Your Global Automation Partner

TURCK

TBPN-L5-4FDI-4FDX
Safety Block I/O Module

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.

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
- EU Declaration of Conformity

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 module with PROFIsafe:

- TBPN-L5-4FDI-4FDX

2.2 Scope of delivery

The scope of delivery includes:

- TBPN-L5-4FDI-4FDX
- M12 closure caps
- 7/8" blind caps (not suitable to guarantee IP67/IP69K)

2.3 Manufacturer and service

Hans Turck GmbH & Co. KG
Witzlebenstraße 7
45472 Mülheim an der Ruhr
Germany

Turck supports you with your projects, from initial analysis to the commissioning of your application. The Turck product database contains software tools for programming, configuration or commissioning, data sheets and CAD files in numerous export formats. You can access the product database at the following address: **www.turck.de/products**

For further inquiries in Germany contact the Sales and Service Team on:

- Sales: +49 208 4952-380
- Technology: +49 208 4952-390

Outside Germany, please contact your local Turck representative.

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

These devices are designed solely for use in industrial areas.

TBPN-L5-4FDI-4FDX is a decentralized safety module for PROFIsafe. The module collects field signals and forwards them safely to a PROFIsafe master. Thanks to an extended 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.

TBPN-L5-4FDI-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 62 061)
- applications up to Category 4 and Performance Level e (according to EN ISO 13 849-1)

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 device is not suitable for:

- The use in explosive areas
- Outdoor use
- The permanent use in liquids

Modifications to the device

It is not permitted to modify the technical function or the construction of the device.

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 only meets the EMC requirements for industrial areas and is not suitable for use in residential areas.
- 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.
- 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. Here, the inspection and maintenance intervals for the machine should be strictly observed.

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 Directives and standards

Manufacturers and operators of machines and plants in which the device is used are responsible for observing all relevant directives and standards.

3.5.1 National and international directives and standards

The following guidelines and regulations must be observed:

- 2006/42/EG (machine directive)
- 2014/30/EU (electromagnetic compatibility)
- 2011/65/EU (RoHS Directive)
- 89/655/EWG (work equipment directive)
- Accident prevention regulation
- Safety rules and safety regulations according to the actual state of the art

3.5.2 Cited standards

Standard	Title
DIN EN ISO 13849-1:2016-06	Safety-related parts of control systems
EN 62061:2005 + Cor.:2010 + A1:2013 + A2:2015 IEC 62061:2005 + A1:2012 + A2:2015	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems
DIN EN 61508:2011 IEC 61508:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems
DIN EN 61131-2:2008 IEC 61131-2:2007	Programmable controllers
EN ISO 12100:2010 DIN EN ISO 12100:211-03	Safety of machinery - General principles for design - Risk assessment and risk reduction

4 Product Description

TBPN-L5-4FDI-4FDX is a safety block I/O module for PROFIsafe via PROFINET. 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.

4.1 Device overview

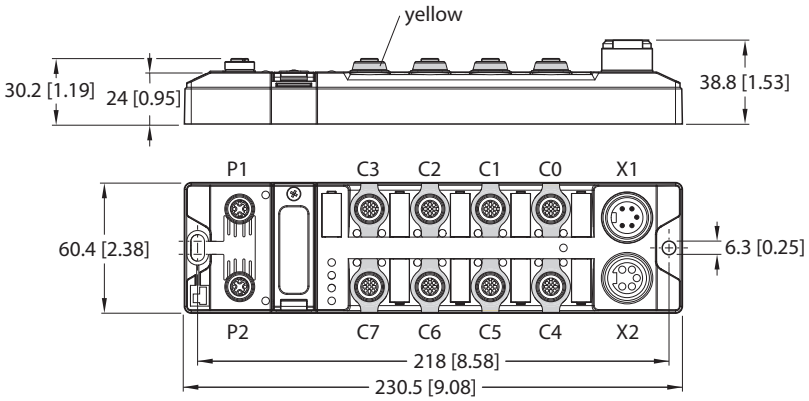


Fig. 1: TBPN-L5-4FDI-4FDX

4.1.1 Type label

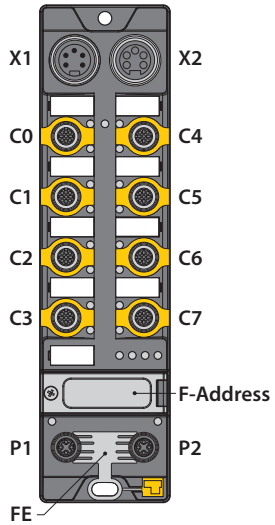
Fig. 2: Type label TBPN-L5-4FDI-4FDX

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
- 7/8'' power supply connectors
- Two 4-pole 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

TBPN-L5-4FDI-4FDX



	Meaning
X1	Power IN
X2	Power OUT
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
F-Address	Rotary coding switch for address setting for PROFIsafe (F-address setting)
P1	Ethernet 1
P2	Ethernet 2
FE	Functional earth

4.2.2 Block diagram

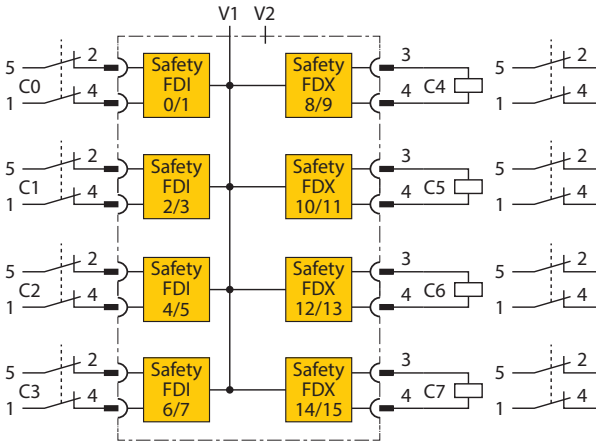


Fig. 3: Block diagram TBPN-L5-4FDI-4FDX

4.3 Functions and operating modes

4.3.1 Safety Function

The TBPN-L5-4FDI-4FDX provides four safe digital SIL3 inputs (FDI) and four SIL3-connectors (FDX), configurable as inputs 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 TBPN-L5-4FDI-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 Mounting

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.

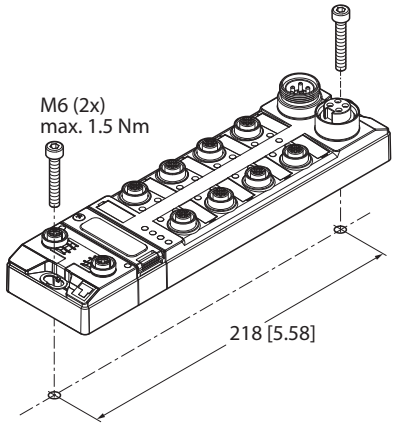


Fig. 4: Mounting the device onto a mounting plate

5.1 Grounding the device

5.1.1 Equivalent wiring diagram and shielding concept

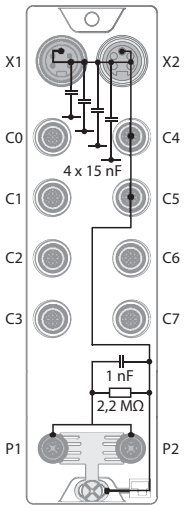


Fig. 5: Equivalent wiring diagram and shielding concept

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5.1.2 Shielding of the fieldbus and I/O level

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

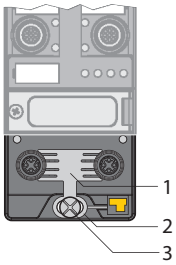


Fig. 6: Grounding clip (1), grounding ring (2) and metal screw (3)

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.

Shielding concept of the I/O modules (I/O level)

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.

Shielding concept of the fieldbus level

On delivery, a grounding clip is provided on the connectors for the fieldbus connection.

When mounted directly on a mounting plate, the shielding of the fieldbus cables is routed directly to the module ground via the grounding clip and the metal screw in the lower mounting hole.

If direct grounding of the fieldbus shield is not desired, the grounding clip must be removed. In this case, the fieldbus shield is connected to the module ground via an RC element.

5.1.3 Grounding the device – I/O level and fieldbus level

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 grounding of the I/O level. If the grounding is to be routed via an RC element, the grounding clip must be removed.

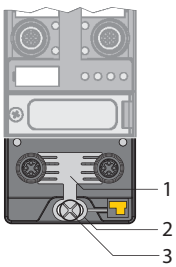


Fig. 7: Grounding clamp (1)

Removing the grounding clip: Disconnect the direct grounding of the fieldbus level

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

Mounting the grounding clip: grounding the fieldbus level directly

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

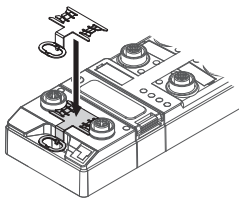


Fig. 8: Mounting the grounding clip

Grounding the device – mounting on a mounting plate

- ▶ For mounting onto a mounting plate: Fix the Device with an M6 metal screw through the lower mounting hole.
- ⇨ The shielding of the M12 flanges for the I/O level is connected to the reference potential of the installation via the M6 metal screw.
- ⇨ With mounted grounding clip: The shielding of the fieldbus is connected to the reference potential of the installation via the module grounding of the I/O level.

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 0.8 Nm.
- ▶ Always seal unused connectors with suitable screw caps or blind caps.
- ▶ Use appropriate 7/8" sealing caps, e.g. type RKMV-CCC. The caps not part of the scope of delivery.

6.1 Connecting the M12 connectors

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

Fig. 9: Torque screwdriver

Description	Type	Ident no.
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

6.2 Connecting the device to Ethernet

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

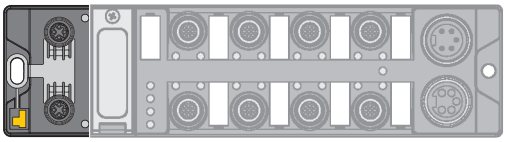


Fig. 10: M12 Ethernet connector

▶ Connect the device to Ethernet according to the pin assignment below.

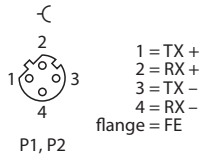


Fig. 11: Pin assignment Ethernet connectors

6.3 Connecting the power supply

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 5-pole 7/8" connectors. V1 and V2 are galvanically isolated. The maximum tightening torque is 0.8 Nm.

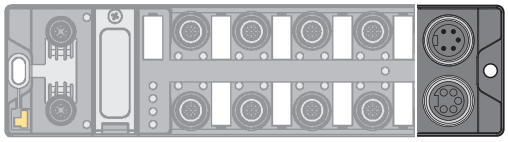


Fig. 12: 7/8'' connector for connecting the supply voltage

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

Fig. 13: Pin assignment voltage supply connectors

Connector	Function
X1	Power feed
X2	Continuation of the power to the next node
V1	System voltage: Supply voltage 1 (incl. supply of electronics)
V2	Load voltage: Power supply 2

6.3.1 24 V Supply (SELV/PELV)

WARNING
Incorrect or defective power supply unit
Danger to life due to dangerous voltages on touchable parts
- Only use 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 TBPN-L5-4FDI-4FDX. The use of SELV or 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 V DC).

6.4 Connecting safe sensors and actuators

NOTE
We recommend pre-assembled 5-pin 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.

Safety inputs (FDI)

The device has eight M12 connectors for connecting safe sensors and actuators. The maximum tightening torque is 0.8 Nm.

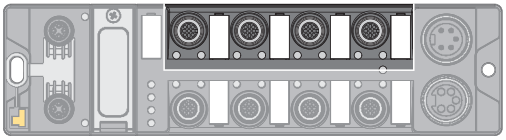


Fig. 14: M12 connector, safety inputs (FDI)

▶ Connect the sensors to the device according to the pin assignment.

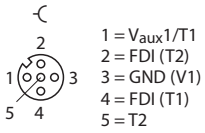


Fig. 15: Pin assignment C0…C3, FDI

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

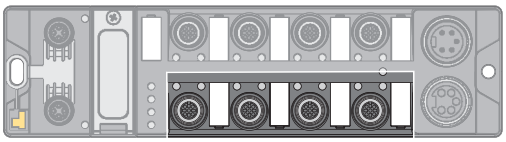


Fig. 16: M12 connector, safety in-/outputs (FDx)

- ▶ Connect the sensors and actuators to the device according to the pin assignment.

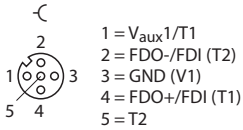


Fig. 17: Pin assignment C4…C7, FDX

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

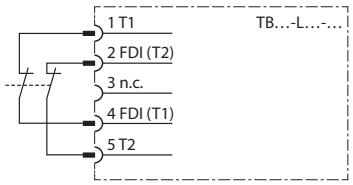
DANGER
Connection of fast reacting loads
Danger to life due to connection failures

- ▶ Use loads with mechanical or electrical inertia. Positive and negative test pulses have to be tolerated.

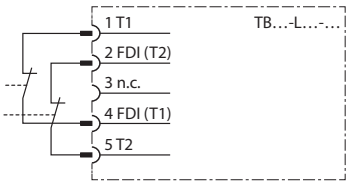
6.5 Switching examples

6.5.1 Inputs

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

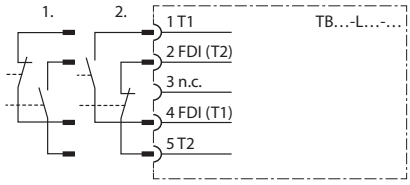


Connected in the switch



Two individual switches switching simultaneously via one application

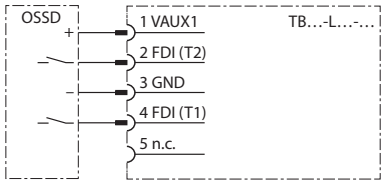
Safe equivalent input for potential-free contacts (normally closed/normally closed)



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: e.g. for two-hand switches with two separate contacts

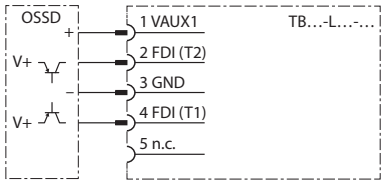
Safe electronic input (OSSD)



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.

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

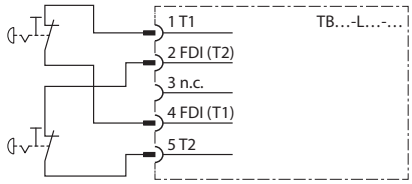
Safe electronic input (OSSD) antivalent switching



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

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

Safe inputs with single-channel mechanical contacts



Inputs can be queried 1-channel.

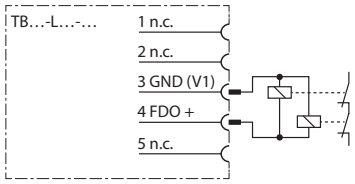
- Connect sensors via two connection cables and a Y-plug (i.e. Ident-no.: 6634405) to the M12 sockets of the modules.

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.

6.5.2 Outputs

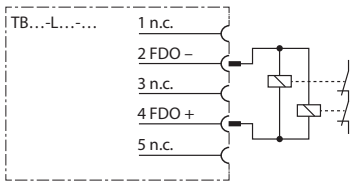
NOTE
Any change in the test pulse interval of the outputs will change the performance level. The software and the online help of the software contain further information.

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).
- Another connection of the negative pole to the GND of the power supply unit is not permitted.
- The wiring has to allow an exclusion of faults regarding cross connection.

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

- Set the F address at the module [▶ 28].
- Please assure the proper closing of the protective cover over the rotary coding switches [▶ 28].
- Mount the device according to the instructions [▶ 16].
- Connect Ethernet cables according to the instructions [▶ 20].
- Connect the power supply according to the instructions [▶ 20].
- Wire the in- and outputs depending on their use [▶ 22], [▶ 24].
- Seal unused connectors with the respective protection caps [▶ 19].

Connecting the supply voltage

- Before the operating voltage is applied, assure that:
  - no wiring or grounding errors exist
  - a safe grounding of the device/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” [▶ 30].

7.1.3 Commissioning the device at the PLC

- Configure the device in the PLC.
- Configure the device in the PLC configuration software [▶ 58].
- 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").

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
PL (Performance Level)	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	
PFD	4.1×10^{-6}	
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 %	
PROFIsafe > local output	25 ms	EN 61508
Local input > PROFIsafe	20 ms	
Local input <> local output	35 ms	

7.3 Addressing the device

7.3.1 Setting the F address at the device

- ▶ Open the cover above the switches.
- ▶ Set the F 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.

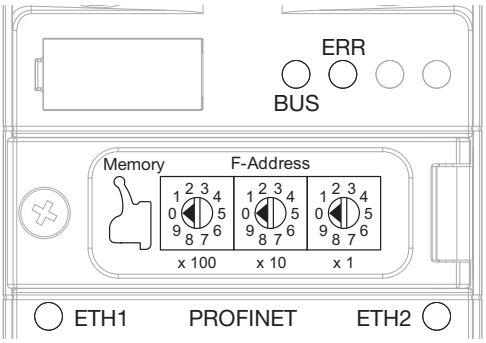


Fig. 18: Rotary coding switches at the device

In the delivery state, the rotary switches are set to 000 (0 - 0 - 0). The addresses 000 and ≥ 900 are no valid F addresses.

Switch position	Meaning
0	Delivery state, no valid F address
1…899	F address, accept setting by restarting the device
900	Factory Reset: resets the device to factory settings
901	Erase Memory: deletes the content of the memory chip.

7.3.2 Addressing the device at PROFINET

In the delivery state or after a device reset to factory settings, neither a device name nor an IP address is set in the device .

PROFINET name

In PROFINET, the connected device is not identified by it's IP address, but recognized and addressed by it's device name. The device name can be freely chosen.

- Default device name (from GSDML): tben-l5-4fdi-4fdx

Assigning the IP address

The devices IP address is usually set through the PROFINET controller. In the delivery state, the device can be accessed via the IP address 192.168.1.254.

The start page of the device web server can be accessed via**http://192.168.1.254/info.html** to make initial settings. For this, the PC used for configuration must be in the same IP network as the device.

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 Integrate Turck Safety Configurator in TIA Portal

Register Turck Safety Configurator in TIA Portal

- ▶ Select the **Register in TIA/Step7** option in the installation step **Custom Setup** in order to be able to start Turck Safety Configurator directly from TIA portal.

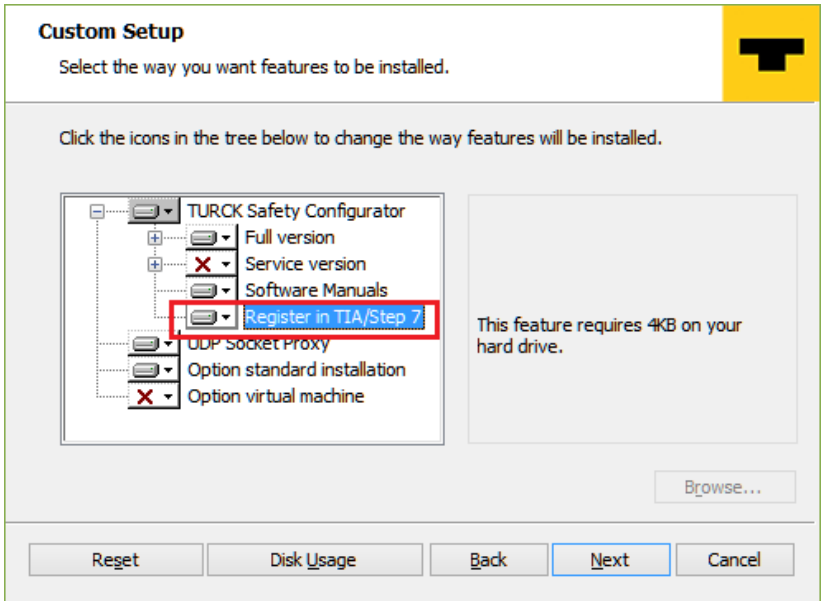


Fig. 19: Register the TSC in TIA/Step7

Start the Turck Safety Configurator from TIA/Step 7

- Right click the TBPN-L5-4FDI-4FDX and open Turck Safety Configurator via **Start device tool** in TIA-Portal.

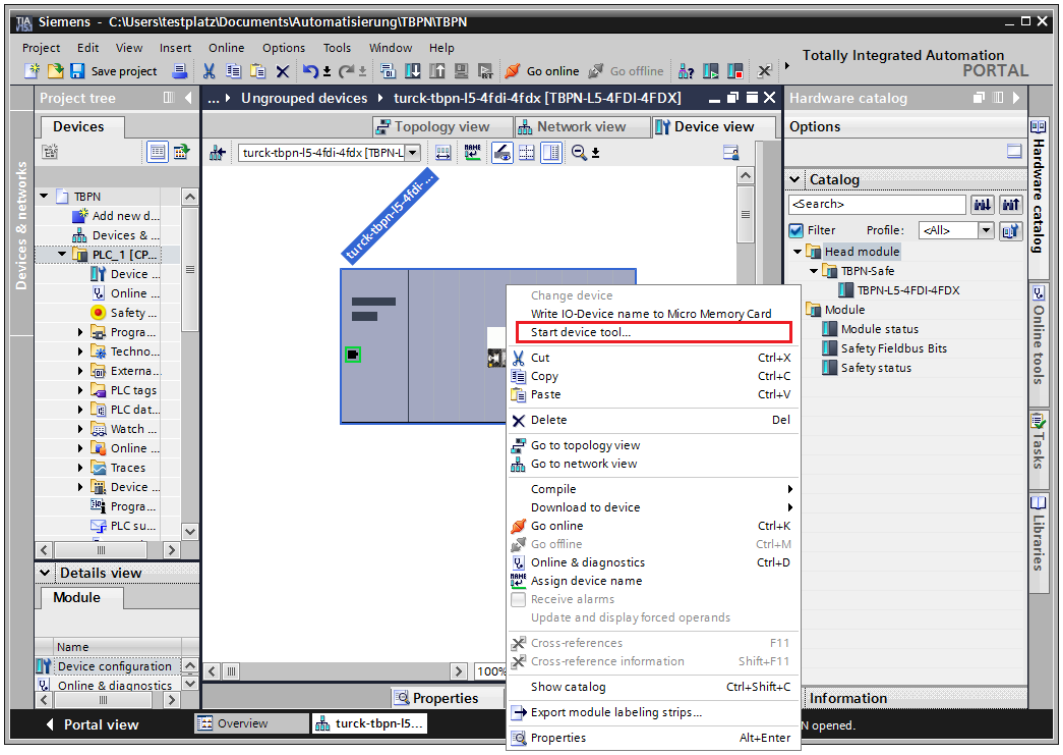


Fig. 20: Start the Turck Safety Configurator from TIA/Step7

8.3 Licensing Turck Safety Configurator

The licensing is done via coupon code.

- Enter the coupon code on the Turck web page following this link: http://www.turck.de/de/turck-safety-configurator-license-6174.php
- If the coupon code is missing, please order a coupon code via E-mail under the following E-mail address: TM-BWSoftwareSupport@turck.com

8.4 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.

8.4.1 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**.

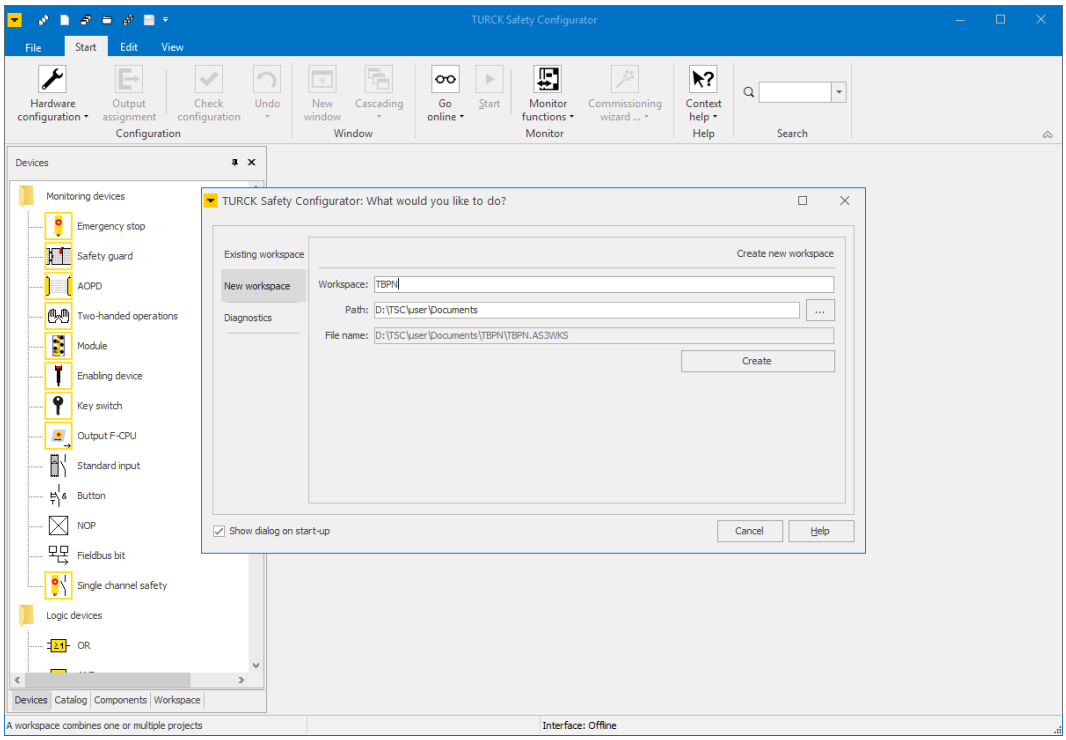


Fig. 21: Start assistant – new workspace

- ⇨ The new workspace is created.

8.4.2 Selecting a master and creating a basic configuration

▶ Select the TBPN-L5-4FDI-4FDX in the **Select master** dialog and confirm with **OK**.

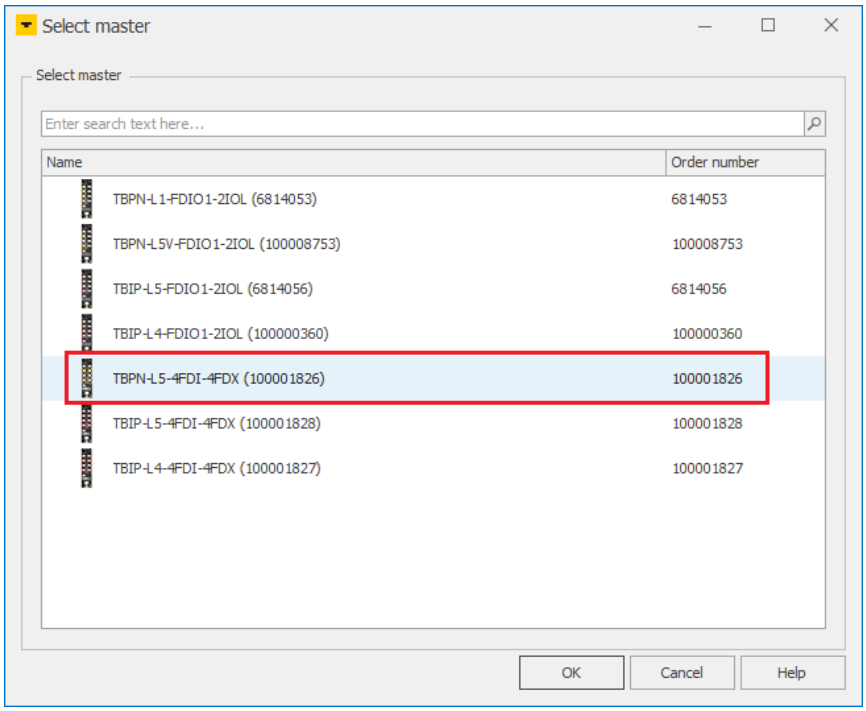


Fig. 22: TSC – Selecting a master

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

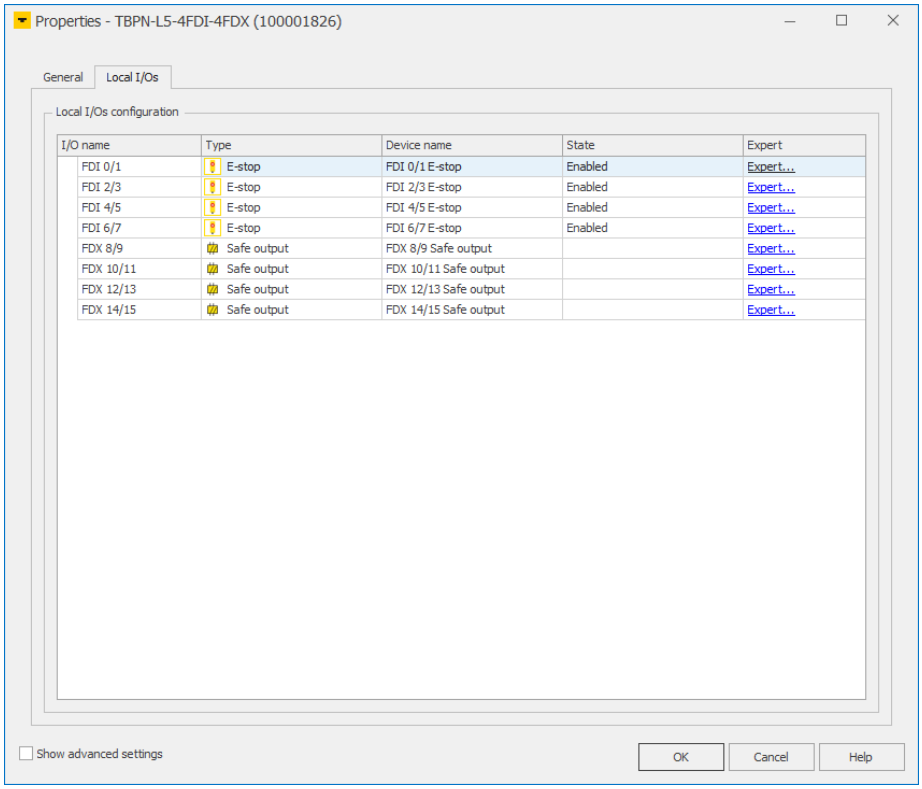


Fig. 23: TSC – Hardware configuration

In the register tab Local I/Os, the safe slots of TBPN-L5-4FDI-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 milliseconds)
FDX10/11	Safe output	Safe output	Safe output according to PLe (test pulse every 500 milliseconds)
FDX12/13	Safe output	Safe output	Safe output according to PLe (test pulse every 500 milliseconds)
FDX14/15	Safe output	Safe output	Safe output according to PLe (test pulse every 500 milliseconds)

- ▶ 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

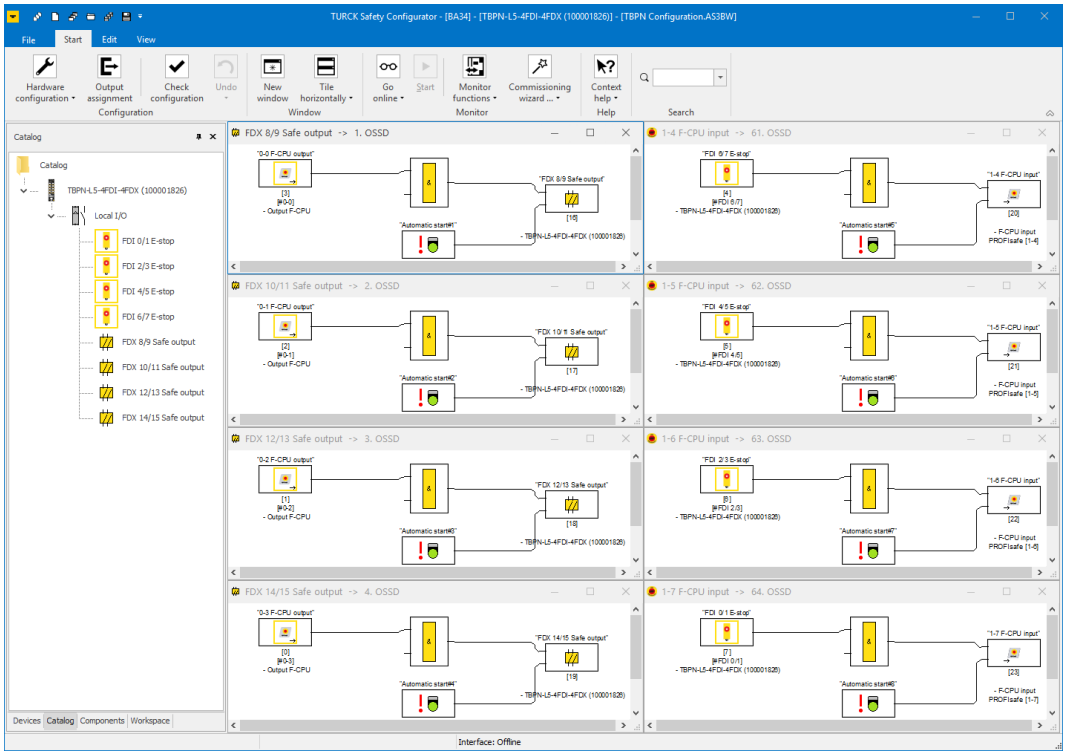


Fig. 24: TSC – Release circuits (OSSDs) of the basic configuration

8.4.3 Adapting the configuration of the safe channels

The channels of TBPN-L5-4FDI-4FDX are adapted to requirements of the respective application in the register tab **Local I/Os** → **Expert**.

Configuration options

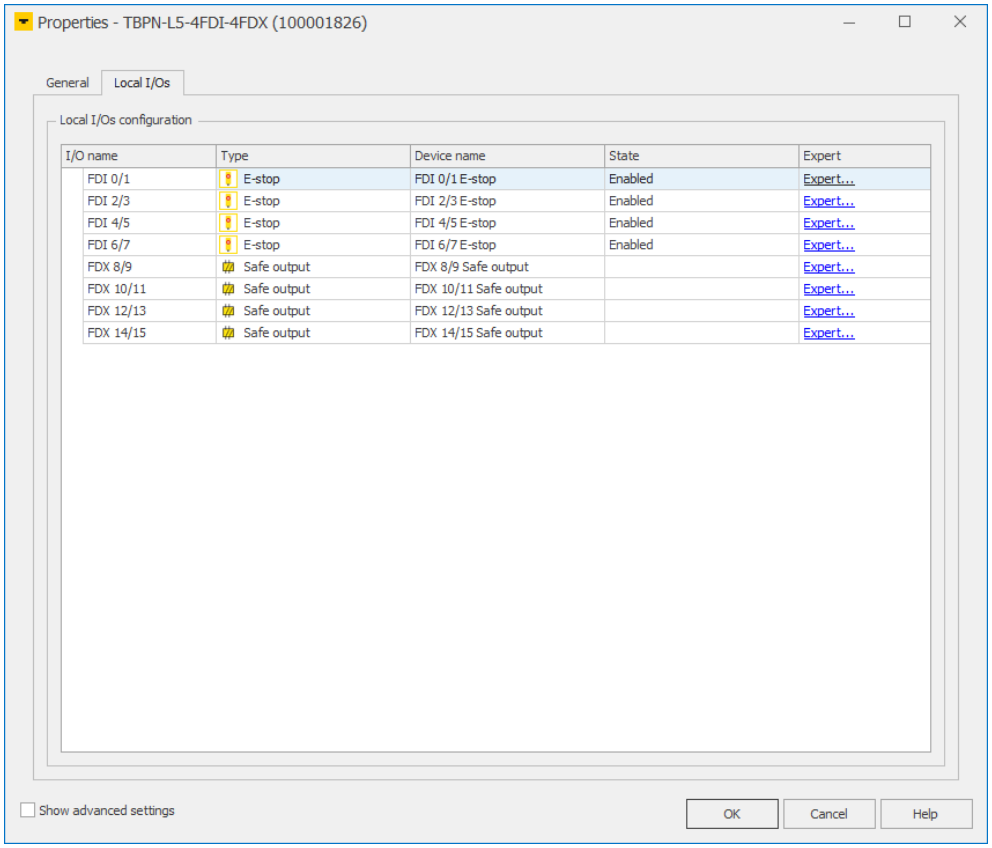


Fig. 25: TSC – Configuration of I/Os

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

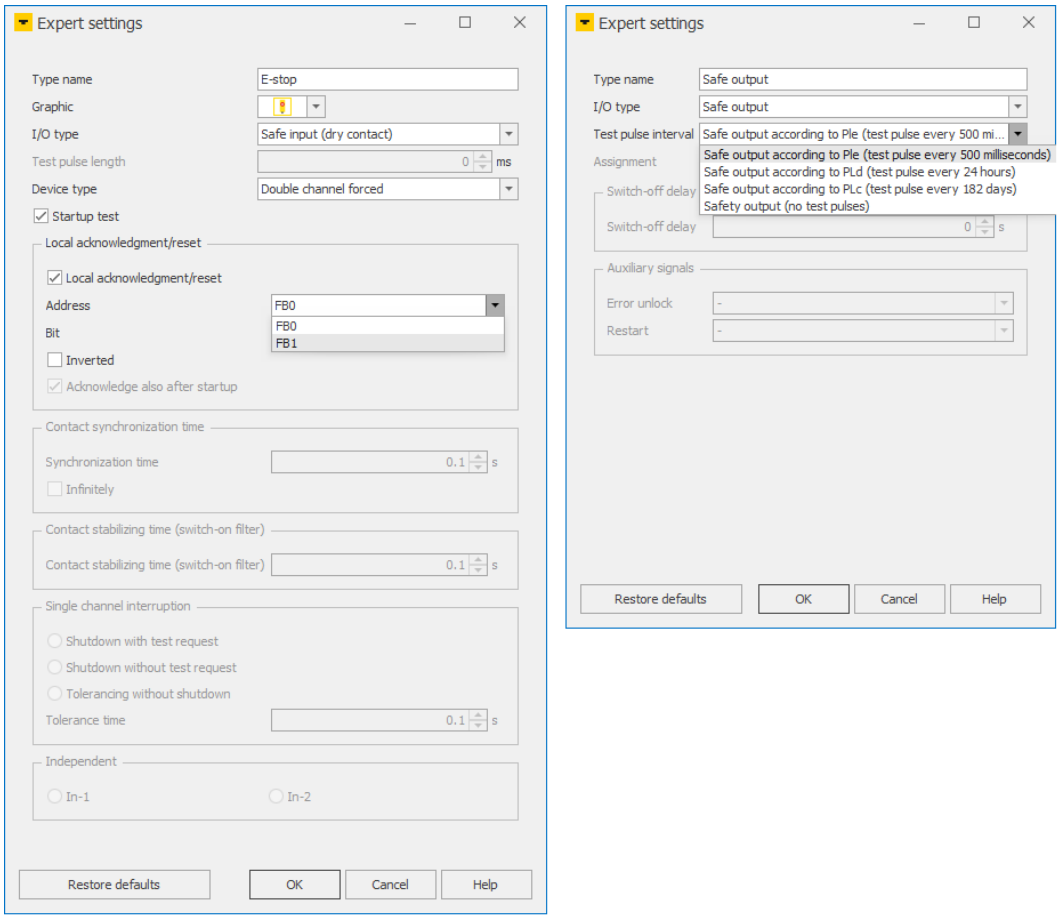


Fig. 26: TSC – Expert settings

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

Example configuration

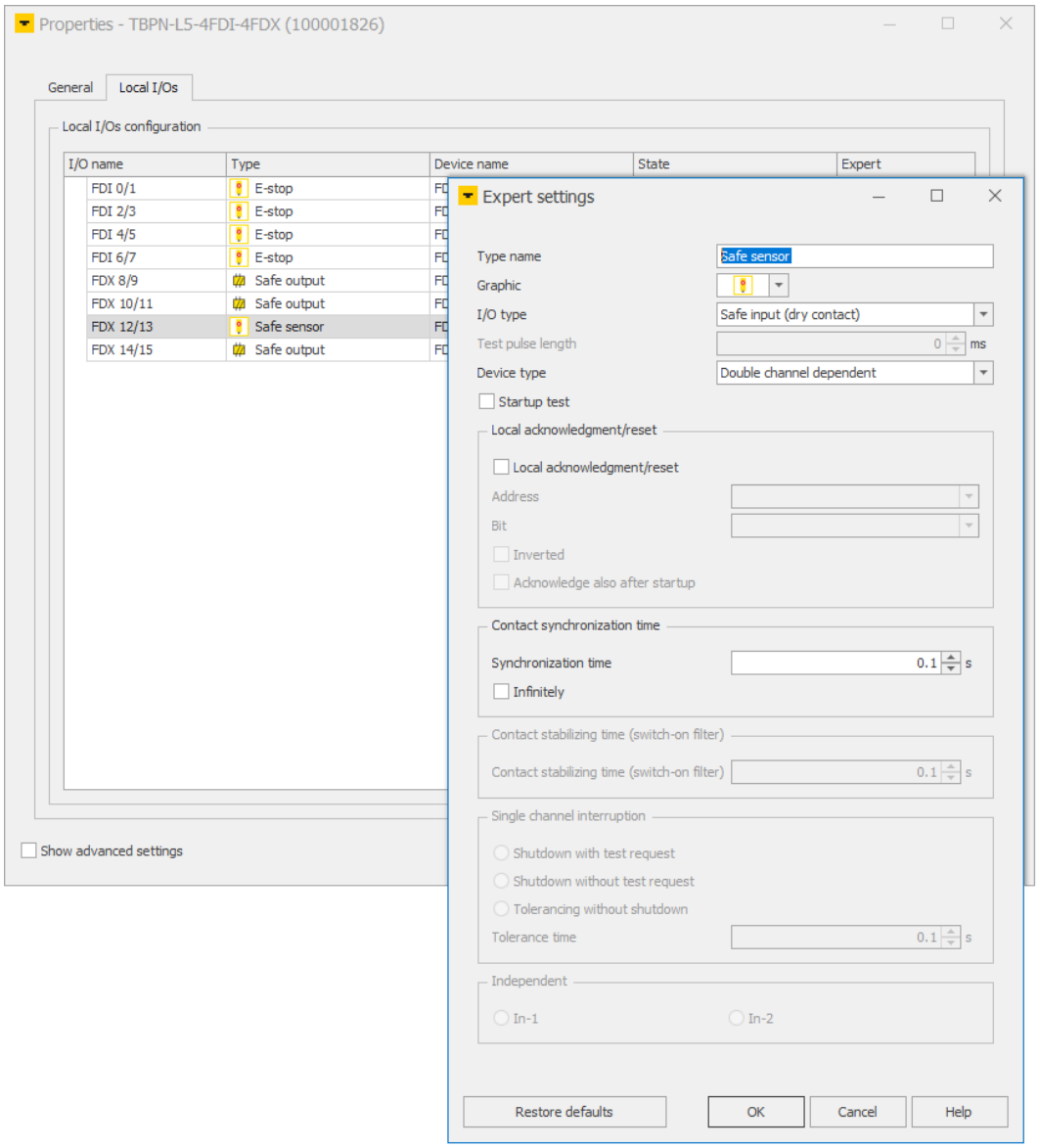


Fig. 27: TSC – Expert settings (example configuration)

Connector at device	Channels	Type	I/O type (Expert setting)	Later function (see application example [▶ 48])
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 milliseconds)	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.

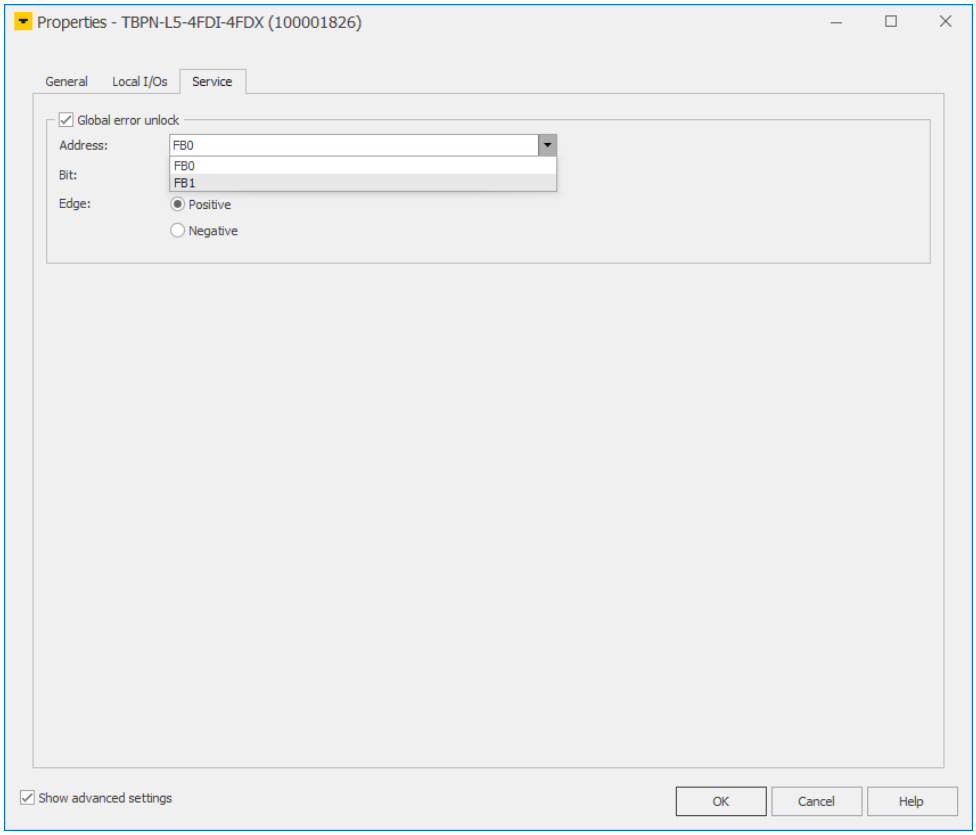


Fig. 28: TSC – Advanced settings, global error unlock

▶ 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 [▷ 67].

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.

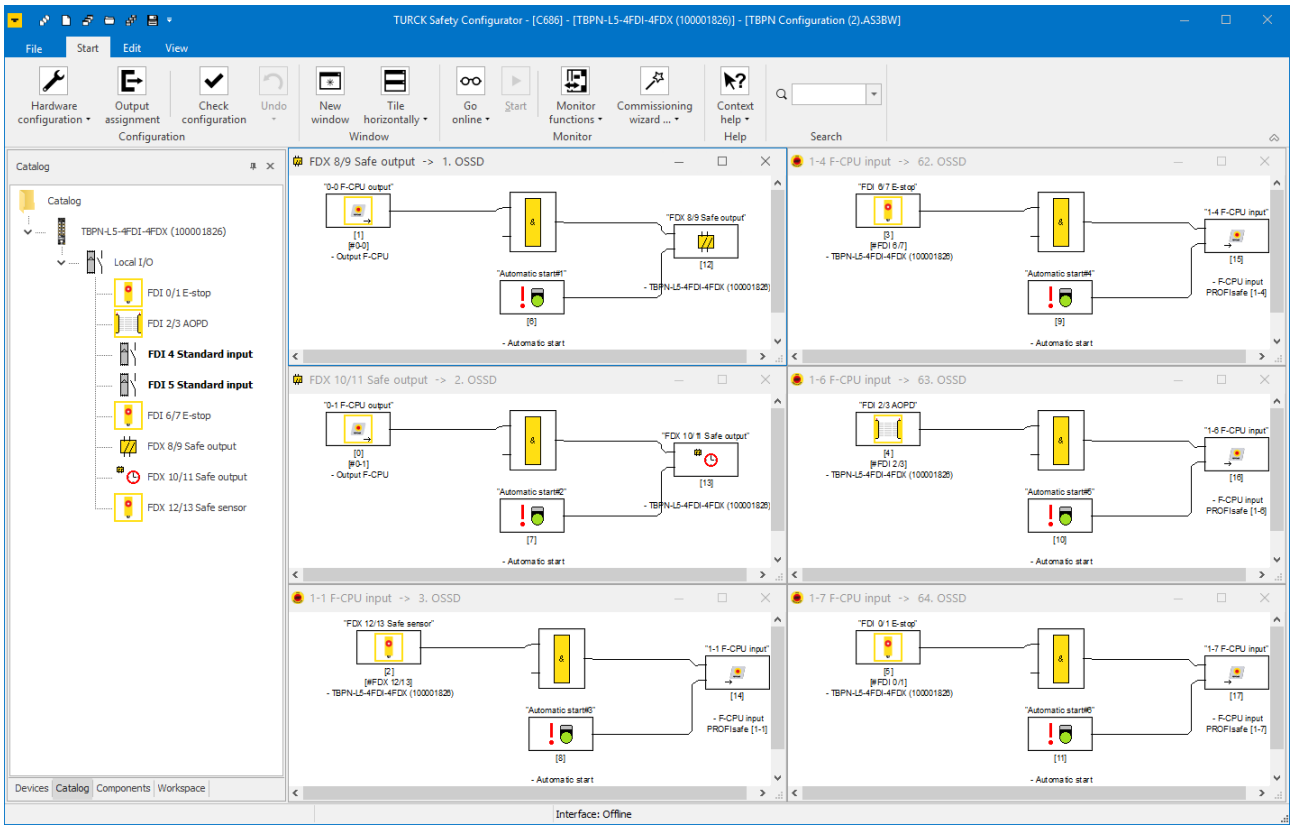


Fig. 29: TSC – release circuits (example configuration)

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	

8.5 Loading the configuration with the TSC commissioning wizard

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

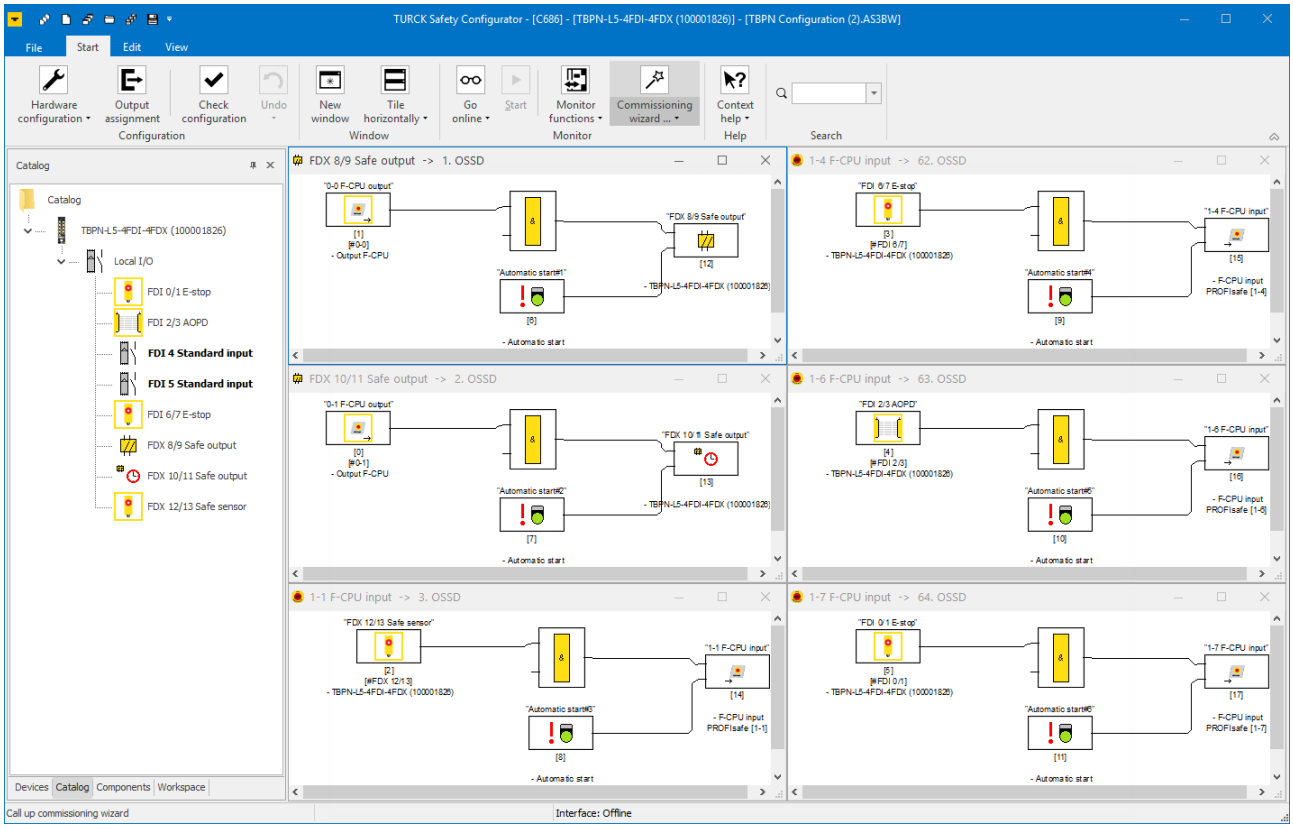


Fig. 30: TSC – starting the commissioning wizard

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

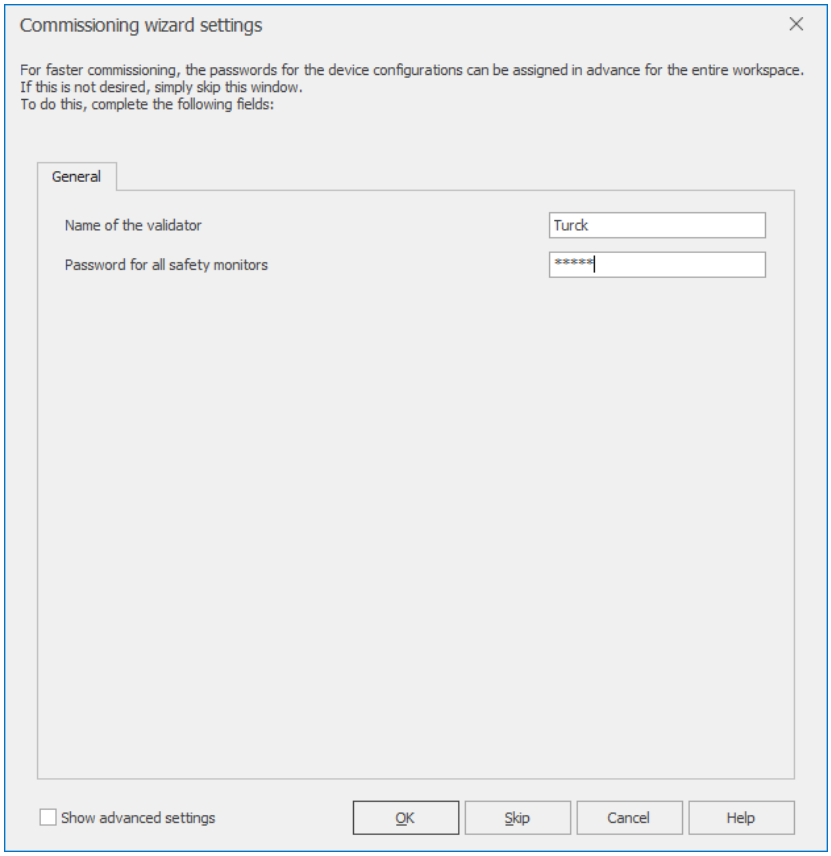


Fig. 31: TSC – commissioning wizard, assigning a password

➪ The connected TBPN-L5-4FDI-4FDX is prepared for the configuration download.

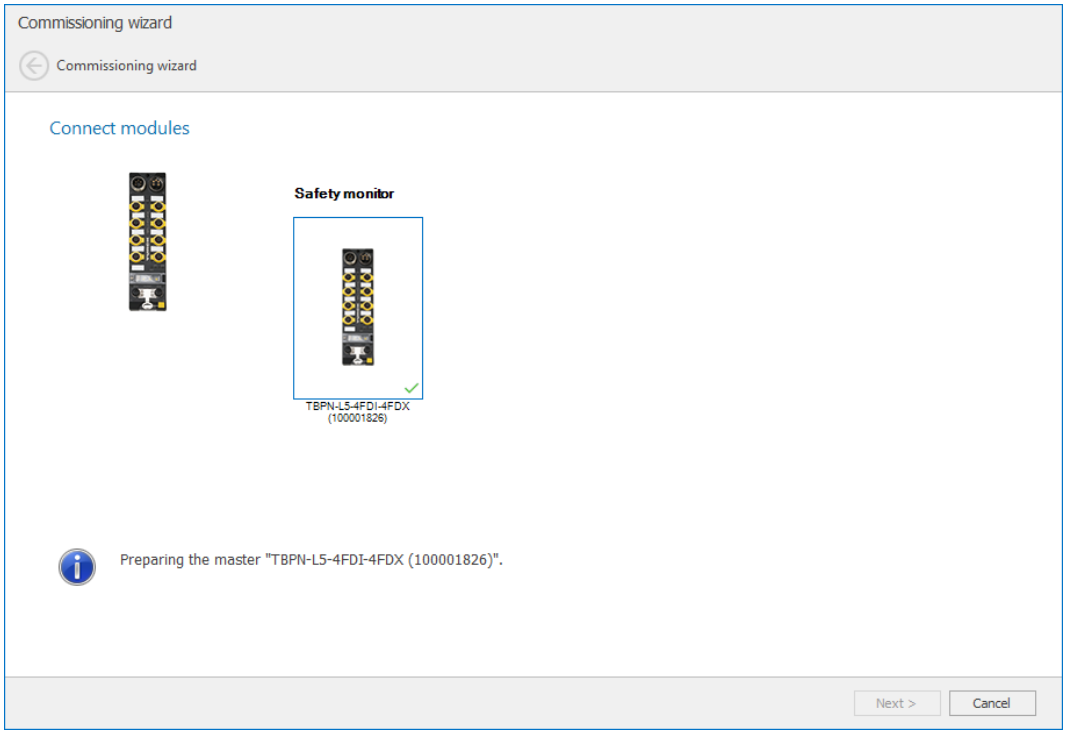


Fig. 32: TSC – commissioning wizard, preparing the device

▶ **Optional:** If the TBPN-L5-4FDI-4FDX is not found, enter the device's IP address under **Ethernet** or search the connected device via the button ….

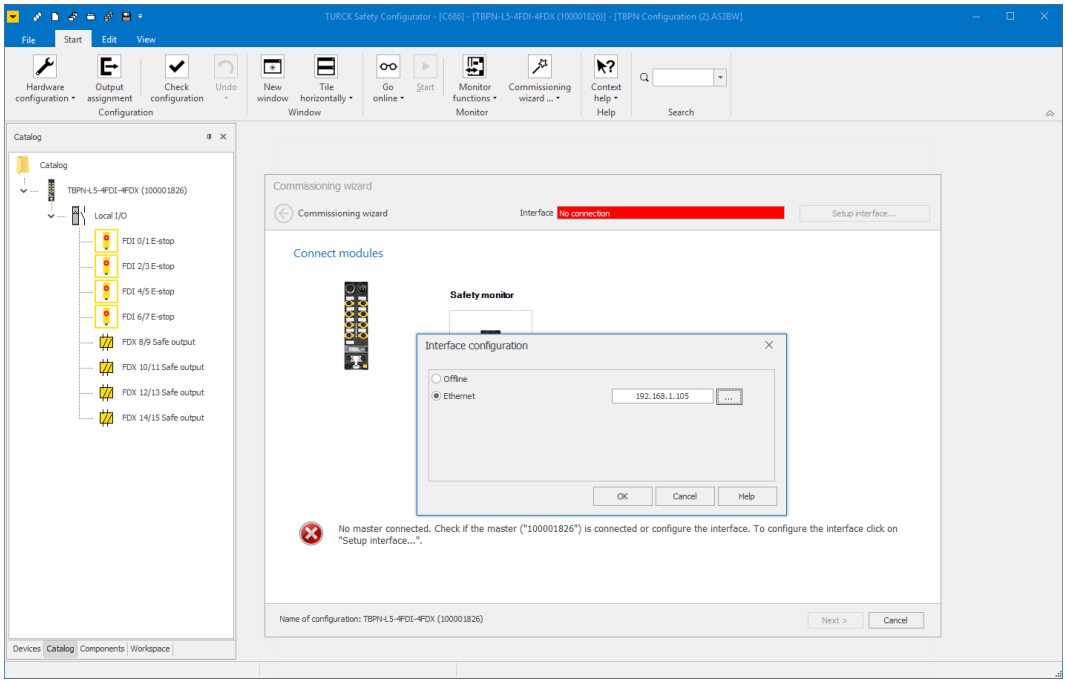


Fig. 33: TSC – interface configuration

▶ Confirm with OK and store the setting in the project (**store the interface in the workspace**).

⇨ The configuration is sent to the TBPN-L5-4FDI-4FDX. This process may take a few seconds.

⇨ The configuration protocol is created.

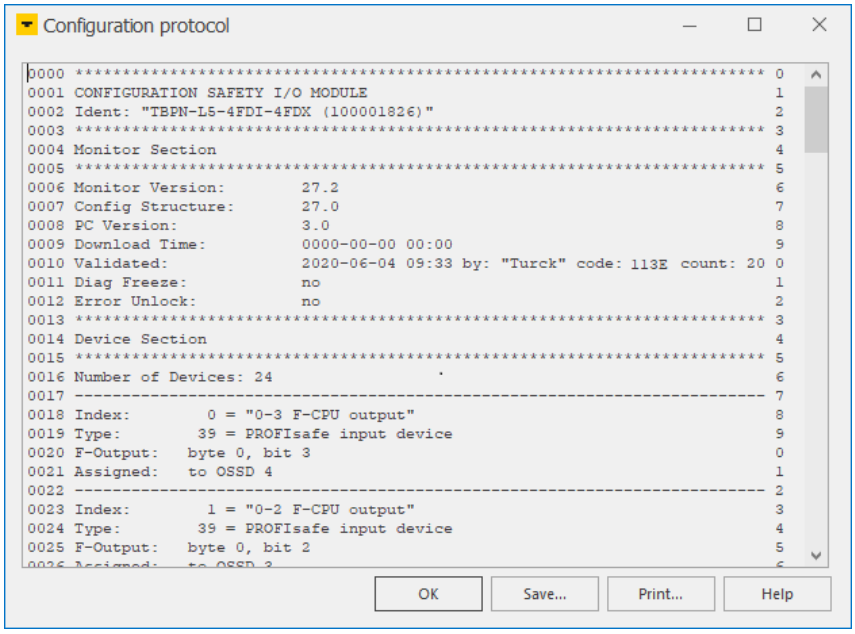


Fig. 34: TSC – commissioning wizard, configuration protocol

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

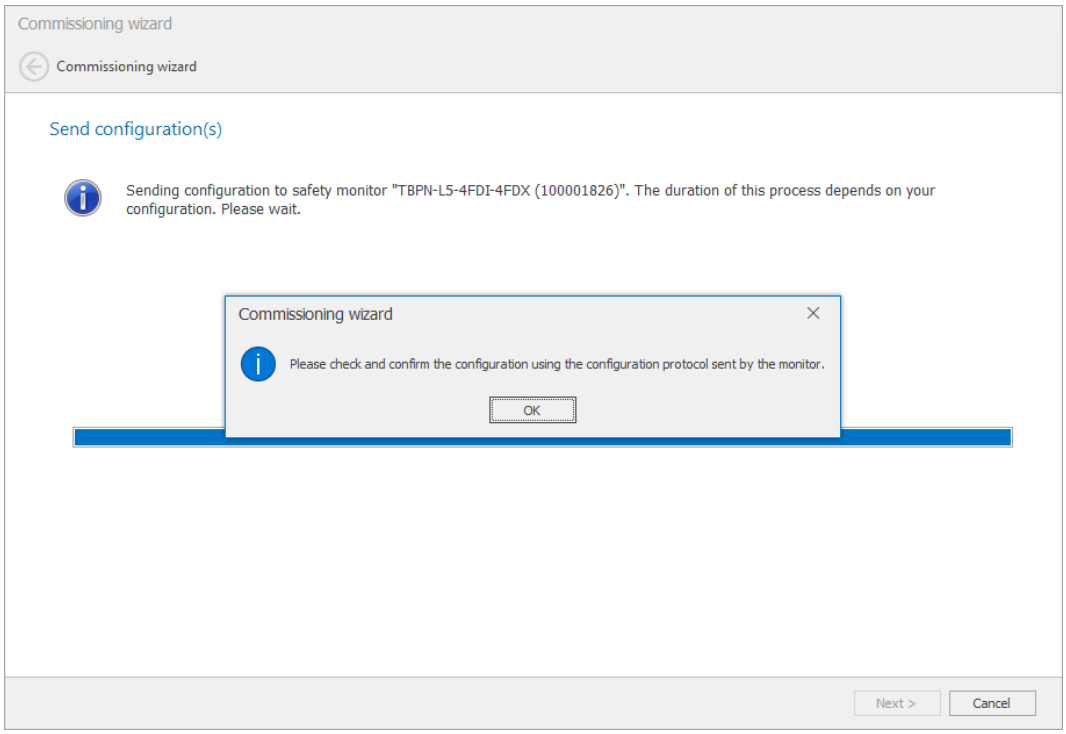

Fig. 35: TSC – confirming the configuration protocol check

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

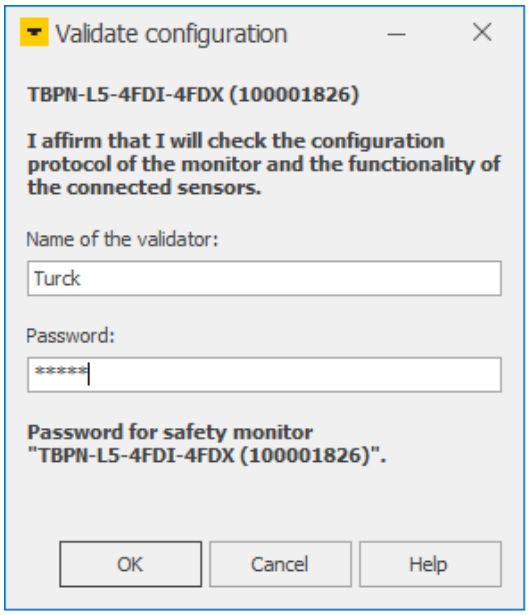

Fig. 36: TSC – release configuration

⇨ The configuration has been released.

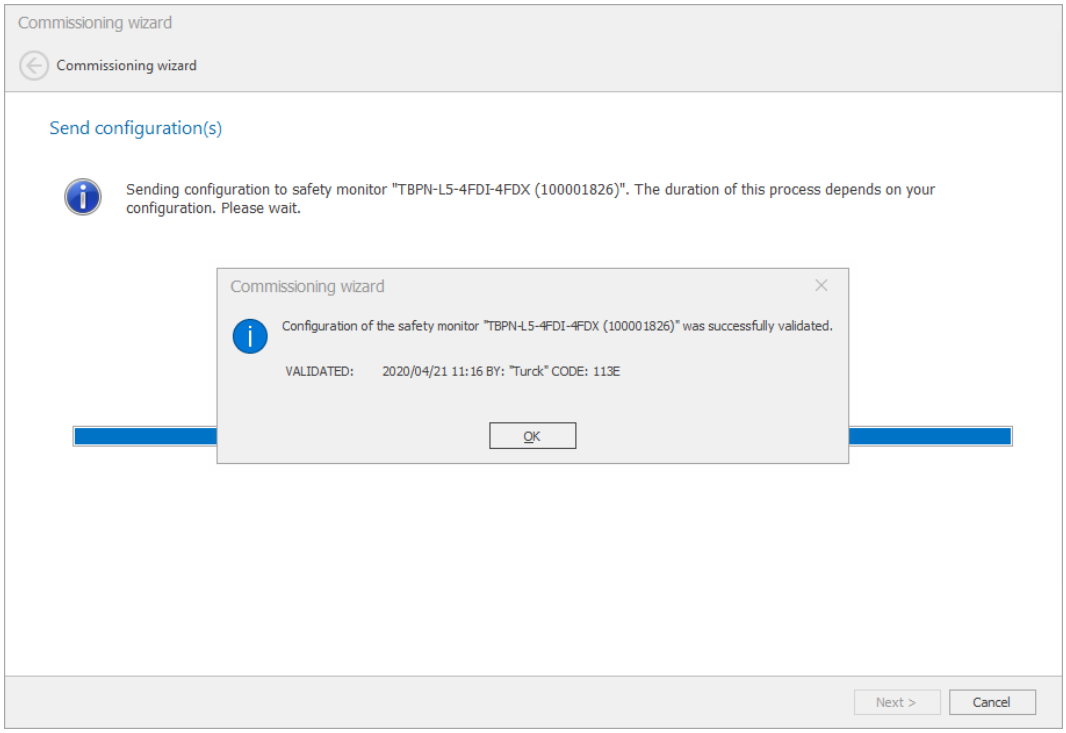

Fig. 37: TSC – release configuration

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

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

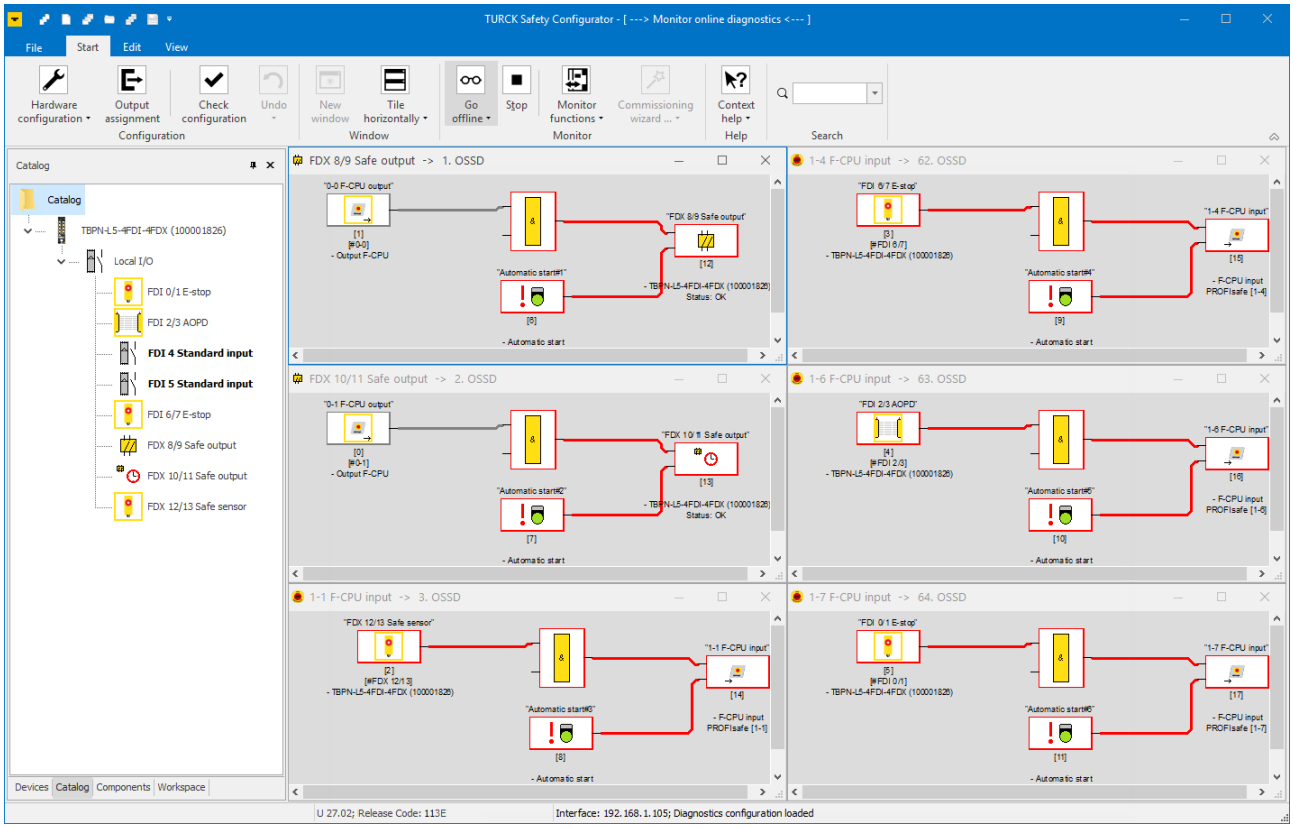

Fig. 38: TSC – Diagnostics configuration (online)

8.6 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 PROFIsafe 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**.

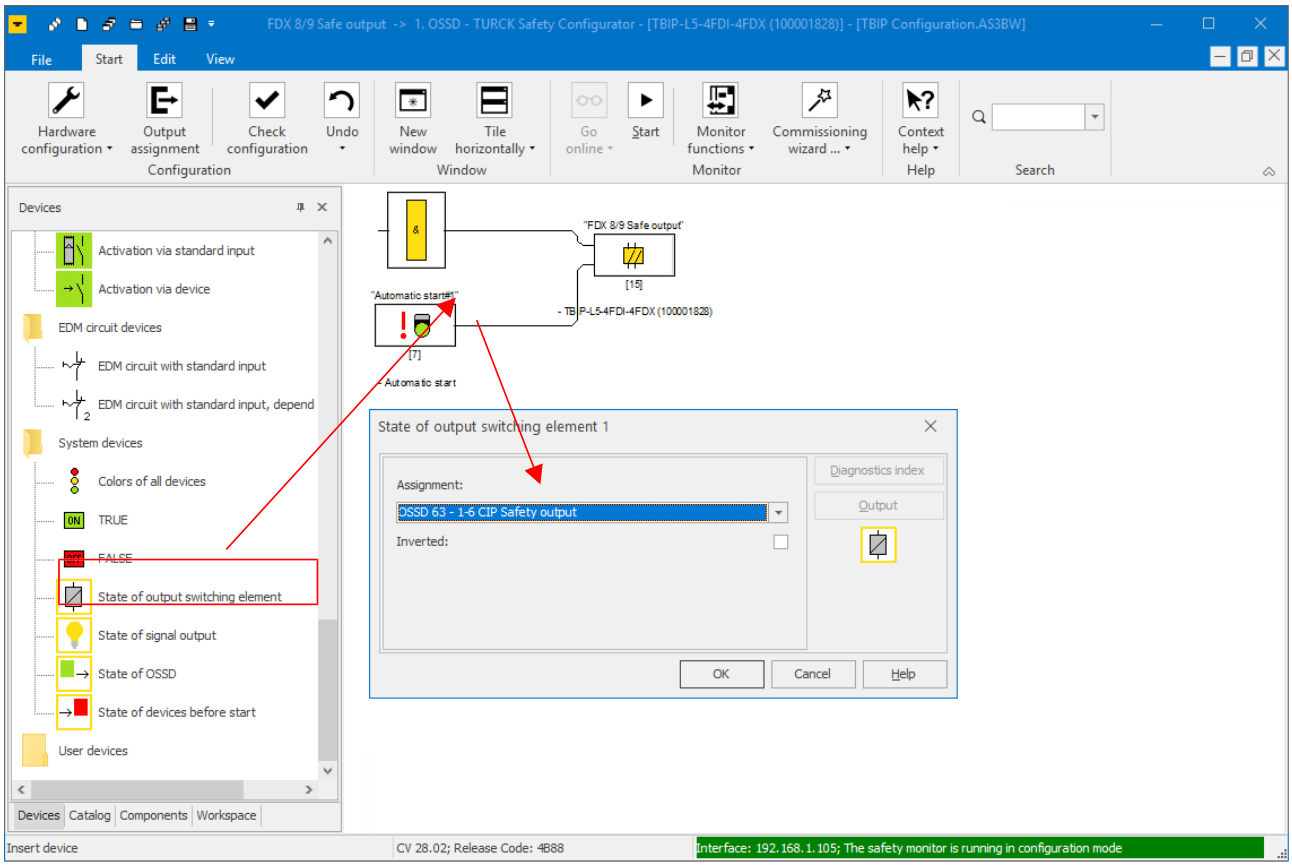

Fig. 39: TSC – 1. OSSD, state of output switching element OSSD 63

▶ 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**.

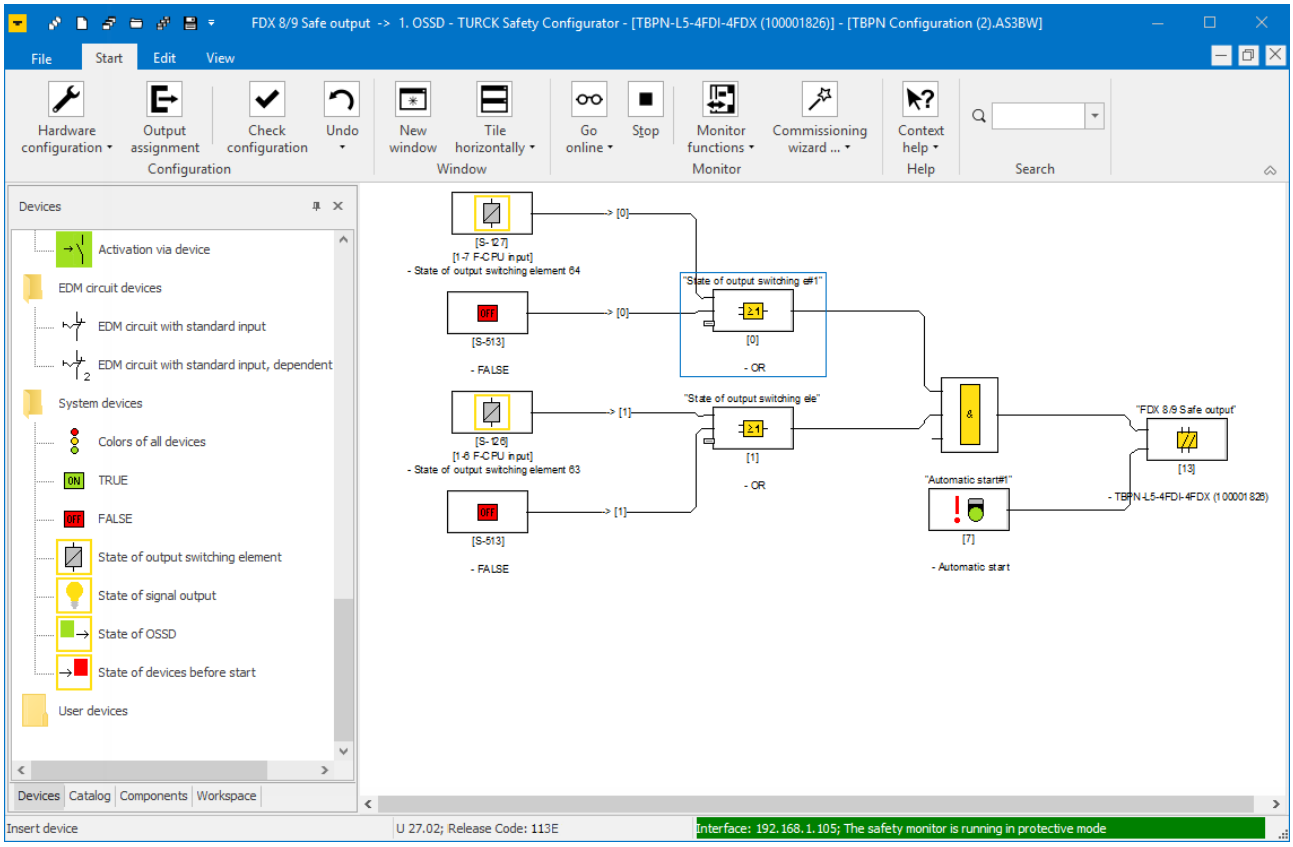

Fig. 40: TSC – 1. OSSD, state of output switching element OSSD 63 and OSSD 64

⇨ 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**.

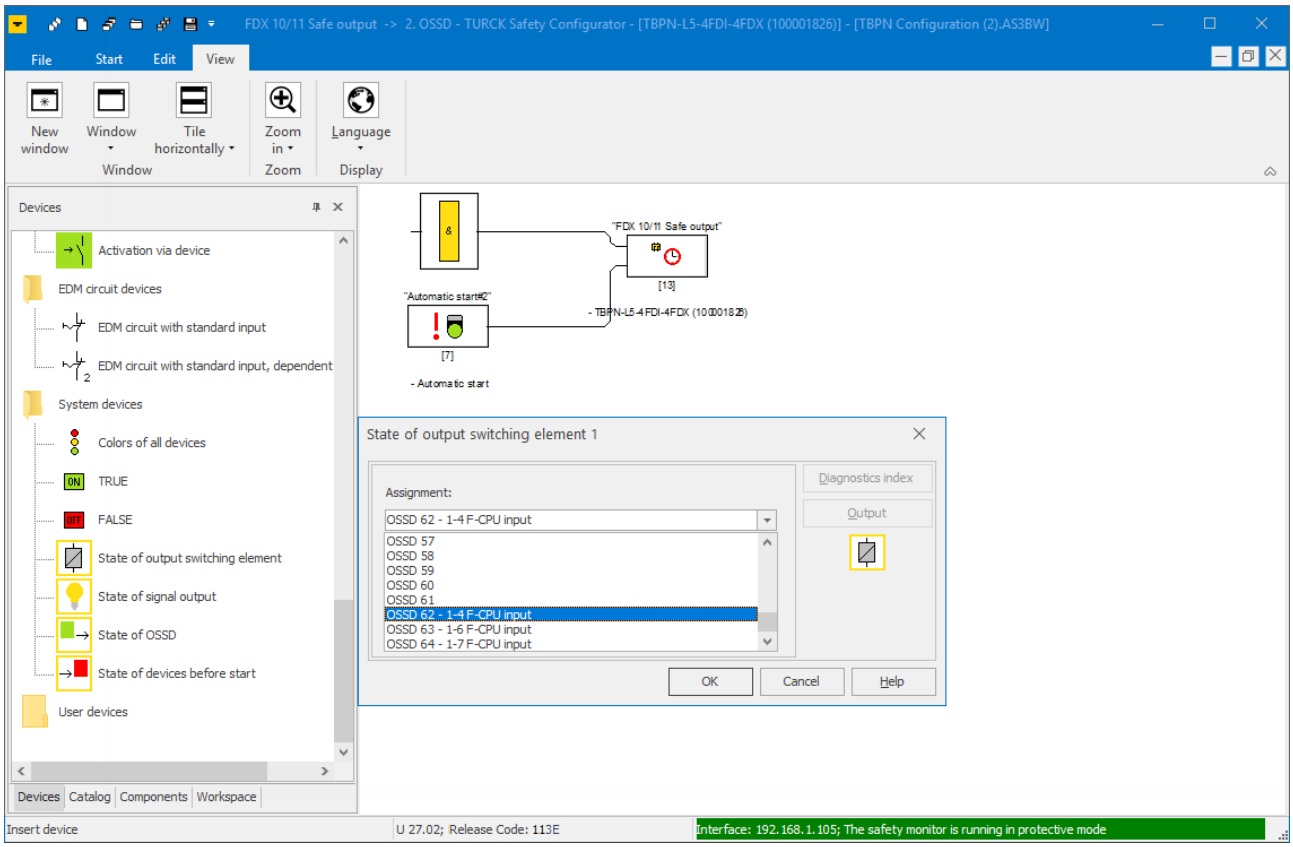

Fig. 41: TSC – 2. OSSD, state of output switching element OSSD 62

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

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

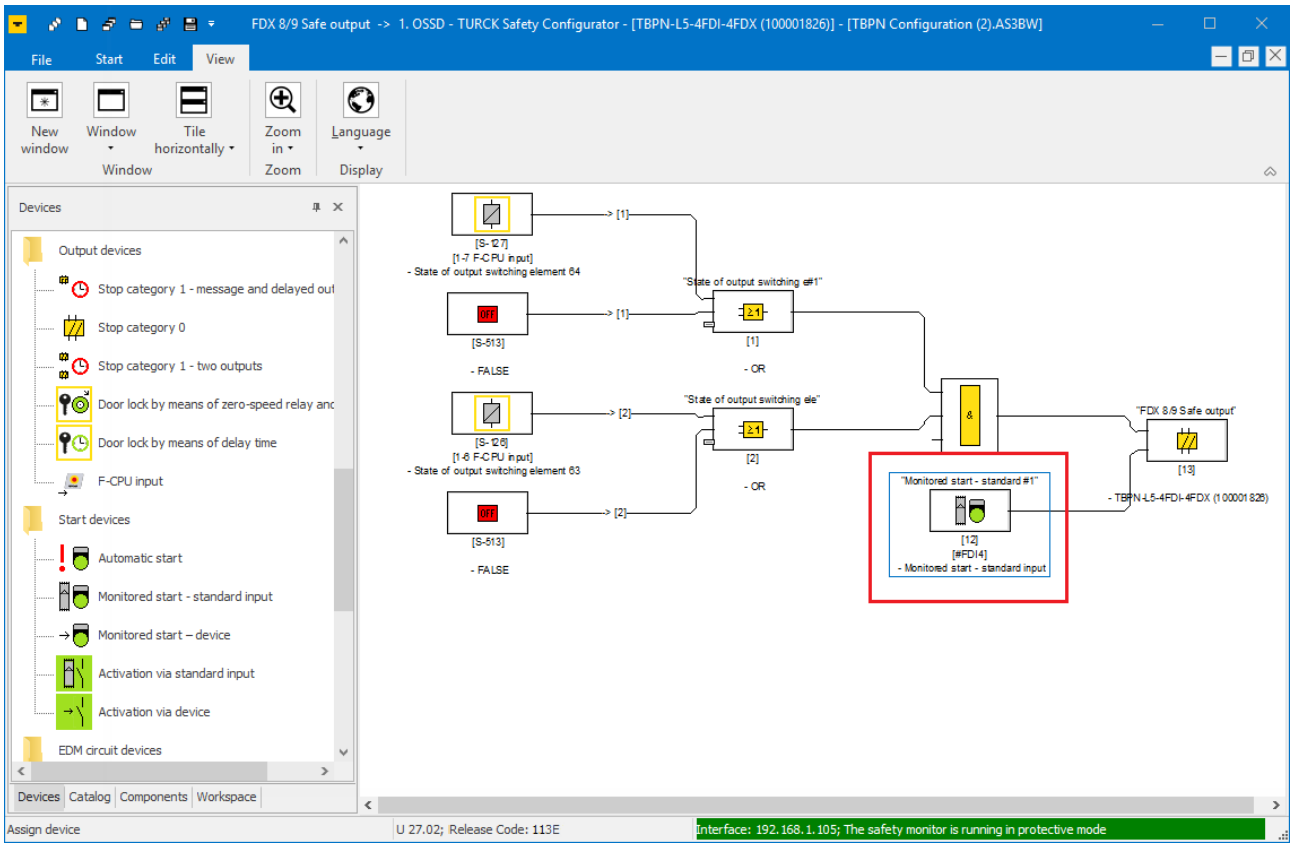

Fig. 42: TSC – monitored start via standard input (example 1. OSSD)

⇨ 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.

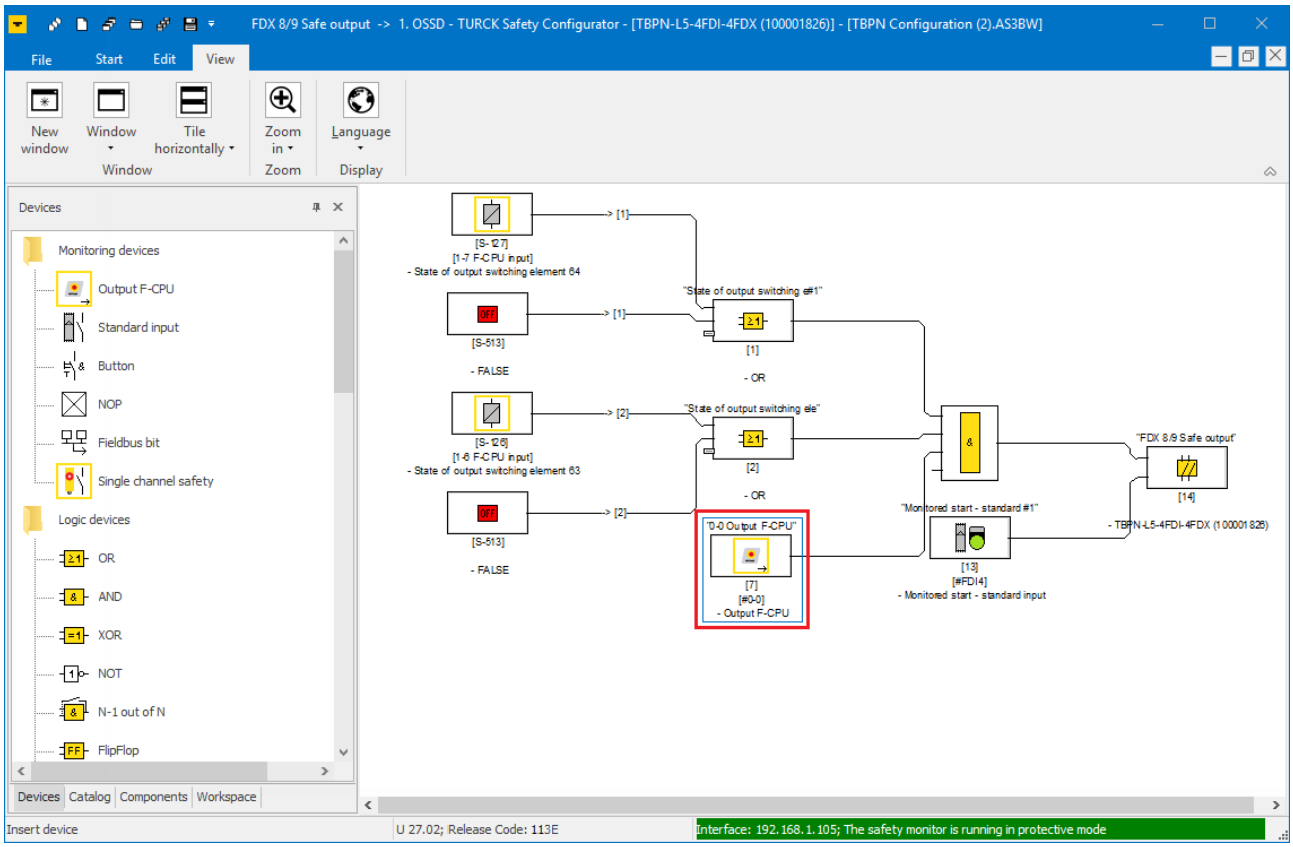

Fig. 43: TSC – release of the safety function via a release bit from the F-CPU

⇨ 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 PROFIsafe bit in the F-CPU.

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

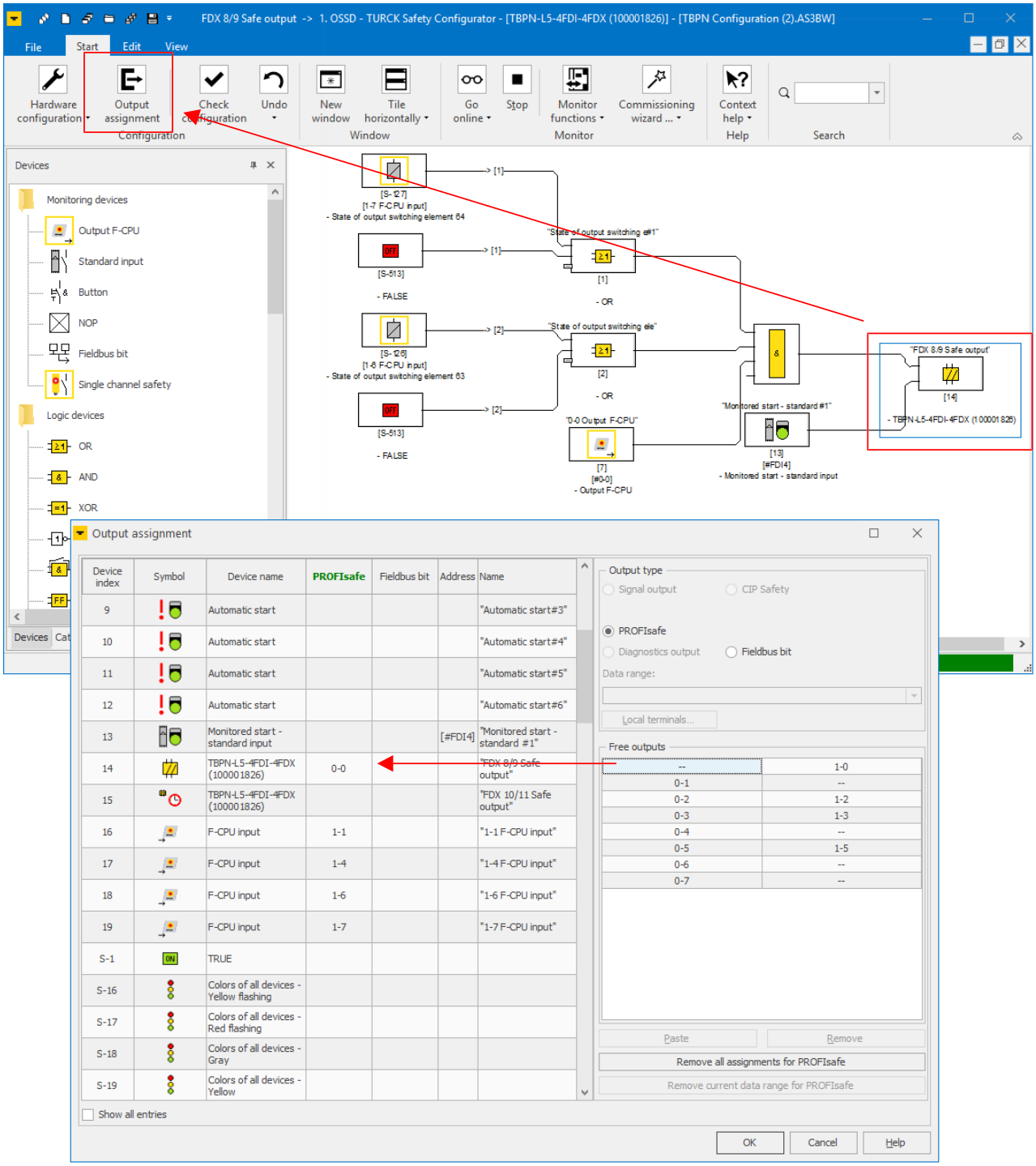

Fig. 44: TSC – output assignment PROFIsafe bit

8.6.1 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 ([▷ 42]) or by using the **PC → Monitor** function.

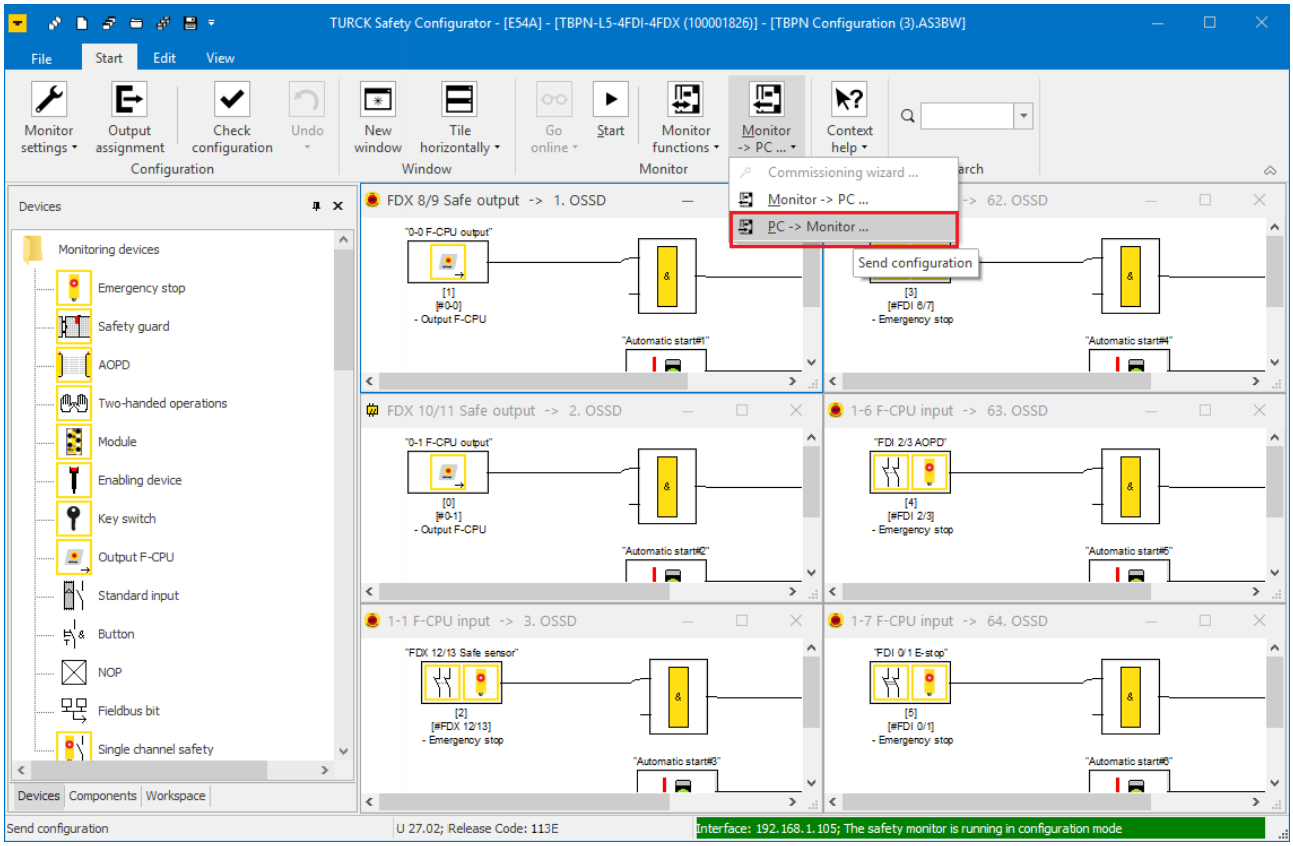

Fig. 45: TSC – sending the configuration

8.7 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.

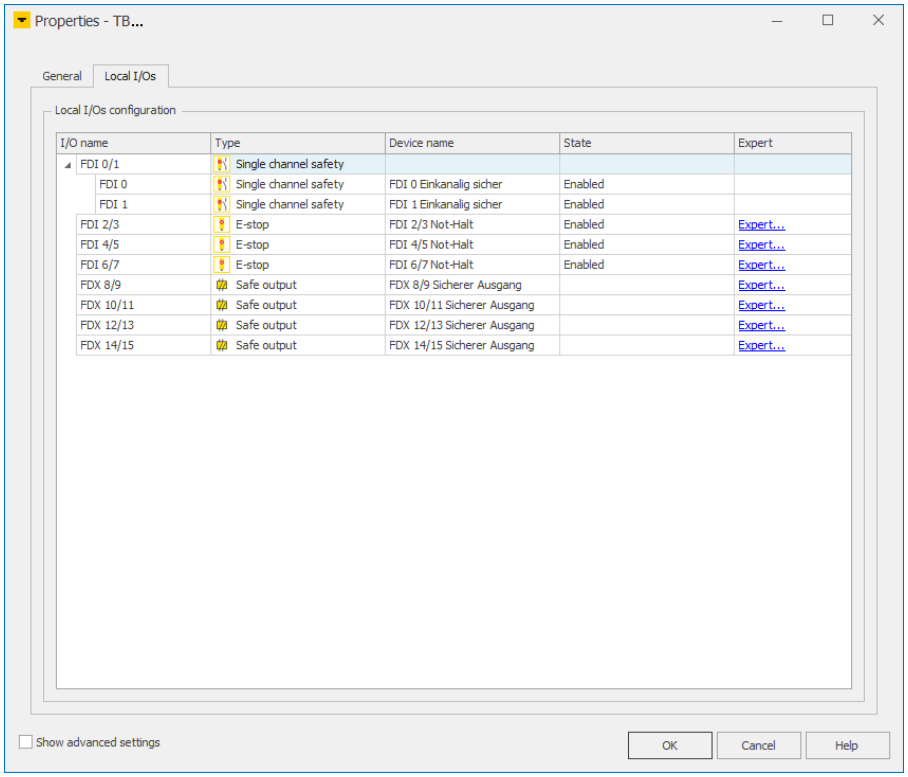

Fig. 46: TSC – Single channel inputs

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.

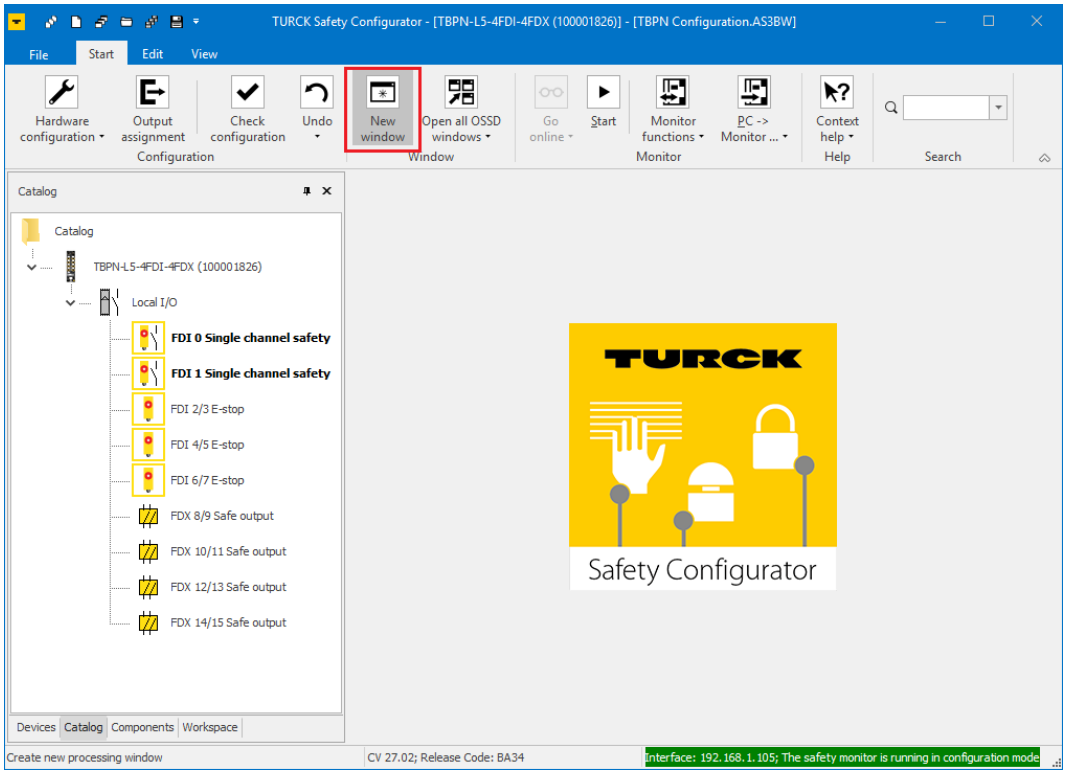

Fig. 47: TSC – Creating an new window

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

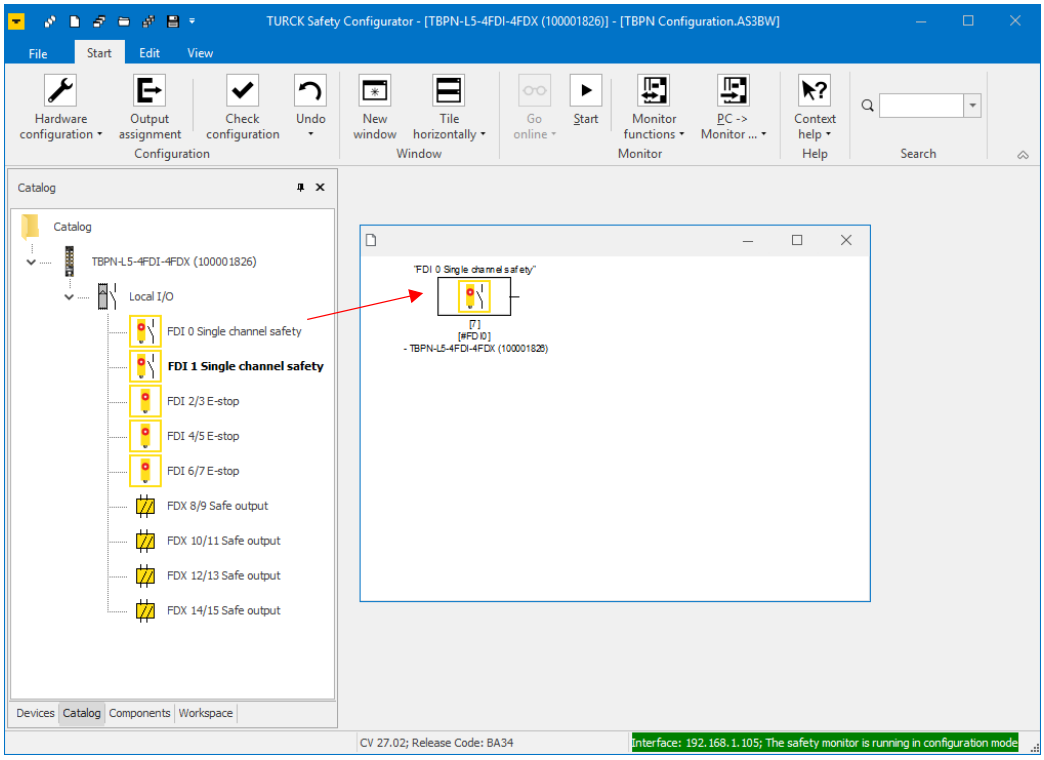

Fig. 48: TSC – configuring an OSSD for a single channel safety input

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▶ Link the single channel safe input with an **Input F-CPU**.

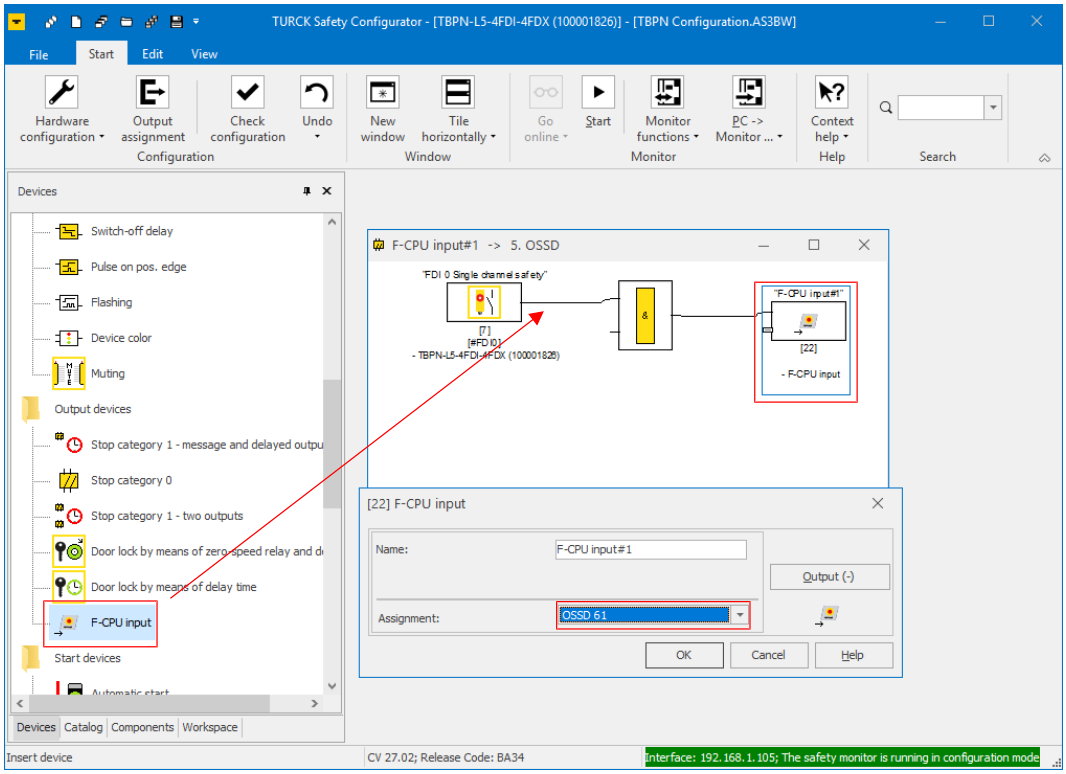


Fig. 49: TSC – Linking a single channel safe input with the PLC

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

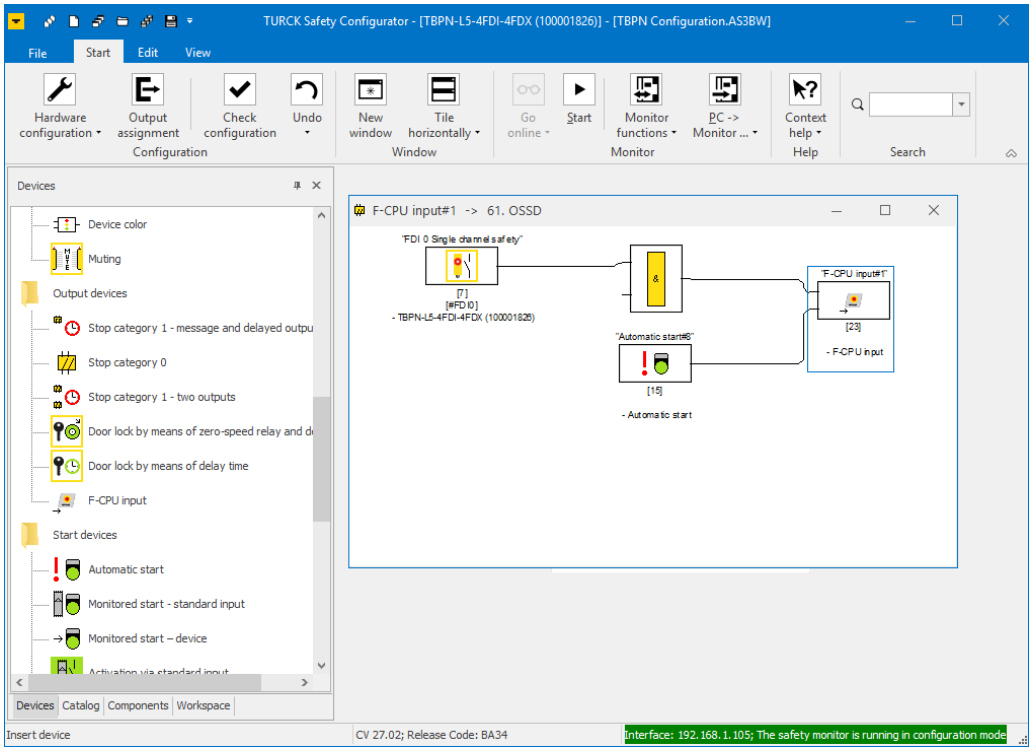


Fig. 50: TSC – single channel safe input with automatic start and PROFIsafe assignment

8.8 Configuring the device at PROFINET/PROFIsafe in TIA Portal

8.8.1 Adding the device via GSDML

- ▶ Install the device's GSDML-file.
- ▶ Add device to the **PROFINET-IO-System (100)**.

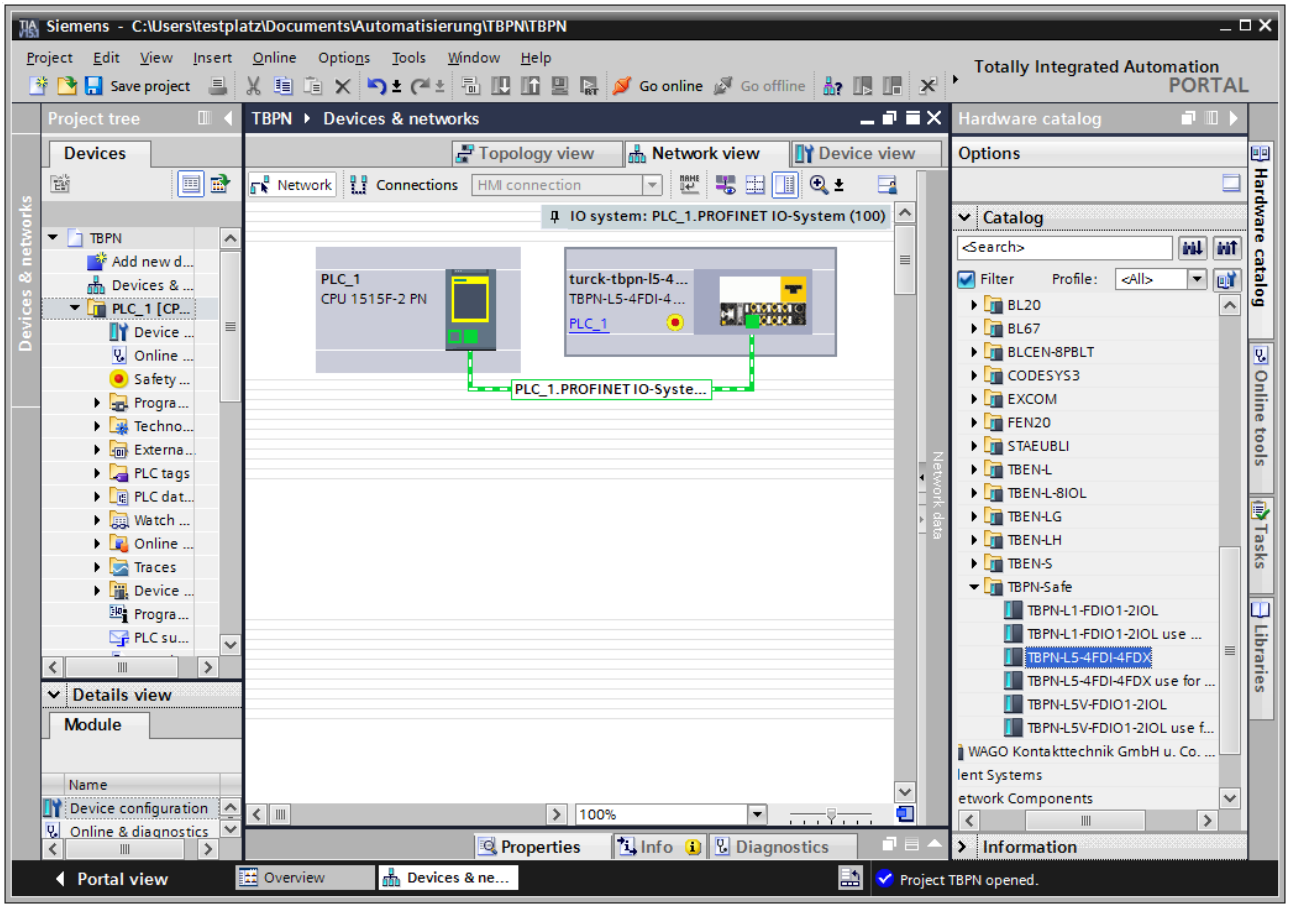


Fig. 51: Adding the TBPN-L5-4FDI-4FDX to PROFINET.

⇨ TBPN-L5-4FDI-4FDX appears as a modular slave with four virtual slots.

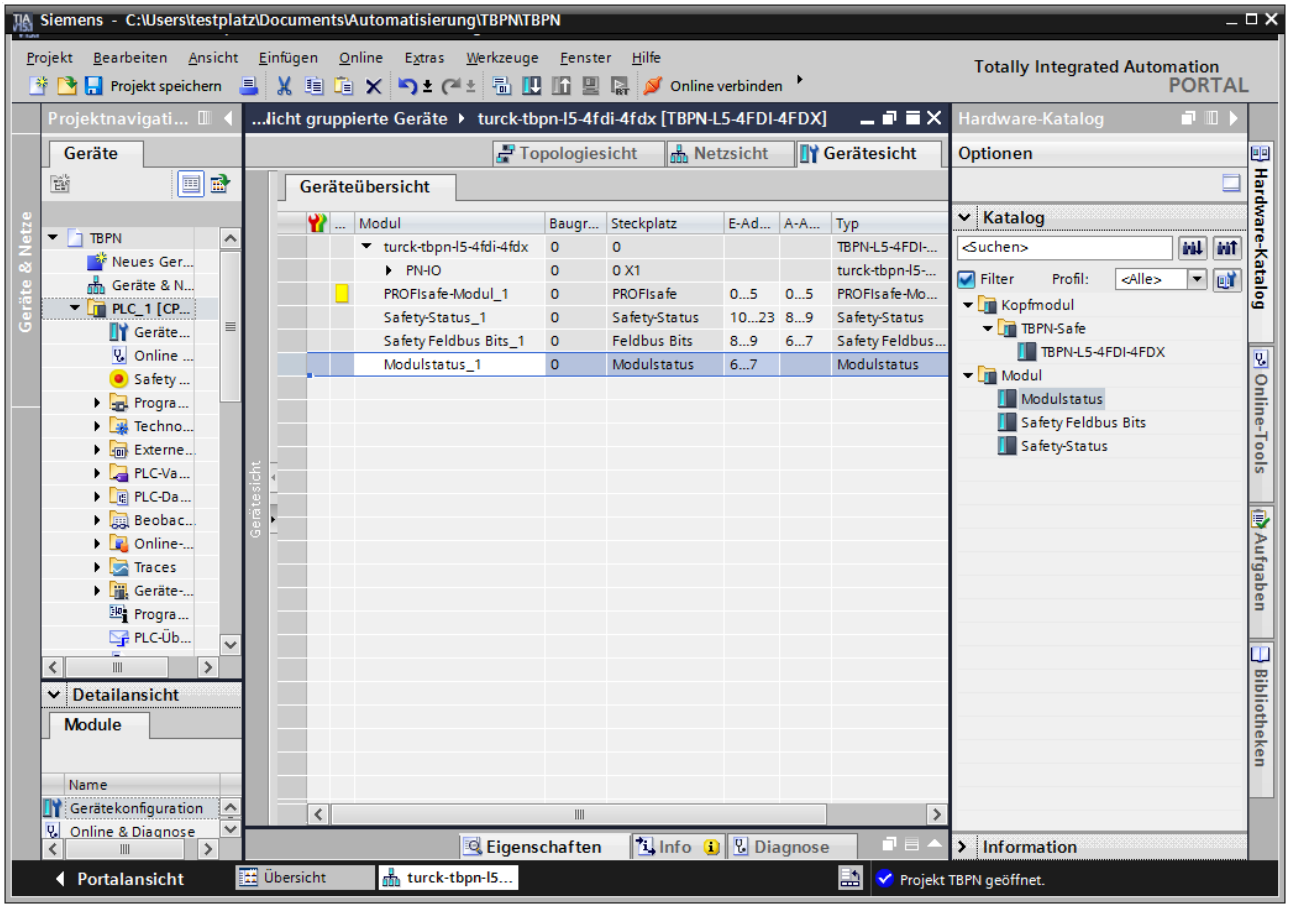


Fig. 52: Slots of TBPN-L5-4FDI-4FDX

The function of these slots is either pre-defined via GSDML or can only be used for a specific purpose.

Module	Name
turck-tbpn-l5-4fdi-fdx (default name)	Main module, parameterization of parameters (deactivation of protocols, etc.) which concern the complete device.
PN-IO	Parameterization of PROFINET functions (MRP, etc.) and the Ethernet port properties (topology, connection options, etc.)
PROFIsafe module	Process data of the safety channels
Safety-Status	Status information of the safety channels
Safety fieldbus bits	Fieldbus bits which are used for the communication in the unsafe part of the PLC.
Module status	Module status, optionally mapped

8.8.2 Setting the F_parameters

Set the F_parameters of TBPN-L5-4FDI-4FDX at slot **PROFISAFE-Modul_1**:

F_parameters	Meaning
F_Dest_Add	F address of TBPN-L5-4FDI-4FDX, in this example: address **105**
F_iPar_CRC	CRC from the protocol in the Turck Safety Configurator, in this example: **113E**

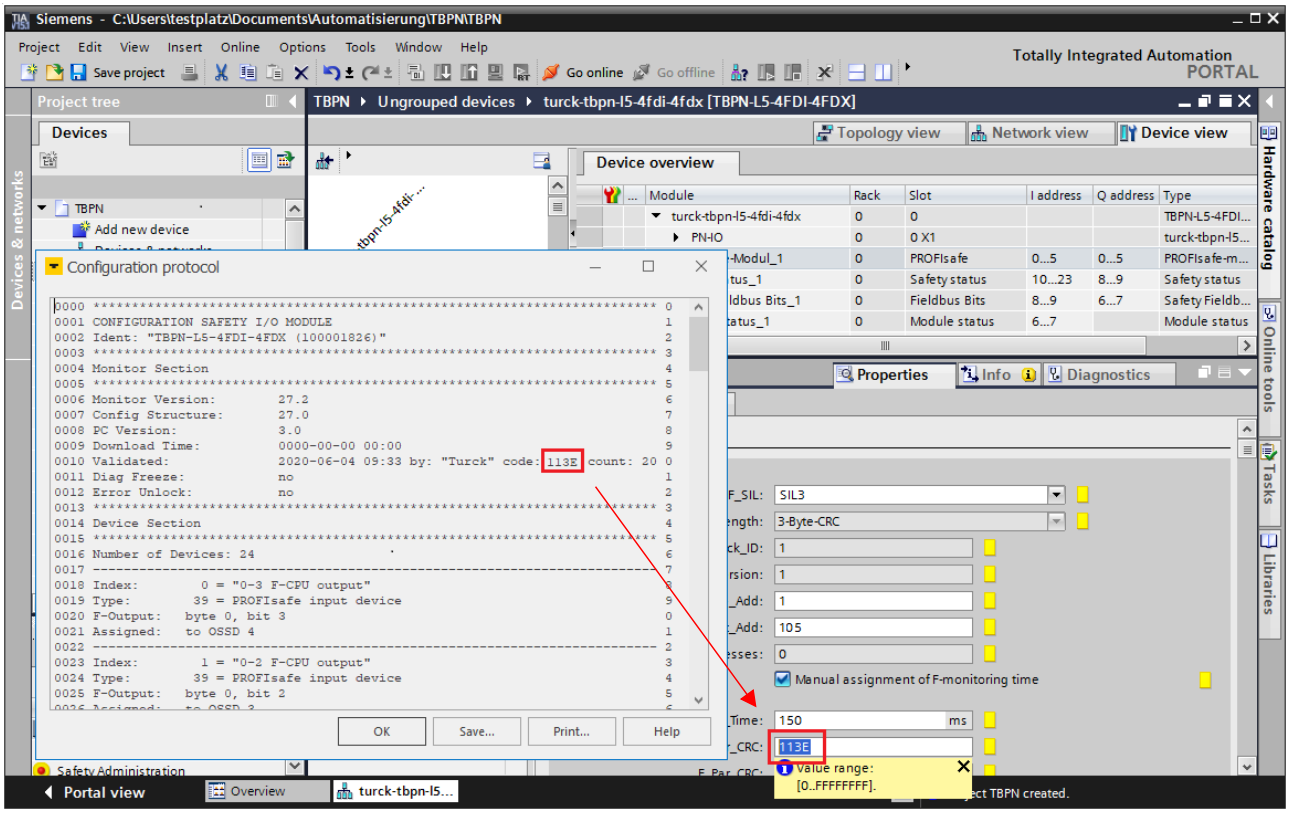


Fig. 53: F_parameters of TBPN-L5-4FDI-4FDX

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 inactive
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 inactive	Output inactive
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 BUS	Meaning
Off	No voltage supply
Green	Active connection to a master
Green flashing	Device ready for operation
Red	IP address conflict, restore mode or F_reset active
Red flashing	Wink command active
Red/green, 1 Hz	Autonegotiation and/or waiting for DHCP-/BootP-address assignment.

LED ERR	Meaning
Off	No voltage connected
Green	No diagnostics
Green flashing, 4 Hz	Initialization, configuration transfer from memory chip running

LED ERR	Meaning
Red	Diagnostic message pending
Red/green	No valid state, device switches to the safe state

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

LEDs ETH1 and ETH2	Meaning
Off	No Ethernet connection
Green	Ethernet connection established, 100 Mbps
Green flashing	Ethernet traffic, 100 Mbps
Yellow	Ethernet connection established, 10 Mbps
Yellow flashing	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 V DC).

Control word

The control word is not in use.

9.3 Process input data

Byte no.	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
n	**PROFIsafe input data** (The assignment depends on the configuration of the channels in Turck Safety Configurator)							
n + 1								
n + 2	**PROFIsafe Status Byte** [▶ 64]							
n + 3… n + 5	**PROFIsafe checksum (CRC)**							
	Safe Unit Status [▶ 64]							
n + 6	reserved					SUUM	SUCM	SUPM
n + 7	reserved							
	PROFIsafe Error Codes [▶ 65]							
n + 8	71	70	69	68	67	66	65	64
n + 9	reserved						75	72
	Memory and F-Config Status [▶ 65]							
n + 10	FERR	-	-	COMLO	-	CNFMM	NCNF	PMS
n + 11	reserved							
	Safe Status Connector C0 [▶ 66]							
n + 12	OVL	-	TCCH1	TCCH0	ERRFIN	TEST	WAIT	RGG
n + 13	Safe Status, Connector C1…C7, 1 byte per connector according to connector C0							
n + 14								
n + 15								
n + 16								
n + 17								
n + 18								
n + 19								
	Status of the safe unit (fieldbus bits) [▶ 66]							
n + 20	FBO7	FBO6	FBO5	FBO4	FBO3	FBO2	FBO1	FBO0
n + 21	FBO15	FBO14	FBO13	FBO12	FBO11	FBO10	FBO9	FBO8
	Module status [▶ 62]							
n + 22… n + 23	-	-	-	-	-	-	-	DIAG

PROFIsafe status byte

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
reserved	Cons_nr_R	Toggle_d	FV activated	WD time-out		Device error	iPar_OK

Name	Meaning
iPar_OK	The bit is set if new parameter values have been assigned to TBPN-L5-4FDI-4FDX.
Device error	The bit is set by the device for at least two message cycles if there is a malfunction in the TBPN-L5-4FDI-4FDX.
CE_CRC	The bit is set if the TBPN-L5-4FDI-4FDX detects a communication error (CRC error). This bit information enables the F-Host to count all faulty messages within a defined time period and to trigger a configured safe state of the system if the number exceeds a certain limit (maximum residual error rate).
WD time-out	The bit is set if the TBPN-L5-4FDI-4FDXdetects an F communication error, i.e. If the watchdog time in the device is exceeded.
FV activated	This bit is set during a device restart and in case of an communication error. The outputs of TBPN-L5-4FDI-4FDX are set to the failsafe values.
Toggle_d	Toggle bit in TBPN-L5-4FDI-4FDX that requests a trigger to increment the virtual serial number within the F-Host (Vconsnr_h) Together with the control bit "Toggle_h" in the master, the bit serves as an acknowledgment mechanism for monitoring the runtimes between sender and receiver.
Cons_nr_R	The bit is set if the TBPN-L5-4FDI-4FDX the device has reset its counter for consecutive numbers (Vconsnr_h).

Safe Unit Status

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

PROFIsafe Error Codes

Code	Name	Meaning	Remedy
64 (0x40)	Destination Address Mismatch	The set PROFIsafe address does not match the parameterized destination address (F_DEST_ADDR).	▶ Check parameterization. ▶ Restart the device.
65 (0x41)	Invalid Destination Address	The set destination address (F_DEST_ADDR) is not valid. Addresses 0x0000 and 0xFFF are not allowed.	
66 (0x42)	Invalid Source Address	The set source address (F_SOURCE_ADDR) is not valid. Addresses 0x0000 and 0xFFF are not allowed.	
67 (0x43)	Invalid Watchdog Time Value	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.	
69 (0x45)	Invalid Length of CRC2	The required CRC length and the CRC length generated by the device do not match.	▶ Check parameterization.
70 (0x46)	Invalid PROFIsafe version	The version of the F_parameter set is invalid.	
71 (0x47)	CRC1 Mismatch	The CRC1 generated by the device does not match the CRC1 in the parameter telegram	▶ Check the configuration in PROFIsafe.
72 (0x48)	Invalid PROFIsafe Parameters	Device specific or undefined diagnostic information	
75 (0x4B)	Wrong iParameter CRC	The iParCRC from the device and the iParCRC in the PROFIsafe configuration do not match.	▶ Check the configuration in PROFIsafe.

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 Status (connector C0 - C7)

Name	Code	Meaning
RGG	-	Normal State
WAIT	528	Wait for input signal
TEST	544	Test input
ERRFIN	560	Error at input
TCCH0	576	Cross-circuit channel 0
TCCH1	592	Cross-circuit channel 1

Status of the safe unit (fieldbus bits)

Name	Meaning
PROFIsafe bit 0.0…1.7	Status output bits of the TBPN-L5-4FDI-4FDX which can be used as input signals for the non-safety part of the higher level control. These bits have to be configured by the user in Turck Safety Configurator. Bits 1.4…1.7 are automatically assigned. The other bits can be configured by the user.

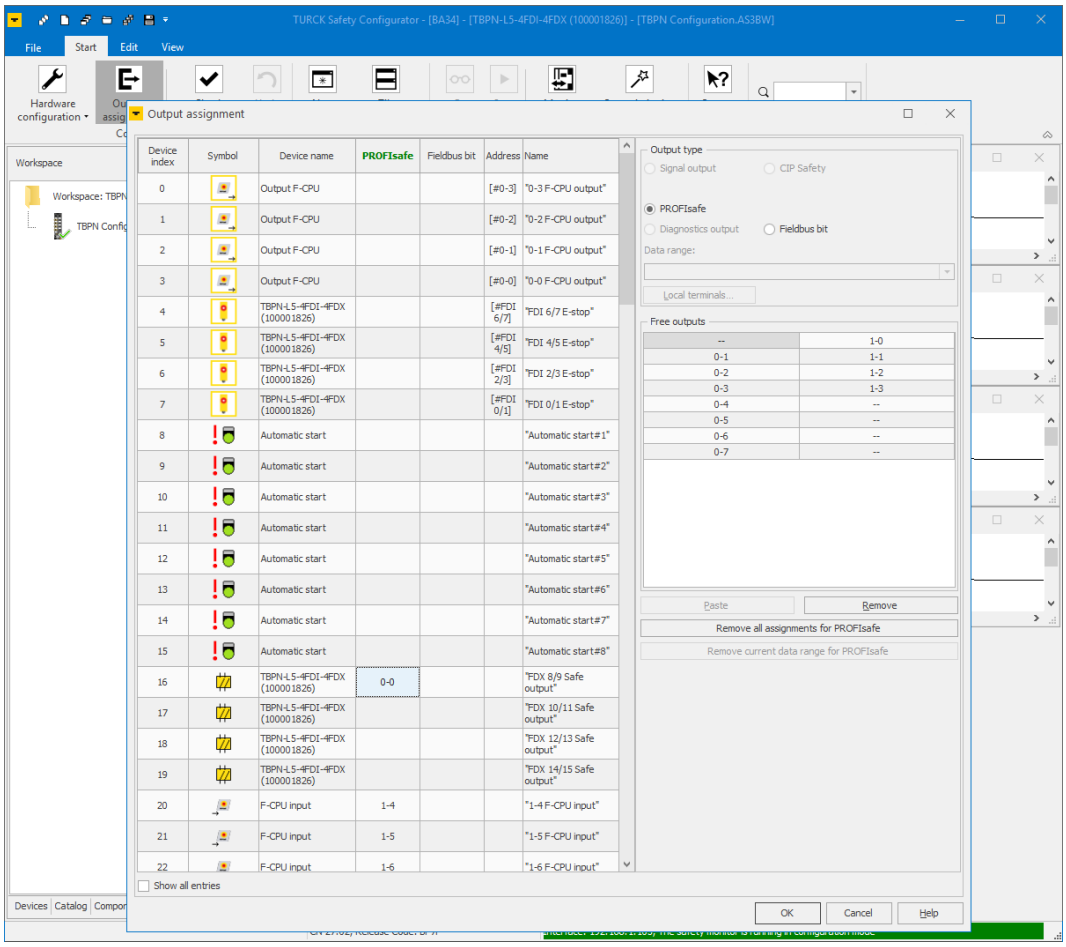


Fig. 54: Output assignment in Turck Safety Configurator

9.4 Process output data

Byte no.	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
n	**PROFIsafe output data** (The assignment depends on the configuration of the channels in Turck Safety Configurator)							
n + 1								
n + 2	**PROFIsafe Control Byte** [▶ 67]							
n + 3… n + 5	**PROFIsafe checksum (CRC)**							
	Unlock Safe Unit [▶ 67]							
n + 6	reserved							UNLK
n + 7	reserved							
	PROFINET output data (fieldbus bits) [▶ 68]							
n + 8	FBI7	FBI6	FBI5	FBI4	FBI3	FBI2	FBI1	FBI0
n + 9	FBI15	FBI14	FBI13	FBI12	FBI11	FBI10	FBI9	FBI8

PROFIsafe control byte

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
reserved	reserved	Toggle_h	Activ-ate_FV	reserved	R_cons_nr	OA_Req	iPar_EN

Name	Meaning
iPar_EN	The bit is set by the application of the TBPN-L5-4FDI-4FDX needs new parameters.
OA_Req	The bit is set by the TBPN-L5-4FDI-4FDX for at least two message cycles if there is a malfunction in the device.
R_cons_nr	The bit is set if a communication error is detected. The counter of the virtual consecutive number (Vconsnr_d) in the TBPN-L5-4FDI-4FDX is set to "0". The bit is reset if the error has been eliminated. Then the consecutive numbering (Vconsnr_d) is started again.
Activate_FV	The bit activates the forcing of outputs to the failsafe values at TBPN-L5-4FDI-4FDX.
Toggle_h	Toggle bit in the master that requests the incrementation of the virtual serial number within the F-Device (Vconsnr_d). Together with the control bit "Toggle_d" in the TBPN-L5-4FDI-4FDX, the bit serves as an acknowledgment mechanism for monitoring the runtimes between sender and receiver.

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.

PROFINET output data (to TBPN-L5-4FDI-4FDX)

Name	Meaning
FB0.0… FB1.7	These input bits are sent via Ethernet to the TBPN-L5-4FDI-4FDX and can be configured in the Turck Safety Configurator as field bus bits (inputs).

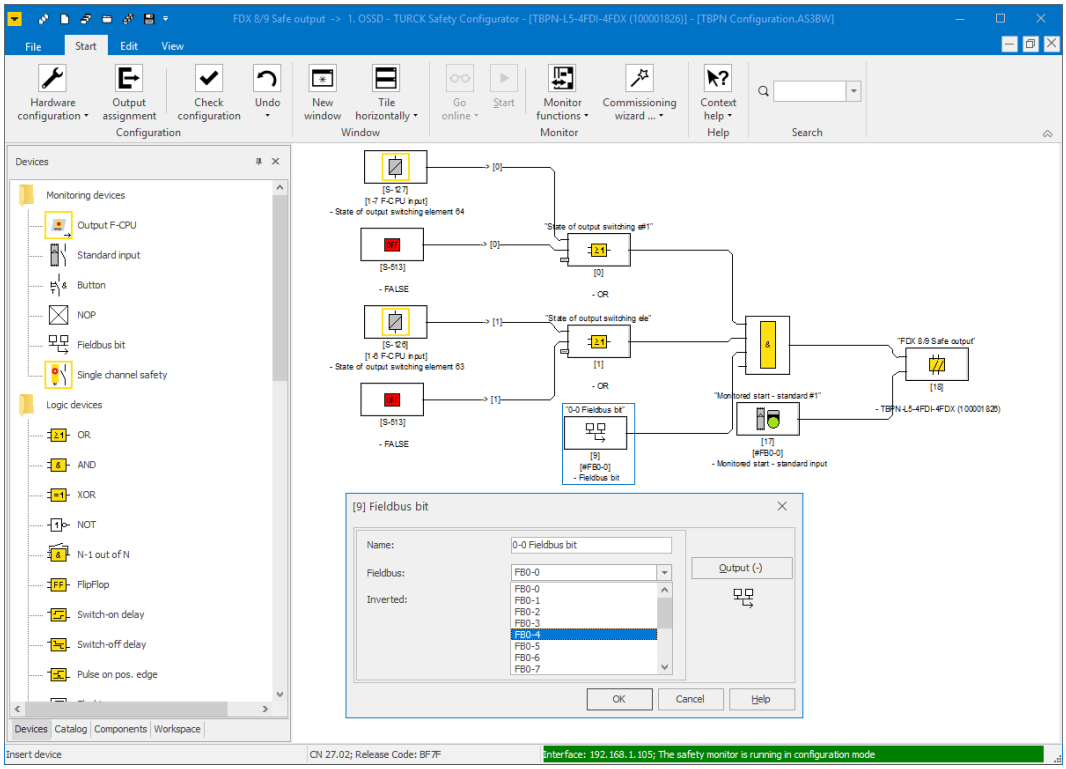


Fig. 55: Input assignment in Turck Safety Configurator

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 for example the device's PROFINET name, or the 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.

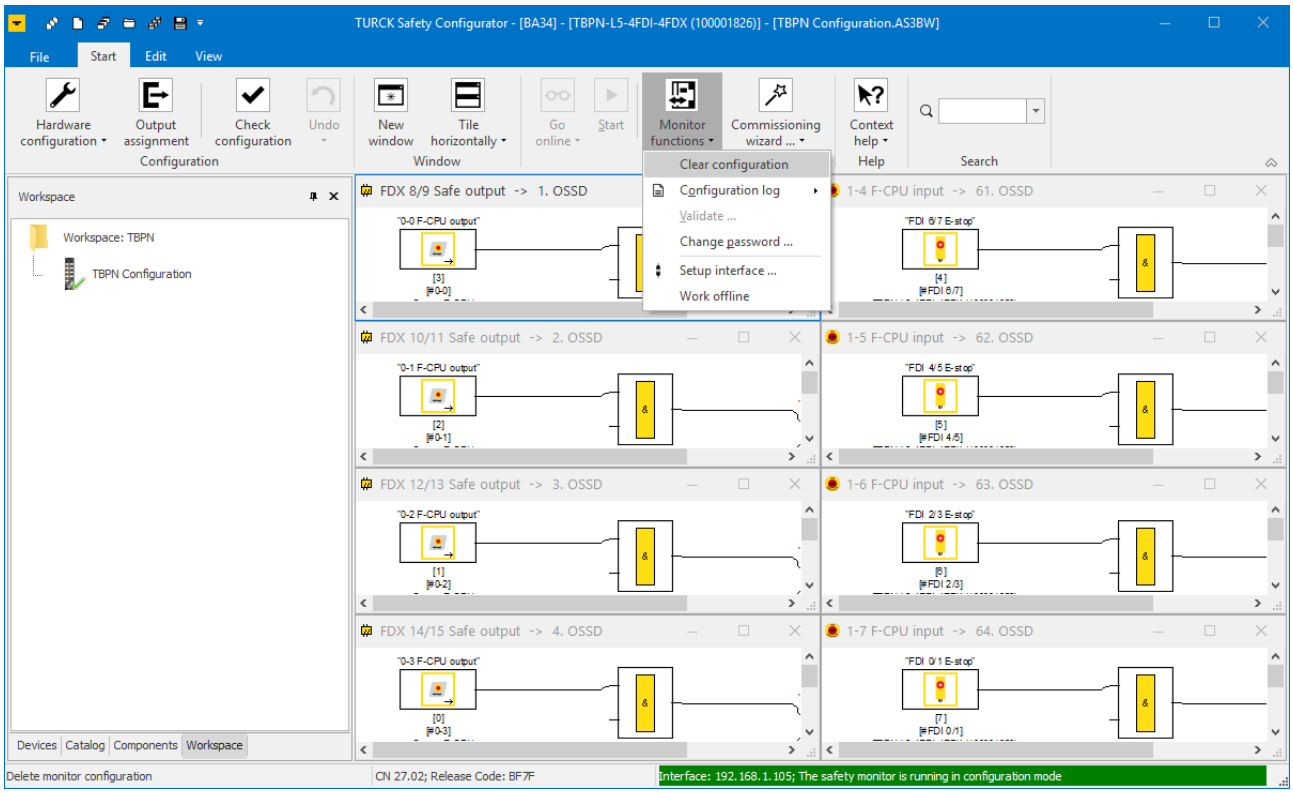


Fig. 56: Deleting the configuration via Turck Safety Configurator

⇨ 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" [▷ 65]
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	-

Configuration			Module behavior	Diagnostics
In device	**External memory**	**Device/ memory**		
Valid	Valid	unequal	Device start →Device running	Configuration miss-match, see „Memory and F-Config Status" [▷ 65]
Valid	No memory chip plugged	-	Device start → Device **not** running	No memory chip plugged, see „Memory and F-Config Status" [▷ 65]
Valid	Memory chip pulled	-	During operation	No memory chip plugged, see „Memory and F-Config Status" [▷ 65]
changed during operation	Valid	unequal	During operation → The new configuration is checked. → Loading the configura-tion 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 an identical device 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 [▷ 70] to transfer an existing configuration from the configuration memory of the original device into the exchange device.

10.1.2 Procedure for device replacement

- ▶ Dismount the device to be exchanged: Take devices out of operation according to chapter "Decommissioning" [▷ 74].
- ▶ Mount the replacement device as described in chapter “Mounting” [▷ 16].
- ▶ Commission the replacement device as described in chapter "Commissioning" → „Initial commissioning” [▷ 26].
- ▶ Defective or faulty devices must not, in any event, be put back into circulation. Dispose of devices according to the chapter "Disposal” [▷ 74].

11 Maintenance

The TBPN-L5-4FDI-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 TBPN-L5-4FDI-4FDX.

12 Decommissioning

The machine manufacturer is responsible for decommissioning the TBPN-L5-4FDI-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 [▶ 75].

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	
TBPN-L5-4FDI-4FDX	
■ Ident no.	100001826
■ YoC	According to device labeling

Power supply	
Connector	
■ TBPN-L5-4FDI-4FDX	7/8“, 5-pole
V1 (incl. electronics supply)	24 VDC
V2	24 VDC, only through connected
Permissible range	20.4…28.8 VDC
Isolation voltages	≥ 500 VAC

Interfaces	
Ethernet	2 x 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 [▷ 27]

General technical data	
Max. cable length	
■ Ethernet	10 m (per segment)
■ Sensor/actuator	30 m
Operating/storage temperature	-40 °C… +70 °C (- -40 °F…+158 °F)
Protection class	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)
Window material	Lexan

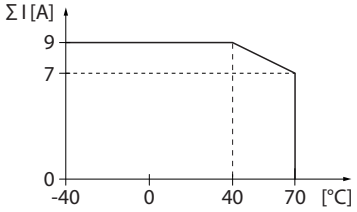
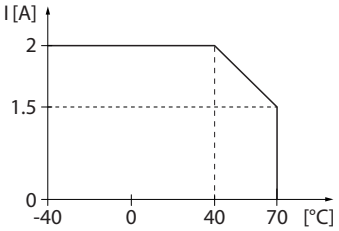
Tests	
Vibration test	According to EN 60068-2-6, IEC 68-2-47, acceleration up to 20 g
Drop and topple	According to IEC 60068-2-31/IEC 60068-2-32
Shock test	According to EN 60068-2-27
Electro-magnetic compatibility	According to EN 61131-2/EN 61326-3-1

14.2 Technical data – safety inputs

Safety inputs for OSSD	
Signal voltage, low level	EN 61131-2 type 1 (< 5 V; < 0,5 mA)
Signal voltage, high level	EN 61131-2 type 1 (< 15 V; < 2 mA)
Max. OSSD supply per channel	2 A
Max. tolerated test pulse width	1 ms
Min. interval between 2 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. cable length	Max. 1 µF at 150 Ω, limited by line capacity recommended calbe lenght: max.100 m at a with a cable cross-section of 0.5 mm^2
Test pulse, typ.	0.6 ms
Test pulse max.	0.8 ms
Interval between 2 test pulses, min.	900 ms (for static inputs)

14.3 Technical data – safety outputs

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 2 test pulses, typical	500 ms
Interval between 2 test pulses, min.	250 ms
Max. output current	2 A (resistive)
Max. total current for device	9 A
	Derating curve 
Max. output current	2 A (DC load)
	Derating curve 
The user has to provide an additional overcurrent protection on site.	

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