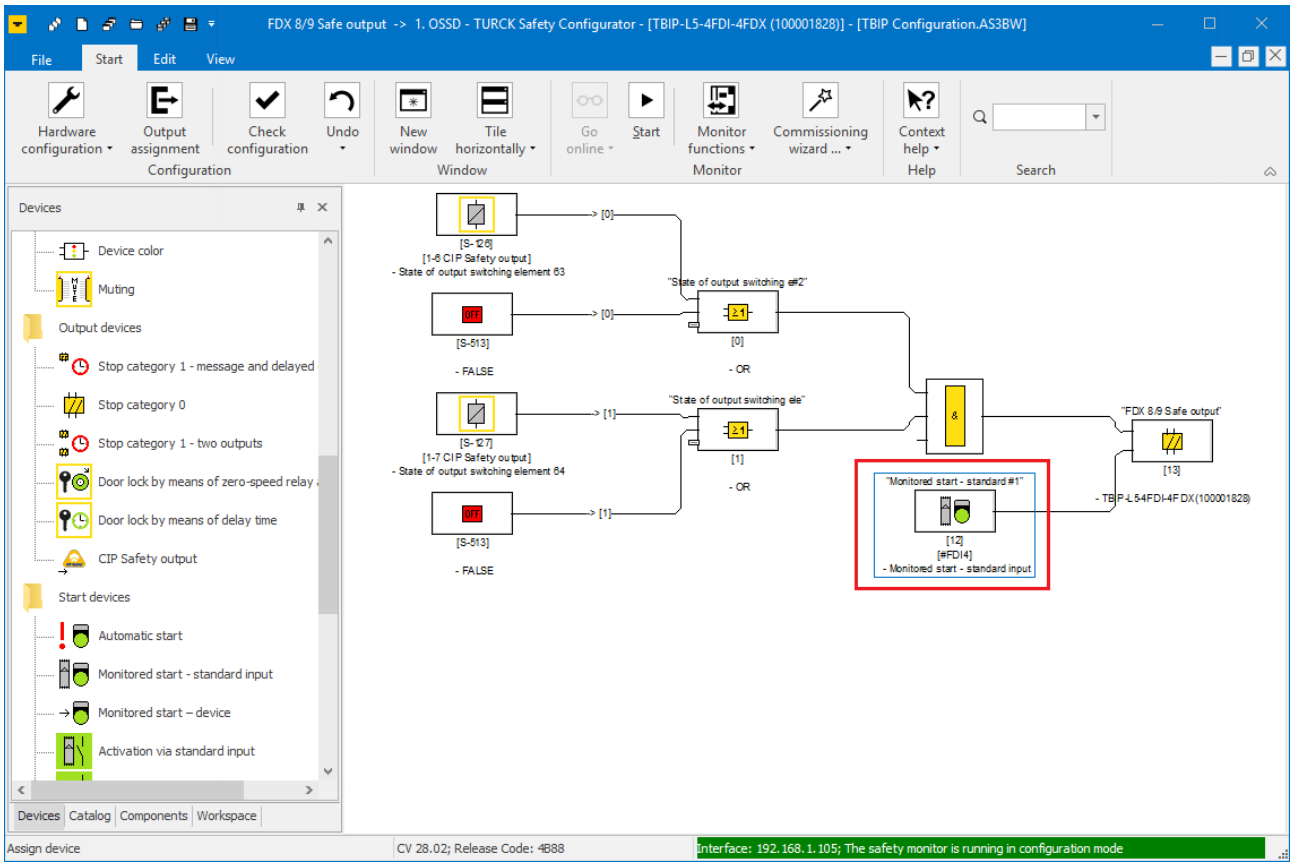


Fig. 56: TSC – monitored start via standard input (example 1. OSSD)

⇨ The safe outputs FDX8/9 and FDX10/11 will only restart with a positive edge at FDI4.

Release of the safety function via a release bit in the F-CPU

The release of the safety function is done using a release bit in the F-CPU. Therefore, an output bit of the F-CPU is assigned to the output function in the 2. OSSD.

- ▶ Select the element "Output F-CPU" in the device library and place it at the third input (OSSD 1) and the second input (OSSD 2) of the function.

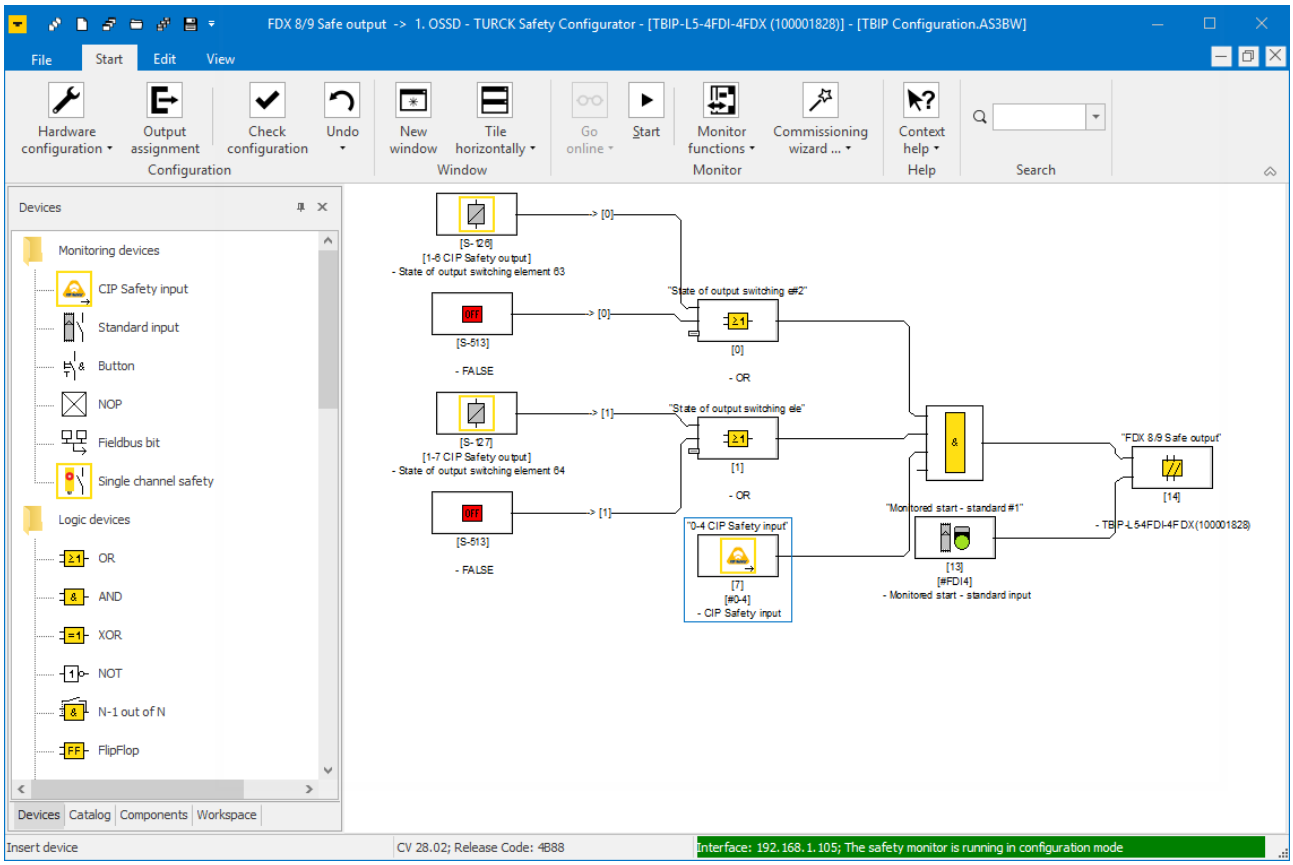


Fig. 57: TSC – release of the safety function via a release bit from the F-CPU

- ⇨ After an error, the safety function will only restart if the emergency shutdown **as well as** the light grid are error free and the release bit in the F-CPU is set.

Monitoring an output in the F-CPU

The state of the output is monitored via a CIP Safety bit in the F-CPU.

- Open the **Output assignment** and assign a CIP Safety bit to output FDX8/9.

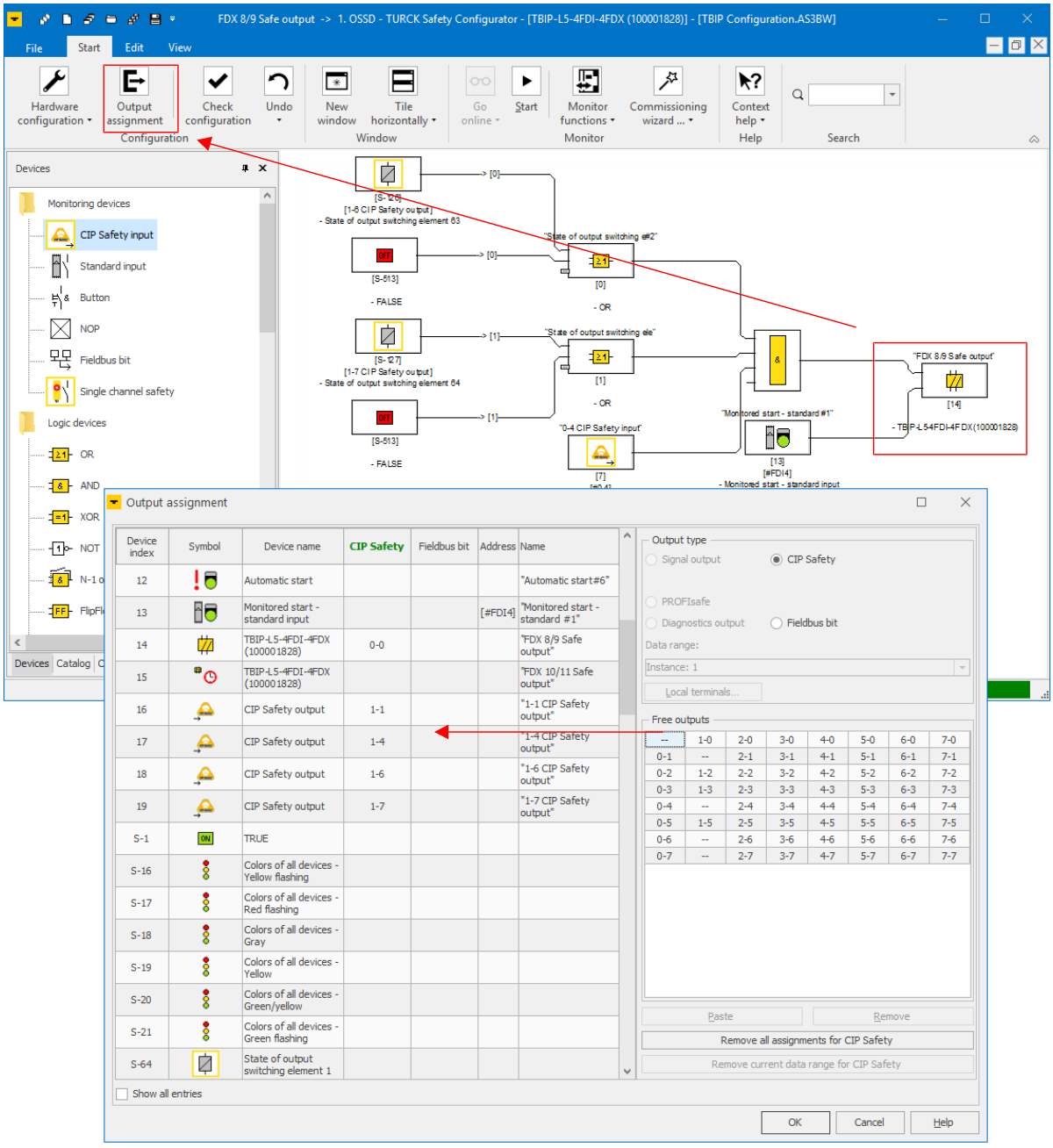


Fig. 58: TSC – output assignment CIP Safety bit

8.5.1 Checking and loading the configuration

The Turck Safety Configurator checks the created configuration for logical errors, which meas, the logical wiring of the single components in the release circuits is checked. The configuration check does not consider double allocation etc.

- Start the check using the **Check configuration** button.
- Load the configuration into the device via the Commissioning wizard ([▶ 47]) or by using the **PC → Monitor** function.

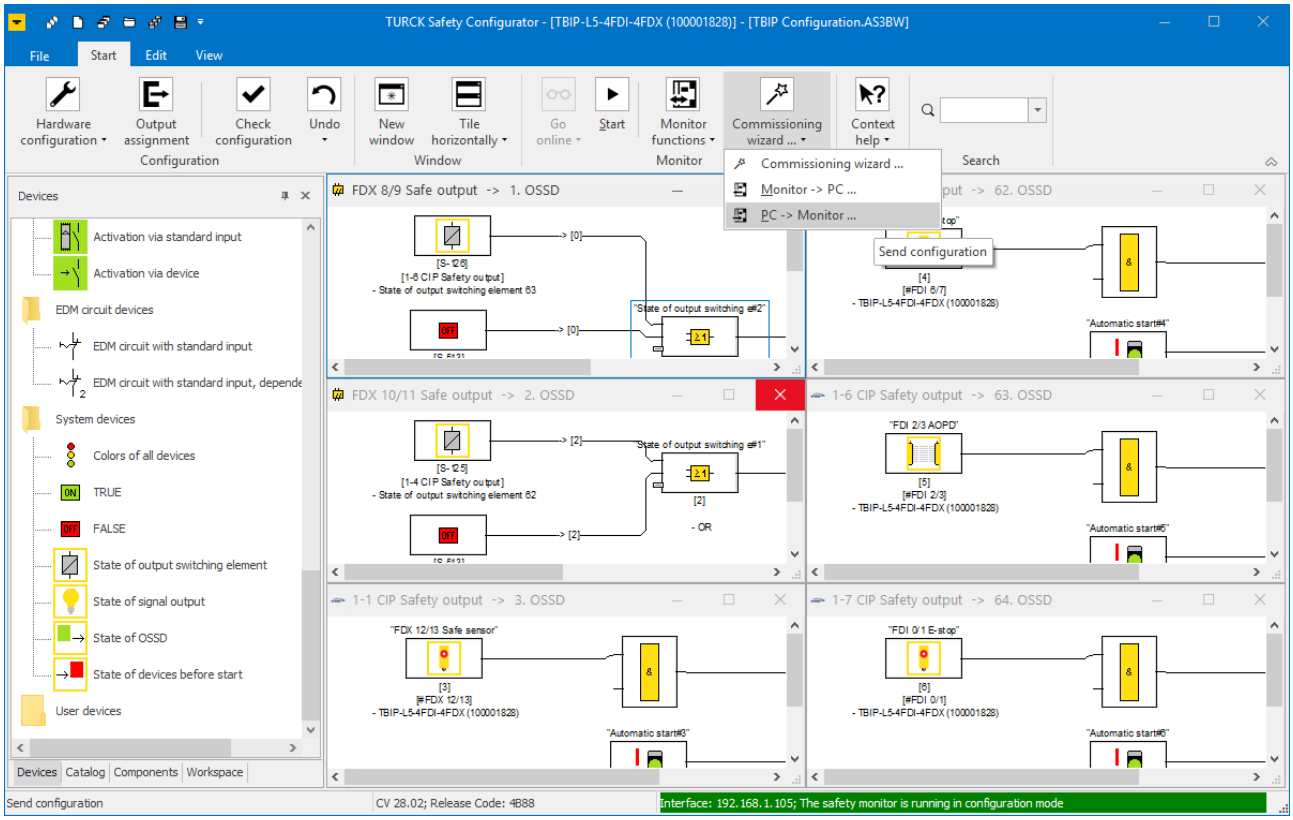


Fig. 59: TSC – sending the configuration

8.6 Configuring single channel safety sensors

If a slot is configured as **Single channel safety** in Turck Safety Configurator, then the double channel function for the slot is disabled.

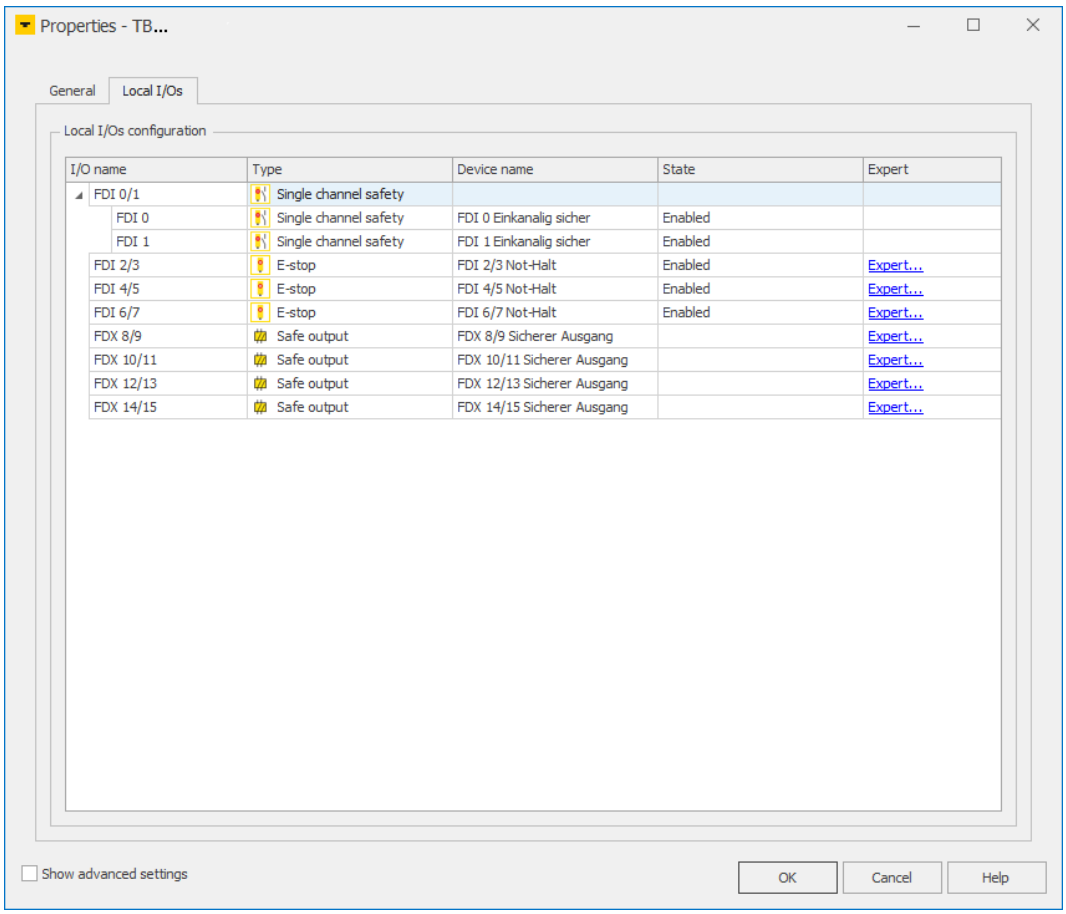


Fig. 60: TSC – single channel inputs

No release circuits are generated for the single channel inputs. The OSSDs have to be created manually.

▶ Create an OSSD by using the **New window** function.

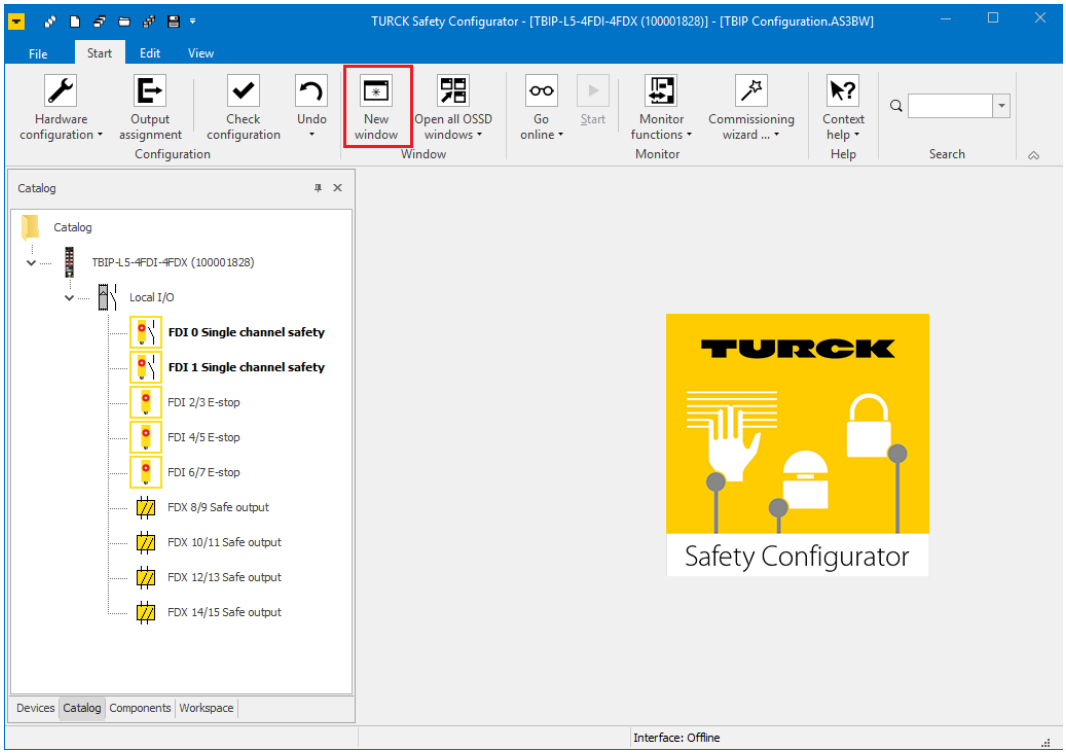


Fig. 61: TSC – creating an new window

▶ Add a **Single channel safety** input from the device catalog to the new window

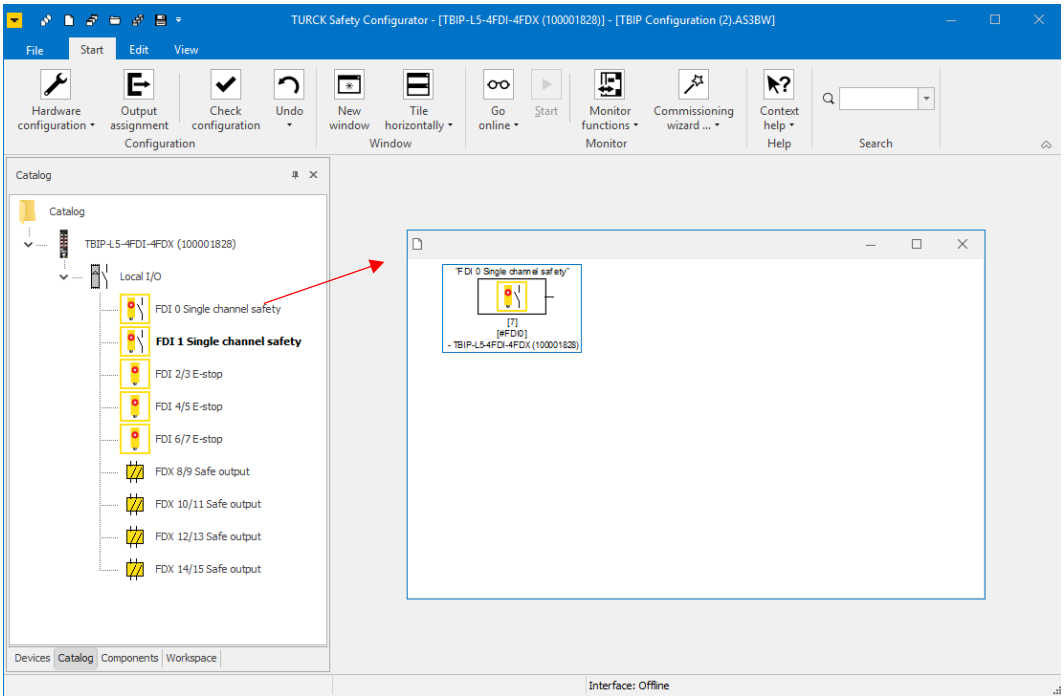


Fig. 62: TSC – configuring an OSSD for a single channel safety input

- Link the single channel safe input with an **CIP Safety Output**.

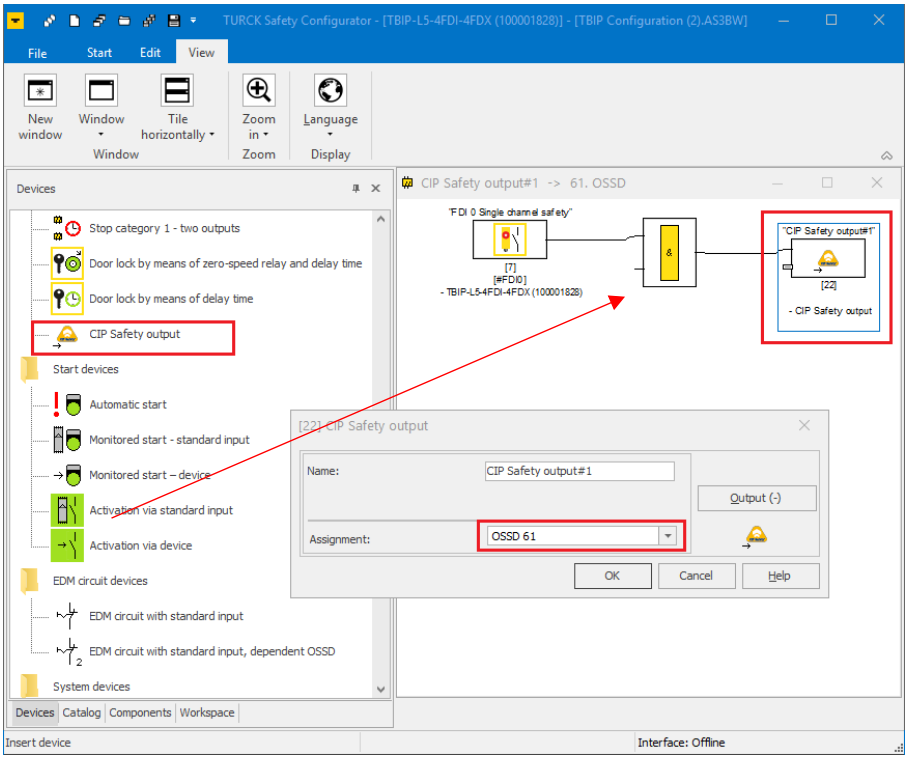


Fig. 63: TSC – linking a single channel safe input with the PLC

- Add an automatic start and assign a CIP Safety bit in order to be able to monitor the single channel sensor from the PLC.

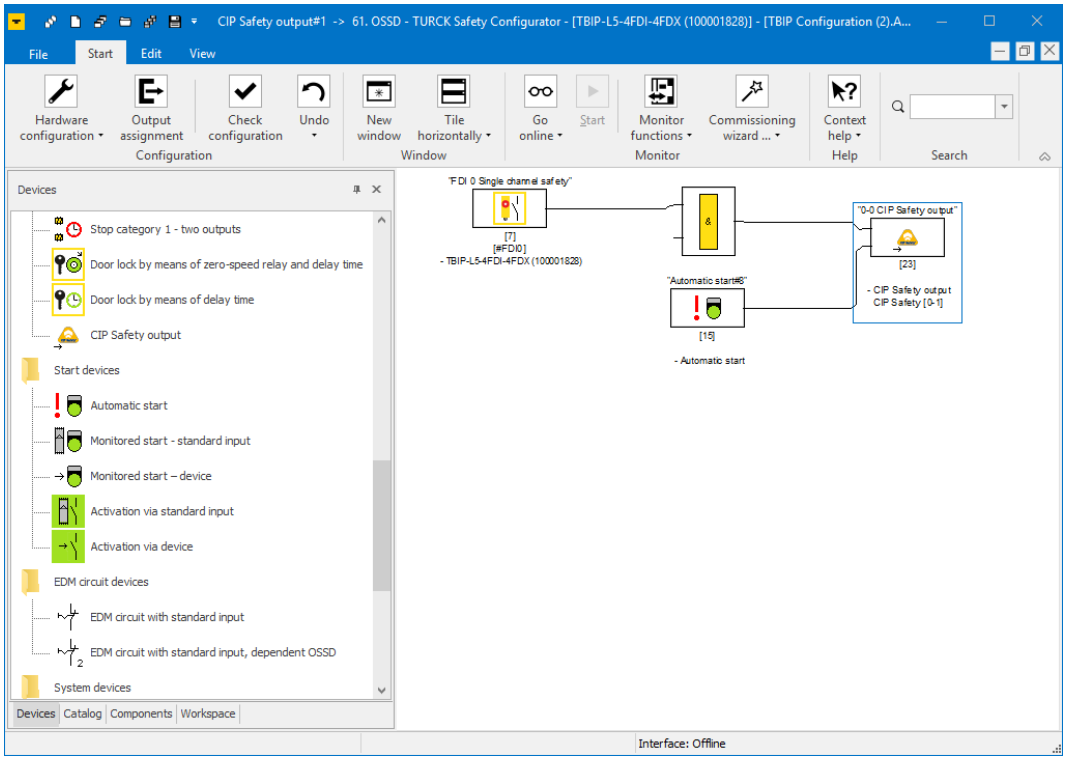


Fig. 64: TSC – single channel safe input with automatic start and CIP Safety assignment

8.7 Configuring the device at EtherNet/IP in Rockwell Studio 5000

NOTE
Before starting the configuration in Rockwell Studio 5000:
- ▶ Close the Turck Safety Configurator.
- ▶ Restart the device.

8.7.1 Used Hardware

- TBIP-L…-4FDI-4FDX
  Main IP-Address: 192.168.1.105
- Allen-Bradley Controller: Compact Logix 1769-L30ERMS/A LOGIX5370

8.7.2 Used Software

- RSLinx (Rockwell Automation)
- Studio 5000 (Rockwell Automation)
- Catalog file for Safety module

Catalog files

Turck offers the catalog file „TURCK_SAFETY_BLOCK_STATIONS_V….L5K" for the configuration of the devices in RSLogix/Studio5000 from Rockwell Automation.

The module entry TBIP-L…-4FDI-4FDX creates a generic dual EtherNet/IP and CIP Safety connection, with module definitions pre-configured for both connections. Additionally, the CIP Safety I/O tags of the standard configuration from Turck Safety Configurator as well as configuration tags and I/O tags for the GPIO module are predefined.

The unique device name, the IP address, the SNN (Safety Network Number) and the Safety Configuration Signature must be assigned by the user depending on the application. If available, the user must also make additional module parameterizations for the GPIO behavior in the configuration tags.

The version of the catalog file used must match the revision of the RSLogix software used.

8.7.3 Scanning the network in RSLinx

- ▶ Scan the network with RSLinx using the **RSWho** function.
- ⇨ The device is shown with the Main IP Address. The second IP address was previously set to 0.0.0.0 via the web server and is not displayed. [▷ 32].

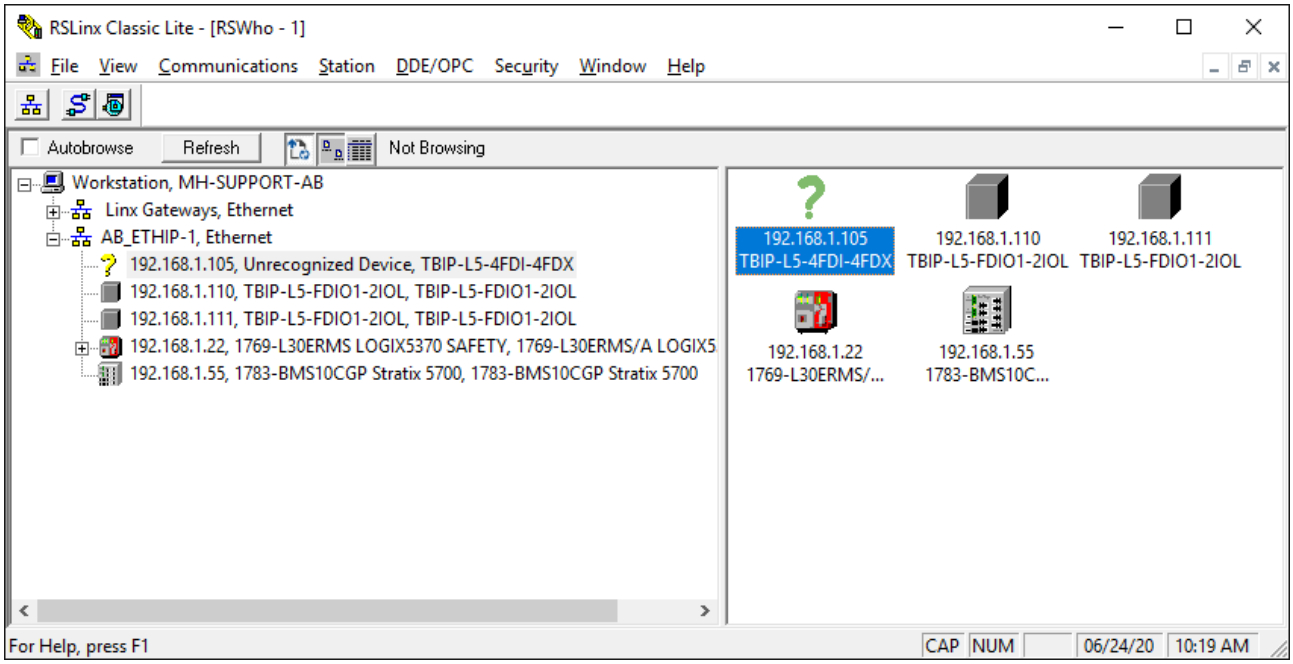


Fig. 65: RSLinx – Who Active

8.7.4 Creating a new project in Studio 5000

- Start Studio 5000.
- Click **New Project** select the used Safety controller and enter a project name.
- Confirm with **Next**.
- If necessary, adjust the settings in the **New Project** window and complete the project creation using the **Finish** button.

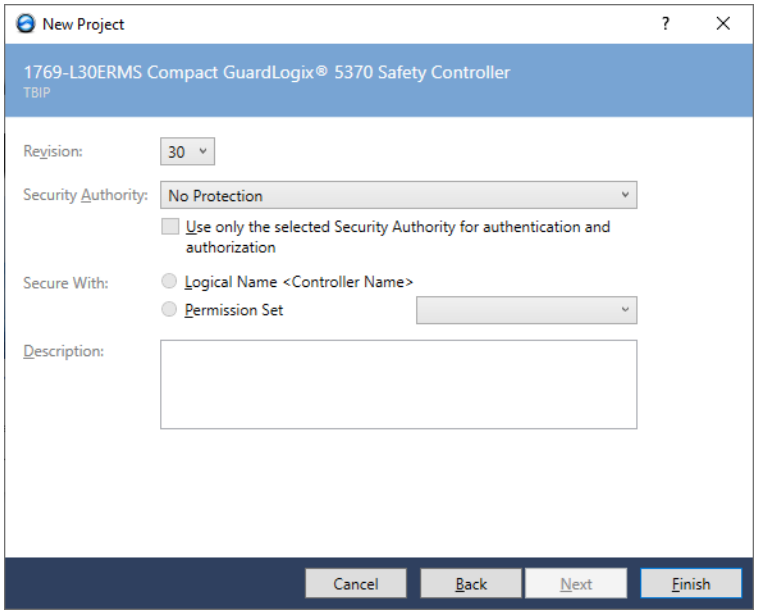


Fig. 66: Studio 5000 – finish the project creation

➪ The new project is created and opened in the RSLogix Designer.

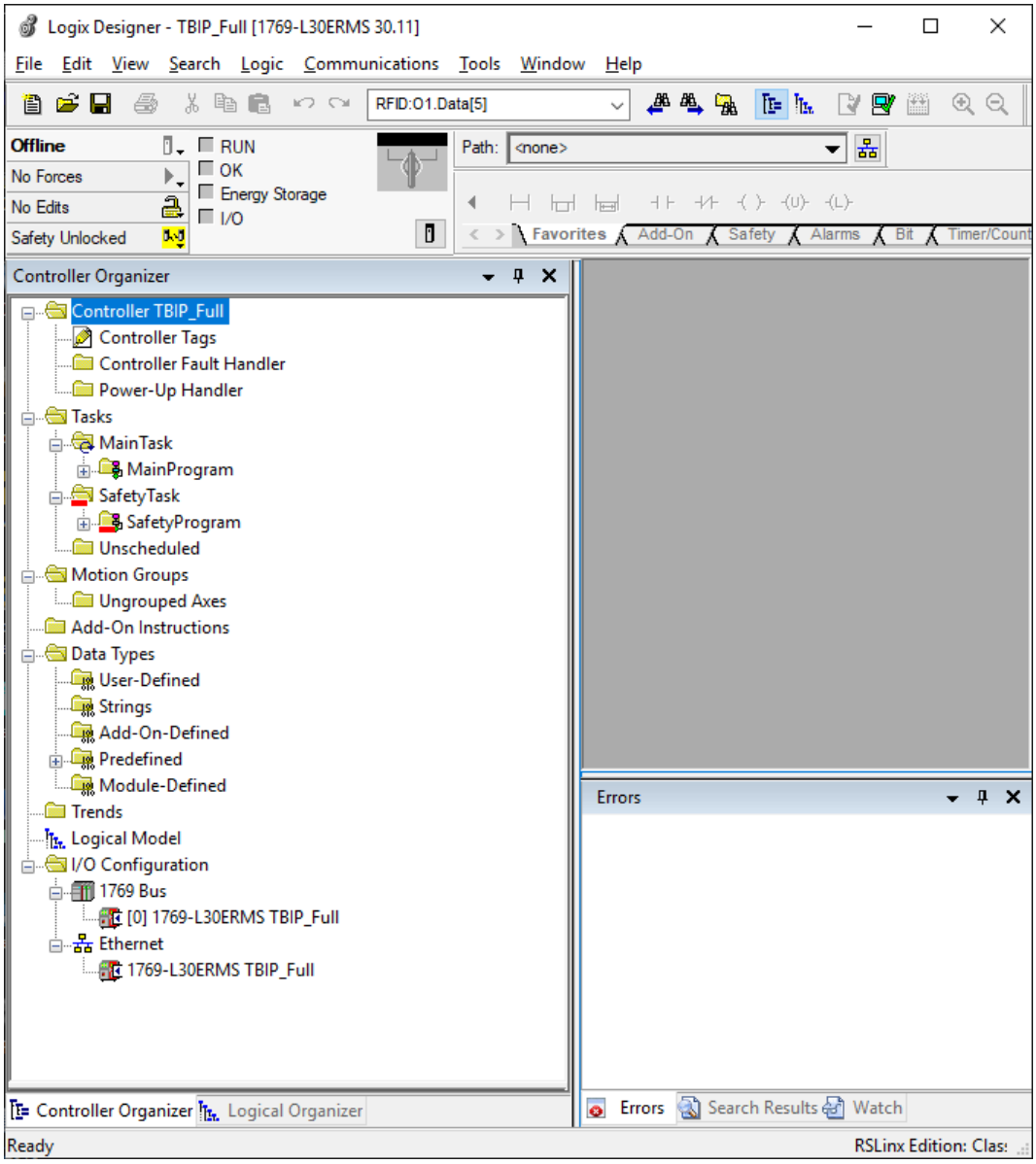


Fig. 67: Logix Designer – new project

8.7.5 Opening the catalog file

✓ The catalog file was downloaded from www.turck.com.

✓ The ZIP archive has been unpacked.

✓ The configuration of the with the Turck Safety Configurator is completed.

✓ A Studio 5000 project with the used CIP Safety PLC was created. [▶ 65]

▶ Open the catalog file in Studio 5000 by using the import function and save it as project.

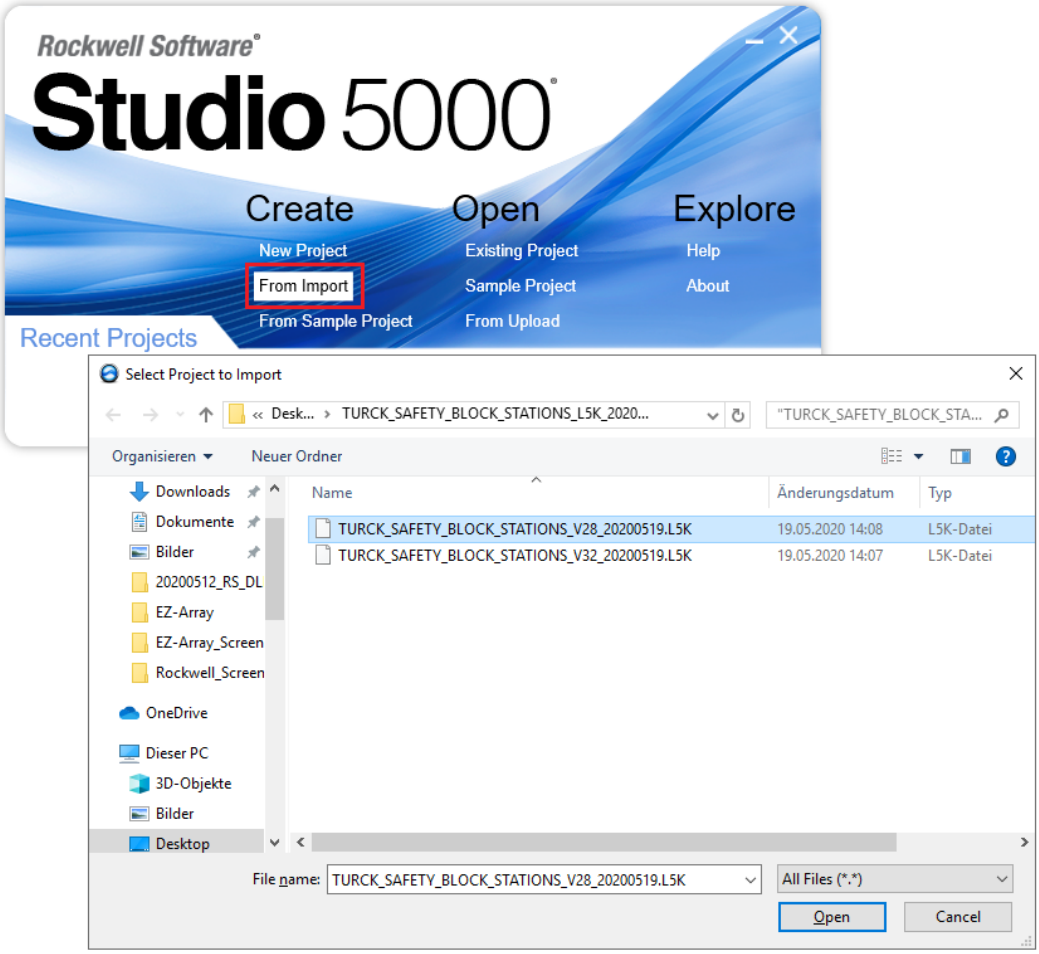


Fig. 68: Studio 5000 – import of the catalog file

➪ The project with the catalog file is created.

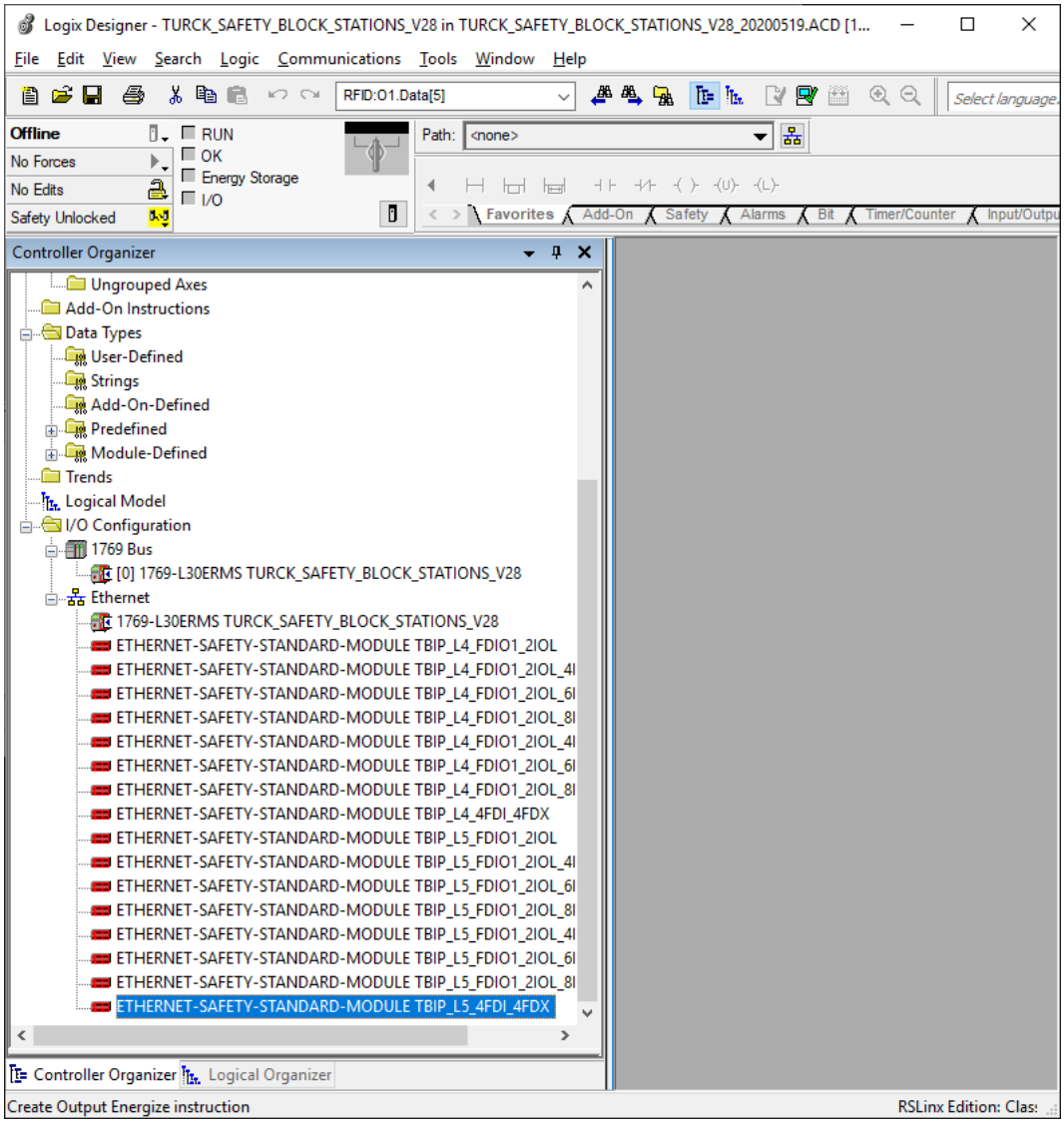


Fig. 69: Studio 5000 – project with catalog file

8.7.6 Configuring the device in Logix Designer

Adding TBIP-L…-4FDI-4FDX from catalog file to the project

- ▶ Add the TBIP-L…-4FDI-4FDX from the project with the catalog file under Ethernet to the new project.

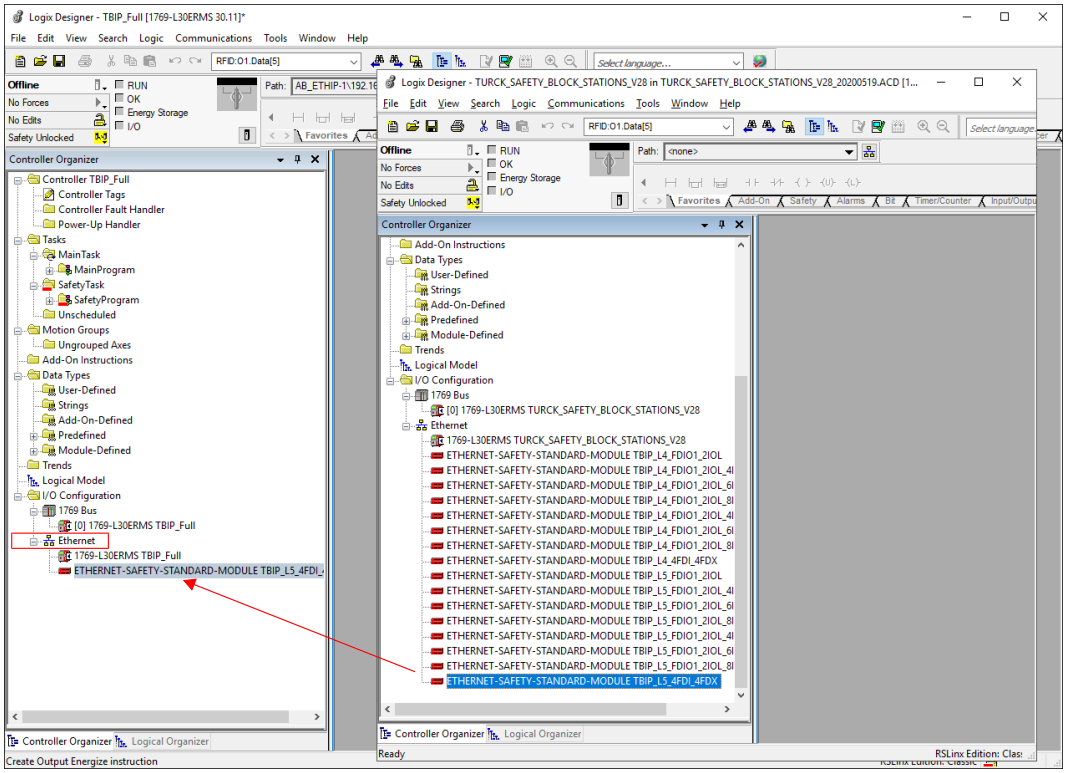


Fig. 70: Logix Designer – adding TBIP-L5-4FDI-4FDX to the project

Assigning module properties

- In the **Module Properties** dialog, double-click the module entry and define a device name and the IP address (in the example 192.168.1.105).

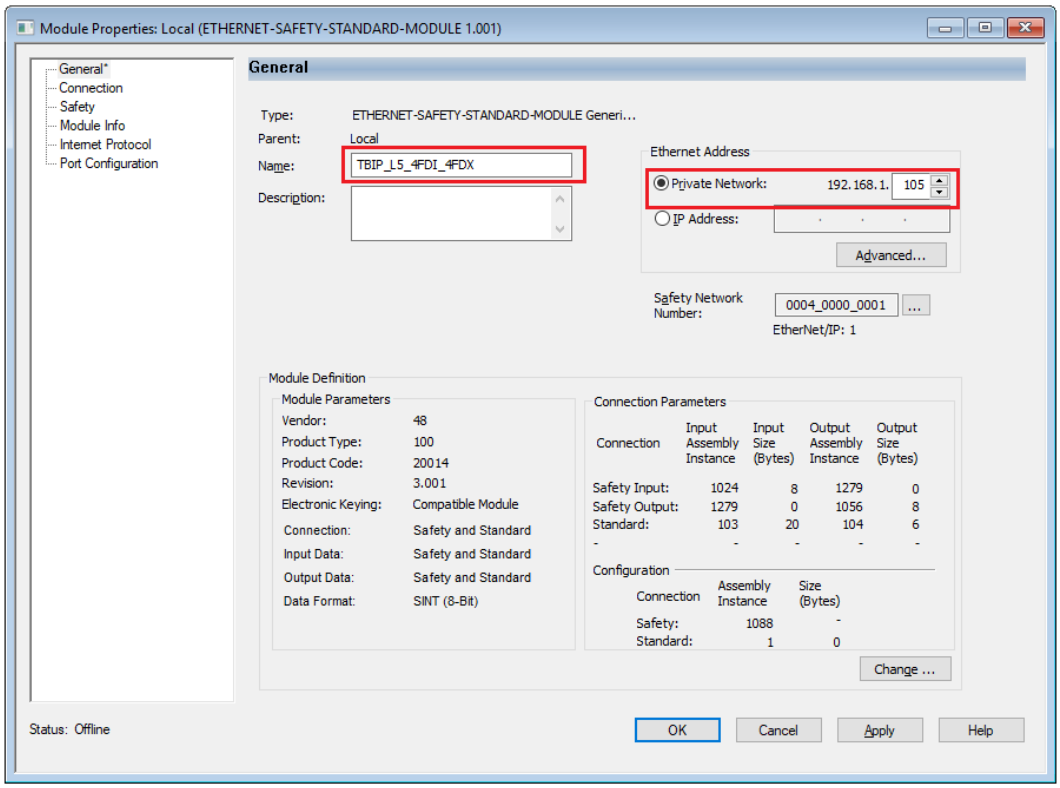


Fig. 71: Logix Designer – setting name and IP address

Set the the Configuration Signature

The Configuration Signature is used by the controller to clearly identify the safety device and assures that the configured device matches the connected device concerning the configured safety function. The Configuration Signature consists of an ID and a time stamp and is generated by the Turck Safety Configurator. The Configuration Signature is part of the configuration log.

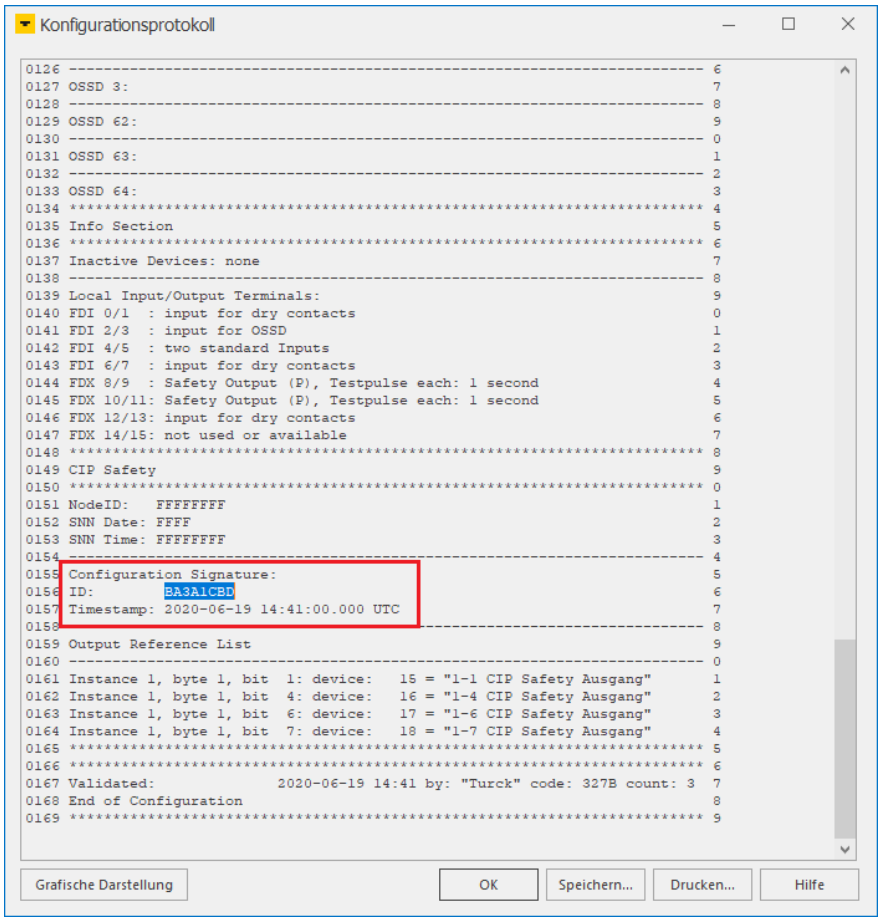


Fig. 72: TSC – configuration log from the example project with Configuration Signature

NOTE

The time stamp in the configuration protocol of the Turck Safety Configurator is calculated depending on the system time (local time) of the computer on which the software is installed. The time in RSLogix Designer is though based on the UTC. Therefore, a conversion of the system-time based entry in the protocol to the UTC is necessary. In the example the CEST (Central European Summer Time) + 2 hours is entered in Logix Designer.

▶ Set the Configuration Signature under **Safety → Configuration Signature**.

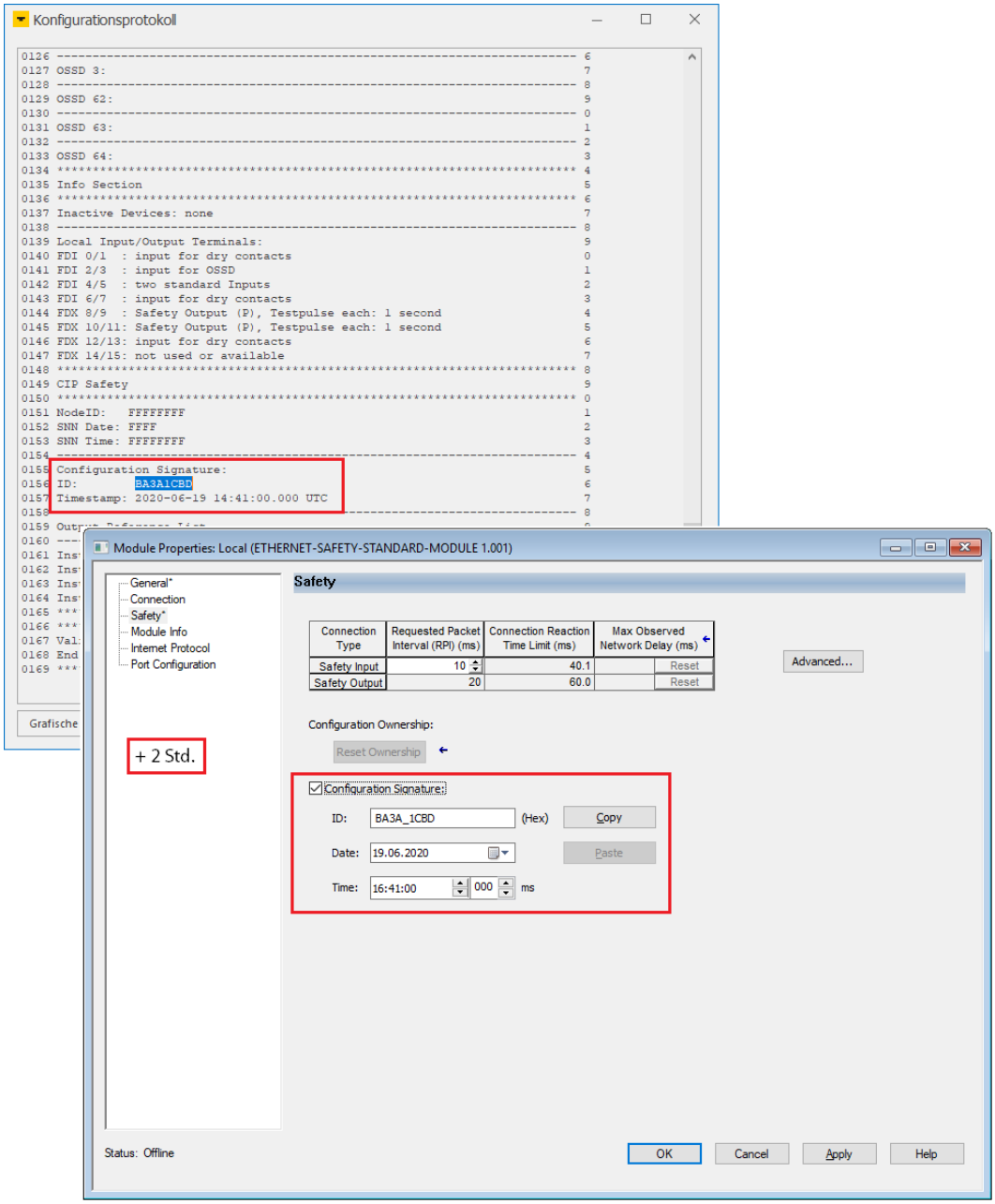


Fig. 73: Logix Designer – entering the Configuration Signature from the configuration protocol

Examples for calculating

CET (winter time)	UTC CET + 1 Std.	CEST (summer time)	UTC CEST + 2 Std.
1:34:00 000 PM	2:34:00 000 PM	2:34:00 000 PM	4:34:00 000 PM

▶ Save the **Module Properties** with **OK** and close the configuration.

Defining the Project Path

- Scan the network via Communications → **Who Active**.
- Select the used controller.
- Define the project path via the **Set Project Path** button.

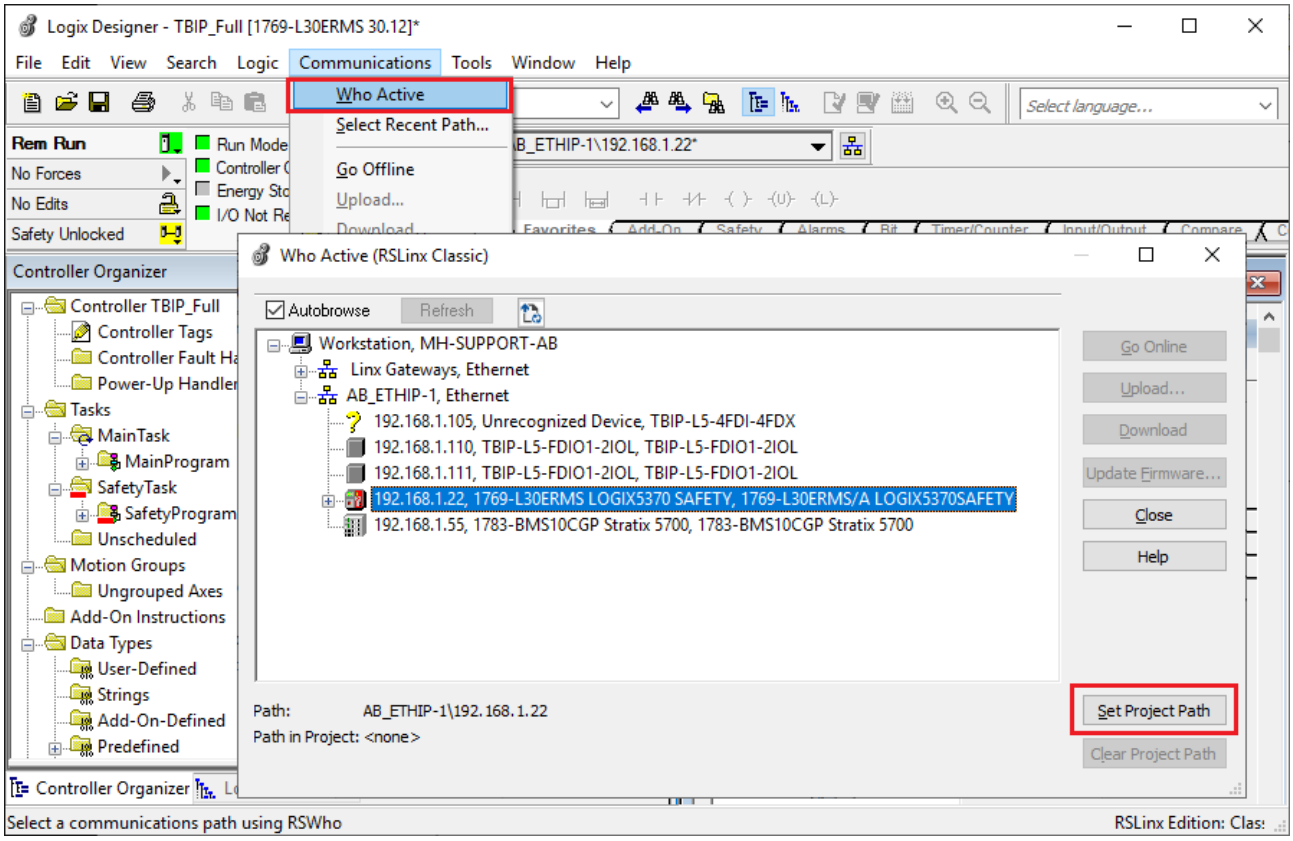


Fig. 74: Logix Designer – Who Active – setting the project path

- Close the **Who Active** window.

Going online with the controller

- Click **Offline** → **Go Online**.
- Load the configuration into the controller by pressing the **Download** button in the **Connected To Go Online** window.
- Execute the download in the **Download** window by pressing the **Download** button.

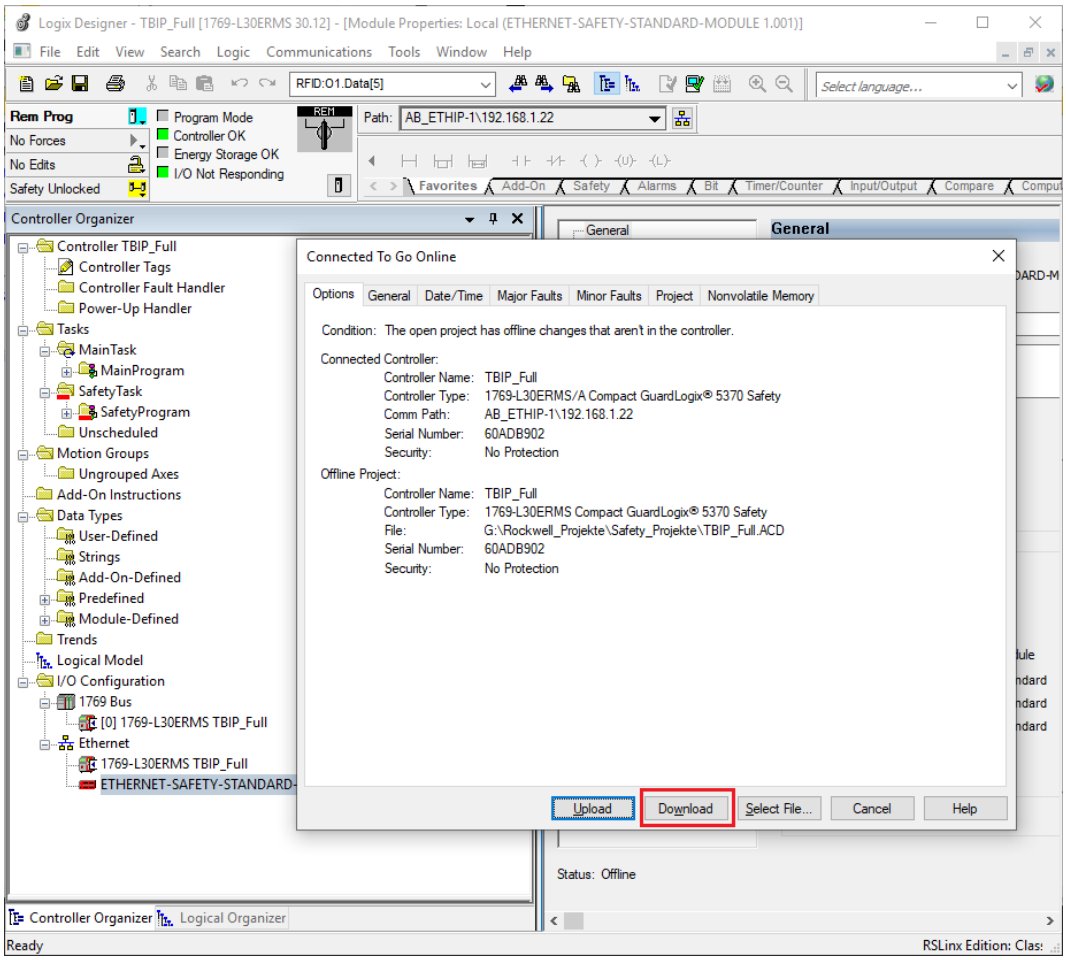


Fig. 75: Logix Designer – downloading the configuration into the controller

⇨ The download is executed.

➪ The TBIP-L…-4FDI-4FDX (ETHERNET-SAFETY-STANDARD-MDOULE TBIP_L5_4FDI_4FDX) in the project tree shows an error.

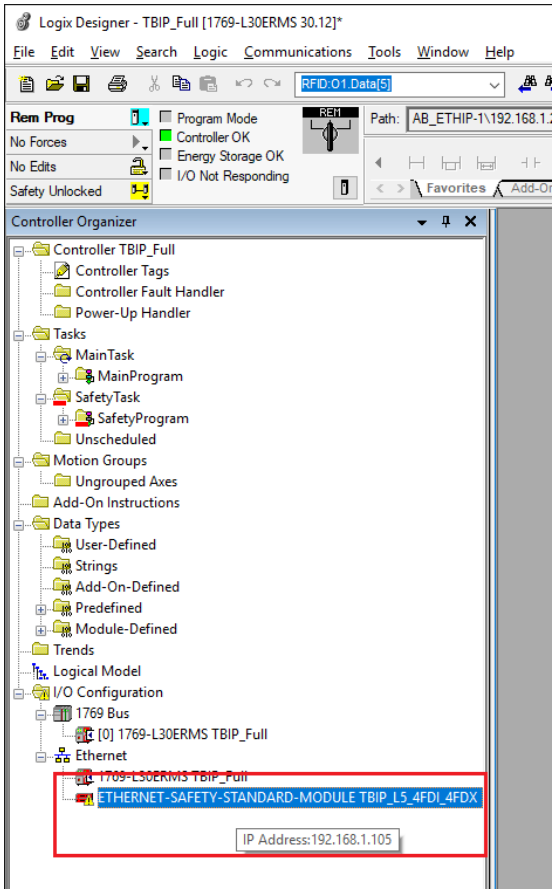


Fig. 76: Logix Designer – error at the device

▶ Open the module properties by double-clicking the device entry in the project tree.

⇨ The fault is specified under **Module Fault** in the **Connection** tab: "Safety network number mismatch".

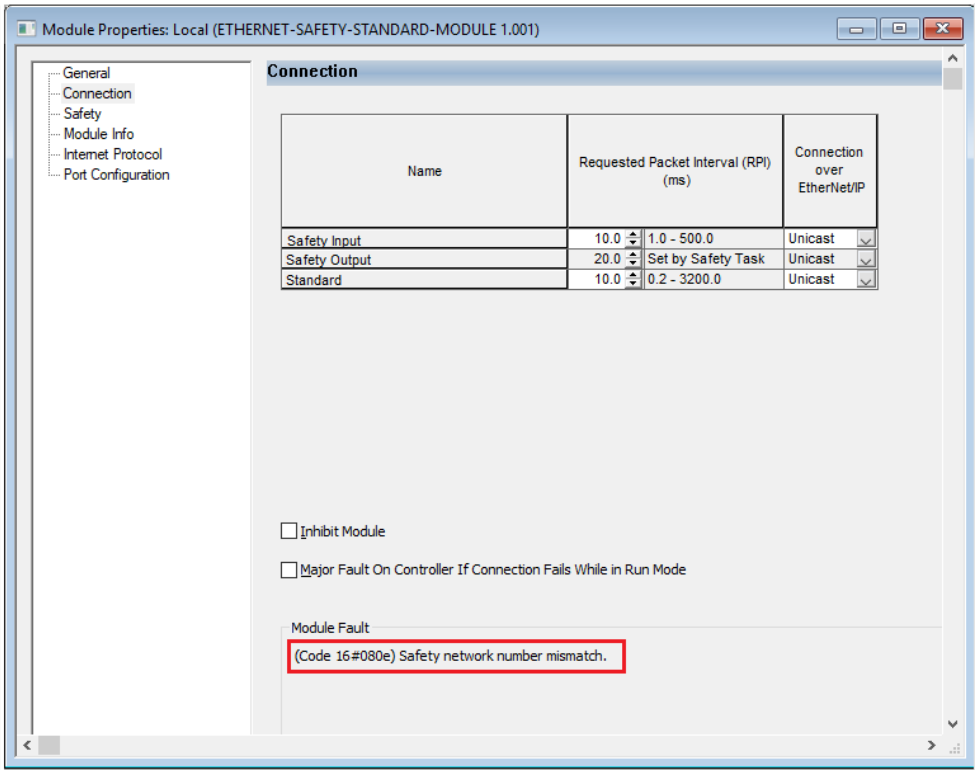


Fig. 77: Logix Designer – copying the Safety Network Number

Before a connection to the device can be established, the CIP Safety Ownership must be configured. In this process the TBIP-L…-4FDI-4FDX is assigned to the CIP Safety Controller via the Safety Network Number (SNN). In case of several controllers in one network, this procedure inhibits an unintentional access of another controller to the safety device.

Assigning the Safety Network Number

The Safety Network Number clearly assigns the safety I/O module to one CIP Safety Controller. In case of several controllers in one network, this inhibits an unintentional access of another controller to the safety device.

Copying the Safety Network Number from the controller

- Go offline.
- Open the **Controller Properties**.
- Click to **…** (right to the Safety Network Number) in the **General** tab and open the the **Safety Network Number** window.
- Use the **Copy** button to copy the Safety Network Number and close the window with **OK**.

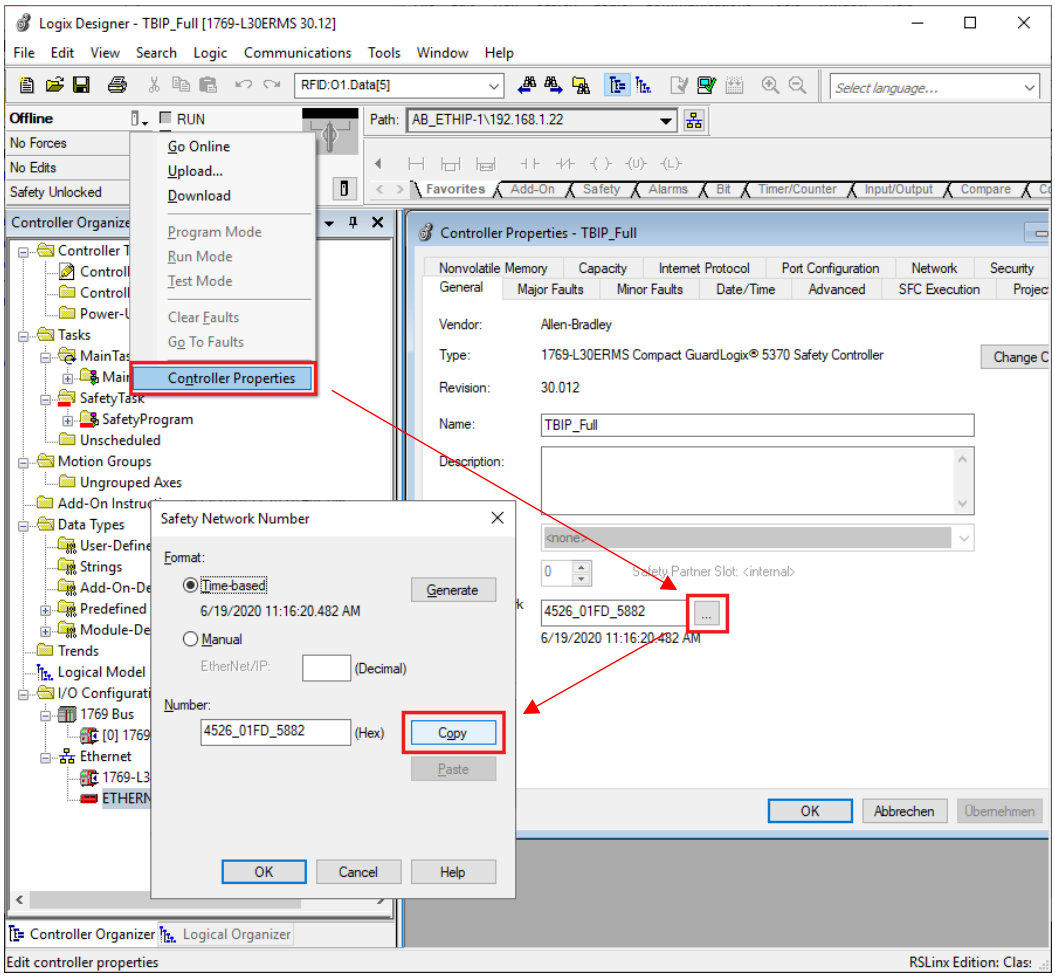


Fig. 78: Logix Designer – copying the Safety Network Number

Assigning the Safety Network Number to the device

- Open the **Module Properties** of the TBIP-L…-4FDI-4FDX and open the **Safety Network Number** window by clicking the **…** button.
- Use the **Paste** button to paste the controller's Safety Network Number into the module configuration and close the window with **OK.**

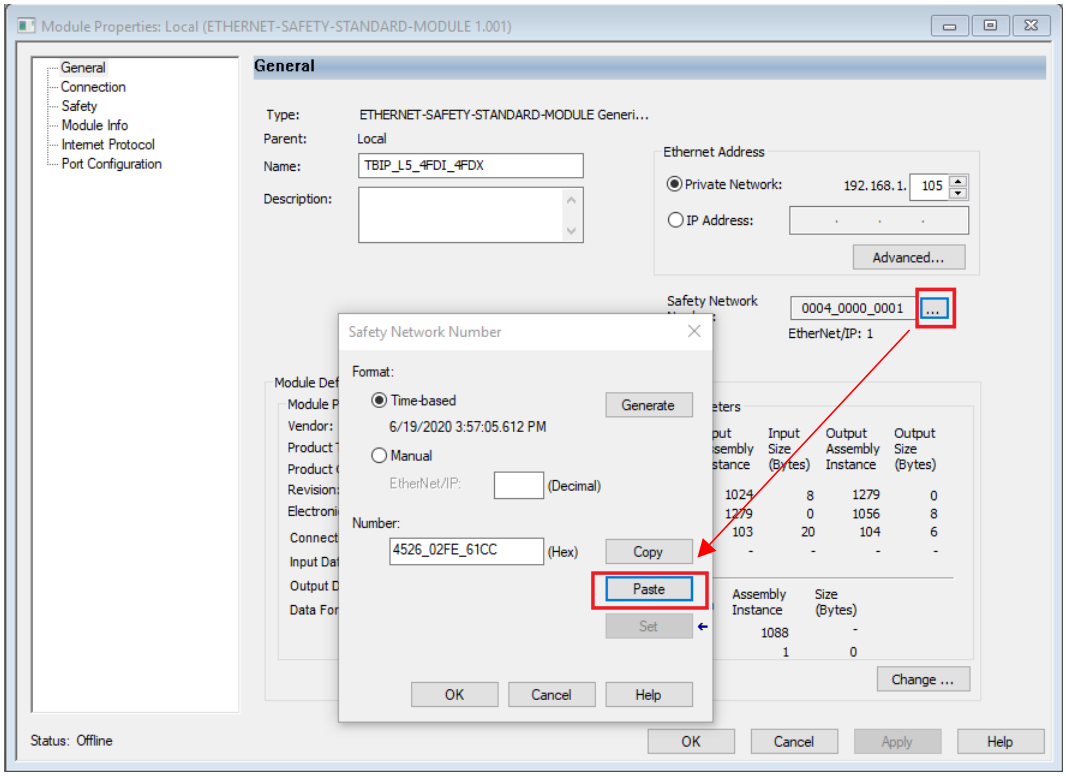


Fig. 79: Logix Designer – copying the Safety Network Number to the module properties

Reset Ownership

If a device has already been used on a CIP Safety Controller, it must first be reset via a **Reset Ownership**.

- ▶ Go online.
- ▶ Click **Reset Ownership** in the **Safety** tab in the **Module Properties** and confirm all upcoming warnings.

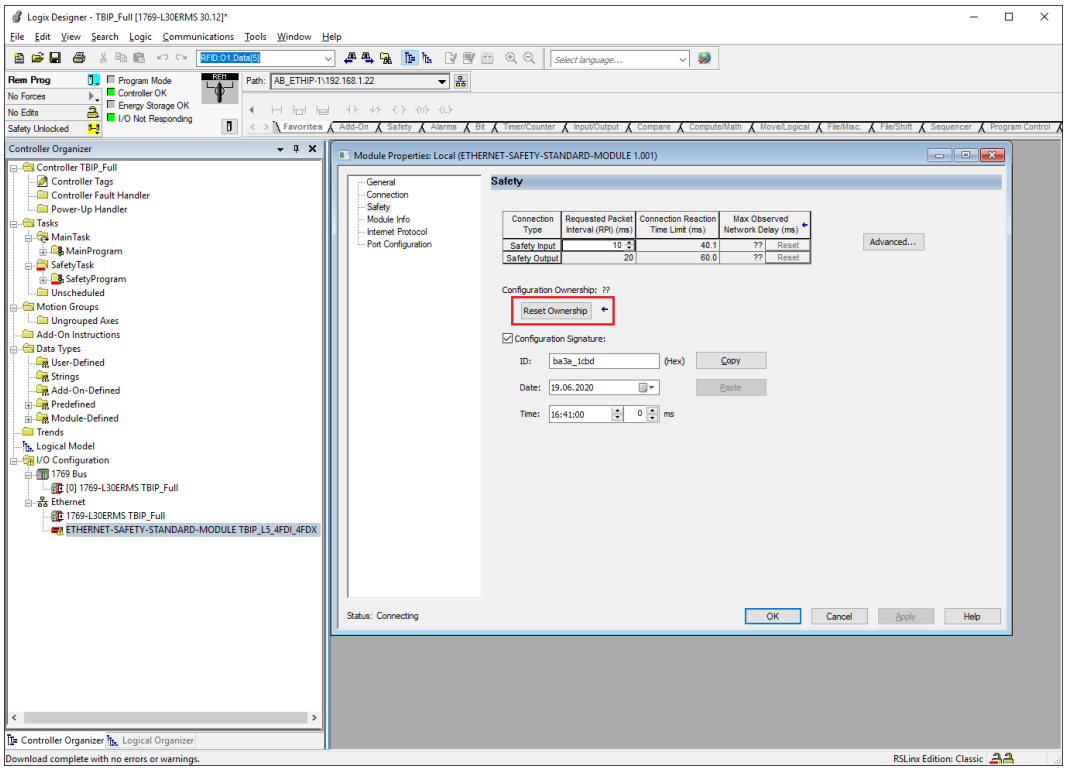


Fig. 80: Logix Designer – Reset Ownership

- ▶ Open the **General** tab in the **Module Properties** and open the **Safety Network Number** window.

- In the **Safety Network Number** window, write the Safety Network Number to the device by clicking the **Set** button and confirm the setting.

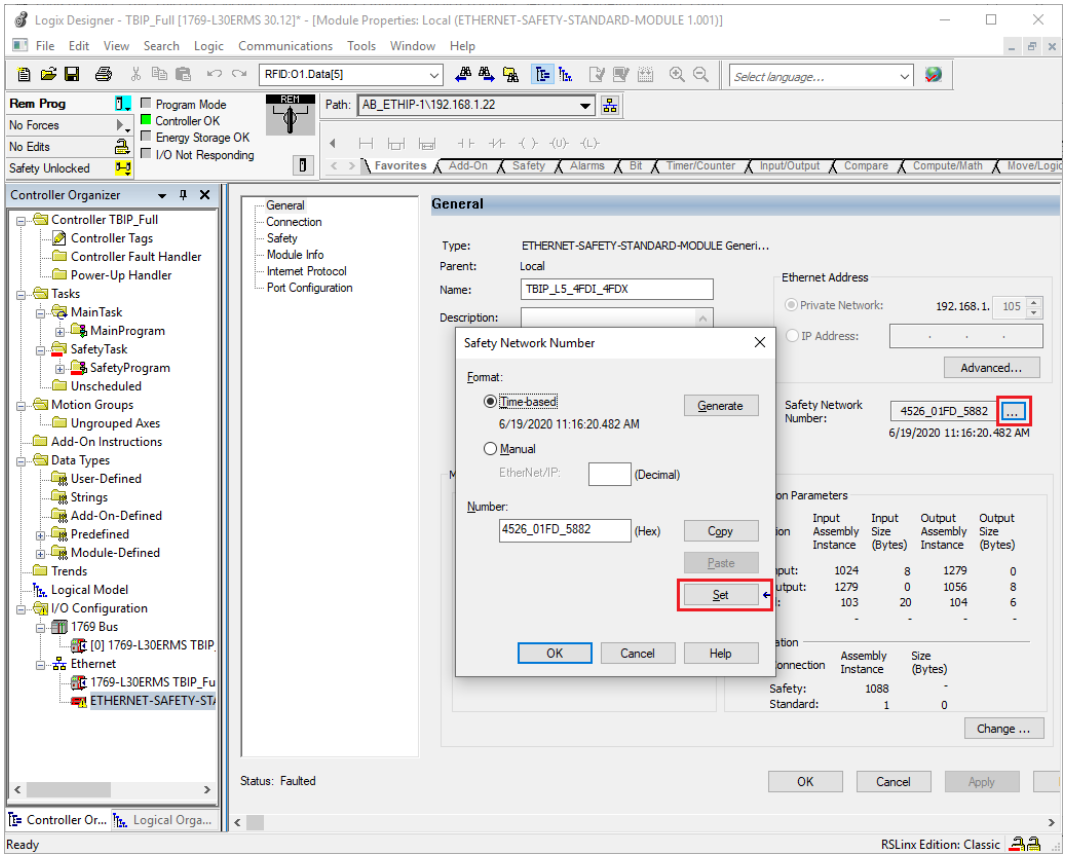


Fig. 81: Logix Designer Writing the Safety Network Number to the device

9 Operating

9.1 LED displays

The device has the following LED indicators:

- Power supply
- Group and bus errors
- Status
- Diagnostics

LED PWR	Meaning
Off	No voltage connected or under voltage at V1
Green	Voltage V1 and V2 OK
Red	No valid state, device switches to the safe state
Red/green	No valid state, device switches to the safe state

LED 0…7	Meaning
Off	Input not active
Green	Input active
Green flashing	Self-test input
Red flashing	Cross-circuit
Red	Discrepancy

LED 8…15	Meaning	
	Channel is input	Channel is output
Off	Input not active	Output not active
Green	Input active	Output active
Green flashing	Self-test input	-
Red flashing	Cross-circuit	-
Red	Discrepancy	Overload

LED 0…15	Meaning
Red flashing, all alternating	Fatal Error

LED NS	Meaning
Off	■ Device is not on-line. ■ Device not powered
Green	Active connection to a master
Green flashing	■ Device on-line but no connection ■ A connection may be established, but not completed.
Red	Communication error
Red flashing	One or more I/O connections are in the timed–out state.
Green/red flashing	■ During start-up: device is in self test ■ During operation: network access error detected, communication failed (Communication Faulted State)

LED WINK	Meaning
White flashing	Helps to localize the module if the Blink/Wink command is active

Note: The Ethernet ports P1 and P2 or XF1 and XF2 each have an LED ETH or L/A.

LEDs ETH… or L/A	Meaning
Off	No Ethernet connection
Green	Ethernet connection established, 100 Mbps
Green flashing	Ethernet traffic, 100 Mbps
Yellow	Ethernet connection established, 10 Mbps
Yellow blinking	Ethernet traffic, 10 Mbps

9.2 Status- and control word

Status word

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	-	-	-	-	-	-	-	DIAG
Byte 0	-	FCE	-	-	-	COM	V1	-

Bit	Description
COM	Internal error The device-internal communication is disturbed.
DIAG	Diagnostic message at the device
FCE	The DTM Force Mode is activated. The actual output values may no match the ones defined and sent by the field bus.
V1	V1 too low (< 18 VDC)

Control word

The control word is not in use.

9.3 Process input data

Byte no.	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
n	**Status word** [▶ 82]															
n + 1	**Safe Unit Status** [▶ 84]															
	Reserved													SUUM	SUCM	SUPM
n + 2	**Error Codes** [▶ 84]															
	Reserved											68	67	66	65	64
n + 3	**Memory and F-Config Status** [▶ 83]															
	Reserved								F ERR	-	-	COM LO	-	CNF MM	NCNF	PMS
	Safe Status [▶ 84]															
n + 4	Connector C1/X1								Connector C0/X0							
	OVL	-	TC CH1	TC CH0	ERR FIN	TEST	WAIT	RGG	OVL	-	TC CH1	TC CH0	ERR FIN	TEST	WAIT	RGG
n + 5	Connector C3/X3								Connector C2/X2							
	OVL	-	TC CH1	TC CH0	ERR FIN	TEST	WAIT	RGG	OVL	-	TC CH1	TC CH0	ERR FIN	TEST	WAIT	RGG
n + 6	Connector C5/X5								Connector C4/X4							
	OVL	-	TC CH1	TC CH0	ERR FIN	TEST	WAIT	RGG	OVL	-	TC CH1	TC CH0	ERR FIN	TEST	WAIT	RGG
n + 7	Connector C7/X7								Connector C6/X6							
	OVL	-	TC CH1	TC CH0	ERR FIN	TEST	WAIT	RGG	OVL	-	TC CH1	TC CH0	ERR FIN	TEST	WAIT	RGG
n + 8	**Status of the safe unit** (fieldbus bits) [▶ 85]															
	FBI15	FBI14	FBI13	FBI12	FBI11	FBI10	FBI9	FBI8	FBI7	FBI6	FBI5	FBI4	FBI3	FBI2	FBI1	FBI0

Memory and F-Config Status

Name	Code	Meaning
PMS	512	No memory chip plugged
NCNF	513	No configuration available
CNFMM	514	Configuration mismatch
COMLO	516	Communication loss
FERR	519	Fatal Error

Safe Unit Status

Name	Value	Meaning
SUPM	Safe Unit Protective Mode	
	0	Not active
	1	Active
SUCM	Safe Unit Configuration Mode	
	0	Not active
	1	Active
SUUM	Safe Unit Unknown Mode	
	0	Not active
	1	Active

Safe Status (connector C0…C7 or X0… X7)

Name	Code	Meaning
RGG	-	Normal state
WAIT	528	Waiting for input signal
TEST	544	Test input
ERRFIN	560	Error at input
TCCH0	576	Cross-circuit channel 0
TCCH1	592	Cross-circuit channel 1
OVL	62…	Overload at output (pin 4)

Error Codes

Code	Name	Meaning	Remedy
64 (0x40)	Destination Address Mismatch	The set IP address does not match the parameterized IP address.	▶ Check parameterization ▶ Restart the device.
65 (0x41)	Invalid Destination Address	The set destination IP address is not valid. Addresses 0x00 and 0xFF are not allowed.	
66 (0x42)	Invalid Source Address	The set source IP address is not valid. Addresses 0x00 and 0xFF are not allowed.	
67 (0x43)	Invalid Watchdog-Time	Invalid value for watchdog time (F_WD_Time, F_WD_Time 2). A watchdog time of 0 ms is not allowed.	
68 (0x44)	SIL Value Exceeded	The required SIL level is not supported by the device.	

Status of the safe unit (fieldbus bits)

Name	Meaning
FBI 0.0…1.7	Inputs in the TBIP-L…-4FDI-4FDX which can be addressed by the non-safe part of the safety controller. These bits have to be configured by the user in Turck Safety Configurator.

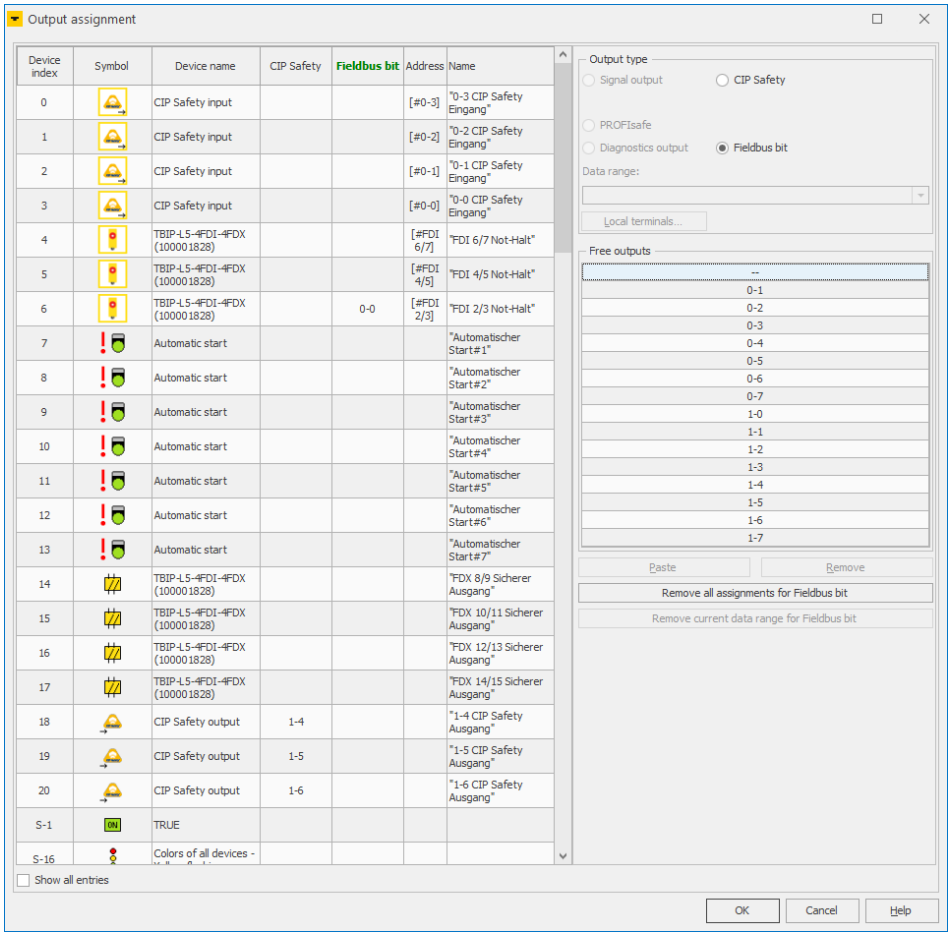


Fig. 82: TSC – assignment of fieldbus bits

9.4 Process output data

Byte no.	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
n	**Control-Wort** (no function)															
	Unlock Safe Unit [▶ 87]															
n + 1	reserved															UNLK
	Field bus bits [▶ 86]															
n + 2	FBO 15	FBO 14	FBO 13	FBO 12	FBO 11	FBO 10	FBO9	FBO8	FBO7	FBO6	FBO5	FBO4	FBO3	FBO2	FBO1	FBO0

Fieldbus bits

Name	Meaning
FB0.0… FB1.7	In the Turck Safety Configurator, these output bits can be linked to states of the safe signals and used as inputs by the non-safe controller.

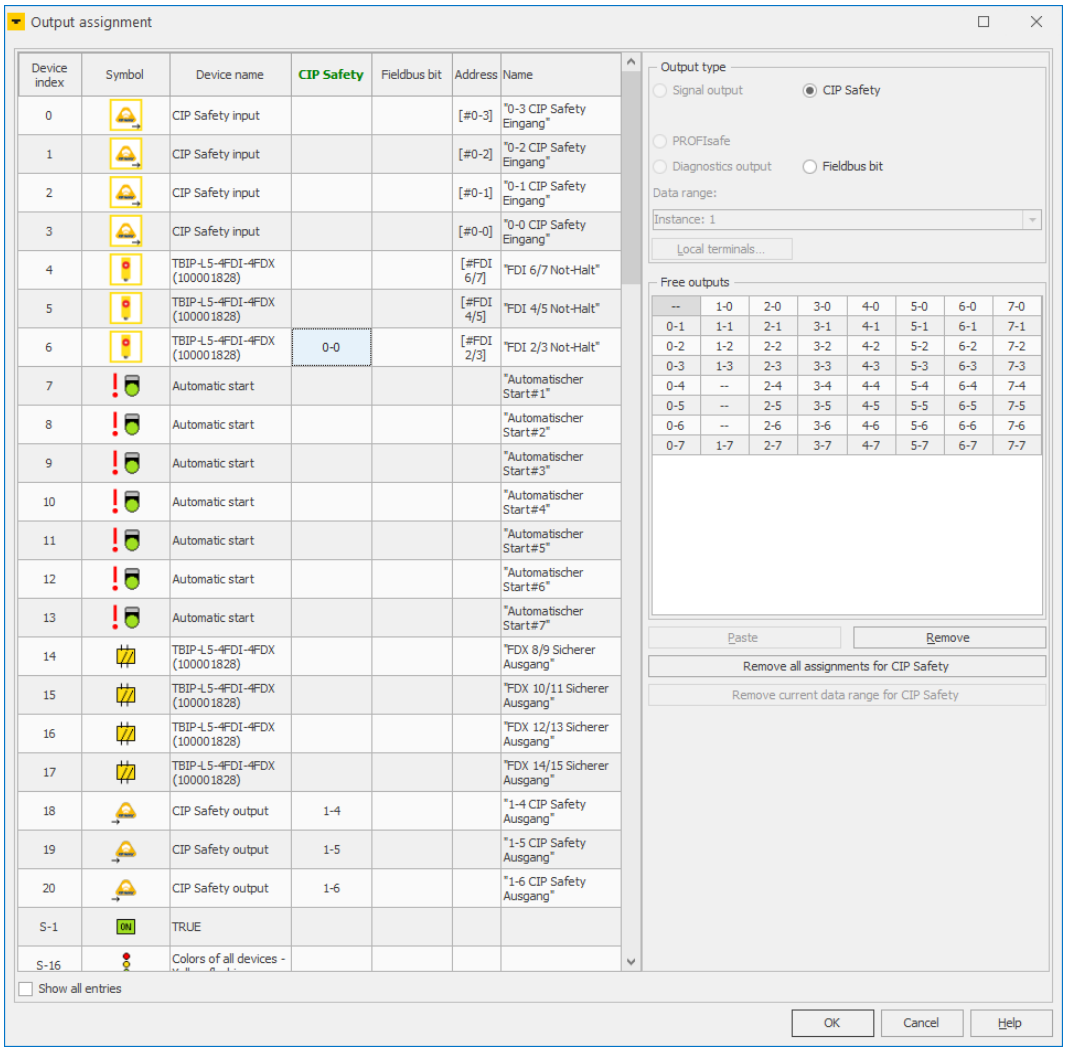


Fig. 83: Output assignment in Turck Safety Configurator

Unlock Safe Unit

Name	Meaning
UNLK	This bit serves for unlocking the safe unit. It responds to a falling edge.

▶ Set bit UNLK to 1 and back to 0.
⇨ The safe unit is unlocked.

9.5 Using the configuration memory

9.5.1 Storing a configuration

The safety function is automatically stored to the memory stick after a configuration has been downloaded to the device via Turck Safety Configurator.

NOTE
Non-safety-related configurations as the device's IP address will not be stored on the memory chip.

Storing the configuration during module start

- ✓ The device is not supplied.
- ✓ The memory chip is empty.
- ✓ The device has stored a valid configuration.
- ▶ Plug the empty memory chip into the device.
- ▶ Switch-on the power supply.
- ⇨ The configuration will be loaded from the device to the memory stick during device start.

Storing the configuration during operation

- ✓ The device is connected to the Turck Safety Configurator.
- ✓ The memory chip is plugged from the device start and contains the actual configuration (identical configuration as in the Turck Safety Configurator).
- ▶ Load a new or changed configuration into the device via Turck Safety Configurator.

9.5.2 Loading a configuration from the memory chip

- ✓ Memory chip with valid configuration
- ▶ Set the rotary coding switches to 900 (F_Reset)
- ▶ Execute a power cycle.
  - ⇨ The device is reset.
- ▶ Set the rotary coding switch to an address unequal to "9xx".
- ▶ Plug the memory chip containing a valid configuration onto the device.
- ▶ Switch-on the power supply.
- ⇨ The configuration will be loaded from the memory chip to the device during device start.

9.5.3 Deleting the memory chip (Erase Memory)

The content of the memory chip can either be deleted by using the rotary coding switches or via the Turck Safety Configurator.

Deleting the configuration via rotary switch setting (901)

- ▶ Plug the memory chip into device.
- ▶ Set the rotary coding switches to 901 (Erase Memory).
- ▶ Execute a power cycle at the device.
- ⇨ The content of the memory chip is deleted. The procedure completed as soon as the ERR LED stops blinking.

Deleting the configuration via Turck Safety Configurator

- ▶ Select the function **monitor settings → delete configuration** in the Turck Safety Configurator to delete the content of the memory stick.

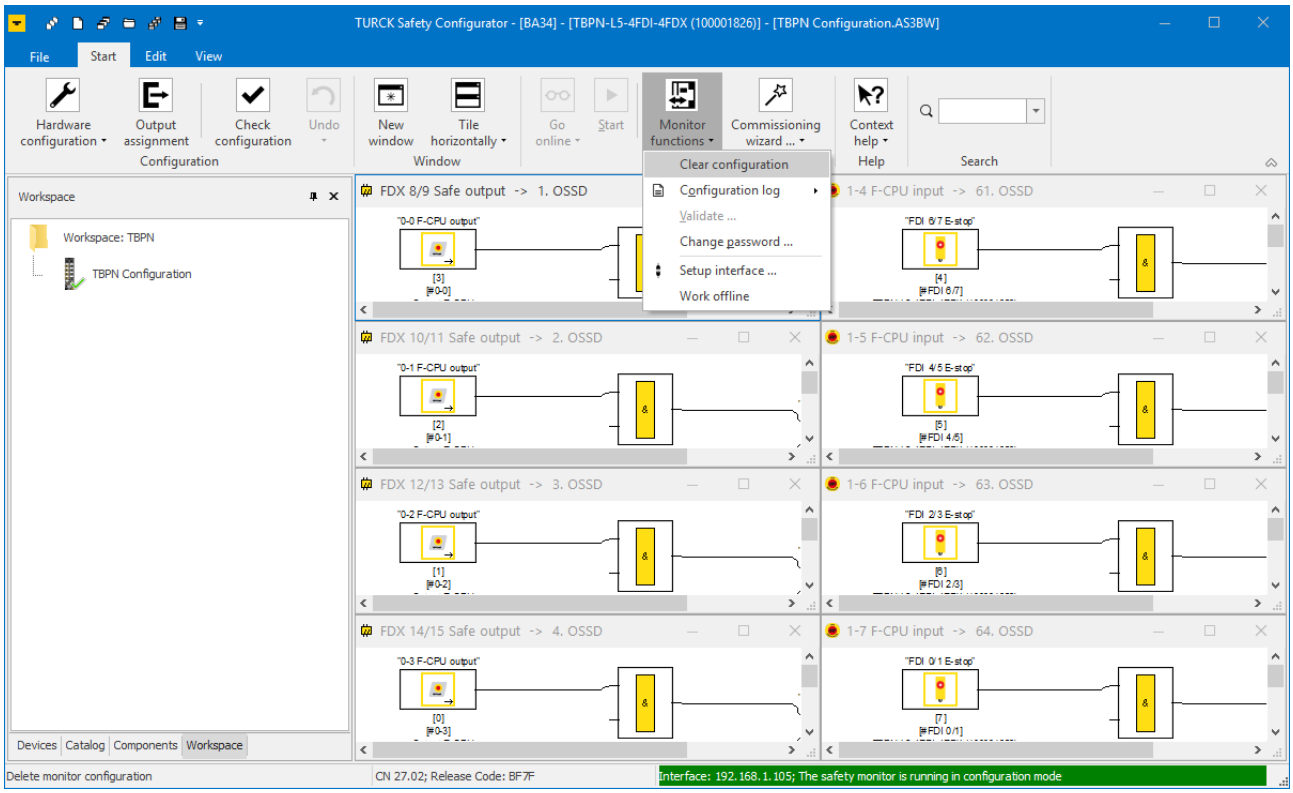


Fig. 84: Deleting the configuration via Turck Safety Configurator

- ⇨ The configuration on the memory chip is deleted. The procedure completed as soon as the ERR LED stops blinking.

9.5.4 Configuration transfer and module behavior

Configuration			Module behavior	Diagnostics
In device	**External memory**	**Device/ memory**		
Invalid/ none	Invalid/ none	-	Device start → Device **not** running	No configuration available, see „Memory and F-Config Status" [▷ 83]
Invalid/ none	Valid	-	Device start → Device running → Loading the configuration from the memory to the device	-
Valid	Invalid/ none	-	Device start → Device running → Loading the configuration from the device to the memory	-
Valid	Valid	equal	Device start → Device running	-
Valid	Valid	unequal	Device start → Device running	Configuration missmatch, see „Memory and F-Config Status" [▷ 83]
Valid	No memory chip plugged	-	Device start → Device **not** running	No memory chip plugged, see „Memory and F-Config Status" [▷ 83]
Valid	Memory chip pulled	-	During operation	No memory chip plugged, see „Memory and F-Config Status" [▷ 83]
changed during operation	Valid	unequal	During operation → The new configuration is checked. → Loading the configuration from the memory to the device	-

9.6 Reset the device to factory settings (factory reset)

NOTE
Sets the device and the plugged memory chip to factory settings, the content of the memory stick is deleted.

- ▶ Plug the memory chip into device.
- ▶ Set the rotary coding switches to 900 (Factory Reset).
- ▶ Execute a power cycle at the device.
- ⇨ The device as well as the plugged memory chip are reset, stored configuration is deleted.
- ⇨ The procedure completed as soon as the ERR LED stops blinking.

10 Restarting after device exchange or modification

10.1 Changing a device

DANGER
Mounting or unmounting under voltage
Personal damage due to unintentional machine start
- ▶ Mount or unmount the device only in a de-energized condition.

10.1.1 Prerequisites for device replacement

The replacement device has to be a device of the same type with the identical or a higher device version.

Observe for device replacement:

- ▶ The parameterization and the configuration of the exchange devices exactly matches the parameterization and the configuration of the device to be changed.
- ▶ Please follow the description under ”Procedure for device replacement” to transfer an existing configuration from the configuration memory of the original device into the exchange device.

10.1.2 Procedure for device replacement

- ✓ The device to be replaced must be in Rotary mode [▷ 32].
- ▶ Disconnect the device to be replaced from the power supply and remove the memory chip with the valid configuration.
- ▶ **Important:** Do not mix up the memory chip.
- ▶ Take devices to be replaced out of operation according to chapter "Decommissioning” [▷ 93].
- ▶ Install the new device as described in the chapter ”Installing” [▷ 16].
- ▶ Connect the device to the supply voltage with the power supply switched off [▷ 21].
- ▶ **Important:** Do not yet connect I/O level and Ethernet, do not plug memory chip.
- ▶ Optional: If the replacement device is not in the delivery state, reset the device to factory settings. To do this, proceed as follows:
  Set the rotary coding switch on the device to 900 (factory reset) [▷ 32], switch on the supply voltage, wait 1 min. and switch the device off again.
- ▶ A factory reset is not necessary for a device in the delivery state.
- ▶ Insert the memory chip with the valid configuration and set the IP address of the original device at the rotary coding switches [▷ 32].
- ▶ Close the service window.
- ▶ Switch on supply voltage and wait 1 min.
- ▶ Disconnect the device from the power supply again.
- ▶ Connect sensors and actuators as well as Ethernet cables [▷ 21].
- ▶ Switch on supply voltage.
- ▶ Check the safety configuration.
- ▶ Defective or faulty devices must not, in any event, be put back into circulation. Dispose of the devices as described in the chapter "Disposal" [▷ 93].

11 Maintenance

The TBIP-L…-4FDI-4FDX is maintenance-free for the duration of use of 20 years.

Used cables as well as connected sensors and actuators have to be tested according to vendor specifications during the duration of use of TBIP-L…-4FDI-4FDX.

12 Decommissioning

The machine manufacturer is responsible for decommissioning the TBIP-L…-4FDI-4FDX. The operator must ensure that the device is used for its intended purpose.

Please observe the storage and transport requirements according to the general technical data.

13 Disposal

Defective or faulty devices must not, in any event, be put back into circulation. Send the devices back to Turck for testing and disposal.

14 Technical data

14.1 General technical data

Devices	
TBIP-L5-4FDI-4FDX	
■ ID	100001828
■ YoC	According to device labeling
TBIP-L4-4FDI-4FDX	
■ ID	100001827
■ YoC	According to device labeling
TBIP-LL-4FDI-4FDX	
■ ID	100027259
■ YoC	According to device labeling
Power supply	
V1 (incl. electronics supply)	24 VDC
V2	24 VDC, only through connected
Current feedthrough	
■ X1 to X1 (7/8")	9 A
■ XD1 tot XD2 (M12)	16 A
Permissible range	20.4…28.8 VDC
Total current	9 A
Isolation voltages	≥ 500 VAC
Connector	
■ TBIP-L5-4FDI-4FDX	7/8", 5-pin
■ TBIP-L4-4FDI-4FDX	7/8", 4-pin
Interfaces	
Ethernet	2 × M12, 4-pin, D coded
Service interface	Ethernet
Times	
Internal delay time (for calculating the watchdog time)	10 ms
Response times	See Safety Characteristic Data [▶ 31]
General technical data	
Max. cable length	
■ Ethernet	100 m (per segment)
■ Sensor/actuator	30 m
Dimensions (W × L × H)	60.4 × 230.4 × 39 mm
Operating temperature	-40 °C… +70 °C
Storage temperature	-40 °C… +85 °C
Operating altitude	Max. 5000 m

General technical data	
Protection class	IP65 IP67 IP69K The degree of protection is only guaranteed if unused connections are closed with suitable screw caps or blind caps.
Housing material	Fibre-glass reinforced Polyamide (PA6-GF30)
Housing color	black
Material connectors	brass, nickel-plated
Window material	Lexan
Material screw	303 stainless steel
Material label	Polycarbonate
Halogen-free	Yes
Mounting	2 mounting holes, Ø 6,3 mm

Standard/directive conformity	
Directives	2006/42/EG machine directive
	2014/35/EU Low Voltage Directive
	2014/30/EU EMC directive
Vibration test	According to IEC 60068-2-6/ IEC 60068-2-47, acceleration up to 20 g
Drop and topple	According to IEC 60068-2-31/IEC 60068-2-32
Shock test	According to IEC 60068-2-27
Electro magnetic compatibility	According to IEC 61131-2/IEC 61326-3-1
Approvals and certificates	CE
	UV-resistant according to DIN EN ISO 4892-2A (2013)
Note on ATEX/IECEx	[▶ 98]

14.2 Technical data – safety inputs

General technical data	
Connector	M12, 5-pin
Input delay	2.5 ms

Safety inputs for OSSD	
Signal voltage, low level	IEC 61131-2, type 1 (< 5 V; < 0,5 mA)
Signal voltage high level	IEC 61131-2, type 1 (< 15 V; < 2 mA)
Max. OSSD supply per channel	2 A per connector C0/X0…C7/X7 1.5 A at 70° C, observe derating [▶ 97]
Max. tolerated test pulse width	1 ms
Min. interval between two test pulses	12 ms at 1 ms test pulse width 8.5 ms at 0.5 ms test pulse width 7.5 ms at 0.2 ms test pulse width

Safety inputs for potential free contacts	
Loop resistance	< 150 Ω
Max. line capacity	max. 1 µF at 150 Ω, limited by line capacity
Test pulse typ.	0.6 ms
Test pulse max.	0.8 ms
Sensor supply	Supply VAUX1/T1 max. 2 A, observe derating [▶ 97]
Interval between two test pulses, minimum	900 ms (for static inputs)
Connection to external potential	Not allowed

14.3 Technical data – safety outputs

General technical data	
Connector	M12, 5-pin
Safety outputs	
Suitable for inputs according to EN 61131-2, type 1	
Output level in OFF-state	< 5 V
Output level in OFF-state	< 1 mA
Test pulse resistive load, max.	0.5 ms
Test pulse, max.	1.25 ms
Interval between two test pulses, typical	500 ms
Interval between two test pulses, minimum	250 ms
Actuator supply	Supply VAUX1/T1 max. 2 A, observe derating [▶ 97]
Max. output current	2 A (resistive)
	1 A (inductive)
Max. total current for device	9 A
	Derating [▶ 97]
Max. output current	2 A (DC load)
	Derating [▶ 97]
The user have to provide an additional overcurrent protection on site.	

14.4 Derating

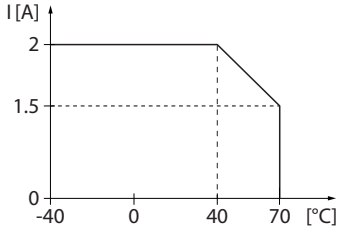


Fig. 85: Derating – output current

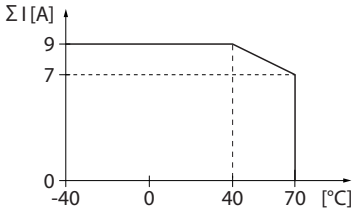


Fig. 86: Derating – total current

15 Appendix: approvals and markings

Approvals	Marking according to ATEX directive UKSI (SI 2016/1107)	EN 60079-0/-7/-31
ATEX approval no.: TÜV 20 ATEX 264795 X UKEX approval no.: TURCK Ex-20002HX	Ⓔx II 3 G Ⓔx II 3 D	Ex ec IIC T4 Gc Ex tc IIIC T115 °C Dc
IECEx approval no.: IECEx TUN 20.0010X		Ex ec IIC T4 Gc Ex tc IIIC T115 °C Dc

Ambient temperature T_{amb}.: -25 °C…+60 °C

Type designation	TB…-L…-4FDI-4FDX
Power supply	24 VDC ±10 % (SELV/PELV)
Input current I_{max}	9 A (total per module)
Output current I_{max}	1.5 A (per output)

16 Turck subsidiaries — contact information

Germany	Hans Turck GmbH & Co. KG Witzlebenstraße 7, 45472 Mülheim an der Ruhr www.turck.de
Australia	Turck Australia Pty Ltd Building 4, 19-25 Duerdin Street, Notting Hill, 3168 Victoria www.turck.com.au
Belgium	TURCK MULTIPROX Lion d'Orweg 12, B-9300 Aalst www.multiprox.be
Brazil	Turck do Brasil Automação Ltda. Rua Anjo Custódio Nr. 42, Jardim Anália Franco, CEP 03358-040 São Paulo www.turck.com.br
China	Turck (Tianjin) Sensor Co. Ltd. 18,4th Xinghuazhi Road, Xiqing Economic Development Area, 300381 Tianjin www.turck.com.cn
France	TURCK BANNER S.A.S. 11 rue de Courtalin Bat C, Magny Le Hongre, F-77703 MARNE LA VALLEE Cedex 4 www.turckbanner.fr
Great Britain	TURCK BANNER LIMITED Blenheim House, Hurricane Way, GB-SS11 8YT Wickford, Essex www.turckbanner.co.uk
India	TURCK India Automation Pvt. Ltd. 401-403 Aurum Avenue, Survey. No 109 /4, Near Cummins Complex, Baner-Balewadi Link Rd., 411045 Pune - Maharashtra www.turck.co.in
Italy	TURCK BANNER S.R.L. Via San Domenico 5, IT-20008 Bareggio (MI) www.turckbanner.it
Japan	TURCK Japan Corporation Syuuhou Bldg. 6F, 2-13-12, Kanda-Sudacho, Chiyoda-ku, 101-0041 Tokyo www.turck.jp
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