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# Programmable
# Safety Systems PSS®-Range

more than automation
safe automation

Serie PSS SB 3006-3
Units with two SafetyBUS p Interfaces

**Operating Manual – Item No. 21 143-02**

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# Introduction

This operating manual explains the function and operation of the programmable safety system, describes the installation and provides guidelines on how to connect the inputs and test pulse outputs on programmable safety systems from the PSS SB 3006-3 series. A PSS from the PSS SB 3006-3 series is a 3rd generation programmable safety system.

For connection to SafetyBUS p, units are available with one SafetyBUS p interface as well as two SafetyBUS p interfaces.
This operating manual describes the programmable safety systems from the PSS SB 3006-3 series with two SafetyBUS p interfaces.

Different interfaces are available for connection to various non-safety-related standard bus systems, depending on the unit type. These interfaces are described in separate operating manuals. The necessary operating manuals are supplied with the relevant unit types.

Please refer to the PSS-range manuals, in particular the information and requirements stated in the “PSS-Range Safety Manual”, “FS System Description”, “ST System Description” and also the “SafetyBUS p Installation Manual” from the SafetyBUS p manual package.

You will need to be conversant with the information in these manuals in order to fully understand this manual.

This documentation is intended for instruction and should be retained for future reference.



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# Introduction

## Validity of documentation

This documentation is valid for the following programmable safety systems from the PSS SB2 3006-3 series:

- PSS SB2 3006-3 DP-S from Version 1.0
- PSS SB2 3006-3 IBS-S from Version 1.0
- PSS SB2 3006-3 CN-A from Version 1.0
- PSS SB2 3006-3 DN-S from Version 1.0
- PSS SB2 3006-3 ETH-2 from Version 1.0
- PSS SB2 3006-3 ETH-2 DP-S from Version 1.0
- PSS SB2 3006-3 ETH-2 IBS-S from Version 1.0

It is valid until new documentation is published. The latest documentation is always enclosed with the unit.



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## Overview of documentation

**1 Introduction**
The introduction is designed to familiarise you with the contents, structure and specific order of this manual.

**2 Overview**
This chapter provides information on the most important features of the programmable safety systems.

**3 Safety**
This chapter **must** be **read** as it contains important information on safety regulations and intended use.

**4 Function Description**
This chapter describes the individual components of the programmable safety systems: CPU, inputs and test pulse outputs.

**5 Installation**
This chapter explains how to install the programmable safety systems.

**6 Supply Voltage**

This chapter explains what you need to consider when connecting the supply voltage.

**7 Wiring the Inputs and Test Pulse Outputs**
This chapter describes the safety-related wiring of the inputs and test pulse outputs.

**8 Interfaces**
This chapter describes the configuration of the available interfaces.

**9 Operation and Maintenance**
This chapter explains how to commission the safety systems and advises on what to do if a fault occurs.

**10 Technical Details**

**11 Appendix**



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## Definition of symbols

Information in this manual that is of particular importance can be identified as follows:



**DANGER!**

This warning must be heeded! It warns of a **hazardous situation that poses an immediate threat of serious injury and death** and indicates preventive measures that can be taken.



**WARNING!**

This warning must be heeded! It warns of a **hazardous situation that could lead to serious injury and death** and indicates preventive measures that can be taken.



**CAUTION!**

This refers to a hazard that can lead to a less serious or minor injury plus material damage, and also provides information on preventive measures that can be taken.



**NOTICE**
This describes a situation in which the unit(s) could be damaged and also provides information on preventive measures that can be taken.



**INFORMATION**
This gives advice on applications and provides information on special features, as well as highlighting areas within the text that are of particular importance.



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# Overview

A PSS from the PSS SB2 3006-3 series is a complete programmable safety system in a single unit. The following are all integrated into the housing:

- Power supply
- CPU
- 6 integral on-board inputs
- 2 test pulse outputs
- Programming device interface (combined RS 232/RS 485 interface)
- User interface (combined RS 232/RS 485 interface)
- 2 interfaces for connection to SafetyBUS p
- Interface(s) for connection to various standard bus systems

The integral on-board inputs can be used to monitor local emergency stops or to trigger an I/O-Group start, for example. They are suitable for connecting single or dual-channel input devices, with or without test pulses. The dedicated test pulse outputs are suitable for testing input devices.
SafetyBUS p enables you to establish a safe decentralised network of several programmable safety systems and/or to connect decentralised modules. The PSS can perform the function of a Management, Logic or Input/Output Device on SafetyBUS p.
For non-safety-related applications, the PSS can be connected to various standard bus systems (e.g. Ethernet, PROFIBUS-DP, INTERBUS, ControlNet, DeviceNet). The bus interfaces that are available will depend on the unit type.

**INFORMATION**

- The standard bus interfaces are described in separate operating manuals. The necessary operating manuals are supplied with the relevant unit types.
- Drivers (standard function blocks) from the corresponding Pilz software package will be required in order to connect to the various standard bus systems.



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# Overview

## Front views

### PSS SB2 3006-3 DP-S

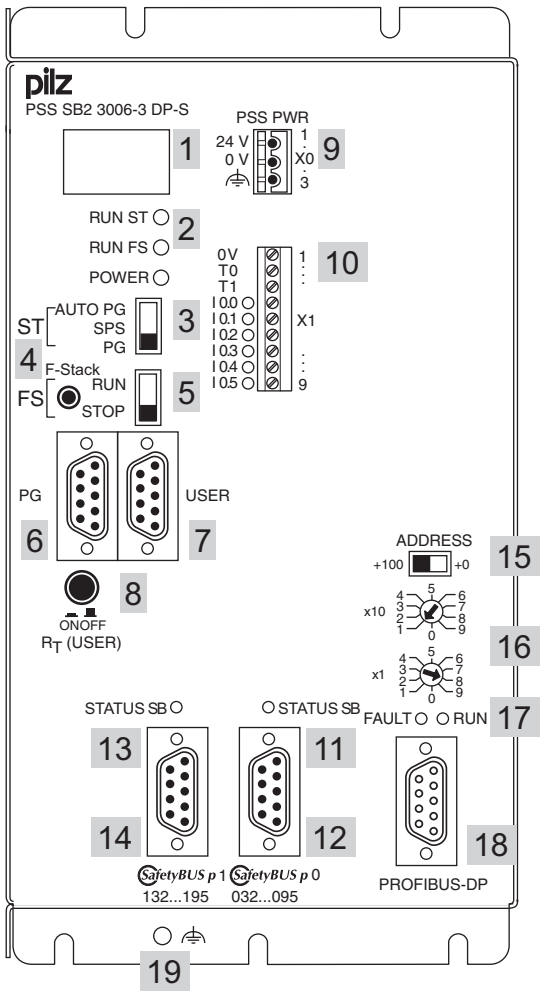



Fig. 2-1: Front view of PSS SB2 3006-3 DP-S

**Key:**

1: 4-digit display
2: LEDs for PSS operating mode and supply voltage
3: 3-position switch for selecting the standard section's operating mode
4: Button for scrolling the error stack



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5: 2-position switch for selecting the failsafe section's operating mode
6: Programming device interface
RS 232 (minimum configuration: TxD, RxD, GND)/RS 485
7: User interface
RS 232/RS 485
8: Pushbutton for switching on and off the RS 485 termination on the user interface
9: Supply voltage connection (24 VDC)
10: Inputs and test pulse outputs
11: LED for status of SafetyBUS p 0
12: SafetyBUS p interface (SafetyBUS p 0)
13: LED for status of SafetyBUS p 1
14: SafetyBUS p interface (SafetyBUS p 1)
15: 2-position switch for selecting the station address (PROFIBUS-DP)
16: Rotary switch for setting the station address (PROFIBUS-DP)
17: LED for status of PROFIBUS-DP
18: PROFIBUS-DP interface
19: Functional earth connection

**INFORMATION**
Please refer also to the manual: "PROFIBUS-DP for Compact 3rd Generation PSS".



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# Overview

## PSS SB2 3006-3 IBS-S

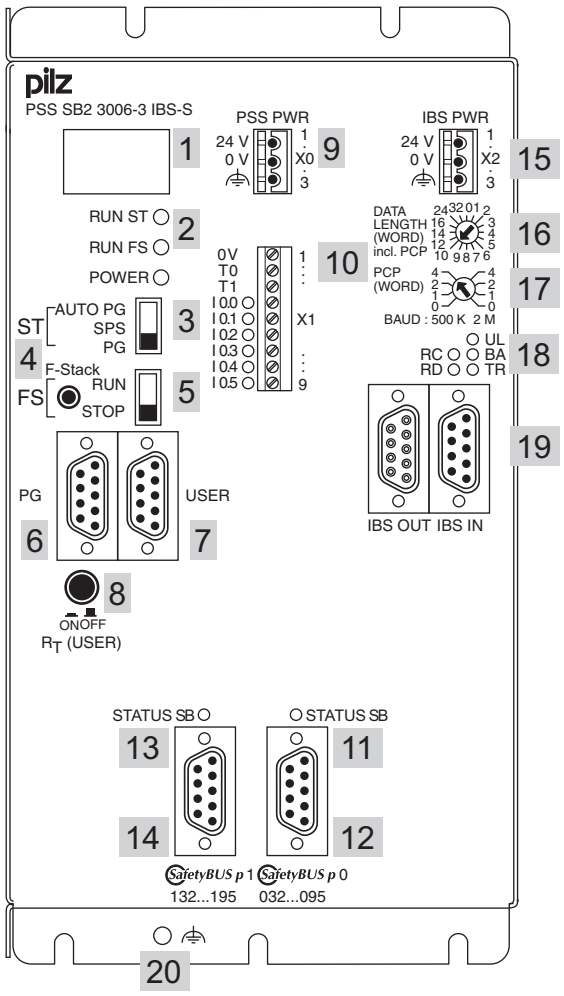



Fig. 2-2: Front view of PSS SB2 3006-3 IBS-S

**Key:**

1: 4-digit display
2: LEDs for PSS operating mode and supply voltage
3: 3-position switch for selecting the standard section's operating mode
4: Button for scrolling the error stack
5: 2-position switch for selecting the failsafe section's operating mode



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6: Programming device interface
RS 232 (minimum configuration: TxD, RxD, GND)/RS 485

7: User interface
RS 232/RS 485

8: Pushbutton for switching on and off the RS 485 termination on the user interface

9: Supply voltage connection (24 VDC)

10: Inputs and test pulse outputs

11: LED for status of SafetyBUS p 0

12: SafetyBUS p interface (SafetyBUS p 0)

13: LED for status of SafetyBUS p 1

14: SafetyBUS p interface (SafetyBUS p 1)

15: IBS supply voltage connection (24 VDC)

16: Rotary switch for setting the whole data length
(process plus parameter data length)

17: Rotary switch for setting the parameter data length (PCP) and the transmission rate

18: LED for status of Interbus

19: Interbus interfaces
(IBS OUT, IBS IN)

20: Functional earth connection

**INFORMATION**
Please refer also to the manual: “INTERBUS for Compact 3rd Generation PSS”.



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# Overview

## PSS SB2 3006-3 CN-A

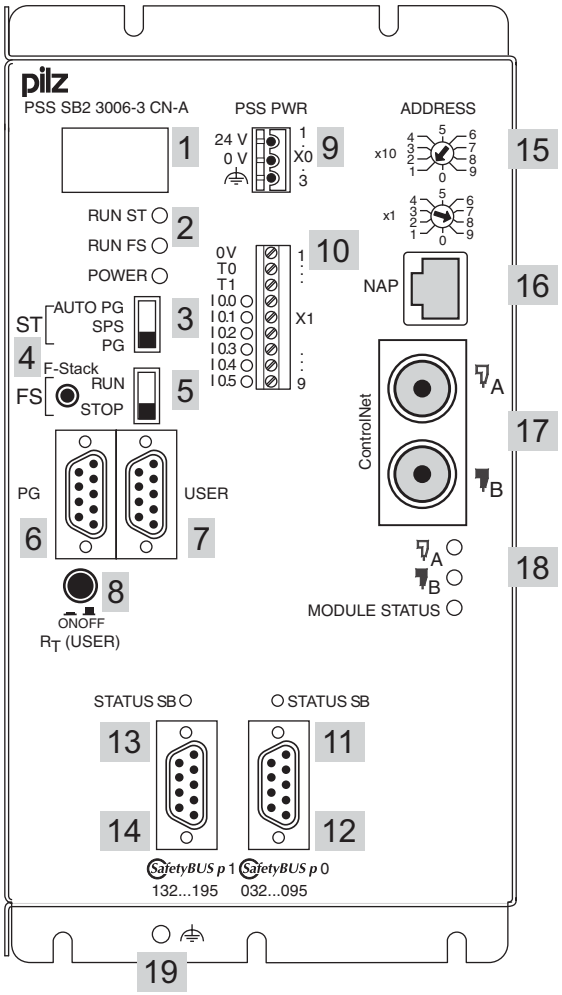



Fig. 2-3: Front view of PSS SB2 3006-3 CN-A

**Key:**

1: 4-digit display
2: LEDs for PSS operating mode and supply voltage
3: 3-position switch for selecting the standard section's operating mode
4: Button for scrolling the error stack
5: 2-position switch for selecting the failsafe section's operating mode



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6: Programming device interface
RS 232 (minimum configuration: TxD, RxD, GND)/RS 485

7: User interface
RS 232/RS 485

8: Pushbutton for switching on and off the RS 485 termination on the user interface

9: Supply voltage connection (24 VDC)

10: Inputs and test pulse outputs

11: LED for status of SafetyBUS p 0

12: SafetyBUS p interface (SafetyBUS p 0)

13: LED for status of SafetyBUS p 1

14: SafetyBUS p interface (SafetyBUS p 1)

15: Rotary switch for setting the station address

16: Connection for temporary bus access (Network Access Port)

17: ControlNet interfaces (Channel A and Channel B)

18: LEDs for communication error with ControlNet (Channel A and B) and to display operation (module and PSS)

19: Functional earth connection

**INFORMATION**
Please refer also to the manual: “ControlNet-Adapter for Compact 3rd Generation PSS”.



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## PSS SB2 3006-3 DN-S

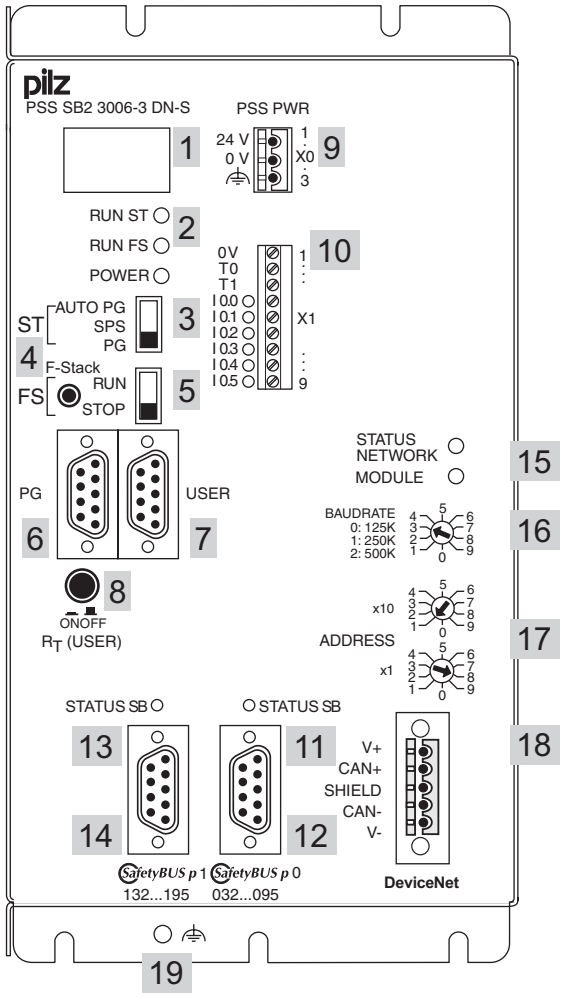



Fig. 2-4: Front view of PSS SB2 3006-3 DN-S

**Key:**

1: 4-digit display
2: LEDs for PSS operating mode and supply voltage
3: 3-position switch for selecting the standard section's operating mode
4: Button for scrolling the error stack
5: 2-position switch for selecting the failsafe section's operating mode



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6: Programming device interface
RS 232 (minimum configuration: TxD, RxD, GND)/RS 485

7: User interface
RS 232/RS 485

8: Pushbutton for switching on and off the RS 485 termination on the user interface

9: Supply voltage connection (24 VDC)

10: Inputs and test pulse outputs

11: LED for status of SafetyBUS p 0

12: SafetyBUS p interface (SafetyBUS p 0)

13: LED for status of SafetyBUS p 1

14: SafetyBUS p interface (SafetyBUS p 1)

15: LEDs for network and module status

16: Rotary switch for setting the transmission rate

17: Rotary switch for setting the station address

18: Connection to DeviceNet

19: Functional earth connection

**INFORMATION**
Please refer also to the manual: “DeviceNet-Slave for Compact 3rd Generation PSS”.



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## PSS SB2 3006-3 ETH-2

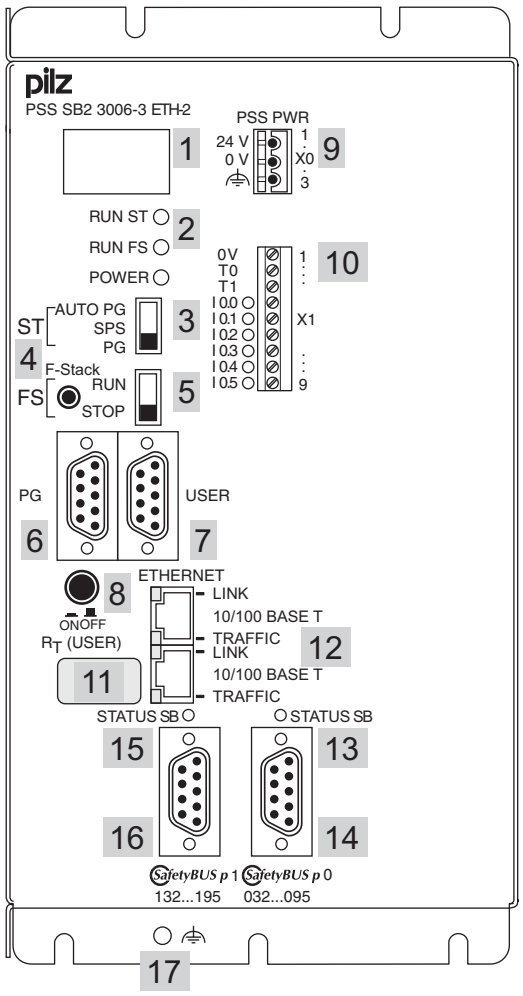



Fig. 2-5: Front view of PSS SB2 3006-3 ETH-2

### Key

1: 4-digit display
2: LEDs for PSS operating mode and supply voltage
3: 3-position switch for selecting the standard section's operating mode
4: Button for scrolling the error stack
5: 2-position switch for selecting the failsafe section's operating mode



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6: Programming device interface
RS 232 (minimum configuration: TxD, RxD, GND)/RS 485

7: User interface
RS 232/RS 485

8: Pushbutton for switching on and off the RS 485 termination on the user interface

9: Supply voltage connection (24 VDC)

10: Inputs and test pulse outputs

11: Labelling strip for Ethernet address

12: ETH-2 interface with connection to ETHERNET via integrated switch (2 free ports); LEDs on each port for
- Status of network connection (LINK)
- status of data traffic (TRAFFIC)

13: LED for status of SafetyBUS p 0

14: SafetyBUS p interface (SafetyBUS p 0)

15: LED for status of SafetyBUS p 1

16: SafetyBUS p interface (SafetyBUS p 1)

17: Functional earth connection

**INFORMATION**
Please refer also to the manual: “ETH-2 for Compact 3rd Generation PSS”.



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## PSS SB2 3006-3 ETH-2 DP-S

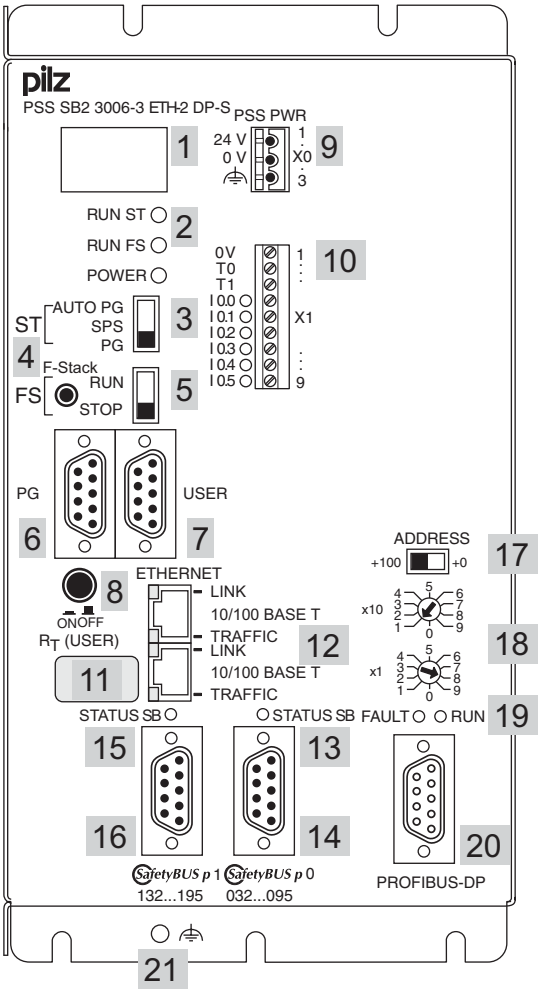



Fig. 2-6: Front view of PSS SB2 3006-3 ETH-2 DP-S

### Key

1: 4-digit display
2: LEDs for PSS operating mode and supply voltage
3: 3-position switch for selecting the standard section's operating mode
4: Button for scrolling the error stack
5: 2-position switch for selecting the failsafe section's operating mode



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6: Programming device interface
RS 232 (minimum configuration: TxD, RxD, GND)/RS 485

7: User interface
RS 232/RS 485

8: Pushbutton for switching on and off the RS 485 termination on the user interface

9: Supply voltage connection (24 VDC)

10: Inputs and test pulse outputs

11: Labelling strip for Ethernet address

12: ETH-2 interface with connection to ETHERNET via integrated switch (2 free ports); LEDs on each port for
- Status of network connection (LINK)
- status of data traffic (TRAFFIC)

13: LED for status of SafetyBUS p 0

14: SafetyBUS p interface (SafetyBUS p 0)

15: LED for status of SafetyBUS p 1

16: SafetyBUS p interface (SafetyBUS p 1)

17: 2-position switch for selecting the station address (PROFIBUS-DP)

18: Rotary switch for setting the station address (PROFIBUS-DP)

19: LED for status of PROFIBUS-DP

20: PROFIBUS DP interface

21: Functional earth connection

**INFORMATION**
Please refer also to the manuals: “ETH-2 for Compact 3rd Generation PSS” and “PROFIBUS-DP for Compact 3rd Generation PSS”.



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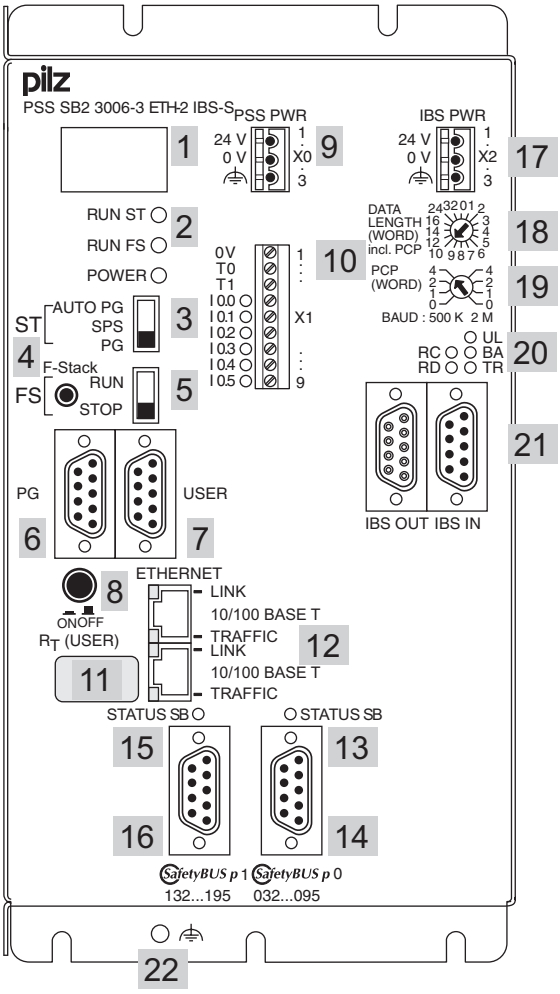



Fig. 2-7: Front view of PSS SB2 3006-3 ETH-2 IBS-S

**Key**

1: 4-digit display
2: LEDs for PSS operating mode and supply voltage
3: 3-position switch for selecting the standard section's operating mode
4: Button for scrolling the error stack
5: 2-position switch for selecting the failsafe section's operating mode
6: Programming device interface



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6: Programming device interface
RS 232 (minimum configuration: TxD, RxD, GND)/RS 485

7: User interface
RS 232/RS 485

8: Pushbutton for switching on and off the RS 485 termination on the user interface

9: Supply voltage connection (24 VDC)

10: Inputs and test pulse outputs

11: Labelling strip for Ethernet address

12: ETH-2 interface with connection to ETHERNET via integrated switch (2 free ports); LEDs on each port for
- Status of network connection (LINK)
- status of data traffic (TRAFFIC)

13: LED for status of SafetyBUS p 0

14: SafetyBUS p interface (SafetyBUS p 0)

15: LED for status of SafetyBUS p 1

16: SafetyBUS p interface (SafetyBUS p 1)

17: IBS supply voltage connection (24 VDC)

18: Rotary switch for setting the whole data length (process plus parameter data length)

19: Rotary switch for setting the parameter data length (PCP) and the transmission rate

20: LED for status of Interbus

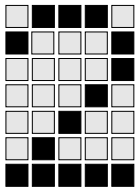
21: Interbus interfaces
(IBS OUT, IBS IN)

22: Functional earth connection

**INFORMATION**
Please refer also to the manuals: “ETH-2 for Compact 3rd Generation PSS” and “INTERBUS for Compact 3rd Generation PSS”.



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## Notes



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# Safety

## Intended use

Programmable safety systems from the PSS SB2 3006-3 series are intended for use as follows:

- Safety-related applications
  in the failsafe section of the PSS, including connection to SafetyBUS p
- Non-safety-related applications
  in the standard section of the PSS, including connection to standard bus systems.

**INFORMATION**
The following system software is required in order to program the safety systems:

- PSS WIN-PRO from Version **1.3.0** for
  - PSS SB2 3006-3 DP-S
  - PSS SB2 3006-3 IBS-S
  - PSS SB2 3006-3 CN-A
  - PSS SB2 3006-3 DN-S
  - PSS SB2 3006-3 ETH-2
  - PSS SB2 3006-3 ETH-2 DP-S
  - PSS SB2 3006-3 ETH-2 IBS-S

**INFORMATION**
Drivers (standard function blocks) from the corresponding Pilz software package will be required in order to connect to the various standard bus systems:

- ST-SB-DP-S: Driver for PROFIBUS-DP Slave
- ST-SB-ControlNet: Driver for ControlNet Adapter
- ST-SB-DN-S: Driver for DeviceNet Slave
- ST-SB-IBS-S: Driver for INTERBUS Slave

For the standard bus interface ETH-2, the Ethernet Configurator is available as part of the PSS WIN-PRO system software from Version 1.3.0.



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The following is deemed improper use:

- Any component, technical or electrical modification to the safety system
- Use of the safety system outside the areas described in this manual
- Use of the safety system outside the documented technical details (see chapter entitled “Technical Details”).

Intended use includes making the installation EMC-compliant. Please observe the guidelines given in this manual and in the “Safety Manual” for the PSS-range. The „Safety Manual“ also includes check lists designed to help you with the safety-related planning, construction and operation of a plant.

### Product modifications

Details of the changes made to a unit from one version to the next are described in the “Product Modifications” file. This file can be found on the “Documentation PSS-Range/SafetyBUS p” CD or on the Internet (www.pilz.com) with the unit’s documentation.

## Categories in accordance with EN 954-1



**WARNING!**

Please note: To achieve the corresponding category or requirement class, the whole system including all safety-related components (parts, devices, user program etc.) must be included in the assessment. For this reason, Pilz cannot accept liability for the correct classification into a category or requirement class.



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### Digital inputs (DI2)

Depending on the application area and its respective regulations, the PSS may be used without test pulses for applications up to category 3 in accordance with EN 954-1 (03/97). The possibility of a short circuit occurring in the external wiring between different inputs or to L+ must be eliminated through appropriate wiring.

Test pulses must be used for category 4 applications (for connection examples please see Chapter 7, “Wiring the Inputs and Test Pulse Outputs”).

## Safety guidelines

Failure to keep to these guidelines will render all warranty and liability claims invalid:

- All health and safety / accident prevention regulations for the particular area of application must be observed.
- Before using the unit it is necessary to perform a safety assessment in accordance with the Machinery Directive 98/37/EC.

## Use of qualified personnel

The safety system may only be assembled, installed, programmed, commissioned, operated, maintained and decomissioned by qualified personnel. Qualified personnel are people who, because they are:

- Qualified electrical engineers and
- Have received training from qualified electrical engineers,

are suitably experienced to operate devices, systems, plant and machinery in accordance with the general standards and guidelines for safety technology.



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## EMCD

The safety system is designed for use in an industrial environment. Interference may occur if used within a domestic environment.

## Warranty and liability

All claims to warranty and liability will be rendered invalid if:

- The safety system was used contrary to the purpose for which it was intended
- Damage can be attributed to not having followed the guidelines in the manual
- Operating personnel are not suitably qualified.
- Any type of modification has been made (e.g. exchanging components on the PCB boards, soldering work etc.).

## Disposal

The programmable safety system must be disposed of properly when it reaches the end of its service life.



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## CPU

The CPU controls the test pulse outputs, reads the inputs and processes / stores the user program and variable data. The failsafe section is designed to be multi-channel, i.e. different CPUs process the user program independently.
A four-digit display and several LEDs provide information on the status of the safety system and indicate any errors.



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# Function Description

## Interfaces

### CPU interfaces

The CPU of each programmable safety system in the PSS SB2 3006-3 series provides the following interfaces:

- Programming device interface
  Combined RS 232 interface (minimum configuration: TxD, RxD, GND)/ RS 485
- User interface
  Combined RS 232/RS 485 interface

For further information please refer to the “System Manual for the PSS-Range”.

### SafetyBUS p interface

Each programmable safety system in the PSS SB2 3006-3 series has two SafetyBUS p interfaces.
The second SafetyBUS p interface can be used to divide up large plants. This can help to optimise the reaction time.

For further information on SafetyBUS p, please refer to the “System Manual for SafetyBUS p”.

### Interfaces for standard bus systems

Different interfaces are available for connection to various standard bus systems, depending on the unit type. The standard bus interfaces are described in separate operating manuals. The necessary operating manuals are supplied with the relevant unit types.



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## Digital inputs (DI2)

All programmable safety systems in the PSS SB2 3006-3 series have six integral on-board inputs, which are suitable for connecting single and dual-channel input devices, with or without test pulses. Input signals must show a “High” (“1” signal) of 24 VDC (+15 ... +30 VDC) and a “Low” (“0” signal) of 0 VDC (-3 ... +5 VDC).

LEDs are used as status indicators. An LED lights up as soon as a “1” signal is present at the input. All inputs have input filters.

Internal diagnostic circuitry checks the function of the inputs, including the input filter. If an error occurs, the PSS will switch to a STOP condition and output a message to the CPU display. In addition, all the decentralised outputs in the I/O-Groups assigned to the PSS Logic Device will be switched off (see also “SafetyBUS p System Description”).

Where test pulses are not used, inputs with single-channel input devices can be used in applications up to and including Category 2 in accordance with EN 954-1; in the case of dual-channel input devices, this extends to Category 3 applications. The device should be suitably wired to eliminate the risk of a short circuit in the external wiring between the different inputs and also between the PSS supply and any bus interface.

Test pulses must be used for applications with single-channel input devices above Category 2 and for applications with dual-channel input devices above Category 3. Connection examples can be found in Chapter 7 of this manual, “Wiring the Inputs and Test Pulse Outputs”.



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## Test pulse outputs

The two test pulse outputs T0 and T1 are suitable for testing the wiring of input devices. All safety-related inputs must operate in accordance with the failsafe principle (on switching off). Test pulses are allocated to inputs via the configurator in the system software (PG). Each test pulse has a maximum load capacity of 0.5 A.

**INFORMATION**
The test pulse outputs may **not** be used as digital outputs for safety functions.

## Configuration coding

The inputs are located on a sub-slot, which is allocated a code:

| Slot | Sub-slot | Inputs/outputs | Code |
|---|---|---|---|
| 0 | 0 | E0.0 - E0.5 | $8004_H$ |



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# Installation

## General requirements

Please note the following:

- The safety system should be installed in an enclosure, e.g. control cabinet, that conforms to the protection class required for the environment.
- When installing the system in an enclosure such as a control cabinet, the environmental data for the safety system must be taken into account. Details can be found in the chapter entitled “Technical Details”.
- Ensure there is sufficient ventilation to prevent heat building up within the control cabinet. Please note the ambient temperature of 0 ... 60 °C.
- In extreme ambient conditions, additional measures may be required in order to keep within the prescribed value range.
- Use low interference panel lighting for inside the control cabinet.
- The safety system must be installed in such a way that there is adequate protection against buttons and switches being operated unintentionally.



**CAUTION!**

Damage due to electrostatic discharge!
Electrostatic discharge can damage components on the safety system. Ensure against discharge before touching the PSS, e.g. by touching an earthed, conductive surface or by wearing an earthed armband.



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# Installation

## Installing the safety system

There are two options for installing the safety system. Both are illustrated in Fig. 5-1. Drill M5 or M6 holes in the control cabinet's mounting plate, as shown in Fig. 5-1 (tolerance: +/-0.3 mm/0.012"). You will require 4 holes. Attach the safety system to the mounting plate in your control cabinet, using washers.

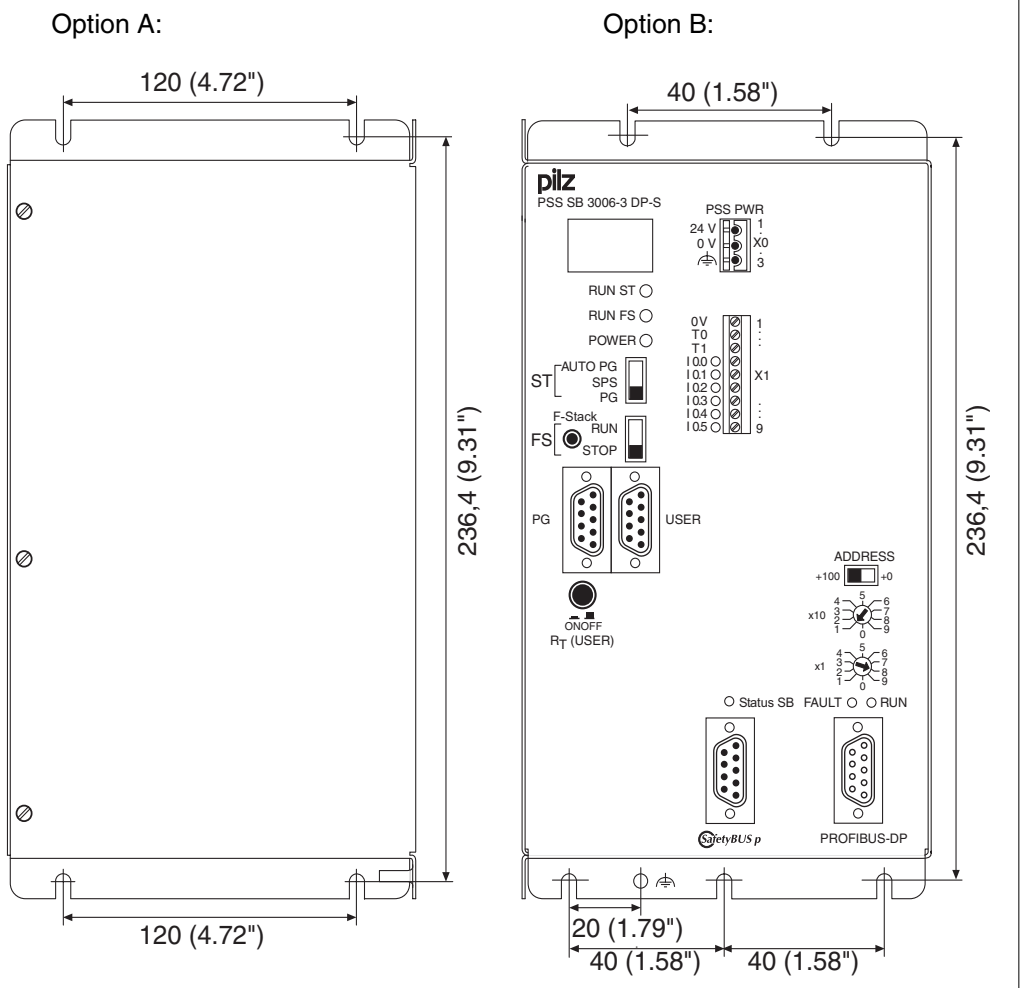



Fig. 5-1: Options for installing safety systems from the PSS SB/SB2 3006-3 series (example: PSS SB 3006-3 DP-S), dimensions stated in mm (")

Dimensions in mm (");
H x W x D: 246 x 123 x 161 (9.70" x 4.84" x 6.34")



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# Installing the safety system in a control cabinet

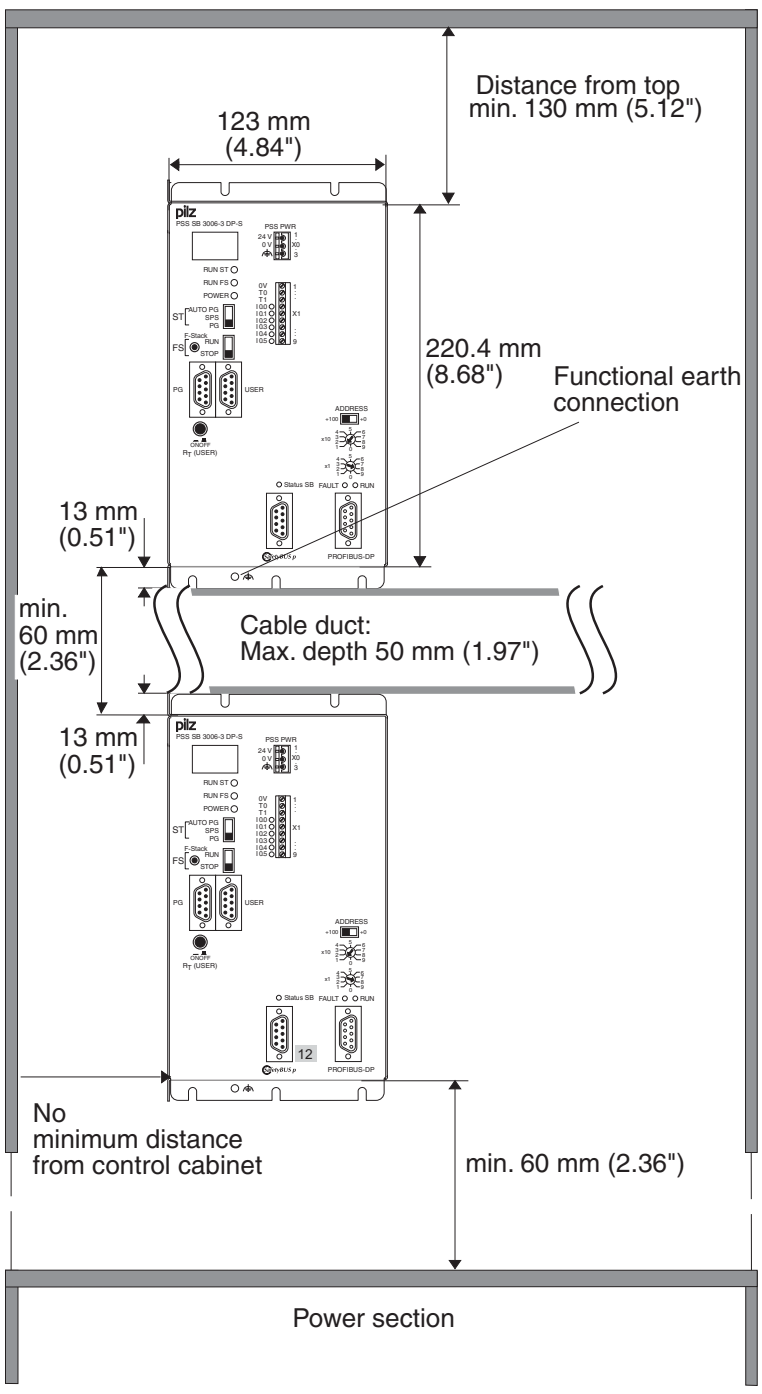
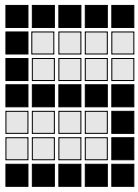



Fig. 5-2: Installing safety systems from the PSS SB/SB2 3006-3 series in a control cabinet (example: PSS SB 3006-3 DP-S), dimensions stated in mm (")



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## Notes



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# Supply Voltage

## General requirements

Please note the following:

- When selecting the power supply, please refer to the requirements stated under “Technical Details”.

**INFORMATION**
When test pulse outputs are used, the output circuits are designed to guarantee maximum safety. To achieve this, extensive tests are carried out internally. If the supply voltage is interrupted during a test function, the relevant test pulse output will be deemed to be defective.
The normal error reaction will occur: the PSS switches to a STOP condition.
Remedy: buffer the PSS supply voltage.

- Overvoltage and spikes of interference outside the specifications can damage the PSS. In this case the PSS will switch to a safe condition. You should therefore ensure that appropriate EMC measures are taken.
- To achieve the lowest possible residual ripple (< ± 1.2 V), we recommend that you install a three-phase bridge rectifier or regulated supply.
- The fuse between an external power supply and the PSS protects the external supply. The size of the fuse will depend on the specification of the external power supply, the cable cross section and on local regulations.

**WARNING!**

Electric shock!
Safe electrical isolation must be ensured for the external 24 V supply. Failure to do so could result in electric shock. Power supplies must conform to EN 60950, 03/97, section 2.3, EN 60742, 9/95 or EN 50178, 10/97.



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# Supply Voltage

- Connecting the external power supply on programmable safety systems **without an INTERBUS interface**
  - The external power supply should be connected to the PSS as shown in Fig. 6-1.

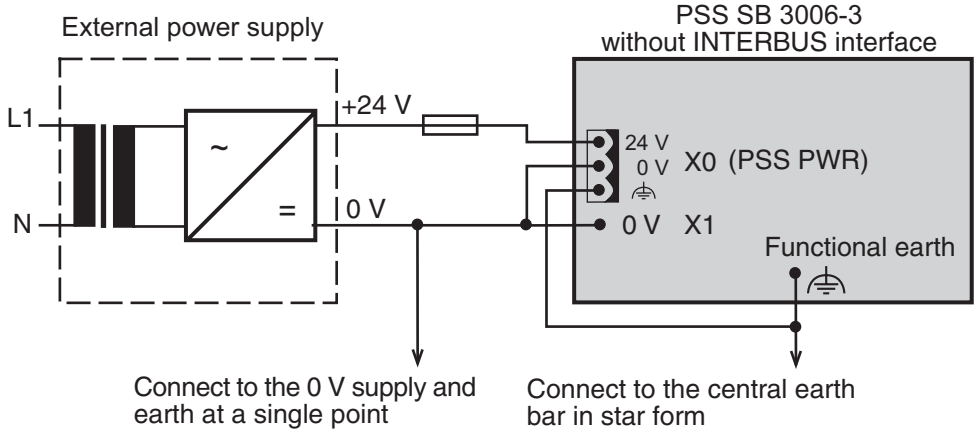



Fig. 6-1: Supplying programmable safety systems from the PSS SB 3006-3 series

- The programmable safety system (“PSS PWR”) requires a 24 VDC supply. Check that the voltage supplied from the external power supply corresponds.
- The external 24 V supply must be able to provide a current of max. 550 mA plus load currents taken from the test pulse outputs and load currents for SafetyBUS p fibre-optic couplers (25 mA per fibre-optic coupler).

**CAUTION!**

The maximum permitted load current at connector X0 should not be exceeded. Connector X0 should therefore be fused (see Fig. 6-1).



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- Connecting the external power supply on programmable safety systems **with an INTERBUS interface** and **a common supply**
  - If the PSS supply and the INTERBUS interface are fed from a common power supply, the external supply should be connected as shown in Fig. 6-2.

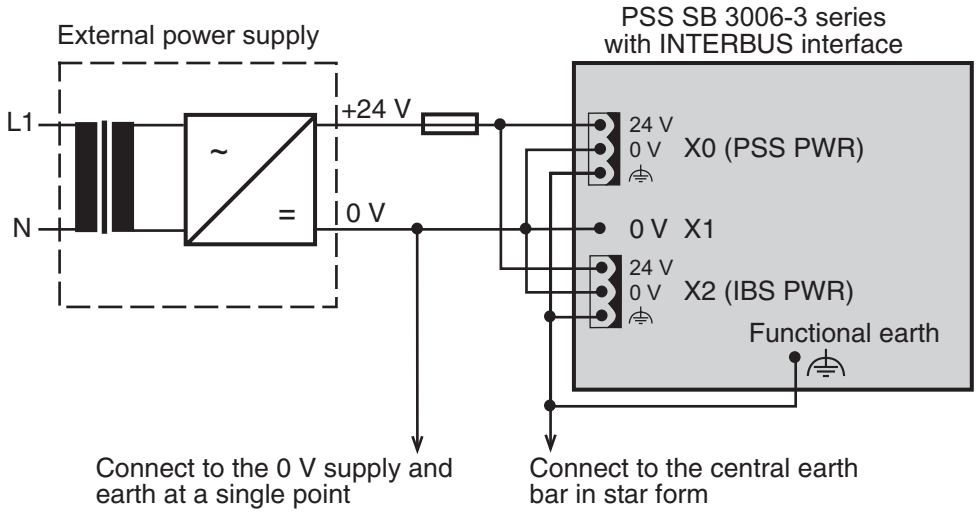



Fig. 6-2: Supplying the programmable safety system and INTERBUS interface (common power supply)

  - The external 24 V supply must be able to provide a current of max. 550 mA for the PSS and 150 mA for the INTERBUS interface, plus load currents taken from the test pulse outputs and load currents for SafetyBUS p fibre-optic couplers (25 mA per fibre-optic coupler).

**CAUTION!**

The maximum permitted load current at connector X0 should not be exceeded. Connector X0 should therefore be fused (see Fig. 6-2).



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- Connecting external power supplys on programmable safety systems **with an INTERBUS interface** and **a separate supply**
  - If the PSS supply and the INTERBUS interface are fed from separate supplies, the two external supplies should be connected as shown in Fig. 6-3.

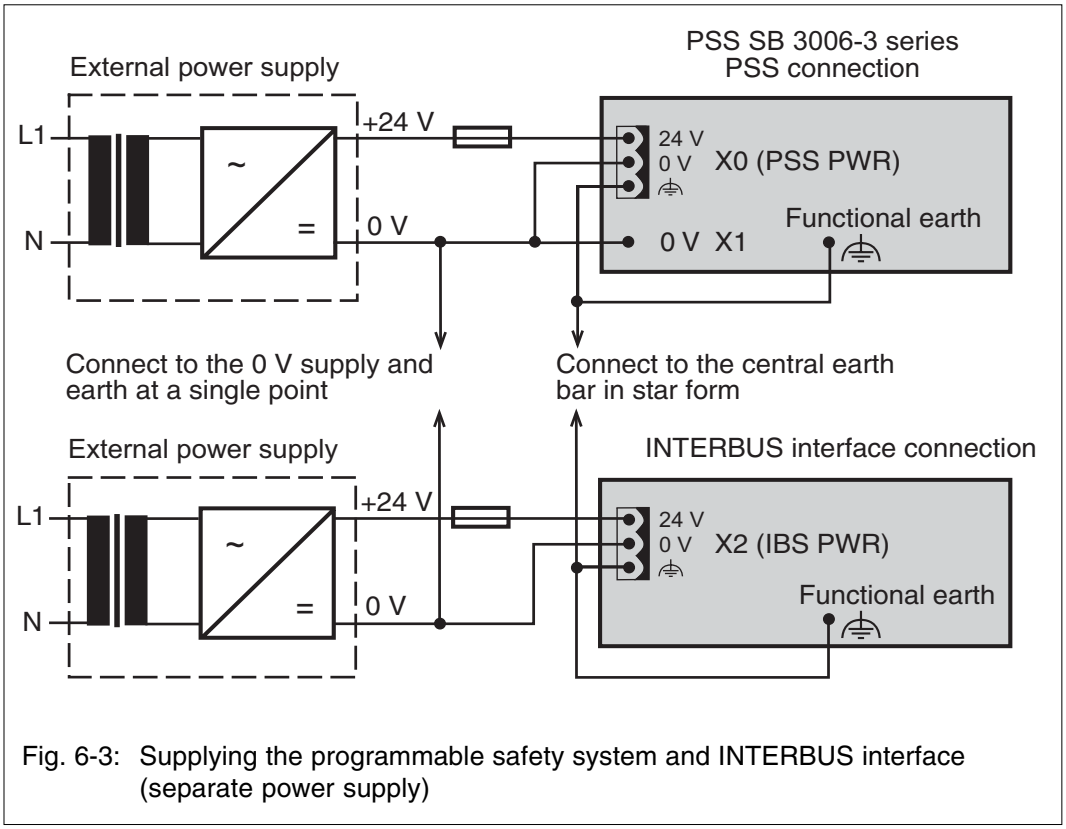



Fig. 6-3: Supplying the programmable safety system and INTERBUS interface (separate power supply)

- The external 24 V supply for supplying the PSS must be able to provide a current of max. 550 mA plus load currents taken from the test pulse outputs and load currents for SafetyBUS p fibre-optic couplers (25 mA per fibre-optic coupler).
- The external 24 V supply for supplying the INTERBUS interface must be able to provide a current of 150 mA.

**CAUTION!**

The maximum permitted load current at connectors X0 and X2 should not be exceeded. Connectors X0 and X2 should therefore be fused (see Fig. 6-3).



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- **NOTICE**
  There must be no direct connection between “N” and the 0 V output on the external power supply or external power supplies!

- Connect together the 0V connections on all the 24 V power supplies and earth the 0 V mains at a single point. The connection of the 0 V supply to the central earth bar or earth fault monitor must be in accordance with relevant national regulations (e.g. EN 60204-1, NFPA 79:17-7, NEC: Article 250).

**INFORMATION**
If the inputs on the PSS are being used with test pulses, connect L- on the input device supply to the 0 V terminal for the supply voltage (connector X0). Please refer to Chapter 7, “Wiring the Inputs and Test Pulse Outputs”.



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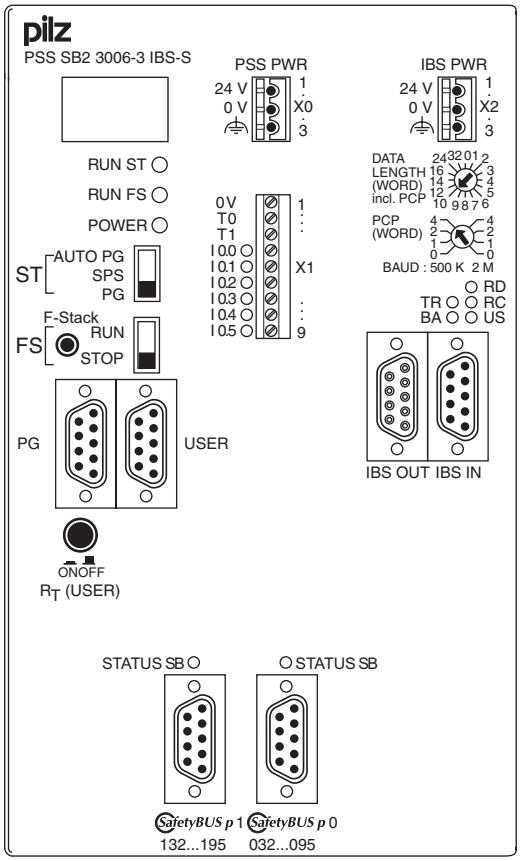
## Notes on wiring

- Minimum range for cable cross sections on field connection terminals in $mm^2$, in accordance with EN 61131-2, 07/00:
  - Power supply: 1.5 (AWG16) ... 2.5 (AWG12)
  - Functional earth: 1.5 (AWG16) ... 2.5 (AWG12)
- Use copper wiring.
- The torque setting on the terminals should be 0.5 … 0.6 Nm.



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## Configuration of the screw terminals and connector description




**Supply voltage**

**X0** PSS PWR

**X2** IBS PWR
(only on PSS with INTERBUS interface)

**Digital inputs**

**X1** I0.0 ... I0.5

**Test pulse outputs**

**X1** T0 and T1

Fig. 7-1: Terminal configuration on programmable safety systems from the PSS SB 3006-3 series (example: PSS SB2 3006-3 IBS-S)



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# Wiring the Inputs and Test Pulse Outputs

## Notes on wiring

Where safety-related applications are concerned, it is essential that short circuits and open circuits are unable to cause a hazardous condition within a plant.

The way in which this is done will depend on the degree of hazard within the plant itself, the switching frequency of the input devices and the level of safety of the input devices and actuators. You should assess these points in conjunction with the relevant standards or approvals body (e.g. BG or TÜV).

Please observe the following when wiring:

- Earthing:
  - Connect the housing to the central earth bar.
  - A cable cross section of at least 2.5 $mm^2$ should be used.
  - Connections should be kept as short as possible.
- Open circuits, short circuits and earth faults:
  - In principle it is possible to eliminate short circuits between signals within electrically-enclosed areas and also outside electrically-enclosed areas when the signals are conducted in different multicore cables. However, all components must meet the relevant regulations in accordance with EN, DIN and VDE.
  - Open circuits and earth faults cannot be eliminated.
  - On multi-channel input devices with frequent operation, short circuits and open circuits can be detected via feasibility checks in the control program.
  - The input test on the programmable safety system uses test pulses to enable the system's operating program to carry out a test to detect open circuits and short circuits.



**NOTICE**
Please read the description that accompanies the connection examples! The connection examples can be found on the following pages.



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- Connecting and laying the cables
  - Screened cables are not required for digital I/Os. However, if the connection cables have screening, it should be connected at one end.
  - Minimum range for cable cross sections on field connection terminals in $mm^2$, in accordance with EN 61131-2, 07/00:
    - ¤ Digital inputs: 0.5 (AWG20) ... 1.5 (AWG16)
    - ¤ Test pulse outputs: 0.5 (AWG20) ... 1.5 (AWG16)
    - ¤ Power supply: 1.5 (AWG16) ... 2.5 (AWG12)
    - ¤ Functional earth: 1.5 (AWG16) ... 2.5 (AWG12)
  - If you use a multi-strand cable with a cross section of 1.5 $mm^2$ to connect the inputs and test pulse outputs, you will need to use ferrules conforming to DIN 46228, Part 1 and Part 2 0.5 ... 1.5 $mm^2$, Form A or C. To crimp the ferrules you can use crimp pliers (crimp form A or C) conforming to EN 60947-1, such as the PZ 1.5 or PZ 6.5 from Weidmüller, for example.
  - Use copper wiring.
  - The torque setting on the terminals should be 0.5 … 0.6 Nm.

The terms “signal inputs with frequent operation” and “single-channel safe input devices” are used in the wiring examples. These terms are defined as follows:

- Signal inputs with frequent operation
  These are signals which change status on several occasions within a period of time.
- Single-channel safe input devices
  These are positively-driven, normally-closed contacts which open on actuation (failsafe principle).



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# Wiring the Inputs and Test Pulse Outputs

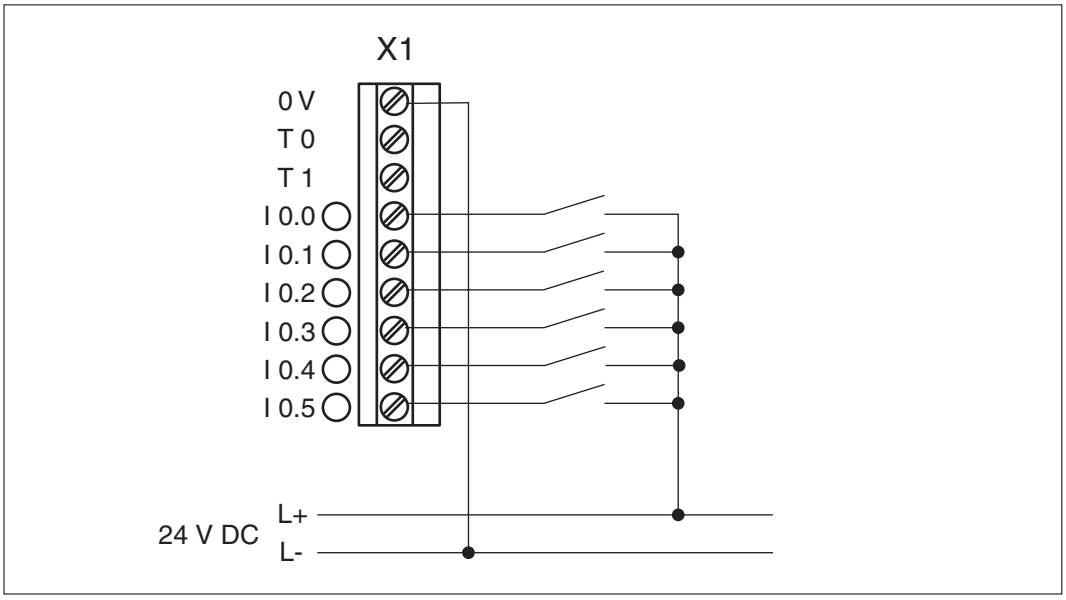
## Digital inputs (DI2)

Features:

- 6 digital inputs I0.0 ... I0.5
- Only input signals which operate in accordance with the failsafe principle (on switching off) are safety-related.
- Signals may be connected using unscreened cables.
- Connect the 0 V terminal.
- Inputs are **not** galvanically isolated.

**CAUTION!**

The connection shown below is only approved for non-safety-related input devices. The connection of safe input devices is described later in the chapter.




**Please ensure safety regulations and EMC guidelines are met!**



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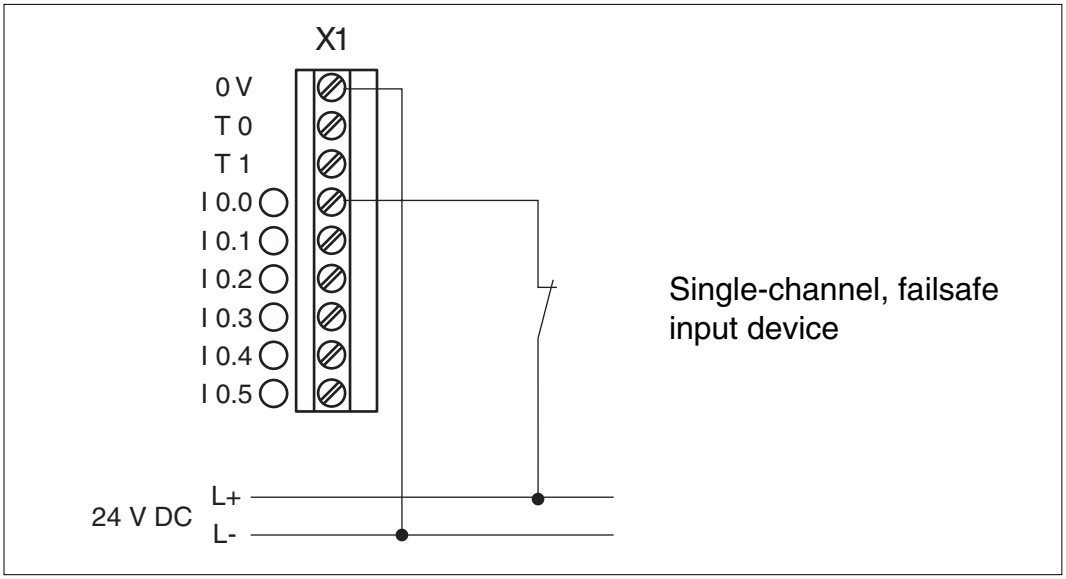
## Example: Single-channel, failsafe input device, without test pulse

Features:

- The input device must be approved for failsafe applications.
- Please read the instructions provided with the input device.

**CAUTION!**

A short circuit in the cable between the input device and input with the 24 VDC line or between adjacent inputs will not be detected. Depending on the type of input device connected, this could create a risk to both personnel and machinery (e.g. E-STOP). Always ensure that the unit is suitably wired to eliminate the risk of short circuits.




**Please ensure safety regulations and EMC guidelines are met!**

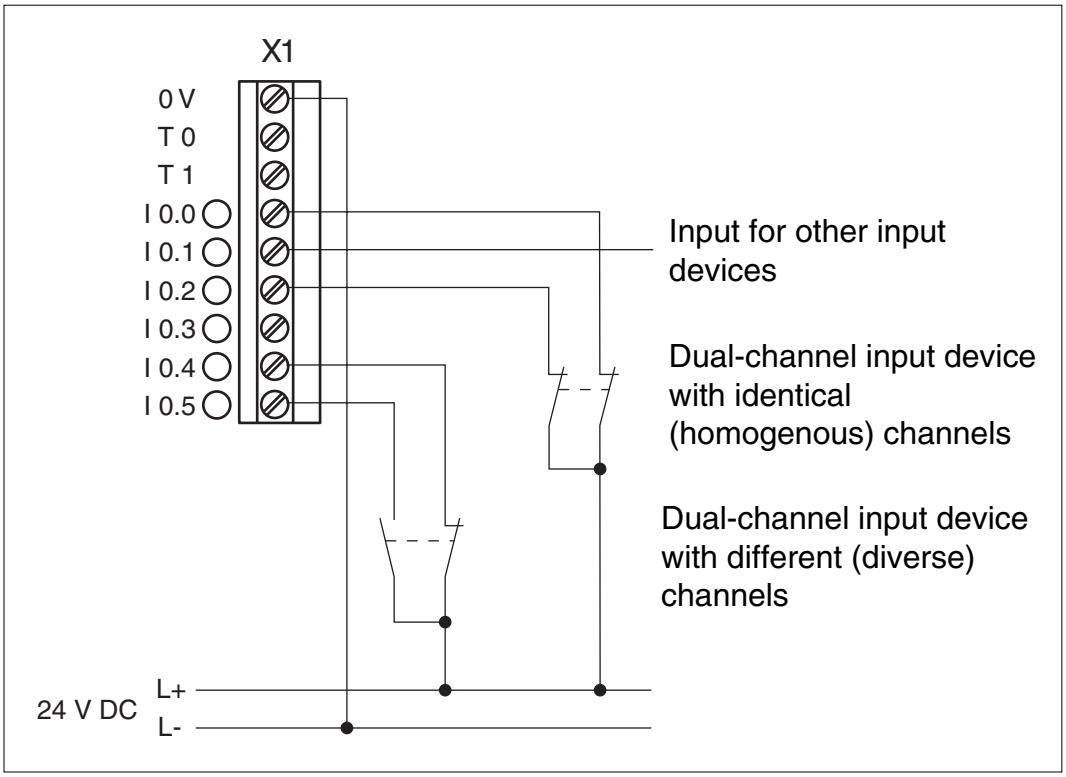


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## Example: Dual-channel input devices, without test pulses

Features:

- This type of connection is mainly used for signal inputs with frequent operation.
- The functionality of both input device channels should be monitored in the application program via feasibility checks (see example in the Programming Manual for the PSS-range).
- The possibility of a short circuit occurring between adjacent connector terminals cannot be eliminated. For this reason, the two identical (homogenous) channels on an input device must **not** be connected to adjacent inputs.
- If you are using input devices with different (diverse) channels, adjacent inputs may be used. Short circuits will be detected in the user program via the feasibility check (see example in the Programming Manual).




**Please ensure safety regulations and EMC guidelines are met!**

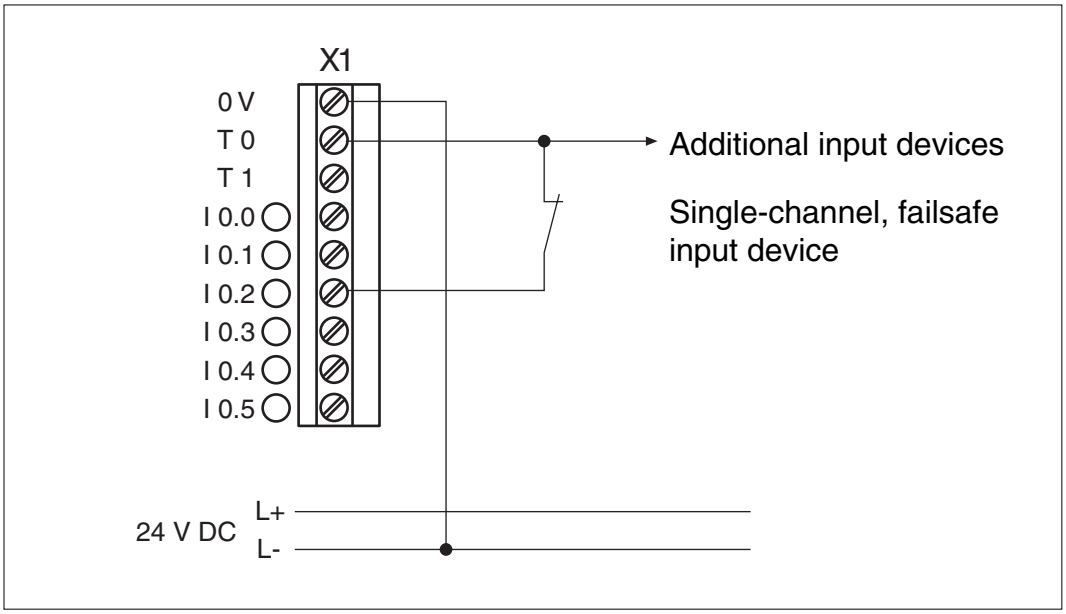


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## Example: Single-channel, failsafe input device, with test pulse

Features:

- The input device must be approved for failsafe applications.
- Please read the instructions provided with the input device.
- The test pulse must be allocated to the input via the configurator on the programming device (see Programming Manual for the PSS-range).
- Short circuits between the cable from the test pulse to the input device and the cable from the input device to the input will **not** be detected.
- Only single-channel safe input devices, i.e. positively-driven normally-closed contacts which operate according to the failsafe principle, can be tested.




**Please ensure safety regulations and EMC guidelines are met!**

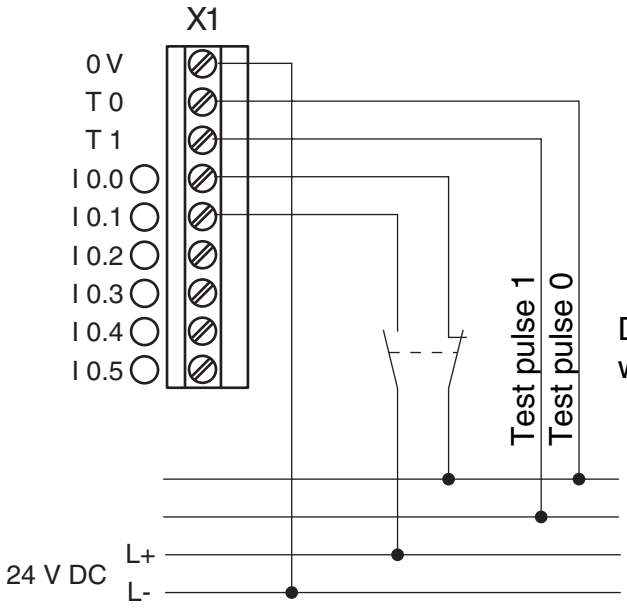


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## Example: Dual-channel, failsafe input device, with test pulses

Features:

- This type of connection is mainly used for signal inputs with infrequent operation.
- The test pulse must be allocated to the input via the configurator on the programming device (see Programming Manual for the PSS-range).
- On input devices with identical channels, each channel should be given a separate test pulse, where possible. This will ensure that all short circuits are detected, with the exception of short circuits which short out the input device (cable from the test pulse to the input device and cable from the input device to the input).
- If the input device has only one test pulse, a short circuit between the cables from the input device to the inputs will **not** be detected. In this case the unit should be suitably wired to avoid the risk of this type of short circuit. If diverse input devices are used, this type of error will be detected.

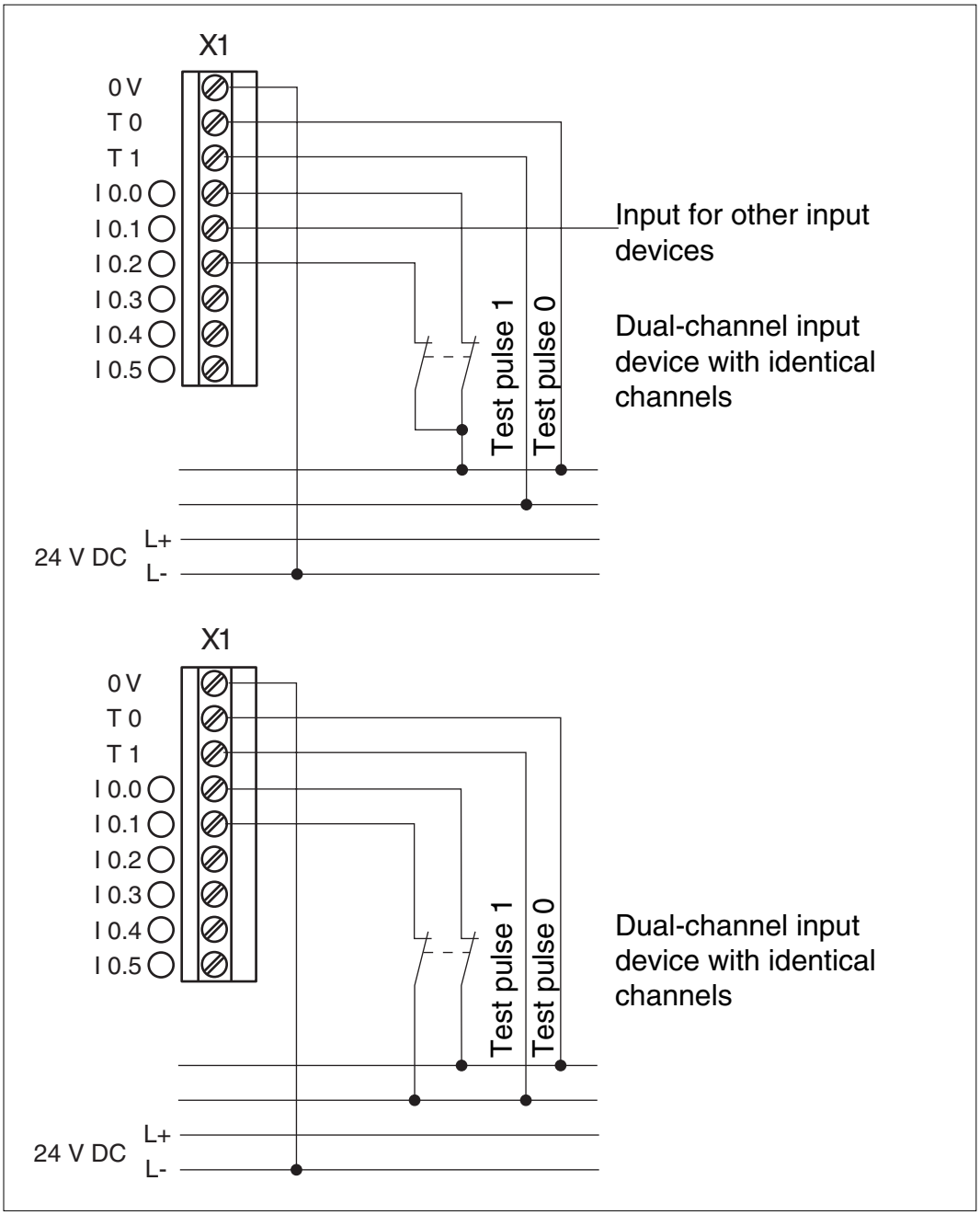



Dual-channel input device with diverse channels

Continued overleaf …



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**Please ensure safety regulations and EMC guidelines are met!**

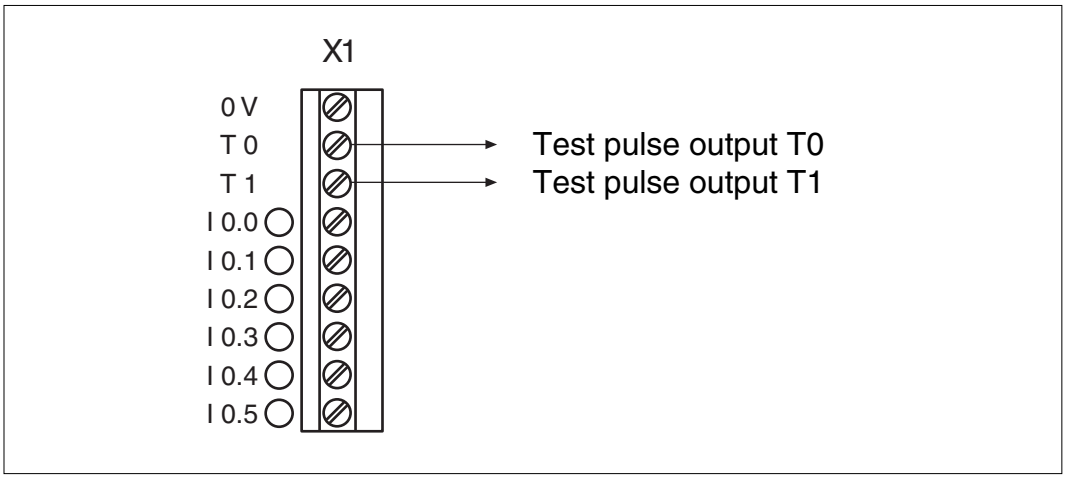


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## Dedicated test pulse outputs

Features:

- 2 test pulse outputs T0 and T1
- The test pulse must be allocated to the input via the configurator on the programming device (see Programming Manual for the PSS-range).
- Test pulses cannot be addressed via the PSS process I/O-image.
- Test pulses must only be used for test signals.




**Please ensure safety regulations and EMC guidelines are met!**



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# Interfaces

## General requirements

We recommend you use screened cable for the RS 232/RS 485 interfaces. If unscreened cables are used, the interfaces may malfunction.

- Earth the cable screening on both sides (e.g. on a bus bar).
- If you are using longer cables and there is the possibility of transient currents, you can prevent these by using equipotential bonding cables. If you are unable to use equipotential bonding cables, connect the screening at one end.



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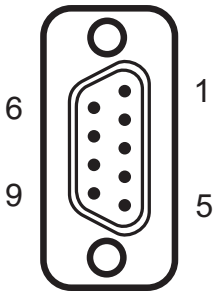
# Interfaces

## Programming device interface (“PG”)

The programming device interface is a combined RS 232/RS 485 interface. Both interfaces are available on a male 9-pin D-Sub connector. The interface enables communication between the programming device and the PSS.
The termination can be activated via links within the connector (see Fig. 8-3 in the section entitled “RS 485 programming device interface”).

**NOTICE**
Never operate the combined RS 232 and RS 485 interface simultaneously or in parallel. The programmable safety system is not designed for this.

**Male D-Sub connector**
9-pin




| RS 232 | RS 485 |
|---|---|
| 1: RxD | 2: R1 |
| 5: GND | 3: B |
| 6: TxD | 4: R2 |
| | 5: GND |
| | 7: A |
| | 8: R3 |

Fig. 8-1: Configuration of the programming device interface



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## Programming device interface RS 232

The RS 232 interface for connecting the programming device is provided in a minimum configuration. The connections TxD, RxD and GND are available.

**INFORMATION**
To connect the PSS to the programming device via the RS 232 interface you will need a cable with a layout as shown in Fig. 8-2. This cable is available under order number 301 960.
A null modem cable can also be used; this is connected to the programming device interface using a special adapter. This adapter is available under order number 311 080.

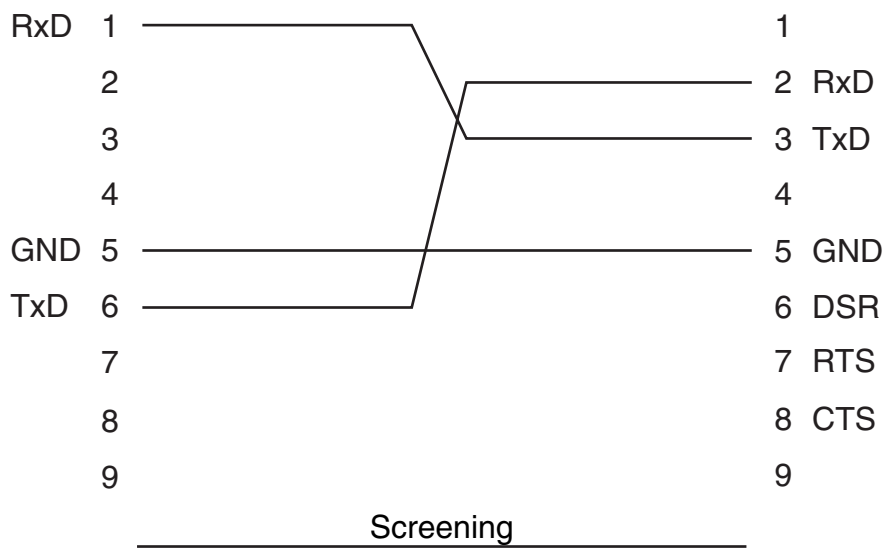



Fig. 8-2: Connection cable between programming device and PSS



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### Programming device interface RS 485

If you need to cover longer distances between the programming device and PSS (from approx. 15 m), use the RS 485 interface on the PSS.
If the programming device has **no** RS 485 interface, connect the RS 485 interface on the PSS to the RS 232 interface on the programming device via the C-PC-PAP-2 interface adapter (order no. 305 155).
To connect the PSS to the programming device or to the interface adapter, you will need a cable with a layout as shown in Fig. 8-3. This cable is available under order number 374 205. It contains all the necessary links.

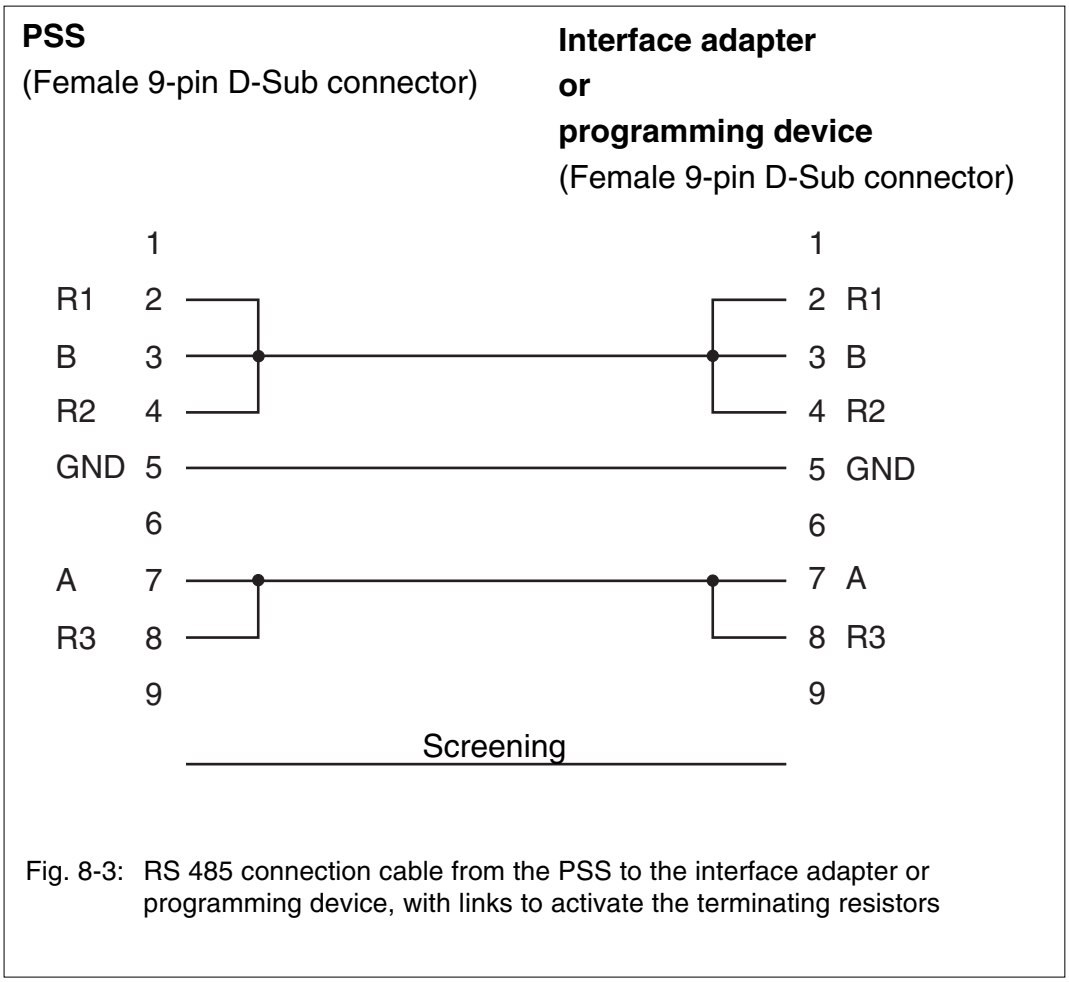



Fig. 8-3: RS 485 connection cable from the PSS to the interface adapter or programming device, with links to activate the terminating resistors



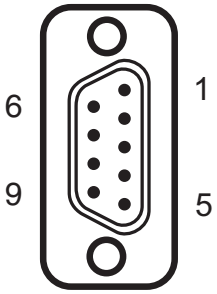
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## User interface (“USER”)

The user interface is a combined RS 232/RS 485 interface. Both interfaces are available on a male 9-pin D-Sub connector.

**NOTICE**
Never operate the combined RS 232 and RS 485 interface simultaneously or in parallel. The programmable safety system is not designed for this.

**Male D-Sub connector**
9-pin




| RS 232 | | RS 485 | |
|---|---|---|---|
| 2: | RxD | 1: | A |
| 3: | TxD | 5: | GND |
| 4: | DTR | 9: | B |
| 5: | GND | | |
| 6: | DSR | | |
| 7: | RTS | | |
| 8: | CTS | | |

Fig. 8-4: Configuration of the user interface



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## User interface RS 232

A detailed description of the interface can be found in the “FS System Description” and “ST System Description” in the PSS-range manual package.

**INFORMATION**
To connect PX(T) display systems, PMI graphics systems and the Pilz MPI adapter to the RS 232 user interface on the PSS you will need a cable with a layout as shown in Fig. 8-5. This cable is available under order number 301 965. The cable is not suitable for connecting a PX 20 (see operating manual PX 20).

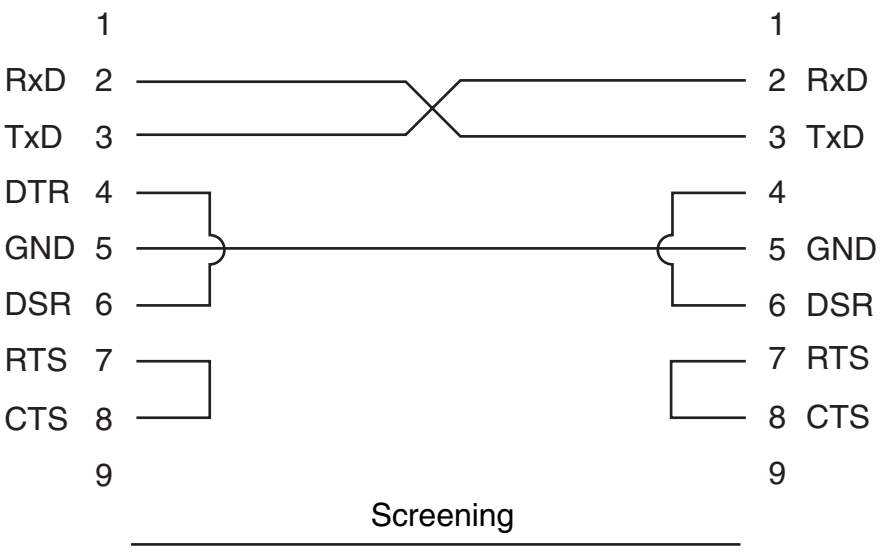



Fig. 8-5: RS 232 connection cable from the PSS to a PX(T) display system for example



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## User interface RS 485

A detailed description of the interface can be found in the “FS System Description” and “ST System Description” in the PSS-range manual package.

The RS 485 interface has internal termination: 120 Ohm between A and B, 270 Ohm between A and 5 V and between B and GND.

The termination on the RS 485 user interface can be switched off. To do this, press the **$R_T$ (USER)** button on the front of the module to the OFF position. This will enable you to build up an RS 485 network.

| **Button $R_T$ (USER)** | **Status** | **Key** |
|---|---|---|
|  | Button operated, ON position | Terminating resistors are connected |
|  | Button not operated, OFF position | Terminating resistors are disconnected |



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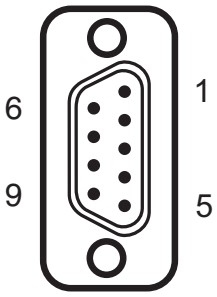
# Interfaces

## SafetyBUS p interface (“SafetyBUS p 0” and “SafetyBUS p 1”)

Connection to SafetyBUS p is via a male 9-pin D-Sub connector. Detailed information on SafetyBUS p can be found in the SafetyBUS p manual.

**Male D-Sub connector**

9-pin




1: n.c.
2: CAN_L (brown)
3: CAN_GND (white)
4: n.c.
5: CAN_SHLD
6: n.c.
7: CAN_H (green)
8: Supply voltage for fibre-optic couplers from Pilz
9: n.c.

n.c. = not connected

Fig. 8-6: Configuration of the SafetyBUS p interface

## Interfaces for standard bus connections

The standard bus interfaces are described in separate operating manuals. The necessary operating manuals are supplied with each programmable safety system in the PSS SB2 3006-3 series, depending on the unit type.



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# Operation and Maintenance

## Commissioning

- Install the programmable safety system as described in Chapter 5, “Installation”.
- Connect the inputs and test pulse outputs as described in Chapter 7, “Wiring the Inputs and Test Pulse Outputs”.
- Supply voltage for the PSS - as described in Chapter 6 “Supply Voltage” - connect and switch on.

## Faults

**PSS and SafetyBUS p functionality**
If a fault occurs on the safety system or there is a wiring error, the PSS will switch to a STOP condition and output a message to the display. All the decentralised outputs in the I/O-Groups that are assigned to the LD on the PSS will also be switched off.
The error stack display in the system software (e.g. PSS-WIN-PRO) can be used to locate the error. The description for error evaluation can be found in the “FS System Description” in the PSS-range manual package.

**Standard bus functionality**
Various options are available, should a standard bus interface not achieve the correct operating status:

- Evaluation of the relevant LEDs for operating status
  (see operating manual for the relevant standard bus system)
- The drivers (standard function blocks) of the standard bus systems will provide some diagnostic options (see operating manual for the relevant software package).
- Bus diagnostics via a corresponding network analyzer
  Network analyzers from various companies are available for the different bus systems. Further information can be found in the operating manual for the relevant analyzer.



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# Operation and Maintenance

## Display elements

### PSS functionality

| LED | Signal | Key |
|---|---|---|
| RUN ST | Off | Standard section of PSS in “STOP” |
| | Lights green | Standard section of PSS in “RUN” |
| RUN FS | Off | Failsafe section of PSS in “STOP” |
| | Lights green | Failsafe section of PSS in “RUN” |
| | Flashes green | Major error<br>Remedy: Read the error stack, switch off the PSS, rectify the error, switch on the PSS |
| POWER | Lights green | The internally-generated 5 V supply is within the permitted range. |
| I0.0 ... I0.5 | Off | Input has status “0” |
| | Lights green | Input has status “1” |

### SafetyBUS p functionality

**LED “STATUS SB”**
The LED lights as soon as the connection to SafetyBUS p is made.

### Standard bus functionality

Various operating and fault statuses are displayed via the LEDs on the various standard bus interfaces (see operating manual for the relevant standard bus system).



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## Changing the battery

If the battery voltage drops below 2.5 V, the CPU will issue the error message “S-04”. You should then change the battery, Only use a battery type that has been approved by Pilz (see chapter entitled “Technical Details”). Battery types that are approved by Pilz are “UL-Recognized”.



**CAUTION!**

- Damage due to electrostatic discharge!
  Electrostatic discharge can damage components on the safety system. Ensure against discharge before touching the PSS, e.g. by touching an earthed, conductive surface or by wearing an earthed armband.
- Data loss!
  The battery should be changed when the supply voltage is switched off. The CPU will retain data for approx. 2 minutes. If it takes longer to change the battery, data will be lost.



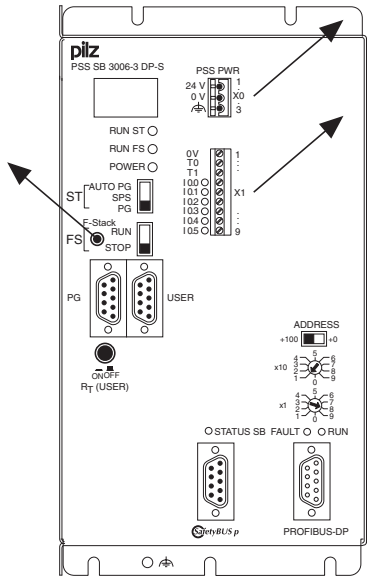
**WARNING!**

Risk of injury due to improper handling or due to damaged lithium batteries!
Lithium batteries may only be exchanged by specialist staff who have been trained to deal with lithium batteries.

Dead batteries must be disposed of properly!



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Switch off the supply voltage, remove connector and terminal blocks.

Remove the cap from the “F-STACK” button.

Fig. 9-1: Changing the battery, part 1 (example: PSS SB 3006-3 DP-S)

**CAUTION!**

Adverse effect on the safety functions!
Please ensure that no metal parts get into the open PSS system, as this could adversely affect the system’s safety functions. Please proceed with care!



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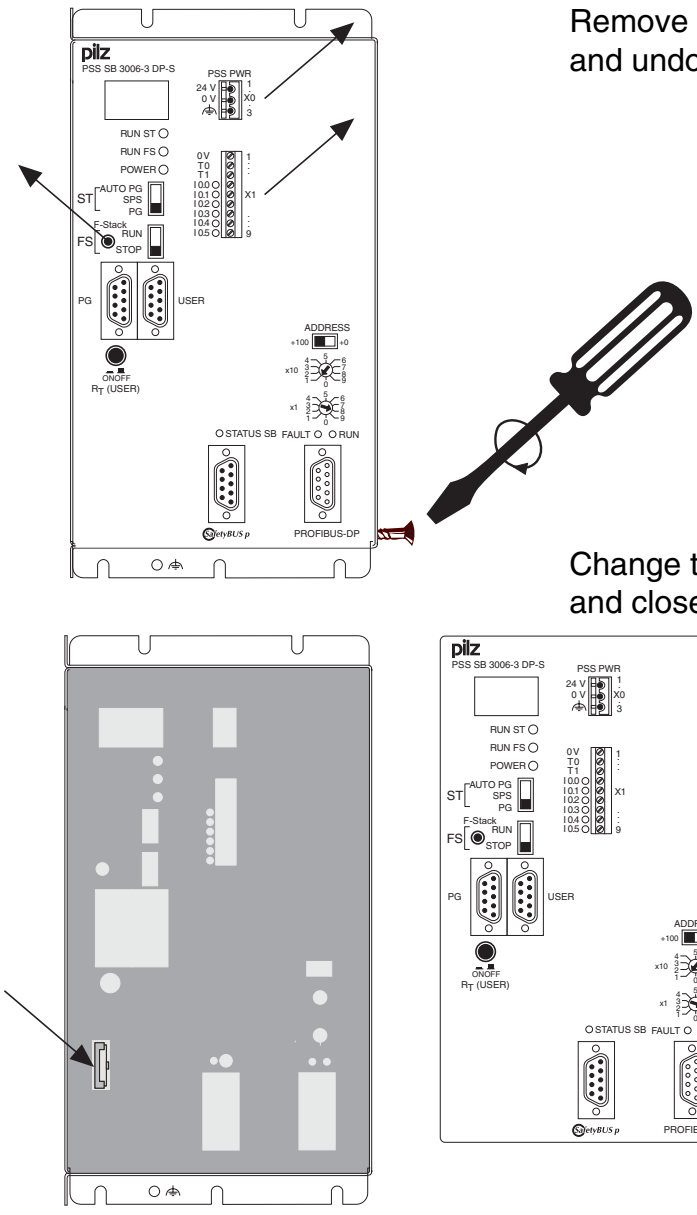


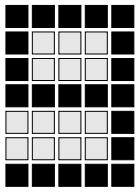

Fig. 9-2: Changing the battery, part 2 (example: PSS SB 3006-3 DP-S)

**NOTICE**

Make sure all the screws are tightened up securely, to ensure the housing is properly connected to the functional earth.



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## Notes



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| | |
|---|---|
| **Electrical data** | |
| Supply voltage | 24 VDC |
| Tolerance | 20 ... 30 VDC including residual ripple of max. ± 1.2 V |
| Current consumption | |
| “PSS PWR” | Max. 850 mA plus load currents taken from the test pulse outputs and load currents for SafetyBUS p fibre-optic couplers (25 mA per fibre-optic coupler) |
| “IBS PWR” | Max. 150 mA (where available) |
| Power dissipation | Max 20.5 W |
| **CPU** | |
| Processing time for 1000 instructions | Typ. 0.5 ms |
| Real-time clock | Quartz-driven clock in standard section |
| Alarm processing | Max. 32 alarms in failsafe section |
| Flags | |
| Failsafe section | 5184 |
| Standard section | 2048 |
| Times | 64 in both FS and ST section |
| Time base | 50, 100 ms; 1, 10, 60 s |
| Counter | 64 in both FS and ST section |
| Data memory | |
| Failsafe section | 64 kByte, **non**-retentive |
| Standard section | 170 KByte, non-volatile (battery) |
| Program memory | |
| Failsafe section | Integral 512 kByte Flash memory |
| Standard section | Integral 512 kByte Flash memory |
| Display | 4-digit |
| Interfaces | Galvanically isolated:<br>Combined RS 232 (with minimum configuration)/RS 485 interface for programming device,<br>Combined RS 232/RS 485 as user interface (termination for RS 485 is selectable)<br>SafetyBUS p and standard bus interfaces (depending on the unit type) |



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# Technical Details

| | |
|---|---|
| Battery<br>Service life | Lithium, Type CR2477N (see accessories)<br>ca. 2 years |
| **SafetyBUS p** | |
| Application range | Failsafe applications conforming to<br>EN 954-1, 03/97, DIN V 19250, 05/94<br>VDE 0116, 09/97 |
| Status indicator | LED |
| Transmission rate | Max. 500 kBit/s |
| Cable runs | Max. 3500 m |
| Transmission type | Differential two-wire cable,<br>Fibre-optic cable via fibre-optic coupler |
| Connection | Male 9-pin D-Sub connector |
| **Integral on-board inputs** | |
| Number of inputs | 6 |
| Galvanic isolation | No |
| Potential isolation | No |
| Polarity protection | Yes |
| Connection type | Screw connector |
| Status indicator | LED |
| High signal level (“1”) | +15 ... +30 VDC |
| Low signal level (“0”) | -3 ... +5 VDC |
| Input current | Typ. 6 mA |
| Input delay | < 1 ms |
| Pulse suppression | ≤ 300 µs<br>(requirement: in the PSS Configurator, ≥ 3 ms must be configured under “Max. delay of digital inputs” and/or “DI test time”.) |
| **Dedicated test pulse outputs** | |
| Number | 2 |
| Output current at signal level “1” | 0.5 A |



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| Environmental data | |
|---|---|
| Protection type (EN 60529, 02/00) | IP20 |
| Mounting position | Vertical |
| Ambient temperature (EN 60068-2-14, 11/99) | 0 ... 60 °C |
| Storage temperature (EN 60068-2-1/-2, 07/94) | -25 ... +70 °C |
| Climatic suitability (EN 60068-2-78, 10/01) | 93 % r.h. at 40 °C |
| Condensation | Not permitted |
| Vibration (EN 60068-2-6, 04/95) | Frequency range: 10 ... 57 Hz<br>Amplitude: 0.075 mm<br>Frequency range: 57 ... 150 Hz<br>Acceleration: 1g |
| Shock (EN 60068-2-27, 03/93) | 15g, 11 ms |
| Continuous shock (EN 60068-2-29, 04/93) | 10g, 16 ms |
| EMC | EN 61000-6-2, 10/01<br>EN 61000-6-4, 10/01 |
| **Mechanical data** | |
| Weight | 2200 g |
| Dimensions (H x W x D) | 246 x 123 x 161 mm |

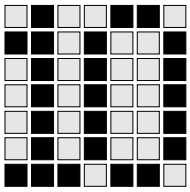
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## Accessories

| Battery | **Order no.** |
|---|---|
| Lithium Type CR2477N<br>3.0 V 950 mAh | 300 930 |



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## Notes



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# Appendix

## Address of SafetyBUS p Club

SafetyBUS p Club International e.V.
Robert-Bosch-Straße 30
D-73760 Ostfildern
Germany
Tel. No.: +49 7 11 34 09-1 18
Fax No.: +49 7 11 34 09-4 49
E-Mail: info@safetybus.com

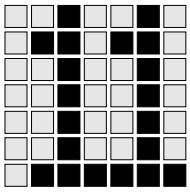
## Changes in the documentation

### Changes in Version 21 143-02

| Old page | New page | Change |
|---|---|---|
| - | 3-2 | New: section "Product modifications" |



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## Notes



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