PSS u2 ES 6DI 120V AC

PILZ
THE SPIRIT OF SAFETY

- Control system PSS u2
- Remote I/O system PSS u2

Operating Manual-1005014-EN-01

1 Introduction

1.1 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 ES 6DI 120V AC. It is valid until new documentation is published.

1.2 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.

Please refer to the PSS u2 Installation Manual.

1.3 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.

2 Overview

Module structure:

A module consists of

- An electronic module
- A terminal block with cage clamp terminals and
- A backplane

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 ES 6DI 120V AC:

Electronic module with digital inputs for standard applications

The product has the following features:

- 6 type 1/3 digital inputs in accordance with IEC 61131-2
- Configurable input filter time: 5 … 25.5 [ms]
- Configurable pulse stretching: 0 … 255 [ms]
- Energy-saving functions
- LEDs for:
  - Status of inputs
  - Module error
  - Operating status

3 Safety

3.1 Intended use

The module provides standard type 3 inputs in accordance with IEC 61131-2 and may be used for standard applications in the PSS u2 system.

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 ES 6DI 120V AC may be used in conjunction with the following terminal block:

- 8-pin terminal block

3.2 System requirements

INFORMATION

The module is supported by

- PASconfig from version 3.0
  - We recommend that you always use the latest version (download from www.pilz.com).

3.3 Safety regulations

3.3.1 Use of qualified personnel

The products may only be assembled, installed, programmed, commissioned, operated, maintained and decommissioned by competent persons.

A competent person is someone who, because of their training, experience and current professional activity, has the specialist knowledge required to test, assess and operate the work equipment, devices, systems, plant and machinery in accordance with the general standards and guidelines for safety technology.

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 this description under "Safety",
- And have a good knowledge of the generic and specialist standards applicable to the specific application.

3.3.2 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.).

3.3.3 Disposal

- When decommissioning, please comply with local regulations regarding the disposal of electronic devices (e.g. Electrical and Electronic Equipment Act).

4 Function description

4.1 Block diagram

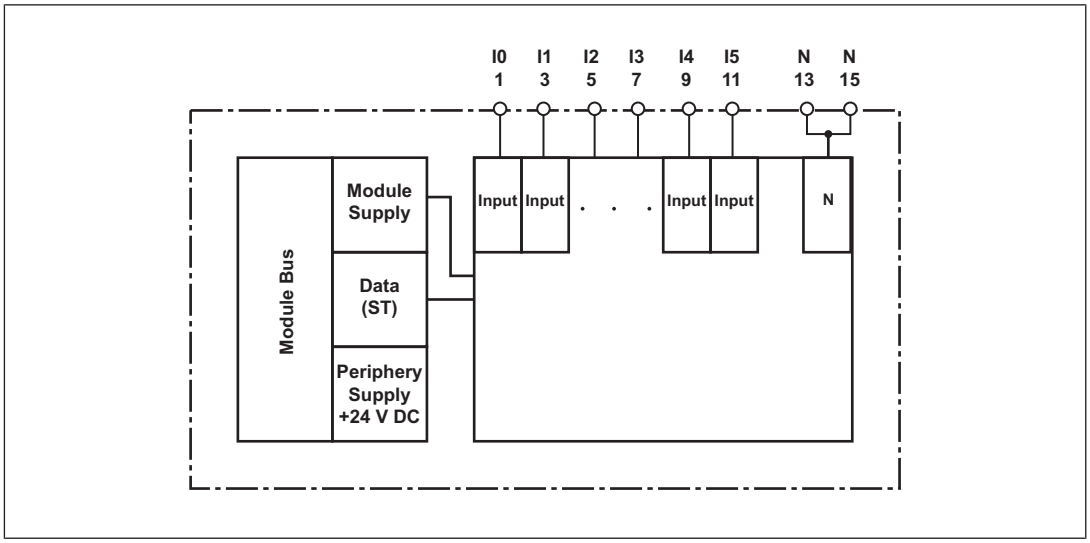


Fig.: Block diagram PSSu ES 6DI 120V AC

4.2 Supply

- The module is supplied with voltage via the head module.

4.3 Inputs

- The status of the inputs is signalled to the head module via the module bus.
- The inputs are fitted with a configurable software filter. The default value for the software filter is 5 ms. This prevents toggling of the signal near the zero crossing.
- Pulse stretching can be configured for the inputs.

Software filter

- Any signals that are shorter than the signal suppression time t_{pulse_sup} are filtered out. The signal suppression time depends on the configured software filter time.

  $t_{pulse\_sup} = t_{filter} – 300\ \mu s$
- The module detects any signals that are present at the input for longer than the minimum signal time t_{signal_min}.

  $t_{signal\_min} = t_{filter}$
- A signal is always detected and signalled to the head module's PII if it is present for longer than the sum of the following times:
  - Minimum signal time t_{signal_min}
  - ST scan time

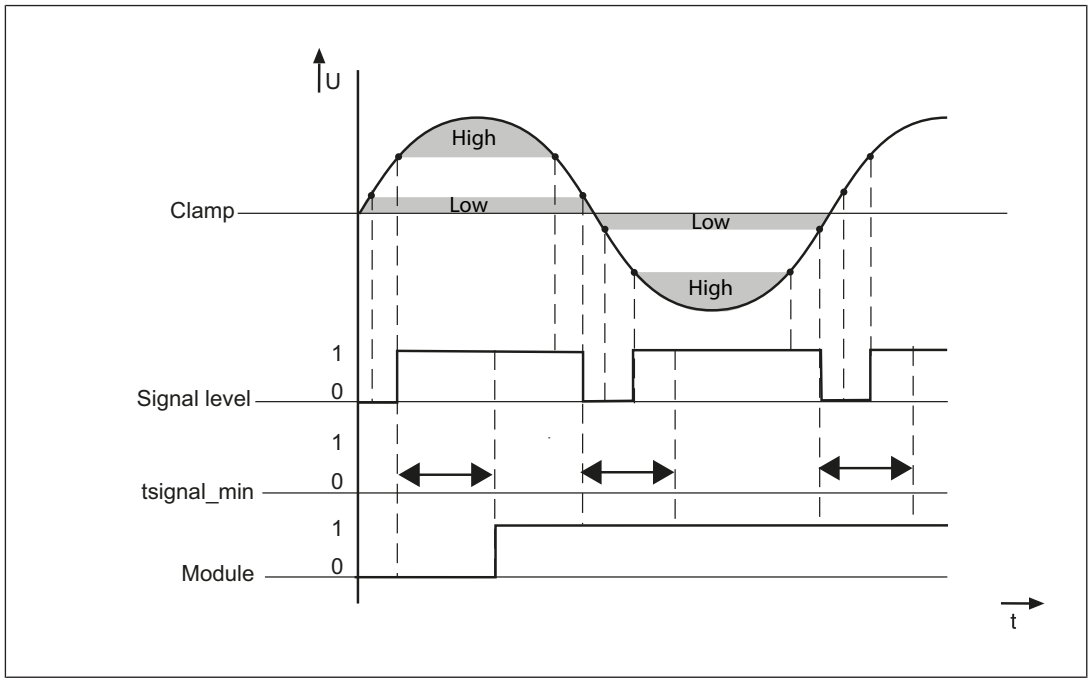


Fig.: Software filter

Legend

Clamp	AC input signal at the terminal. To be able to detect the signal it must be present for at least half a period T/2.
Signal level	State of the rectified signal depending on the AC input signal.
t_{signal_min}	Time for which a signal must be present at the input in order to be detected. This time is determined by the filter time. The filter time prevents toggling of the signal with zero crossing.
	Default value of the filter time t_{filter}: 5 ms
Module	Filtered signal in the module
High	Signal level for signal "1"
Low	Signal level for signal "0"

Pulse stretching:

The module stretches the filtered 1 signal or 0 signal to the configured pulse stretch time $t_{stretch}$. If the signal is longer than the pulse stretch time, then it is not stretched any further.

Requirements for the filtered signals:

The 0-signal and the subsequent 1-signal together must be present at the input for longer than twice the configured pulse stretch time $t_{stretch}$.

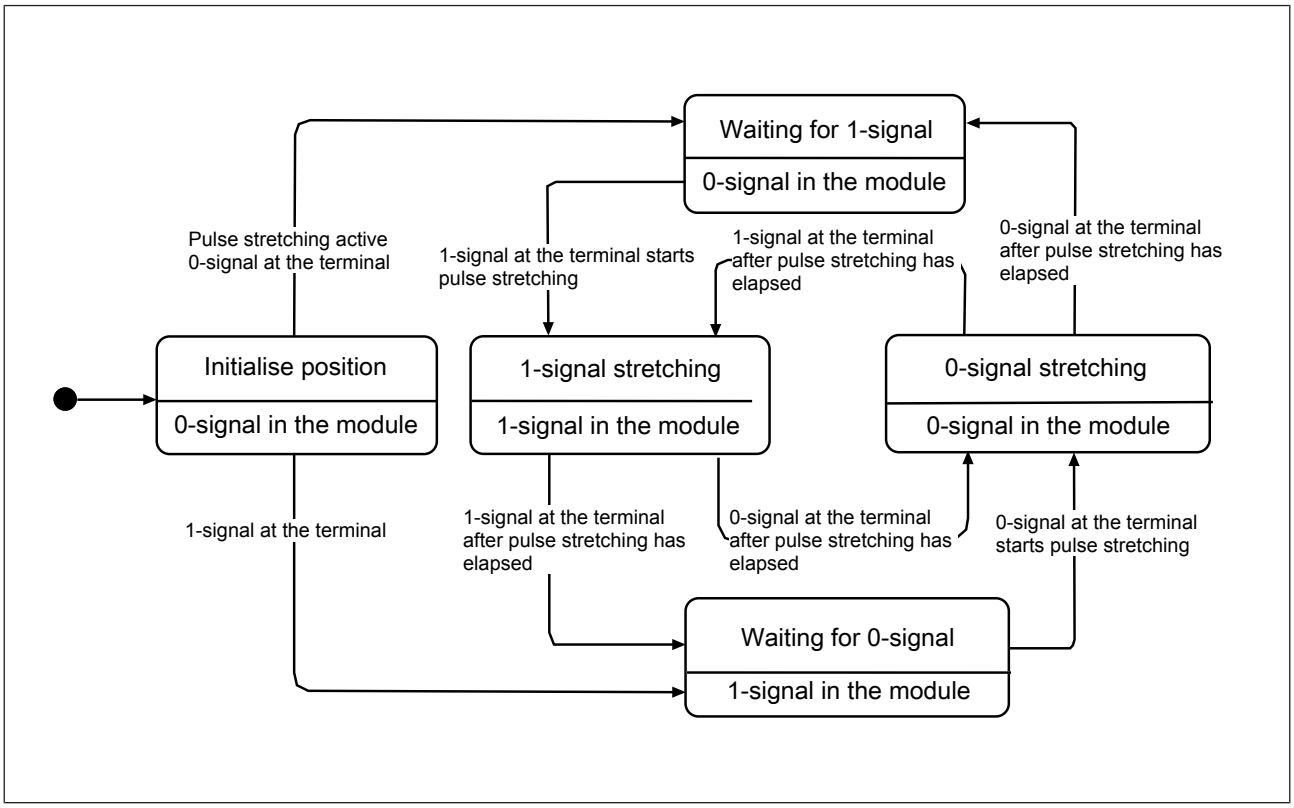


Fig.: States for pulse stretching

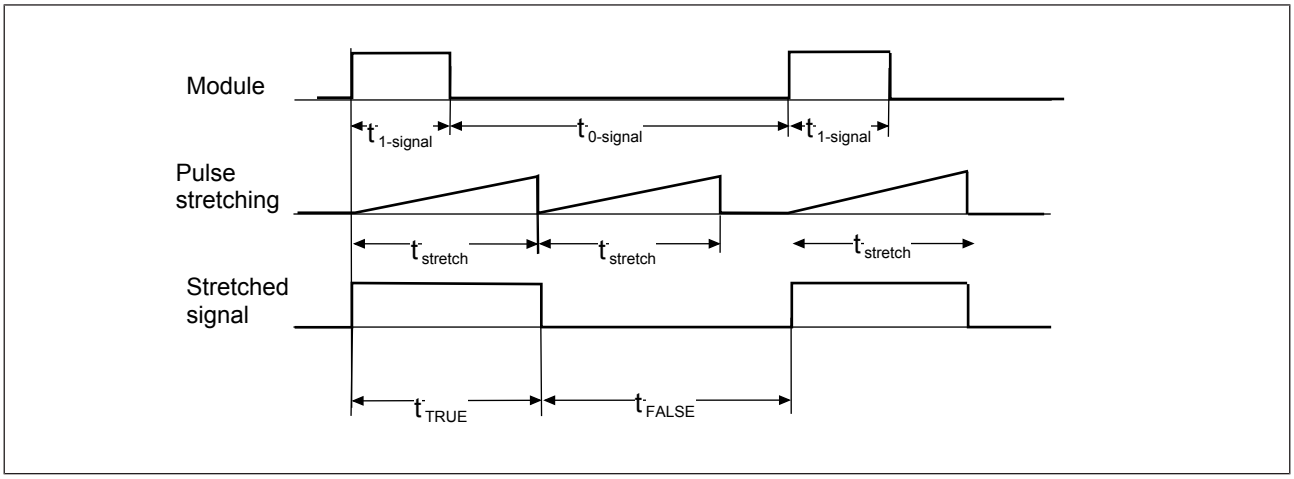


Fig.: Timing diagram: pulse stretching > signal duration of 1-signal

Legend

Module	Filtered signal in the module
Pulse stretching	Pulse stretching
Stretched signal	Stretched signal
$t_{1\text{-signal}}$	Duration of 1-signal
$t_{stretch}$	Duration of pulse stretching
t_{TRUE}	Stretched 1-signal in the module
t_{FALSE}	Stretched 0-signal in the module

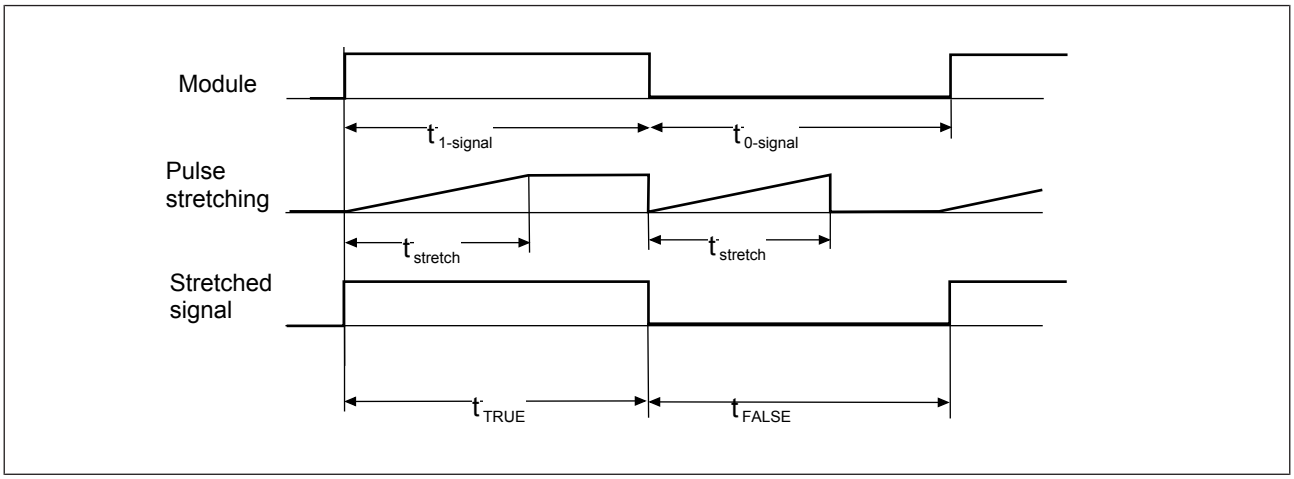


Fig.: Timing diagram: pulse stretching ≤ signal duration of 1-signal

Legend

Module	Filtered signal in the module
Pulse stretching	Pulse stretching
Stretched signal	Stretched signal
$t_{1\text{-signal}}$	Duration of 1-signal
$t_{stretch}$	Duration of pulse stretching
t_{TRUE}	Stretched 1-signal in the module
t_{FALSE}	Stretched 0-signal in the module

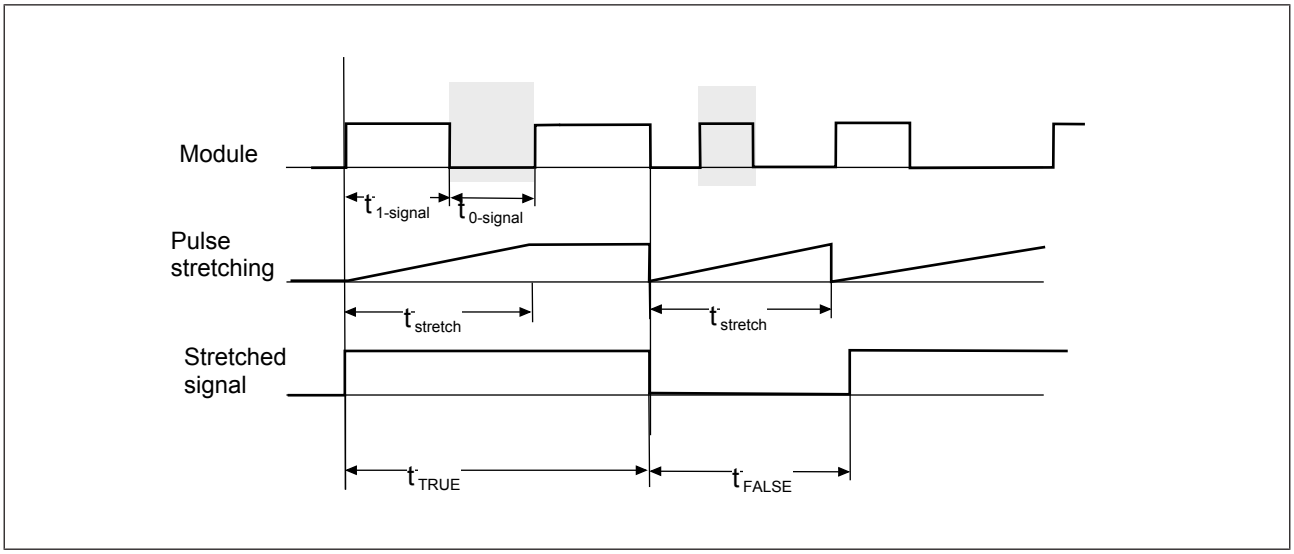


Fig.: Timing diagram: pulse stretching with variable signal duration

Legend

Module	Filtered signal in the module
Pulse stretching	Pulse stretching
Stretched signal	Stretched signal
$t_{1\text{-signal}}$	Duration of 1-signal
$t_{stretch}$	Duration of pulse stretching

t_{TRUE}	Stretched 1-signal in the module
t_{FALSE}	Stretched 0-signal in the module
Grey shaded area	Signals that are not detected during stretching

4.4 Reaction times

Detailed information on the reaction times is available in the operating manual of the head modules.

4.5 Energy-saving functions

The energy-saving levels are controlled by the head module and are not configurable. The module supports the following energy-saving levels:

- Switching off the LEDs

  The LEDs have two energy-saving levels:

  – Switching off the LEDs to display the terminal status

  – Switching off the LEDs to display the module and terminal status

- Standby mode

  – All module functions are inactive.

  – The LEDs for displaying the module and terminal status are switched off.

5 Structure of the process image

The module occupies 1 Byte in the process image.

Byte	Bit	Meaning	State
0	Bit 0	Input data I0	0: "0" signal at the input 1: "1" signal at the input
	Bit 1	Input data I1	
	Bit 2	Input data I2	
	Bit 3	Input data I3	
	Bit 4	Input data I4	
	Bit 5	Input data I5	
	Bit 6-7	None	

6 Installation

6.1 General installation guidelines

NOTICE

Damage due to electrostatic discharge!

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 armband.

6.1.1 Dimensions

The dimensions include the backplane, electronic module and terminal block.

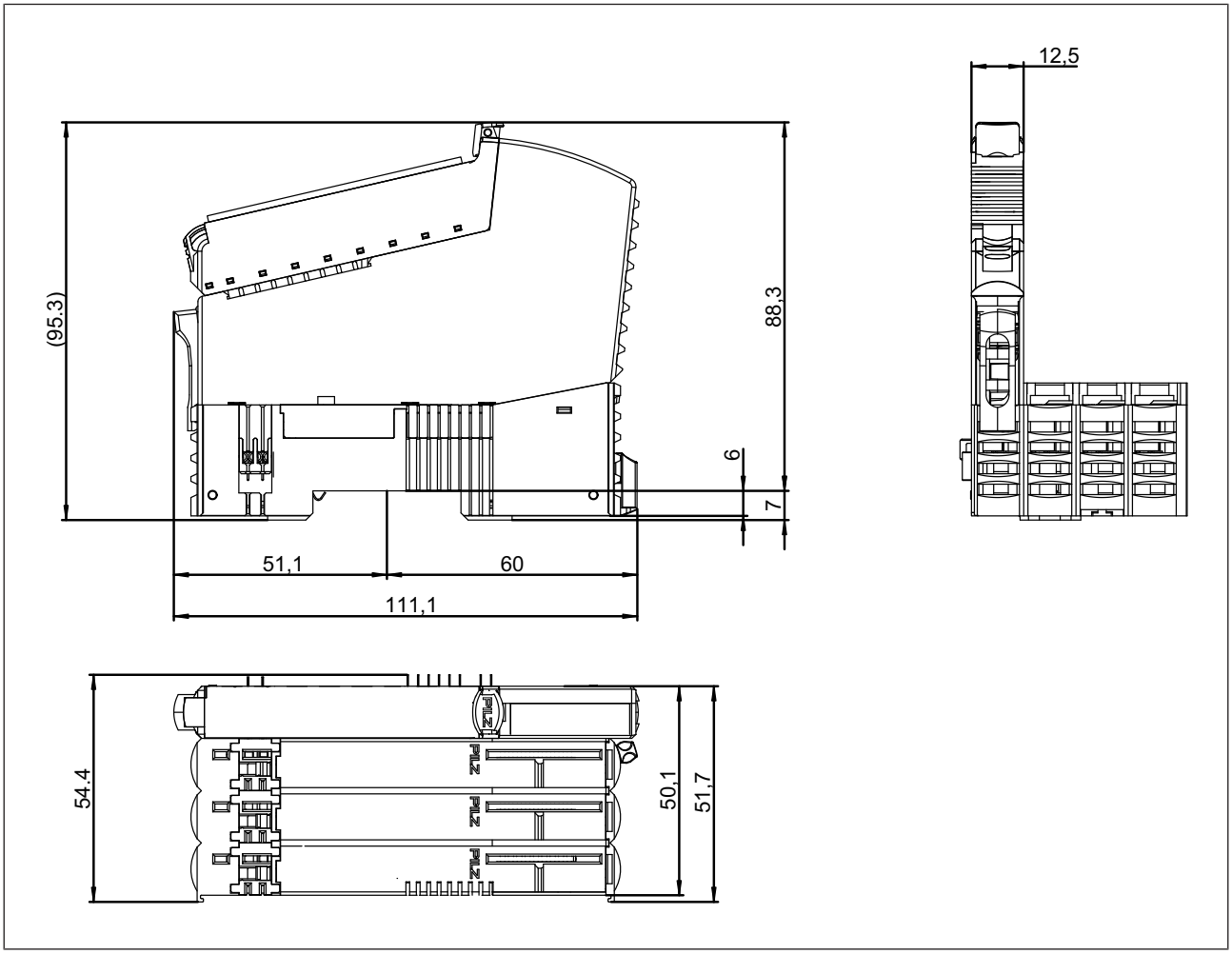
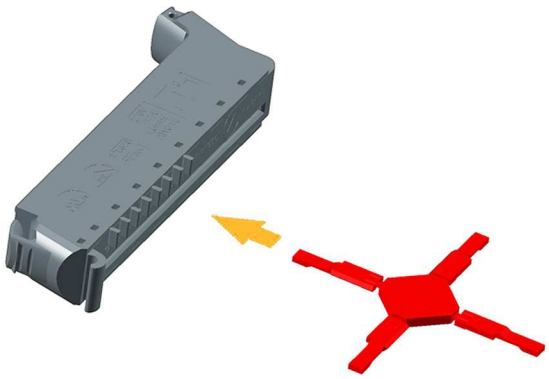
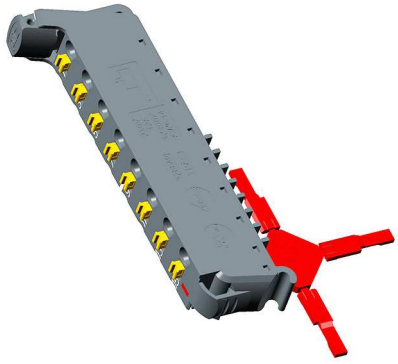
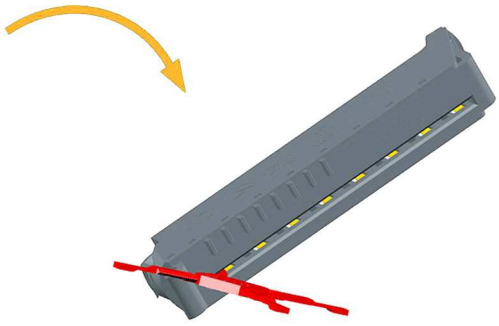
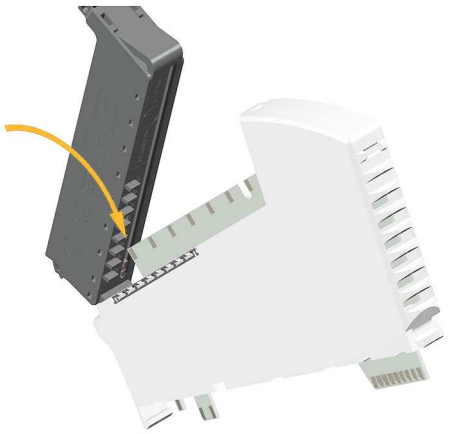


Fig.: Dimensions in mm, including backplane, electronic module and terminal block

6.2 Install protective coding

Use a terminal block with protective coding. 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 is embedded within the terminal block.	

4. Plug the coded terminal block into the module.	

6.3 Inserting and removing an electronic module

WARNING!

Risk of electrocution!

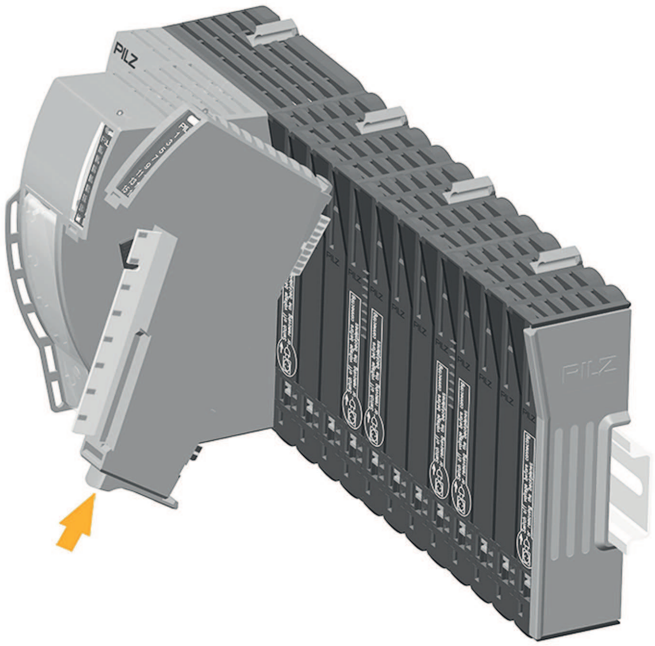
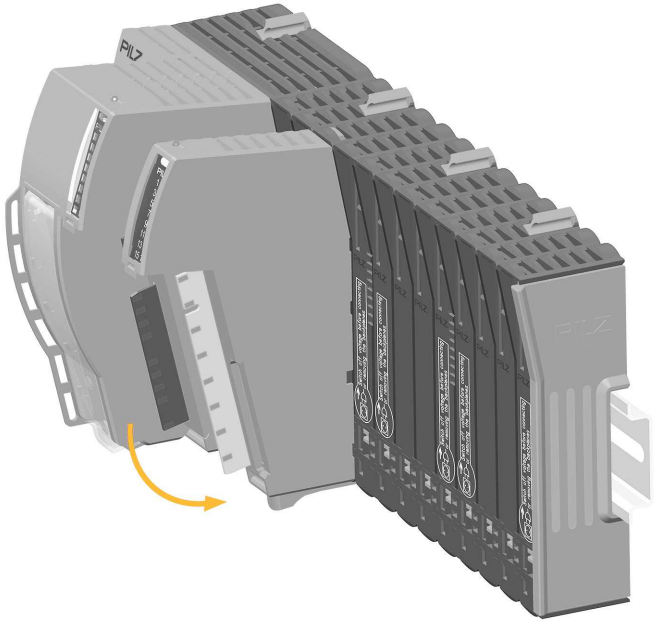
When voltage is applied, contact with live components could result in serious or even fatal injury from an electric shock.

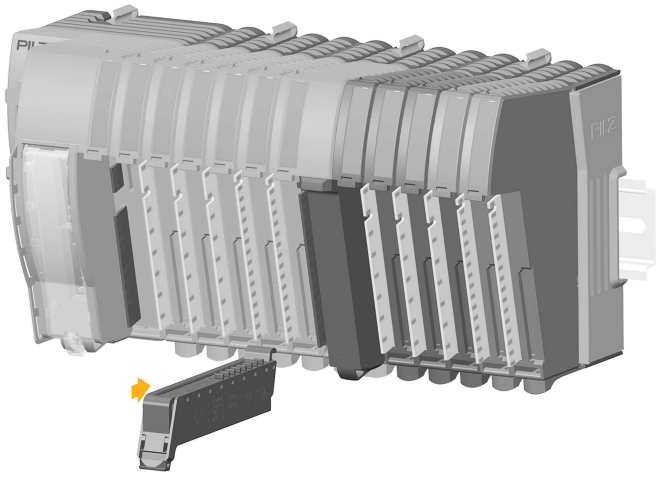
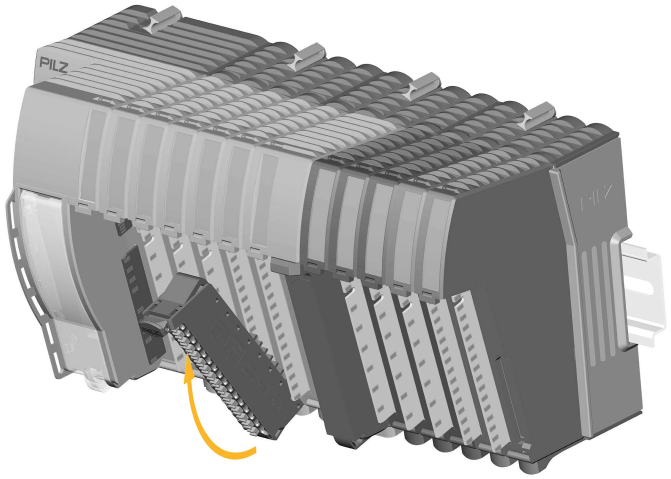
Before working with the terminal block, switch off all the voltages at the terminal block.

Please note:

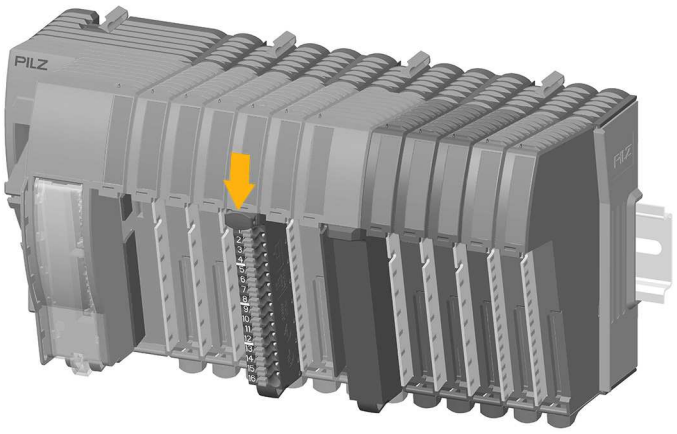
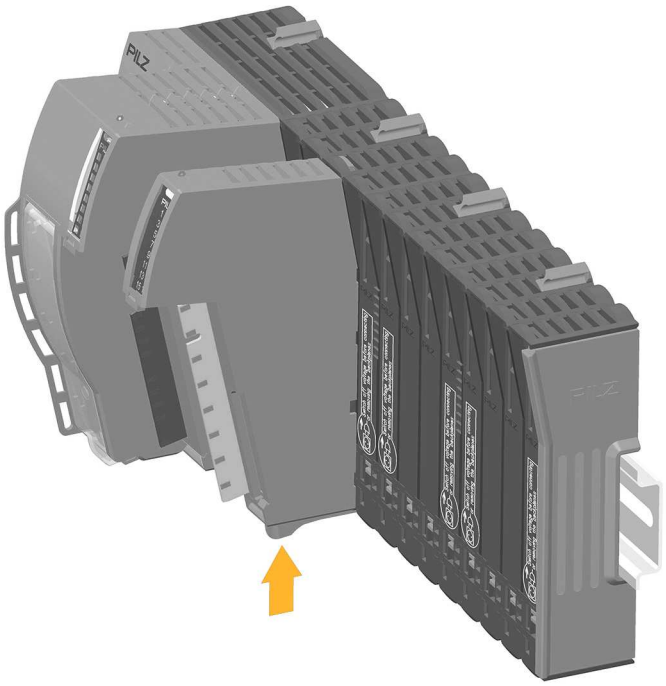
- Backplane must be installed first.
- Electronic modules may only be plugged or unplugged if the terminal block has been removed first.
- The mechanics of the electronic modules are designed for 20 plug in/out cycles.

6.3.1 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.	

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

6.4 Changing an electronic module during operation

WARNING!

Risk of electrocution!

When voltage is applied, contact with live components could result in serious or even fatal injury from an electric shock.

Before working with the terminal block, switch off all the voltages at the terminal block.

An electronic module can be hot swapped.

Effects:

- Module bus communication between the other modules is not interrupted.
- The configuration data is retained.
- The module is detected automatically as soon as the module is re-inserted.

Procedure:

1. Removing an electronic module [📖 20]
2. Inserting an electronic module [📖 18]

A new electronic module can be inserted during operation.

Procedure:

- Inserting an electronic module [📖 18]

Effects:

- Module bus communication between the other modules is not interrupted.
- The head module may need to be configured and restarted in order for the new module to be detected.

7 Wiring

7.1 General wiring guidelines

Please note:

- Signal lines do not have to be shielded.

WARNING!

Risk of electrocution!

When voltage is applied, contact with live components could result in serious or even fatal injury from an electric shock.

Before working with the terminal block, switch off all the voltages at the terminal block.

7.1.1 Connection mechanism for terminal blocks

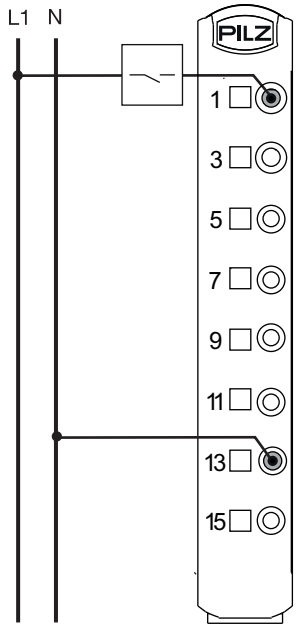
Procedure:

- 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 mm^2 (AWG26).
- The maximum cable cross section for field connection terminals on the terminal blocks is 1.5 mm^2 with ferrules (AWG14)
- Use copper wiring.

7.2 Terminal configuration

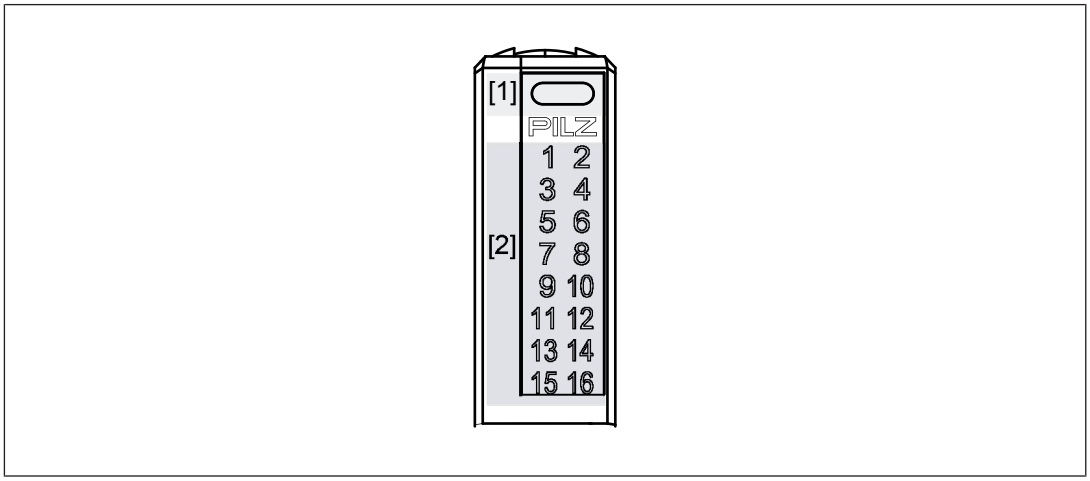
Terminal configuration	Connection example
1: Input I0 3: Input I1 5: Input I2 7: Input I3 9: Input I4 11: Input I5 13, 14: Reference potential (N) for digital inputs. Terminals are internally interconnected.	

8 Operation

The status of the module is displayed via a red and a green LED. The status of the terminals is displayed via a green LED. If there is a module error, the module status display will light up red. The error will be signalled to the head module and will be entered in the head module's diagnostic log.

8.1 Display elements and messages

Only the terminal status displays 1, 3, 5, 7, 9, 11, 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 there is a "1"-signal at the input	
	Green	●	--	Module in operation and there is a "0"-signal at the input	
◐ϟ	Red	●	--	Configuration error Module was inserted in the wrong slot.	
☼	Red	●	--	Internal errors	See module's diagnostic log
◐	Red	●	--	Temperature error: Too warm (1)	See module's diagnostic log.

[1]	Colour [1]	[2]	Colour [2]	Meaning	Further information
◐	Red	◐	Green	The module status display and all terminal status displays flash simultaneously Periphery supply is missing/temperature error: Too hot (1)	See module's diagnostic log.

([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 inputs continue to be read and appear in the ST-PII

  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.

Legend

☼	LED on
◐	LED flashes
◐ϟ	LED flashes briefly
●	LED off

9 Technical details

General	
Certifications	**CE, cULus Listed**
Application range	**Standard**
Module's device code	**000Eh**
Number of ST input bits	**6**
Electrical data	
Internal supply voltage (module supply)	
Module's power consumption	**0,16 W**
Max. power dissipation of module	**0,86 W**
Inputs	
Number	**6**
Signal level at "0"	**0 - 20 V AC**
Signal level at "1"	**74 - 120 V AC**
Voltage at inputs	**120 V**
Kind	**AC**
Input type	**EN 61131-2 Typ 1, EN 61131-2 Typ 3**
Input current range	**5 - 10 mA**
Software filter time	**5 ms ... 25,5 ms**
Potential isolation	**yes**
Environmental data	
Climatic suitability	**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**
Temperature range	**0 - 55 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-40 - 70 °C**
Climatic suitability	
In accordance with the standard	**EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**
Max. operating height above sea level	**2000 m**
EMC	**EN 61131-2 (Zone B)**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**8,4 - 150 Hz**
Acceleration	**10 m/s²**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Acceleration	**150 m/s²**
Duration	**11 ms**

Environmental data	
Airgap creepage	
In accordance with the standard	**EN 61131-2**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
In accordance with the standard	**EN 60529**
Housing	**IP20**
Mounting area (e.g. control cabinet)	**IP54**
Potential isolation	
Potential isolation between	**Input and module supply**
Type of potential isolation	**reinforced insulation**
Rated surge voltage	**4000 V**
Potential isolation between	**Periphery supply and module supply**
Type of potential isolation	**Functional insulation**
Rated surge voltage	**2500 V**
Potential isolation between	**Input and periphery Supply**
Type of potential isolation	**reinforced insulation**
Rated surge voltage	**4000 V**
Mechanical data	
Material	
Housing	**PPE**
Mounting type	**plug-in**
Dimensions	
Height	**110,8 mm**
Width	**12,5 mm**
Depth	**72,5 mm**
Weight	**35 g**

Where standards are undated, the 2015-04 latest editions shall apply.

10 Order reference

10.1 Product

Product type	Features	Order no.
PSS u2 E S 6DI 120V AC	Electronic module	328 308

10.2 Accessories

Terminal block

Product type	Features	Order No.
PSS u2 T 8 (1 pc.)	Terminal block 8-pin, 1 piece	328 840
PSS u2 T 8 (10 pcs.)	Terminal block 8-pin, 10 pieces	328 841
PSS u2 T 8 (5 x 10 pcs.)	Terminal block 8-pin, 50 pieces	328 842

Label holder

Product type	Features	Order No.
PSS u2 A LC E1 (10 pcs.)	Label holder 23.5 x 10.5 mm, 10 pieces	328 910
PSS u2 A LC E2 (10 pcs.)	Label holder 103 x 10.5 mm, 10 pieces	328 911
PSS u2 A LA E1 (10 pcs.)	Labelling strips 23.5 x 10.5 mm (10 x DIN A4 sheet)	328 913
PSS u2 A LA E2 (10 pcs.)	Labelling strips 103 x 10.5 mm (10 x DIN A4 sheet)	328 914

Plastic clip terminal block

Product type	Features	Order no.
PSS u2 A LC T3 (10 pcs.)	Plastic clip terminal block 61 x 11.5 mm, 10 pieces	328 912

Coding elements

Product type	Features	Order no.
PSS u2 A CE E (10 pc.)	Coding elements for electronics modules, 10 pieces	328 860
PSS u2 A CE T (10 pc.)	Coding elements for terminal block (protective coding), 10 pieces	328 861

Backplanes

Product type	Features	Order no.
PSS u2 B 1	Backplane, 1 slot	328 811
PSS u2 B 4	Backplane, 4 slots	328 810