

**Programmable
Safety Systems PSS®-Range**

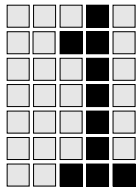


PSS SB Router1

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Introduction

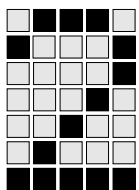
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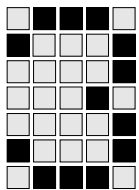
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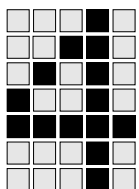
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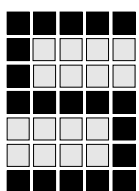
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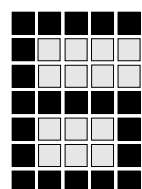
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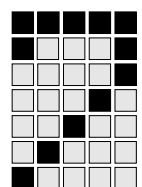
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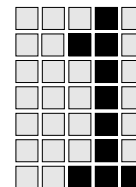
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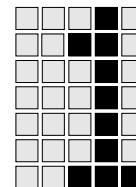


Introduction

This installation manual contains all the information you need to install the PSS SB Router1. It gives safety guidelines which should be followed during installation and also describes the installation procedure and measures which can be taken to ensure EMC-compliance. Examples are also given to show bus architectures when using Routers.

Validity of the documentation

This documentation is valid for the PSS SB Router1 from Version 2.0. It is valid until new documentation is published. The latest documentation is always enclosed with the unit.



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 which 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.



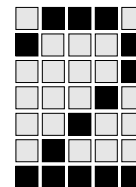
NOTICE

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.



Safety

Safety guidelines

To ensure that the PSS SB Router1 module functions correctly, please follow the safety guidelines given below:

- Electrical connections should be made by a qualified electrical engineer who is familiar with the information in this manual, the “SafetyBUS p Installation Manual” and the relevant regulations concerning health and safety at work.
- Ensure VDE and local regulations are met, especially those relating to safety. The relevant safety regulations for the respective application must also be met.



- **CAUTION!** Electrostatic discharge can damage components on the PSS SB Router1. Ensure against discharge before touching the module, e.g. by touching an earthed, conductive surface or by wearing an earthed armband.
- If the module is altered in any way, such as exchanging a component or carrying out soldering work, the guarantee, and any approval, will be rendered invalid.

Supply voltage

- Check that the voltage supplied from the external power supplies corresponds with the supply “X1-Power” on the PSS SB Router1 (24 VDC).



- **CAUTION!** The tolerance on the supply voltage is +20 % or -15 % maximum. Safe operation cannot be guaranteed outside this range.
- Overvoltage and spikes of interference can damage the electronics on the PSS SB Router1. If this occurs, the affected I/O-Groups will switch to a STOP condition and all the outputs in the affected groups will be switched off. Please refer to the relevant EMC-measures (see Chapter 3).

Safety



- **WARNING!**

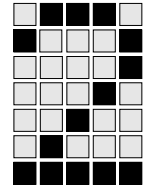
Safe electrical isolation must be ensured for the external 24 V supply. Failure to do so could result in electric shock. Power supplies must conform to DIN EN 60950 (11/97), section 2.3 or DIN VDE 0551 / EN 60742 and DIN VDE 0160.

- To achieve the lowest possible residual ripple, we recommend that you install a three-phase bridge rectifier or regulated supply.
- The connection between “Ground” and the earth bar or earth fault monitor must be in accordance with relevant international standards such as EN 60204-1.

Installation

- The system should be installed in an enclosure (e.g. control cabinet) which conforms to the protection class required.
- When installing the module in an enclosure such as a control cabinet, the technical specifications below must be taken into account:

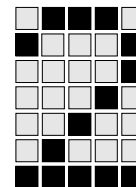
Protection type (EN 60 529, 10/91)	IP 20
Protection class (DIN VDE 0106, Part1/A1, 04/90)	3
Mounting position	Any
Ambient temperature (DIN IEC 68-2-14, 06/87)	0 ... 60 °C
Storage temp. (EN 60 068-2-1/-2, 03/93)	-25 ... +70 °C
Climatic suitability (DIN IEC 68-2-30, 09/86)	Max. 95 % r. h.
Condensation	Not permitted
Vibration (EN 60 068-2-6, 04/95)	Frequency range: 10 ... 100 Hz Amplitude: 0.1 mm, max. 5g
Vibration resistance (DIN IEC 68-2-29)	30g, 11 ms/10g, 16 ms
EMC	EN 50082-2, 03/95 EN 55011 A, 08/96



-
- Ensure there is sufficient ventilation to prevent heat building up within the control cabinet.
 - In extreme ambient conditions, additional measures may be required in order to keep within the prescribed value range.

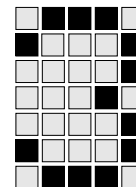
Connections

- Cable layout must meet the EMC-guidelines stated in Chapter 3.
- The 24 V power supplies must be fused/protected at 10 A maximum.
- Minimum ranges for cable cross sections on field connection terminals in mm², in accordance with EN 61131-2, 08/94 and A11, 06/96:
 - Power supply: 1.5 (AWG16) ... 2.5 (AWG12)
 - Earth: 1.5 (AWG16) ... 2.5 (AWG12)
- Only the original Pilz screw connectors should be used as remote connection terminals.
- Permitted cable cross section on the screw connectors:
 - rigid cables: 0.2 ... 2.5 mm²
 - flexible cables: 0.2 ... 2.5 mm²
- Use copper wiring.
- The torque setting on the connection terminals should be 0.5 ... 0.6 Nm.



Safety

Notes



Electromagnetic Compatibility (EMC)

Overview

The PSS SB Router1 is designed to be installed within an electromagnetic industrial environment. To ensure electromagnetic compatibility the correct procedures must be carried out when installing the system.

A device is electromagnetically compatible if:

- It functions without error in a given electromagnetic environment
- It does not adversely affect its own environment.

Electromagnetic interference reaches the system through:

- Radiated fields
- Power supply
- Earth cabling
- Interfaces
- Input and output cables

The interference can be transferred from the source to the receiver (interference sink) via the coupling routes.

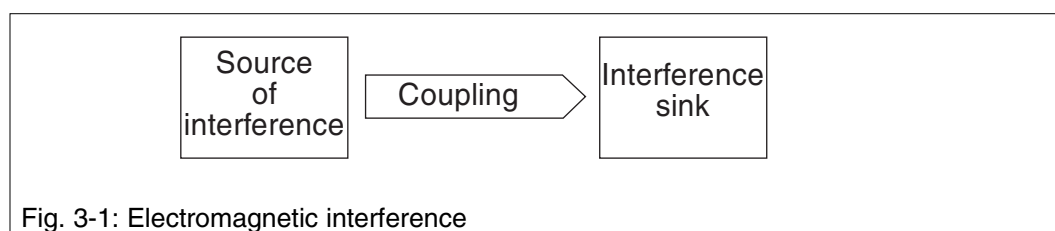


Fig. 3-1: Electromagnetic interference

Interference reaches the interference sink (e.g. PSS SB Router1) in various ways:

- DC coupling
This occurs if the source and sink of interference have common cable connections. The common cable presents complex resistances, inducing potential differences.
Possible sources of interference are switches/relays, running motors or varying potentials for other systems on the same power supply.

Electromagnetic Compatibility (EMC)

- Capacitive (electrical) coupling
A different potential between the source and interference sink (e.g. two cables) creates an electrical field. Cross-coupling is proportional to the rate of voltage change.
Possible sources of interference are contactors, static discharge, parallel signal cables.
- Inductive (magnetic) coupling
A live cable produces a magnetic field which surrounds both the live and neighbouring cables. Interference voltage is induced. Cross-coupling is proportional to the rate of current change.
Possible sources of interference are mains cables running in parallel, live cables, high frequency cables, inductors, transformers, motors.
- Electromagnetic coupling
A cable can emit a signal as a radio wave. This wave is then picked up by another cable.
Possible sources of interference are transmitters such as radios, sparks from spark plugs, welding equipment, etc.



NOTICE

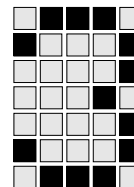
Powerful HF transmitters should only be operated at a distance of more than 0.6 m.

- Static discharge
Static discharge occurs where there are very high differences in potential between two points. If the two points are brought closer together or if the potential difference is increased, discharges can occur in the air gaps.
Possible sources of interference are people who are statically charged from a synthetic carpet, for example.

Making the installation EMC-compliant

Connecting the earth cables

The module meets protection class 3 (DIN VDE 0106, Part 1/A1, 04/90) and therefore does not require a protective earth. The prescribed earth point for the functional earth is designed to guarantee compliance with noise resistance requirements.



- Always connect the functional earth to the central earth point in star form. A cable cross section of at least 2.5 mm² should be used. Connections should be kept as short as possible. Alternatively, the connection to the functional earth can be made by attaching the module to an earthed DIN-Rail.
- Connections should be protected from corrosion.
- Flexible earthing straps should be used on moving earth parts (e.g. machine parts, gates). Ensure these earthing straps are as short and wide as possible.

Cabling

It is possible to differentiate between cables according to their function. The following groups exist:

- Group 1: Data and supply lines for DC voltages below 60 V and AC voltages below 25 V
- Group 2: Data and supply lines for DC voltages from 60 V to 400 V and AC voltages from 25 V to 400 V.
- Group 3: Supply lines above 400 V

Cabling inside buildings:

- The cable groups listed above should be laid separately.
- Cables of the same group can be laid within the same cable duct.
- Cables from group 1 and group 2 should be laid in separate groups or in cable ducts which are at least 10 cm apart.
- Cables from group 1 and group 3 should be laid in separate groups or in cable ducts which are at least 50 cm apart.
- Data and signal lines should be laid as close as possible to an earthed surface.

Electromagnetic Compatibility (EMC)

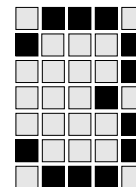
Cabling to open air systems:

- As far as possible use metal conduits. These should be electrically connected and earthed.
- Ensure there is sufficient protection against lightning by:
 - Using metal conduits earthed at both ends, or concrete cable ducts with reinforcements connected across the joints.

Equipotential bonding

Potential differences can occur if the module and its connected peripheral devices have different earth connections. In order to avoid interference, equipotential bonding cables must be installed. In doing so you must ensure the following:

- Select a low impedance equipotential bonding cable.
- Select the following as standard values for the cross section of the equipotential bonding cables:
 - 16 mm² for equipotential bonding cables up to 200 m in length.
 - 25 mm² for equipotential bonding cables over 200 m in length.
- Use copper or galvanised steel equipotential bonding cable.
- Connect equipotential bonding cables to the earth conductor over as wide a surface area as possible.
- As short a distance as possible should be kept between the equipotential bonding cable and signal cable.



Miscellaneous

Lighting inside the cabinet

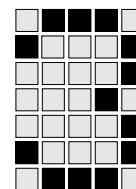
Use low interference panel lighting for inside the control cabinet.

Electromagnetic Compatibility (EMC)

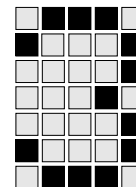
Testing the EMC-compliance of an installation

Use the following list to check that the PSS SB Router1 has been installed to conform with EMC-regulations.

Check	Action	Done
Before installation:		
Are there areas with a high probability of interference? (e.g. computers running, process control areas, distribution cabinets, cable casing, frequency converters, hand-held radios etc.)	Make detailed plans for EMC protection in these areas.	
Are areas where computers are running and areas such as process control rooms sufficiently shielded from electromagnetic coupling?	If necessary shield the whole area.	
Have you, or the installer, sufficient knowledge where cable layout is concerned?	Some important points: Lay cables close to earth, keep clear of other electrical equipment, keep cables in ducts separate from other parts of the installation, keep cables as short as possible.	
Is the supply voltage free of interference?	Build in a mains filter where interference may occur.	
EMC characteristics of individual units / all units once installed?	Test under operating conditions, e.g. while hand-held radios are in use, or HF frequency generators are close by. Test static discharge with operating personnel, test mutual interference between units under different operating conditions.	

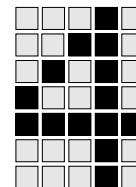


Check	Action	Done
During installation:		
Earthed parts connected correctly?	Most important are the connections to base module racks, racking bars, earth conductors and earth bars. Inactive metal parts should be connected over a wide surface area and earthed to a central point. With insulated metal: Remove insulation or use special contact fixings. Protect the connection from corrosion. Connect the cabinet doors to the body of the cabinet using earthing straps.	
Are the cables laid correctly?	Separate cables into groups. Supply and signal leads must be laid separately.	
Are the shields connected correctly?	Use shielded cables for analogue and data leads. Use metallic plugs. Connect cable shields to earth bar at point of entry to cabinet. Connect cable shields over a wide surface area and with low impedance.	
Equipotential bonding carried out?	Equipotential bonding cables should be laid if the installation extends over a wide area.	
Are inductive loads	Inductive loads must be wired with suppression elements.	
24 VDC power supply?	The power supply must conform to DIN EN 60950 (11/97), Section 2.3 or DIN VDE 0551 / EN 60 742 and DIN VDE 0160.	



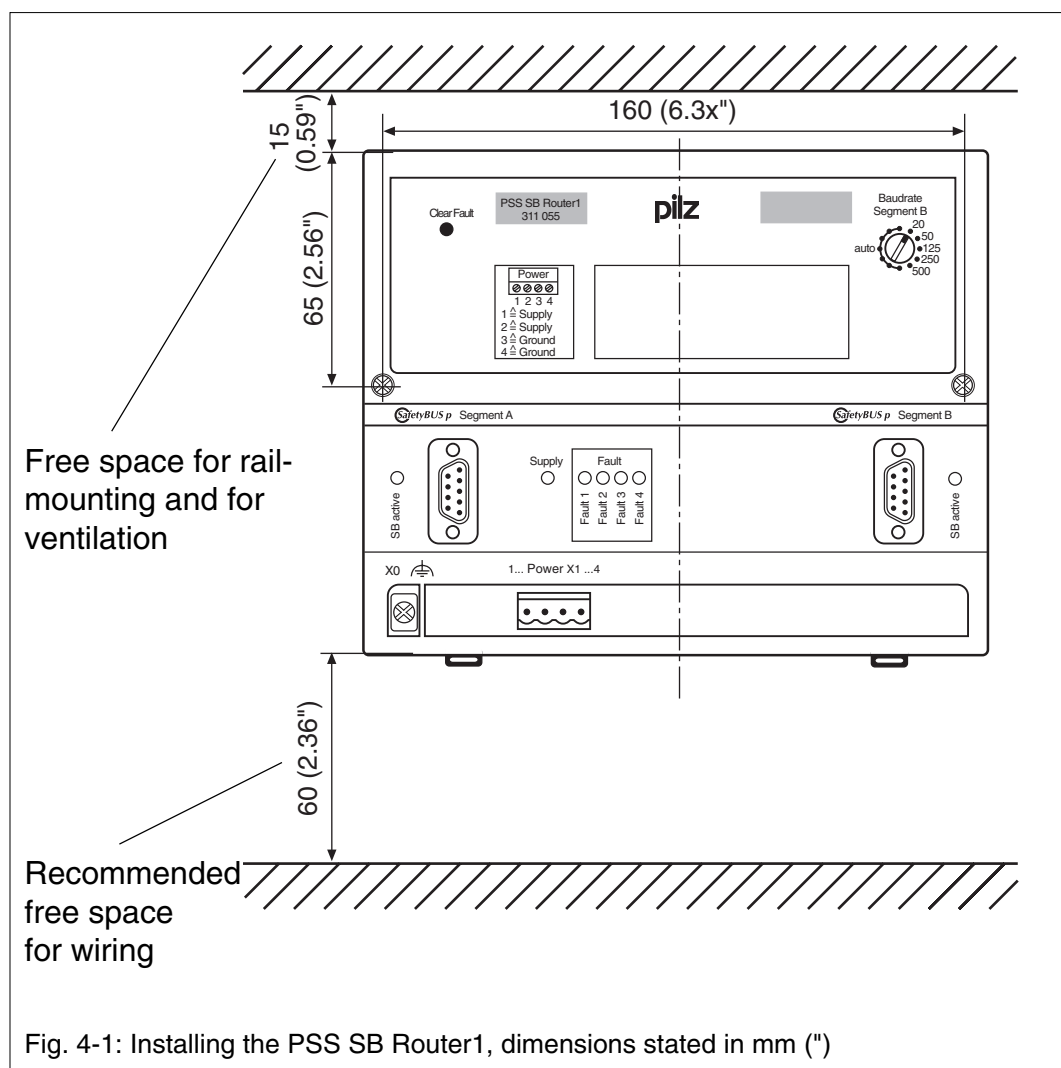
Electromagnetic Compatibility (EMC)

Notes

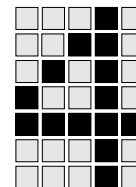


Installation

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 Fig. 4-1 (tolerance: ± 0.2 mm/0.01").

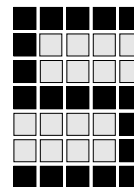


Dimensions in mm ("):
H x W x D 140 x 170 x 52 (5.51 x 6.69 x 2.05)



Installation

Notes



Voltage Supply

Voltage Supply

“Supply”


The 24 V supply for the module electronics and the SafetyBUS p interfaces is connected to terminal 1 or 2 on the “Power” block (the terminals are linked inside the unit).

For details of the power supply, please refer to the “Technical Details” in the operating manual. The inrush current on the module is limited to 3 A maximum.

“Ground”

The earth on the supply must be connected to terminal 3 or 4 on the “Power” block (the terminals are linked inside the unit).

Functional earth

The functional earth is connected to the screw marked . Alternatively, the connection to the functional earth can be made by attaching the module to an earthed DIN-rail.

The functional earth can be utilised from the terminal block marked .



NOTICE

Always observe the regulations stated in Chapter 2.

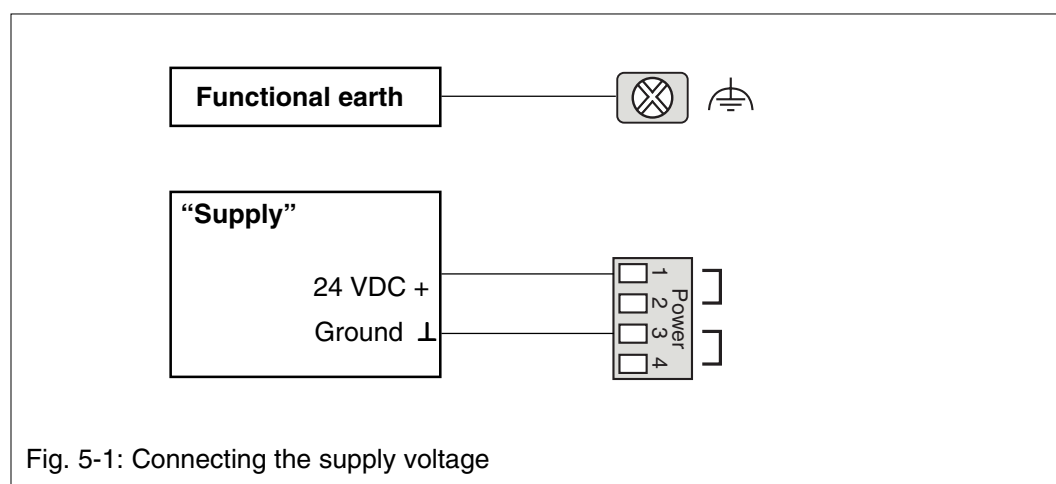
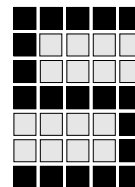
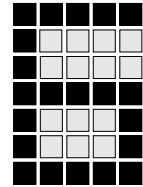


Fig. 5-1: Connecting the supply voltage



Voltage Supply

Notes



Bus termination

The signal lines (CAN_L and CAN_H) on the first and last subscribers in a bus segment must be fitted with terminating resistors.

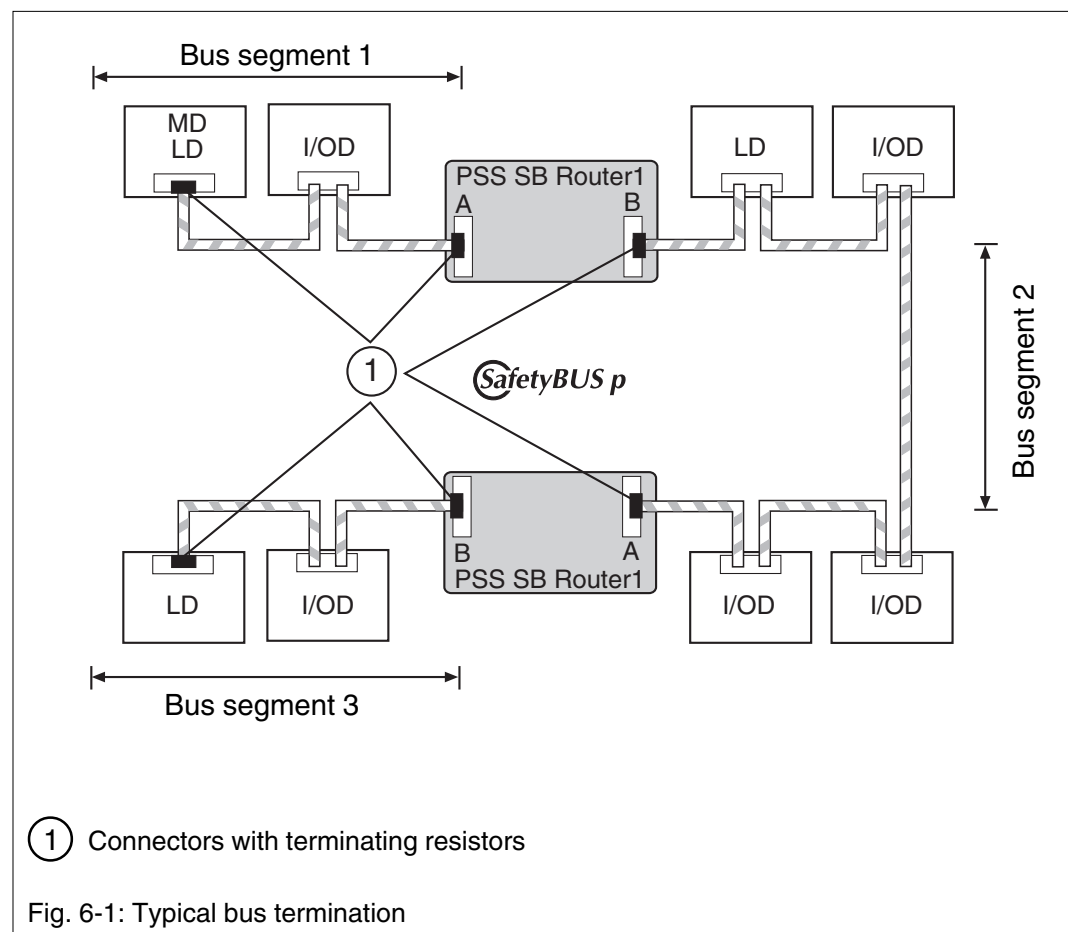
The bus termination on SafetyBUS p is achieved through the connector (see “SafetyBUS p Installation Manual”).



INFORMATION

Signal lines on the first and last subscribers of a bus segment must use connectors with terminating resistors.

Specification: 120 Ohm, 5%, 1/4 Watt



SafetyBus p

Earthing the screened cable

- In each bus connector, connect the braided screening on the bus cable with low impedance to the metal clamp provided (see “SafetyBUS p Installation Manual”).



INFORMATION

The screening on the SafetyBUS p cable goes to PIN 5 on the bus connector. It is connected internally to the functional earth connection via an HF filter.

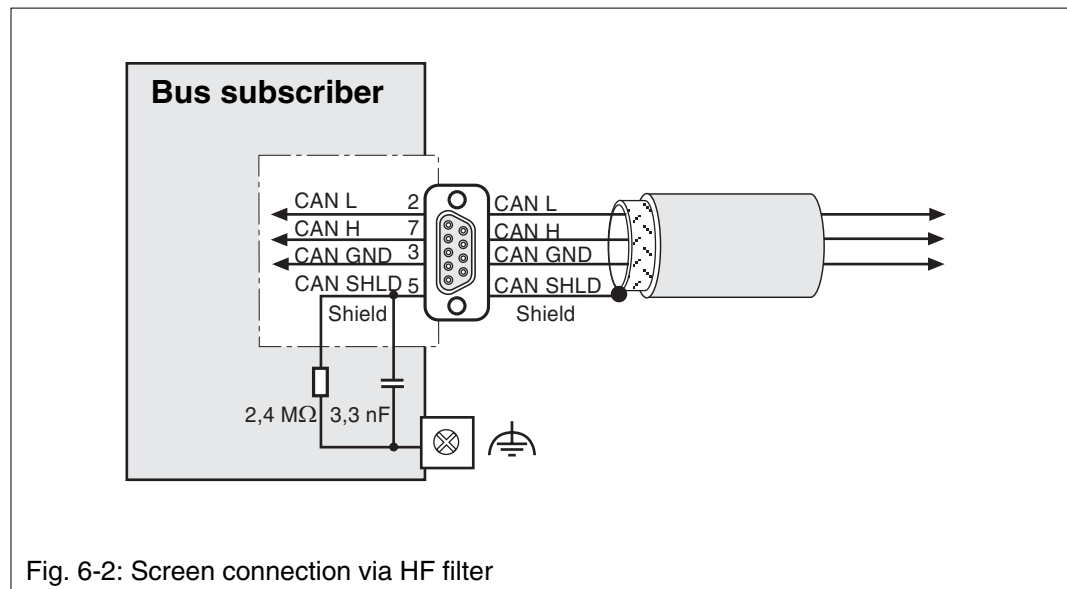


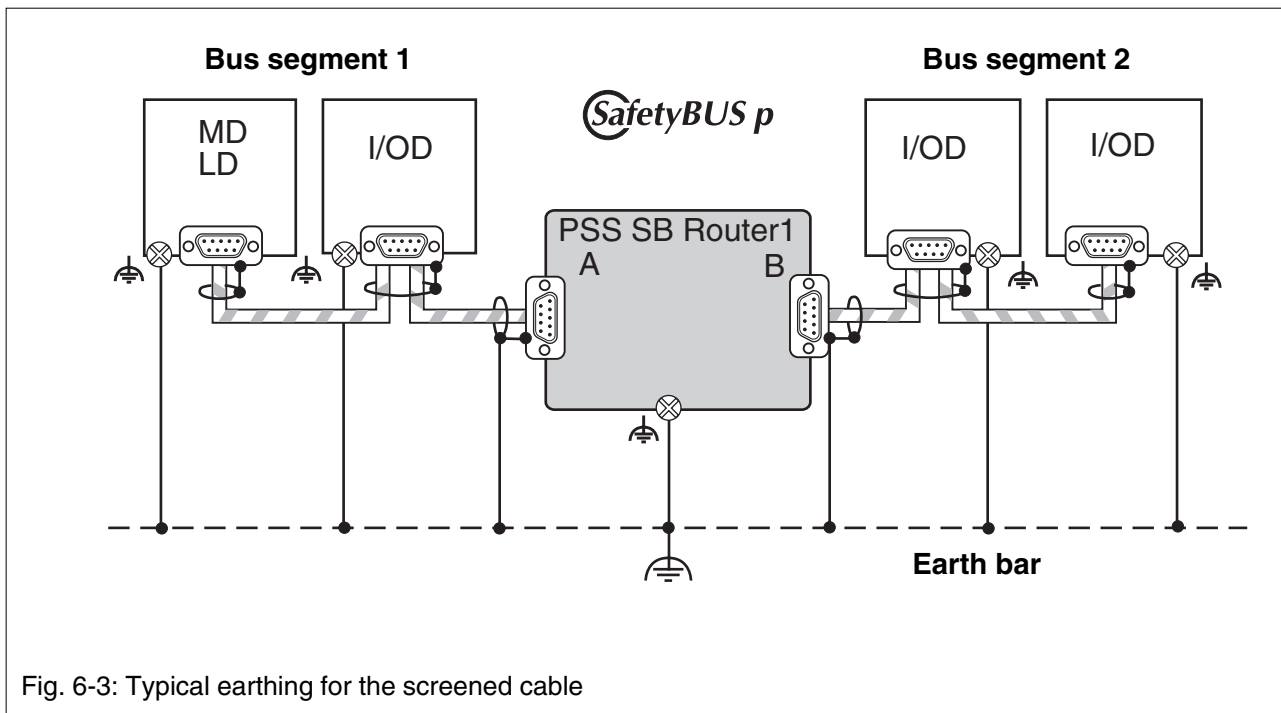
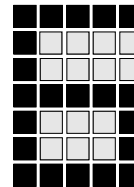
Fig. 6-2: Screen connection via HF filter

- Connect the functional earth of each bus subscriber to the earth bar (see Chapter 3).
- Connect the screened cable with low impedance to the screen bar or earth bar. This only needs to be done **once** per bus segment. It is preferable to do this in the terminator at the start or end of the segment (see Fig. 6-3).



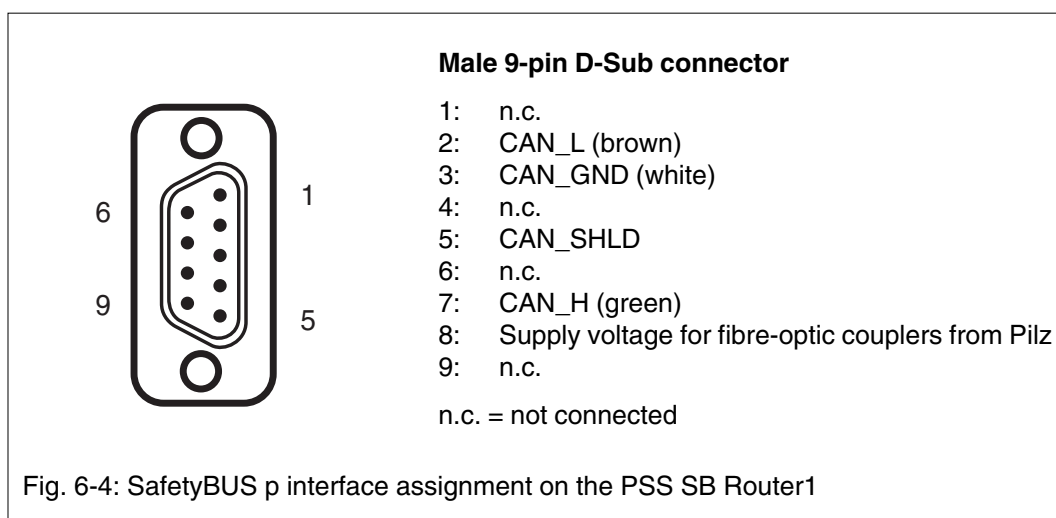
INFORMATION

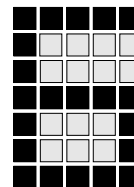
Pull a piece of screened cable from out of the terminator. This should be kept as short as possible.



Interfaces

Connection to both SafetyBUS p segments is made via two male 9-pin D-Sub connectors. These are labelled “Segment A” and “Segment B” on the Router housing.





SafetyBus p

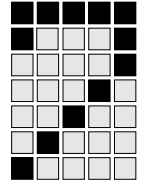
Setting the transmission rate

The transmission rate for bus segment B must be set in order to operate the Router on SafetyBUS p. This is done via the rotary switch labelled “Baudrate Segment B”.

If the Router is to operate at the same transmission rate in both bus segments, set the switch to one of the “auto” settings. Otherwise select one of the fixed transmission rates. Please note that the transmission rate must match the setting on all the other bus subscribers in bus segment B.

If the transmission rate is changed while the Router is operating on SafetyBUS p (LED “SB active Segment B” lights up in green), all the affected I/O-Groups will switch to a STOP condition. The Router will perform a software reset and then operate at the new transmission rate (see “PSS SB Router1 Operating Manual”).

In this case, either correct the setting on the Router or modify the transmission rate on all the bus subscribers in bus segment B. After an initialisation period, the Router will once again be ready for operation (LED “SB active Segment B” lights up in green). Restart all the affected I/O-Groups.



Appendix

Changes in the documentation

Changes in version II to version I

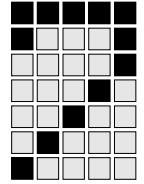
Old p. no.	New p. no.	Change
---	1-1	new: section "Validity of the documentation"
6-3	6-3	new: Interface assignment - Supply voltage for fibre-optic couplers from Pilz

Changes in version 20 229-03

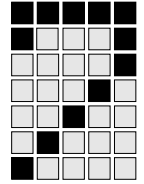
Old p. no.	New p. no.	Change
3-5	---	INFO deleted

Appendix

Notes



Notes



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.

► **www**
www.pilz.com

► **Technical support**
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