Manual

Safety Field Box SFB-PN-V2

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Table of Contents

1 Introduction

1.1 About this document

1.1.1 Purpose of this document

This manual provides all the information required for mounting, commissioning, safe operation and also disassembly of the safety fieldbox.

This document instructs the technical staff of the machine manufacturer or machine operator on the safe use of the devices.

1.1.2 Further applicable documents

Document	Part number	Location
Operating instructions SFB-PN-V2	103042285	Included in the scope of delivery or downloadable from www.products.schmersal.com [1)]
Manual SFB-PN-V2	103042289	Downloadable from www.products.schmersal.com [1)]
GSDML File	---	Stored in the device and downloadable with the web server or from Internet at www.products.schmersal.com [1)]
Quick-Start Guide SFB-PN	---	Downloadable from www.products.schmersal.com [1)]
Manual SFB Configuration Tool	---	Downloadable from www.products.schmersal.com [1)]
1) Enter search term "SFB" in the Schmersal Online Catalog at www.products.schmersal.com		

1.1.3 Target group: authorized qualified personnel

All operations described in this manual must be carried out by trained specialist personnel, authorised by the plant operator only.

Please make sure that you have read and understood these manual and the operating instructions and that you know all applicable legislations regarding occupational safety and accident prevention prior to installation and putting the component into operation.

The machine builder must carefully select the harmonised standards to be complied with as well as other technical specifications for the selection, mounting and integration of the components.

1.1.4 Explanation of the symbols used

	**⚠ CAUTION** Failure to comply with this warning notice could lead to failures or malfunctions.
	**⚠ WARNING** Failure to comply with this warning notice could lead to physical injury and/or damage to the machine.
	**INFORMATION** This symbol is used for identifying useful additional information.

1.1.5 Used short forms

Short form	Meaning
SFB	Safety Field Box
PN	PROFINET
TCI	Tool Calling Interface / open calling interface for equipment operating tools
GSDML	Generic Station Description Markup Language / device description file
F_iPar_CRC	CRC Checksum of safety parameters for the validation
IRT	Isochronous Real Time
MRP	Media redundancy protocol
I&M	Identification & Maintenance
SNMP	Simple Network Management Protocol
LLDP	Link Layer Discovery Protocol
1oo1	1 out of 1, single channel application (IEC 61508)
1oo2	1 out of 2, two channel (redundant) application (IEC 61508)
OSSD	Output Signal Switching Device / safety PNP semiconductor switching output
PELV	Protective Extra Low Voltage / protective extra low voltage with safe isolation

1.2 Safety instructions

1.2.1 General safety instructions

The user must observe the safety instructions in this manual and the operating instructions, the country specific installation standards as well as all prevailing safety regulations and accident prevention rules.

	INFORMATION
	Further technical information can be found in the Schmersal catalogues or in the online catalogue on the Internet at www.products.schmersal.com .

The information contained in this operating instruction manual is provided without liability and is subject to technical modifications.

There are no residual risks, provided that the safety instructions as well as the instructions regarding mounting, commissioning, operation and maintenance are observed.

1.2.2 Appropriate use

The products described in these operating instructions are developed to execute safety-related functions as part of an entire plant or machine. It is the responsibility of the manufacturer of a machine or plant to ensure the correct functionality of the entire machine or plant.

The safety fieldbox must only be used according to the following versions or for applications that are approved by the manufacturer.

Detailed information regarding the range of applications can be found in chapter 2 "Product description".

1.2.3 Warning about misuse

	⚠ WARNING
	In the event of improper or unintended use or tampering, use of the safety fieldbox could expose persons to danger or cause damage to the machine or system components.

1.2.4 Exclusion of liability

We shall accept no liability for damages and malfunctions resulting from defective mounting or failure to comply with this manual / operating instruction.
The manufacturer shall accept no liability for damages resulting from the use of unauthorized spare parts or accessories.

For safety reasons, invasive work on the device as well as arbitrary repairs, conversions and modifications to the device are strictly forbidden; the manufacturer shall accept no liability for damages resulting from such invasive work, arbitrary repairs, conversions and/or modifications to the device.

2 Product description

2.1 Module description

2.1.1 Purpose, ordering code, module overview

The SFB-PN-IRT-8M12-IOP-V2 safety fieldbox is designed for connection of up to 8 safety switchgear units with parallel IO signals to a PROFINET/PROFIsafe network.

A maximum of 4 BDF200-FB control panels can be connected to the device ports X4 – X7.

⚠ WARNING

Only safety switchgears are allowed to be connected for which the feedback of an external voltage can be safely excluded.

The safety signals from the connected safety switchgear are forwarded to a safety controller via the safety field bus for evaluation.

For larger safety applications, multiple fieldboxes can be connected to the power supply and field bus in series.

⚠ WARNING

The user must evaluate and design the safety chain in accordance with the relevant standards and the required safety level.

The non-safe IO signals of the connected devices are connected to the control system via the field bus.

Safety switchgear with parallel IO signals can be connected to device ports X0 - X7.

INFORMATION

BDF200-FB control panels can only be connected to device ports X4 - X7.

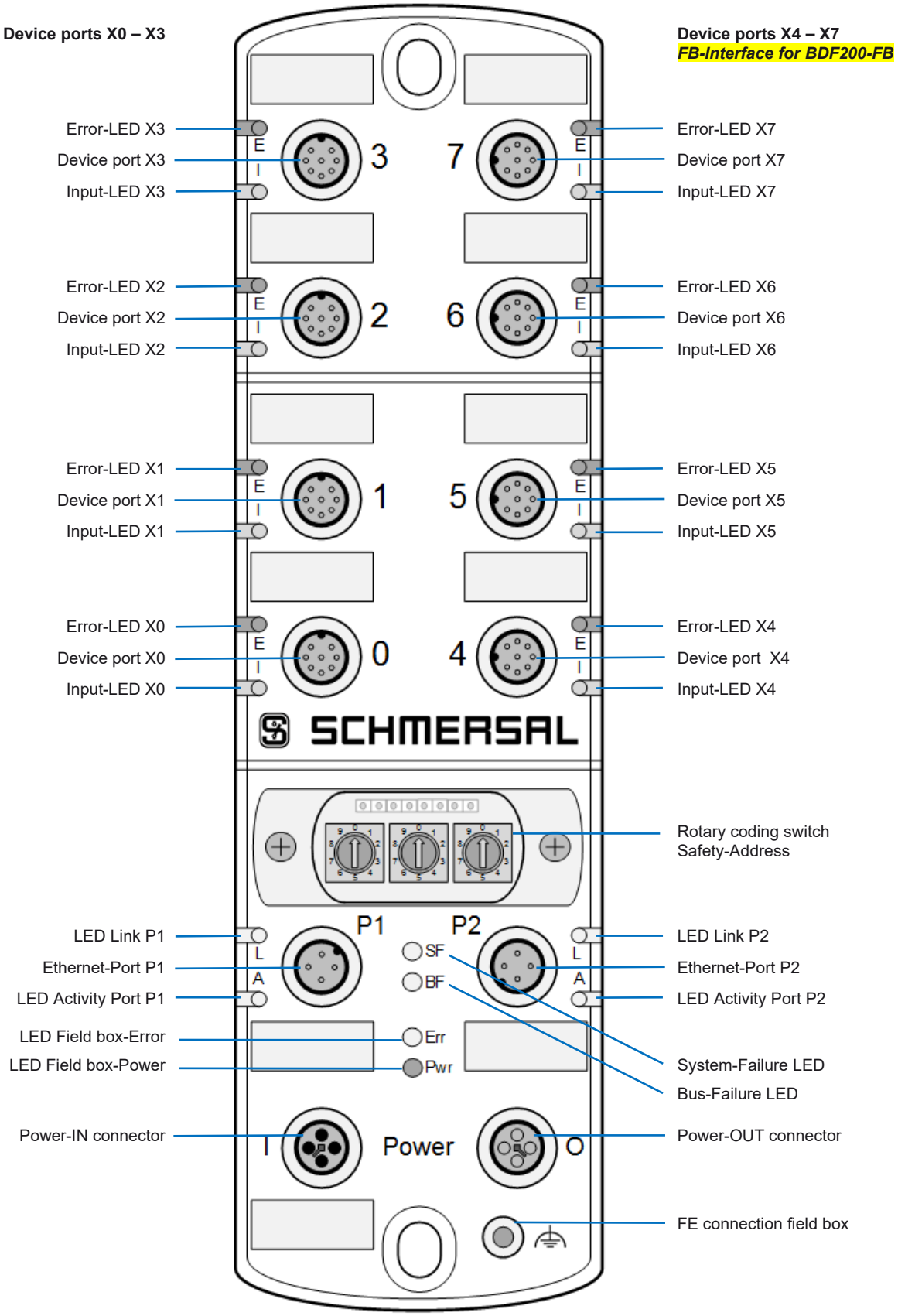
Ordering code

This manual applies to the following types:

SFB-PN-IRT-8M12-IOP-V2

Option	Description
SFB	Safety Field Box
PN	PROFINET
IRT	Switch IRT-capable
8M12	8 device ports for M12 connector, 8-pole
IOP	Device connection: I/O parallel
V2	Version 2

Module overview



2.1.2 Safety inputs and test pulse outputs

The SFB-PN-IRT-8M12-IOP-V2 has two safety inputs and two test pulse outputs for the supply of dry contacts at each of the 8 device ports X0 - X7.

These safety inputs are usable for:

1 channel safety switches (1oo1) with dry NC contacts

- Cross fault monitoring to all other safety inputs of the fieldbox
- Configurable debounce filter / stable time filter for the input signal
- Supply contact by test pulse outputs with test pulse duration 1 ms and test pulse interval 500 ms

2 channel safety switches (1oo2) with dry NC contacts

- Cross fault monitoring to all other safety inputs of the fieldbox
- Configurable debounce filter / stable time filter for the input signals
- Supply contacts by test pulse outputs with test pulse duration 1 ms and test pulse interval 500 ms

2 channel Safety switches (1oo2) with 24 V-PNP solid state outputs (OSSDs)

- **No cross fault monitoring** of the device connection cables by the fieldbox
- Configurable debounce filter / stable time filter for the input signals
- Supply safety inputs of the safety switchgear with 24 VDC **without test pulses**
- When the OSSD is switched on, **negative test pulses** with a length of 10 µs to 1 ms and an interval of 20 ms to 120 s must be sent.

	**⚠ WARNING**
	For safety switchgear with electronic OSSDs, cross fault detection of the device connection cable must be carried out by the safety switchgear!

2.1.3 Safety outputs

The SFB-PN-IRT-8M12-IOP-V2 has a safety digital output at each of the 8 device ports X0 - X7 for controlling loads up to 0.8 A and a configurable safety signal output for controlling 2-channel safety inputs up to 15 mA.

Safety output via 1 wire (digital output DO)

- Safety digital output (PP switching) up to PL d, for controlling e.g. solenoids in interlocks
- Tested output, short-circuit and overload protected

Safety output via 2 wires (digital output DO and test pulse output Y1)

- Safety digital outputs (2P switching) up to PL e, for controlling e.g. interlocks with 2-channel locking functions or for 2-channel control of SRB-E-301ST safety relay modules
- Tested outputs, short-circuit and overload protected

2.1.4 Diagnostic input / FB interface

The SFB-PN-IRT-8M12-IOP-V2 has one diagnostic input at each of the 8 device ports X0 - X7 for status signals of the connected safety switchgear.

At the 4 device ports X4 - X7 a FB interface is additionally integrated on this input.

The non-safe signals from command and signalling devices, e.g. the BDF200-FB, can be transmitted via the single-wire FB-Interface interface.

FB interface automatically detects if a safety switchgear with integrated FB interface is connected.

2.1.5 PROFINET IO communication

PROFINET IO PROFINET IO is an open communication protocol that complies with IEC 61784-2. The communication protocol is based on Ethernet.

Data is exchanged between the control unit, referred to as the PROFINET IO Controller, and connected users, which are called PROFINET IO devices.

Communication is based on a full-duplex Ethernet network running at 100 Mbit/s. IO controllers and IO devices communicate by means of Ethernet telegrams.

Devices exchange data cyclically based on the provider-consumer principle. Devices function as receiver (consumer) and transmitter (provider) at the same time.

The IO controller sends output data to the IO devices and receives input data from the IO devices. The IO devices send input data and receive output data.

Other components of the communication protocol include telegrams in form of acyclic communication for parameter transfer and read/write access to the I&M data or manufacturer-specific features.

2.1.6 PROFIsafe communication

PROFIsafe is a functionally safe expansion of standard communication via PROFINET or PROFIBUS. Communication based on PROFIsafe is safe against alteration, transmission errors and changes to the telegram sequence, etc.

The SFB-PN Safety Field Box is a PROFIsafe module and complies with "PROFIsafe – Profile for Safety Technology on PROFIBUS DP and PROFINET IO”.

The module establishes a safe communication to a PROFIsafe master.

2.1.7 Module in the PROFINET system

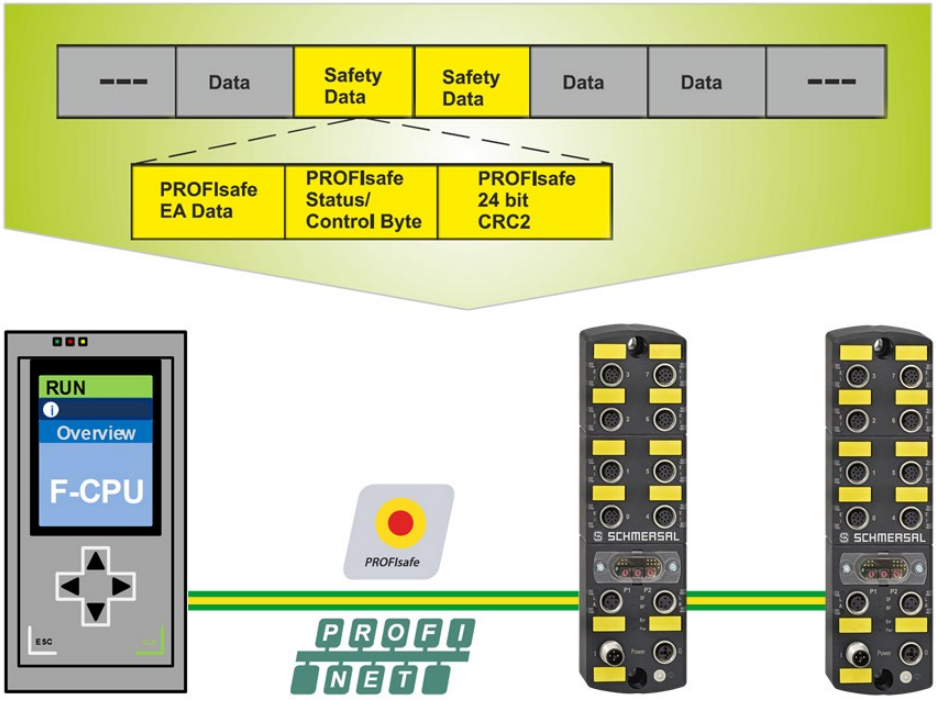
The SFB-PN safety module is also a PROFINET IO device and a PROFIsafe slave. It receives and sends data to and from the F-PLC in form of the PROFIsafe telegrams. PROFIsafe telegrams are tunnelled in PROFINET standard telegrams. (Black Channel principle)

The F-PLC processes safe input data and sends safe output data cyclically to the PROFIsafe slave. PROFIsafe telegrams contain control and status bits. The telegrams signal the states of masters/slaves and initiate a status change if necessary.

The SFB-PN safety module detects errors in the module and errors in the installation or the connected safety switching devices. After an error has been detected in the safety section, the module returns to the safe state.

External errors are rectified by eliminating the error cause and then acknowledging the error.

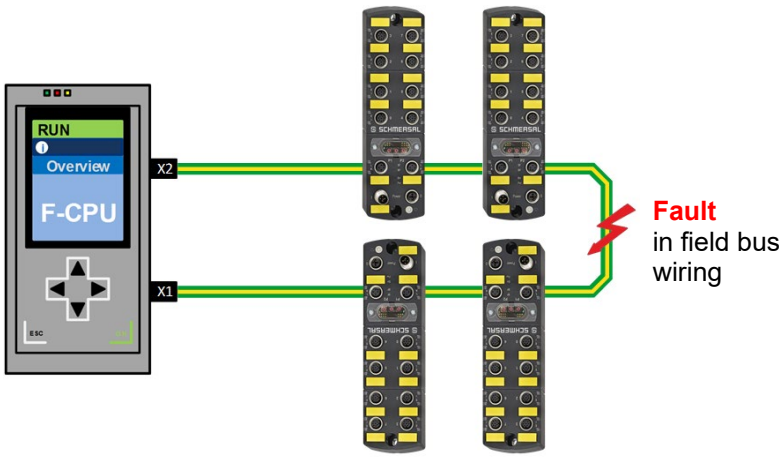
Normally, internal errors are only rectified by module replacement.



2.1.8 Media redundancy protocol (MRP)

The MRP protocol according to IEC 62439 describes PROFINET redundancy with a typical reconfiguring time of < 200 ms for communication paths with TCP/IP and RT frames after a fault.

Error-free operation of an automation system involves a media redundancy manager (MRM) and several media redundancy clients (MRC) arranged in a ring.



The function of a Media Redundancy Manager (MRM) consists in checking the ring structure required by the configuration for its operability. This is done by sending cyclic test telegrams. As long as the test telegrams are received again by the MRM, the ring structure is intact. An MRM uses this behaviour to prevent circulation of telegrams and to convert a ring structure into a line structure.

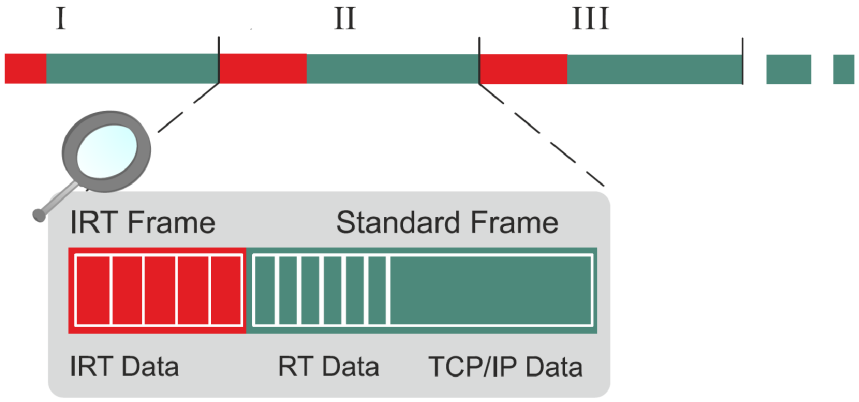
A Media Redundancy Client (MRC) is a switch that functions only as a so called "forwarder" of telegrams and does normally not play an active role. It must have two switch ports in order to connect to other MRCs or the MRM in a single ring. SFB-PN modules can be configured as MRCs.

	INFORMATION
	Information about the configuration of the Media redundancy protocol (MRP) can be found in the system manual of your engineering software.

2.1.9 PROFINET IRT

For PROFINET, a clock-synchronized data exchange by the transmission of data packages in regular time intervals of a few hundred milliseconds up to four milliseconds are defined by the IRT concept (isochronous real time).

The beginning of a bus cycle is adhered to with the highest precision (jitter <= 1µs). Each of the individual time intervals during the IRT communication is split into an IRT interval and an open standard interval which requires the use of special IRT switches.



	INFORMATION
	The SFB-PN module is no active participant in the IRT data exchange. It supports the loss-free transmission of IRT telegrams for synchronized fieldbus devices in the same Ethernet subnet.

	INFORMATION
	Information about the configuration of IRT can be found in the system manual of your engineering software.

2.1.10 PROFINET services I&M, SNMP; LLDP, Shared Device and PROFIenergy

I&M services (Identification and Maintenance)

The SFB-PN supports I&M services I&M0 ... I&M3 according to the PROFINET specification.

SNMP services (Simple Network Management Protocol)

The SFB-PN supports SNMP requests according to the PROFINET specification.

LLDP services (Link Layer Discovery Protocol)

The SFB-PN supports the LLDP services according to the PROFINET specification.

Shared Device

The Shared Device function is **not supported** by the safety fieldbox.

The safety signals and the non-safety diagnostic signals of the connected safety relays are interpreted in the F-PLC.

The F-PLC can transfer this interpreted data to other IO-Controllers in PROFINET.

PROFIenergy

The PROFIenergy profile is **not supported** by the safety fieldbox.

2.2 Configurable functions SFB-PN-V2

2.2.1 Parameters of the safety inputs

For each device port there are 2 parameters for configuring the safety inputs.

Parameters	Value range	Default settings
Safety inputs	1 channel / 2 channels	2 channels
Cross fault monitoring	ON / OFF	OFF

Safety inputs

- 1 channel for safety switches with one dry contact, evaluation 1oo1
- 2 channels for safety switches with two dry contacts,
- 2 channels for safety switchgear with 2 OSSDs and test pulses, evaluation 1oo2

Cross fault monitoring

- ON for safety switches with one or two dry contacts
- OFF for safety switchgear with electronic OSSDs

	**⚠ WARNING** The default setting is used for safety switchgear with electronic OSSDs. If safety switchgear with dry contacts are used, cross fault monitoring must be activated!
	**⚠ WARNING** For safety switchgear with electronic OSSDs, cross fault detection of the device connection cable must be carried out by the safety switchgear! The SFB-PN-V2 monitors the test pulses on the outputs of the safety switchgear.

2.2.2 Parameters of the safety outputs

For each device port there are 1 parameter for configuring the safety outputs.

Parameters	Value range	Default settings
Safety outputs	1 wire (PL d) / 2 wires (PL e)	1 wire (PL d)

Safety outputs

- 1 wire (PL d) for safety switchgear with one safety input, e.g. for solenoid control of interlocks.
- 2 wires (PL e) for safety switchgear with two safety inputs, e.g. for controlling the locking function of interlocks.

2.2.3 Debounce filter / stable time filter

The stable time filter is used for bouncing safeguards.
The default settings are normally adequate.
For very difficult applications with extremely bouncing safeguards, the stable time and the monitoring time can also be set manually.

	INFORMATION
	The default settings specified in Chapter 2.3 "Wiring examples and parameterization" are normally adequate for the reliable operation of a machine with bouncing safeguards!

The stable time filter automatically detects when a bouncing safeguard has come to a standstill, in other words when it has come to a "stable" situation.
If a constant switch-on signal is received at both inputs for the duration of the stable time, the safety function is switched on.

In difference to discrepancy time filters, the release of the safety function is only delayed by the set stable time in the stable time filter and the release of the safety function is not time-dependent, but only when the safeguard has actually come to a standstill.

The stability time filter is required for safety switchgear with contacts.
In safety switchgear with electronic OSSDs, the output signals are normally filtered internally.

Operation of the stable time filter when using 2 channel safety inputs

- The stability time filter effects an intelligent discrepancy monitoring of the input signals.
- If one contact is switched on for the first time, the monitoring time is started.
- If both contacts are switched on for the duration of the stable time inside the set monitoring time, the safety function is switched on.
- If the contacts do not come to a standstill, the fault message "Discrepancy / stability time fault Device-Port X…" is displayed after the monitoring time has passed.
- If only one contact, temporary or permanent, is switched off or the two contacts do not come to a standstill, the fault message is also displayed after the monitoring time has passed.

Operation of the stable time filter when using 1 channel safety inputs

- The stable time filter effects a debounce function for the input signal.
- If the contact is switched on for the first time, the monitoring time is started.
- If the contact is switched on for the duration of the stable time inside the set monitoring time, the safety function is switched on.
- If the contact does not come to a standstill, the fault message "Discrepancy / stability time fault Device-Port X…" is displayed after the monitoring time has passed.
- If the contact switches off temporary or does not come to a standstill, the error message is also displayed after the monitoring time has passed

Manual parameterization of the stability time filter:

For very difficult applications with extremely bouncing safeguards, the stable time and the monitoring time can also be set manually.

For each device port there are 2 parameters for configuring the stable time filter.

Parameters	Value range	Default settings
Stable time	0.1 – 2.0 s	0.1 s for devices with OSSDs 0.7 s for devices with dry contacts
Monitoring time	1 – 20 s	2 s for devices with OSSDs 10 s for devices with dry contacts

	INFORMATION
	For manual parameterization, please ensure that the monitoring time is at least 5 times longer than the set stable time.

Frequency limit of the input signal:

The maximum switching frequency of the input signal depends on the adjusted stability time.

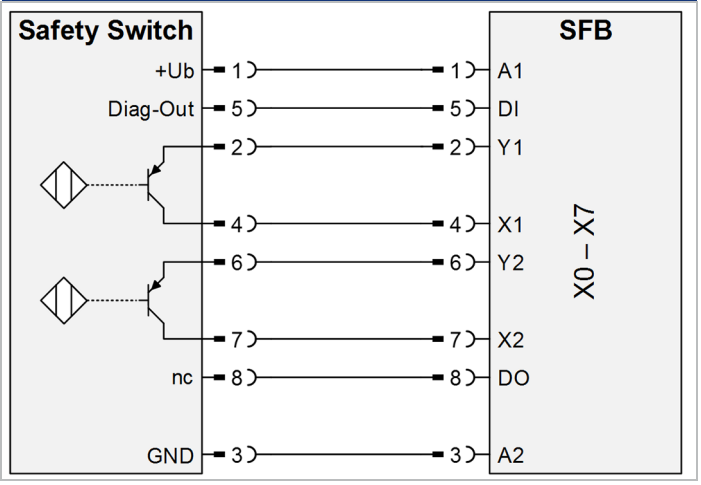
The switch-on time and also the switch-off time of the input signal must both be present at the input for at least 2 x the adjusted stable time.

The cut-off frequency of the input signal is therefore 2.5 Hz if the lowest stability time of 0.1 s has been adjusted.

2.3 Wiring examples and parameterization

2.3.1 Electronic safety sensor, 8-pole M12 connector

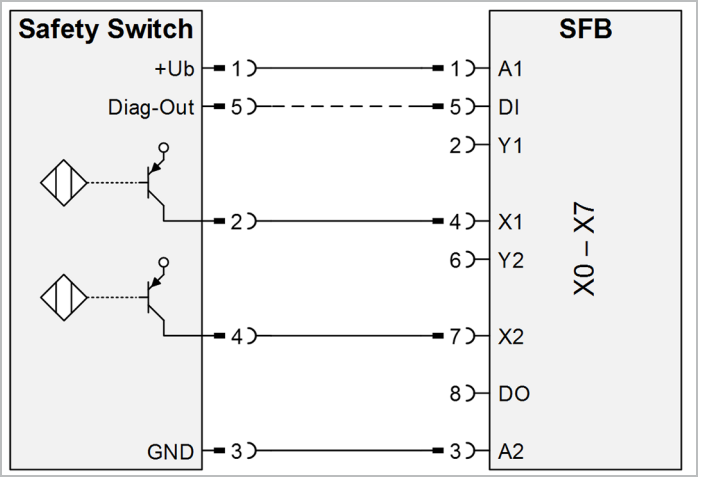
Safety sensor with electronic OSSD, monitoring 1oo2

Parameters	Value	Connection example
Safety inputs	2 channels	
Cross-fault detection	OFF	
Safety outputs	1 wire (PL d)	
Monitoring time	2 s	
Stable time	0.1 s	
Safety classification Inputs X1 & X2 – up to Cat 4 / PL e / SIL 3 Output DO: –		

SCHMERSAL devices: CSS range, RSS range, …

2.3.2 Electronic safety sensor / AOPD, 4/5-pole M12 connector

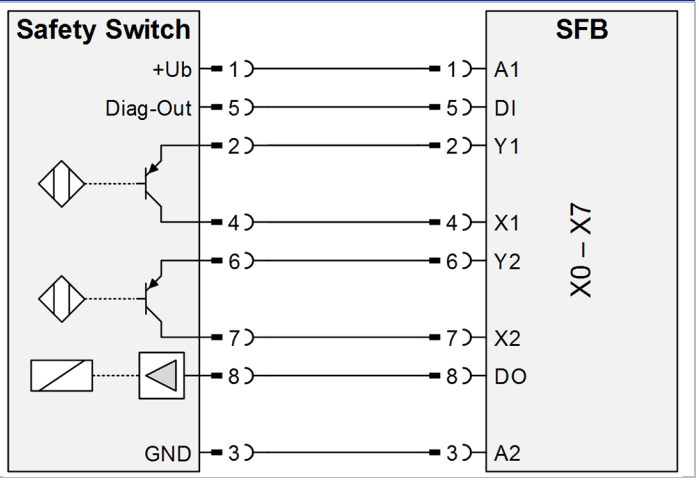
Safety sensor with electronic OSSD, monitoring 1oo2

Parameters	Value	Connection example
Safety inputs	2 channels	
Cross-fault detection	OFF	
Safety outputs	1 wire (PL d)	
Monitoring time	2 s	
Stable time	0.1 s	
Safety classification Inputs X1 & X2 – up to Cat 4 / PL e / SIL 3 Output DO: –		

Various safety switchgears from different manufacturers.

2.3.3 Electronic safety interlock, interlock function via 1 wire

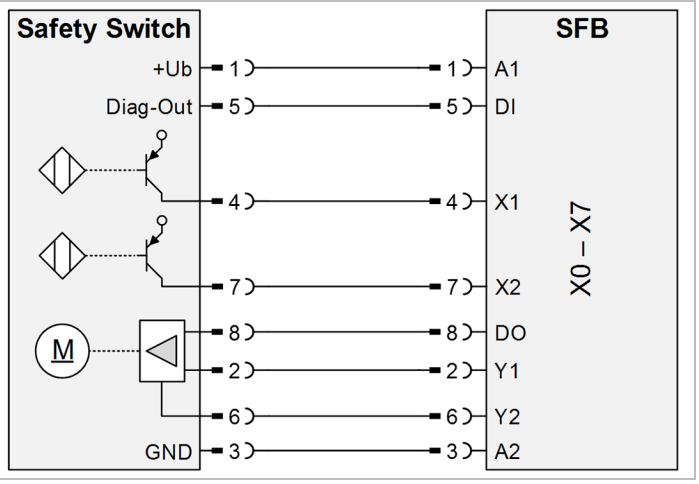
Solenoid interlock with electronic OSSD, monitoring 1oo2

Parameters	Value	Connection example
Safety inputs	2 channels	
Cross-fault detection	OFF	
Safety outputs	1 wire (PL d)	
Monitoring time	2 s	
Stable time	0.1 s	
Safety classification Inputs X1 & X2 – up to Cat 4 / PL e / SIL 3 Output DO: – up to Cat 3 / PL d / SIL 2		

SCHMERSAL devices: MZM 100, AZM 200, AZM 201, AZM 300, AZM 40, …

2.3.4 Electronic safety interlock, interlock function via 2 wires

Solenoid interlock with electronic OSSD, monitoring 1oo2

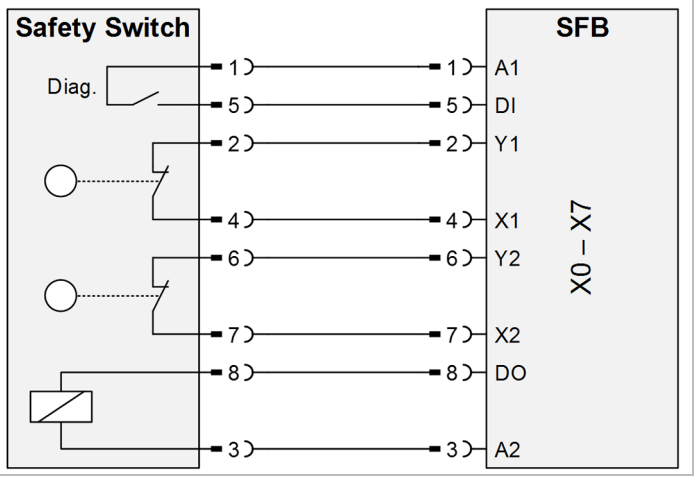
Parameters	Value	Connection example
Safety inputs	2 channels	
Cross-fault detection	OFF	
Safety outputs	2 wires (PL e)	
Monitoring time	2 s	
Stable time	0.1 s	
Safety classification Inputs X1 & X2 – up to Cat 4 / PL e / SIL 3 Outputs DO & Y1: – up to Cat 4 / PL e / SIL 3		

SCHMERSAL devices: AZM 400, …

	INFORMATION
	The safety output Y1 can be loaded with a maximum of 15 mA.

2.3.5 Electromechanical safety interlock, interlock function via 1 wire

Solenoid interlock with dry contacts equivalent, monitoring 1oo2

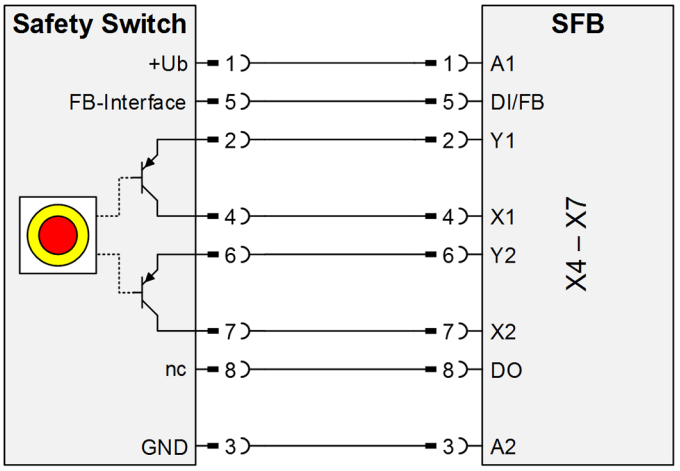
Parameters	Value	Connection example
Safety inputs	2 channels	
Cross-fault detection	**ON**	
Safety outputs	1 wire (PL d)	
Monitoring time	10 s	
Stable time	0.7 s	
Safety classification Inputs X1 & X2 – up to Cat 4 / PL e / SIL 3 Output DO: – up to Cat 3 / PL d / SIL 2		

SCHMERSAL devices: AZM 161-FB, AZM 170-FB, AZM 150-FB, …

	⚠ WARNING
	For safety switchgear with dry contacts, cross-fault detection must be activated ! Set Stable time 0.7 s and Monitoring time 10 s.

2.3.6 Electronic E-STOP and control panels with FB-Interface, 8-pole M12 connector

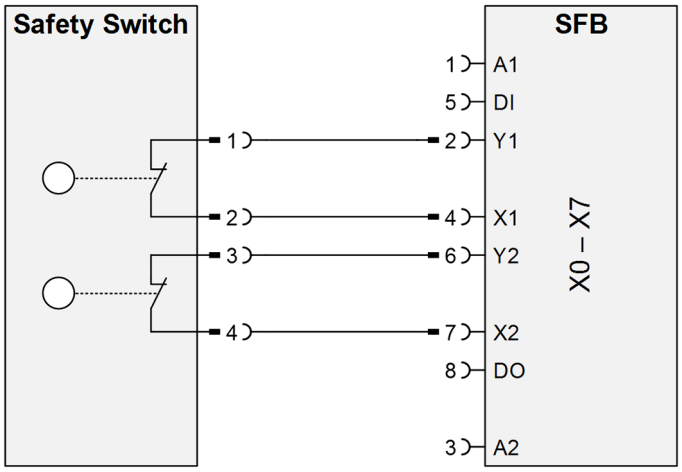
E-STOP pushbuttons with electronic OSSD and FB-Interface, monitoring 1oo2

Parameters	Value	Connection example
Safety inputs	2 channels	
Cross-fault detection	OFF	
Safety outputs	1 wire (PL d)	
Monitoring time	2 s	
Stable time	0.1 s	
Safety classification Inputs X1 & X2 – up to Cat 4 / PL e / SIL 3 Output DO: –		

SCHMERSAL devices: BDF 200-FB, …

2.3.7 Electromechanical safety sensor or safety switch, 4-pole M12 connector

Safety switch or sensor with dry contacts equivalent, monitoring 1oo2

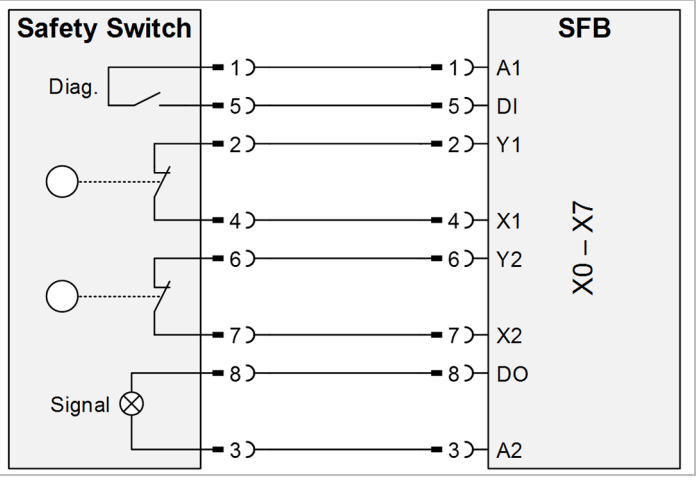
Parameters	Value	Connection example
Safety inputs	2 channels	
Cross-fault detection	**ON**	
Safety outputs	1 wire (PL d)	
Monitoring time	10 s	
Stable time	0.7 s	
Safety classification Inputs X1 & X2 – up to Cat 4 / PL e / SIL 3 Output DO: –		

SCHMERSAL devices: BNS range, TESK, …

	⚠ WARNING
	For safety switchgear with dry contacts, cross-fault detection must be activated ! Set Stable time 0.7 s and Monitoring time 10 s.

2.3.8 Electromechanical safety switch, 8-pole M12 connector

Safety switch with dry contacts equivalent, monitoring 1oo2

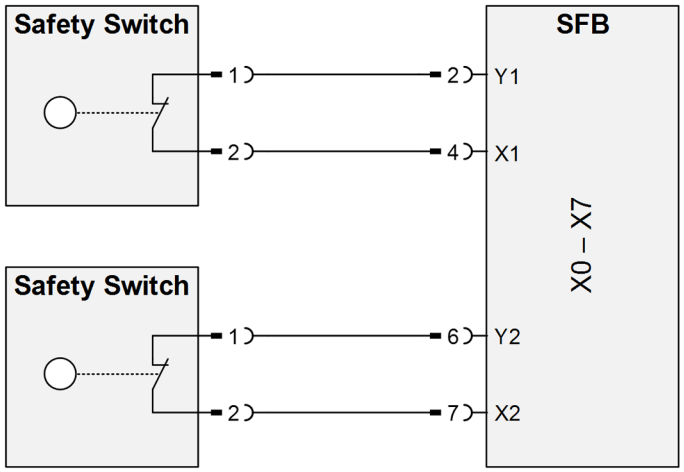
Parameters	Value	Connection example
Safety inputs	2 channels	
Cross-fault detection	**ON**	
Safety outputs	1 wire (PL d)	
Monitoring time	10 s	
Stable time	0.7 s	
Safety classification Inputs X1 & X2 – up to Cat 4 / PL e / SIL 3 Output DO: – up to Cat 3 / PL d / SIL 2		

SCHMERSAL devices: AZ range, PS range, BDF 100-NH(K), ZQ range, …

	⚠ WARNING
	For safety switchgear with dry contacts, cross-fault detection must be activated ! Set Stable time 0.7 s and Monitoring time 10 s.

2.3.9 Connection of single-channel safety switches

One or two safety switches 1 channel with dry contacts, monitoring 1oo1

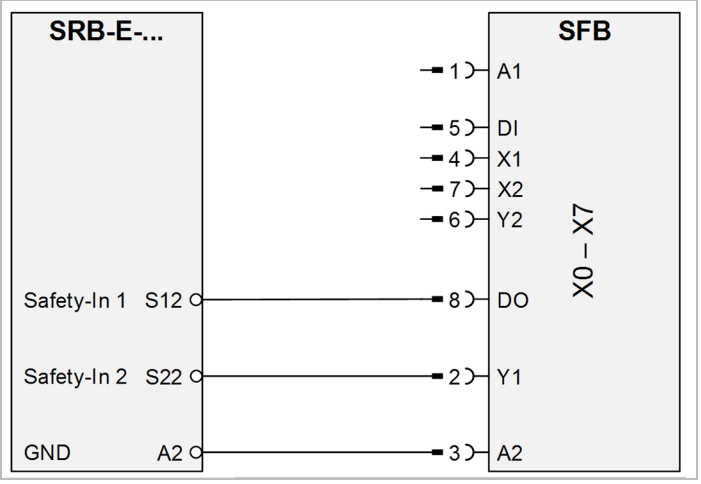
Parameters	Value	Connection example
Safety inputs	1 channel	
Cross-fault detection	**ON**	
Safety outputs	1 wire (PL d)	
Monitoring time	10 s	
Stable time	0.7 s	
Safety classification Inputs X1 & X2 – up to Cat 2 / PL d / SIL 1 Output DO: –		

Various safety switchgear from different manufacturers.

	⚠ WARNING
	For safety switchgear with dry contacts, cross-fault detection must be activated ! Set Stable time 0.7 s and Monitoring time 10 s.

2.3.10 Safety-Relay-Module SCHMERSAL SRB-E

Safety-Relay-Modules with 2 channel safety inputs, monitoring 1oo2

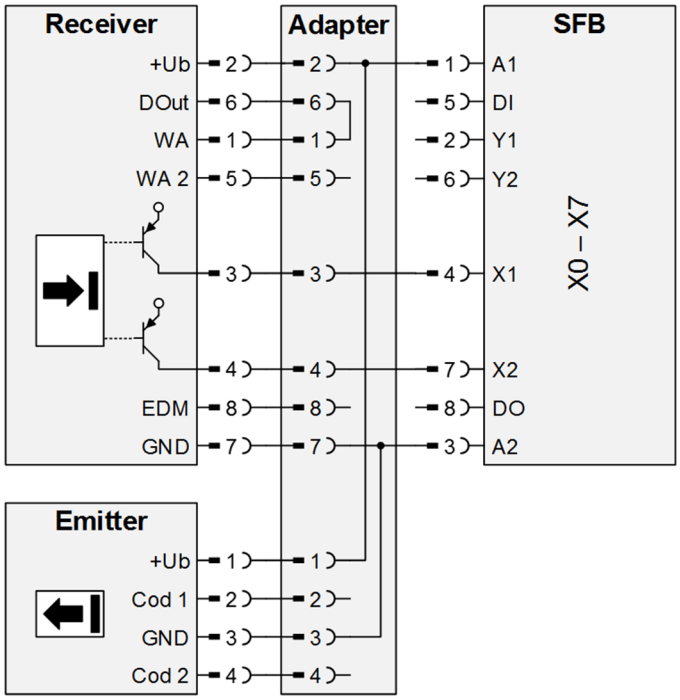
Parameters	Value	Connection example
Safety inputs	2 channels	
Cross-fault detection	OFF	
Safety outputs	2 wires (PL e)	
Monitoring time	2 s	
Stable time	0.1 s	
Safety classification Inputs X1 & X2 – Outputs DO & Y1: – up to Cat 4 / PL e / SIL 3		

	INFORMATION
	The safety output Y1 can be loaded with a maximum of 15 mA.

All SCHMERSAL Safety-Relay-Modules of the SRB-E series with 2 inputs for pulsed 24V signals up to a load of < 15 mA can be connected. (e.g. SRB-E-301ST, SRB-E-201ST/LC, etc.)

2.3.11 Optoelectronic AOPD SCHMERSAL, 4/8-pole M12 connector

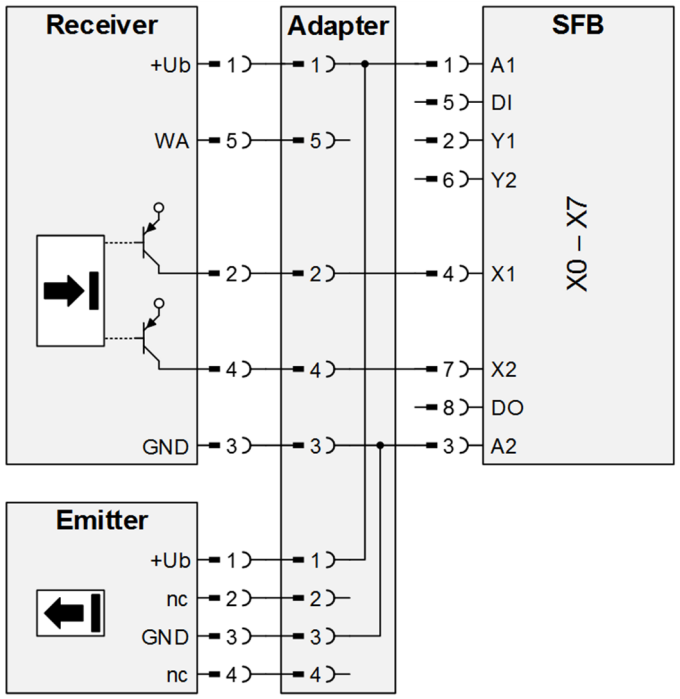
Active opto-electronic protective devices AOPD with electronic OSSD, monitoring 1oo2

Parameters	Value	Connection example
Safety inputs	2 channels	
Cross-fault detection	OFF	
Safety outputs	1 wire (PL d)	
Monitoring time	2 s	
Stable time	0.1 s	
Safety classification Inputs X1 & X2 – up to Cat 4 / PL e / SIL 3 Output DO: –		

SCHMERSAL devices: SLC 440 range, SLG 440 range, …

2.3.12 Optoelectronic AOPD, 4/5-pole M12 connector

Active opto-electronic protective devices AOPD with electronic OSSD, monitoring 1oo2

Parameters	Value	Connection example
Safety inputs	2 channels	
Cross-fault detection	OFF	
Safety outputs	1 wire (PL d)	
Monitoring time	2 s	
Stable time	0.1 s	
Safety classification Inputs X1 & X2 – up to Cat 4 / PL e / SIL 3 Output DO: –		

SCHMERSAL devices: SLC 440-COM range, SLG 440-COM range, SLB 440 range, …

2.4 Technical Data

2.4.1 General technical Data

Designation	Value
Standards	EN 61131-1, EN 61131-2, EN 60947-5-3, EN ISO 13849-1, IEC 61508
Time to readiness	≤ 8 s
Worst Case Delay Time (WCDT_Input / DIN EN 61784-3-3)	≤ 20 ms
Worst Case Delay Time (WCDT_Output / DIN EN 61784-3-3)	≤ 50 ms
Device Watchdog Time (Device_WD / DIN EN 61784-3-3)	10 ms
Device Acknowledgement Time (DAT / DIN EN 61784-3-3)	≤ 25 ms
Materials	
Enclosure	Polyamide / PA 6 GF
Viewing window	Polyamide / PACM 12
Encapsulation	Polyurethane / 2K PU
Labelling plates	Polyamide / PA
Mechanical Data	
Electrical connection version Device ports X0 – X7 Power I/O PROFINET P1/P2	Build in socket / connector M12 / 8-pole A-coded M12-POWER / 4-pole, T-coded M12 / 4-pole, D-coded
M12 connector tightening torque Recommended for SCHMERSAL cables	min. 0.8 Nm / max. 1.5 Nm 1.0 Nm
Fixing screws Tightening torque	2x M6 max. 3.0 Nm
Viewing window screws Tightening torque	2x Torx 10 0.5 … 0.6 Nm
Ambient conditions	
Ambient temperature	-25°C ... +55°C
Storage and transport temperature	-25°C ... +70°C
Relative humidity	10 % … 95 %, non-condensing
Resistance to shock	30 g / 11 ms
Resistance to vibration	5 … 10 Hz, amplitude 3.5 mm 10 … 150 Hz, amplitude 0.35 mm / 5 g
Degree of protection	IP66 / IP67 to EN 60529
Installation altitude above sea level	max. 2,000 m
Protection class	III
Insulation values to EN 60664-1 Rated insulation voltage U_i Rated impulse withstand voltage U_{imp} Over-voltage category Degree of pollution	 32 VDC 0.8 kV III 3

	**⚠ CAUTION** Protection class IP66 / IP67 is only reached if all M12 connectors and blanking plugs, as well as the viewing window are properly fastening with screws.

	**⚠ CAUTION** All fieldboxes have a good resistance against chemicals and oil. When used in aggressive media (e.g. chemicals, oils, lubricants and coolants in high concentrations) the material resistance must in each case be checked in advance for the specific application.

2.4.2 Electrical Data

Designation	Value
Electrical Data – Power I / O	
Supply voltage U_B	24 VDC -15% / +10% (stabilised PELV mains unit)
Rated operating voltage U_e	24 VDC
Current consumption SFB	200 mA
Rated operating current I_e	10 A (external fuse protection required)
Device fuse rating	≤ 10A slow blow when used to UL 61010
Electrical Data – Device ports X0 – X7	
Maximum cable length X0 – X7	30 m
Safety inputs	**X1 and X2**
Switching threshold (acc. EN 61131, type 1)	- 3 V … 5 V (Low) 13 V … 30 V (High)
Current consumption per input	< 6 mA / 24 V
Permissible residual drive current	< 1.0 mA
Accepted test pulse duration on input signal With test pulse interval of	0.01 … 1.0 ms 20 ms … 120 s
Classification	ZVEI CB24I
Sink: C1 | Source: C1 C2 C3	
Test pulse outputs	**Y1 and Y2**
Switching elements	p-type, short-circuit proof
Rated operating voltage U_e	24 VDC
Rated operating current I_e	Y1: 15 mA Y2: 10 mA at 24 V / 30 mA at GND
Leakage current I_r	≤ 0.5 mA
Voltage drop U_d	≤ 1 V
Test pulse duration	≤ 1 ms
Test pulse interval	500 ms
Classification	ZVEI CB24I
Sink: C1 | Source: C1	
Digital output	**DO**
Switching elements	2 p-type, short-circuit proof
Utilisation category	DC 12 / DC 13
Rated operating voltage U_e	24 VDC
Rated operating current I_e	0.8 A
Leakage current I_r	≤ 0.5 mA
Voltage drop U_d	≤ 2 V
Inductive load	≤ 400 mH
Switching frequency output	≤ 1 Hz
Test pulse duration	≤ 1 ms
Test pulse interval	15 … 500 ms
Classification	ZVEI CB24I
Sink: C1 | Source: C1	

⚠ CAUTION

The sum of the total current of the individual device ports X0 - X7 for outputs A1 (power supply to devices) and DO (digital output) should not exceed 850 mA.

Designation	Value
Diagnostic input / FB interface	**DI**
Switching thresholds	- 3 V … 5 V (Low) 13 V … 30 V (High)
Current consumption per input	< 12 mA / 24 V
Permissible residual drive current	< 1.0 mA
Input debounce filter	10 ms
FB interface data transmission rate	19.2 kBaud
Power supply devices	**A1 and A2**
Rated operating voltage U_e	24 VDC
Rated operating current I_e	0.8 A
Device port line fuse	1.5 A (integrated automatic resettable fuse)
Electrical Data – PROFINET P1 / P2	
Field bus protocol	PROFINET / PROFIsafe
Specification PROFINET Supported options PROFIsafe	 V2.3, Conformance Class C MRP, Fast Start Up V2.4
Network load class PROFINET	3
Transmission rate	100 Mbit/s Full Duplex
PROFINET addressing	via DCP
Integrated Switch	Dual Port, 100 Mbit/s, IRT-capable
Supported PROFINET services	I&M0 … I&M3, SNMP, LLDP
Service interface	WEB-Interface HTTP

2.5 Safety classification

2.5.1 Safety inputs 2 cannels

Designation	Value
Standards	EN ISO 13849-1, IEC 61508, EN 62061
PL	e
Category	4
DC	99 %
PFH	1.1×10^{-9} /h
PFD_{avg}	9.6×10^{-5}
SIL	suitable for SIL 3 applications
Mission time	20 years
Response time of local safety input > PROFINET	20 ms

The SFB fulfils the requirements as PDDB (proximity switch with defined behaviour under fault conditions) according to EN 60947-5-3 in combination with magnetic sensors (2 NC contacts) up to PL e / SIL 3.

2.5.2 Safety inputs 1-channel

Designation	Value
Standards	EN ISO 13849-1, IEC 61508, EN 62061
PL	d
Category	2
DC	90 %
PFH	2.3 x 10^{-7} /h
PFD_{avg}	2.0 x 10^{-2}
SIL	suitable for SIL 1 applications
Mission time	20 years
Response time of local safety input > PROFINET	20 ms
Test interval for error detection	10 s

2.5.3 Safety outputs 1 wire (PL d)

Designation	Value
Standards	EN ISO 13849-1, IEC 61508, EN 62061
PL	d
Category	3
DC	90 %
PFH	1.0 x 10^{-7} /h
PFD_{avg}	8.8 x 10^{-3}
SIL	suitable for SIL 2 applications
Mission time	20 years
PROFINET reaction time > local safety output	50 ms

2.5.4 Safety outputs 2 wires (PL e)

Designation	Value
Standards	EN ISO 13849-1, IEC 61508, EN 62061
PL	e
Category:	4
DC	99 %
PFH	1.2 x 10^{-9} /h
PFD_{avg}	1.1 x 10^{-4}
SIL	suitable for SIL 3 applications
Mission time	20 years
PROFINET reaction time > local safety output	50 ms

⚠ WARNING

This product must only be replaced in the application by an identical product of type SFB-PN-IRT-8M12-IOP-**V2** with part no. 103040357.
The older product version has a lower safety level.

2.5.5 Safety response time SFB-PN-V2

The overall response time of a safety function is made up of the following individual times:

- Response time of connected safety switchgear *(see operating instructions safety switchgear)*
- **Delay Time Safety fieldbox SFB-V2**
- PROFINET / PROFIsafe transmission time
- Cycle time F runtime group F-PLC
- Response time of safety shut-off element (actuator)

For all components installed in the system, the difference between the reaction time and the watchdog time must also be calculated.

The longest difference time calculated must be added to the sum of all response times to calculate the "Safety Function Response Time" (SFRT).

	**⚠ WARNING** In addition to the maximum response time of the SFB-PN-V2, the response times of the connected safety switchgear, the transmission time from PROFINET and the response times of additional PROFIsafe components (if applicable) must be taken into consideration.
	**⚠ WARNING** The maximum acceptable response times of the safety functions are defined in the risk analysis of the machine!

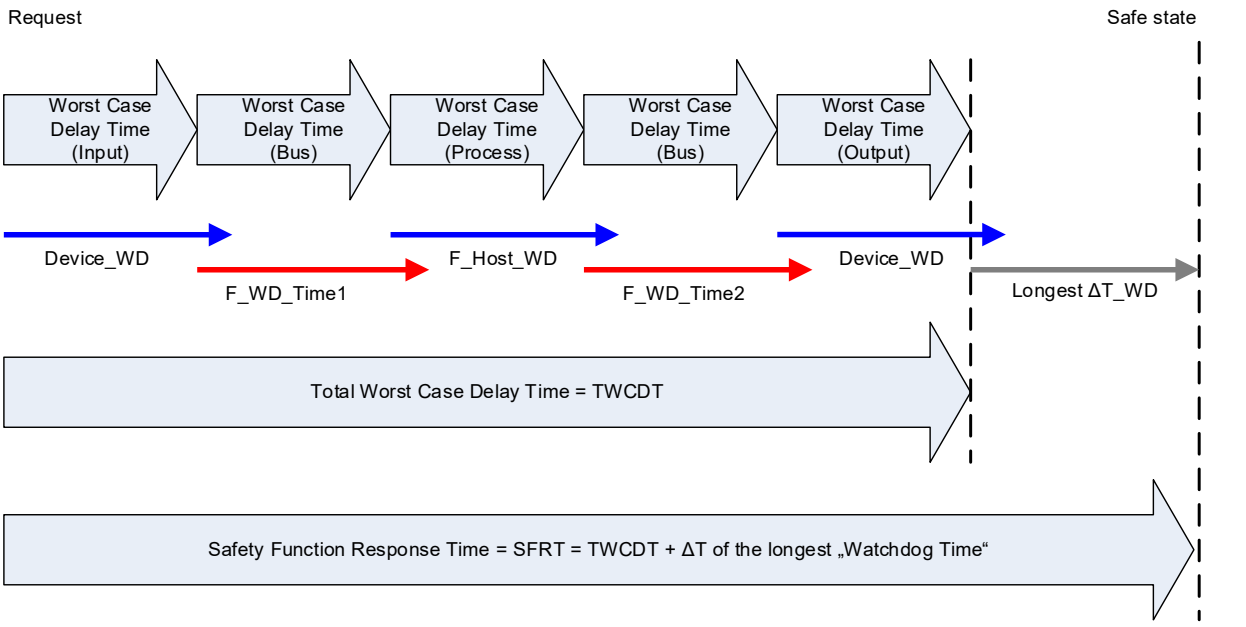
The safety field box (SFB-V2) has the following specifications:

Worst Case Delay Time SFB:	20 ms / 50 ms	(Delay time Input / Output)
Device Watchdog Time SFB:	10 ms	(Device_WD)

General information about the "Safety Function Response Time" (SFRT)

The "Safety Function Response Time" (SFRT) is the maximum time in which the safety system responds to changes in input signals or to module errors.

In order to calculate the response time of a safety function, the overall system from the safety switching device to the actuator must always be considered.
(see also DIN EN IEC 61784-3-3)



3 Installation

3.1 Mounting

	**⚠ CAUTION** The field box must be installed in a way that only authorised specialist personnel can access it.

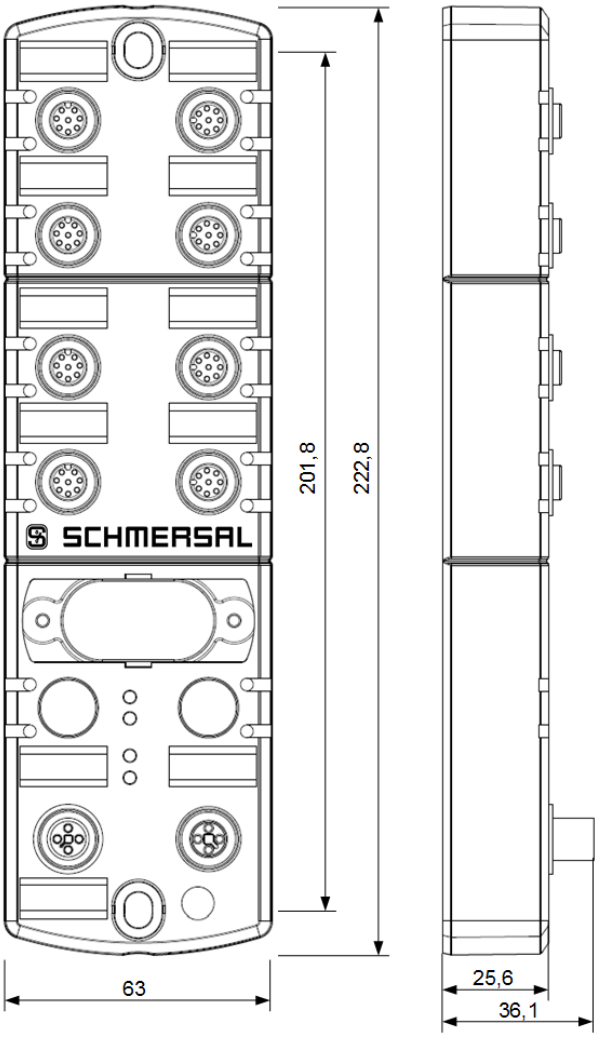
3.1.1 General mounting instructions

Fasten fieldbox with two M6-screws on a flat mounting surface, for mechanically strain-free installation. The maximum tightening torque is 3.0 Nm.
Any mounting position.

	**⚠ CAUTION** Do not install fieldbox outside closed rooms.

3.1.2 Dimensions

All measurements in mm.



3.1.3 Disassembly and disposal

Only disassemble the safety fieldbox if it is in de-energized state.

Dispose of the safety fieldbox properly in accordance with national regulations and laws.

3.1.4 Accessories

	INFORMATION
	Further accessories can be found under the search term "SFB-PN" in the Schmersal Online Catalogue at **products.schmersal.com**.

Pre-wired and connecting cables

	Description	Length [m]	Type designation	Part number
M12 Power cables, 4-poe, straight, T-coded	Pre-wired cable, female connector	5,0	**A-K4P-M12P-S-G-5M-BK-2-X-T-4**	**103013430**
		10,0	**A-K4P-M12P-S-G-10M-BK-2-X-T-4**	**103013431**
		20,0	**A-K4P-M12P-S-G-20M-BK-2-X-T-4**	**103038975**
		30,0	**A-K4P-M12P-S-G-30M-BK-2-X-T-4**	**103038976**
	Connecting cable, male / female	1,5	**V-SK4P-M12P-S-G-1,5M-BK-2-X-T-4**	**103025136**
		3,0	**V-SK4P-M12P-S-G-3M-BK-2-X-T-4**	**103013432**
		5,0	**V-SK4P-M12P-S-G-5M-BK-2-X-T-4**	**103013433**
		7,5	**V-SK4P-M12P-S-G-7,5M-BK-2-X-T-4**	**103013434**
		10,0	**V-SK4P-M12P-S-G-10M-BK-2-X-T-4**	**103038978**
M12 Ethernet cables, 4-pole, straight, D-coded, shielded	Connecting cable, RJ45 to M12	5,0	**AIE-S4P-M12/RJ45-S-G-5M-GN-2-X-D-1**	**103013435**
		7,5	**AIE-S4P-M12/RJ45-S-G-7,5M-GN-2-X-D-1**	**103013436**
		10,0	**AIE-S4P-M12/RJ45-S-G-10M-GN-2-X-D-1**	**103013437**
		20,0	**AIE-S4P-M12/RJ45-S-G-20M-GN-2-X-D-1**	**103038980**
	Connecting cable, male / male	1,5	**VIE-SS4P-M12-S-G-1,5M-GN-2-X-D-1**	**103038982**
		3,0	**VIE-SS4P-M12-S-G-3M-GN-2-X-D-1**	**103013438**
		5,0	**VIE-SS4P-M12-S-G-5M-GN-2-X-D-1**	**103013439**
		7,5	**VIE-SS4P-M12-S-G-7,5M-GN-2-X-D-1**	**103013440**
		10,0	**VIE-SS4P-M12-S-G-10M-GN-2-X-D-1**	**103038983**
M12 Device connection cables, 8-pole, straight, A-coded	Connecting cable, male / female	0,5	**V-SK8P-M12-S-G-0,5M-BK-2-X-A-4-69**	**101217786**
		1,0	**V-SK8P-M12-S-G-1M-BK-2-X-A-4-69**	**101217787**
		1,5	**V-SK8P-M12-S-G-1,5M-BK-2-X-A-4-69**	**101217788**
		2,5	**V-SK8P-M12-S-G-2,5M-BK-2-X-A-4-69**	**101217789**
		3,5	**V-SK8P-M12-S-G-3,5M-BK-2-X-A-4-69**	**103013428**
		5,0	**V-SK8P-M12-S-G-5M-BK-2-X-A-4-69**	**101217790**
		7,5	**V-SK8P-M12-S-G-7,5M-BK-2-X-A-4-69**	**103013429**
		10,0	**V-SK8P-M12-S-G-10M-BK-2-X-A-4-69**	**103013125**
		15,0	**V-SK8P-M12-S-G-15M-BK-2-X-A-4-69**	**103038984**
		20,0	**V-SK8P-M12-S-G-20M-BK-2-X-A-4-69**	**103038566**
		30,0	**V-SK8P-M12-S-G-30M-BK-2-X-A-4-69**	**103038567**

Adapter cables

	Description	Length [m]	Type designation	Part number
Adapter connecting cables, 8-pole M12 to 4-pole M12, Sensors with OSSD.	Connecting cable, male / female	2,5	**VFB-SK8P/4P-M12-S-G-2,5M-BK-2-X-A-4**	**103032864**
		5,0	**VFB-SK8P/4P-M12-S-G-5M-BK-2-X-A-4**	**103032865**
Y-Adapter cables for Schmersal AOPD, SLC/G-440, SLC/G-440-COM and SLB-440.	Y-Adapter cable, male / female	1,0	**SFB-Y-SLCG-8P-S-G-1M-BK-2-X-A-4**	**103032867**
		1,0	**SFB-Y-SLCG-COM-8P-S-G-1M- BK-2-X-A-4**	**103032866**

Further accessories

	Description	Amount	Type description	Part number
Further accessories	Labels for PFB/SFB	20 pcs.	**ACC-PFB-SFB-LAB-SN-20PCS-V2**	**103035090**
	M12 Protective caps for PFB/SFB	10 pcs.	**ACC-PFB-SFB-M12-PCAP-10PCS**	**103013920**
	Adhesive seal for PFB/SFB	4 pcs.	**ACC-PFB-SFB-SLLAB-4PCS**	**103013919**

3.2 Electrical connection

3.2.1 General information for electrical connection

⚠ CAUTION

The electrical connection may only be carried out by authorised personnel in a de-energised condition.

To supply the safety fieldbox, M12 power connectors, cables with a cross-section of max. 1.5 mm² can be connected to the fieldbox.

⚠ WARNING

In case of a fault, a voltage of up to 60 V can be applied to the device ports.

3.2.2 Notes for replacing the device

To replace a defective SFB, follow the steps below:

- Bring the machine and the SFB into a de-energised state
- Check replacement device for correct version

⚠ WARNING

This product must only be replaced in the application by an identical product of type SFB-PN-IRT-8M12-IOP-**V2** with part no. 103040357.
The older product version has a lower safety level.

INFORMATION

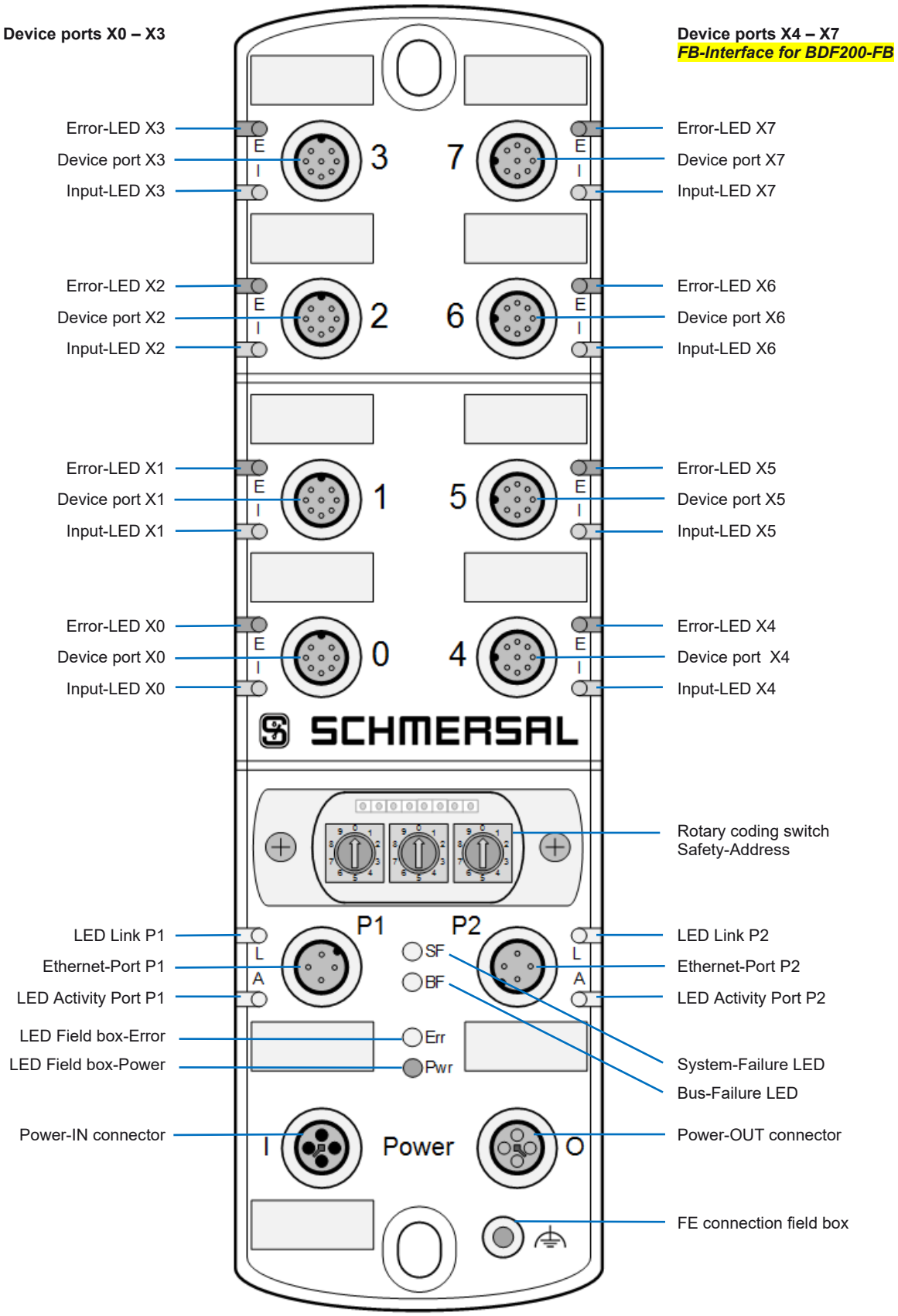
The replacement of the older SFB-PN-IRT-8M12-IOP with the newer SFB-PN-IRT-8M12-IOP-**V2** is possible.

- The replacement device must be in the delivery state.
  If necessary, carry out a "factory reset" (see also point 4.3.4 / page 48)
- Set or transfer the safety address to the new device
- Mount and install the unit
- Put the system and SFB back into operation
- Check all safety functions

INFORMATION

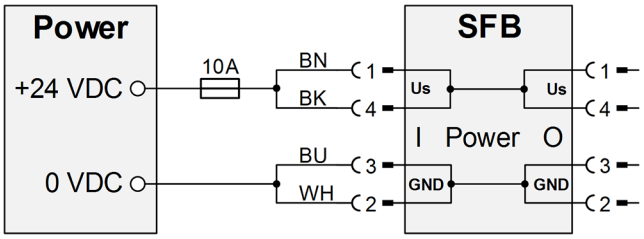
The simple device change is only possible if the "Support device replacement without exchangeable medium" has been activated in the F-CPU for the PROFINET interface under "General / Advanced options / Interface options".

3.2.3 Overview of connections and LED indicators



3.2.4 Power supply and fuse protection

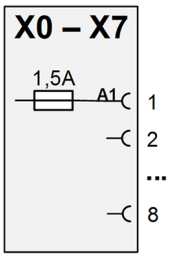
The supply voltage of the safety fieldbox is to be protected with a fuse of 10 A.
In order to increase the cable cross section for the supply voltage of the fieldbox, both connections from Us and GND must be connected in parallel. Pins 1 + 4 and 2 + 3 in the fieldbox are bridged.



Internal fuse elements device ports

The device ports X0 - X7 are designed for 0.8 A continuous current and equipped in each case with an auto-resettable fuse of 1.5 A for line protection. If the fuse element is triggered, the red LED on the device port flashes with 4 pulses.

After eliminating the overload at one of the device ports, the fuse resets itself after a short cool-down phase.



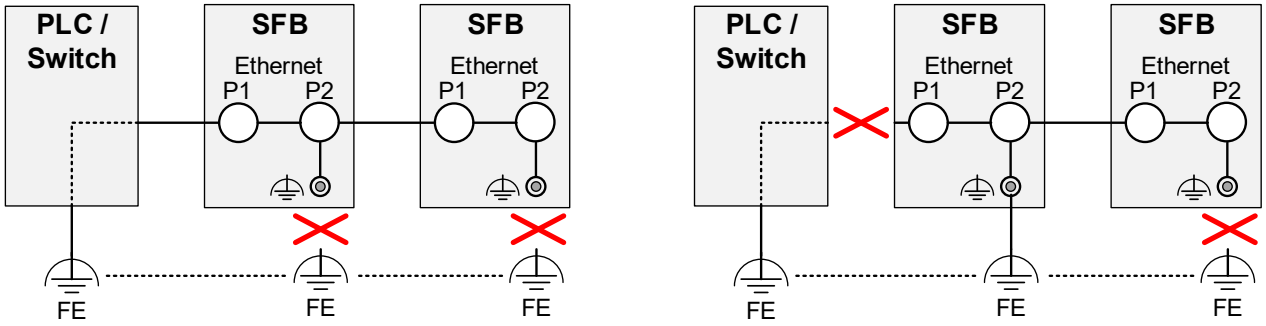
3.2.5 Earth concept and shielding

A functional earth is connected for fault-free operation of the safety fieldbox.
Earth loops must be avoided when connecting the functional earth.

The FE functional earth is normally connected via the switch. In the event of EMC problems, the fieldbox can be earthed via the separate FE connection.

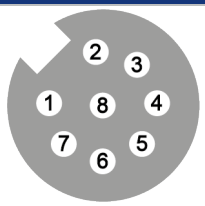
An earth strap is available as an accessory.

Wiring examples for avoidance of earth loops:



3.2.6 Connector device ports X0 – X7

Version: M12 socket, 8-pin, A-coded

Pin assignment	Pin	Colour	Signal	Description of fieldbox signals
	1	WH	A1	+24 VDC device supply, internal fused, max. 0.8 A
	2	BN	Y1	Test pulse output 1, supply safety channel 1
	3	GN	A2	0 VDC device supply
	4	YE	X1	Safety input 1
	5	GY	DI	Diagnostic input / FB-Interface
	6	PK	Y2	Test pulse output 2, supply safety channel 2
	7	BU	X2	Safety input 2
	8	RD	DO	Safety output, max. 0.8 A

⚠ CAUTION

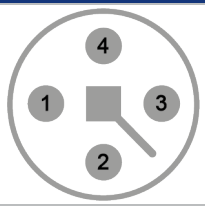
The pulse output / safety output Y1 can be loaded with a maximum of 15 mA at 24 VDC. The pulse output / safety output Y2 can be loaded with a maximum of 10 mA at 24 VDC and of 30 mA at 0 VDC.

⚠ WARNING

In case of a fault, a voltage of up to 60 V can be applied to the device ports.

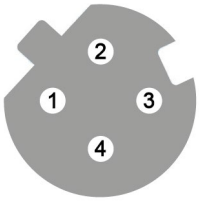
3.2.7 Connector Power I/O

Version: M12-Power connector / socket, 4-pin, T-coded

Pin assignment	Pin	Colour	Signal	Description of fieldbox signals
	1	BN	Us	+24 VDC power supply SFB (bridged with Pin 4)
	2	WH	GND	0 VDC power supply SFB (bridged with Pin 3)
	3	BU	GND	0 VDC power supply SFB (bridged with Pin 2)
	4	BK	Us	+24 VDC power supply SFB (bridged with Pin 1)

3.2.8 Connector PROFINET P1/P2

Version: M12 socket, 4-pin, D-coded

Pin assignment	Pin	Colour	Signal	Description of fieldbox signals
	1	YE	TD+	Transmit-Data +
	2	WH	RD+	Receive-Data +
	3	OG	TD-	Transmit-Data -
	4	BU	RD-	Receive Data -
	Flange		FE	Ethernet shielding

Colour code of the SCHMERSAL M12 cables, acc. DIN 47100

M12, 4-pin			M12, 8-pin					
Pin	Wire colour		Pin	Wire colour		Pin	Wire colour	
1	BN	Brown	1	WH	White	5	GY	Grey
2	WH	White	2	BN	Brown	6	PK	Pink
3	BU	Blue	3	GN	Green	7	BU	Blue
4	BK	Black	4	YE	Yellow	8	RD	Red

3.3 LED diagnostic indicators

3.3.1 LED indicators, device ports X0 – X7

There are 2 LED indicators on each device port.

A green/red error LED and a yellow input LED to display the switching condition at the safety inputs.

Error LED device ports (E)

The error LED may exhibit the following display and flashing pattern:

LED	Display	Description
	Green, ON	No fault at device port
	Green, flashes	Device port fault can be acknowledged *Send acknowledgement pulse or power reset*
	Red, flashes 1 pulses	Cross-fault safety inputs *Check cord set and device*
	Red, flashes 2 pulses	Fault safety inputs *No test pulses, check cord set and device*
	Red, flashes 3 pulses	Fault test pulse outputs *Check cord set and device*
	Red, flashes 4 pulses	Overload device power supply *Fuse device power supply has tripped, check cord set and device*
	Red, flashes 5 pulses	Overload digital output *Current limiter activated, check cord set and device*
	Red, flashes 6 pulses	Cross-fault digital output *Check cord set and device*
	Red, flashes 7 pulses	Fault FB-Interface (only device port 4-7) *Check cord set and device*

	INFORMATION
	Some errors can no longer be detected after passivation of the device port. The red flashing patterns for these errors are displayed at the affected port for approx. 60 seconds.

Input-LED device ports (I)

The input LED may exhibit the following display and flashing pattern:

LED	Display	Description
	Yellow, OFF	Both safety inputs LOW
	Yellow, ON	Both safety inputs HIGH
	Yellow, flashes	Only one safety input HIGH, or discrepancy / stable time error

3.3.2 LED indicators, PROFINET ports P1/P2

There are 2 LED indicators at the Ethernet ports.

A green link LED and yellow activity LED.

Link LED (L)

The link LED may exhibit the following display and flashing pattern:

LED	Display	Description
	Green, ON	Connection to Ethernet active

Activity LED (A)

The activity LED may exhibit the following display and flashing pattern:

LED	Display	Description
	Yellow, flashes	Ethernet data transmission active

3.3.3 Central LED indicators of SFB-PN

There are 4 LEDs for central diagnostics of the fieldbox:

- (SF) = green / red dual LED for System Failure
- (BF) = red LED for Bus Failure
- (Err) = green / red dual LED for fieldbox errors
- (Pow) = green LED for power supply

System Failure LED (SF)

The system failure LED may exhibit the following display and flashing pattern:

LED	Display	Description
	Red, ON	System failure SFB-PN *A module error or a device port error was detected*
	Green, flashes	BLINK signal for identifying the fieldbox *Can be activated via web server of SFB-PN*

Bus Failure LED (BF)

The bus failure LED may exhibit the following display and flashing pattern:

LED	Display	Description
	Red, ON	No or slow connection to Ethernet *Check Ethernet connection*
	Red, flashes	Connection to Ethernet but no PROFINET data transmission *Check connection settings in the PLC*

Error-LED fieldbox (Err)

The Error LED may exhibit the following display and flashing pattern:

LED	Display	Description
	Green, ON	Fieldbox in RUN
	Green, flashes	Module fault can be acknowledged *Acknowledge via PLC or by power reset*
	Red, ON	Internal fieldbox fault *Try power reset / module defective*
	Red, flashing **3 Hz**	F_WD_Time SFB-PN exceeded *Check configured cycle time of the F-Runtime Group and selected F_WD_Time of the F-CPU*
	Red, flashes 1 pulses	Internal over temperature fault *Check ambient temperature*
	Red, flashes 2 pulses	Invalid F address fault *Change F address*
	Red, flashes 3 pulses	Invalid F_iPar_CRC fault *Check configuration*
	Red, flashes 4 pulses	Fault acknowledgement pulse length *Check 500 ms pulse time for acknowledgement*
	Red, flashes 5 pulses	Fault overload test pulse outputs *Check cord set and device*
	Red, flashes 6 pulses	Over voltage fieldbox U > 29 V *Check power supply*

	INFORMATION
	The module only starts correctly if the polling cycle of the PLC safety program is significantly shorter than the F_WD_Time. (e.g. polling cycle 20 ms, F_WD_Time ≥ 80 ms)

Power-LED fieldbox (Pwr)

The power LED may exhibit the following display and flashing pattern:

LED	Display	Description
	Green, ON	Supply voltage of fieldbox OKAY
	Green, flashes 1 Hz	Low voltage warning U < 20 V *Check power supply*
	Green, flashes 3 Hz	Low voltage fault U < 17 V *Check power supply*
	Green, OFF	Fieldbox switched off U < 12 V *Check power supply*

4 Set-up

4.1 Set-up and maintenance

4.1.1 Set-up

A check must be carried out to ensure that the projected safety function is effective.

⚠ WARNING

The safety functions, configuration of the safety fieldbox and correct installation must be checked by a responsible safety specialist/safety representative.

4.1.2 Maintenance

The safety fieldbox operates maintenance-free if installed and used properly.

4.2 SFB Configuration Tool

The SFB Configuration Tool is used to check the module parameters in the engineering tool for safe control (e.g. TIA Portal) for correctness.
This is a safety-related validation measure.
Without this check and the transfer of the checksum (F_iPar_CRC) from the SFB Configuration Tool to the F-PLC, the device will not operate.

4.2.1 Install the SFB Configuration Tool

Start the installation of the SFB Configuration Tool by executing the setup file.

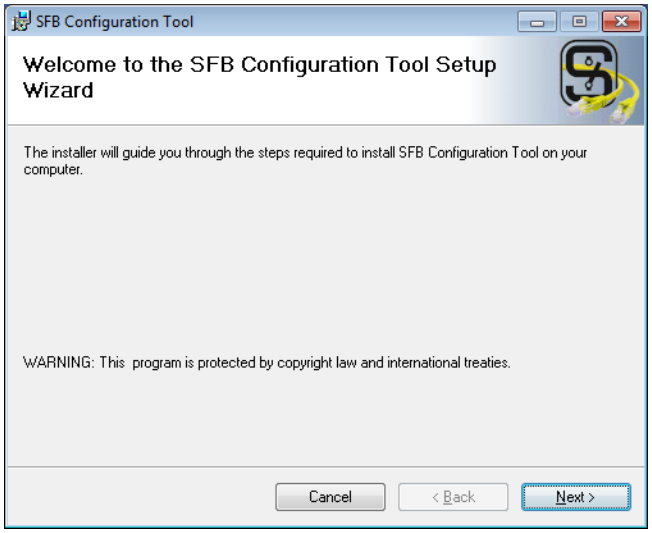
SFB Configuration Tool Setup VX_Y.exe

The latest version is available at www.products.schmersal.com .

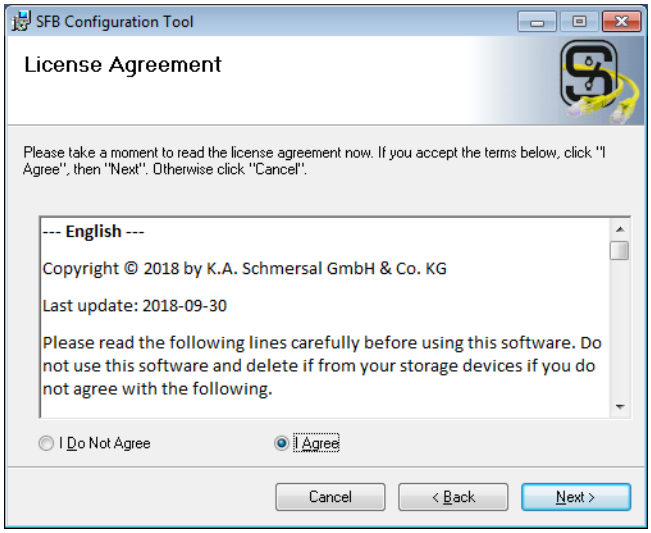
	INFORMATION
	You need administrator rights to install the SFB Configuration Tool. System requirements: Windows 7 / 10, Microsoft .NET Framework 4 or higher and WinPcap 4.1.3 or higher.

	INFORMATION
	Setup automatically asks you to install the required components if they are not installed on the used PC.

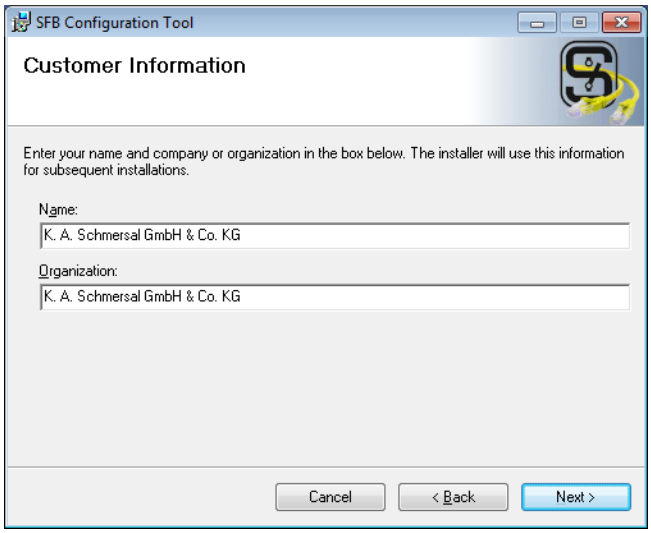
You will be guided through the English-language setup.



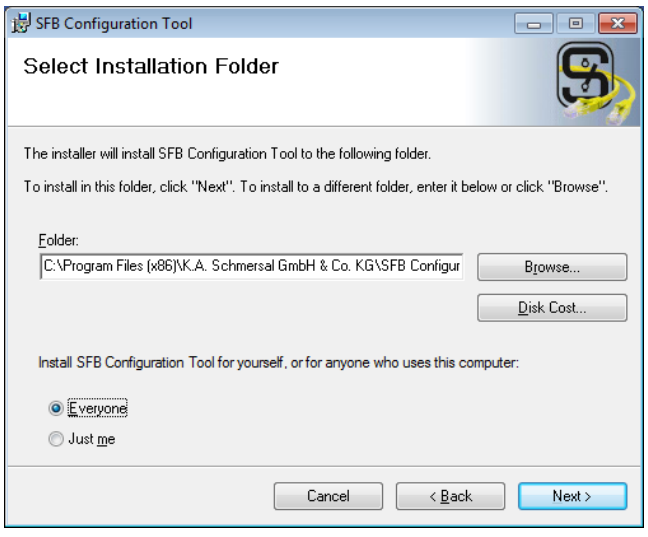
Accept the terms in the licence agreement.



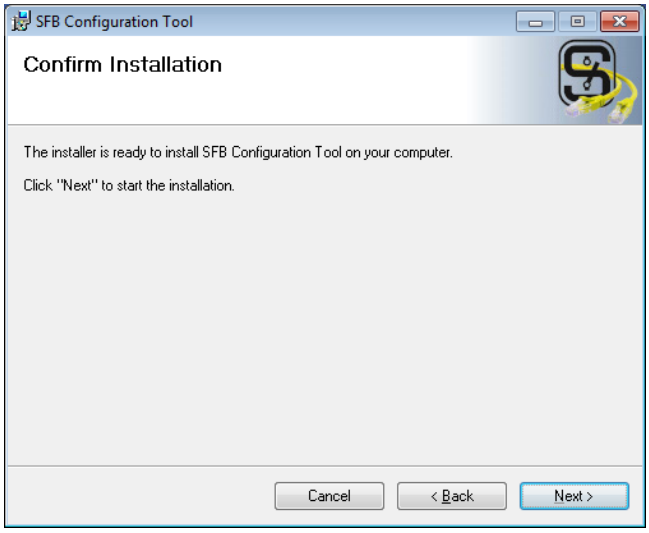
Introduce user name and organization.



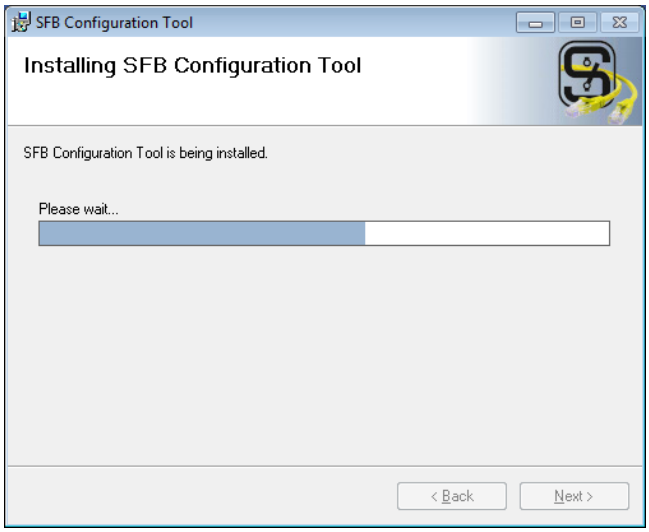
Select the destination folder.



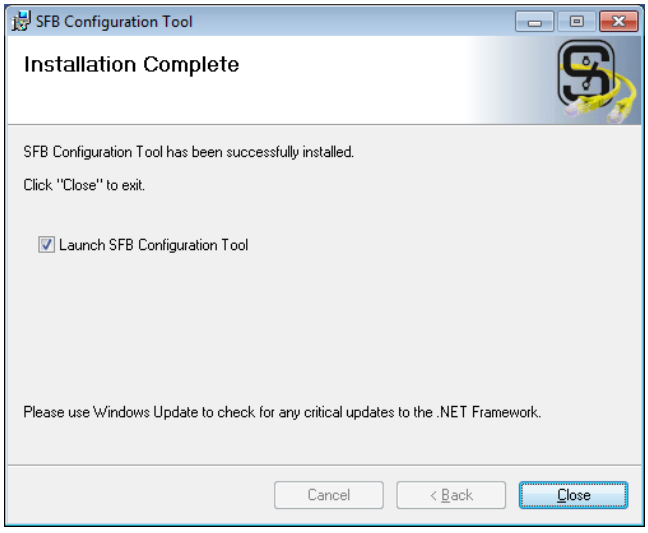
Confirm and start installation.



Wait until the installation process is ready.



Finish and close the installation.



4.2.2 General operation

The SFB Configuration Tool can be started in 2 ways.

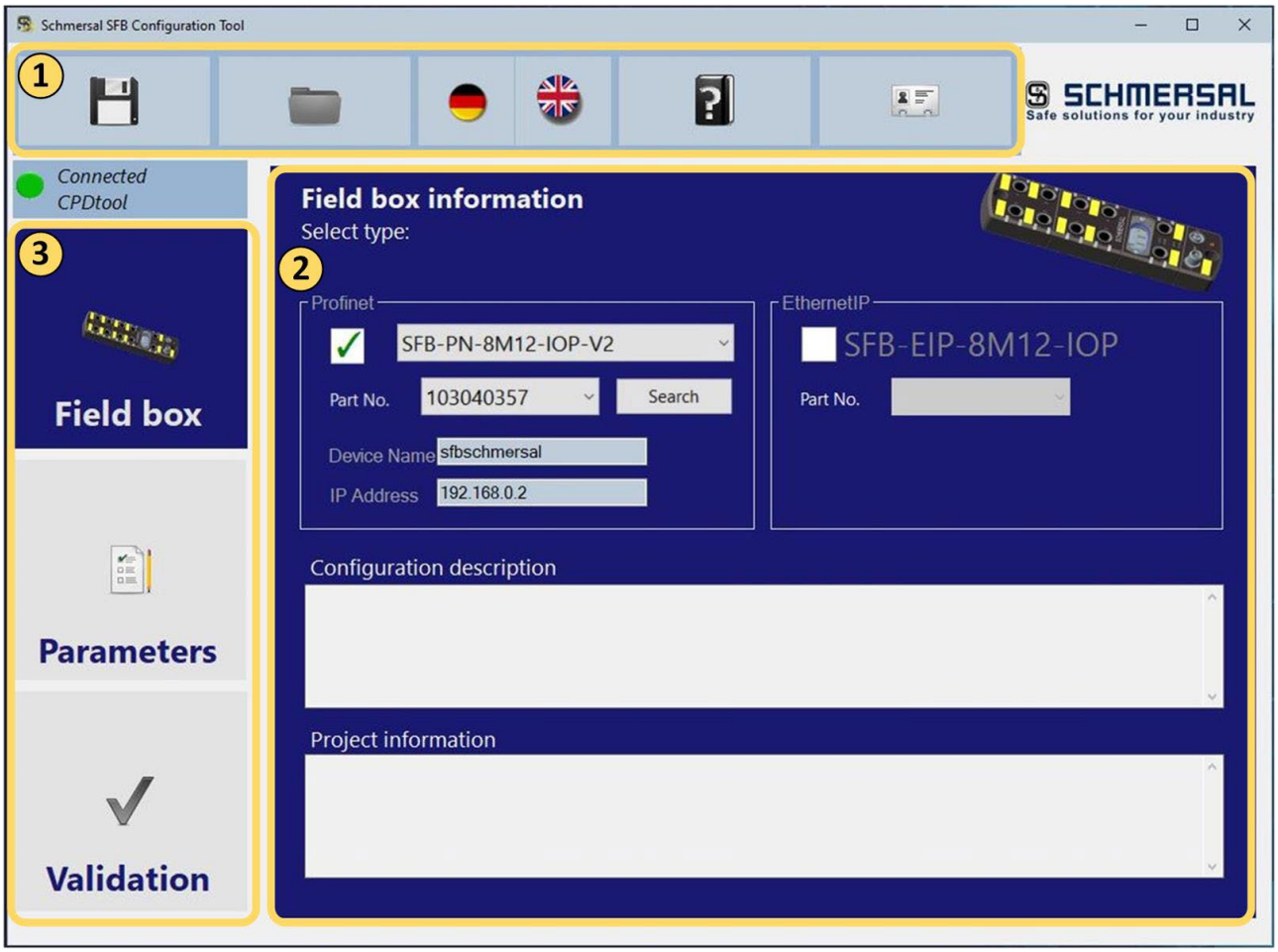
Normally the tool should be started via the TCI interface of the engineering software of the PLC (refer to Chapter 4.4.2).

Alternatively, it can also be started via the desktop under:

– „All Programs / Schmersal / SFB Safety Configuration Tool / SFB Configuration Tool“

Here you can also uninstall the tool.

The SFB Configuration Tool is bilingual DE / EN. The language can be selected in the tool. Detailed information can be found in the "Help" of the tool.



Legend

1	Menu area	Save / Open / Language / Help / Info
2	Navigation area	Field box / Parameters / Validation
3	Working area	Input and display of data

	INFORMATION
	More information about using the tool can be found in the chapters: 4.4.2 Parameterization with TCI support in the TIA Portal 4.4.3 Parameterization without TCI support

4.3 PROFINET configuration

4.3.1 Project engineering

When projecting PROFINET devices, a device is mapped as a modular system with a header module and several data modules.

The safety fieldbox SFB-PN has the 3 data modules

- FS data
- Functional data
- Diagnosis and FB-Interface

The address assignment and the data areas of the 3 modules are described in Chapter 4.3.6.

The project engineering of the SFB-PN should be done in the following steps

- Install GSDML file of SFB-PN
- Add the SFB-PN module to the hardware configuration
- Configuring SFB-PN in the PROFINET network (IP address & PROFINET name)
- Set the F address (PROFIsafe address) on the field box by using the rotary coding switches and configure it in the configuration software
- Configure safety parameters in the F-PLC
- Set F_WD_Time depending on the polling cycle of the safety program in the F-PLC.
- Execute safety validation with the SFB Configuration Tool
- Transfer F_iPar_CRC to the F-PLC
- Implementing a program for the acknowledgement of module faults and device port faults
- Download configuration from the engineering software to the F-PLC

	INFORMATION
	The PROFIsafe sub-module of the SFB-PN-V2 uses **address type 1**: **F_DestAdd is checked only** The destination address (F_DestAdd) must be unique network-wide.

4.3.2 Install GSDML file

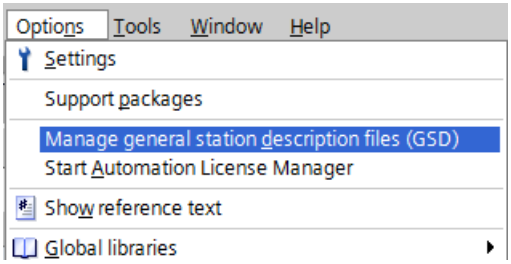
The device data required for project planning is saved in GSDML files (Generic Station Description Markup Language).

You will find the bilingual GSDML file for the SFB-PN-V2:

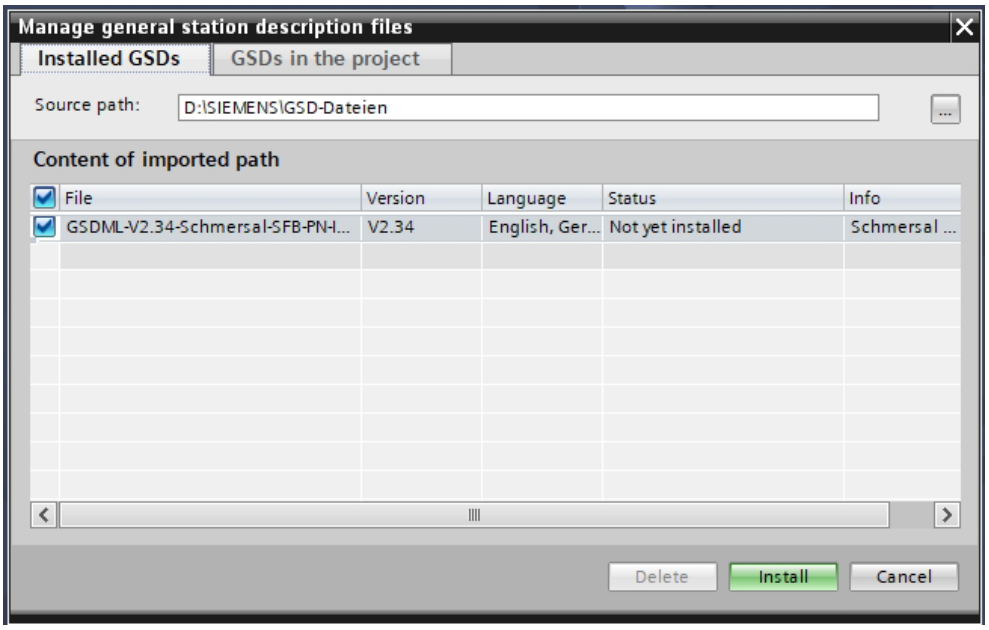
- Online at www.products.schmersal.com / search keyword "SFB"
- Downloadable from device via the web server info page (refer to Chapter 6)

The import procedure for the GSDML files is described in your engineering software manual.

Installation of GSDML



Select source path and GSDML file to install



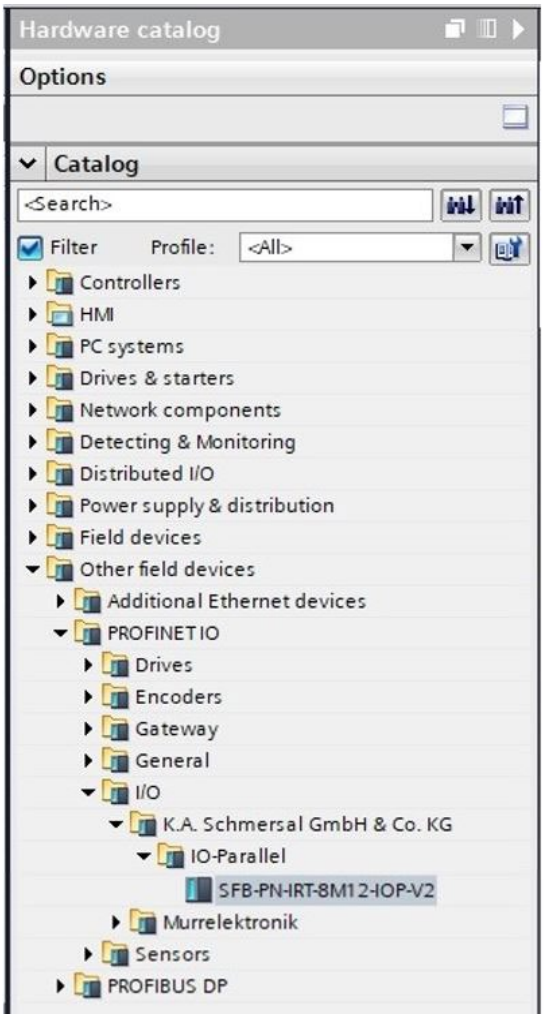
	INFORMATION
	The image file " GSDML-024B-044C.bmp " of the SFB-PN must be saved together with the GSDML file in one directory.

When using the Siemens TIA portal, you will find then the module SFB-PN-IRT-8M12-IOP-V2 in the hardware catalogue.

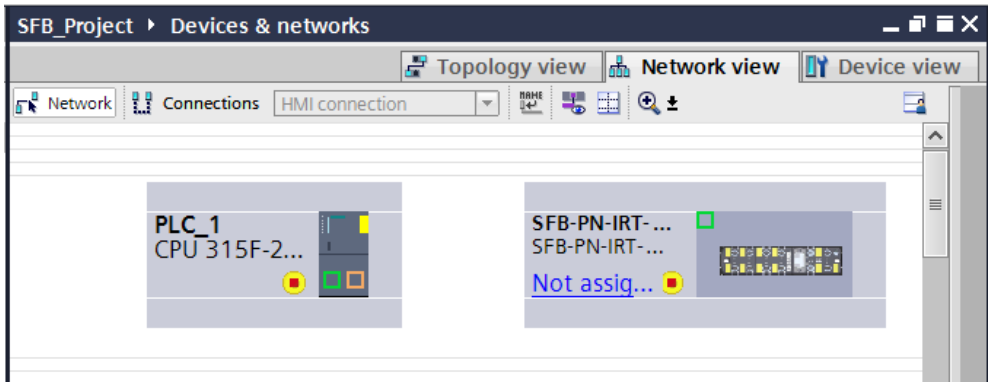
4.3.3 Add module to hardware configuration

The SFB-PN-V2 can be found in the hardware catalogue:

→ Other field devices → PROFINET IO → I/O → K.A. Schmersal GmbH & Co. KG → IO-Parallel → SFB-PN-IRT-8M12-IOP-V2



With "Drag & Drop" you can insert the SFB-PN in the window "Devices & networks".



Now the SFB-PN have to be connected to the F-PLC.

The SFB-PN should then be configured in the PROFINET network and the PROFINET device name be assigned.

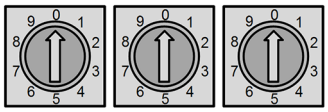
4.3.4 Setting the F-address and factory reset

The 3 rotary coding switches behind the viewing window can be used to set the safety address and to carry out a factory reset of the SFB.

Carefully remove the viewing window. (Screws Torx 10)

	**⚠ CAUTION** **The screws in the viewing window are not locked!** Keep the screws safe so that they do not get lost.
	**⚠ CAUTION** When you open the inspection window, ensure that no moisture or excessive humidity penetrates into the fieldbox.
	**⚠ CAUTION** **Electrostatically sensitive components!** Do not touch the printed circuit board directly.

x 100 x 10 x 1



F address

0 0 1 … 9 9 9 Valid F address

0 0 0 Factory reset

Setting of the F address

- Remove power from the SFB
- Set F address in the range 1 - 999
- Supply with voltage again

Carrying out an SFB factory reset

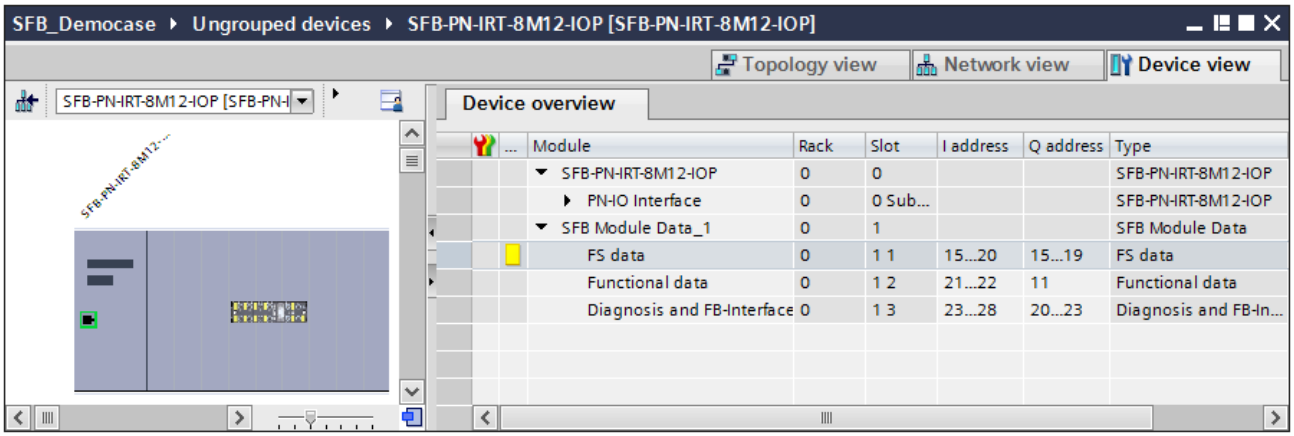
- Remove power from the SFB
- Setting of F address 0 – 0 – 0
- Supply with voltage again
- After 1 minute, switch off the power of the SFB-PN again

The IP address and the PROFINET name are deleted during a factory reset.

4.3.5 PROFIsafe configuration

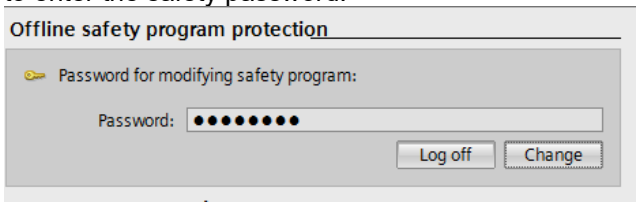
After the safe field box has been connected in the PROFINET network, the PROFIsafe configuration follows.
To do this, the PROFIsafe parameters have to be set in the engineering software.

Select the FS data submodule in the device overview.

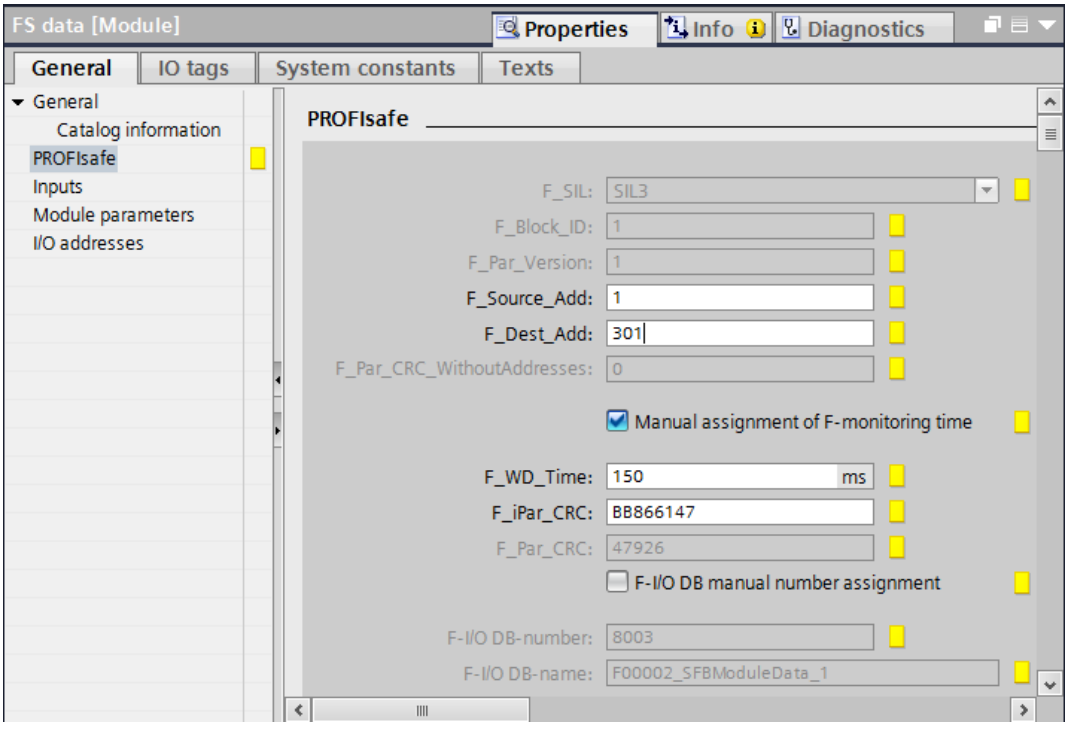


INFORMATION

For some changes of the F parameters it is necessary to enter the safety password.

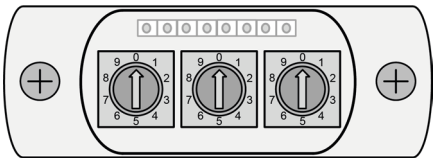


The F address (F_Dest_Add) and the F monitoring time (F_WD_Time) are configured under Properties / General / PROFIsafe.



Enter the F address of the F-PLC under F_Source_Add.

Under F_Dest_Add enter the F address of the SFB-PN set at the 3 rotary coding switches.



INFORMATION

If the F_Dest_Add is not identical to the F address set in the SFB-PN, a System Failure SF is generated.

Enter the required F monitoring time under F_WD_Time.

The F_WD_Time parameter defines the monitoring time for the PROFIsafe communication between the F control system and the SFB-PN.

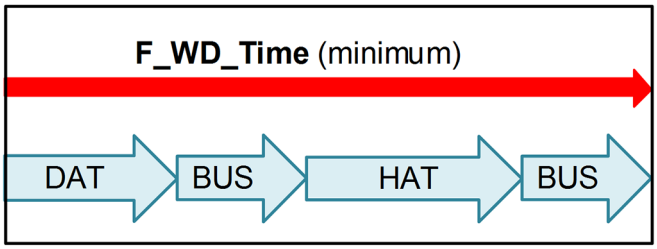
The module returns to the safe state if no valid F telegram is received within the F_WD_Time. This ensures that communication problems or failures transfer the F-PLC or the F device to a safe state.

INFORMATION

Set the F_WD_Time to a value, which allows toleration of communication delays. In the event of erros, however, the response time should not be too high.

The minimum F watch dog time F_WD_Time, can be calculated as follows:

Acknowledgement time SFB-PN-V2 (DAT):		≤ 25 ms
Cycle time F runtime group F-PLC (HAT):	+	___ ms
Double cycle time PROFINET (BUS):	+	___ ms
Minimum F_WD_Time:	=	___ ms



Definitions of terms from the DIN EN IEC 61784-3-3

DAT Maximum acknowledgement time of the F module (Device Acknowledgement Time)

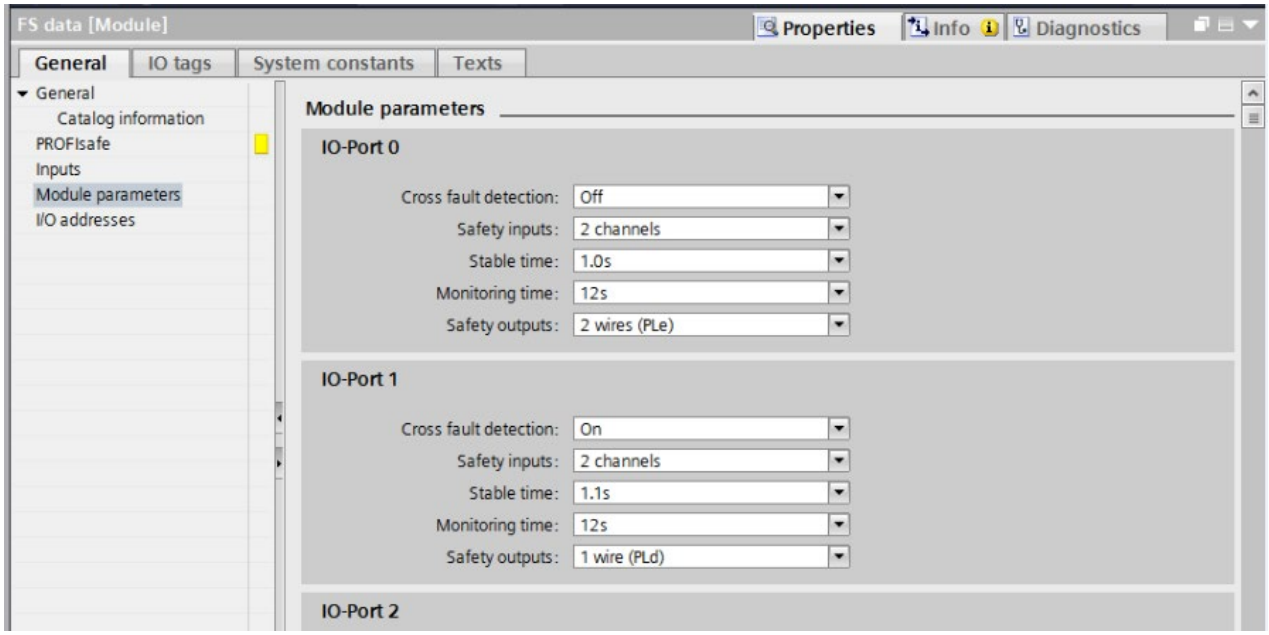
HAT Configured cycle time of F runtime group (Host Acknowledgement Time)

BUS Configured PROFINET Bus cycle time multiplied by factor 2

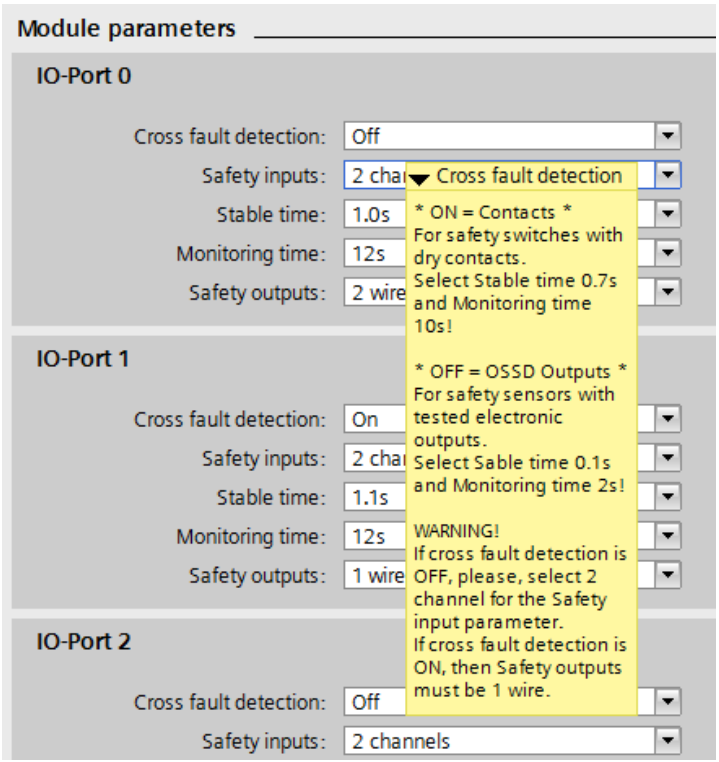
INFORMATION

The module only starts correctly if the polling cycle of the PLC safety program is significantly shorter than the F_WD_Time.
(e.g. polling cycle 20 ms, F_WD_Time ≥ 80 ms)

The F parameters for the individual device ports are configured under Properties / General / Module parameters.



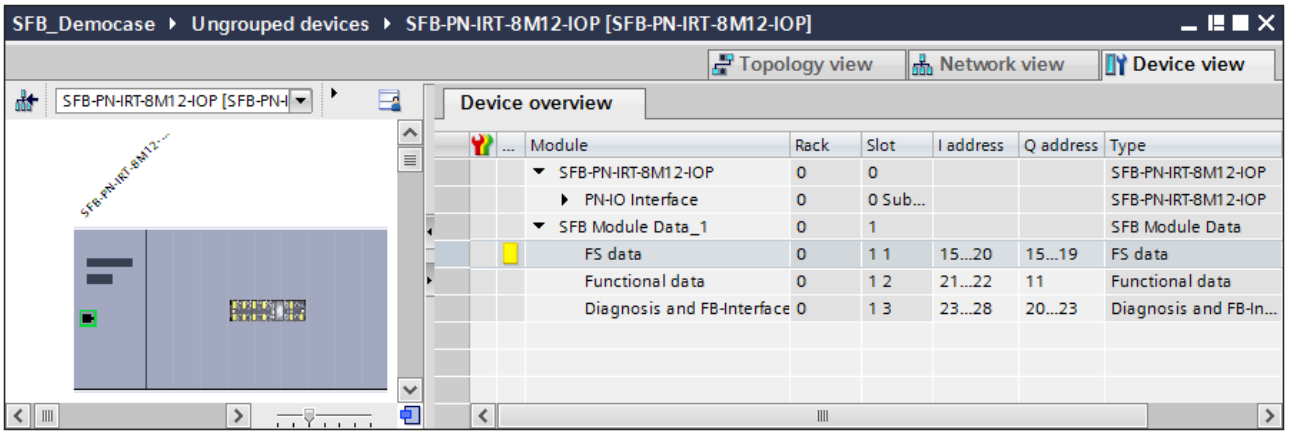
	INFORMATION
	If you move the mouse over the individual parameters or fields, you get a context help with an explanation of the parameters.



4.3.6 Address assignment and data areas

The address assignment and the data areas of the individual modules of the SFB-PN can be found in the device overview.

Module: SFB Module Data_1
Submodule: FS data / Functional data / Diagnosis and FB-Interface



The bit assignments of the data bytes of the individual submodules are described below.

Submodule: FS data, Input data (SFB => PLC)

Slot	I-Address	SFB Data Byte	Bit	Signal
1	6 Byte (n+0 … n+5)	Module: SFB Module Data_1 Submodule: FS data		
1 1	n+0	Safety Input X1/X2 2-channel device Safety Inputs X1 AND X2 1-channel device Safety Input X1	0 1 2 3 4 5 6 7	Device port X0 Device port X1 Device port X2 Device port X3 Device port X4 Device port X5 Device port X6 Device port X7
1 1	n+1	Safety Input X2 2-channel device --- 1-channel device Safety Input X2	0 1 2 3 4 5 6 7	Device port X0 Device port X1 Device port X2 Device port X3 Device port X4 Device port X5 Device port X6 Device port X7
1 1	n+2 … n+5	Safety-Header		Internal FS data

n = base address

	INFORMATION
	If **one** 2-channel device is connected, only **1** safety bit is transmitted in PROFINET at the I-Address n+0 If **two** 1-channel devices are connected, **2** safety bits are transmitted separately for each device at I-Addresses n+0 and n+1.

Submodule: FS data, Output data (PLC => SFB)

Slot	O-Address	SFB Data Byte	Bit	Signal
1	5 Byte (n+0 … n+4)	Module: SFB Module Data_1 Submodule: FS data		
1 1	n+0	Safety Output Safety Outputs DO	0 1 2 3 4 5 6 7	Device port X0 Device port X1 Device port X2 Device port X3 Device port X4 Device port X5 Device port X6 Device port X7
1 1	n+1 … n+4	Safety-Header		Internal FS data

n = base address

Submodule: Functional data, Input data (SFB => PLC)

Slot	I-Address	SFB Data Byte	Bit	Signal
1	2 Byte (n+0 … n+1)	Module: SFB Module Data_1 Submodule: Functional data		
1 2	n+0	Qualifier-Bit Device port 0 = Device port passivated 1 = Device port active	0 1 2 3 4 5 6 7	Device port X0 Device port X1 Device port X2 Device port X3 Device port X4 Device port X5 Device port X6 Device port X7
1 2	n+1	Fault-Flags (Bit 0-2) 0 = Fault detected 1 = No fault present Request fault acknowledgement (Bit 7) 0 = no request 1 = Fault can be acknowledged	0 1 2 3 4 5 6 7	Fault-Flag Module Fault-Flag Device port Fault-Flag COM FB interface Diagnostic data valid --- --- --- Request acknowledgement

n = base address

Submodule: Functional data, Output data (PLC => SFB)

Slot	O-Address	SFB Data Byte	Bit	Signal
1	1 Byte (n+0)	Module: SFB Module Data_1 Submodule: Functional data		
1 2	n+0	Acknowledge fault / Bit 0 High Pulse 500 ms = Acknowledge fault	0 1-7	Acknowledge fault ---

Submodule: Diagnosis and FB-Interface, Input data (SFB => PLC)

Slot	I-Address	SFB Data Byte	Bit	Signal
1	6 Byte (n+0 … n+5)	Module: SFB Module Data_1 Submodule: Diagnosis and FB-Interface		
1 3	n+0	Diagnose Selector 0 = IO-Device diagnosis 1 = FB-Interface device diagnosis Device port X0 – X3 **only IO** Device port X4 – X7 **IO or FB**	0 1 2 3 4 5 6 7	Device diagnosis X0 Device diagnosis X1 Device diagnosis X2 Device diagnosis X3 Device diagnosis X4 Device diagnosis X5 Device diagnosis X6 Device diagnosis X7
1 3	n+1	Diagnosis signals IO-Devices only 0 = Device diagnosis Bit is LOW 1 = Device diagnosis Bit is HIGH	0 1 2 3 4 5 6 7	Device diagnosis X0 Device diagnosis X1 Device diagnosis X2 Device diagnosis X3 Device diagnosis X4 Device diagnosis X5 Device diagnosis X6 Device diagnosis X7
1 3	n+2	FB-I Response data from device at X4 0/1 = FB-I response bits BDF200 *FB-I response data, see also operating instructions BDF200-SD/FB*	0 1 2 3 4 5 6 7	E-STOP **not** actuated NO contact Pos. 2 NC contact Pos. 2 NO contact Pos. 3 NC contact Pos. 3 NO contact Pos. 4 Fault warning FB device Fault at FB device
1 3	n+3	FB-I Response data from device at X5 0/1 = FB-I response bits BDF200 *FB-I response data, see also operating instructions BDF200-SD/FB*	0 1 2 3 4 5 6 7	E-STOP **not** actuated NO contact Pos. 2 NC contact Pos. 2 NO contact Pos. 3 NC contact Pos. 3 NO contact Pos. 4 Fault warning FB device Fault at FB device
1 3	n+4	FB-I Response data from device at X6 0/1 = FB-I response bits BDF200 *FB-I response data, see also operating instructions BDF200-SD/FB*	0 1 2 3 4 5 6 7	E-STOP **not** actuated NO contact Pos. 2 NC contact Pos. 2 NO contact Pos. 3 NC contact Pos. 3 NO contact Pos. 4 Fault warning FB device Fault at FB device
1 3	n+5	FB-I Response data from device at X7 0/1 = FB-I response bits BDF200 *FB-I response data, see also operating instructions BDF200-SD/FB*	0 1 2 3 4 5 6 7	E-STOP **not** actuated NO contact Pos. 2 NC contact Pos. 2 NO contact Pos. 3 NC contact Pos. 3 NO contact Pos. 4 Fault warning FB device Fault at FB device

n = base address / FB-Interface = Field-Box-Interface

Submodule: Diagnosis and FB-Interface, Output data (PLC => SFB)

Slot	O-Address	SFB Data Byte	Bit	Signal
1	4 Byte (n+0 … n+3)	Module: SFB Module Data_1 Submodule: Diagnosis and FB-Interface		
1 3	n+0	FB-I Request data for device at X4 0/1 = FB-I request bits BDF200 *FB-I request data, see also operating instructions BDF200-SD/FB*	0 1 2 3 4 5 6 7	--- LED G24 Signal lamp red LED G24 Signal lamp green LED in push button Pos. 2 LED in push button Pos. 3 LED in push button Pos. 4 --- Acknowledge device fault
1 3	n+1	FB-I Request data for device at X5 0/1 = FB-I request bits BDF200 *FB-I request data, see also operating instructions BDF200-SD/FB*	0 1 2 3 4 5 6 7	--- LED G24 Signal lamp red LED G24 Signal lamp green LED in push button Pos. 2 LED in push button Pos. 3 LED in push button Pos. 4 --- Acknowledge device fault
1 3	n+2	FB-I Request data for device at X6 0/1 = FB-I request bits BDF200 *FB-I request data, see also operating instructions BDF200-SD/FB*	0 1 2 3 4 5 6 7	--- LED G24 Signal lamp red LED G24 Signal lamp green LED in push button Pos. 2 LED in push button Pos. 3 LED in push button Pos. 4 --- Acknowledge device fault
1 3	n+3	FB-I Request data for device at X7 0/1 = FB-I request bits BDF200 *FB-I request data, see also operating instructions BDF200-SD/FB*	0 1 2 3 4 5 6 7	--- LED G24 Signal lamp red LED G24 Signal lamp green LED in push button Pos. 2 LED in push button Pos. 3 LED in push button Pos. 4 --- Acknowledge device fault

n = base address / FB-Interface = Field-Box-Interface

4.4 Configuration and parameterization of the SFB-PN-V2

4.4.1 Engineering software of the F-PLC

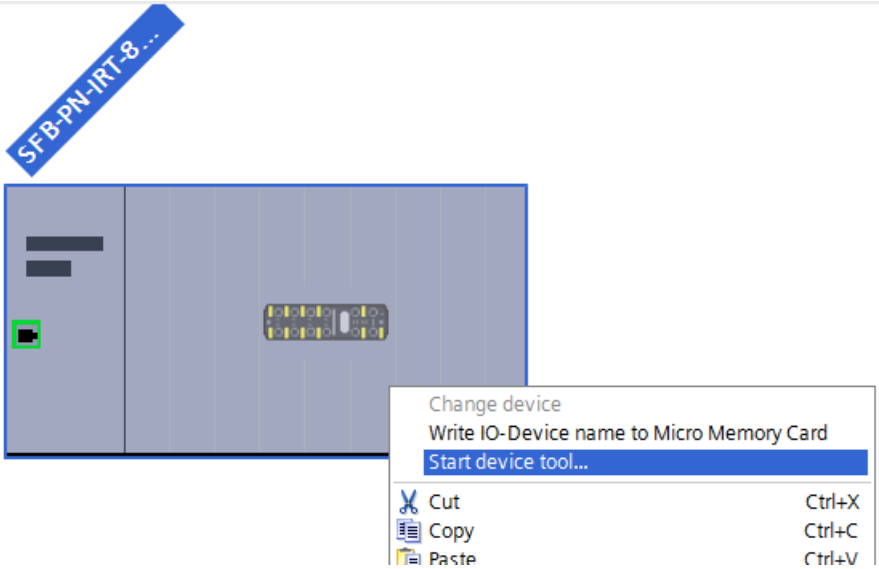
After the F-parameters for the safe field box SFB-PN-V2 and the individual device ports have been configured (refer to chapter 4.3.5), the safety parameters are validated via the SFB Configuration Tool.

If the engineering software supports TCI, the settings are transferred to the SFB-PN by TCI. (refer to chapter 4.4.2)

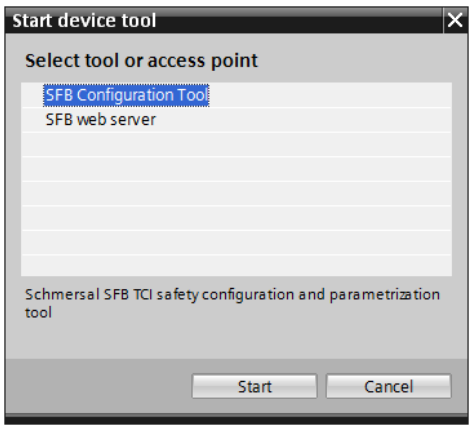
If TCI is not supported, the settings must be set manually in the SFB Configuration Tool. (refer to chapter 4.4.3)

4.4.2 Parameterization with TCI support in the TIA Portal

Open the dialog box for starting the Device Tool by right-clicking on the SFB-PN image in the Device overview.

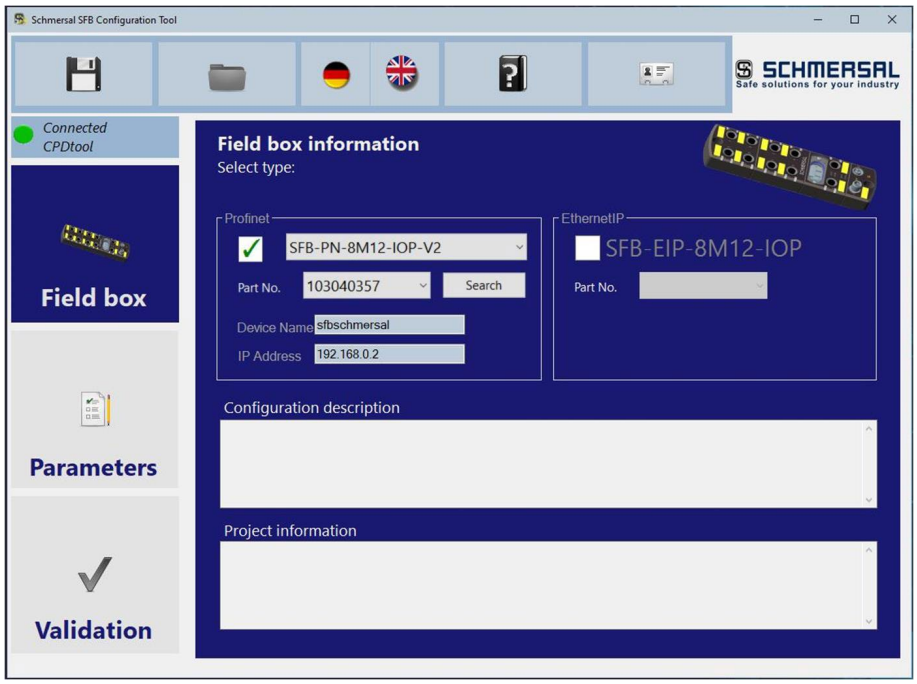


Select the SFB Configuration Tool and start it via the “Start” button.



With TCI support, the default parameter settings are transferred to the SFB Configuration Tool when it is started.
The SFB Configuration Tool displays all the settings and requests you to check and confirm the displayed parameters.

The SFB Configuration Tool automatically detects the part number of the connected field box when starting with TCI support.



In addition, project planning data can also be entered here.
When saving the configuration, these data are stored in addition to the parameters in the project file.

The corresponding network parameters can be opened and edited via "Search".

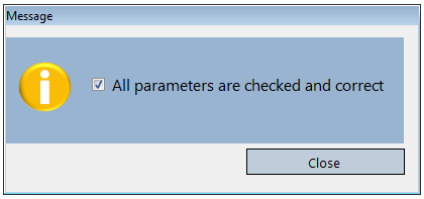
If you now select "Validation", the device parameters transmitted by the F-PLC can be checked and confirmed.

The safety-related validation of the set device port parameters is made in the following steps:

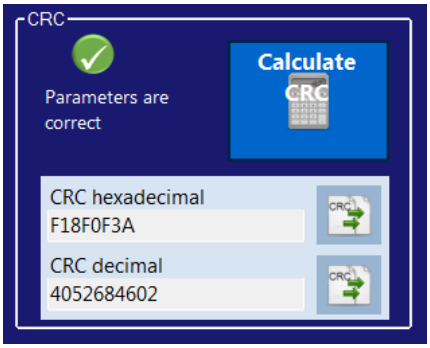
1. Validation of the parameters for each device port

With the checkbox (1.) you confirm that the parameters for each device port X0 - X7 have been checked.

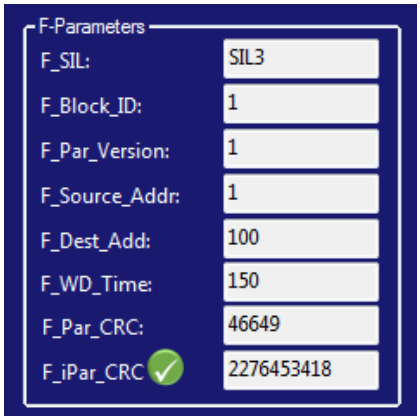
Then click on "Calculate CRC" (2.) and confirm that all parameters have been checked.



2. Calculate the F_iPar_CRC

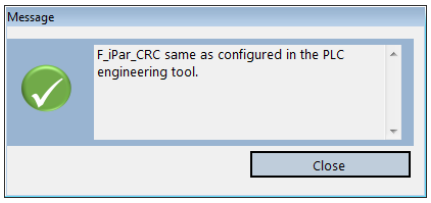


The hexadecimal CRC value can be copied via  to the clipboard to be used in the engineering tool.



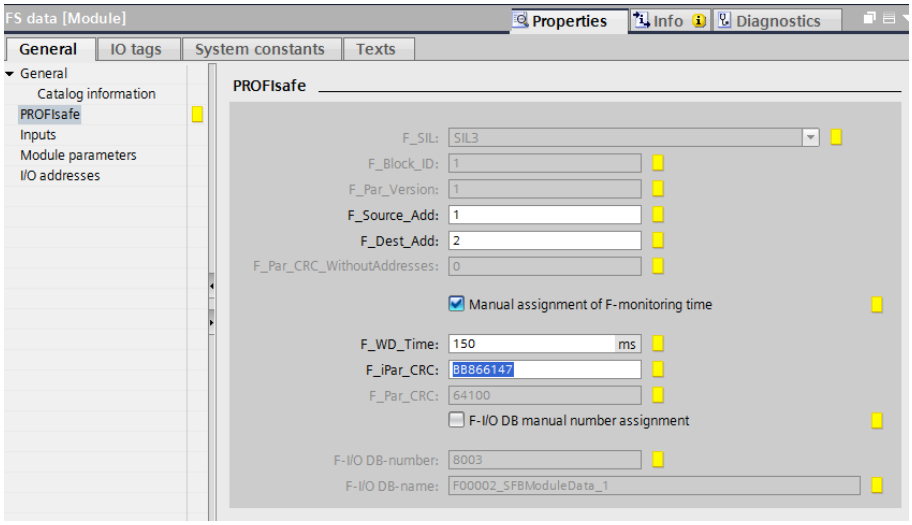
The SFB Configuration Tool compares the calculated CRC values and the values transmitted by the F-PLC.

If the CRC values match, you see the message:



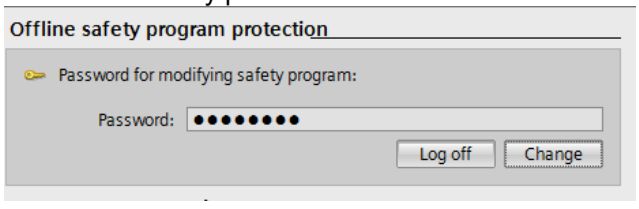
3. Transfer the F_iPar_CRC into the configuration of the F-PLC

Under Properties / General / PROFIsafe you can now insert the F_iPar_CRC from the clipboard in the engineering software.



INFORMATION

For some changes of the F parameters it is necessary to enter the safety password.

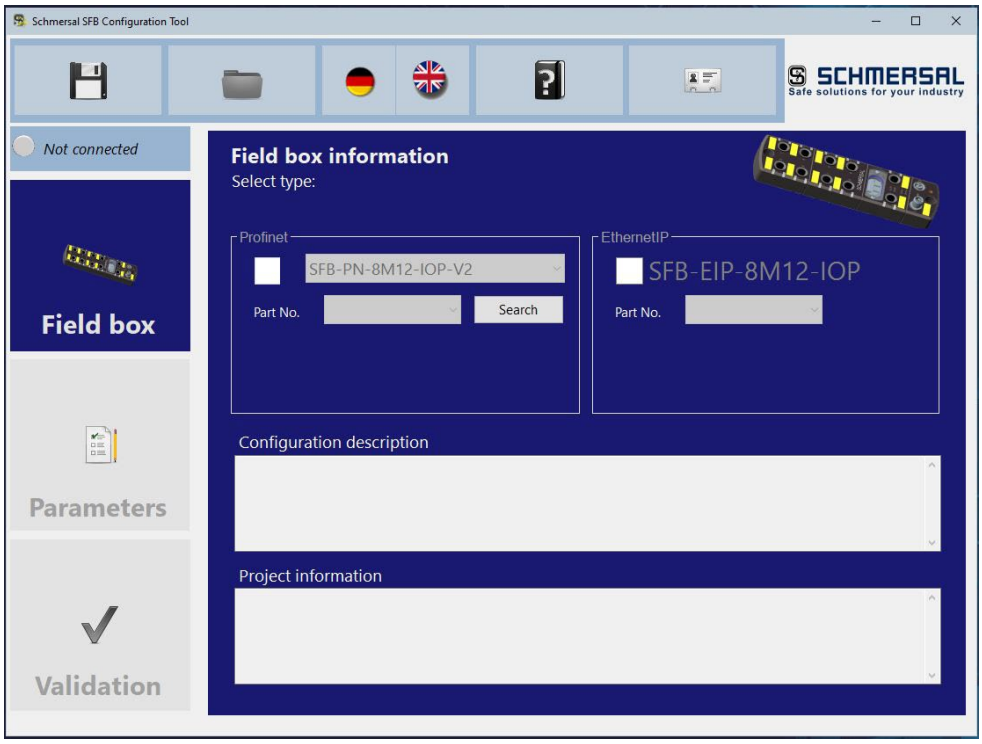


Then the changed configuration must be "Compile" and "Downloaded" to the PLC.

	INFORMATION
	Detailed information about the operation of the SFB Configuration Tool can be found in the help function.

4.4.3 Parameterization without TCI support

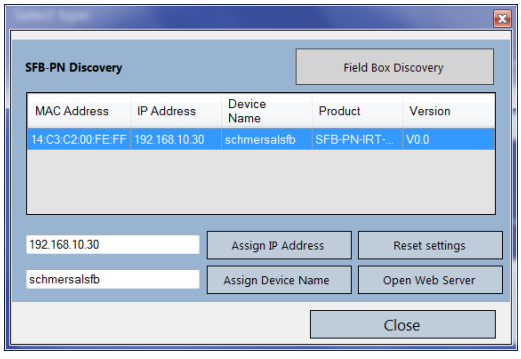
The SFB Configuration Tool starts without TCI support and displays the field box information.

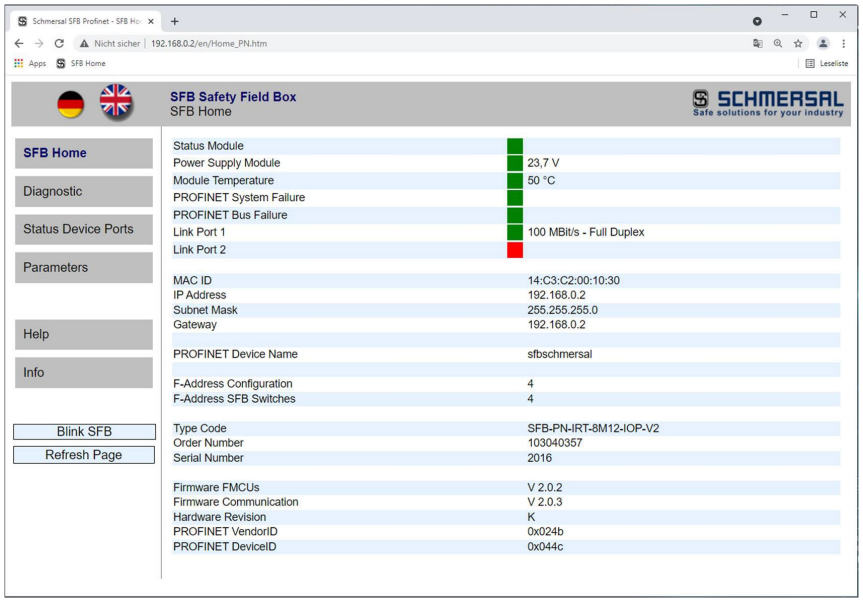


Select the field box variant SFB-PN-IRT-8M12-IOP-V2 with the checkbox.
The corresponding part number is displayed.

In addition, project planning data can also be entered here.
When saving the configuration, these data are stored in addition to the parameters in the project file.

With the "Search" button you can search and identify the SFB in the PROFINET network.
Click on "Field box Discovery" to search for the SFB.
If you click on the IP address, the SFB web server will open and the field box data will be displayed.





	INFORMATION
	The field box and the network adapter of the computer must be in the same network (IP area).

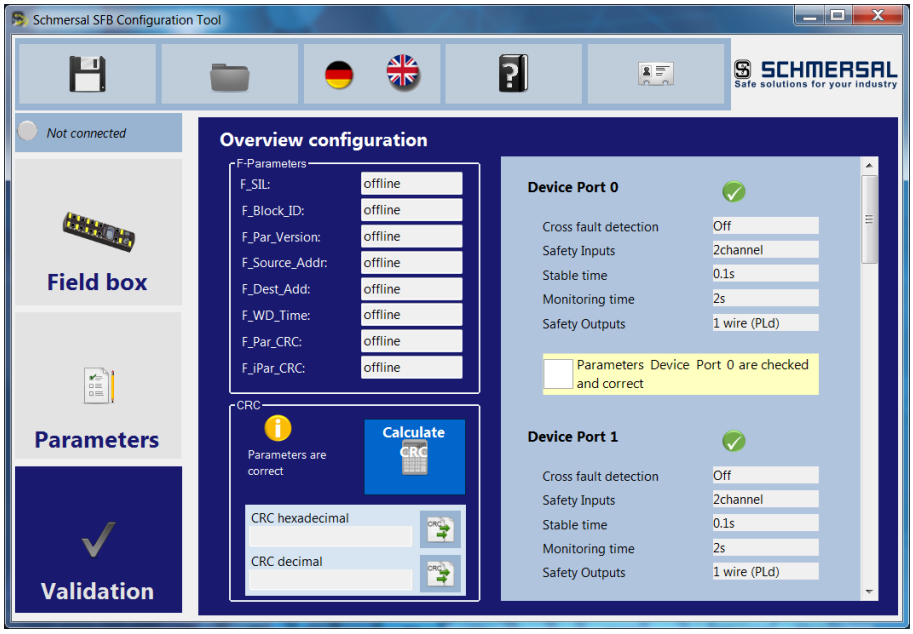
The safety-related validation of the set device port parameters is made in the following steps:

1. Manual input of parameters

Enter the device parameters for each device port and note the dependencies between the parameters. The optimal parameters for the different device types can be found in Chapter 2.3 „Wiring examples and parameterization“.

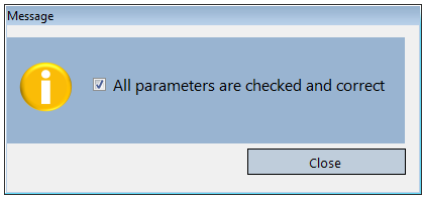
	INFORMATION
	If you move the mouse over the individual parameters or fields, you get a context help with an explanation of the parameters.

2. Validation of the parameters for each device port

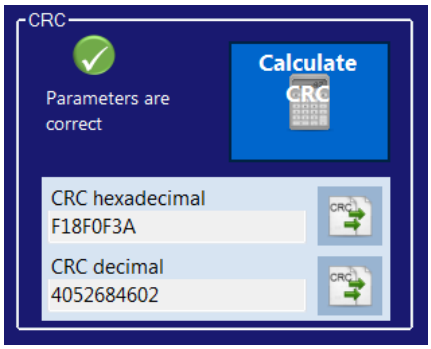


With the checkbox you confirm that the parameters for each device port X0 - X7 have been checked.

Then click on "Calculate CRC" and confirm that all parameters have been checked.



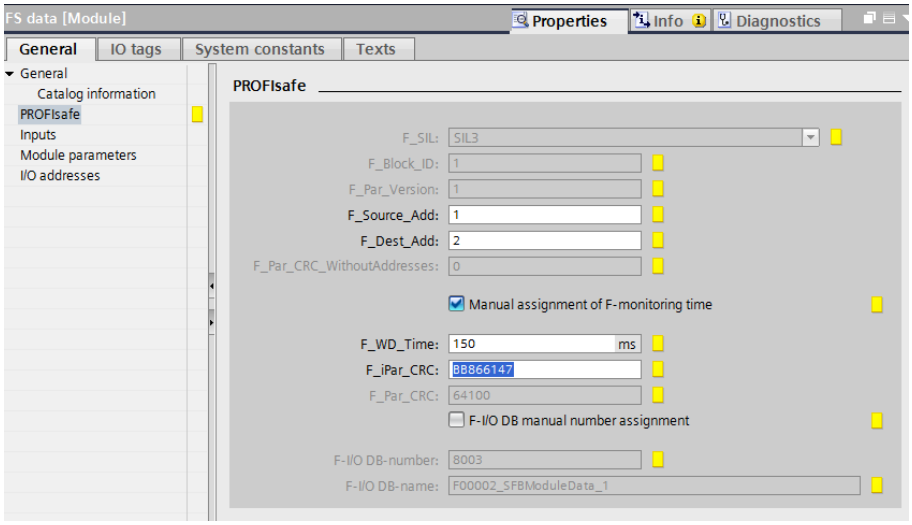
3. Calculate the F_iPar_CRC



The hexadecimal CRC value can be copied via  to the clipboard to be used in the engineering tool.

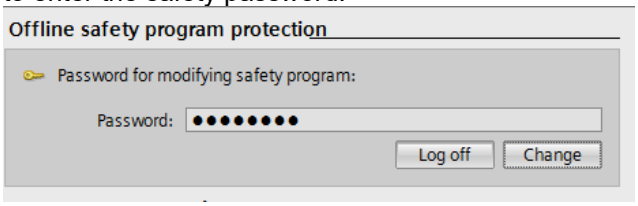
4. Transfer the F_iPar_CRC into the configuration of the F-PLC

Under Properties / General / PROFIsafe you can now insert the F_iPar_CRC from the clipboard in the engineering software.



INFORMATION

For some changes of the F parameters it is necessary to enter the safety password.



Then the changed configuration must be "Compile" and "Downloaded" to the PLC.

INFORMATION

Detailed information about the operation of the SFB Configuration Tool can be found in the help function.

5 Diagnostic system

5.1 PROFINET Diagnostics

The safety fieldbox SFB-PN can detect module faults and device port faults.

In case of module faults, the SFB-PN is completely passivated and acknowledgement is made by the PROFIsafe acknowledgement mechanism.

Module faults are for example, over temperature of the SFB-PN, under voltage or internal module faults.

In case of device port faults, only the affected device port X0 - X7 is passivated and the acknowledgement is made by the device port acknowledgement mechanism. Device port faults are for example, cross-faults on the device connection cables or faults in the connected safety switchgear.

The SFB-PN sends diagnostic alarms to the F-PLC for each detected fault. These are stored in the diagnostic buffer of the F-PLC and can be analysed and visualised.

	INFORMATION
	Further information can be found in the online help or in the system manual of your engineering software.

5.1.1 Diagnostic messages Module faults

Error No.	Error message	Help information / Note
	Module faults SFB	
0999	Internal fault	Try power reset / Module defect
1000	Fault: internal over temperature T > 85 °C	Check ambient temperature
1001	Fault: invalid F-Address	Change F-Address
1002	Fault: invalid F_iPar_CRC	Check configuration
1003	Fault: acknowledge pulse time	Check acknowledge pulse time (500 ms)
1004	Warning: under voltage U < 20,4 V	Check supply voltage
1005	Fault: under voltage U < 17 V	Check supply voltage
1006	Fault: overload pulse outputs Device-Port 0-7	Check load on Device-Ports
1007	Fault: overvoltage U > 29 V	Check supply voltage
1008	Warning: over temperature T > 80 °C	Check ambient temperature

5.1.2 Diagnostic messages Device-Port faults

Error No.	Error message	Help information / Note
	Status Device-Ports	**Fault at Device-Port**
1010	Device-Port X0 passivated	See previous message single error at X0
1011	Device-Port X1 passivated	See previous message single error at X1
1012	Device-Port X2 passivated	See previous message single error at X2
1013	Device-Port X3 passivated	See previous message single error at X3
1014	Device-Port X4 passivated	See previous message single error at X4
1015	Device-Port X5 passivated	See previous message single error at X5
1016	Device-Port X6 passivated	See previous message single error at X6
1017	Device-Port X7 passivated	See previous message single error at X7

INFORMATION

"Device port passivated" is reported if a previous fault had passivated the device port.

Error No.	Error message	Help information / Note
	Fault Safety-Inputs	**Cross-fault Safety-Inputs at Device-Port**
1020	Fault: safety inputs Device-Port X0	Cross-fault monitoring wrong parameterized or cross-fault safety inputs X0. Check parameter setting, cord set and device.
1021	Fault: safety inputs Device-Port X1	Cross-fault monitoring wrong parameterized or cross-fault safety inputs X1. Check parameter setting, cord set and device.
1022	Fault: safety inputs Device-Port X2	Cross-fault monitoring wrong parameterized or cross-fault safety inputs X2. Check parameter setting, cord set and device.
1023	Fault: safety inputs Device-Port X3	Cross-fault monitoring wrong parameterized or cross-fault safety inputs X3. Check parameter setting, cord set and device.
1024	Fault: safety inputs Device-Port X4	Cross-fault monitoring wrong parameterized or cross-fault safety inputs X4. Check parameter setting, cord set and device.
1025	Fault: safety inputs Device-Port X5	Cross-fault monitoring wrong parameterized or cross-fault safety inputs X5. Check parameter setting, cord set and device.
1026	Fault: safety inputs Device-Port X6	Cross-fault monitoring wrong parameterized or cross-fault safety inputs X6. Check parameter setting, cord set and device.
1027	Fault: safety inputs Device-Port X7	Cross-fault monitoring wrong parameterized or cross-fault safety inputs X7. Check parameter setting, cord set and device.

INFORMATION

"Fault safety inputs" is reported if either the cross-fault-monitoring was not activated when connecting contacts or a cross-fault is detected by a safety input X1 or X2 against +24 VDC, 0 VDC or between them.

INFORMATION

This fault can only be acknowledged after the safety guard has been opened one time without fault.

INFORMATION

The message "Fault safety inputs" is automatically reset when test pulses are detected on the safety inputs for 10 s after the safety guard is closed again.

Error No.	Error message	Help information / Note
	Fault Pulse-Outputs	**Cross-fault Pulse-Outputs at Device-Port**
1030	Fault: pulse outputs Device-Port X0	Cross-fault pulse outputs X0, check cord set and device.
1031	Fault: pulse outputs Device-Port X1	Cross-fault pulse outputs X1, check cord set and device.
1032	Fault: pulse outputs Device-Port X2	Cross-fault pulse outputs X2, check cord set and device.
1033	Fault: pulse outputs Device-Port X3	Cross-fault pulse outputs X3, check cord set and device.
1034	Fault: pulse outputs Device-Port X4	Cross-fault pulse outputs X4, check cord set and device.
1035	Fault: pulse outputs Device-Port X5	Cross-fault pulse outputs X5, check cord set and device.
1036	Fault: pulse outputs Device-Port X6	Cross-fault pulse outputs X6, check cord set and device.
1037	Fault: pulse outputs Device-Port X7	Cross-fault pulse outputs X7, check cord set and device.

	INFORMATION
	"Fault pulse outputs" is reported if there is a cross-fault between a pulse output Y1 or Y2 and +24 VDC, 0 VDC or between them. All pulse outputs are switched off if there is a cross-fault to 0 VDC.

	INFORMATION
	10 s after correcting the fault, the message "Fault outgoing" appears and the fault can be acknowledged.

Error No.	Error message	Help information / Note
	Overload fault Power-Supply	**Overload Power-Supply at Device-Port**
1040	Fault: overload power supply Device-Port X0	Fuse power supply X0, has tripped check cord set and device.
1041	Fault: overload power supply Device-Port X1	Fuse power supply X1, has tripped check cord set and device.
1042	Fault: overload power supply Device-Port X2	Fuse power supply X2, has tripped check cord set and device.
1043	Fault: overload power supply Device-Port X3	Fuse power supply X3, has tripped check cord set and device.
1044	Fault: overload power supply Device-Port X4	Fuse power supply X4, has tripped check cord set and device.
1045	Fault: overload power supply Device-Port X5	Fuse power supply X5, has tripped check cord set and device.
1046	Fault: overload power supply Device-Port X6	Fuse power supply X6, has tripped check cord set and device.
1047	Fault: overload power supply Device-Port X7	Fuse power supply X7, has tripped check cord set and device.

	INFORMATION
	"Overload power supply device port" is reported if the internal auto-resettable fuse has tripped.

Error No.	Error message	Help information / Note
	Overload fault Digital-Output	**Overload Digital-Output at Device-Port**
1050	Fault: overload digital output Device-Port X0	Current limiter digital output X0 activated, check cord set and device.
1051	Fault: overload digital output Device-Port X1	Current limiter digital output X1 activated, check cord set and device.
1052	Fault: overload digital output Device-Port X2	Current limiter digital output X2 activated, check cord set and device.
1053	Fault: overload digital output Device-Port X3	Current limiter digital output X3 activated, check cord set and device.
1054	Fault: overload digital output Device-Port X4	Current limiter digital output X4 activated, check cord set and device.
1055	Fault: overload digital output Device-Port X5	Current limiter digital output X5 activated, check cord set and device.
1056	Fault: overload digital output Device-Port X6	Current limiter digital output X6 activated, check cord set and device.
1057	Fault: overload digital output Device-Port X7	Current limiter digital output X7 activated, check cord set and device.

INFORMATION

"Overload digital output" is reported if the electronic current limitation of the digital output has tripped.

INFORMATION

If the device port is passivated, the error can no longer be detected and the message "Fault outgoing" appears“.

Error No.	Error message	Help information / Note
	Fault Digital-Output	**Cross-fault Digital-Output at Device-Port**
1060	Fault: digital output Device-Port X0	Cross-fault digital outputs X0, check cord set and device.
1061	Fault: digital output Device-Port X1	Cross-fault digital outputs X1, check cord set and device.
1062	Fault: digital output Device-Port X2	Cross-fault digital outputs X2, check cord set and device.
1063	Fault: digital output Device-Port X3	Cross-fault digital outputs X3, check cord set and device.
1064	Fault: digital output Device-Port X4	Cross-fault digital outputs X4, check cord set and device.
1065	Fault: digital output Device-Port X5	Cross-fault digital outputs X5, check cord set and device.
1066	Fault: digital output Device-Port X6	Cross-fault digital outputs X6, check cord set and device.
1067	Fault: digital output Device-Port X7	Cross-fault digital outputs X7, check cord set and device.

INFORMATION

"Fault digital output" is reported if there is a cross-fault from a digital output to +24 VDC, 0 VDC or an external potential.

INFORMATION

If there is a cross-fault between the digital output and +24V, the master switch is switched off internally and all digital outputs DO 0 - DO 7 are switched off.

INFORMATION

If the error message appears several times, there is a permanent short circuit.
If the device port is passivated, the error can no longer be detected and the message "Fault outgoing" appears.

Error No.	Error message	Help information / Note
	Discrepancy- / Stable time fault	**Discrepancy- / Stable time out**
1070	Discrepancy / stable time error Device-Port X0	Monitoring time at X0 exceeded, check safety guard.
1071	Discrepancy / stable time error Device-Port X1	Monitoring time at X1 exceeded, check safety guard.
1072	Discrepancy / stable time error Device-Port X2	Monitoring time at X2 exceeded, check safety guard.
1073	Discrepancy / stable time error Device-Port X3	Monitoring time at X3 exceeded, check safety guard.
1074	Discrepancy / stable time error Device-Port X4	Monitoring time at X4 exceeded, check safety guard.
1075	Discrepancy / stable time error Device-Port X5	Monitoring time at X5 exceeded, check safety guard.
1076	Discrepancy / stable time error Device-Port X6	Monitoring time at X6 exceeded, check safety guard.
1077	Discrepancy / stable time error Device-Port X7	Monitoring time at X7 exceeded, check safety guard.

INFORMATION

A "discrepancy / stability time error" is reported if there is either a temporary or permanent discrepancy (a difference) between the two input signals, or the input signals are not stable (refer to Chapter 2.2.3).
This error is also reported if the safeguard has not been closed correctly or if a temporary single-channel switch-off has occurred.

INFORMATION

Discrepancy errors can also be detected for electronic safety switchgear (= switched off cross-fault detection) if there is a short circuit to +24 VDC or 0 VDC at the safety inputs X1/X2 or the pulse outputs Y1/Y2.
Check device connection cables!

INFORMATION

This fault can only be acknowledged after the safety guard has been opened one time without fault.
For certain types of interlocks, it may be necessary to switch off the operating voltage of the interlock or of the SFB-PN one time in order to acknowledge the fault.

Error No.	Error message	Help information / Note
	Fault FB-Interface	**FB-Interface disturbed at Device-Port**
1084	Fault: FB-Interface Device-Port X4	No valid response from device at X4, check cord set and device.
1085	Fault: FB-Interface Device-Port X5	No valid response from device at X5, check cord set and device.
1086	Fault: FB-Interface Device-Port X6	No valid response from device at X6, check cord set and device.
1087	Fault: FB-Interface Device-Port X7	No valid response from device at X7, check cord set and device.

INFORMATION

"Fault FB-Interface" is reported as long as no communication with the FB-Interface device (BDF200-FB) is possible.

5.2 System behaviour in the event of an error

The SFB-PN-V2 only supports "module-granular passivation" with a "manual reintegration" of the F-Sub module, according to variant A of the specification "PROFIsafe V2.6MU1 in table C.7 under point C.1.4.2.

- Reintegration is only possible when the "Device_Fault" bit has changed from TRUE to FALSE.

	**⚠ WARNING**
	The user must specify depending on the necessary safety requirements whether an automatic restart of the safety function is permissible.
	**INFORMATION**
	Further information can be found in the online help or in the system manual of your engineering software.

5.2.1 Module error

If a module error is detected, the SFB-PN responds as follows:

- In PROFIsafe, the SFB-PN is passivated, all input and output data are set to "0".
- The RED SF-LED of the SFB-PN is switched on. (refer to Chapter 3.3.3)
- The SFB-PN sets the error flag "Module" as collective error message. (Bit 0, I-ADR n+1 in submodule „Functional data“, refer to Chapter 4.3.6)
- The SFB-PN sends diagnostic alarms with the error numbers to the F-PLC.
- The Err-LED of the SFB-PN displays a RED flashing code. (refer to Chapter 3.3.3)
- Normally the RED SF LED of the F-PLC is also switched on. This depends on the type of F-PLC used.

5.2.2 Device port error

If a device port error is detected, the SFB-PN responds as follows:

- The device port is passivated, all input and output data are set to "0".
- The RED SF-LED of the SFB-PN is switched on. (refer to Chapter 3.3.3)
- The SFB-PN sets the error flag "Device Port" as collective error message. (Bit 1, I-ADR n+1 in submodule „Functional data“, refer to Chapter 4.3.6)
- At FB-Interface communication errors the error flag "COM FB-Interface" is set. (Bit 2, I-ADR n+1 in submodule „Functional data“, refer to Chapter 4.3.6)
- The SFB-PN sends diagnostic alarms with the error numbers to the F-PLC.
- The error LED at the device port displays a RED flashing code. (refer to Chapter 3.3.1)
- The qualifier bit of the disturbed device port is reset to "0". A qualifier bit is available for each device port X0 - X7. "1" = device port active and "0" = device port passivated (Bit 0-7, I-ADR n+1 in submodule „Functional data“, refer to Chapter 4.3.6)

5.2.3 Errors in safety related communication to F-PLC

Errors in safety-related communication are detected by mechanisms defined in the PROFIsafe profile. The system reacts according to the responses defined in the PROFIsafe profile.

In the event of an error in the safety related communication, all input and output data of the SFB-PN are set to "0" and the module remains passivated until the error in the communication has been corrected.

After eliminating an error in the safety-related communication, the module must be reintegrated, as required by the PROFIsafe specification.

5.3 Acknowledgement corrected faults

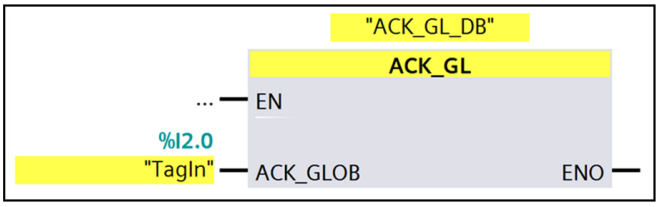
5.3.1 Acknowledgement module faults

To acknowledge module faults, the F function block "F_ACK_GL" [FB219] should be used for global acknowledgement of F_peripheral faults.

F_ACK_GL = Global acknowledgement of all F_peripheral faults of a F_runtime group

INFORMATION

If you use the ACK_GL command, it is not necessary to program an acknowledgement individually for each F_periphery of the F_runtime group by using the ACK_REI variable of the corresponding F_periphery DB.



Acknowledge with "F_ACK_GL"

Module fault outgoing / can be acknowledged:

- If there are no further module faults for the SB-PN:
- The Err-LED of the SFB-PN flashes GREEN as acknowledgement request. (refer to Chapter 3.3.3)
- Diagnostic alarm "Fault outgoing" is sent to the F-PLC.
- The acknowledgement request ACK_REQ is set internally in the F_periphery block.
  The signal ACK_REQ can be read from the F_Peripherie_DB.
- With the input ACK_GLOB at the FB F_ACK_GL the fault can be acknowledged and the SFB-PN is reintegrated.
- The RED SF-LED of the SFB-PN is switched off. (refer to Chapter 3.3.3)
- The Err-LED of the SFB-PN lights up GREEN = Module faultless / RUN. (refer to Chapter 3.3.1)
- If there are no further faults on the F-module, the F-PLC clears the RED SF-LED. This depends on the type of F-PLC used.

Separate acknowledgement of individual F_peripherals

Alternatively, a separate acknowledgement can be manually programmed for each F_periphery of the F_runtime group. The acknowledgement mechanism defined in the PROFIsafe profile is used for this.

- Acknowledgement request ACK_REQ (Acknowledge Request)
- Acknowledgement ACK_REI (Acknowledge Reintegration)

INFORMATION

Further information on acknowledgement via the PROFIsafe acknowledgement mechanism can be found in the online help or in the system manual of the engineering software.
Search for: ACK_GL, ACK_REQ, ACK_REI and ACK_NEC

5.3.2 Acknowledgement device port faults

The device port acknowledgement mechanism is used to acknowledge individual device port faults.

The real acknowledgement is done via an acknowledgement pulse of 500 ms (+/- 150 ms) which is sent from the F-PLC to the SFB-PN.

The pulse always globally acknowledges all outgoing device port faults!

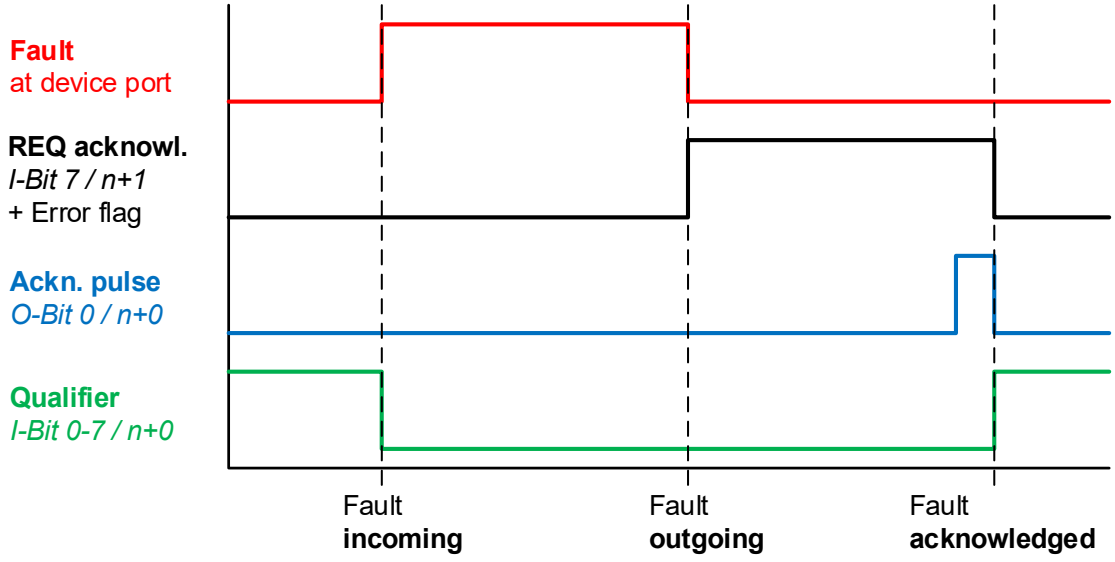
Faults that have not yet been outgoing are not acknowledged.

	INFORMATION
	For the acknowledgement of device port faults, the qualifier bits, the error flags, one bit for the request of the fault acknowledgement (fault outgoing) and one bit for the acknowledgement pulse are used. These bits are described in Chapter 4.3.6 in the submodule "Functional Data".

Acknowledgement with acknowledgement pulse

Device port fault outgoing / can be acknowledged:

- If there are no further faults for the device port:
- The error LED of the device port flashes GREEN as acknowledgement request. (refer to Chapter 3.3.1)
- Diagnostic alarm "Fault outgoing" is sent to the F-PLC.
- SFB-PN sets the " Fault acknowledgement request" to "1".
  (Bit 7, I-ADR n+1 in submodule „Functional data“, refer to Chapter 4.3.6)
  The acknowledgement request for a device port fault can be evaluated by the F-PLC.
- The error can then be acknowledged with an acknowledgement pulse of 500 ms (+/- 150 ms) and the device port is reactivated.
  (Bit 0, O-ADR n+1 in submodule „Functional data“, refer to Chapter 4.3.6)
- The qualifier bit of the device port is reset to "1".
  (Bit 0-7, I-ADR n+1 in submodule „Functional data“, refer to Chapter 4.3.6)
- The RED SF-LED of the SFB-PN is switched off. (refer to Chapter 3.3.3)
- The fault LED of the device port lights up GREEN = device port free of faults. (refer to Chapter 3.3.1)



6 Web Server

6.1 Description Web server

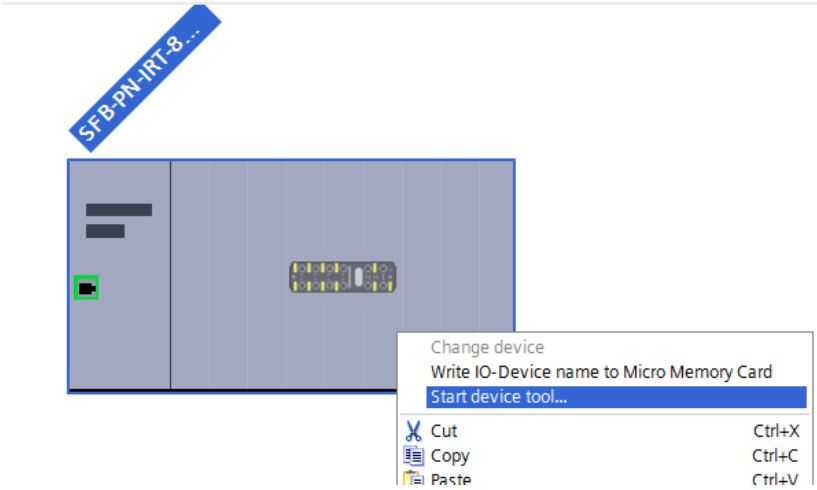
A web server for displaying status and diagnostic data is integrated in the SFB-PN.

From MS Edge V17, Internet Explorer V10, Mozilla Firefox V66 and Chrome V73, all browser versions are supported.
Java scripts must be enabled for correct display.

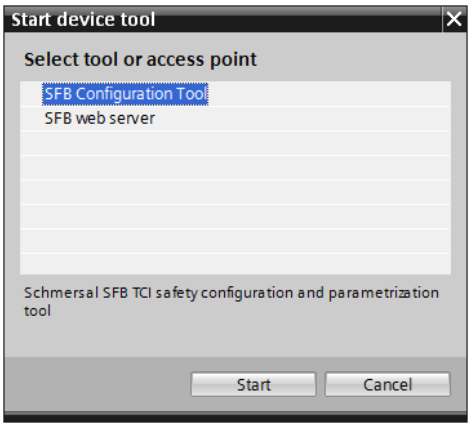
The web server can be started in three different ways.

1. Via the engineering software of the F-PLC (refer to Chapter 4.4.2)

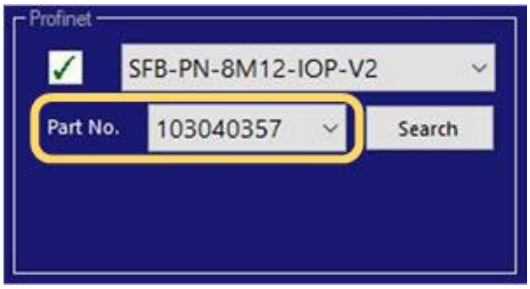
   - Open the dialog box for starting the Device Tool by right-clicking on the SFB-PN image in the Device overview.



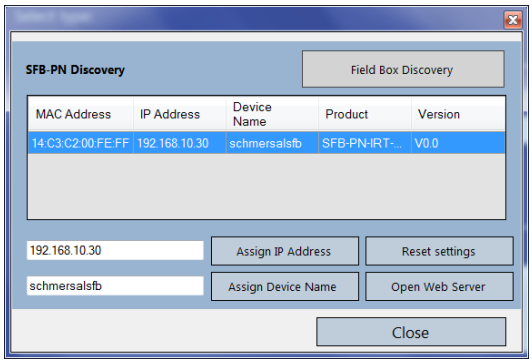
   - Select the **“SFB web server”** and start it via the “Start” button.



2. With the SFB Configuration Tool (refer to Chapter 4.4.3)
   - Select the field box variant SFB-PN-IRT-8M12-IOP-V2 used with the check-box.
     With the "Search" button you can search and identify the SFBs in the PROFINET network.



   - Click on "Field Box Discovery" to search the SFB.
     If you click on the IP address, the SFB's web server will be started and the field box data will be displayed.



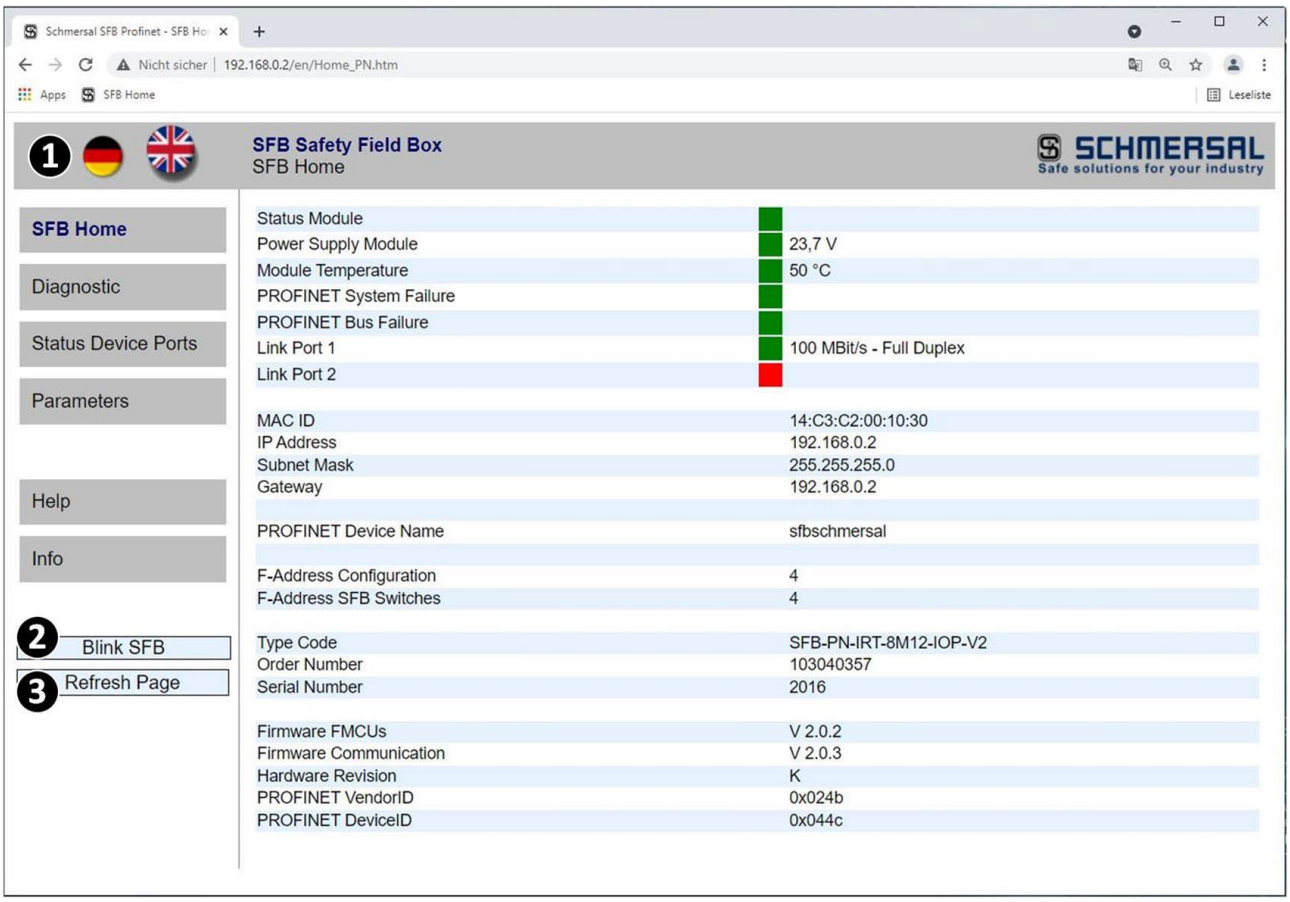
3. By entering the IP address in an Internet browser

   If the IP address is known, the web server can also be started by entering the IP address in the address bar of an Internet browser.

	INFORMATION
	The field box and the network adapter of the computer must be in the same network (IP area).

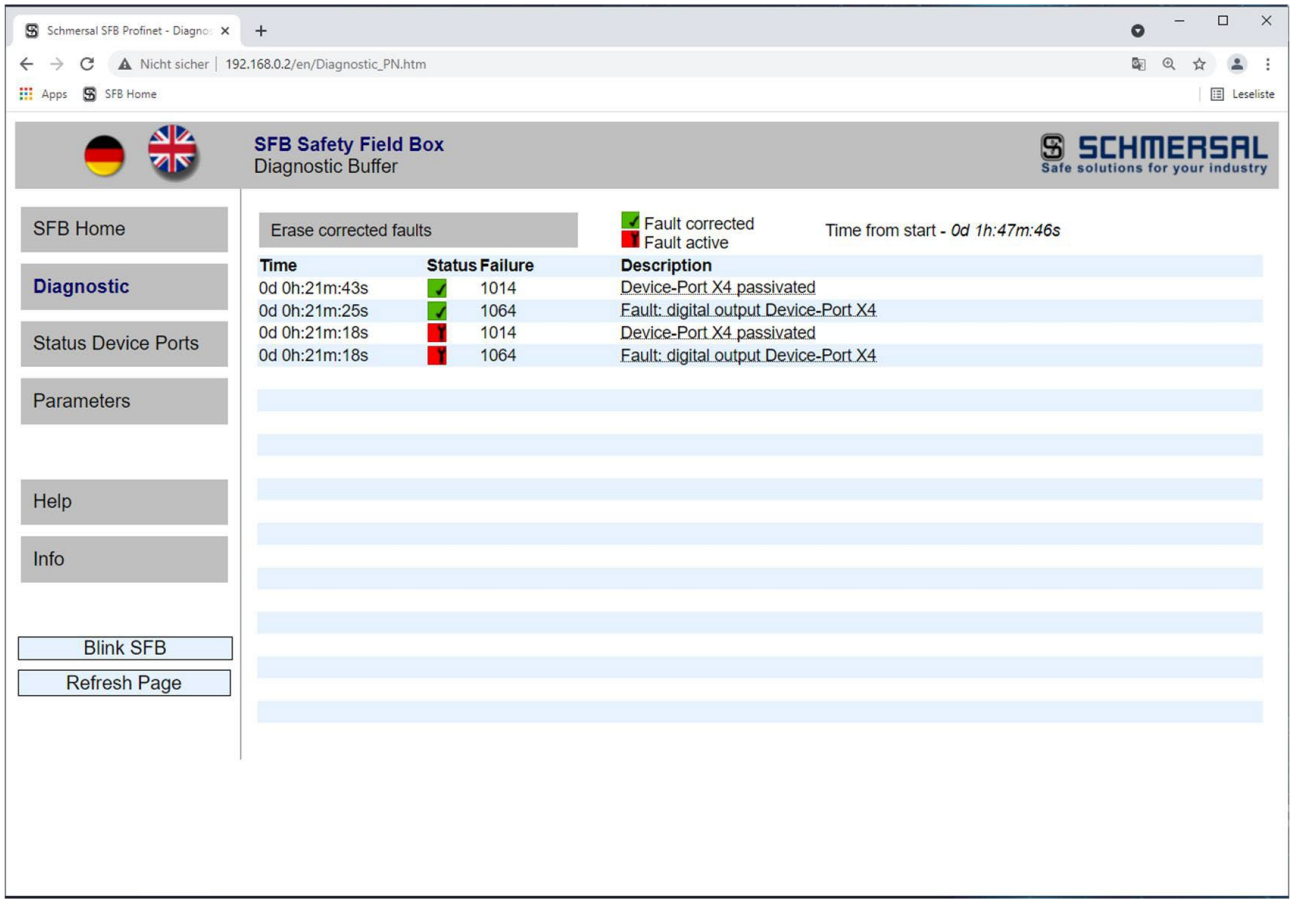
6.1.1 Page: SFB Home

The "SFB Home" page displays an overview of the most important status, network and device data.



Pos.	Graphic	Definition	Description
1		Language	The language of the display can be changed between German and English with the language buttons.
2	Blink SFB	Blink SFB	The "Blink SFB" button sends a signal to a connected field box and the SF LED flashes green for a few seconds.
3	Refresh Page	Refresh Page (actualisation)	The page is updated automatically every 4 seconds. The "Refresh Page" button can be used to manually refresh the page at any time.

6.1.2 Page: Diagnostic



The "Diagnostics" page displays the PROFINET fault messages that the field box has sent to the PLC.
The PROFINET fault messages should be stored in the controller.

The SFB-PN stores these fault messages only so long as switched on.

Each fault message is displayed with a time stamp, a status icon, the fault number and the fault description.

Time stamp — Display when a fault was detected after power-on of the field box.
The time starts again after each power-on of the field box!

Status icon

Fault active	„Fault incoming“
Fault fixed	„Fault outgoing“

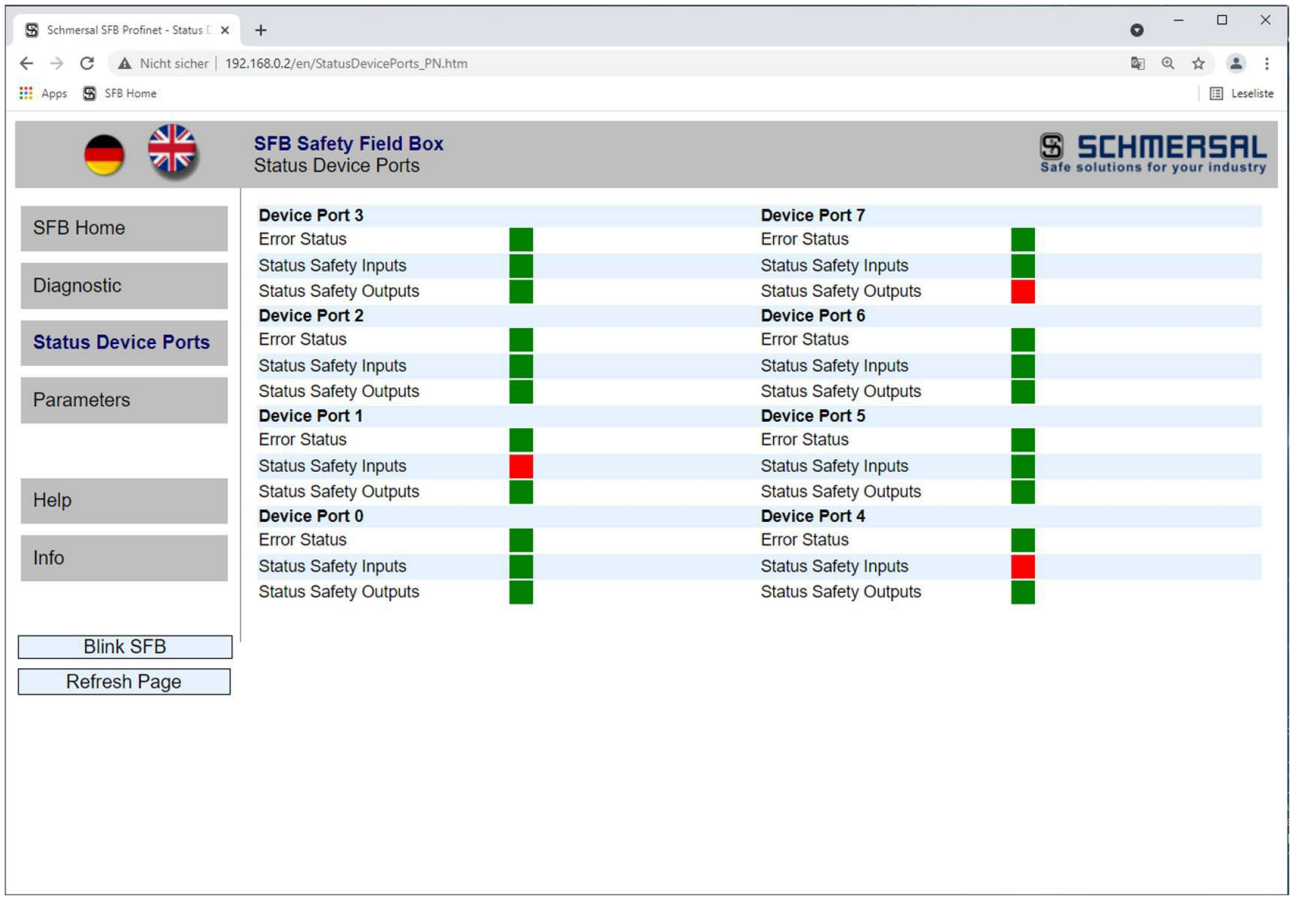
Fault number — Displays the PROFINET fault number which was detected.

Description — Display of the fault message with the fault description.
If you move the mouse pointer over the description, the help text of the fault message is displayed!

Delete faults from the list

If faults have been fixed (outgoing), they can be deleted from the fault list of the SFB-PN via the button "Erase corrected faults".

6.1.3 Page: Status Device Ports

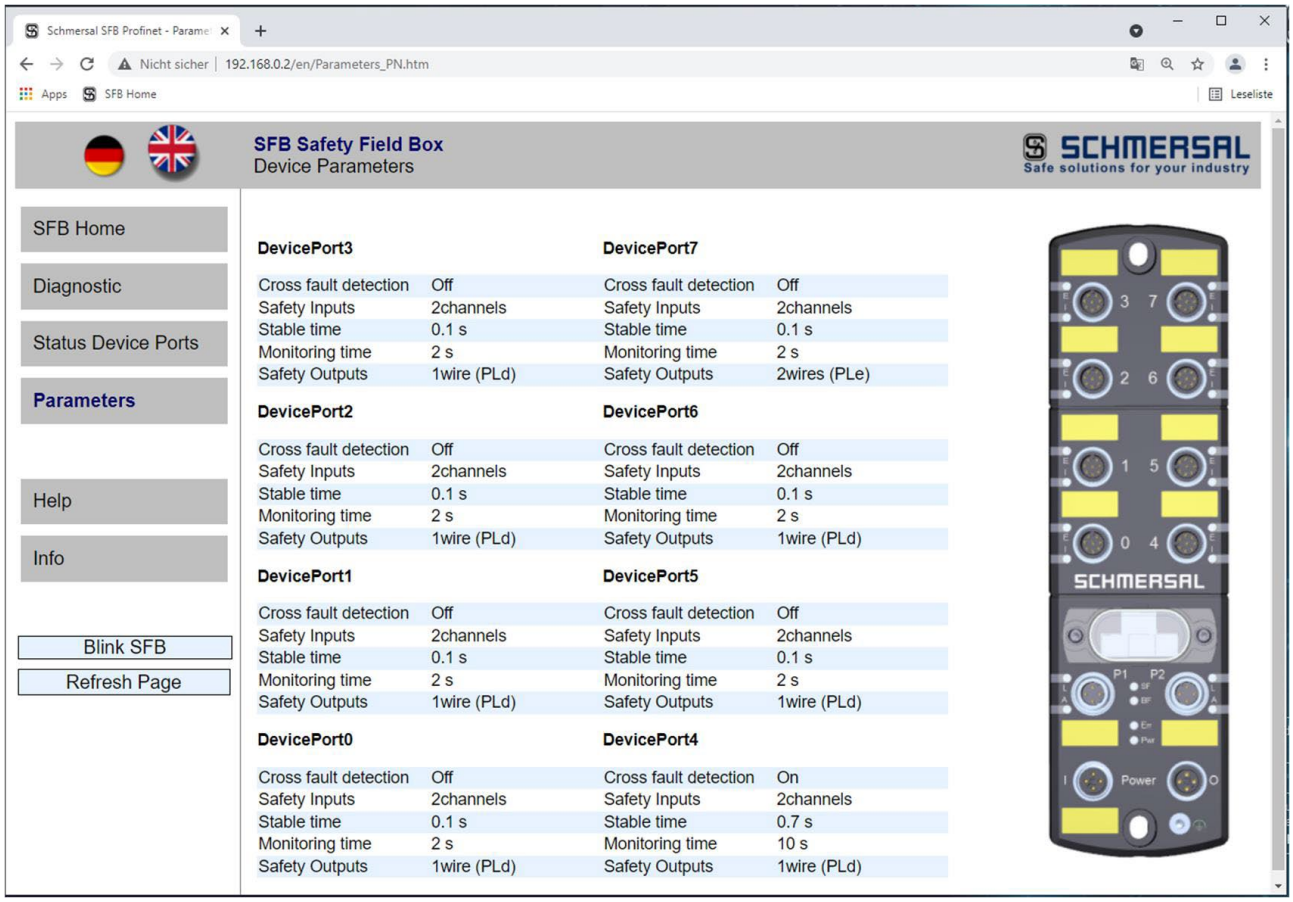


The "Status Device Ports" page displays the fault status and I/O status of each device port.

The meaning of the colours of the status indicators are explained on the "Help" page. (refer to Chapter 6.1.5)

Device-Port Error Status		Device-Port OK
		Device-Port Failure
Device-Port Status Safety-Inputs		Safety-Inputs ON
		Discrepance-Failure
		Safety-Inputs OFF
Device-Port Status Safety-Output		Safety-Output ON
		Safety-Output OFF

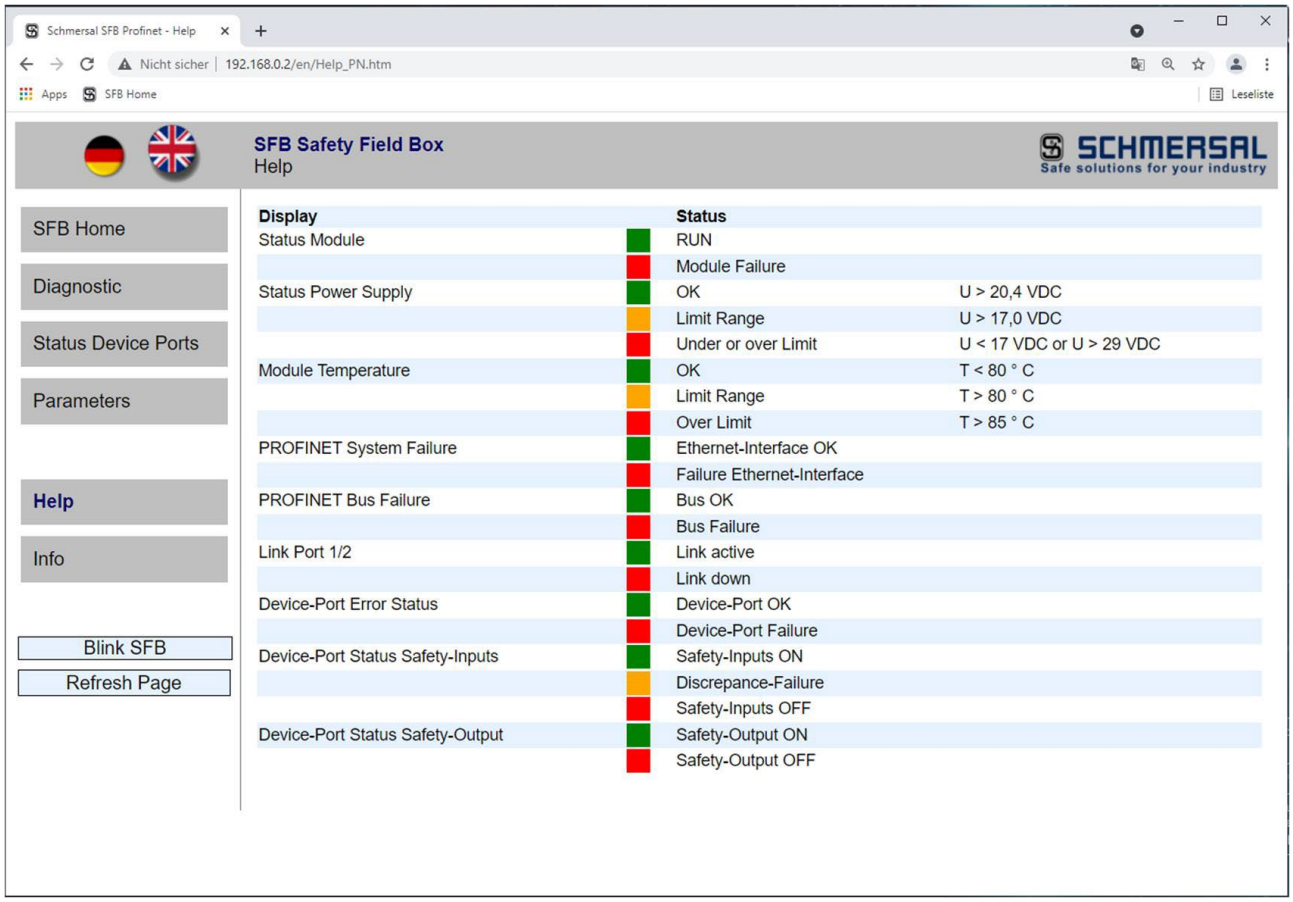
6.1.4 Page: Parameters



The "Parameters" page displays the set parameter values from each device port.

If the SFB-PN has not been parameterized yet, the parameter values are empty!

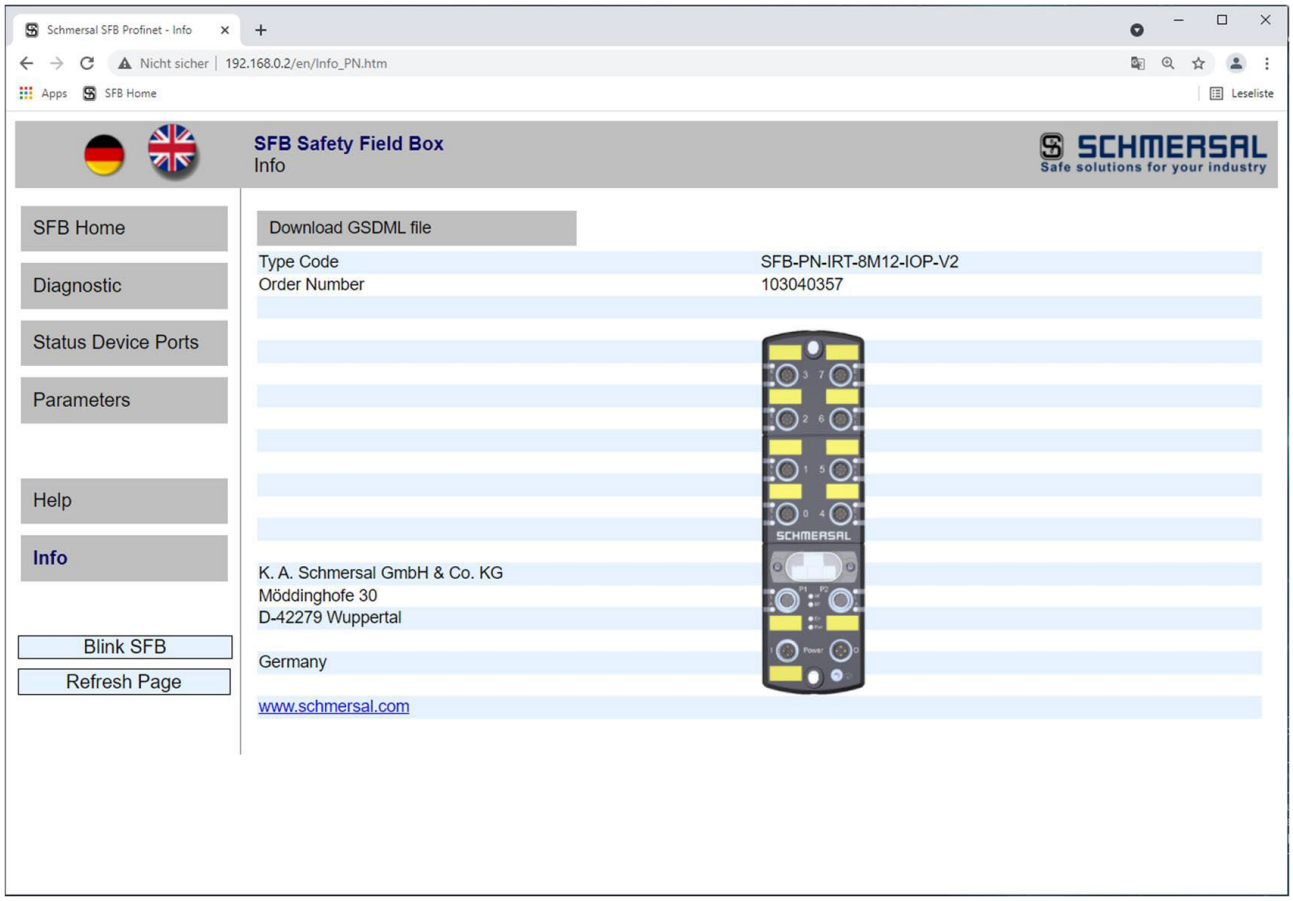
6.1.5 Page: Help



The "Help" page shows the meaning of the colours of all status displays on the web server.

In addition, the limit values are displayed for the supply voltage and the field box temperature.

6.1.6 Page: Info



The "Info" page shows the type designation, the order number and the support address of Schmersal.

The GSDML file saved in the field box can be downloaded using the "Download GSDML File" button.

7 Annex

7.1 Configuration examples for power supply

If each field box is supplied with power individually, the maximum length of a field box line is limited only by the maximum cable length of the field bus.

However, if the power supply is looped through from field box to field box, the maximum ratings given below apply.

Three different configurations are shown for each of the different SCHMERSAL devices. One configuration with long cable lengths (maximum), one configuration with medium cable lengths (medium) and one configuration with shorter cable lengths (small).

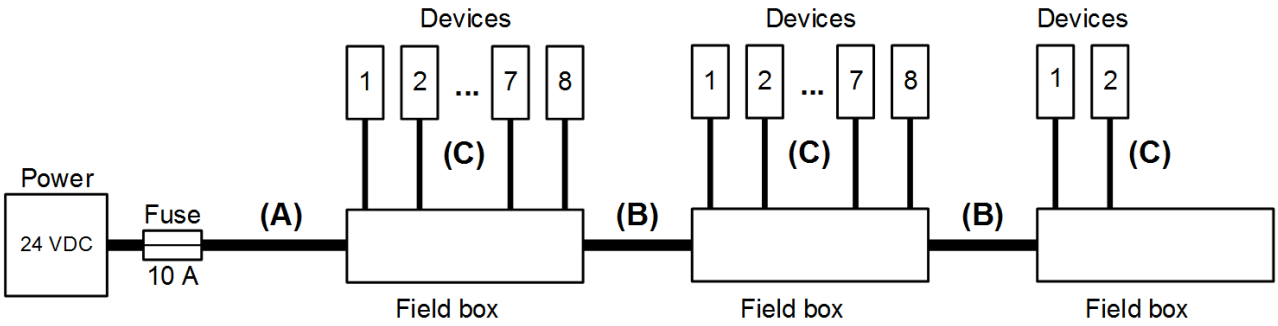
The design examples listed in the table on the next page,
apply to the following assumptions:

- The examples represent maximum configurations.
  If individual cable length is reduced, larger systems are possible.
- Wiring of the power supply with 2 x 1.5 mm² and fuse protection with 10 A.
- Use of SCHMERSAL cables.
- The cable lengths listed in the table between the power supply and the 1st field box, as well as between the field boxes, are the maximum lengths.
  Reducing the individual cable length is not critical.
- These designs assume simultaneous control of all lock or unlock functions for the connected solenoid interlocks.
  Larger systems are possible with time shift activation of the lock or unlock function.

	INFORMATION
	A useful design tool for calculating the real voltage drops is available on the Internet at www.system-engineering-tool.com .

Device / configuration version	Max. number of devices	Number of field boxes	Length of cable (A) until 1st field box	Length of cables (B) between the field boxes	Length of cables (C) for device connection
AZM 201 / Maximum	**16**	2	10.0 m	10.0 m	7.5 m
AZM 201 / Medium	**20**	2.5	7.5 m	7.5 m	5.0 m
AZM 201 / Small	**24**	3	7.5 m	5 m	3.5 m
MZM 100 / Maximum	**20**	2.5	1.0 m	10.0 m	7.5 m
MZM 100 / Medium	**24**	3	7.5 m	7.5 m	5.0 m
MZM 100 / Small	**28**	3.5	7.5 m	5 m	3.5 m
AZM 300 / Maximum	**28**	3.5	10.0 m	10.0 m	7.5 m
AZM 300 / Medium	**32**	4	7.5 m	7.5 m	5.0 m
AZM 300 / Small	**40**	5	7.5 m	5 m	3.5 m
AZM 400 / Maximum	**16**	2	10.0 m	10.0 m	7.5 m
AZM 400 / Medium	**16**	2	7.5 m	7.5 m	5.0 m
AZM 400 / Small	**16**	2	7.5 m	5 m	3.5 m
AZM 1xx / Maximum	**20**	2.5	10.0 m	10.0 m	7.5 m
AZM 1xx / Medium	**24**	3	7.5 m	7.5 m	5.0 m
AZM 1xx / Small	**28**	3.5	7.5 m	5 m	3.5 m
RSS, CSS / Maximum	**48**	6	10.0 m	10.0 m	7.5 m
RSS & CSS / Medium	**56**	7	7.5 m	7.5 m	5.0 m
RSS & CSS / Small	**64**	8	7.5 m	5 m	3.5 m
Mixed / Maximum	**24**	3	10.0 m	10.0 m	7.5 m
Mixed / Medium	**28**	3.5	7.5 m	7.5 m	5.0 m
Mixed / Small	**32**	4	7.5 m	5 m	3.5 m

Mixed assembly of the field box: 2 x AZM 201, 2 x MZM 100, 2 x AZM 300 and 2 x RSS / CSS



	INFORMATION
	A useful design tool for calculating the real voltage drops is available on the Internet at www.system-engineering-tool.com .

7.2 EU Declaration of conformity

EU Declaration of conformity

SCHMERSAL

Original	K.A. Schmersal GmbH & Co. KG Möddinghofe 30 42279 Wuppertal Germany Internet: www.schmersal.com

We hereby certify that the hereafter described components both in their basic design and construction conform to the applicable European Directives.

Name of the component:	SFB
Type:	See ordering code
Description of the component:	Safety fieldbox (IO module with fieldbox interface)
Relevant Directives:	2006/42/EC Machinery Directive 2014/30/EU EMC-Directive 2011/65/EU RoHS-Directive
Applied standards:	EN 61131-2:2007 EN 60947-5-3:2013 EN ISO 13849-1:2015 IEC 61508 Teile 1-7:2010
Notified body for the prototype test:	TÜV Rheinland Industrie Service GmbH Am Grauen Stein, 51105 Köln ID n°: 0035
EC-prototype test certificate:	01/205/5878.00/22
Person authorised for the compilation of the technical documentation:	Oliver Wacker Möddinghofe 30 42279 Wuppertal
Place and date of issue:	Wuppertal, January 5, 2022

Authorised signature
Philip Schmersal
Managing Director

SFB-PN-IOP-V2-A-EN

INFORMATION

The currently valid declaration of conformity can be downloaded from the internet at www.products.schmersal.com .

K. A. Schmersal GmbH & Co. KG
Möddinghofe 30, D - 42279 Wuppertal
Germany

Phone: +49 - (0)2 02 - 64 74 - 0
Telefax: +49 - (0)2 02 - 64 74 - 1 00
E-Mail: info@schmersal.com
Internet: www.schmersal.com

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