

**Programmable
Safety Systems PSS®-Range**



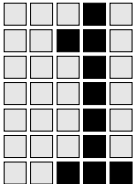
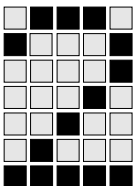
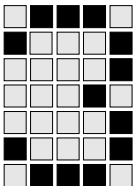
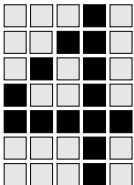
PSS SB BRIDGE

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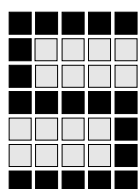
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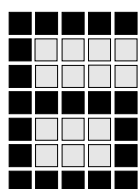
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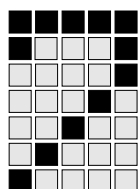
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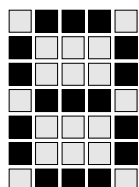
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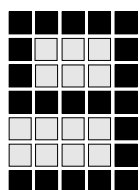
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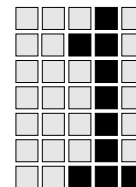
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Introduction

This operating manual describes the “PSS SB BRIDGE”. The Bridge is used in SafetyBUS p networks.

To fully understand this manual you will need to be conversant with the information found in the general documentation for the SafetyBUS p PSS-range. In particular you should read the SafetyBUS p System Description and SafetyBUS p Installation Manual.

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

Overview of manual

This manual is divided into the following chapters:

1 Introduction

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

2 Overview

This chapter provides a brief overview of the module’s most important features and its application range.

3 Safety

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

4 Function Description

The function description contains detailed information on how the module operates.

5 Configuration

This chapter describes the special features which need to be considered when configuring a SafetyBUS p system using a Bridge.

4 Installation

This chapter describes how to install the module.

7 Commissioning and Operation

This chapter describes the different requirements and options when commissioning and operating the module.

8 Technical Details

9 Appendix

Introduction

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.



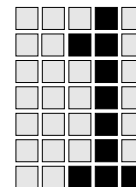
NOTICE

This describes a situation in which the product or devices in its immediate environment could be damaged. It also provides information on preventive measures that can be taken.



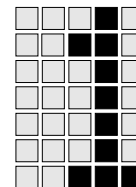
INFORMATION

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



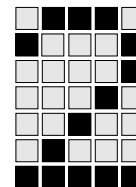
Terminology

- The term “PSS” is used as the generic term for all applicable PSS programmable safety systems.
If the description only relates to a specific system, the product name of that system will be used (e.g. PSS 3000, PSS 3100).
- The term “Programming device” is used as the generic term for the system software “PSS SW PG” and “PSS WIN-PRO”.
If the description only relates to a specific system software, that specific product name will be used.



Introduction

Notes



Overview

The “PSS SB BRIDGE” is a Bridge designed for use in SafetyBUS p networks. It is suitable for connecting two independent SafetyBUS p networks. The general rules for building a SafetyBUS p network apply to each of the two independent networks (see “SafetyBUS p Installation Manual”).

The Bridge is a safety-related device, with a two-channel structure.

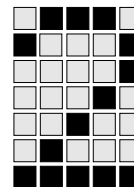
Using a Bridge or several Bridges has the following advantages for the whole system:

- Increases the max. number of bus subscribers
A max. of 64 bus subscribers (including PSS SB BRIDGE) can be managed in each of a Bridge’s two independent SafetyBUS p networks.
- Increases the max. transmission rate (depending on cable runs)
By dividing a SafetyBUS p system into two or more independent networks, with 100 m cable runs the max. transmission rate of 500 kBit/s can be achieved in each network, for example.
- Increases availability, as error management is carried out independently in each SafetyBUS p network.

Range

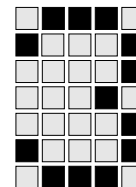
The hardware package consists of:

- One Bridge
PSS SB BRIDGE
- One operating manual
PSS SB BRIDGE
- One standard function block SB251
PSS SB BRIDGE



Overview

Notes



Safety

Intended use

The “PSS SB BRIDGE” is designed for use in SafetyBUS p systems.

Specific data for the Bridge is given in the chapter entitled “Technical Details”. Use of the device outside the specifications given here will be deemed as improper use.

Any component, technical or electrical modifications to the Bridge will be deemed as improper use. The approval will also be invalidated.

Use of the Bridge outside the areas described in this manual will be deemed as improper use.

Intended use includes following the information in this manual.

The “PSS SB BRIDGE” is a safety-related device.

PSS CPU versions

Please note that, on the PSS-range of programmable safety systems listed below, the Bridge is only supported from the CPU versions stated:

- Modular programmable safety systems from the PSS-range:
 - PSS SB CPU from Version 1.5 onwards
 - PSS1 SB CPU from Version 1.5 onwards
- Compact programmable safety systems from the PSS-range:
 - PSS SB 3006 DP-S from Version 1.0 onwards
 - PSS SB 3006 IBS-S from Version 1.3 onwards
 - PSS SB 3056 from Version 1.3 onwards



INFORMATION

Please note that the Bridge may only be operated with SB 251, otherwise the approval will be rendered invalid.

Programming device versions

Please note that use of the Bridge in a SafetyBUS p architecture is only supported by the PSS SW PG system software from Version 4.3 onwards.

Safety

EMC

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

ESD



CAUTION!

Electrostatic discharge can damage components on the device. Ensure against discharge before touching the device, e.g. by touching an earthed, conductive surface or by wearing an earthed armband.

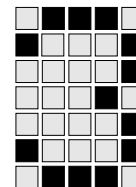
Warranty and liability

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

- The module 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 trained or sufficiently qualified
- The housing was opened
- Any type of modification has been made (e.g. exchanging components on the PCB boards, soldering work etc.).

Disposal

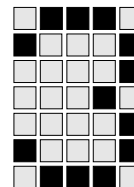
The module must be disposed of properly when it reaches the end of its service life.



Safety guidelines

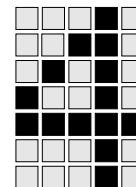
Information and requirements stated in the “SafetyBUS p Installation Manual” and “PSS SB BRIDGE Installation Manual” are also valid for use with the Bridge (see System Manual for the “SafetyBUS p-range”).

Failure to keep to these guidelines and safety requirements will render all warranty, guarantee and liability claims invalid.



Safety

Notes



Function Description

The “PSS SB BRIDGE” is a safety-related device designed for use with SafetyBUS p. It has a dual-channel structure. The Bridge enables the safe connection of two independent SafetyBUS p networks.

It is possible to use several Bridges to connect several independent SafetyBUS p networks.

When using a Bridge or several Bridges, the general rules for building and operating a SafetyBUS p network apply to each individual network (see “SafetyBUS p Installation Manual” and “SafetyBUS p System Description”).

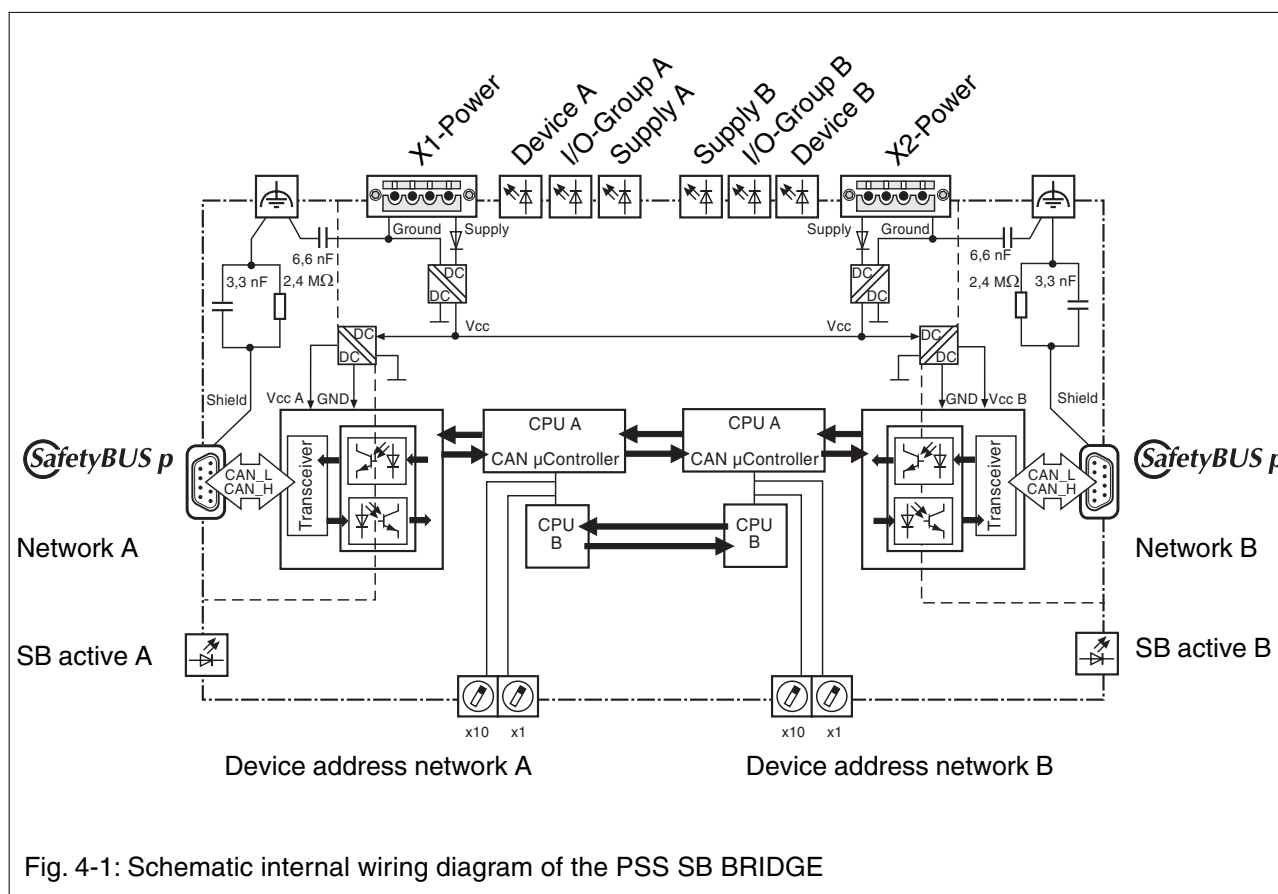


Fig. 4-1: Schematic internal wiring diagram of the PSS SB BRIDGE

The Bridge may only be operated with standard function block SB 250. This SB is a component part of the “FS SB BRIDGE” software package, which is supplied with the Bridge.

Function Description

Setting the Device Address

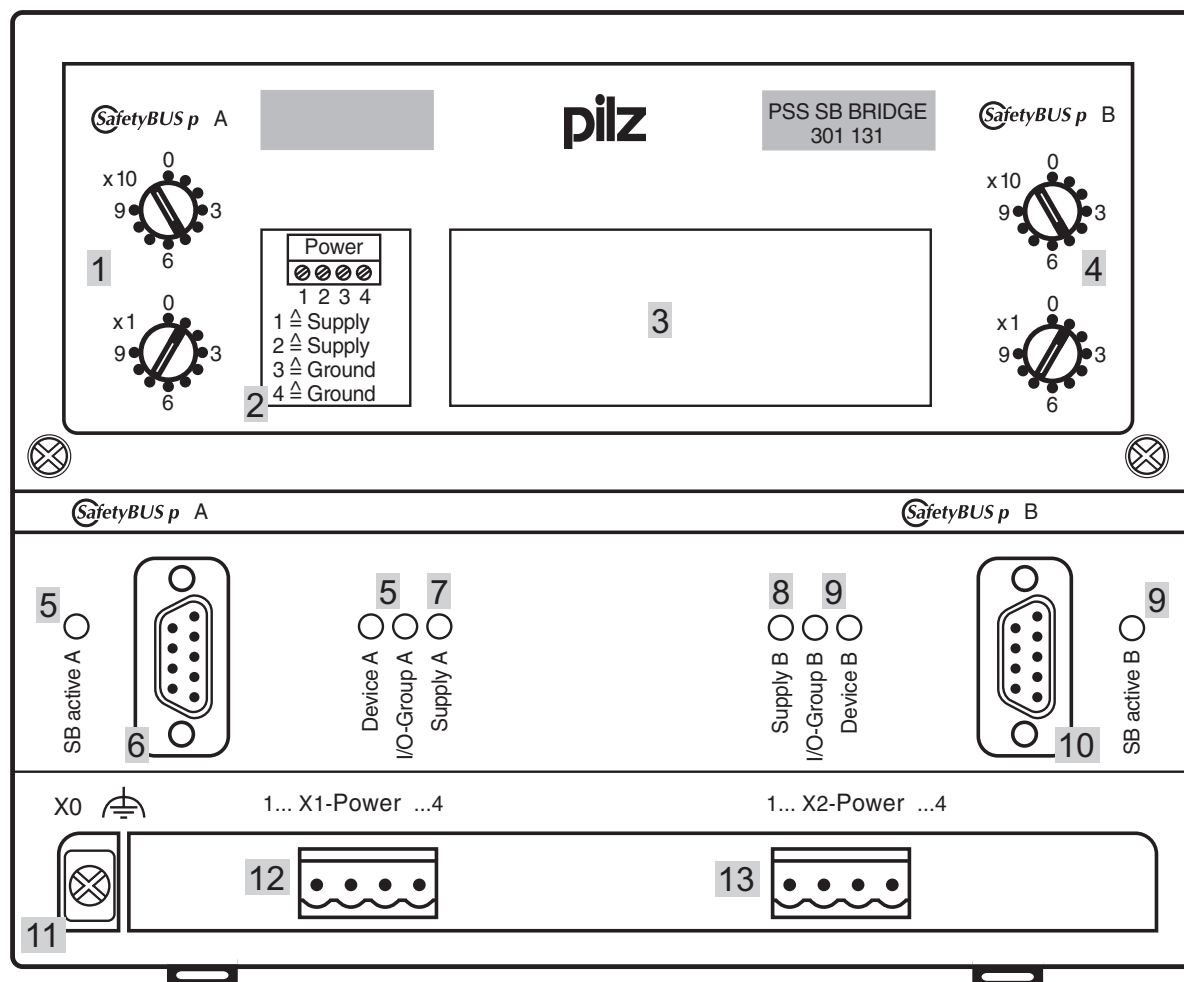
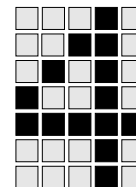
The Bridge occupies a Device Address in each of the two SafetyBUS p networks (SafetyBUS p A and SafetyBUS p B). Accordingly, the Device Address must be established both on the Bridge and in the programming device configurator. The address must be set separately for each network. Two rotary switches for setting the Device Address are provided for each network. As the Bridge manages the Device Address for each network separately, it is possible to set different Device Addresses. The two rotary switches are labelled “x10” and “x1” for the respective network. The Device Address is set as a decimal figure via the rotary switches (valid settings: $32_D \dots 95_D$).

Transmission rate

The Bridge automatically synchronises with the existing transmission rate in networks A and B.
The transmission rate is managed separately for each SafetyBUS p network. This procedure means that different transmission rates can be set in the two SafetyBUS p networks.

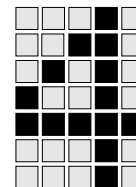
Status LEDs

The Bridge has status LEDs, which display the operating status of the respective SafetyBUS p network. 3 status LEDs are assigned to each of the two networks (see Fig. 4-2). Limited fault diagnostics can be carried out via the status LEDs.



- 1: Rotary switch for setting the Device Address: Network A
- 2: Labelling strip for the supply voltage (X1-Power/X2-Power)
- 3: Labelling strip
- 4: Rotary switch for setting the Device Address: Network B
- 5: Status LEDs: Network A
- 6: SafetyBus p interface: Network A
- 7: LED for supply: Network A
- 8: LED for supply: Network B
- 9: Status LEDs: Network B
- 10: SafetyBus p interface: Network B
- 11: Connection terminal for the functional earth
- 12 and 13: Terminal strip for the supply voltage

Fig. 4-2: Operator and display elements on the PSS SB BRIDGE



Function Description

Function

If it is connected correctly, the Bridge will start to operate as soon as supply voltage ("X1-Power"/"X2-Power") is applied (see Fig. 4-2). Depending on the connection, the LEDs "Supply A" and/or "Supply B" will indicate whether supply voltage is applied to the Bridge.

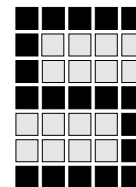
After an initialisation phase, the Bridge will synchronise with the respective transmission rate of SafetyBUS p network A and B. The correct operating status can be read from the status LEDs. The LEDs "SB active A" and "SB active B" indicate the status of the connection to the MD for the respective SafetyBUS p network.

Error handling and error reaction

The Bridge handles errors for the two networks separately. For this reason the Bridge has a separate error stack for SafetyBUS p network A and SafetyBUS p network B. Both error stacks are totally independent of each other.

If an error is detected, the Bridge will set the affected status flags in both networks to logic 0. The outputs from all the affected I/O-Groups in both networks will then be switched off and the affected I/O-Groups will switch to a STOP condition.

The I/O-Groups can be re-started once the error has been rectified. For example, this may occur in both networks due to a change in the operating status of the PSS, whose LD the I/O-Groups are assigned to.



Configuration

Rules for incorporating the Bridge

Using the Bridge will bring extensive benefits, especially if relevant features are taken into consideration when planning the bus architecture. For this reason you should always note the following points:

- Plan the Bridge so that the signal status of the signals to be transmitted seldom changes.
- If possible, arrange the Bridge's virtual I/Os into their own I/O-Groups. This will increase the availability of the network in the case of an error. Only the I/O-Groups to which the Bridge's virtual I/Os are allocated will switch to a STOP condition.
- The Bridge has a telegram buffer for the temporary storage of telegrams transferring between SafetyBUS p networks A and B. Poor bus architecture may cause the telegram buffer to overflow.



INFORMATION

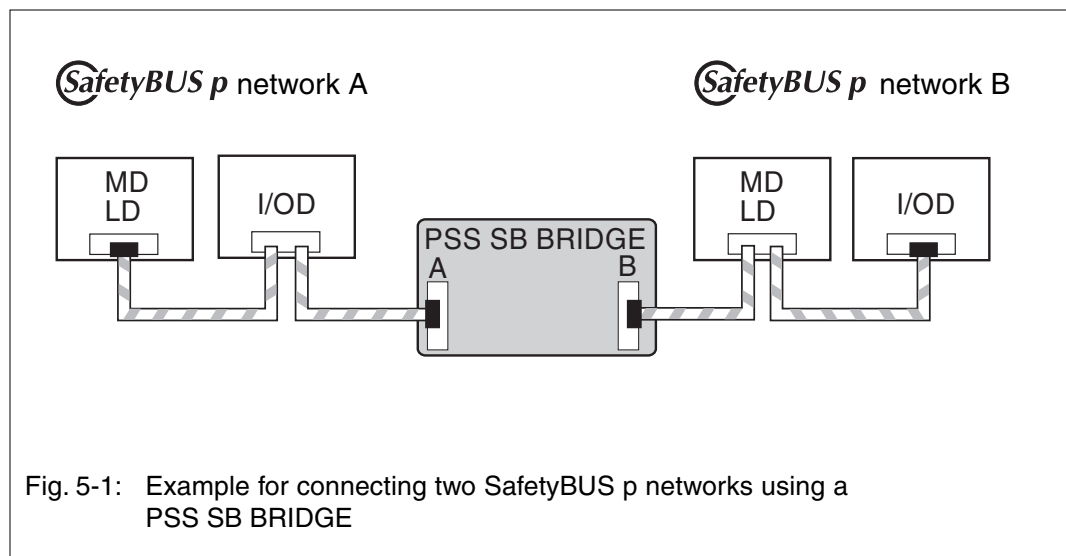
The following configuration should be avoided:

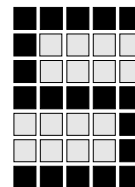
Signals whose status changes frequently have to be transferred between the two SafetyBUS p networks, while at the same time there is a considerable difference in the transmission rates of the SafetyBUS p networks (e.g. 500 kBit/s in network A and 20 kBit/s in network B).

Configuration

Management Device and Logic Device

The Bridge connects two complete and independent SafetyBUS p networks. The general rules for building SafetyBUS p networks therefore apply to both networks. Fig. 5-1 shows a structure with two minimum networks.





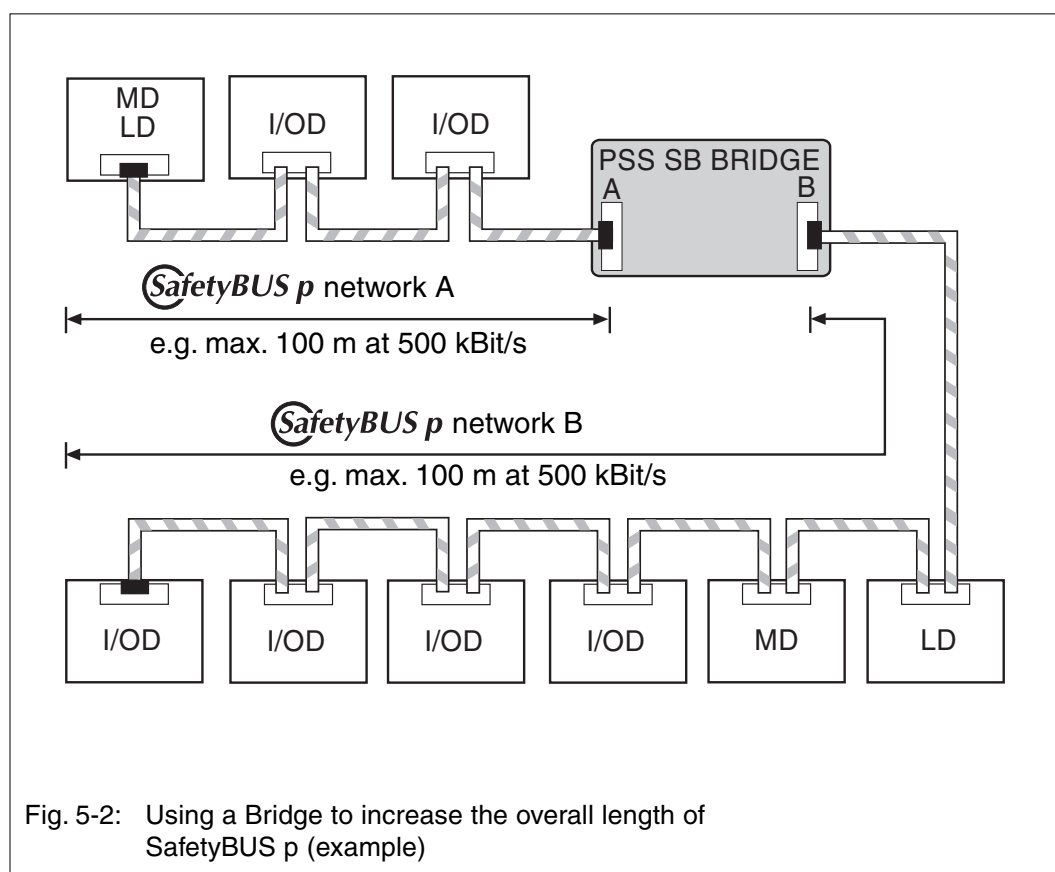
Increasing the max. permitted overall length

The maximum total cable run on a SafetyBUS p system is limited by the selected transmission rate (see also the SafetyBUS p Installation Manual). In such cases Bridges can be used to increase the overall length of SafetyBUS p.



INFORMATION

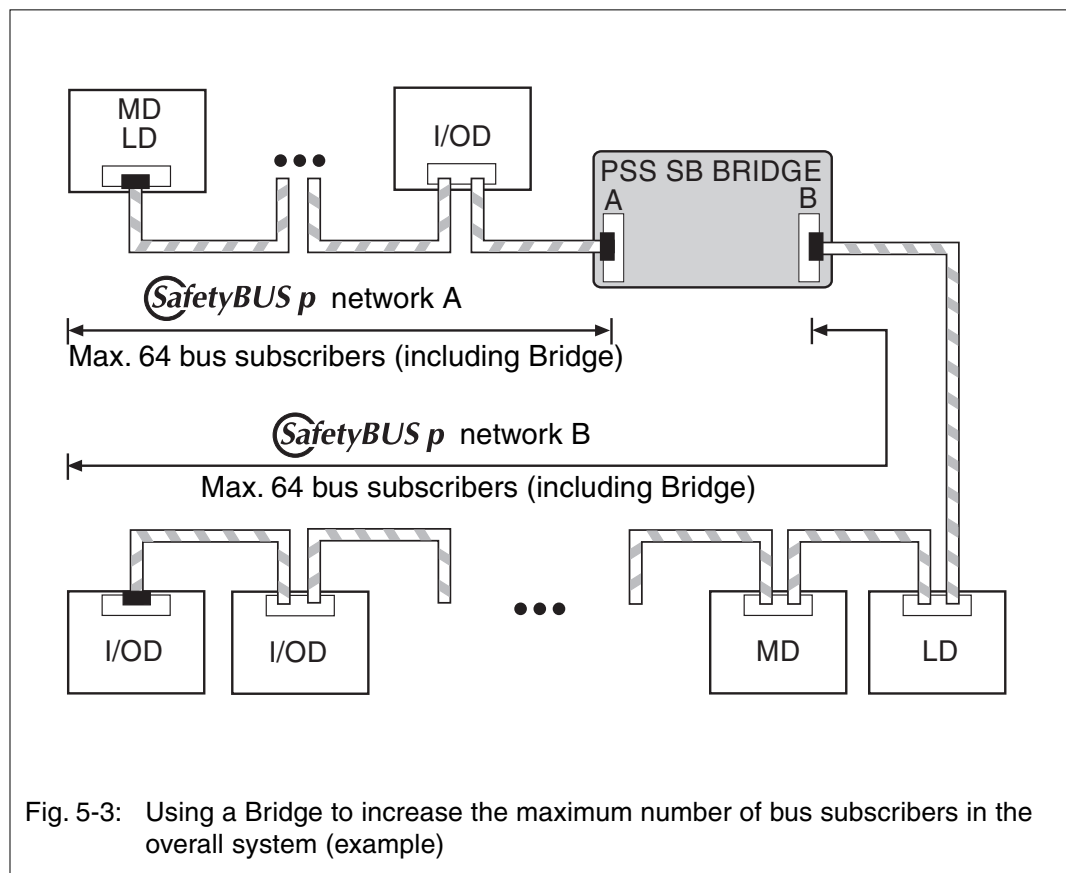
Using a Bridge divides the system into two independent SafetyBUS p networks. The rules regarding the interdependence of transmission rate and cable runs are valid within the bus networks. However, longer cable runs can be achieved by using several Bridges.

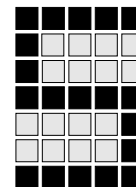


Configuration

Increasing the max. permitted number of bus subscribers

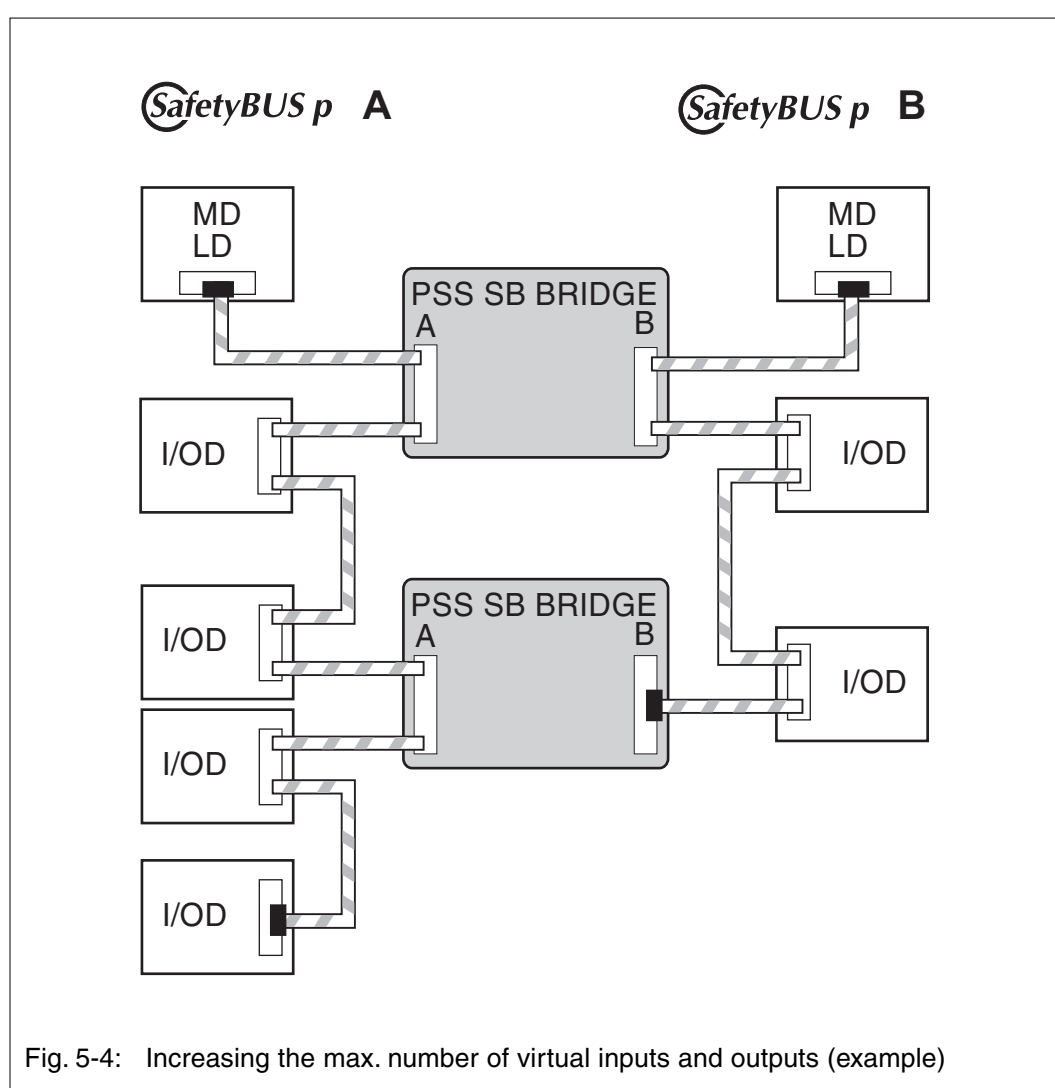
A SafetyBUS p network is limited to a maximum of 64 bus subscribers. The use of Bridges means that a system can be divided into independent SafetyBUS p networks, each of which may have a maximum of 64 subscribers.

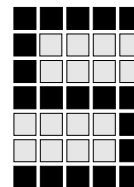




Increasing the max. number of virtual inputs and outputs

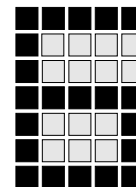
A Bridge has a maximum of 32 virtual inputs and outputs for exchanging data between two SafetyBUS p networks. If this amount is not sufficient for an application, the number of I/Os can be increased by using several Bridges in parallel.



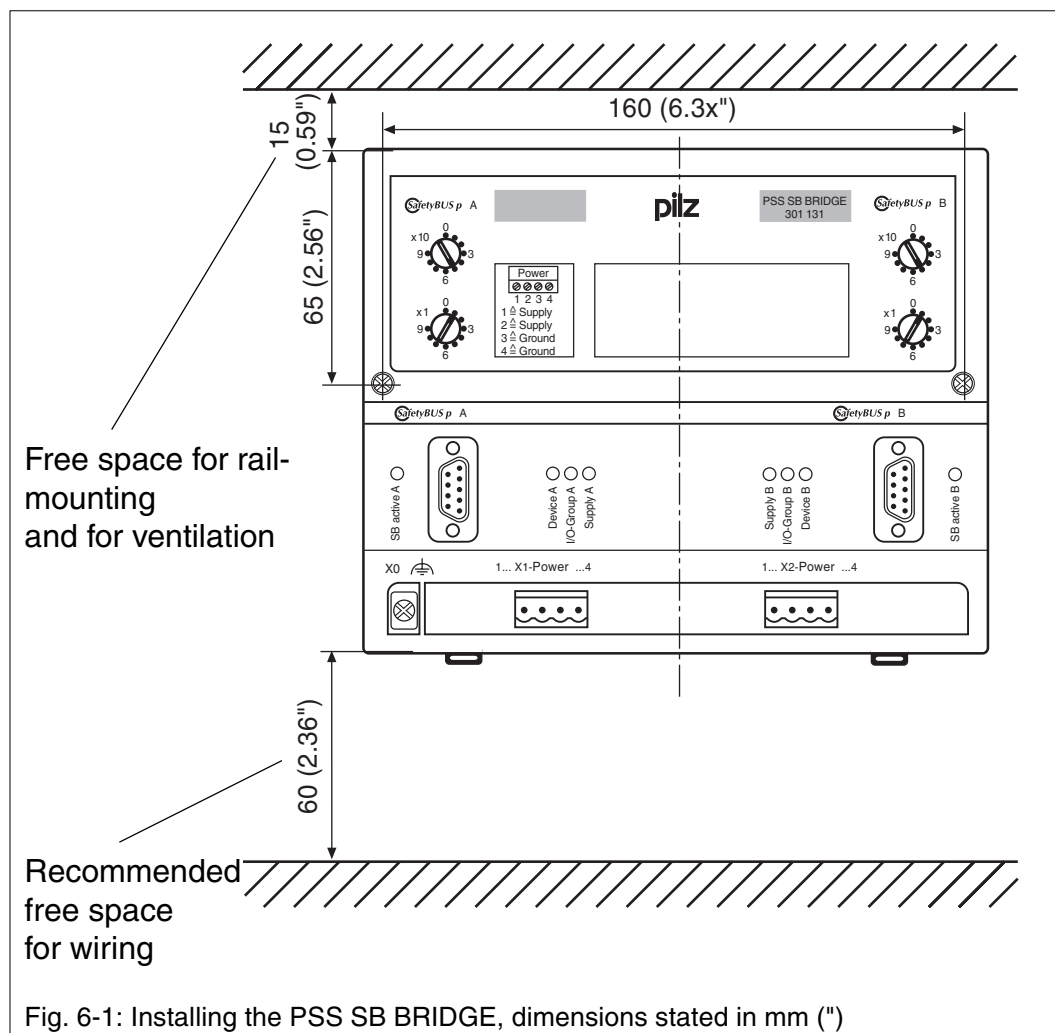


Configuration

Notes



Installation

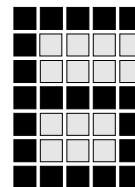


Dimensions in mm ("):

H x W x D: 140 x 170 x 52 (5.51 x 6.69 x 2.05)

The module can be attached to a 35 mm DIN-rail (top hat rail) or can be screwed on to a mounting plate using fixing bolts (order no. 311 068).

To affix the module on to a mounting plate, drill 2 x M4 holes (internal thread) in the mounting plate, as shown in the above diagram (tolerance: $\pm 0.2 \text{ mm}/0.01 \text{ ''}$).



Installation

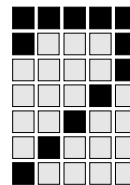


INFORMATION

When installing the Bridge please refer also to the following manuals:

- SafetyBUS p Installation Manual
(part of the System Manual “PSS-Range SafetyBUS p”)
- PSS SB BRIDGE Installation Manual
(part of the System Manual “PSS-Range SafetyBUS p” and supplied with every SafetyBUS p-compatible PSS)

In particular you should take note of the information regarding EMC-compliance.



Commissioning and Operation

Commissioning

Programming device

The procedure for configuring SafetyBUS p is described in the operating manual for the corresponding programming device (e.g. “Programming Device PSS SW PG”). The information given in this section refers only to the special features involved in the configuration of the “PSS SB BRIDGE”.



NOTICE

The “PSS SB BRIDGE” is only supported from Version 4.3 of the “PSS SW PG” system software.

Device addresses

The device address must be set separately for each network. The setting must be made both on the Bridge (rotary switches) and in the corresponding programming device configurator.

The procedure for setting the device address on the Bridge’s rotary switches is described in Chapter 4, in the section entitled “Setting the device address”.

The procedure for configuring a device address in the programming device is described in the operating manual for the relevant programming device.



INFORMATION

The following operator faults will lead to an error in the respective SafetyBUS p network (see also section entitled “Fault diagnostics”):

- Setting an invalid device address
(valid settings: 32_D ... 95_D)
- The Bridge’s device address was not configured in the programming device.
- The set device address (Bridge) is different from the configured device address (programming device).
- Device address adjusted during operation.

Commissioning and Operation

Commissioning procedure

The following description assumes that the Bridge has been configured correctly in the respective SafetyBUS p network and that both networks are ready to run.

Follow the instructions below:

- Install the Bridge.
Please follow the instructions given in the “Safety BUS p Installation Manual” and “PSS SB BRIDGE Installation Manual”.



INFORMATION

If the module is attached to an earthed DIN rail, this will automatically cover the module's functional earth requirements.

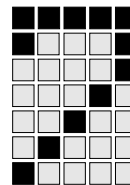
- Connect the Bridge to the SafetyBUS p networks.
- Set the device address on the Bridge for each SafetyBUS p network .
- Connect the supply voltage (terminal block X1-Power/X2-Power). After an initialisation phase the Bridge will reach operating status.
- Use the status LEDs to check that the Bridge connection for networks A and B has been correctly established (see section entitled “Operation”, under “Fault diagnostics”).



INFORMATION

- I/O-Groups may need to be re-started.
- Monitoring times may need to be adjusted.

You can obtain more precise information by reading the FS error stack from any PSS on the respective SafetyBUS p network. This process is described in the operating manual for the “Programming Device PSS SW PG”.



Operation

Display elements for SafetyBUS p network A

A number of display elements can be used to check that the Bridge is operating correctly in network A.

LED “Supply A”

This LED indicates that the supply is present.

- LED green: Supply voltage to the Bridge is via the “X1-Power” terminal. Supply voltage is available.
- LED off: No supply voltage is present at the “X1-Power” terminal.

LED “I/O-Group A”

LED indicates the status of the I/O-Groups which were configured for the virtual I/Os of the Bridge in network A.

- LED green: All the I/O-Groups configured for network A are in a RUN condition.
- LED flashing green: One of the I/O-Groups configured for network A is in a STOP condition.
- LED off: All the I/O-Groups configured for network A are in a STOP condition.

LED “Device A”

This dual-colour LED indicates the device status of the Bridge with regard to network A.

- LED off: A system error has occurred. A system error prevented the Bridge starting up on power up.
Remedy: Change the unit.
- LED red: A device error has occurred.
Remedy: Use the programming device to carry out more detailed fault diagnostics (read the error stack in network A and the Bridge’s error stack).
- LED green: The Bridge is operating without error.

Commissioning and Operation

LED “SB active A”

The LED provides information on the status of the Bridge’s bus connection with network A. If it is connected correctly to the MD of network A, the LED will be green and telegram traffic will occur. The LED flashes green if the set device address for network A (Bridge) has not been configured in the configurator or has been configured incorrectly.

Display elements for SafetyBUS p network B

A number of display elements can be used to check that the Bridge is operating correctly in network B.

LED “Supply B”

This LED indicates that the supply is present,

- LED green: Supply voltage to the Bridge is via the “X2-Power” terminal. Supply voltage is present.
- LED off: No supply voltage is present at the “X2-Power” terminal.

LED “I/O-Group B”

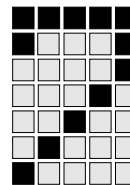
LED indicates the status of the I/O-Groups which were configured for the virtual I/Os of the Bridge in network B.

- LED green: All the I/O-Groups configured for network B are in a RUN condition.
- LED flashing green: One of the I/O-Groups configured for network B is in a STOP condition.
- LED off: All the I/O-Groups configured for network B are in a STOP condition.

LED “Device B”

This dual-colour LED indicates the device status of the Bridge with regard to network B.

- LED off: A system error has occurred. A system error prevented the Bridge starting up on power up.
Remedy: Change the unit.



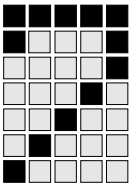
- LED red: A device error has occurred.
Remedy: Use the programming device to carry out more detailed fault diagnostics (read the error stack of an LD in network A and the Bridge's error stack).
- LED green: The Bridge is operating without error.

LED "SB active B"

The LED provides information on the status of the Bridge's bus connection with network B. If it is connected correctly to the MD of network B, the LED will be green and telegram traffic will occur. The LED flashes green if the set device address for network B (Bridge) has not been configured in the configurator or has been configured incorrectly.

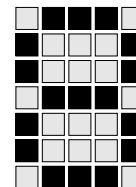
Fault diagnostics

Fault diagnostics can be carried out using the status LEDs or by reading the error stack of any PSS in the relevant SafetyBUS p network.



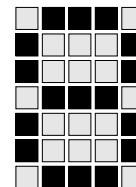
Commissioning and Operation

Notes



Technical Details

Electrical data	
Supply voltage	24 VDC, 90 mA plus load currents required for fibre-optic coupler (40 mA per fibre-optic coupler)
Tolerance	20 ... 30 VDC including residual ripple
Power consumption	2.2 W
Galvanic isolation	Yes (optocoupler), between the two SafetyBUS p networks
SafetyBus p	
Transmission rate	Max. 500 kBit/s (independent for both SafetyBUS p networks, automatic synchronisation)
Cable runs	Max. 3500 m (per SafetyBUS p network)
Transmission type	Differential two-wire cable
Connection	Two 9-pin D-Sub connectors (female)
Status indicator	LEDs for power, bus status and diagnostics
Subscribers	Max. 64 (per SafetyBUS p network) PSS SB BRIDGE occupies a device address in each of the SafetyBUS p networks
Data width	32 Bit as virtual I/Os (per SafetyBUS p network)
Environmental data	
Protection type (EN 60529)	IP20
Mounting position	Any
Ambient temperature (EN 60068-2-14)	0 ... +60 °C
Storage temperature (EN 60068-2-1/-2)	-25 ... +70 °C
Climatic suitability (EN 60068-2-30)	Max. 93 % r.h.
Condensation	Not permitted
Vibration (EN 60068-2-6)	
Frequency range	10 ... 100 Hz
Amplitude	0.1 mm, max. 5g
Shock (EN 60068-2-27)	30g, 11 ms
Bump (EN 60068-2-29)	10g, 16 ms
EMC	EN 50082-2 EN 55011, class A

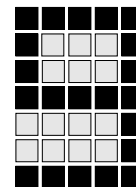


Technical Details

Mechanical data

Weight	450 g
Dimensions (H x W x D)	140 x 170 x 52 mm

The standards current on 200-09 apply.



Appendix

Changes in the documentation

Changes from Version I to Version II

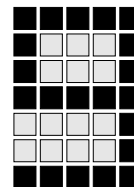
Old page	New page	Changes
1 and 3	1 and 3	Table of contents adapted
3-1	3-1	New INFORMATION text
4-1	4-1	New text: use of SB 250
4-4 to 4-7	---	Texts removed.

Changes in Version 20 459-03

Old page	New page	Changes
3-1, 4-1	3-1, 4-1	SB250 is replaced by SB251.

Änderungen in Version 20 458-04

Old page	New page	Changes
2-1	2-1	Supply list amended
8-1	8-1	Supply voltage data changed, new standards



Appendix

Notes



► ***
In many countries we are represented by our subsidiaries and sales partners.

Please refer to our Homepage for further details or contact our headquarters.

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