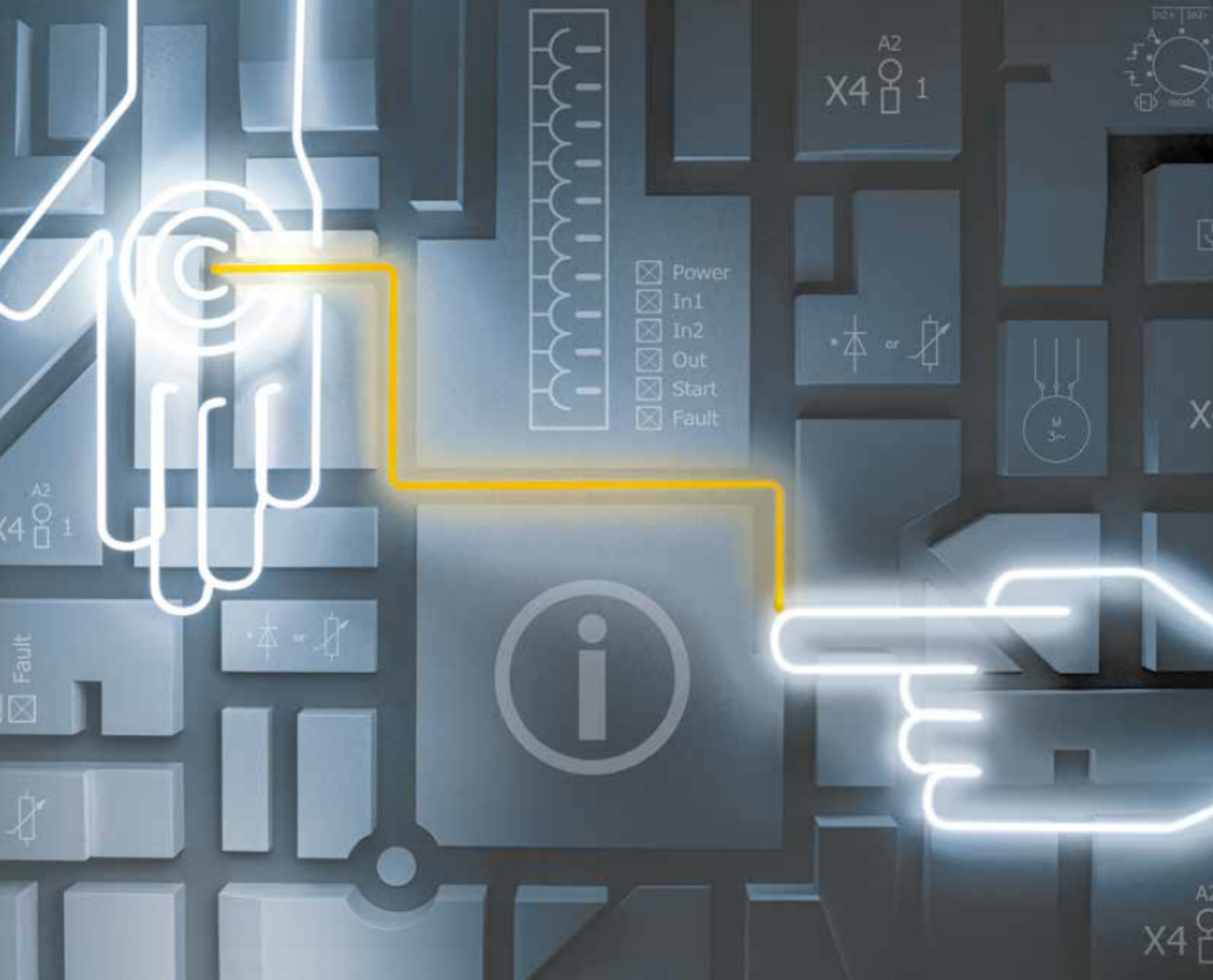




► PSS u2 EF 2DO R 8A (-R)

PILZ
THE SPIRIT OF SAFETY

Operating Manual-1003625-EN-06

- PSS u2 in the automation system PSS 4000
- Remote I/O system PSS u2



This document is the original document.

Where unavoidable, for reasons of readability, the masculine form has been selected when formulating this document. We do assure you that all persons are regarded without discrimination and on an equal basis.

All rights to this documentation are reserved by Pilz GmbH & Co. KG. Copies may be made for the user's internal purposes. Suggestions and comments for improving this documentation will be gratefully received.

Pilz®, PIT®, PMI®, PNOZ®, Primo®, PSEN®, PSS®, PVIS®, SafetyBUS p®, SafetyEYE®, SafetyNET p®, the spirit of safety® are registered and protected trademarks of Pilz GmbH & Co. KG in some countries.



SD means Secure Digital

1	Introduction	5
1.1	Using the documentation	5
1.2	Validity of documentation	5
1.3	Terminology	5
1.4	Definition of symbols	6
1.5	Third-party manufacturer licence information	6
2	Overview	7
2.1	Module features	7
2.2	Side view right	8
3	Safety	9
3.1	Intended use	9
3.2	System requirements (remote I/O system PSS u2)	10
3.3	System requirements (PSS u2 in automation system PSS 4000)	10
3.4	Safety regulations	11
3.4.1	Additional documents that apply	11
3.4.2	Safety assessment in an industrial environment (remote I/O system PSS u2)	11
3.4.3	Safety assessment in railway applications (PSS u2 in the automation system PSS 4000)	11
3.4.4	Use of qualified personnel	12
3.4.5	Warranty and liability	12
3.4.6	Disposal	12
4	Security	13
4.1	Security (remote I/O system PSS u2)	13
4.2	Security (PSS u2 in the automation system PSS 4000)	13
5	Function description	14
5.1	Block diagram	14
5.2	Supply	14
5.3	Outputs	14
5.4	Integrated protection mechanisms	16
5.5	Reaction times	17
5.6	Energy-saving functions	17
6	Structure of the process image (Remote I/O system PSS u2)	18
7	I/O data of the module (PSS u2 in the automation system PSS 4000)	19
7.1	Available I/O data in the I/O mapping	19
7.2	Other I/O data	19
8	Installation	20
8.1	General installation guidelines	20
8.1.1	Dimensions	21
8.2	Protective coding on terminal block	21
8.3	Inserting and removing an electronic module	23
8.3.1	Inserting an electronic module	23
8.3.2	Removing an electronic module	25

8.3.3	Changing an electronic module during operation	25
9	Wiring	27
9.1	General wiring guidelines	27
9.1.1	Wiring (remote I/O system PSS u2)	27
9.1.2	Wiring (PSS u2 in the automation system PSS 4000)	27
9.1.3	Connection mechanism for terminal blocks	28
9.2	Terminal configuration	28
9.3	Function test during commissioning	29
10	Operation	30
10.1	Display elements and messages	30
11	Technical Details	33
11.1	Service life graphs	36
11.2	Safety-related characteristic data (remote I/O system PSS u2)	37
11.3	Safety-related characteristic data (PSS u2 in the automation system PSS 4000)	38
12	Supplementary data	39
12.1	Permitted operating height	39
13	Order reference	40
13.1	Product	40
13.2	Accessories	40
14	EC declaration of conformity for PSS u2 EF 2DO R 8A	42
15	UKCA-Declaration of Conformity for PSS u2 EF 2DO R 8A	43

1 Introduction

1.1 Using the documentation

This document is intended for instruction. Only install and commission the product if you have read and understood this document. The document should be retained for future reference.

1.2 Validity of documentation

This operating manual explains the function and operation, describes the installation and provides guidelines on how to connect the product.

This documentation is valid for the product PSS u2 EF 2DO R 8A ab Version HW 02.01, FW 01.02.00. It is valid until new documentation is published.

This documentation is valid for the product PSS u2 EF 2DO R 8A **-R** from Version HW 01.00, FW 01.02.00. It is valid until new documentation is published.

1.3 Terminology

PSS u2 system

System from a PSS u2 head module and PSS u2 electronic modules.

Remote I/O system PSS u2

PSS u2 system without control functionality that provides I/Os. The I/Os can be controlled via a fieldbus.

The configuration is performed in the tool PASconfig.

PSS u2 in the automation system PSS 4000

PSS u2 system with control functionality that can be used in the automation system PSS 4000. A PSS u2 system is a 2nd generation device in the automation system PSS 4000.

The configuration is performed in the tool PAS4000.

1.4 Definition of symbols

Information that is particularly important is 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 could be damaged and also provides information on preventive measures that can be taken. It also highlights areas within the text that are of particular importance.



INFORMATION

This gives advice on applications and provides information on special features.

1.5 Third-party manufacturer licence information

This product includes Open Source software with various licenses.

Further information is available in the document "Third-party manufacturer licence information PSS u2 EF 2DO R 8A (-R)" (document number 1006612) at www.pilz.com.

2 Overview

Module structure:

A module consists of

- ▶ an electronic module,
- ▶ a terminal block with cage clamp terminals and
- ▶ a module carrier

The electronic modules are plugged into the backplane and determine the function. The backplane is used for communication between the head module and the electronic modules and forms the carrier unit for the electronic modules. The terminal block is plugged into the electronic modules and is used to connect the field wiring.

Details of the terminal blocks that can be used are available under "Intended Use".

2.1 Module features

Application of the product PSS u2 EF 2DO R 8A (-R):

Electronic module with monitored relay outputs for failsafe applications

The product has the following features:

- ▶ Relay contacts with reading back the relay contacts
 - N/O contact
 - Volt-free
 - Current load capacity per output: 10 A
 - Configurable switch-off delay
- ▶ Energy-saving functions
- ▶ LEDs for:
 - Switch status of each output
 - Module error
- ▶ **R-type:**
 - For railway applications (increased environmental requirements)

2.2 Side view right

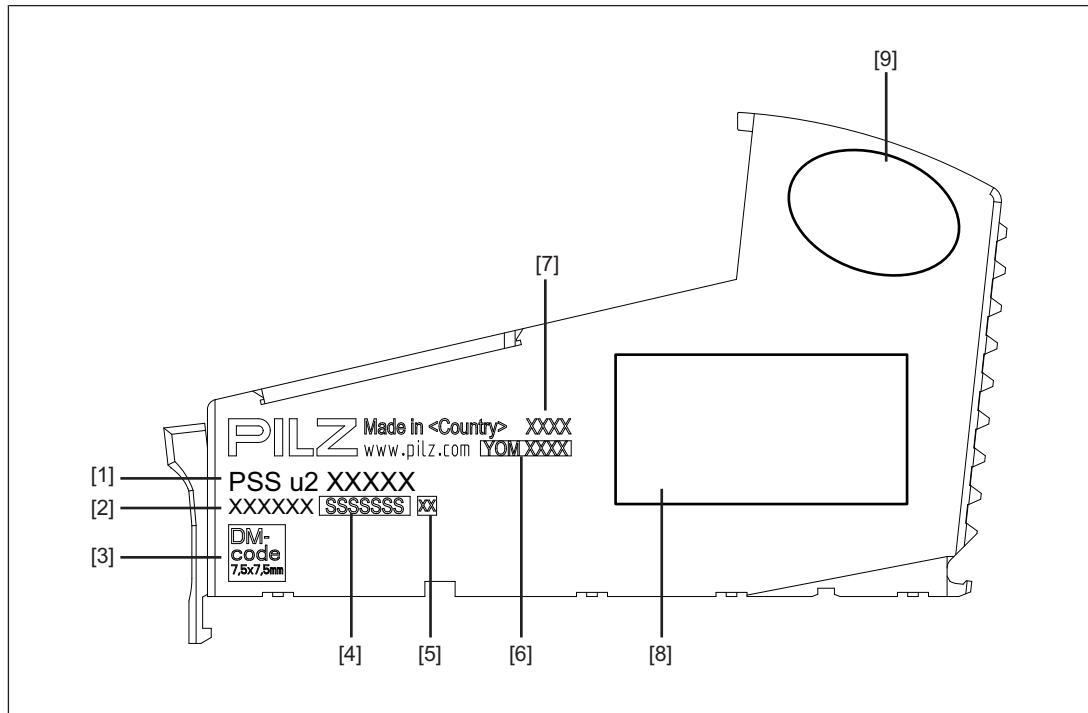


Fig.: Electronic module without terminal block, side view

Legend

[1]	Product Name
[2]	Order number
[3]	2D code product information
[4]	Serial number
[5]	Hardware version
[6]	"YOM" year of manufacture
[7]	Production site
[8]	Placeholder for block diagram
[9]	Placeholder for approval tags

3 Safety

3.1 Intended use

The module PSS u2 EF 2DO R 8A (-R) provides failsafe outputs and may be used for failsafe applications in the PSS u2 systems (see [Terminology](#) [ 5]):

- ▶ Remote I/O system PSS u2
- ▶ PSS u2 in the automation system PSS 4000 (generation 2)

The outputs may be used to switch:

- ▶ Resistive loads
- ▶ Inductive loads

Install the module/the safety controller in a protected environment. Example: Protected inside space or control cabinet with protection class see [Technical details](#) [ 33]. Make sure that only authorised personnel have access to the safety controller.

Intended use includes making the electrical installation EMC-compliant. The module is designed for use in an industrial environment. Interference may occur if used in other areas.

The following is deemed improper use in particular

- ▶ Any component, technical or electrical modification to the module,
- ▶ Use of the module outside the areas described in this manual,
- ▶ Any use of the module that is not in accordance with the technical details.

The module PSS u2 EF 2DO R 8A (-R) may be used in conjunction with the following terminal block:

- ▶ 8-pin terminal block

Module for applications in an industrial environment

Module PSS u2 EF 2DO R 8A

The module meets the requirements of EN IEC 61508 up to SIL 3 and EN ISO 13849-1 up to PL e.

Use in furnaces

The module PSS u2 EF 2DO R 8A can be used in furnaces in accordance with EN 298. If the module's relay outputs shut down the entire fuel supply and the furnace is used in continuous operation, appropriate external measures must be used to establish diversity of the shutdown elements (requirement of EN 50156-1). For example, an appropriate measure may be an additional, monitored switching element (contactor or relay), which is activated by a safe semiconductor output and is switched in series with both relay outputs.

**WARNING!****Risk of electric shock with overvoltage category III!**

If you use the head module PSS u2 P0 F/S PN with the terminal block order no. 328 830, contact with live components could cause life-threatening injuries when voltage is applied.

In applications with overvoltage category III, the head module PSS u2 P0 F/S PN should only be used with terminal block order no. 328 831.

Module for railway applications R-type

Module PSS u2 EF 2DO R 8A -R

- ▶ The module is suitable for use in railway applications (where there are increased environmental requirements) (see [Technical details](#) [33]).
- ▶ Condensation during operation is permitted for the module.
- ▶ The module must only be installed on the carrier module PSS u2 B 4 -R.
- ▶ Depending on the selected railway architecture (see system description Safety architectures for railway applications (1006614)) the requirements of EN 50129 up to SIL 3 or SIL 4.

With reference to the standard IEC 61131-2 the values stated in the technical details for ambient temperature are reduced at heights >2000 m operating height above sea level (see [Supplementary data](#) [39]).

3.2**System requirements (remote I/O system PSS u2)****INFORMATION**

The module is supported by

- ▶ PASconfig from Version 3.0.0
 - We recommend that you always use the latest version (download from www.pilz.com).

3.3**System requirements (PSS u2 in automation system PSS 4000)****INFORMATION**

The module is supported by

- ▶ PAS4000, from Version 1.25.0
 - We recommend that you always use the latest version (download from www.pilz.com).

3.4 Safety regulations

3.4.1 Additional documents that apply

Please read and take note of the following documents:

- ▶ Installation Manual remote I/O system PSS u2 (1004152)
- ▶ Installation Manual PSS u2 in the automation system PSS 4000 (1006253)
- ▶ System Description PSS 4000 (1001467)
- ▶ Safety Manual PSS 4000 (1001468)

With railway applications it also important to note:

- ▶ System description safety architectures for railway applications (1006614)

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

3.4.2 Safety assessment in an industrial environment (remote I/O system PSS u2)

Before using a device, a safety assessment in accordance with the Machinery Directive is required.

The product as an individual component fulfils the functional safety requirements in accordance with EN ISO 13849 and EN IEC 62061. However, this does not guarantee the functional safety of the overall plant/machine. To achieve the relevant safety level of the overall plant/machine's required safety functions, each safety function needs to be considered separately.

3.4.3 Safety assessment in railway applications (PSS u2 in the automation system PSS 4000)

Before using a device, a safety assessment with risk assessment and risk analysis is required.

Using the architectures defined in the system description "Safety architectures for railway applications", the product fulfils the functional safety requirements in accordance with EN 50126/EN 50129. However, this does not guarantee the functional safety of the overall railway application/plant. To achieve the relevant safety level of the overall railway application's/plant's required safety function, each safety function needs to be considered separately.

3.4.4 Use of qualified personnel

The products may only be assembled, installed, programmed, commissioned, operated, maintained and decommissioned by persons who are competent to do so.

A competent person is a qualified and knowledgeable person who, because of their training, experience and current professional activity, has the specialist knowledge required. To be able to inspect, assess and operate devices, systems and machines, the person has to be informed of the state of the art and the applicable national, European and international laws, directives and standards.

It is the company's responsibility only to employ personnel who

- ▶ Are familiar with the basic regulations concerning health and safety / accident prevention,
- ▶ Have read and understood the information provided in the section entitled Safety
- ▶ Have a good knowledge of the generic and specialist standards applicable to the specific application.

3.4.5 Warranty and liability

All claims to warranty and liability will be rendered invalid if

- ▶ The product was used contrary to the purpose for which it is 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.).

3.4.6 Disposal

- ▶ In safety-related applications, please comply with the mission time T_M in the safety-related characteristic data.
- ▶ When decommissioning, please comply with local regulations regarding the disposal of electronic devices (e.g. Electrical and Electronic Equipment Act).

4 Security

To secure plants, systems, machines and networks against cyberthreats it is necessary to implement (and continuously maintain) an overall industrial security concept that is state of the art.

Perform a risk assessment in accordance with VDI/VDE 2182 or IEC 62443-3-2 and plan the security measures with care. If necessary, seek advice from Pilz Customer Support.

4.1 Security (remote I/O system PSS u2)

Further information on Security can be found in the operating manuals of the relevant head modules.

4.2 Security (PSS u2 in the automation system PSS 4000)

Further information on Security can be found in the system description PSS 4000 (1001467).

5 Function description

5.1 Block diagram

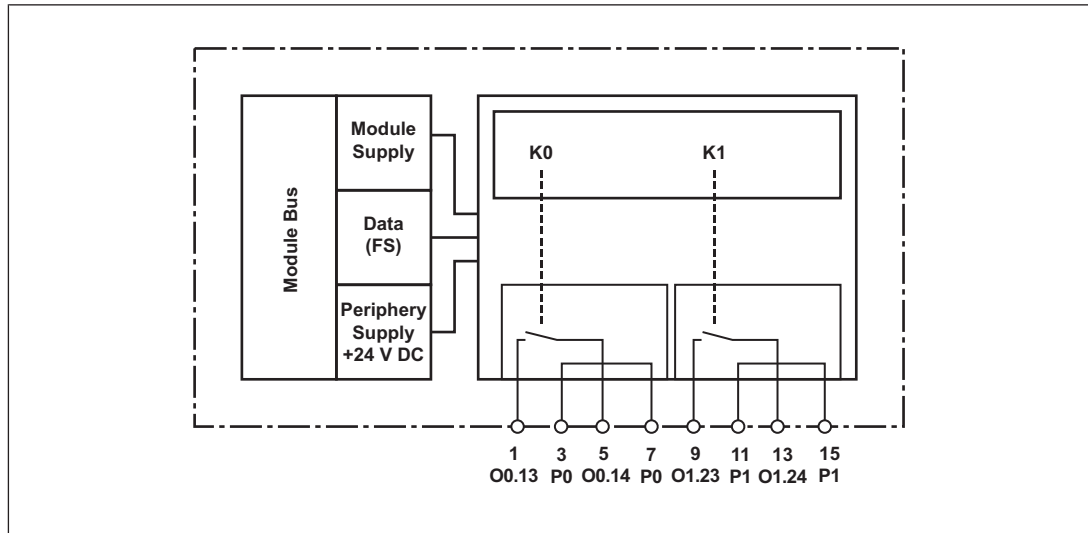


Fig.: Block diagram PSS u2 EF 2DO R 8A (-R)

The two-digit number that follows the relay output (O0.13/O0.14) includes the usual tags of the relay contacts.

5.2 Supply

- The module is supplied with voltage via the head module/main voltage supply PSS u2 PS1 -R connected to the head module.

5.3 Outputs

Outputs

- The head module sets the status of the outputs via the module bus.
- The user must ensure that the relay output is switched on every 75 ms at a maximum.
- The relationship between the load current and the operating temperature is illustrated in the following derating diagrams. The operating point should be below the characteristic curve.

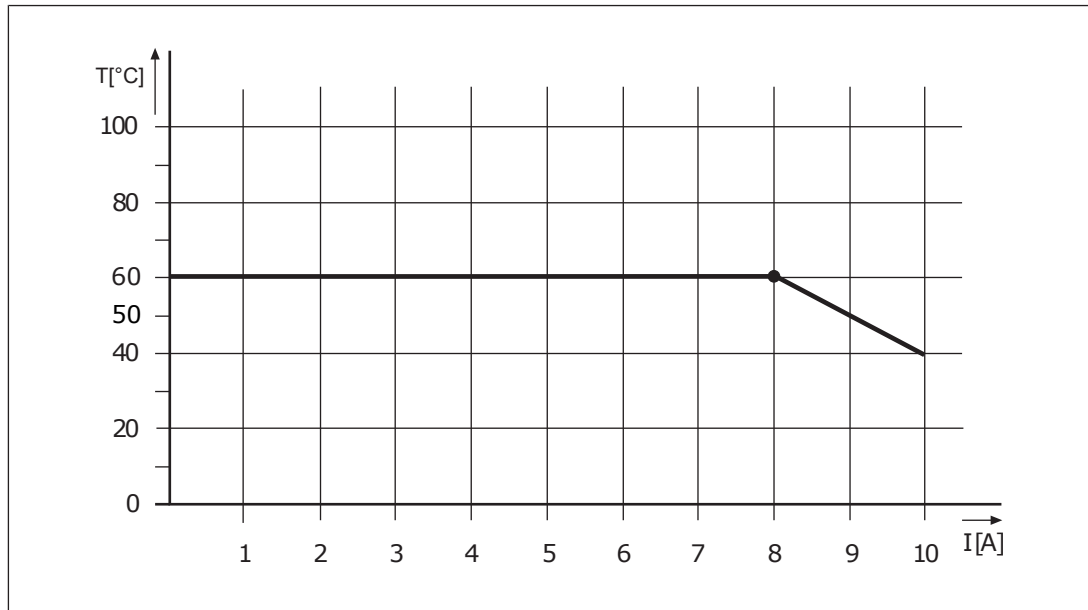


Fig.: Derating PSS u2 EF 2DO R 8A for the permitted ambient temperature T dependent on load current I

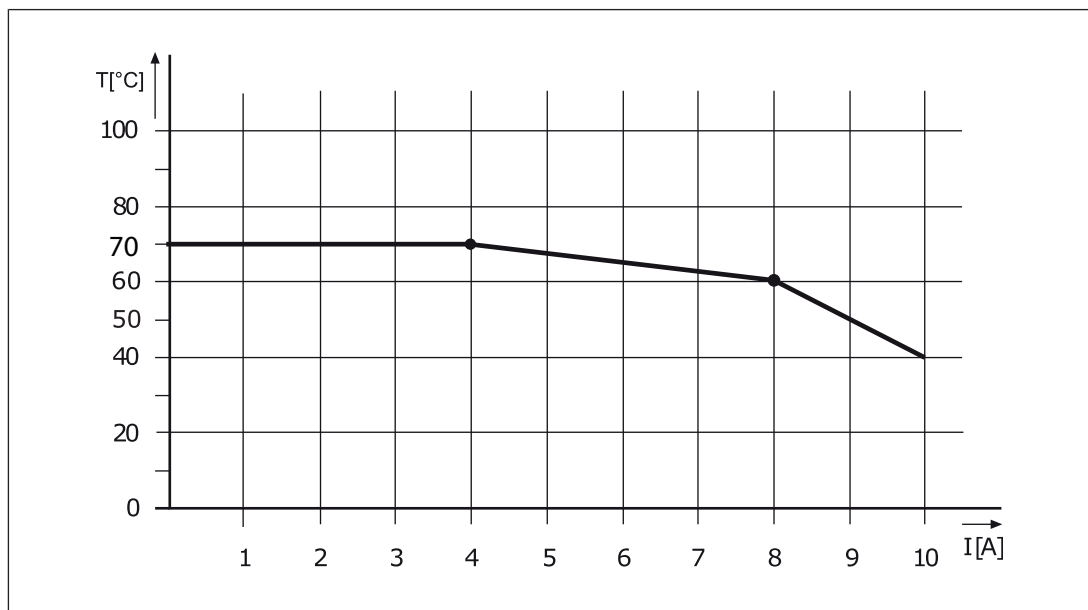


Fig.: Derating PSS u2 EF 2DO R 8A -R for the permitted ambient temperature T dependent on load current I

Switch-off delay

FS outputs can be switched off with a delay. Even if the process image of outputs switches from "1" to "0", a "1" signal may remain at the output for the duration of the delay. If there is another "1" signal during the switch-off delay, the switch-off delay time is reset again and restarts at the next "0" signal.

In the event of external errors, e.g. if the connection to the controller is lost, the output is switched off after the set switch-off delay.

However, in the event of internal module errors, the switch-off delay cannot be guaranteed.
Default value: 0 ms (switch off immediately).

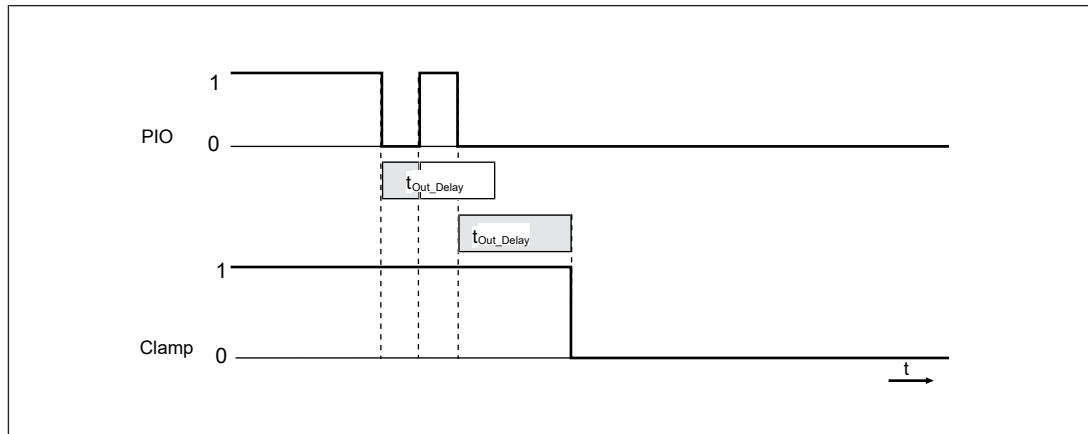


Fig.: Switch-off delay

Legend

PIO	Process image of outputs
t_{Out_Delay}	Configured switch-off delay time
	If there is another "1" signal, the time is reset and restarts at the next "0" signal
Clamp	Signal at the terminal

5.4 Integrated protection mechanisms

The module has the following protection mechanisms:

- ▶ 1 monitored relay contact per output
- ▶ Protective separation between both relay contacts (see [Technical details \[33\]](#))
- ▶ Protective separation between both relay contacts and the periphery supply as well as the module supply, in accordance with DIN VDE 0110 overvoltage category III in a protected industrial network
- ▶ Temperature monitoring

The module provides the following diagnostic data:

- ▶ Start-up error
- ▶ Configuration error
- ▶ FS communication error
- ▶ Temperature error: too warm
- ▶ Temperature error: too hot
- ▶ Relay control error
- ▶ Relay error

5.5 Reaction times

Calculation of the processing times for dual-channel signals.

Worst Case Delay Output

Calculation of the time between the signal being received at the module bus interface and the output switching:

When signal changes from 1 to 0:

$$t_{\text{ProcOM_wcd}} = 4.5 \text{ ms} + t_{\text{Out_Delay}}$$

$t_{\text{Out_Delay}}$: Output's configured switch-off delay

When signal changes from 0 to 1:

$$t_{\text{ProcOM_wcd}} = 18 \text{ ms}$$

One Fault Delay Output

Calculation of the time between the signal being received at the module bus interface and the output switching when a fault is present:

$$t_{\text{ProcOM_ofd}} = t_{\text{ProcOM_wcd}}$$

5.6 Energy-saving functions

The energy levels are supported by the head module and are not configurable. The module supports the following energy levels:

- Switching off the LEDs that display the module and terminal status
- Switching off the LEDs that display the terminal status

6 Structure of the process image (Remote I/O system PSS u2)

When the electronic module is used in the remote I/O system, the data described below are available.

FS-PIO

The module occupies 1 Byte in the process image of outputs.

Byte	Bit	Meaning
0	0	Output data O0
0	1	Output data O1
0	2 ... 7	Not assigned

FS-P11

The module occupies 1 Byte in the process image of inputs.

Byte	Bit	Meaning
0	0	Valid bit of output O0
0	1	Valid bit of output O1
0	2 ... 7	Not assigned

7 I/O data of the module (PSS u2 in the automation system PSS 4000)

When the electronic module for PSS u2 is used in the automation system PSS 4000, the data described below are available.

7.1 Available I/O data in the I/O mapping

Data access is via pre-defined I/O data types:

I/O data name	I/O data type	Data element: Data type	Meaning
O0(1, 5)	FS_O_DO	Data: SAFEBOOL	Output data O0
O1(9,13)	FS_O_DO	Data: SAFEBOOL	Output data O1
OutputValid (*)	FS_I_DI	Data: SAFEBOOL	Bit <i>OutputValid</i>
ReadyForReintegration (*)	FS_I_DI	Data: SAFEBOOL	Bit <i>ReadyForReintegration</i>
Reintegrate (*)	ST_O_DO	Data: BOOL	Bit <i>Reintegrate</i>

(*) Available only if the FS shutdown behaviour "Shutdown of all FS outputs on the electronic module" is configured for the PSS u2 system

7.2 Other I/O data

In addition to the I/O data available via I/O mapping, it is possible to access further I/O data in the user program:

- ▶ Valid bit of the *OutputValid* bit (*)
- ▶ Valid bit of the *ReadyForReintegration* bit (*)

(*) Available only if the FS shutdown behaviour "Shutdown of all FS outputs on the electronic module" is configured for the PSS u2 system

In the Multi programming, access is via the PSS 4000 system control block "Valid".

In IEC 61131 programming, access is via the variable extension "WITH VALID".

8 Installation

8.1 General installation guidelines



NOTICE

R-type electronic modules may only be installed on R-type backplanes.



CAUTION!

Risk of material damage

The incorrect ambient temperature during assembly/dismantling can lead to material damage.

- Comply with the permitted ambient temperature for assembly/dismantling: -20°C ... +45°C



CAUTION!

Risk of material damage

Electrostatic discharge can damage components.

- Ensure against discharge before touching the product, e.g. by touching an earthed, conductive surface or by wearing an earthed arm-band.

8.1.1 Dimensions

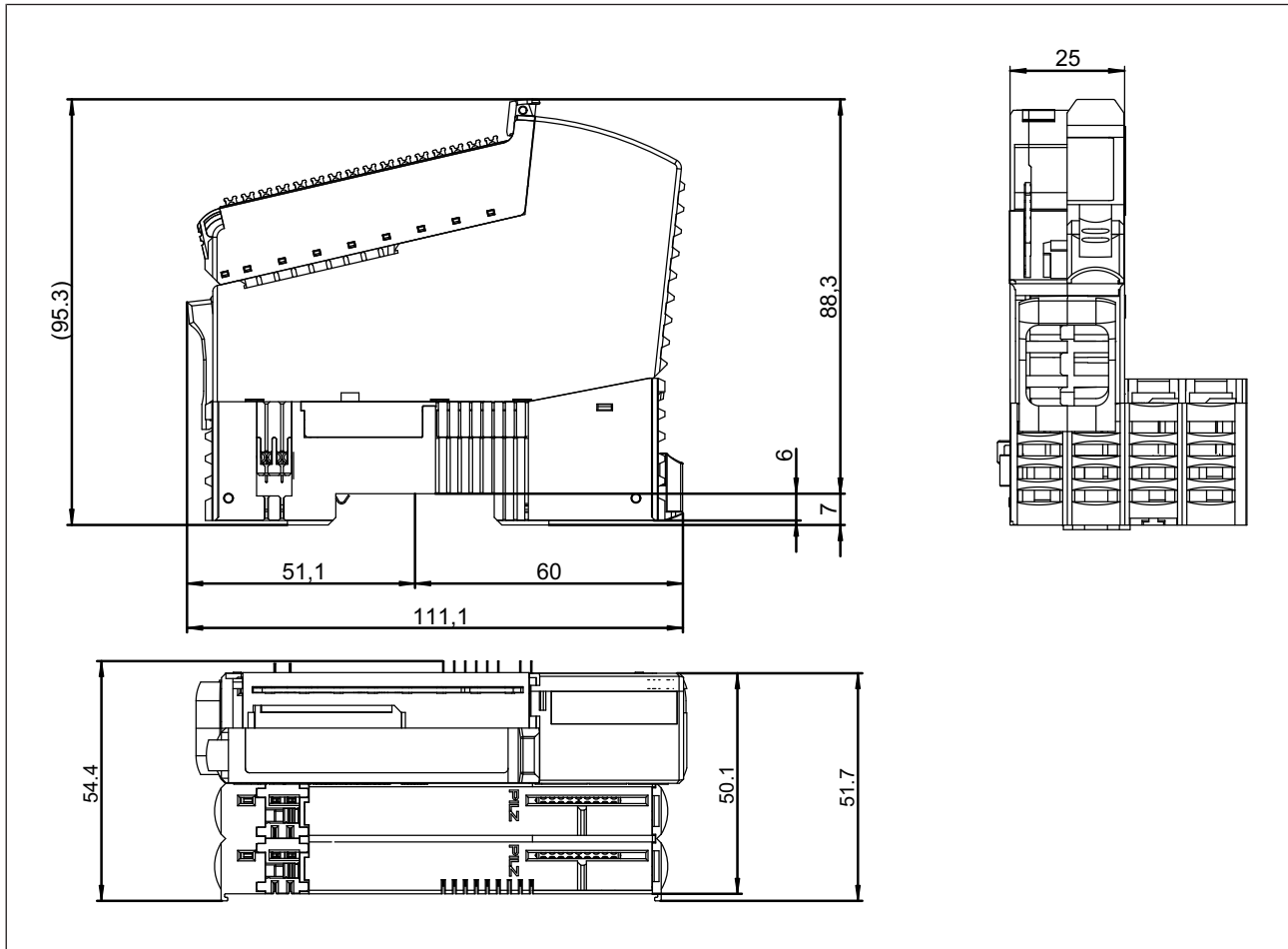
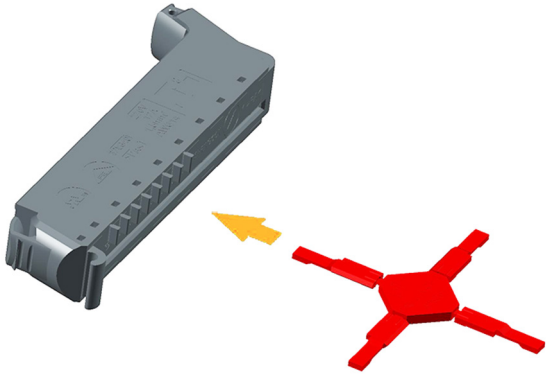
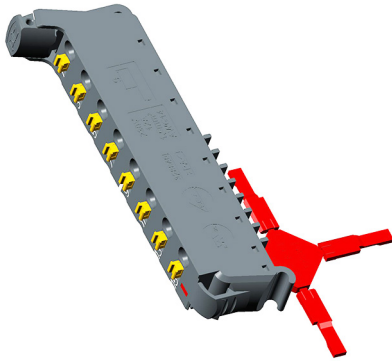
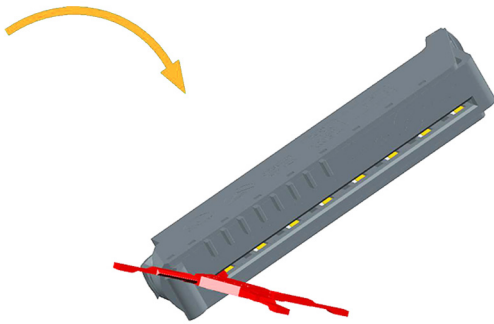
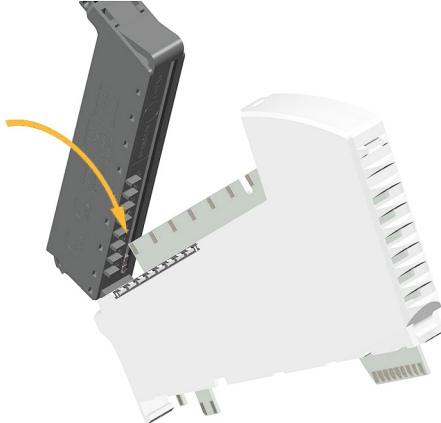


Fig.: Dimensions in mm, including backplane, electronic module and terminal block

8.2 Protective coding on terminal block

If voltages over 50 VAC or 120 VDC are connected to a module's switch contacts, then protective coding must be used. Protective coding prevents the terminal block from being plugged into another module.

1. Insert the protective coding into the 8-pin terminal block.	
2. The protective coding must be visible on the terminal side.	
3. Rotate the protective coding until it is embedded within the terminal block.	
4. Plug the coded terminal block into the module.	

8.3 Inserting and removing an electronic module

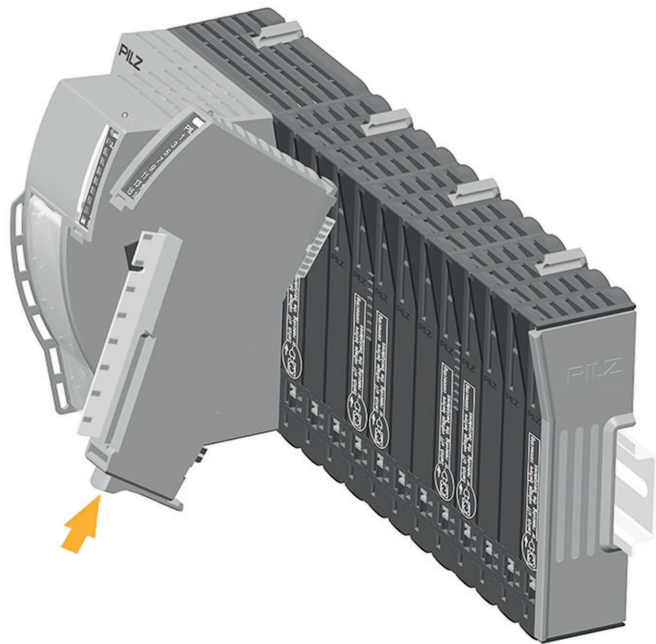
Please note:

- ▶ Backplane must be installed first.
- ▶ Electronic modules may only be plugged or unplugged if the terminal block has been removed first.
- ▶ The mechanics of the electronic modules are designed for 20 plug in/out cycles.
- ▶ On electronic modules with outputs, the terminal block may only be inserted and removed when the load is switched off. Unforeseeable error reactions may be triggered if modules are inserted and removed under load.

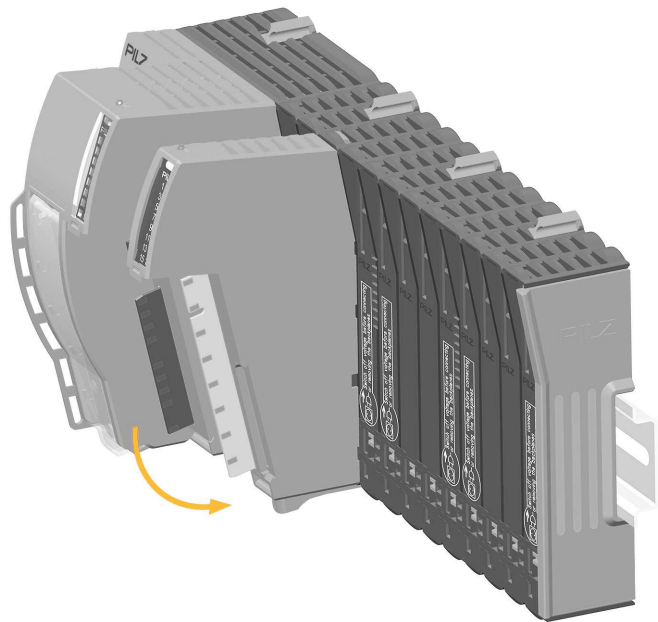
The following illustrations in chapters "Inserting an electronic module", "Removing an electronic module" and "Changing an electronic module during operation" are displayed as an example in the remote I/O system PSS u2 (see [Terminology](#) [ 5]).

8.3.1 Inserting an electronic module

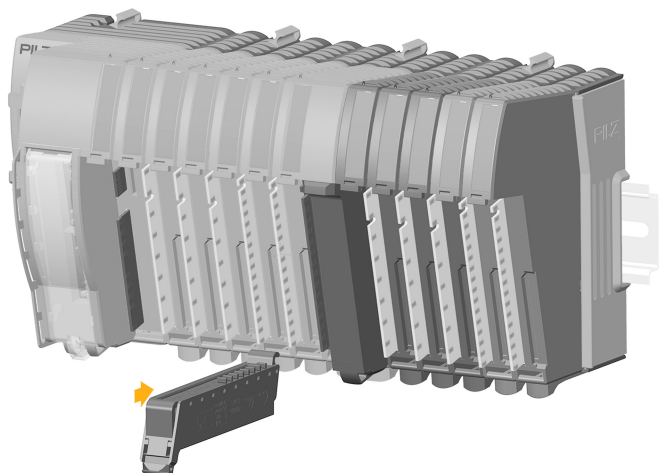
1. Insert the electronic module into the suspension lug on the backplane.



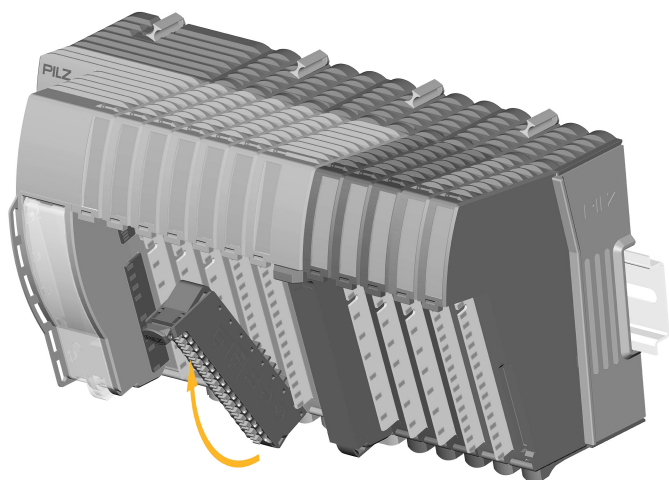
2. Swivel the electronic module downwards until you hear it click into place.



3. Insert the terminal block into the suspension lug on the module.

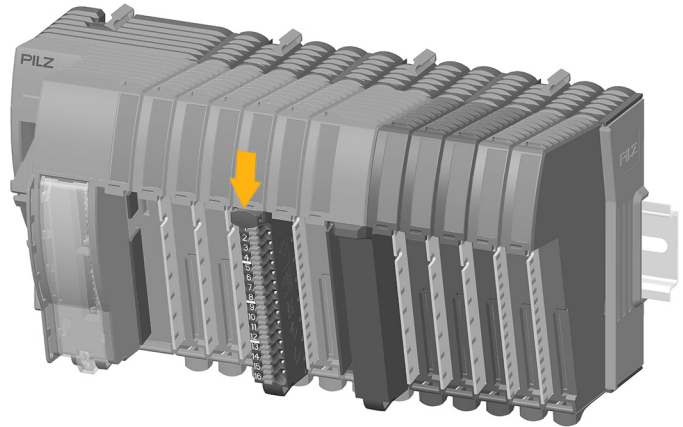


4. Swivel the terminal block upwards until you hear it click into place.

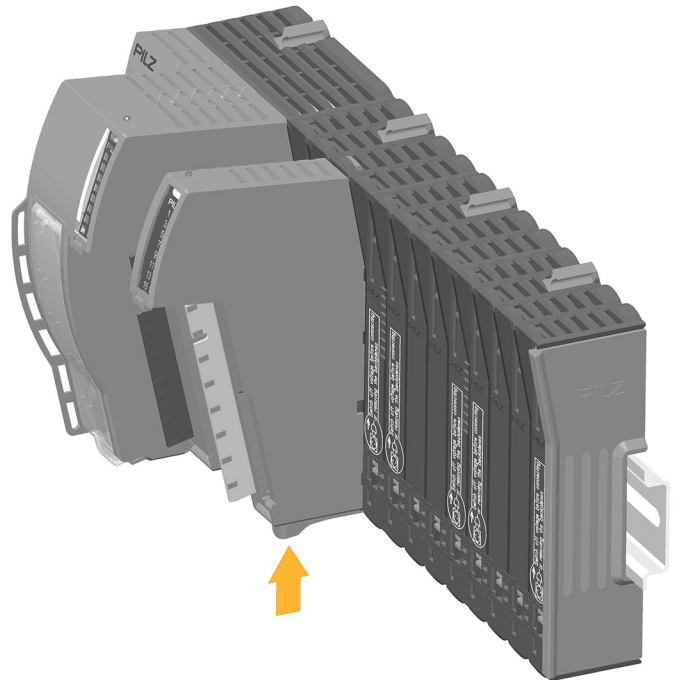


8.3.2 Removing an electronic module

1. Press the unlocking mechanism on the terminal block that is shown by the arrow and pull off the terminal block forward.



2. Press the unlocking mechanism that is shown by the arrow and pull off the electronic module upwards.



8.3.3 Changing an electronic module during operation

An electronic module can be hot swapped.

Effects

- ▶ Module bus communication between the other modules is not interrupted.
- ▶ The configuration data remain (exchange of an electronic module with identical order number).
- ▶ The module is detected automatically as soon as the module is re-inserted.

Procedure

1. [Removing an electronic module](#) [ 25]
2. [Inserting an electronic module](#) [ 23]

A new electronic module can be inserted during operation.

Procedure (inserting an electronic module with not identical order number)

- ▶ [Inserting an electronic module !\[\]\(95b42f0077faf7439a26242a54e021ec_img.jpg\) 23\]](#)

Effects

- ▶ Module bus communication between the other modules is not interrupted.
- ▶ To detect the new module the following steps can be necessary:
 - Creating a new configuration or changing an existing configuration
 - Download of the configuration to the head module
 - Restart of the head module (supply voltage on/off) or Warm Reset using the Reset pushbutton.
- ▶ On electronic modules with outputs, the terminal block may only be inserted and removed when the load is switched off. Unforeseeable error reactions may be triggered if modules are inserted and removed under load.

9 Wiring

9.1 General wiring guidelines

Please note:

- ▶ If short circuits occur between the cable from the output to the load and a supply line, it will no longer be possible to switch off the load. Possible remedies:
 - Exclude the error by using separate multicore cable for supply voltages
 - Use dual actuators, e.g. two contactors in series.
 - Use an additional shutdown device such as a main contactor
- ▶ Use appropriate wiring to exclude short circuits between the outputs.
- ▶ The actuators may be connected using unshielded cables.
- ▶ To prevent contact welding, a fuse should be connected before the output contacts (see [Technical details \[33\]](#)).
- ▶ It is essential to consider the relay's service life graphs to prevent contact welding (see Service life graphs).
- ▶ The safety system must be used only in enclosed spaces.
- ▶ With inductive loads, sufficient fuse protection must be provided on all output contacts.
- ▶ If voltages higher than 50 VAC or 120 VDC are connected to the relay contacts, please note the following:
 - Specific accident prevention regulations apply.
 - These voltages must only be applied at the upper terminals (Ox3), to guarantee protection against contact when removing the terminal blocks.
- ▶ If condensation occurs on the module, only protective extra low voltage may be connected to the relay contacts.

9.1.1 Wiring (remote I/O system PSS u2)

Please note:

- ▶ For applications in accordance with SIL CL 2 and SIL CL 3 relay outputs must be 2-channel. Only the relay contact of the same module may be used.

9.1.2 Wiring (PSS u2 in the automation system PSS 4000)

Please note:

For applications in accordance with SIL CL 2 and SIL CL 3 relay outputs must be 2-channel.

Two relay outputs can be implemented as follows:

- ▶ Operating mode: "Safe state of all FS outputs of the electronic module"
 - with the two relay outputs of the same relay module OR
 - with two different relay modules (independently of whether the modules are part of the same PSS u2 system or not). In this case the user must ensure in the user program that both outputs are switched off when the OutputValid signal of at least one of the two relay modules is FALSE.

- ▶ Operating mode: "Safe state of all the FS outputs of the PSS u2 system"
 - with the two relay outputs in the same PSS u2 system (independently of whether both channels are on the same module or various modules) OR
 - with two different relay modules in two different PSS u2 systems. In this case the user must ensure in the user program that both outputs are switched off when the Output-
tRUN signal of at least one of the two relay modules is FALSE.

9.1.3 Connection mechanism for terminal blocks

Procedure:

- ▶ Use a flat head screwdriver.
- ▶ Strip the wire back 9 mm.
- ▶ Feed the stripped cable as far as it will go into the opening for the spring-loaded terminal.
- ▶ Check that the cable is firmly seated.

Please note:

- ▶ The minimum cable cross section for field connection terminals on the terminal blocks is 0.15 mm² (AWG26).
- ▶ The maximum cable cross section for field connection terminals on the terminal blocks is 1.5 mm² with ferrules (AWG14)
- ▶ Use copper wiring.

9.2 Terminal configuration

Terminal configuration	Connection examples	
1: Output O0.13 3: Potential P0 5: Output O0.14 7: Potential P0 9: Output O1.23 11: Potential P1 13: Output O1.24 15: Potential P1 [1]	1-channel wiring 	2-channel wiring

The terminals P0 are interconnected and they may only be used for the outputs O0.13 and O0.14.

The terminals P1 are interconnected and they may only be used for the outputs O1.23 and O1.24.

- ^[1] The two-digit number that follows the relay output (O0.13/O0.14) includes the usual tags of the relay contacts.

9.3 Function test during commissioning

An error must be simulated for each safety-related output during commissioning: The anticipated error reaction must occur when an output has an error against a supply voltage.



INFORMATION

The safety-related test must be performed on the load and not on the output terminal.

10 Operation

When the relay outputs are switched on, the mechanical contact on the relay cannot be tested automatically. Depending on the operational environment, measures to detect the non-opening of switching elements may be required under some circumstances.

When the product is used in accordance with the following directives, a check must be carried out to ensure that the safety contacts on the relay outputs open correctly. Open the safety contacts (switch off output) and start the device again, so that the internal diagnostics can check that the safety contacts open correctly.

- ▶ European machinery directive
 - for SIL CL 3/PL e at least 1x per month
 - for SIL CL 2/PL d at least 1x per year
- ▶ Application in accordance with EN 50129
 - for SIL 3 and SIL 4 at least 1x in 6 months

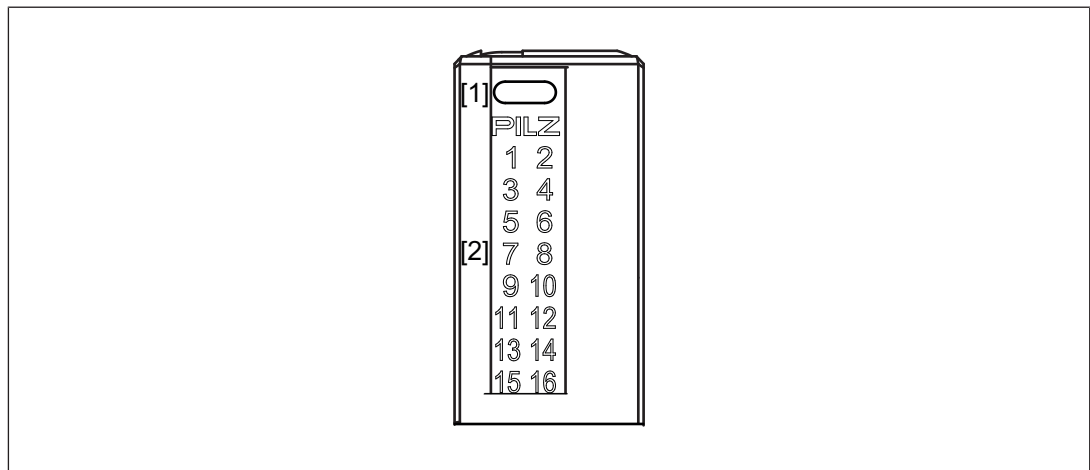


NOTICE

The safety functions should be checked after initial commissioning and each time the plant/machine is changed. The safety functions may only be checked by qualified personnel.

10.1 Display elements and messages

Only the LEDs at the terminals 1, 5, 9, 13 are active.



Legend

- [1] Module status display
- [2] Terminal status display

The module can detect the following errors:

[1]	Colour [1]	[2]	Colour [2]	Meaning	Further information
	--		--	Module not ready for operation	
	Green		--	Module ready for operation	
	Green		Green	Module in operation and the safety contacts are closed	
	Green		--	Module in operation and the safety contacts are open	
	Red		--	Configuration error: Module was inserted in the wrong slot.	
	Red		--	Internal error/firmware update	See module's diagnostic log
	Red		Green	The module status display and the terminal status display on the relevant output flash synchronously Short circuit/overload/undervoltage	See module's diagnostic log.
	Red		Green	Temperature error: too warm ^[1] /warning, e.g. undervoltage	See module's diagnostic log
	Red		Green	The module status display and all terminal status displays flash synchronously Periphery supply is missing/temperature error: too hot ^[1]	See module's diagnostic log

Legend



LED on



LED flashes



LED flashes



LED off

^[1] There are two levels of overtemperature.

► Too warm:

If the module temperature exceeds a threshold value, then:

- a warning is sent to the head module.

If the temperature drops back below the threshold value, the module sends an all-clear.

► Too hot:

If the module temperature exceeds another threshold value, then:

- an error message is sent to the head module
- the outputs are switched off
- The valid bits for the outputs are set to "0"

After the "too hot" message has been received, if the temperature drops back below the "too warm" threshold value, the module will switch to an error-free state.

11 Technical Details

General	328150	327150
Certifications	CE, EAC, KOSHA, TÜV, UKCA, cULus Listed	CE, TÜV
Application range	Failsafe	Failsafe
Module's device code	404Eh	4C4Eh
Electrical data	328150	327150
Supply voltage		
Potential isolation	Yes	Yes
Internal supply voltage (module supply)		
Module's power consumption	0,45 W	0,45 W
Periphery's supply voltage (periphery supply)		
Voltage range	16,8 - 30 V	16,8 - 30 V
Module's current consumption with no load	40 mA	40 mA
Module's power consumption with no load	1,2 W	1,2 W
Max. power dissipation of module	2,6 W	2,6 W
Permitted loads	inductive, resistive	inductive, resistive
Process data remote IO system PSS u2	328150	327150
Number of FS input bytes (assigned bits)	1(2)	–
Number of FS output bytes (assigned bits)	1(2)	–
Process data PSS u2 in the automation system PSS 4000	328150	327150
Number of ST control bits	–	1
Number of FS output bits	–	2
Number of FS status bits	–	4
Relay outputs	328150	327150
Number of relay outputs	2	2
Utilisation category		
in accordance with the standard	EN 60947-4-1	EN 60947-4-1

Relay outputs	328150	327150
Utilisation category of safety contacts		
AC1 at	250 V	250 V
Min. current	5 mA	5 mA
Max. current	10 A	10 A
Max. power	2300 VA	2300 VA
DC1 at	24 V	24 V
Min. current	5 mA	5 mA
Max. current	10 A	10 A
Max. power	240 W	240 W
Utilisation category		
in accordance with the standard	EN 60947-5-1	EN 60947-5-1
Utilisation category of safety contacts		
AC15 at	230 V	230 V
Max. current	3 A	3 A
DC13 (6 cycles/min) at	24 V	24 V
Max. current	5 A	5 A
Utilisation category in accordance with UL		
Voltage	250 V AC G.U. (same polarity)	–
with current	6 A	–
Voltage	24 V DC G. U.	–
with current	6 A	–
Pilot Duty	B300, R300	–
External contact fuse protection, safety contacts		
in accordance with the standard	VDE 0660	VDE 0660
Blow-out fuse, quick	10 A	10 A
Blow-out fuse, slow	6 A	6 A
Blow-out fuse, gG	10 A	10 A
Contact material	AgCuNi + 0,2 µm Au	AgCuNi + 0,2 µm Au
Potential isolation	Yes	Yes
Environmental data	328150	327150
Application site		
in accordance with the standard	–	EN 50125-3
Application site	–	Track area (1 m - 3 m)
Climatic suitability	EN 60068-2-1, EN 60068-2-14, EN 60068-2-2, EN 60068-2-30, EN 60068-2-78	EN 60068-2-1, EN 60068-2-14, EN 60068-2-2, EN 60068-2-30, EN 60068-2-78
Ambient temperature		
in accordance with the standard	EN 60068-2-14	EN 60068-2-14
Temperature range	0 - 60 °C	-40 - 70 °C
Storage temperature		
in accordance with the standard	EN 60068-2-1/-2	EN 60068-2-1/-2
Temperature range	-40 - 70 °C	-40 - 70 °C

Environmental data	328150	327150
Climatic suitability		
in accordance with the standard	EN 60068-2-78	EN 60068-2-78
Humidity	93 % r. h. at 40 °C	95 % r. h. at 40 °C
Condensation during operation	Not permitted	EN 60068-2-30, only with protective extra-low voltage
Max. operating height above SL	2000 m	5000 m
EMC	EN 61131-2 (Zone B)	EN 50121-4, EN 61000-6-2, EN 61000-6-4, EN 61131-2 (Zone B)
Vibration		
in accordance with the standard	EN 60068-2-6	–
Frequency	8,4 - 150 Hz	–
Acceleration	10 m/s²	–
Broadband noise		
in accordance with the standard	–	EN 60068-2-64
Frequency	–	5 - 2.000 Hz
Acceleration	–	2,3 m/s² eff.
Shock stress		
in accordance with the standard	EN 60068-2-27	EN 60068-2-27
Number of shocks	6	6
Acceleration	150 m/s²	20 m/s²
Duration	11 ms	11 ms
Airgap creepage		
in accordance with the standard	EN 60664-1	EN 50124-1
Overvoltage category	III	OV2
Pollution degree	–	PD2
in accordance with the standard	EN 61131-2, UL/IEC 61010-2-201	EN 61131-2
Overvoltage category	II	II
Pollution degree	2	2
Protection type		
in accordance with the standard	EN 60529	EN 60529
Housing	IP20	IP20
Mounting area (e.g. control cabinet)	IP54	IP51
Potential isolation	328150	327150
Potential isolation between	Relay output and relay output	Relay output and relay output
Type of potential isolation	Protective separation	Protective separation
Rated surge voltage in operating heights up to max. 2000 m	6000 V	6000 V
Rated surge voltage in operating heights up to max. 5000 m	–	4000 V
Potential isolation between	Relay output and periphery supply	Relay output and periphery supply
Type of potential isolation	Protective separation	Protective separation
Rated surge voltage in operating heights up to max. 2000 m	6000 V	6000 V

Potential isolation	328150	327150
Rated surge voltage in operating heights up to max. 5000 m	–	4000 V
Potential isolation between	Relay output and module supply	Relay output and module supply
Type of potential isolation	Protective separation	Protective separation
Rated surge voltage in operating heights up to max. 2000 m	6000 V	6000 V
Rated surge voltage in operating heights up to max. 5000 m	–	4000 V
Potential isolation between	Periphery supply and module supply	Periphery supply and module supply
Type of potential isolation	Functional insulation	Functional insulation
Rated surge voltage in operating heights up to max. 2000 m	2000 V	2000 V
Rated surge voltage in operating heights up to max. 5000 m	–	1500 V
Mechanical data	328150	327150
Mechanical life	10,000,000 cycles	10,000,000 cycles
Material		
Housing	PC	PC
Mounting type	plug-in	plug-in
Dimensions		
Height	110,8 mm	110,8 mm
Width	25 mm	25 mm
Depth	72,5 mm	72,5 mm
Weight	93 g	93 g

Where standards are undated, the 2020-01 latest editions shall apply.

11.1 Service life graphs

The service life graphs indicate the number of cycles from which failures due to wear must be expected. The wear is mainly caused by the electrical load; the mechanical load is negligible.

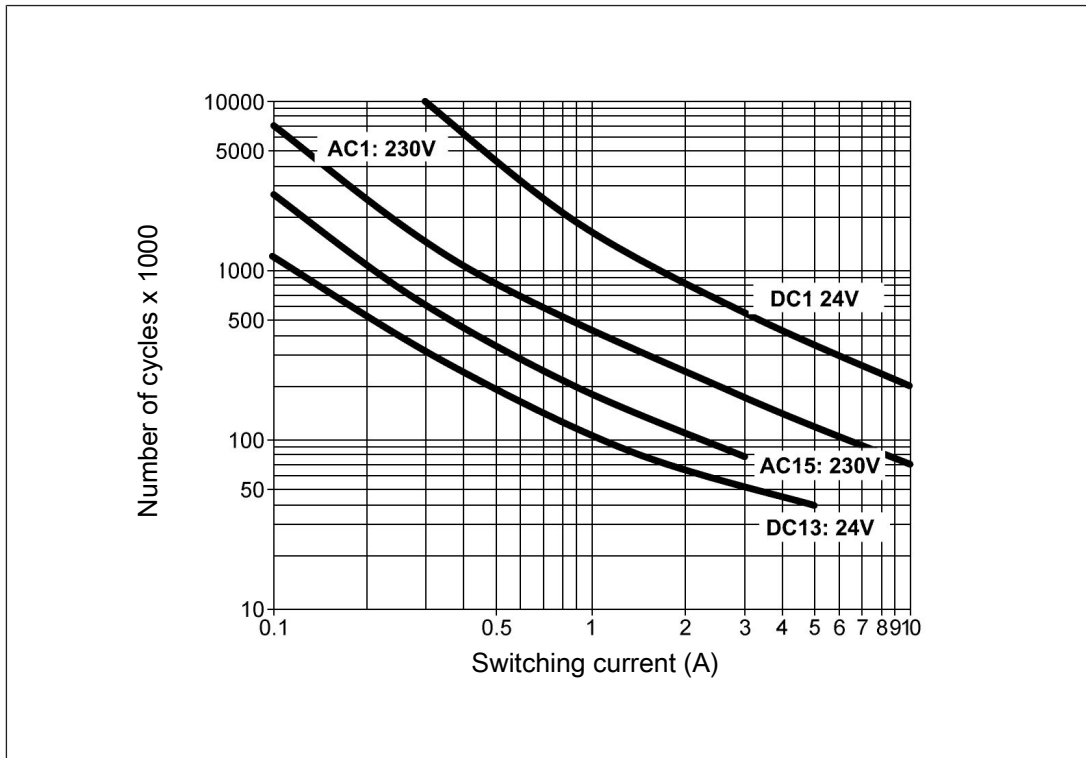


Fig.: Service life graph / Switching capability 24 VDC / 250 VAC

Example

- ▶ Inductive load: 0.2 A
- ▶ Utilisation category: AC15
- ▶ Contact service life: 1 000 000 cycles

Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see [Technical details \[33\]](#)) can be used in the calculation.

To increase the service life, sufficient spark suppression must be provided on all relay contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

We recommend you use semiconductor outputs to switch 24 VDC loads.

11.2

Safety-related characteristic data (remote I/O system PSS u2)



NOTICE

You must comply with the safety characteristic data in order to achieve the required safety level for your plant/machine.

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN IEC 62061 SIL CL/ maximum SIL	EN IEC 62061 PFH _D [1/h]	EN/IEC 61511 SIL	EN/IEC 61511 PFD	EN ISO 13849-1: 2015 T _M [year]
1-channel	PL c	Cat. 1	-	1,17E-07	-	1,03E-02	20
2-channel	PL e	Cat. 4	SIL CL 3	2,42E-10	SIL 3	2,10E-05	20

Explanatory notes for the safety-related characteristic data:

- ▶ Safety characteristic data in accordance with EN IEC 62061 and EN/IEC 61511 was calculated based on EN/IEC 61508.
- ▶ T_M is the maximum mission time in accordance with EN ISO 13849-1. The value also applies as the retest interval in accordance with EN/IEC 61508-6 and EN/IEC 61511 and as the proof test interval and mission time in accordance with EN IEC 62061.

All the units used within a safety function must be considered when calculating the safety characteristic data.



INFORMATION

A safety function's SIL/PL values are **not** identical to the SIL/PL values of the units that are used and may be different. We recommend that you use the PAScal software tool to calculate the safety function's SIL/PL values.



CAUTION!

It is essential to consider the relay's service life graphs. The relay outputs' safety-related characteristic data is only valid if the values in the service life graphs are met.

The PFH value depends on the switch frequency and the load of the relay output.

If the service life graphs are not accessible, the stated PFH value can be used irrespective of the switch frequency and the load, as the PFH value already considers the relay's B10d value as well as the failure rates of the other components.

The safety-related characteristic data (PFH, PFD) are mean values. They have been calculated at an average ambient component temperature of 40 °C.

11.3

Safety-related characteristic data (PSS u2 in the automation system PSS 4000)

Safety-related characteristics of the safety outputs

Safety-related characteristic data for railway applications must be considered for the overall system, see System description for railway applications (1006614).

The mission time of the module is T_M = 20 years.

12 Supplementary data

12.1 Permitted operating height

The values stated in the technical details apply to the use of the device in operating heights up to max. 2000 m above SL. When used at higher levels, restrictions of the ambient temperature (standard IEC 61131-2) must be taken into account.

Operating height above SL [m]	Multiplication factors for the devices' ambient temperature
0 ... 2000	1.0
3000	0.9
4000	0.8
5000	0.7

13 Order reference

13.1 Product

Product type	Features	Order no.
PSS u2 EF 2DO R 8A	PSS u2, electronic module, failsafe, 2 outputs, relay contacts, N/O, for switching resistive and inductive loads, max. 250 V AC 10 A (AC1), volt-free, switch-off delay configurable, protective coding PSS u2 A CE T available for terminal block, 2-row, terminal block PSS u2 T 8 required (not supplied with the device).	328150
PSS u2 EF 2DO R 8A -R	PSS u2, electronic module, failsafe, 2 outputs, relay contacts, N/O, for switching resistive and inductive loads, max. 250 V AC 10 A (AC1), volt-free, switch-off delay configurable, for enhanced environmental requirements and railway applications, protective coding PSS u2 A CE T available for terminal block, 2-row, terminal block PSS u2 T 8 required (not supplied with the device).	327150

13.2 Accessories

Terminal block

Product type	Features	Order no.
PSS u2 T 8 (1 pc.)	Terminal block 8-pin, scope of delivery: 1 piece	328840
PSS u2 T 8 (10 pcs.)	Terminal block 8-pin, scope of delivery: 10 pieces	328841
PSS u2 T 8 (5 x 10 pcs.)	Terminal block 8-pin, scope of delivery: 50 pieces	328842

Labelling bracket

Product type	Features	Order no.
PSS u2 A LC E1 (10 pcs.)	Label holder for electronic module 23.5 x 10.5 mm, scope of delivery: 10 pieces	328910
PSS u2 A LC E2 (10 pcs.)	Label holder for electronic module 103 x 10.5 mm, scope of delivery: 10 pieces	328911
PSS u2 A LA E1 (10 pcs.)	Labelling strips for electronic module 23.5 x 10.5 mm (10 x DIN A4 sheet)	328913
PSS u2 A LA E2 (10 pcs.)	Labelling strips for electronic module 103 x 10.5 mm (10 x DIN A4 sheet)	328914

Label holder for terminal block

Product type	Features	Order no.
PSS u2 A LC T3 (10 pcs.)	Label holder for terminal block 61 x 11.5 mm, scope of delivery: 10 pieces	328912

Coding elements

Product type	Features	Order no.
PSS u2 A CE E (10 pcs.)	Coding elements for electronic modules, scope of delivery: 10 pieces	328860

Protective coding for terminal block

Product type	Features	Order no.
PSS u2 A CE T (10 pc.)	Protective coding for terminal block, scope of delivery: 10 pieces	328861

Backplanes

Product type	Features	Order no.
PSS u2 B 1	PSS u2, accessories, backplane, for electronic modules, 1 slot, width 12.6 mm, height 107 mm, note the mounting distances.	328811
PSS u2 B 4	PSS u2, accessories, backplane, for electronic modules, 4 slots, width 50.1 mm, height 107 mm, note the mounting distances.	328810
PSS u2 B 4 -R	PSS u2, accessories, backplane, for electronic modules, 4 slots, for increased environmental requirements and railway applications, width 50.1 mm, height 107 mm, note the mounting distances.	327810

14 EC declaration of conformity for PSS u2 EF 2DO R 8A

This product/these products meet the requirements of the directive 2006/42/EC for machinery of the European Parliament and of the Council. The complete EC Declaration of Conformity is available on the Internet at www.pilz.com/downloads.

Authorised representative: Norbert Fröhlich, Pilz GmbH & Co. KG, Felix-Wankel-Str. 2, 73760 Ostfildern, Germany

15 **UKCA-Declaration of Conformity for PSS u2 EF 2DO R 8A**

This product(s) complies with following UK legislation: Supply of Machinery (Safety) Regulation 2008.

The complete UKCA Declaration of Conformity is available on the Internet at www.pilz.com/downloads.

Representative: Pilz Automation Technology, Pilz House, Little Colliers Field,
Corby, Northamptonshire, NN18 8TJ United Kingdom, eMail: mail@pilz.co.uk

Support

Technical support is available from Pilz round the clock.

Americas

Brazil

+55 11 97569-2804

Canada

+1 888 315 7459

Mexico

+52 55 5572 1300

USA (toll-free)

+1 877-PILZUSA (745-9872)

Asia

China

+86 21 60880878-216

Japan

+81 45 471-2281

South Korea

+82 31 778 3300

Australia and Oceania

Australia

+61 3 95600621

New Zealand

+64 9 6345350

Europe

Austria

+43 1 7986263-0

Belgium, Luxembourg

+32 9 3217570

France

+33 3 88104003

Germany

+49 711 3409-444

Ireland

+353 21 4804983

Italy, Malta

+39 0362 1826711

Scandinavia

+45 74436332

Spain

+34 938497433

Switzerland

+41 62 88979-32

The Netherlands

+31 347 320477

Turkey

+90 216 5775552

United Kingdom

+44 1536 462203

**You can reach our
international hotline on:**

+49 711 3409-222

support@pilz.com

Pilz develops environmentally-friendly products using ecological materials and energy-saving technologies. Offices and production facilities are ecologically designed, environmentally-aware and energy-saving. So Pilz offers sustainability, plus the security of using energy-efficient products and environmentally-friendly solutions.



1003625-EN-06, 2023-04 Printed in Germany
© Pilz GmbH & Co. KG, 2019

CECE®, CHRE®, CMSE®, InduraNET p®, Leansafe®, Master of Safety®, PAS4000®, PAScale®, PASconfig®, Pilz®, PIR®, PLID®, PMCPprime®, PMCPprotego®, PMCTendo®, PMD®, PMJ®, PNOZ®, PRIZ®, PRCM®, PRIMO®, PRISM®, PRISM p®, PSS®, PVS®, SafetyBUS p®, SafetyNET p®, THE SPIRIT OF SAFETY® are registered and protected trademarks of Pilz GmbH & Co. KG in some countries. We would point out that product features may vary from the details stated in this document, depending on the status at the time of publication and the scope of the equipment. We accept no responsibility for the validity, accuracy and entirety of the text and graphics presented in this information. Please contact our Technical Support if you have any questions.

We are represented internationally. Please refer to our homepage www.pilz.com for further details or contact our headquarters.

Headquarters: Pilz GmbH & Co. KG, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
Telephone: +49 711 3409-0, Telefax: +49 711 3409-133, E-Mail: info@pilz.com, Internet: www.pilz.com

PILZ
THE SPIRIT OF SAFETY