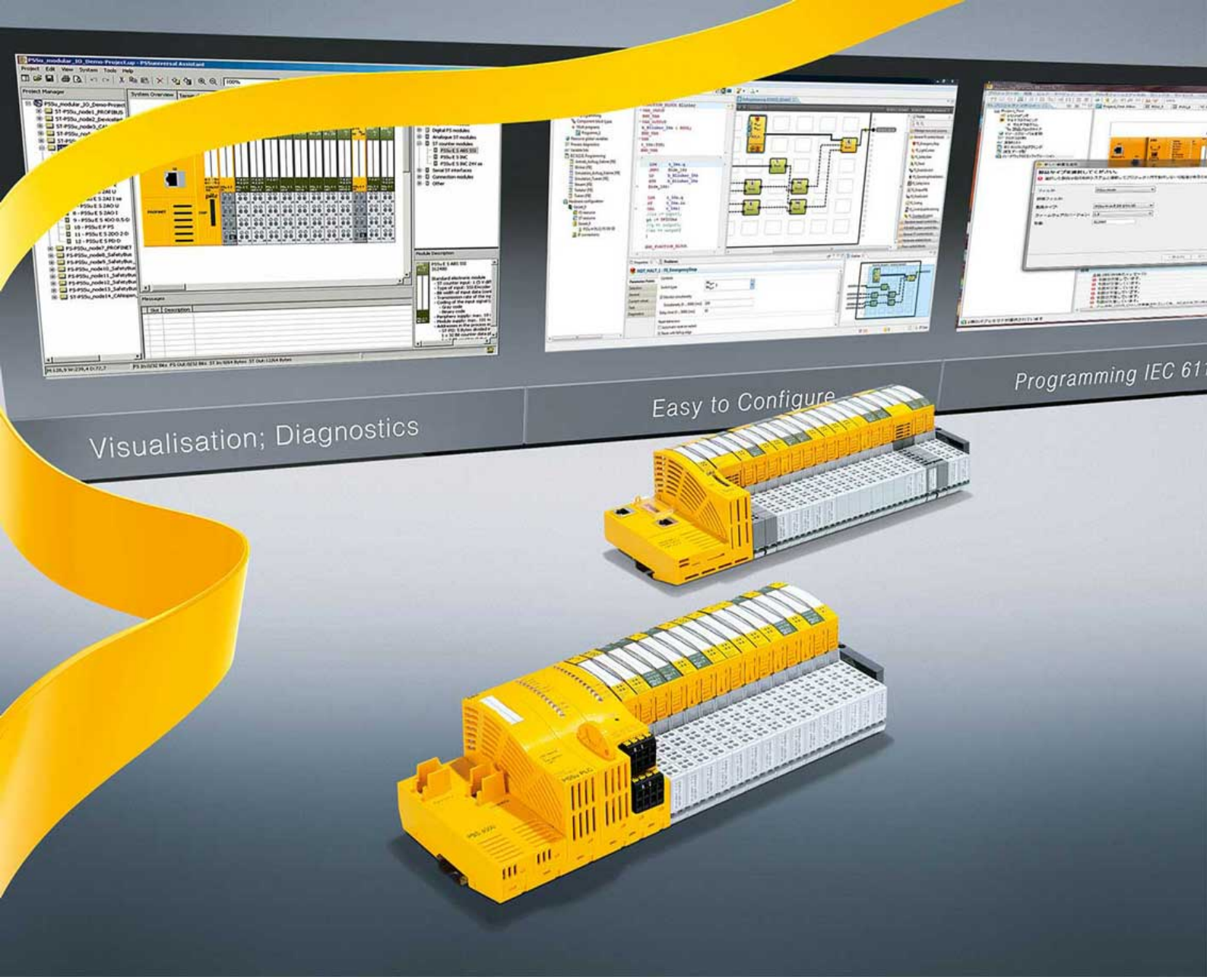


Technical Catalogue PSSuniversal
Version 2018-09

PILZ
THE SPIRIT OF SAFETY

- Control system PSSuniversal PLC
- Control system PSSuniversal multi
- Decentralised system PSSuniversal I/O




Contents

Introduction

The PSSu system offers solutions for standard and safety-related tasks. It can be used as a control system or I/O system. A wide range of modules enables a variety of combinations, allowing the most diverse applications to be implemented.

This catalogue describes the structure of the PSSu system within the automation system PSS 4000 and as a decentralised I/O system. Each module is described in a detailed data sheet, helping you to select the modules and also enabling configuration.

Further information on the PSSu system and the individual modules is available in the following documents:

- Operating manuals for the modules
- PSSuniversal Installation Manual
- PSSuniversal System Description
- System Description PSS 4000
- Safety Manual PSS 4000

Please read these documents before commissioning.

Terminology: System environment A and B

The PSSu system can be used in two different system environments. The module's application area is described in the chapter "Intended Use" of the manual.

The distinction is made between

- PSSu in system environment A
- PSSu in system environment B

The distinction is based on the application area of the PSSu system.

PSSu in system environment A may be used in the

- Decentralised system PSSu I/O with FS fieldbuses such as PROFINET with PROFIsafe profile
- Decentralised system PSSu I/O with ST fieldbuses such as CANopen, DeviceNet, PROFIBUS-DP
- **Not** in the automation system PSS 4000

PSSu in system environment B may be used in the

- Automation system PSS 4000, e.g. with
  - Decentralised system PSSu I/O with SafetyNET p
  - Control system PSSu PLC
  - Control system PSSu multi

Glossary

- **Absolute encoder**

  Encoder that provides an absolute value for each position. The absolute value corresponds directly to the position of the detected machine component.
- **Resolution**

  Number of bits for the display of a numerical value.
- **Base module**

  Carrier unit for an electronic module; used to connect the field wiring
- **Base station**

  PSSu module that exchanges data from the PSSu with a remote station via wireless signals or cable connection.
- **Base system**

  PSSu subsystem that is connected to the remote system, e.g. via wireless signals or cable connection.
- **Competent person**

  A person who, through training, experience and current professional activity, has acquired the necessary knowledge and authorisation to test, assess and handle devices, systems, plant and machinery in accordance with the general standards and guidelines for safety technology.
- **Intended use of a machine**

  Use of a machine in accordance with the information provided in the instructions for use.

  [EN ISO 13849-1] and [EN ISO 14121-1]
- **Sign and magnitude representation**

  Display format of binary figures for positive and negative values
- **Bit module**

  Electronic/compact module whose data requires one bit each in the process image.

  Example: Digital input/output modules
- **Byte module**

  Electronic/compact module, the data for which requires different data widths in the process image (bit, byte and/or word).

  Example: Counter modules
- **C-rail**

  Additional, available power rail
- **Derating diagram**

  Dependency of the maximum permitted current on the ambient temperature.
- **Diagnostic list**

  List of the current diagnostic messages.

Glossary

- **Diagnostic log**

  Log that shows when diagnostic messages arrived, when they were cleared and when they were acknowledged. It also contains entries regarding operation and debugging.
- **Diversely redundant**

  A piece of information is processed more than once and in different ways.
- **Download**

  Transfer of data to a device, e.g. from a PC to a device
- **Real-time system**

  System in which the validity of a calculated result depends not only on logical accuracy but also on the time at which the result is provided. A response that is too early or too late is an incorrect response.
- **Input/output module**

  Electronic module with input or output function and base module with terminals for connecting the inputs or outputs.
- **Single-pole, referenced to earth**

  Property of an earth (0 V) switching output; also: single ended.
- **Electronic module**

  Module that provides a function, e.g. input or output; plugged into the base module.
- **Failsafe**

  Abbreviation: FS
  Safety-related, failsafe; a failsafe system switches to a safe condition in the event of an error.
- **Fieldbus**

  Standard bus system that transfers process data between various bus subscribers, e.g. DeviceNet, PROFIBUS.
- **Firmware**

  Abbreviation: FW

  Software created by the manufacturer to run on a device and perform device-specific functions.
- **Firmware update**

  Updating the device firmware
- **FIR filter**

  Filter with finite impulse response.
- **FS resource**

  Execution unit for safety-related control code
- **Gain**

  Amplification factor; signed value, which is multiplied by the transferred value in the event of a correction.

Glossary

- **Device editor**

  Software tool used to define the settings for a device and call up information from the device
- **Gray code**

  Display format of binary figures, in which adjacent figures differ in only one single bit
- **Hardware output**

  Physical device output
- **Hardware input**

  Physical device input
- **IIR filter**

  Filter with infinite impulse response.
- **Incremental encoder**

  Sensor for detecting linear or rotational positional changes; path, speed and direction can be determined by evaluating the number of pulses, pulse frequency and phase position.
- **Internal inputs/outputs**

  These do not have any connection terminals; they are used for internal data transfer between the head module and the electronic module.
- **Inverted signals**

  Each bit in a transmission is sent inverted on another line, i.e. "1" becomes "0" and "0" becomes "1".
- **I/O mapping**

  Mapping of a PI variable to I/O data from the module bus, I/O data from the external communication or another PI variable
- **I-PI variable**

  Variable in the process image which can be mapped to a hardware input or O-PI variable.
- **Compact module**

  Combines the function unit (inputs or outputs) and connection levels in one housing
- **Head module**

  Module that co-ordinates process data traffic via standard or failsafe fieldbus systems
- **Local enable principle**

  ST section has write access to the FS section; FS outputs can be switched via the ST section
- **LSB**

  Least significant bit.
- **Mechanical coding**

  Coding element on the electronic module, with its counterpart in the base module

Glossary

- **Module bus**

  Abbreviation: MBUS

  Bus to supply voltage to the modules and transfer data between the head module and electronic modules
- **Module supply**

  Internal supply voltage for the head module and electronic modules
- **MSB**

  Most significant bit
- **Restart**

  A PSSu system performs a restart when the module supply is applied.
- **Offset**

  Zero point compensation; constant, signed value, which is added to the transferred value in the event of a correction.
- **O-PI variable**

  Variable in the process image, which can be mapped to O data from the module bus, O data from external communication or an I-PI variable.
- **Periphery supply**

  Supply voltage for the sensors and actuators on input/output modules
- **PI variable**

  Variable in the process image which can be mapped to I/O data from the module bus, I/O data from the external communication or another PI variable.

  There are I-PI and O-PI variables.
- **Program**

  Abbreviation: PRG

  Logical assembly of all the programming language elements and constructs necessary for the intended signal processing required for the control of a machine or process by a PLC-system.

  [IEC 61131-1]
- **Project**

  A project contains all the data needed to control and monitor a system (plant, machine). Project = User program + hardware configuration.
- **PSSuniversal**

  Abbreviation: PSSu; also: PSSu system; modular, programmable system for controlling plant and machinery.
- **Quality of process data**

  Information on whether process data relates to the "process value" or a "substitute value".

Glossary

- **Grid width**

  Base modules and electronic modules have a grid width of 12.6 mm or an integer multiple of it.
- **Reaction time**

  Time it takes for a bus telegram to be finalised or for some other reaction from the head module to take place once a signal has changed at an input, or the time it takes the signal at an output to change once a bus telegram has been received.
- **Remote station**

  First module in a remote system, which exchanges data with the PSSu base station via wireless signals or cable connection.
- **Remote system**

  PSSu subsystem that is connected to the base system, e.g. via wireless signals or cable connection
- **Resource**

  Unit that executes code, e.g. FS resource, ST resource
- **Safe condition**

  Condition in which power is removed from the safety circuits.
- **Scaling**

  Setting for offset and gain on analogue modules
- **SSI**

  Abbreviation for synchronous serial interface; interface for absolute encoder, used in the drive technology sector to transmit positional data.
- **Standard**

  Abbreviation: ST
  Not safety-related, in contrast to failsafe.
- **Standard bus system**

  Non-safety-related bus system, e.g. DeviceNet or PROFIBUS, in contrast to SafetyNET p from Pilz.
- **Status byte**

  Certain modules use the status byte to transfer information about their status to the head module.
- **ST resource**

  Execution unit for non-safety-related control code
- **System**

  A number of modules combined to form a functional unit

Glossary

- **System environment A**

  For use in

  – Decentralised system PSSu I/O

  – Not in the automation system PSS 4000

- **System environment B**

  For use in the automation system PSS 4000, e.g. with

  – Decentralised system PSSu I/O with SafetyNET p

  – Control system PSSu PLC

  – Control system PSSu multi

- **Test pulse**

  The test pulse is wired to an input in order to detect wiring errors in that input, e.g. open circuit, short circuit to 24 VDC or 0 V or shorts between two inputs.

- **T-type**

  The T-type modules are suitable for use where there are increased environmental requirements on temperature and humidity.

- **Processing time**

  The time a module requires internally to process signal changes

- **Supply module**

  Consists of an electronic module and a base module; also: Supply Voltage Module

- **Certification**

  Procedure by which a product's compliance with the applicable regulations and standards is tested by a notified body; proven compliance is confirmed through the issue of a certificate.

- **Certification body**

  Notified body in accordance with Article 14 of the Directive 2006/42/EC;

  Otherwise: Accredited institution, often a government body, which examines and confirms a product's compliance with applicable regulations and standards.

- **Enable principle**

  Configuration that enables the ST section to have write access to the FS section; FS outputs can be switched via the ST section.

- **Two's complement**

  Display format of binary figures for positive and negative values. To form a negative figure, each bit of the positive figure is inverted and 1 is added.

- **Dual-pole, differential**

  Property of a positive (+24 V) switching and earth (0 V) switching output.

System description

System description

System description
Modular structure

A PSSu system is a modular, programmable system for controlling plant and machinery. For PSSu systems there is a system software consisting of PSSuniversal Assistant, Configurator and Start-up. The system software provides support as you select, configure and commission components. A PSSu system consists of:

- One head module
- At least one supply voltage module
- Input/output modules for standard and failsafe applications
- End bracket to secure the system at the start
- Terminating plate with integrated bus terminating resistors and end bracket to secure the system at the end

Head module

- Connects the sensor/actuator level for standard applications with standard fieldbus systems (e.g. PROFIBUS-DP)
- Connects the sensor/actuator level for failsafe applications with failsafe fieldbus systems
- Co-ordinates the entire process data traffic

Supply voltage modules

- Consist of an electronic module and a base module
- Are available for various functions

Input/output modules

Input/output modules are available in different designs:

- Electronic module and base module
- Compact module

The input/output modules are available for a wide range of input/output functions.

Designs

Electronic modules and base modules:

The electronic modules determine the function of the supply voltage or input/output module.

- Electronic modules
  - Are plugged into the base modules
  - Communicate with the head module via the module bus

The base modules are the carrier units for the electronic modules.

- Base modules
  - Are used to connect the field wiring
  - Are available with the following connection types:
    Cage clamp terminals or screw terminals

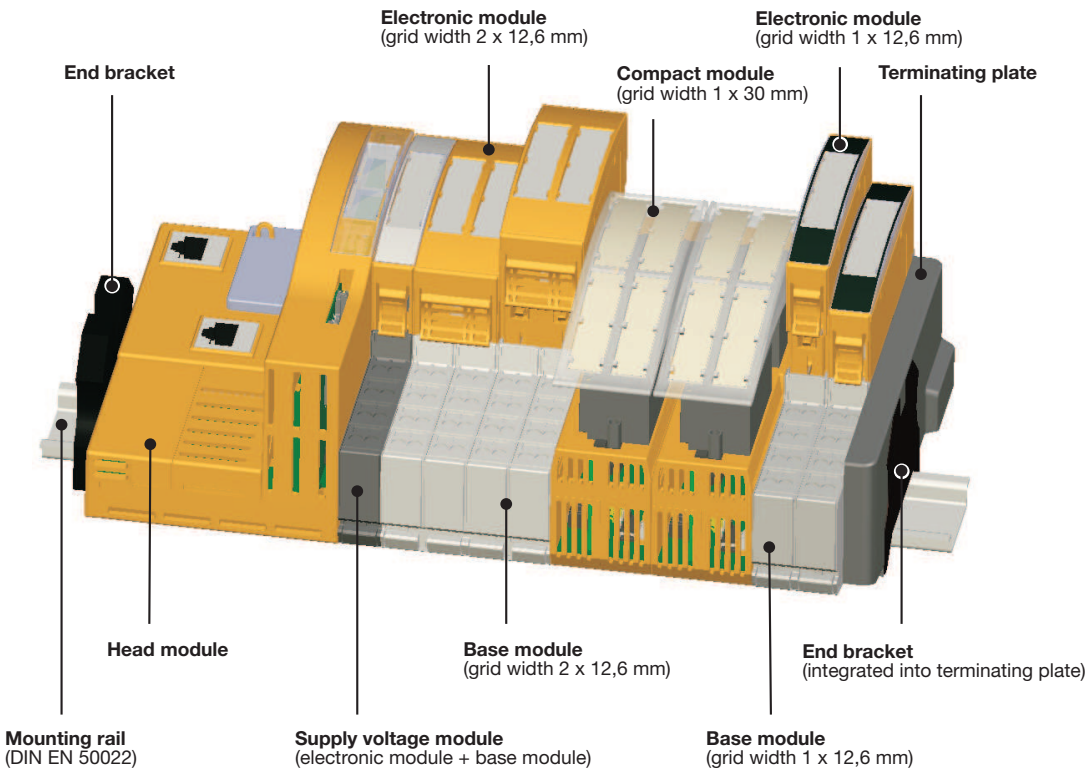
System description
Modular structure

Compact modules:

The compact modules combine the function unit (inputs and/or outputs) and connection levels in one housing. Wiring is via multi-pin connectors with spring-loaded terminals, which are plugged into the connector strips on the module.

Compact modules

- Do not need base modules
- Are used to connect the field wiring
- Communicate with the head module via the module bus



System description
Module descriptions

The module descriptions provide information on their function. The descriptions are made up of multi-stage combinations of letters and numbers. All module names begin with **PSSu**. This is followed by:

- **H** for head modules,
  e.g.: PSSu **H** DP
- **E** for electronic modules, then:
  - **S** for standard module,
    e.g.: PSSu **E S** 4DI
  - **F** for failsafe module,
    e.g.: PSSu **E F** 4DI
- **K** for compact modules, then:
  - **S** for standard module,
    e.g.: PSSu **K S** 16DI
  - **F** for failsafe module,
    e.g.: PSSu **K F** 16DI
- **B** for base modules,
  e.g.: PSSu **B**P 1/8S

Base modules	Basic function	Size	Connection type	Additional function
PSSu B...	PSSu **BP**... – Base module for periphery (input/output) PSSu **BP-C**… – Base module for periphery with C-rail PSSu **BS**... – Base module for power supply PSSu **BS-R**... – Base module for refreshing the power supply	PSSu BP-C **1/8…** – 1 x grid width, 8 connections PSSu BP-C **1/12…** – 1 x grid width, 12 connections PSSu BP-C **2/16…** – 2 x grid width, 16 connections PSSu BP-C **2/8…** – 2 x grid width, 8 connections	PSSu BP-C 1/8**C** – Cage clamp terminals PSSu BP-C 1/8**S** – Screw terminals	PSSu BP 1/8S-**J** – Integrated cold junction compensation

Link modules have individual letter codes, depending on their application, e. g.:

- PSSu **X**B F-T, PSSu **X**R F-T
  (for cable-based subdivision)

Accessories for the PSSu system are identified by **PSSu A...** (A for "Accessory").

PSSu modules are available as different product types:

- Base type
  The basic versions of PSSu modules are called base type modules (e.g. PSSu E F DI OZ 2).

- T-type
  PSSu modules that are suitable for use where there are increased environmental requirements on temperature and humidity are called T-type modules. Their functionality is no different from that of the base type modules. They are identified by a "**-T**" at the end of the product name, e.g.: PSSu E F DI OZ 2**-T.**

In the following text, the designation "PSSu E F DI OZ 2**(-T)**", with "**-T**" in brackets, is used when the information specifically refers to both modules. In function descriptions and diagrams, "PSSu E F DI OZ 2" is used to represent both modules.

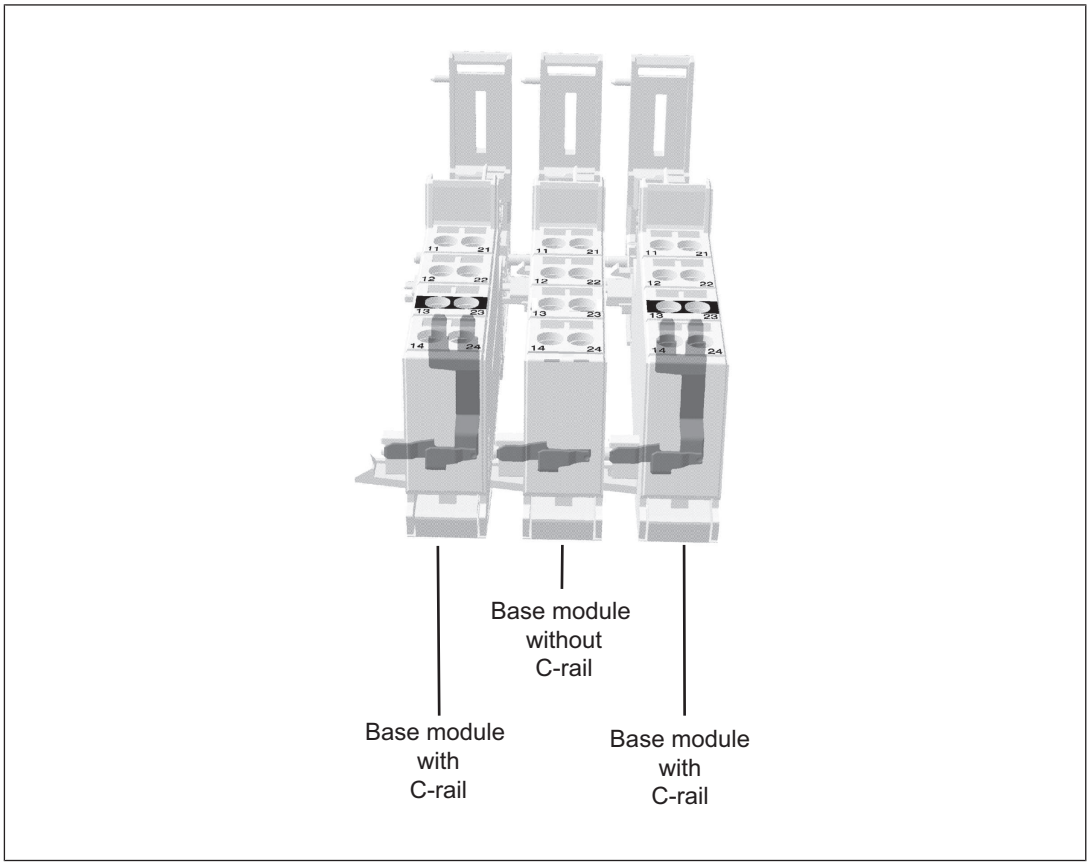
System description
Module bus

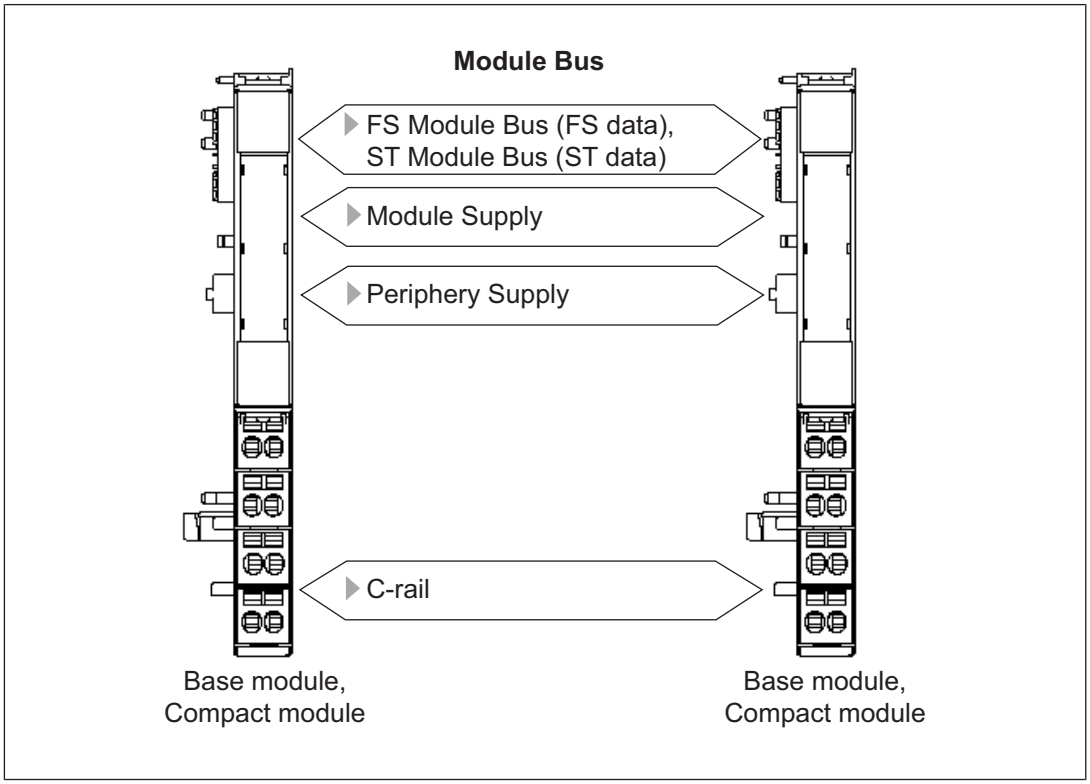
The module bus supplies the modules of a PSSu system with voltage and transfers data between the head module and the electronic/compact modules. The module bus is formed by arranging the base modules/compact modules together and connecting them via a mechanical latch.

The module bus is structured as follows:

- Data bus
  two separate bus systems for failsafe data (FS module bus) and standard data (ST module bus).
- Supply voltage for:
  - Module Supply
    The module supply is the internal supply voltage for the head module and electronic modules.
  - Periphery Supply
    The periphery supply supplies 24 VDC to the sensors and actuators on digital input/outputs on electronic modules. On compact modules, the supply for the inputs is generated from the periphery supply; the supply for the outputs must be fed to the module terminals. The connection on the module bus can be disconnected in order to form supply groups.
- C-rail ("cross connection")
  The C-rail is an additional, free power rail. Access to the C-rail is available via base modules that contain the letter "**-C**" in their description (e.g. PSSu BP**-C** 1/8 S, PSSu BP**-C** 1/8 C).
  The C-rail supply must belong to the same circuit as the other base module connections. Connecting PE to the C-rail provides a simple form of shield. On the compact modules, the C-rail is not looped through and is not available at the terminals.

System description
Module bus





System description
Maximum system expansion

The system software provides support in assembling a PSSu system. It checks the system limits as the data is entered. Once the system is assembled, the system software can be used to generate a requirement list, which you can use for system documentation and for an order form.

The expansion of a PSSu system is limited by the following values

- Number of modules
- Number of failsafe modules
- Number of failsafe inputs/outputs
- Number of standard inputs/outputs
- Current load of module bus

The number of PSSu systems may also be limited by the fieldbus that is used or by a network.

The system limits are listed and explained below.

System limits: Standard bus systems

If the PSSu system is used as a bus subscriber within a standard bus system, the system limits of that standard bus system must be taken into account.

System limits: Number of modules and number of inputs/outputs on a PSSu system

- Absolute number of modules per PSSu system
  Internally, a PSSu system can address a maximum of **64 modules**. The head module and passive junction modules (e.g. PSSu E PD, PSSu E PD1) are not counted. The following modules should be taken into account for the absolute number of modules:
  - Supply voltage modules
    (identifier: PSSu E F PS...)
  - Standard modules
    (identifier: PSSu E S..., PSSu K S…)
  - Failsafe modules
    (identifier: PSSu E F…, PSSu K F…)
- A PSSu system can have a maximum of **32 FS modules**. The following system limits also apply:
  - A maximum of 16 modules of type PSSu E F DI OZ 2 may be used.
  - A maximum of 24 modules of type PSSu E F BSW may be used.
- Maximum number of FS input/output bits per PSSu system:
  In each PSSu system, FS fieldbuses can be used to address a maximum of:
  - **32 FS input bits**
  - **32 FS output bits**

System description
Maximum system expansion

  - Please also note the number of FS input/output bits per module.

- Maximum number of ST input/output bits per PSSu system:
  A PSSu system may have a maximum of **240 ST input bits and 240 ST output bits**.
  This system limit applies irrespective of the fieldbus. Please also note the number of ST input/output bits per module. The following system limits also apply:
  - A maximum of 6 modules of type PSSu E S RS232 may be used.
  - A maximum of 6 modules of type PSSu E S RS485 may be used.

Overview of the modules' bit requirement

The table overleaf contains the modules' bit requirement. The bit requirement is illustrated in accordance with the address assignment in the process image (ST-PII/PIO, FS-PII/PIO). There are configurations for various modules that impact the address and bit requirement. The table overleaf uses the same identifier for these configuration options as is used in a device description file.

Please note:
The table only shows a selection of the available modules. Module-specific information on the bit requirement and address assignment in the process image can be found in the module's operating manual.

Module	Confi-guration	ST-PII	ST-PIO	FS-PII	FS-PIO	Notes
PSSu E S PD-D	- - -	- - -	- - -	- - -	- - -	- - -
	S	8	- - -	- - -	- - -	1 status byte (module status)
PSSu E F PS	- - -	- - -	- - -	- - -	- - -	- - -
	R	8	- - -	- - -	- - -	1 status byte (system status) Configuration only possible on the first module after the head module
PSSu E F PS1	- - -	-	- - -	- - -	- - -	- - -
	R	8	- - -	- - -	- - -	1 status byte (system status) Configuration only possible on the first module after the head module
PSSu E F PS-P	- - -	- - -	- - -	- - -	- - -	- - -
PSSu E F BSW	- - -	- - -	- - -	- - -	1	- - -
	R	1	- - -	- - -	1	ST read access
PSSu E S 4DI	- - -	4	- - -	- - -	- - -	- - -
PSSu E S 4DI-D	- - -	4	- - -	- - -	- - -	4 bits
	S	12	- - -	- - -	- - -	4 bits + 1 status byte
PSSu E S 2DO 2	- - -	- - -	2	- - -	- - -	- - -

System description
Maximum system expansion

Module	Confi-guration	ST-PII	ST-PIO	FS-PII	FS-PIO	Notes
PSSu E S 2DO 2-D	- - -	- - -	2	- - -	- - -	2 bits
	S	8	2	- - -	- - -	2 bits (ST-PAA) + 1 status byte (ST-PII)
PSSu E S 4DO 0.5	- - -	- - -	4	- - -	- - -	- - -
PSSu E S 4DO 0.5-D	- - -	- - -	4	- - -	- - -	4 bits
	S	8	4	- - -	- - -	4 bits (ST-PAA) + 1 status byte (ST-PII)
PSSu E S 2DOR 2	- - -	- - -	2	- - -	- - -	- - -
PSSu E S 2DOR 10	- - -	- - -	2	- - -	- - -	- - -
PSSu K S 16DI	- - -	16	- - -	- - -	- - -	- - -
PSSu K S 16DO 0.5	- - -	- - -	16	- - -	- - -	- - -
PSSu K S 8DI 8DO 0.5	- - -	8	8	- - -	- - -	- - -
PSSu E F 4DI	- - -	- - -	- - -	4	- - -	- - -
	R	4	- - -	4	- - -	ST read access
PSSu E F 2DO 2	- - -	- - -	- - -	- - -	2	- - -
	R	2	- - -	- - -	2	ST read access
	&	2	2	- - -	2	ST read/write access (local enable principle)
PSSu E F 4DO 0.5	- - -	- - -	- - -	- - -	4	- - -
	R	4	- - -	- - -	4	ST read access
	&	4	4	- - -	4	ST read/write access (local enable principle)
PSSu E F 2DOR 8	-	-	- - -	- - -	2	- - -
	R	2	- - -	- - -	2	ST read access
	&	2	2	- - -	2	ST read/write access (local enable principle)
PSSu E F DI OZ 2	- - -	- - -	- - -	2	1	Input I0: Connection terminal Input I1: Open circuit detection R: ST read access &: ST read/write access (local enable principle)
	R	3	- - -	2	1	
	&	3	1	2	1	

System description
Maximum system expansion

Module	Confi-guration	ST-PII	ST-PIO	FS-PII	FS-PIO	Notes
PSSu E S 2AI I se	- - -	32	- - -	- - -	- - -	2 x 2 bytes
	S	16	- - -	- - -	- - -	2 status bytes
	X	48	- - -	- - -	- - -	2 x 2 bytes + 2 status bytes
PSSu E S 2AI U	- - -	32	- - -	- - -	- - -	2 x 2 bytes
	S	16	- - -	- - -	- - -	2 status bytes
	X	48	- - -	- - -	- - -	2 x 2 bytes + 2 status bytes
PSSu E S 4AI U	- - -	64	- - -	- - -	- - -	4 x 2 bytes
	S	32	- - -	- - -	- - -	4 status bytes
	X	96	- - -	- - -	- - -	4 x 2 bytes + 4 status bytes
PSSu E S 2AI RTD	- - -	32	- - -	- - -	- - -	2 x 2 bytes
	X	48	- - -	- - -	- - -	2 x 2 bytes + 2 status bytes
PSSu E S 2AI TC	- - -	32	- - -	- - -	- - -	2 x 2 bytes
	X	48	- - -	- - -	- - -	2 x 2 bytes + 2 status bytes
PSSu E S 2AO I	- - -	- - -	32	- - -	- - -	2 x 2 bytes
PSSu E S 2AO U	- - -	- - -	32	- - -	- - -	2 x 2 bytes
PSSu E S 4AO U	- - -	- - -	64	- - -	- - -	4 x 2 bytes
PSSu E S ABS SSI	- - -	40	- - -	- - -	- - -	4 bytes + 1 status byte
PSSu E S INC	- - -	72	40	- - -	- - -	**ST-PII:** 4 bytes counter data + 4 bytes latch value/period length + 1 status byte **ST-PIO:** 4 bytes (default) counter status + 1 control byte
PSSu E S INC 24V se	- - -	72	72	- - -	- - -	**ST-PII:** 4 bytes counter data + 4 bytes latch value/period length + 1 status byte **ST-PIO:** 4 bytes (default) counter status + 4 bytes limit value + 1 control byte

System description
Maximum system expansion

Module	Confi-guration	ST-PII	ST-PIO	FS-PII	FS-PIO	Notes
PSSu E S RS232	- - -	80	80	- - -	- - -	**ST-PII:** 2 status bytes + 8 bytes receive data **ST-PIO:** 2 control bytes + 8 bytes send data
PSSu E S RS485	- - -	80	80	- - -	- - -	**ST-PII:** 2 status bytes + 8 bytes receive data **ST-PIO:** 2 control bytes + 8 bytes send data
PSSu XB-F	- - -	- - -	- - -	- - -	- - -	- - -
PSSu XR-F	- - -	- - -	- - -	- - -	- - -	- - -
PSSu E AI SHT1	- - -	- - -	- - -	- - -	- - -	- - -
PSSu E AI SHT2	- - -	- - -	- - -	- - -	- - -	- - -
PSSu E PD	- - -	- - -	- - -	- - -	- - -	- - -
PSSu E PD1	- - -	- - -	- - -	- - -	- - -	- - -
PSSu E PS-P 5V	- - -	- - -	- - -	- - -	- - -	- - -
PSSu E PS P +/- 10V	- - -	- - -	- - -	- - -	- - -	- - -
PSSu E PS P +/- 15V	- - -	- - -	- - -	- - -	- - -	- - -

System description
Maximum system expansion

Maximum current load capacity of the supply voltage modules

- Module supply
  The module supply's current load is the total current consumption resulting from the electronic modules and compact modules. If the total current consumption is higher than the supply module's current load capacity, the module supply must be refreshed with an additional supply module (see modules' technical details). The system software takes this into account.
- Periphery supply
  Maximum current load: 10 A
  The current load of the periphery supply is the sum of the current consumption of the sensors and actuators supplied via the input/output modules. If the current load is higher, the periphery supply must be refreshed with an additional supply module to prevent overload. Please refer to the derating diagram.
- C-rail
  Maximum current load: 10 A
  If the current load is higher, the C-rail must use a different supply to prevent overload. Please refer to the derating diagram.

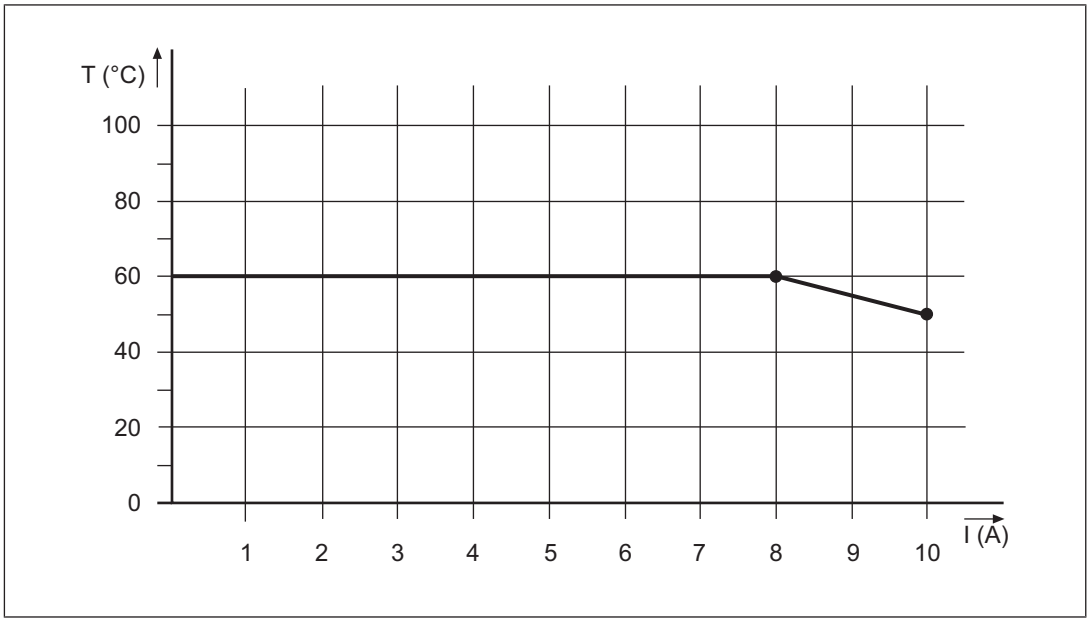
System supply	Max. current load
Module supply when supplied via - PSSu E F PS(-T)	1.5 A
Module supply when supplied via - PSSu E F PS1(-T)	2 A
Periphery supply	10 A
C-rail	10 A

System description
Maximum system expansion

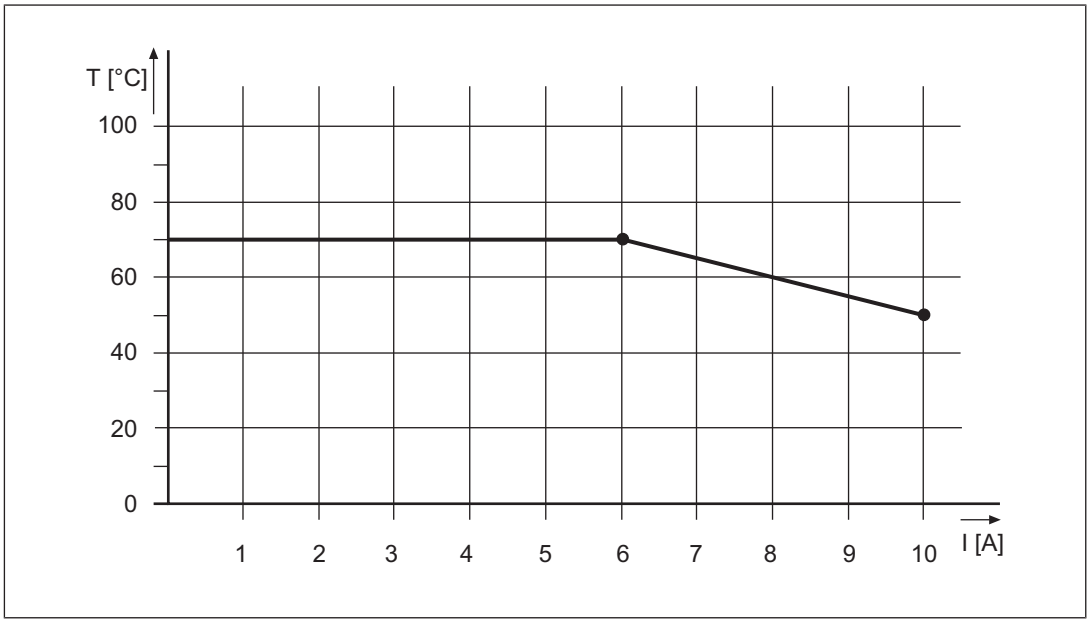
Maximum current load capacity based on temperature

The maximum current load capacity of the module bus with regard to the periphery supply and C-rail can only be achieved if the max. permitted ambient temperature is adhered to.

Derating diagram for periphery supply and C-rail: Temperature T dependent on load current I



T-type: Derating diagram for periphery supply and C-rail: Temperature T dependent on load current I



System description
Diagnostics

Diagnostic options

A PSSu system provides many options for diagnostics, fault detection and communication with other control systems. The diagnostics of a PSSu system can be perfromed via

- The LEDs on the electronic/compact modules and head module,
- The local USB port on the head module,
- Standard fieldbus functions,
- PVIS expanded diagnostics.

Both FS modules and ST modules can be diagnosed via a standard fieldbus or failsafe fieldbus.

For visualisation we recommend PMIvisu/PMIopen type devices plus expanded diagnostics with the PVIS OPC Server.

Error stack

Certain events lead to an entry in the head module's error stack. An event is signalled once only and is not repeated cyclically. Entries in the error stack can be evaluated for diagnostic purposes. The entries in the head module's error stack are graded according to their priority.

How a PSSu system reacts to events and how the error stack entries are forwarded will depend on the head module, the configuration, the connected bus systems and the user programs.

Diagnostic data

The available diagnostic data will depend on the modules you are using. Different errors are detected depending on the electronic module (see operating instructions for the relevant module). Besides the error data, electronic/compact modules can also send messages about their status to the head module.

The table below lists some typical PSSu messages.

Module error	Statement	Remedy
Start-up error	Error as the PSSu system starts up	Change faulty module
Configuration error	Incorrect module type configured	The configured hardware registry does not match the actual hardware registry
FS communication error	Error during FS communication	Change faulty module
ST communication error	Error during ST communication	Change faulty module
Bus termination error	There is no terminating plate or there is a bad contact with the module bus	Install a terminating plate with integrated end bracket or insert the base modules together correctly

System description
Diagnostics

Module error	Statement	Remedy
Temperature error: Too warm ([1])	Ambient temperature too high: Error stack entry	Ensure there is sufficient ventilation in the control cabinet or prevent overload
Temperature error: Too hot ([1])	Ambient temperature too high: Reset the module and stop the affected I/O-Groups	Ensure there is sufficient ventilation in the control cabinet or prevent overload
Output error	Error during cyclical output test for short circuit. Possible causes: Short circuit, or output defective	Rectify the short circuit or change the faulty module
Test pulse error	Possible causes: Short circuit between a test pulse and a supply voltage, or a defective module	Rectify the short circuit or change the faulty module
Relay control error	Error during cyclical monitoring test of the relay coils	Change faulty relay module
Relay error	A relay position is faulty; possible cause: Defective relay contact	Change faulty relay module
Block switching output error	Error during cyclical monitoring test of the relay contacts; possible external cause: Voltages being fed back to the relay contacts	Check the supply voltage and the wiring
Error in the feedback loop	FS input detects an error in the feedback loop or FS input is defective	Check FS input, check the configuration of the feedback loop, check the signals, or check the wiring and contacts
Error in the local enable principle	FS output has reacted incorrectly or unexpectedly	Check the configuration of the FS output, or check the fieldbus signals in the FS and ST section
Input error	Error during the cyclical input test; possible cause: Input defective	Change faulty module
Overload/short circuit	Load on output too high	Rectify overload or short circuit
Supply voltage overload for encoder	Supply voltage for encoder overloaded or short-circuited	Rectify overload or short circuit
Overvoltage error	A system voltage or infeed is too high	Stabilise the supply or change the faulty supply voltage module
Undervoltage error	A system voltage or infeed is too low	Stabilise the supply or change the faulty supply voltage module
Error in the overvoltage protection diodes	Overvoltage protection diodes are defective	Change faulty supply voltage module
Timeout error on the output	No data has been received for the output from the module bus for longer than 50 ms	Check ST communication or configuration

System description
Diagnostics

Module error	Statement	Remedy
Polarity error	Polarity of the periphery supply	Correct the polarity
Error in the periphery supply	Lower voltage limit exceeded on the periphery supply	Ensure there is a sufficient supply

([1]) There are two levels of overtemperature.

- Too warm:
  If a module's temperature exceeds a threshold value, the module sends a warning to the head module. If the temperature drops back below the threshold value, the module sends an all-clear.
- Too hot:
  If a module's temperature exceeds a further threshold value, the module sends an error message to the head module and triggers an I/O-Group stop.

Further information on PSSu error messages is available in the online help for the system software.

Application area of a PSSu system

A PSSu system is designed for use in an industrial environment as follows.

- Safety-related applications in the FS section, including connection to safe bus systems
- Non-safety-related applications in the standard section, including connection to standard bus systems.

Before using a PSSu system in safety-related applications it is necessary to perform a safety assessment in accordance with the Machinery Directive.

In principle, PSSu systems can be used in any situation where the result of the risk assessment indicates they may be used. However, they are primarily suitable for use in machine safety circuits in which a safe condition is brought about by the removal of power.

Examples:

- Presses
- Transfer lines
- Tank storage facilities
- E-STOP functions
- Burner control systems
- Cable cars/traction operations
- Stage technology
- Process engineering

The following is deemed improper use in particular:

- Any component, technical or electrical modification to a product
- Use of a product outside the areas described in the product documentation
- Any use that is not in accordance with the documented technical details.

Achieving a safety class

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

System description
Safety

Safety PSSu system

A PSSu system is divided into a failsafe and standard section. Only the failsafe section may process safety-related tasks.

The failsafe section of a PSSu system is designed to be diversely redundant. Diversely redundant means that information is processed more than once and in different ways, e.g. using several, different processors. All input and output signals are processed in separate channels. Each channel compares the result with its neighbours. The input and output signals are only valid if all three channels reach the same result.

As with the hardware, the software also has a failsafe and standard section.

The failsafe and standard programs use separate hardware resources (memory, modules etc.). The standard section operates without feedback, in other words it is only able to read the failsafe resources, such as failsafe inputs/outputs, unless the user specifically programs access. During configuration and user programming, it is important to ensure that this high level of safety is not compromised by errors and lack of attention.

Safety of the overall plant

The failsafe section of a PSSu system guarantees functional safety, e.g. from errors in hardware and software.

However, the failsafe section does not guarantee the safety of the entire process, configuration and user program. This is the user's responsibility. Pay special attention when programming and observe standards and regulations. A faulty application program can jeopardize the safety of the entire process!

Define the safety requirements for the overall plant and also define how these are to be implemented from a technical and organisational standpoint.

Technical measures include, for example, the choice of control system, the choice of periphery components and the user programming.

Organisational measures include, for example, the appointment of responsible personnel and the documentation of all work stages during commissioning. This also includes the allocation of responsibilities and access rights.

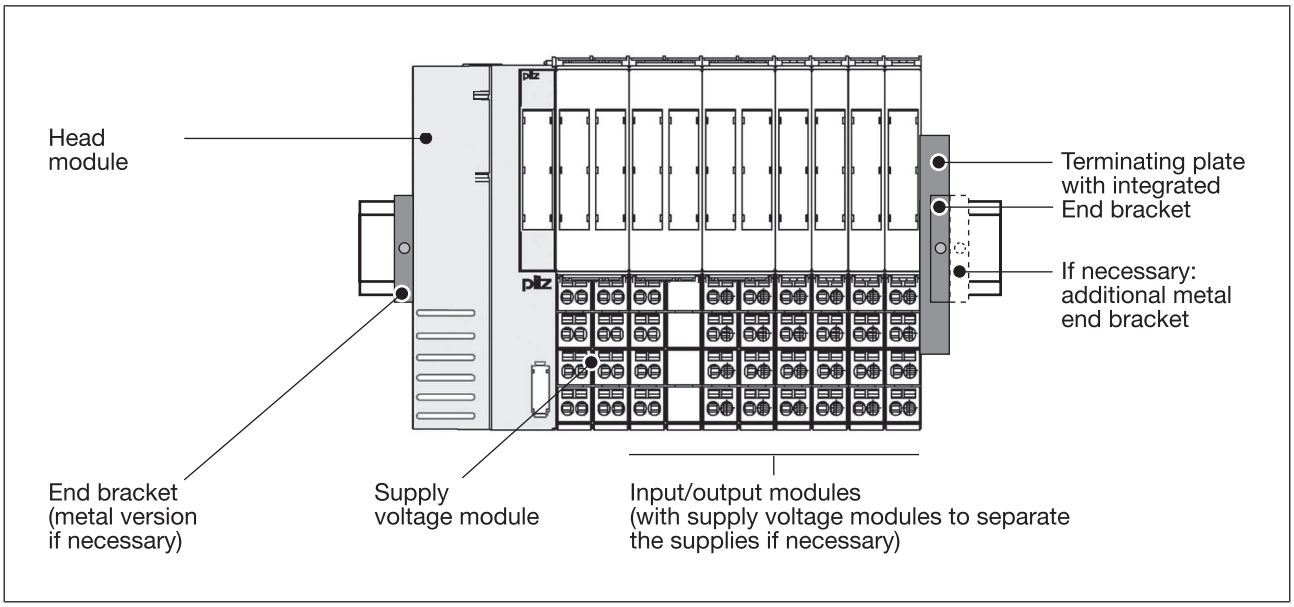
The safety requirement will depend on the plant's function and the risks. A safety assessment must also cover malfunctions, faulty operation and the possible consequences.

System description
Module layout

- The first module on a PSSu system is always a head module.
- A supply voltage module is always connected to the right of the head module
  - To provide the module supply (supply for the head module and the input/output modules)
  - To provide the periphery supply (supply for the sensors and actuators)
- Input/output modules for FS and ST applications may follow on to the right:
  - The input/output modules may be installed in any order.
  - Input/output modules for FS applications and ST applications may be combined as required.
  - If modules of the same function are combined into groups it makes things clearer and simplifies the wiring.
  - Base modules with screw terminals cannot be mixed in one PSSu system with base modules with cage clamp terminals.
  - A base module with screw terminals may not be installed to the left of a compact module.
  - The maximum number of input/output modules is determined by the system limits.
  - Input/output modules for FS applications may not be used with head modules that are only designed for ST applications.
- Additional supply voltage modules may be required in order to refresh the module supply or periphery supply.
- Supply groups require an additional voltage supply module at the start of each group. The modules belonging to the supply group will then follow to the right.
- The final element in a PSSu system is always a terminating plate containing the terminating resistors for the module bus.
- The system is attached to the mounting rail using fastening elements at the start and end of the system. The following end brackets are available, depending on vibration and shock stress:
  - Plastic version (standard)
  - Metal version (where there is increased stress)

System description
Module layout

Layout of the fastening elements:



Connections on the base modules

The connections on the base modules are divided into connection levels and connection columns. The connections have a two-digit number.

- The first digit denotes a base module's connection column (e.g.: connection **2**3 is in the second column).
- The second digit denotes a base module's connection level (e.g.: connection 2**3** is in the third level).

The function of the base module connections depends on the electronic module.

On input/output modules, the connection levels are typically arranged as follows:

- Connection level 1 and 4
  Input and output connections
- Connection levels 2 and 3
  Connections for the common supplies (periphery supply, analogue inputs/outputs or screening)

Many input/output modules may have two more connection levels:

- Connection level 5 and 6
  Connections for the common supplies (periphery supply, analogue inputs/outputs or screening)

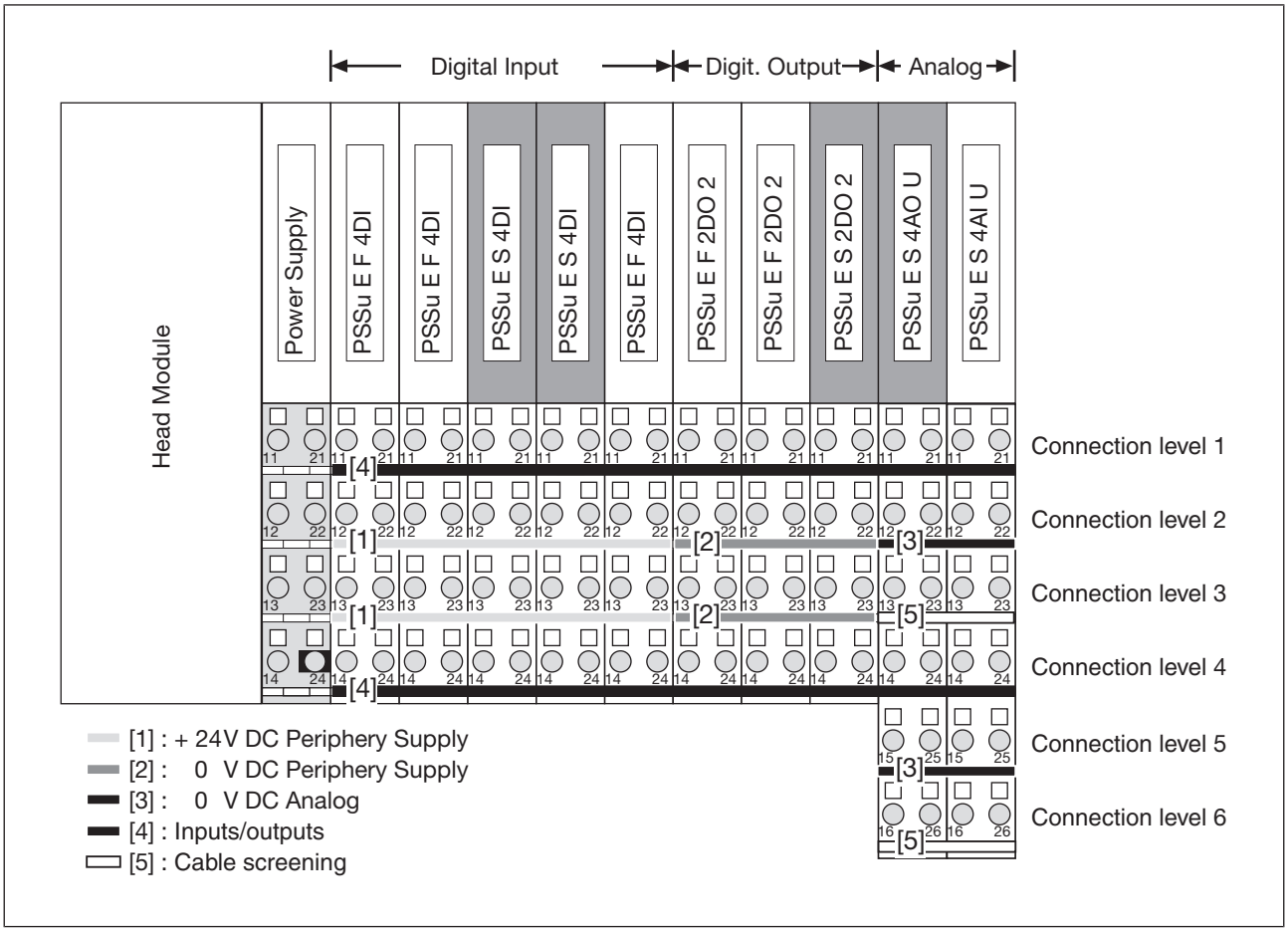
Input/output modules can be installed in any order. However, for the connection diagram to be consistent it makes sense to arrange input/output modules of the same type into groups and not have them interrupted by compact modules (see example).

System description
Connections

Colour marking on the connection levels

The colour marking on the connection levels is a wiring aid. Various colour markers are available for labelling. The colour markers can be used to label different supplies. This way the connection levels remain clearly visible, even after wiring.

Example:



System description
Connections

Connections on the compact modules

The connections on the compact modules are divided into terminal rows. Single or three-row connectors with spring-loaded terminals can be plugged into the device's single-row 10-pin connector strip.

The function of the connections depends on the compact module.

- Terminal row 1

  Connection of the inputs and outputs, periphery supply (24 V and 0 V).

- Terminal row 2

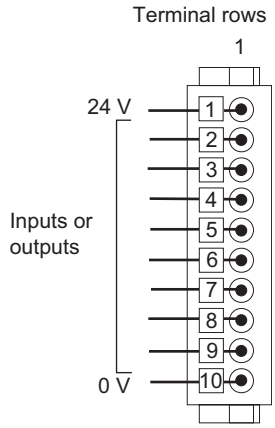
  All connections are linked; bridged to the 24 V periphery supply connection from the first connection level

- Terminal row 3

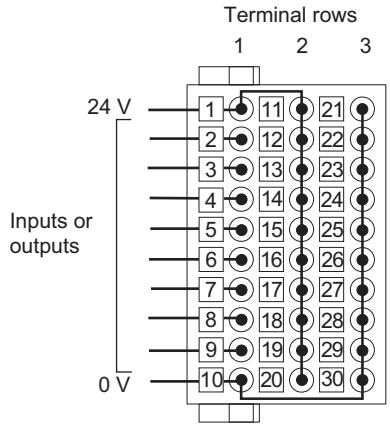
  All connections are linked; bridged to the 0 V periphery supply connection from the first connection level

Input/output modules can be installed in any order. However, for the connection diagram to be consistent it makes sense to arrange input/output modules of the same type into groups.

Single-row connector



Three-row connector



System description
Installing within the control cabinet

The PSSu system must be installed in a protected environment, e.g. in a control cabinet or a protected interior compartment. The interior compartment must provide protection against environmental influences such as dust and humidity, as well as mechanical damage and manipulation. Please refer to the relevant standards for details of the conditions that must be met for the application.

Use a zinc-plated DIN rail as the mounting rail. Dimensions:

- 35 x 7.5 mm or 35 x 15 mm

When installing, please note the following:

- Where vibration and shock stress place increased requirements on the system fastenings, we recommend that the mounting rail is screwed to the mounting plate approximately every 200 mm.
- We strongly recommend that you comply with the mounting distances stated in the chapter entitled Mounting distances. This will enable modules to be exchanged and guarantee sufficient heat dissipation.
- We recommend that it is installed horizontally on a vertical wall.
- If you wish to install the system vertically, optimum upward heat dissipation is no longer guaranteed. Please note the following restrictions:
  - Reduce the maximum ambient temperature by 10°C compared with the values stated in the technical data.
  - Install the head module downwards.
  - You should use additional metallic end brackets in order to comply with the higher requirements on the system fastenings due to vibration and shock stress.

The T-type PSSu modules are suitable for use where there are increased environmental requirements on temperature and humidity. Please refer to the technical details. With some T-type output modules, please also note the derating at higher temperatures.

System description
Installing within the control cabinet

Mounting distances

The values shown in the diagram for mounting distances are minimum specifications.

The ambient temperature of the PSSu system in the control cabinet must not exceed the figure stated in the technical details for the modules, Air conditioning may otherwise be required.

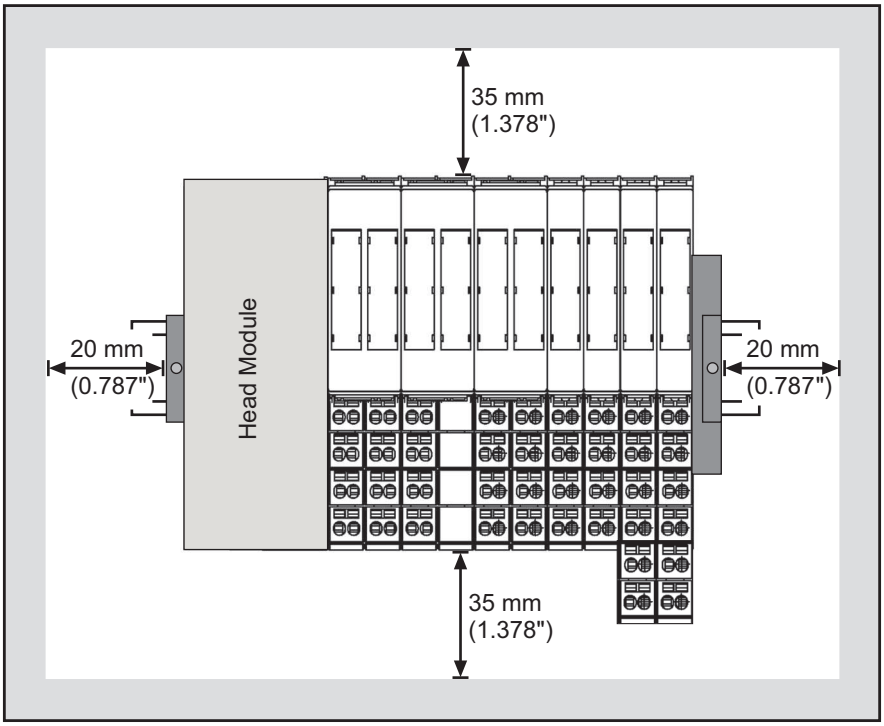


Fig.: Mounting distances when installed horizontally

System description
Installing within the control cabinet

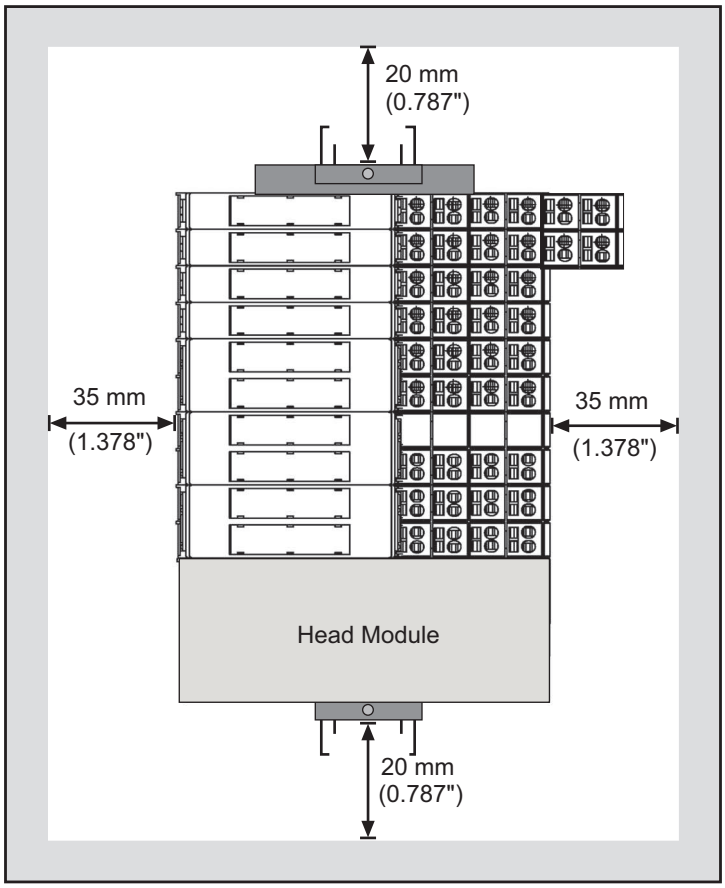
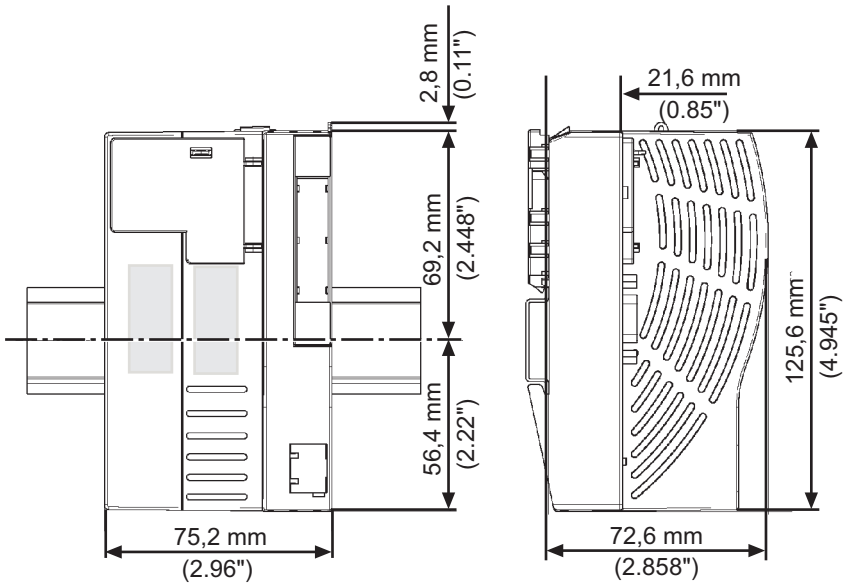


Fig.: Mounting distances when installed vertically

System description
Installing within the control cabinet

Dimensions of the head modules

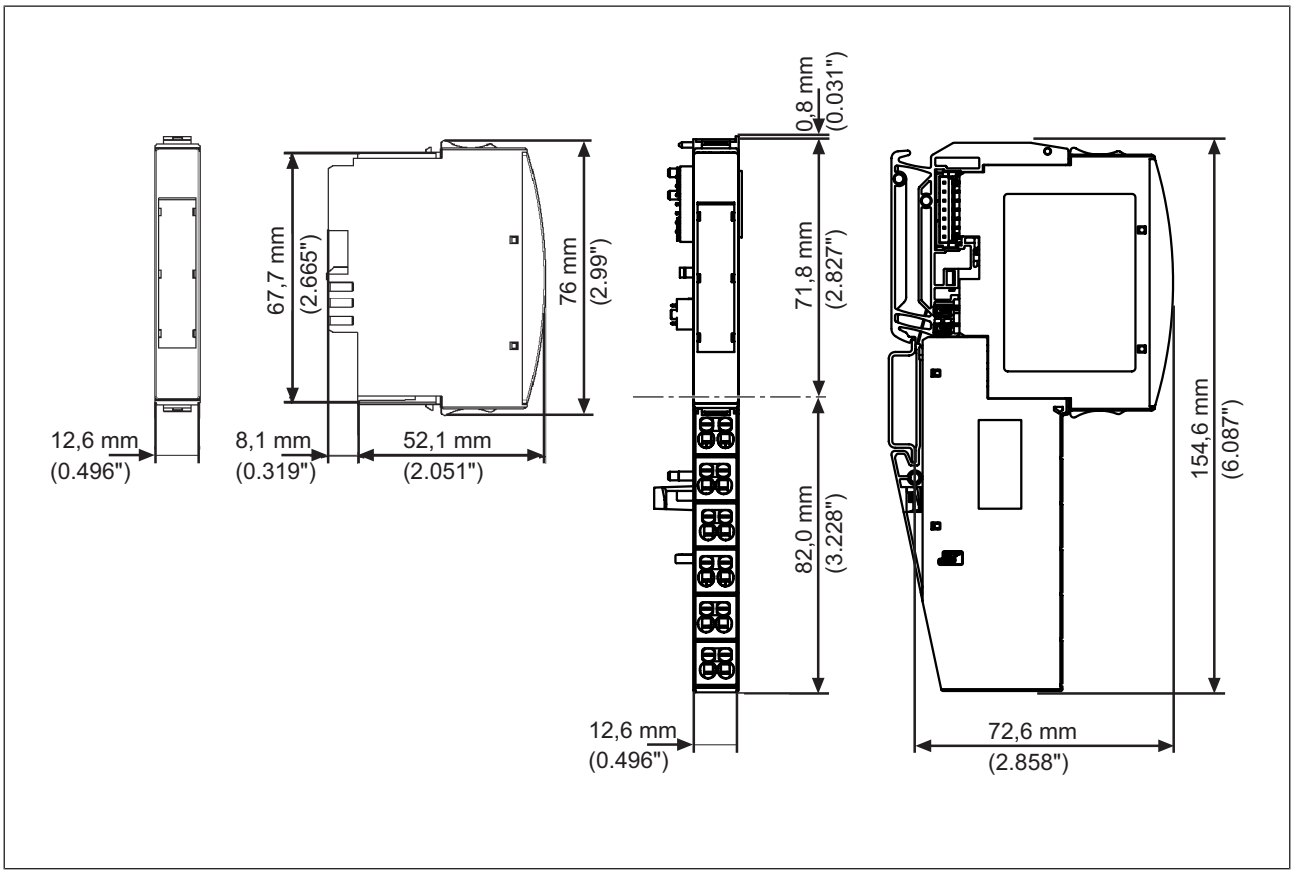
Head modules with a standard fieldbus connection:



System description
Installing within the control cabinet

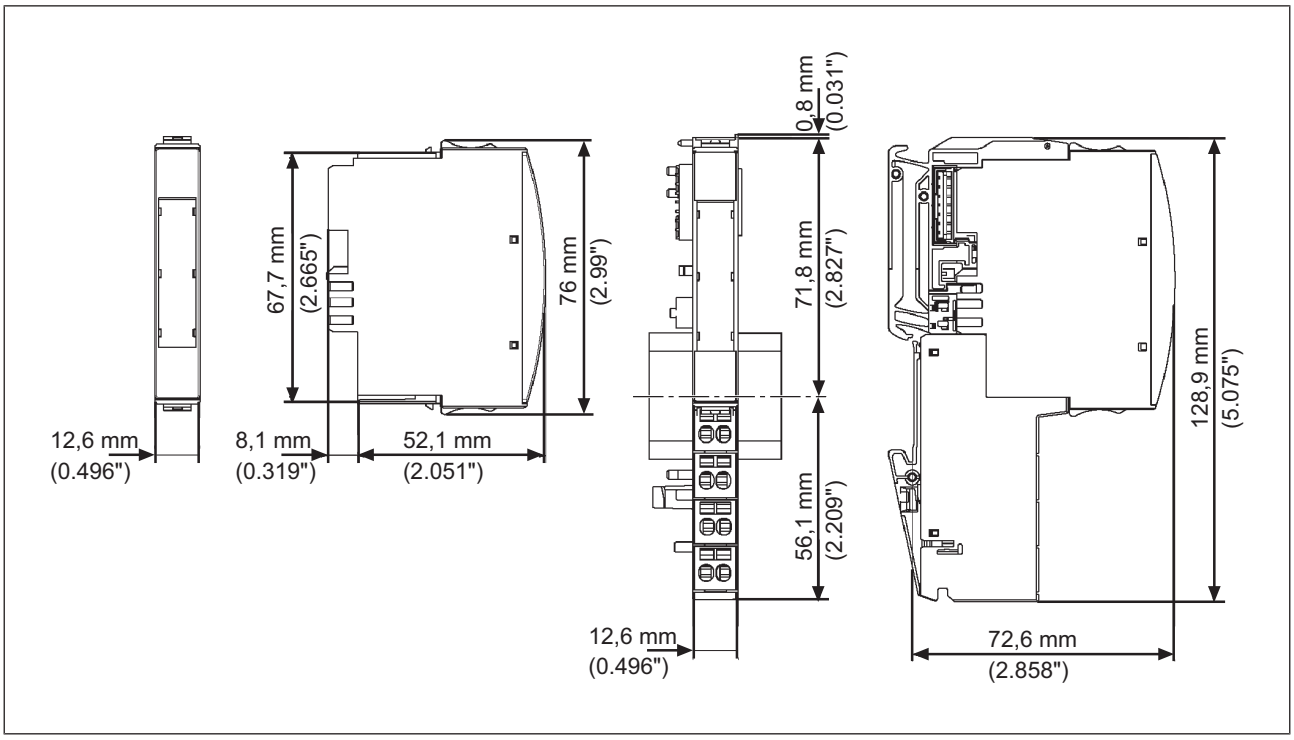
Dimensions of the electronic modules

Base modules with six connection levels:

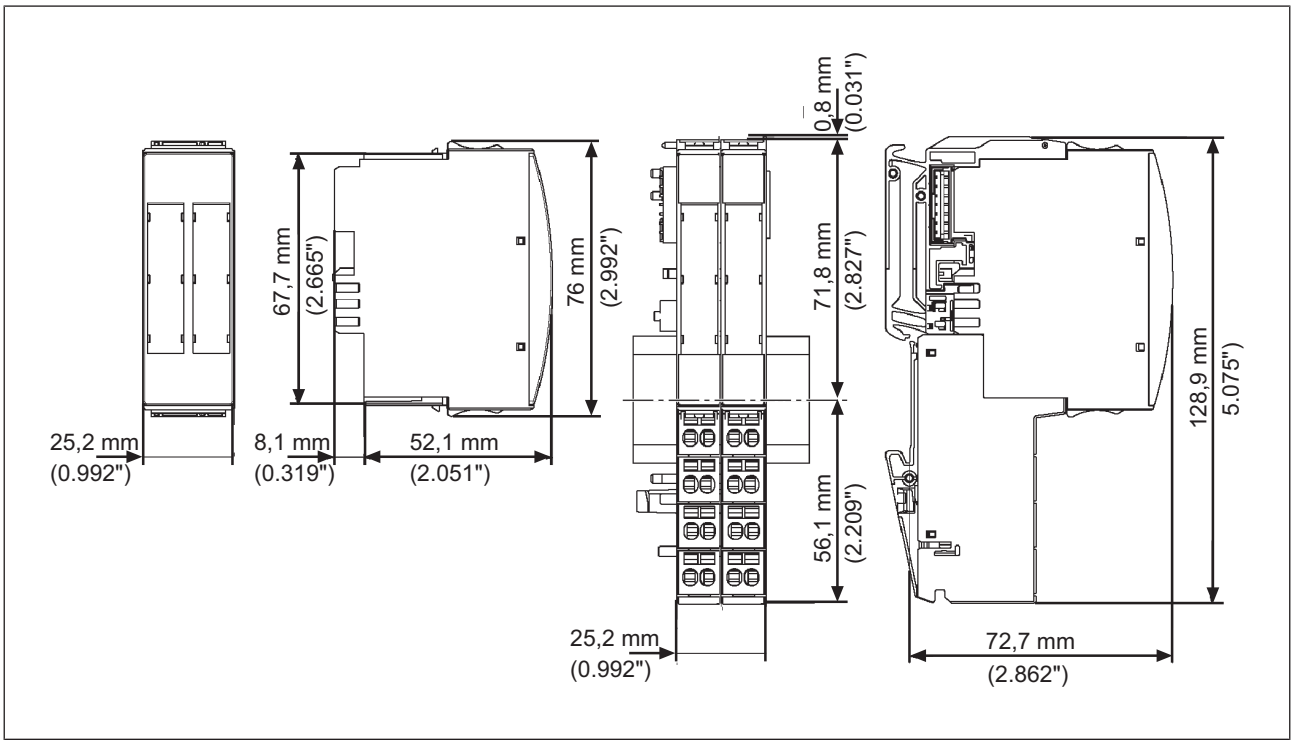


System description
Installing within the control cabinet

Single-width base modules with four connection levels:



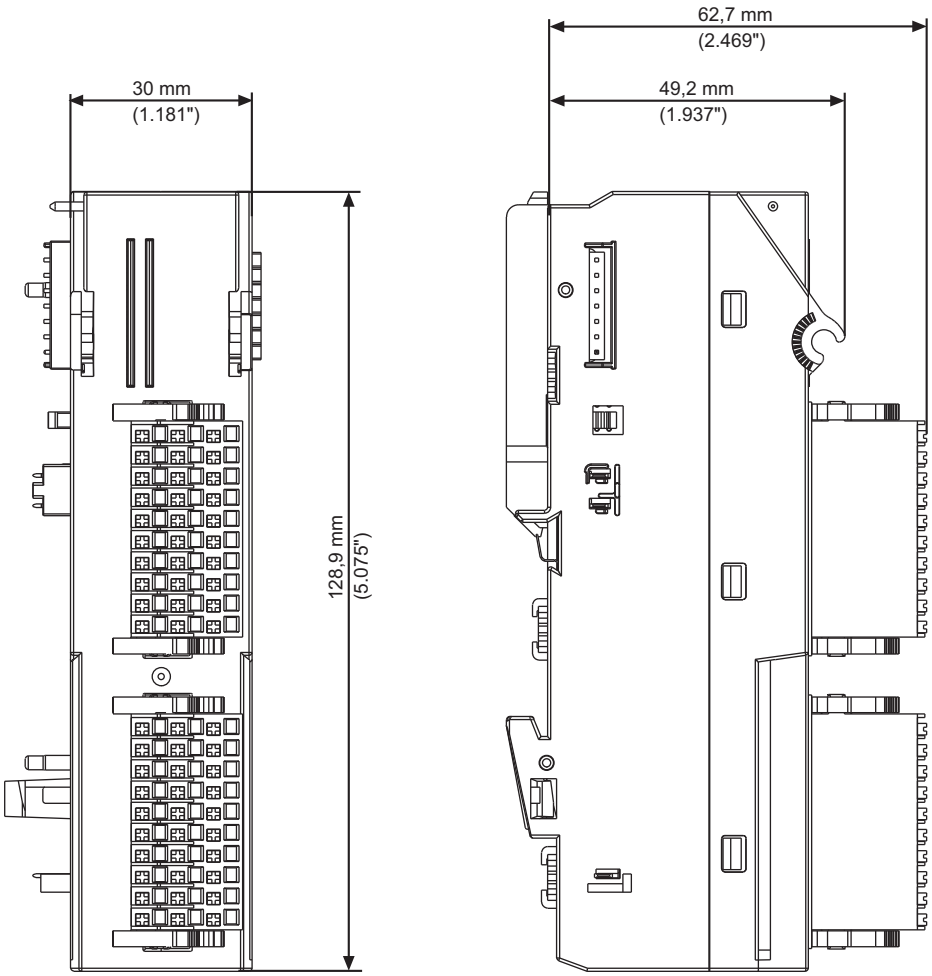
Double-width base modules with four connection levels:



System description
Installing within the control cabinet

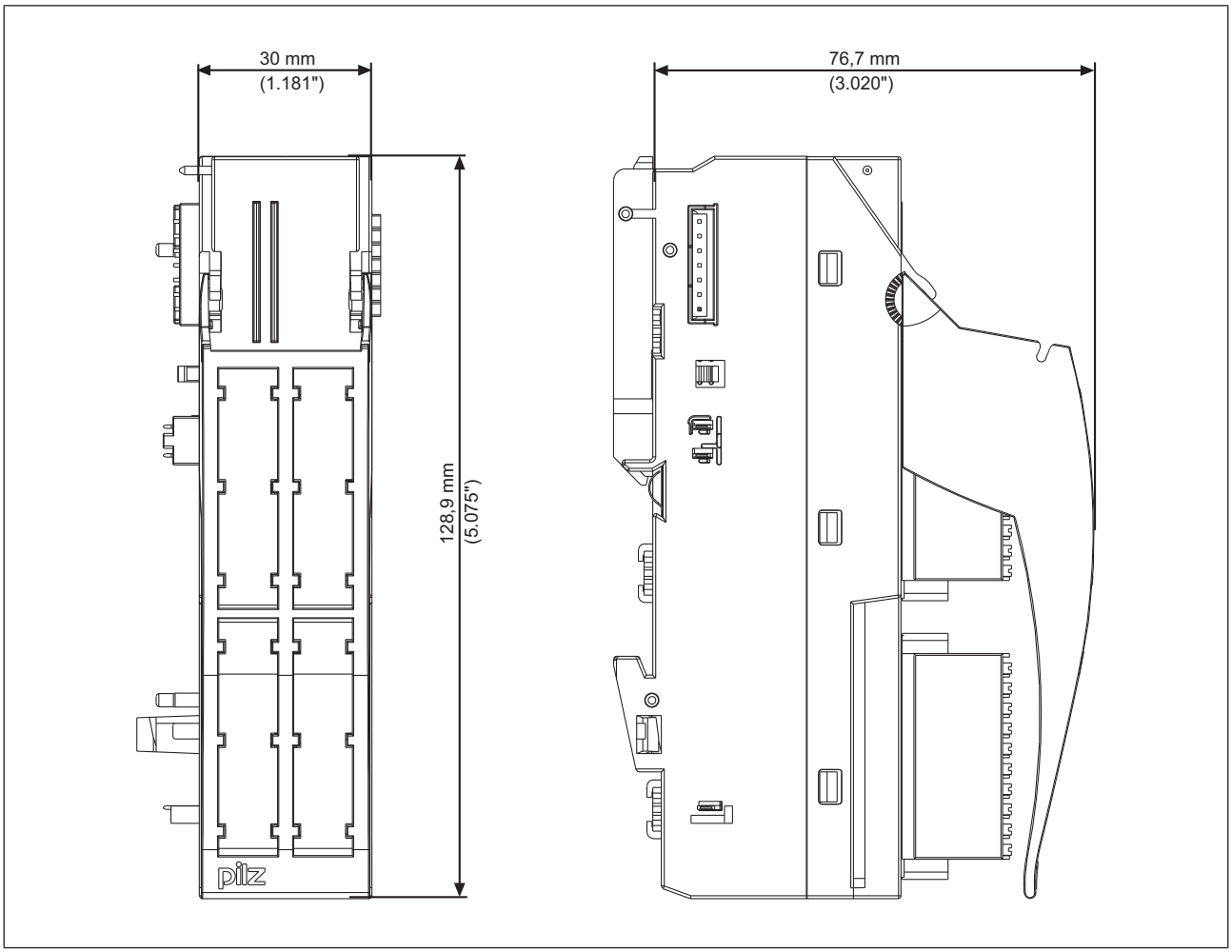
Dimensions of compact modules

Module with connector:



System description
Installing within the control cabinet

Module with connector and labelling bracket:



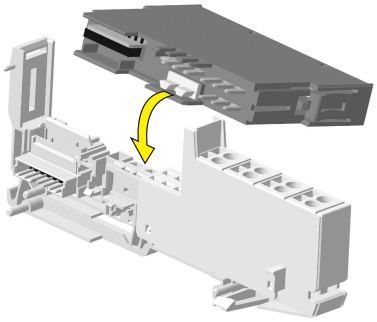
System description
Mechanical coding

Electronic modules are supplied with a two-part coding element.

When an electronic module is plugged into a base module for the first time, one part of the coding element remains on the electronic module, while its counterpart is fixed on to the base module. This is how the base module is coded.

The coding element is designed to help prevent plugging errors (e.g. when exchanging an electronic module). Once a base module has been coded, it will only take electronic modules with the same mechanical coding.

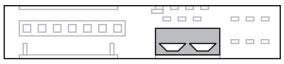
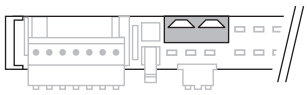
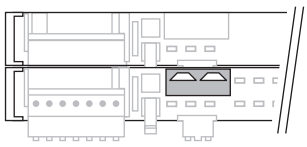
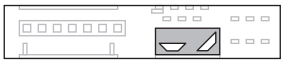
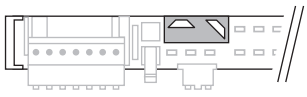
The coding is identified by a letter and a colour. Codings with the same letters are mechanically identical and are distinguished through a different colour.



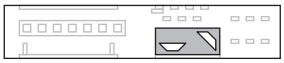
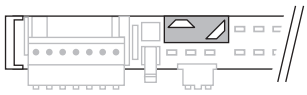
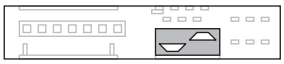
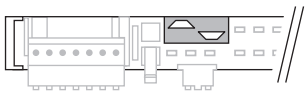
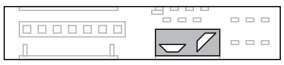
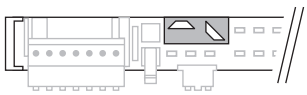
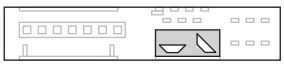
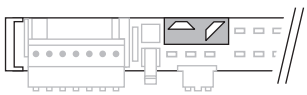
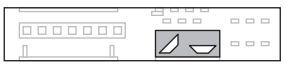
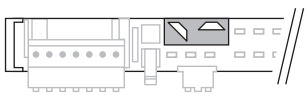
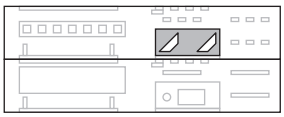
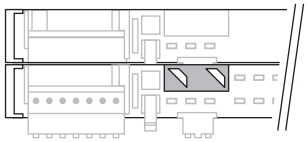
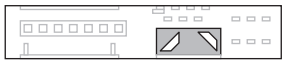
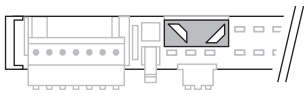
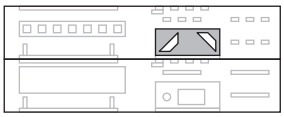
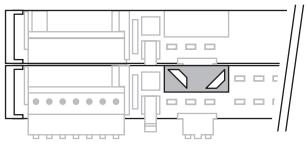
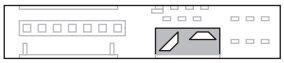
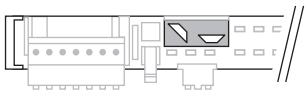
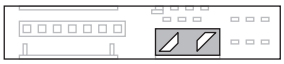
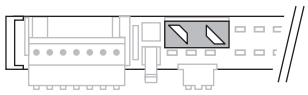
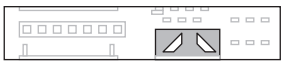
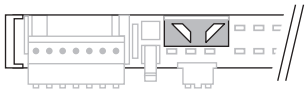
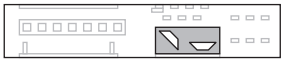
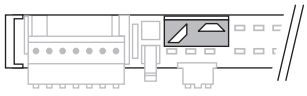
Overview of the mechanical coding elements

The types of coding elements are listed in the table below.

Please note:
Details of the mechanical coding of the electronic modules (type and colour) can be found in the technical details in the data sheet and operating manual.

Type	Coding element Electronic module	Coding element on counterpart Base module
A		
		
B		

System description
Mechanical coding

Type	Coding element Electronic module	Coding element on counterpart Base module
C		
D		
E		
F		
G		
H		
I		
		
J		
K		
L		
M		

System description
Supply voltage and insulation

All PSSu systems voltages are provided via supply voltage modules. The voltages are distributed to the modules via the module bus.

- Module supply

  The module supply is the internal supply voltage for the head module, the compact modules and the electronic modules.

- Periphery supply

  The periphery supply supplies 24 VDC to the sensors and actuators on digital input/outputs on electronic modules. On compact modules, the supply for the inputs is generated from the periphery supply; the supply for the outputs must be fed to the module terminals.

  The connection on the module bus can be disconnected in order to form supply groups. On digital failsafe modules, the periphery supply is used to provide test pulses. Failsafe input/output modules will not start until the periphery supply is connected correctly. On analogue input/output modules, the periphery supply is galvanically isolated from the inputs/outputs.

- C-rail

  The C-rail is an additional, free power rail. Access to the C-rail is available via base modules that contain the letter "**-C**" in their description (e.g. PSSu BP**-C** 1/8 S, PSSu BP**-C** 1/8 C).
  The C-rail supply must belong to the same circuit as the other base module connections. Connecting PE to the C-rail provides a simple form of shield. On the compact modules, the C-rail is not looped through and is not available at the terminals. Permitted infeed at the C-rail:

  – PE
  – 0 V
  – Screen
  – - 30 VDC ... + 30 VDC
  – - 48 VAC ... + 48 VAC

- Inputs/outputs on the analogue modules and counter modules

  The inputs and outputs on the analogue modules and counter modules are galvanically isolated from the periphery supply. On the base modules, the supply for the outputs is generated from the periphery supply.

- Earth (Ground)

  The module supply and periphery supply have separate connections for the respective earth potential (Ground).

- Functional earth

  A contact spring on the base modules and compact modules connects the modules' functional earth to the mounting rail.

System description
Supply voltage and insulation

The supply voltages for module supply and periphery supply must be extra low voltages with protective electrical separation (PELV or SELV) in accordance with VDE 0100, Part 410. Further requirements of the power supplies can be found in the data sheets for the supply voltage modules or head modules.

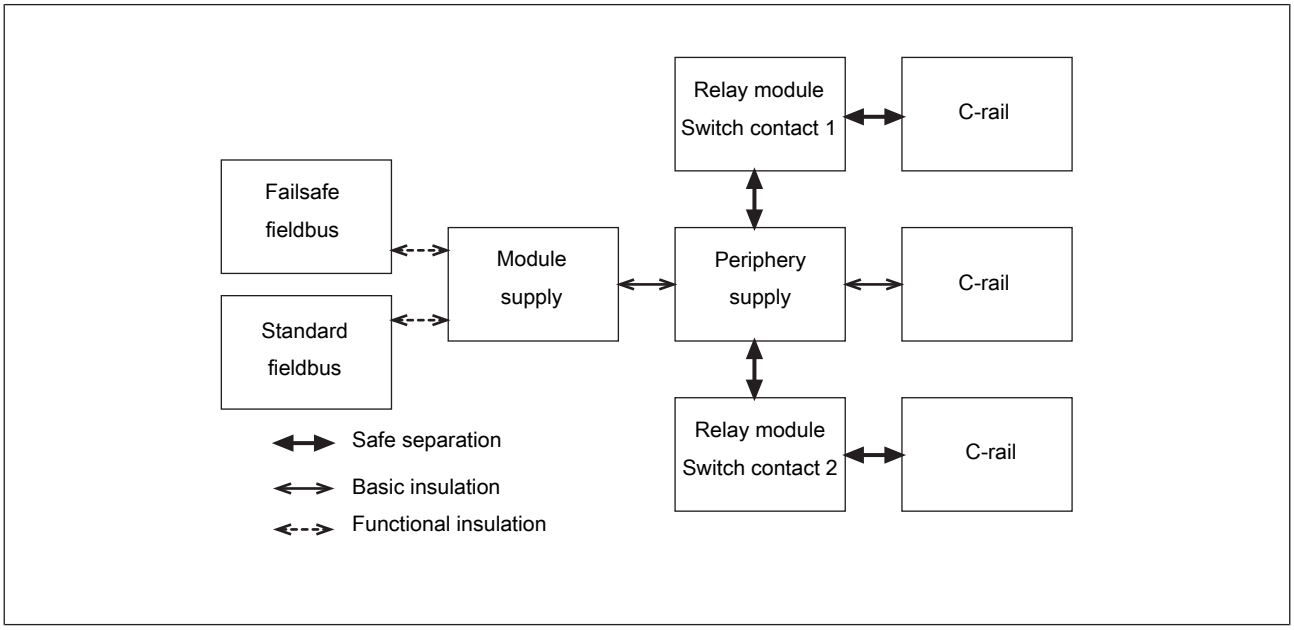
When the voltages are fed separately using two power supplies, the module supply and periphery supply are galvanically isolated. If galvanic isolation is not required, a common power supply may be used for the periphery supply and module supply.

Separate power supplies for module supply and periphery supply increase availability: In the case of a short circuit in the periphery supply, the module supply is maintained and the head module can continue to exchange data with fieldbus systems, e.g. for diagnostic purposes.

If voltages higher than 50 VAC or 120 VDC are connected to the PSSu system, e.g. to switch contacts on relay modules, please note the following:

- Specific accident prevention regulations apply.
- For safety reasons, only the protective earth (PE) may be connected to the C-rail of the supply group.

Insulation of supplies in a PSSu installation:



System description
Earthing and connection

Earthing of the system

When modules are attached to the mounting rail, a contact spring makes the electrical contact between the modules' functional earth and the mounting rail.

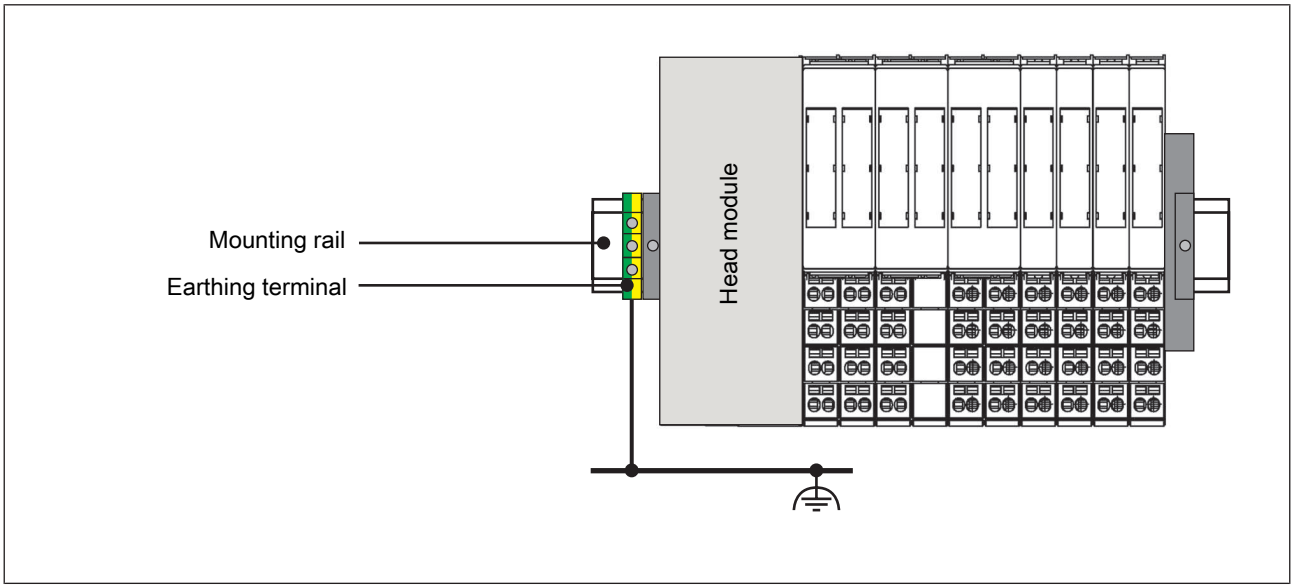
- Always connect the mounting rail to the protective earth via an earthing terminal. This will be used to dissipate hazardous voltages in the case of a fault.

The earthing terminal is available as an accessory. The mounting rail must be properly earthed to ensure interference-free operation in accordance with EMC regulations.

The supplies on the PSSuniversal module bus (module supply, periphery supply, C-rail) are not connected to the functional earth through the contact spring.

On analogue modules and counter modules with base modules without a C-rail, the contact spring also connects the shielding connections to the mounting rail.

Earthing the mounting rail:



System description
Earthing and connection

Cable requirements with base modules

Please note:

- The minimum cable cross section for field connection terminals on the base modules is 0.14 mm^2 (AWG26).
- The maximum cable cross section for field connection terminals is:
  - Digital inputs: 1.5 mm^2 (AWG16)
  - Digital outputs: 2.0 mm^2 (AWG14)
  - Inputs/outputs on the counter modules: 1.5 mm^2 (AWG16)
  - Analogue inputs/outputs: 1.5 mm^2 (AWG16)
  - Communication cables: 1.5 mm^2 (AWG16)
  - Test pulse outputs: 1.5 mm^2 (AWG16)
  - Power supply: 2.5 mm^2 (AWG12)
  - Functional earth: 2.5 mm^2 (AWG12)
- On base modules with screw terminals:
  - If you use a multi-strand cable to connect the I/Os, it is recommended that you use ferrules conforming to Parts 1 and 2 of DIN 46228, 0.14 ... 1.5 mm^2, Form A or C, although this is not essential. To crimp the ferrules you can use crimp pliers (crimp form A or C) conforming to EN 60947-1, such as the PZ 1.5 or PZ 6.5 from Weidmüller, for example.
  - Maximum torque setting: 0.8 Nm
- Use copper wiring.

Cable requirements with compact modules

Please note:

- The cable cross section with spring-loaded terminals without ferrules is 0.20 – 1 mm^2, 22 -16 AWG.
- If you are using multi-core or fine-core cables we recommend ferrules in accordance with DIN 46228/Part 1 or DIN 46228/Part 4, 0.2 ... 1 mm^2. To crimp the ferrules we recommend crimping pliers (crimp form A) conforming to EN 60947-1, such as the PZ 6/5 from Weidmüller, for example.
- Terminal points per connection: 1
- Stripping length: 8 mm

System description
Electromagnetic compatibility (EMC)

EMC-compatible application

The PSSu system is designed for use in an industrial environment. It is not suitable for use in a domestic environment, as this can lead to interference.

Connecting the earth cables

Please note:

- A conductor cross section of at least 2.5 mm^2 should be used for the connection to the central earth bar. Connections should be kept as short as possible.
- Connections to the earth bar should always be in star form.
- Connect together the 0V connections on all the 24 V power supplies and earth the 0 V mains at a single point, or ensure that measures are in place to monitor for earth faults.
- Earthed supply voltages offer the best noise immunity.
- The connection of the 0 V supply to the central earth bar or earth fault monitor must be in accordance with relevant national regulations (such as EN 60204-1, NFPA 79, NEC: Article 250).
- Define a central earthing point.
- Make sure that the control system and motor are earthed correctly.
- Earth the mounting plate.
- 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.

Equipotential bonding

Potential differences may occur if the system and its periphery devices are connected to different earth connections. Equalising currents can flow through cable shields that are connected at either end and have different earth connections. These equalising currents can cause interference or destroy the cable shield. In order to avoid interference, equipotential bonding cables must be installed. Please note:

- Select a low impedance equipotential bonding cable.
- Select the following as standard values for the cross section of the equipotential bonding cables:
  - 16 mm^2 for equipotential bonding cable up to 200 m in length
  - 25 mm^2 for equipotential bonding cable over 200 m in length
- If the system and periphery devices are connected with shielded signal cables which are earthed at either end, the impedance is calculated as follows:
  - Impedance equipotential bonding cable = 10 % of shield impedance
- Use copper or galvanised steel equipotential bonding cable.

- Connect equipotential bonding cables to the earth bar 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.

Suppression of inductive loads

Suppression should not be used to protect the digital semiconductor outputs.

Control cabinet lighting

Use low interference panel lighting for inside the control cabinet.

Shielded cables

Digital inputs and outputs on the PSSu system do not need shielded cables. However, if the connection cables have a shield, it should be connected at one end.

Analogue inputs and outputs plus the inputs and outputs on the counter modules should always be connected using shielded cables.

- On base modules with C-rail:
  - Connect the shield to the terminals on the C-rail.
  - Connect the C-rail with low impedance to the functional earth.
- On analogue modules and base modules without C-rail:
  - Connect the shield as shown in the terminal configuration section of the configuration data sheets.
  - The module connects the shield to the functional earth via the mounting rail.

ESD

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

System description
Supply groups

When used with the relevant base module, any electronic supply voltage module is suitable to separate supplies and form supply groups.

To separate supplies, the supply (periphery supply and C-rail supply) to the preceding (left-hand) modules is disconnected and a new supply provided for subsequent (right-hand) modules.

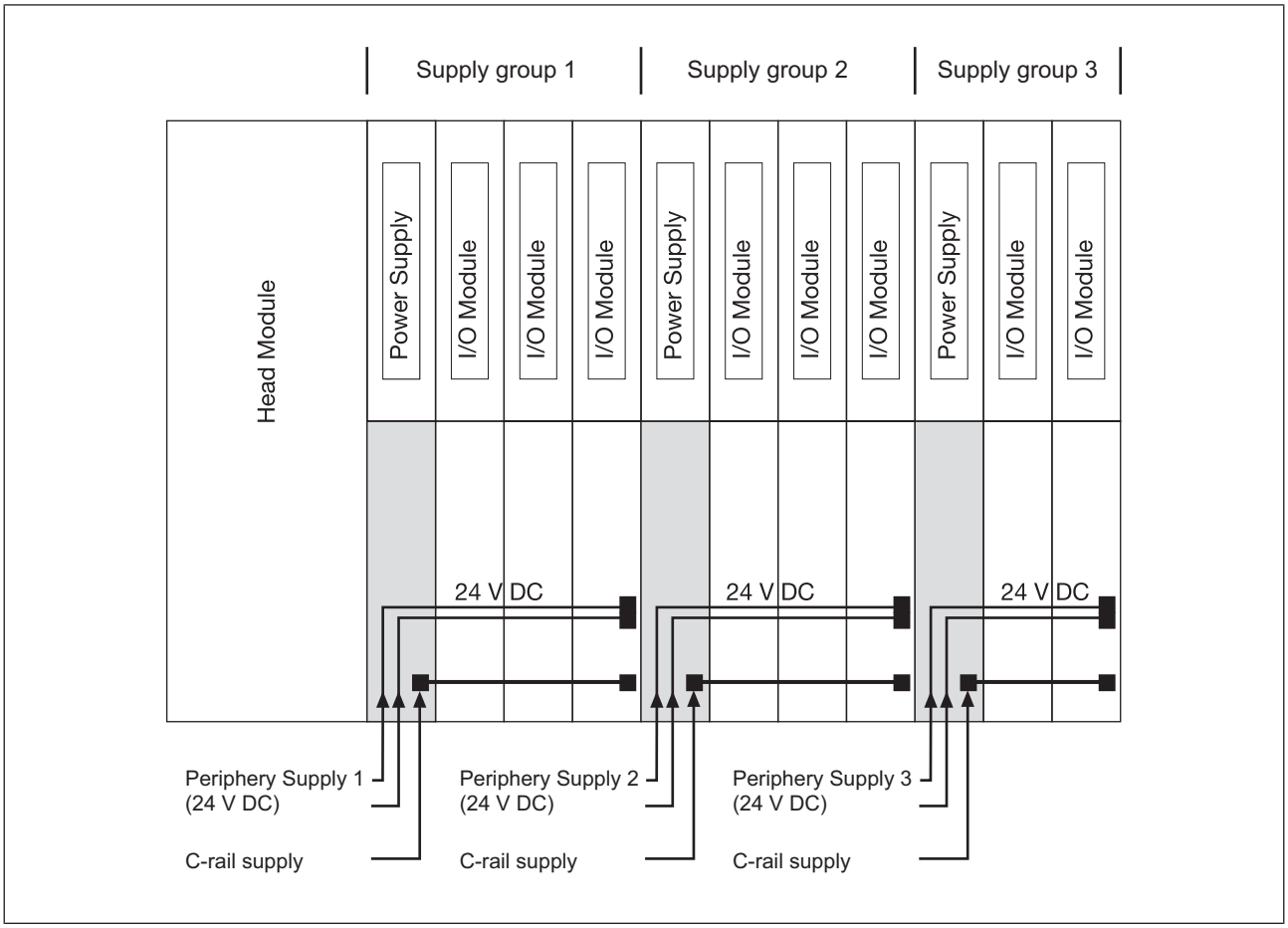
With a new supply group it is also possible to refresh the module supply by providing a new supply voltage. The 0 V supply on the module supply is never interrupted, but is always looped through across the whole module bus.

You should always refer to the description of the relevant electronic supply voltage module.

The following modules are suitable for separating supplies, for example:

Electronic module	Base module	Module supply	Periphery supply and C-rail
PSSu E F PS	PSSu BS-R 1/8 S PSSu BS-R 1/8 C	Refreshing (new supply voltage is provided, 0 V supply is not interrupted).	Supply of the left-hand modules is interrupted and a new supply is provided for the right-hand modules.
PSSu E F PS1	PSSu BS-R 2/8 S PSSu BS-R 2/8 C		
PSSu E F PS-P	PSSu BS 1/8 S PSSu BS 1/8 C	No refreshing (5 V is not separated).	
PSSu E F BSW	PSSu BS 2/8 S PSSu BS 1/8 C		

System description
Supply groups



System description
System software

System software is available to provide support when designing and assembling a PSSu system, configuring modules and during the wiring test. It consists of the following parts:

PSSuniversal Assistant

The PSSuniversal Assistant is a software package that provides support for designing and assembling PSSu systems. The software is available licence-free and can be used independently from the system software PSS WIN-PRO.
The PSSuniversal Assistant has the following function range, for example:

- Create project with PSSu systems and assemble PSSu systems
- Configure module parameters
- Generate project parts list
- Update modules' firmware
- Print/documentation

PSSuniversal Configurator

The PSSuniversal Configurator is a software package used to configure a PSSu system for PROFINET/PROFINET with PROFIsafe profile. The software can only be used in conjunction with the Siemens software SIMATIC STEP 7 (TIA Portal).
The PSSuniversal Configurator has the following function range, for example:

- Assemble PSSu system
- Configure PSSu system for local enable principle
- Configure module parameters
- Configure PSSu system for PROFINET or PROFINET with PROFIsafe profile
  A licence for PSSuniversal Startup is required to download the FS configuration to a PSSu system via the Siemens software SIMATIC STEP 7.
- Print/documentation

PSSuniversal Startup

PSSuniversal Startup is a software package used to test the wiring of a PSSu system connected online. A separate licence is required for the software. The software has the following function range, for example:

- Upload the system data of a PSSu system
- Test the wiring of the inputs on a PSSu system
- Test the wiring of the outputs on a PSSu system (forcing)
- Show system properties and system information
- Read error stack
- Print/documentation

System description
System software

PSSu systems can be assembled using both the PSSuniversal Assistant and PSSuniversal Configurator. However, it is easier and clearer to assemble a system while designing a configuration with the PSSuniversal Assistant. Already assembled PSSu systems can be imported in both system software sections.
Once installed, all the above system software sections are available. PSSuniversal Assistant and PSSuniversal Startup can be launched via the "Programs" directory" or a desktop icon, while PSSuniversal Configurator can only be launched via the Siemens software SIMATIC STEP 7.

System description
Reaction times

The reaction times refer exclusively to the inputs and outputs on a PSSu system. To determine the overall reaction times, the corresponding bus systems, periphery devices and controllers also need to be taken into account.

- Digital inputs:
  The reaction time of the digital inputs is the time a PSSu system needs for a bus telegram to be finalised or for some other reaction from the head module to occur, once a signal has changed at an input.
- Digital outputs:
  The reaction time of the digital outputs is the time a PSSu system needs to change a signal at the output once a bus telegram has been received.
- Analogue inputs:
  The reaction time of the analogue inputs is the time a PSSu system needs to read in a value at the input and to make it available within a bus telegram.
- Analogue outputs:
  The reaction time of the analogue outputs is the time a PSSu system needs to make the value available at the output once a bus telegram has been received.

Cycle time of a PSSu system

The PSSu module bus transfers failsafe data and standard data independently from each other. This is why the FS cycle time differs from the ST cycle time.

$t_{FS\ Cycle}$

The FS cycle time of the PSSuniversal is a constant 4 ms.

$t_{ST\ Cycle}$

The ST cycle time of the PSSuniversal depends on the number of events that have occurred. The longest cycle time will need to be considered when the maximum number of ST modules is configured and all the inputs/outputs are changing simultaneously.

- Typical: 1 ms
- Maximum: 4 ms

Input/output processing time

$t_{Processing\ In}$

$t_{Processing\ Out}$

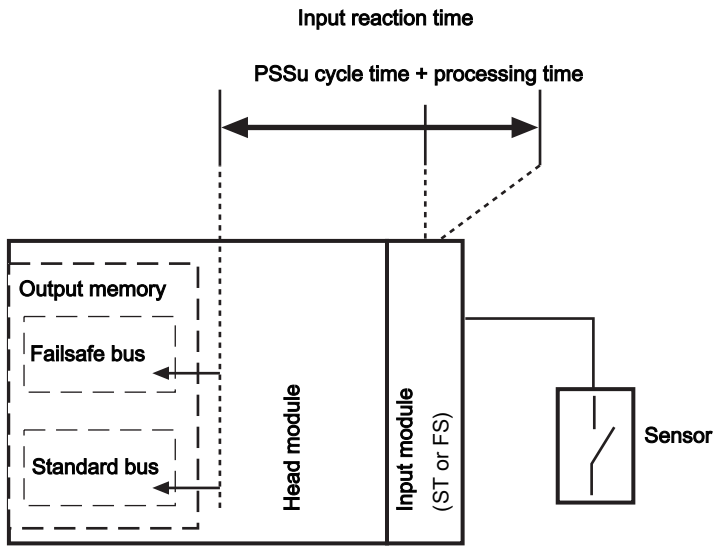
The processing time is the time an input/output module needs internally for signal processing. It varies depending on the module.

The processing time takes into account the input filter time and various influences such as internal run times, temperature drifts, spread of components, etc.

The processing times can be found in the technical details for the input/output modules.

System description
Reaction times

Input		Reaction time	
Failsafe	Typical	$t_{FS\text{-}Reaction\ typ} = (1.5 \times t_{FS\text{-}Cycle}) + t_{Processing\ In}$	$= 6\ ms + t_{Processing\ In}$
	Max-imum	$t_{FS\text{-}Reaction\ max} = (2 \times t_{FS\text{-}Cycle}) + t_{Processing\ In}$	$= 8\ ms + t_{Processing\ In}$
Stand-ard	Typical	$t_{ST\text{-}Reaction\ typ} = (1.5 \times t_{ST\text{-}Cycle\ typ}) + t_{Processing\ In}$	$= 1.5\ ms + t_{Processing\ In}$
	Max-imum	$t_{ST\text{-}Reaction\ max} = (2 \times t_{ST\text{-}Cycle\ max}) + t_{Processing\ In}$	$= 8\ ms + t_{Processing\ In}$

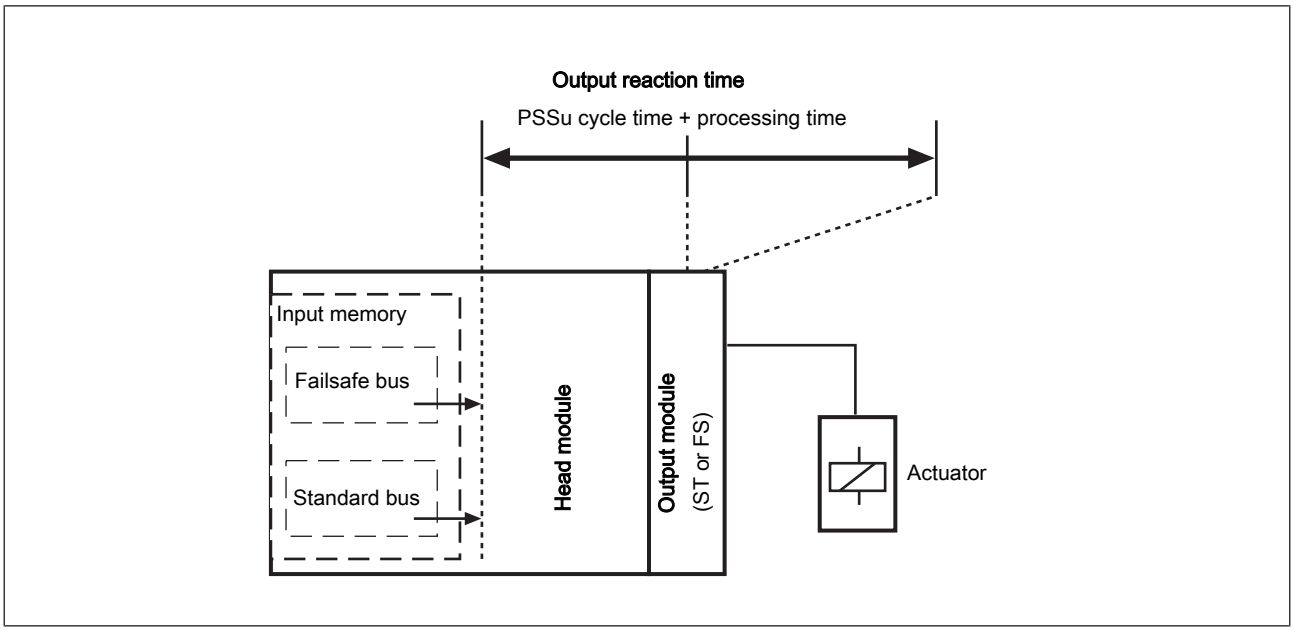


Output		Reaction time	
Failsafe	Typical	$t_{FS\text{-}Reaction\ typ} = t_{FS\text{-}Cycle} + t_{Processing\ Out}$	$= 4\ ms + t_{Processing\ Out}$
	Max-imum	$t_{FS\text{-}Reaction\ max} = (2 \times t_{FS\text{-}Cycle}) + t_{Processing\ Out}$	$= 8\ ms + t_{Processing\ Out}$
Failsafe with "&" ([1])	Typical	$t_{FS\text{-}Reaction\ typ} = t_{FS\text{-}Cycle} + 2\ ms$	$= 6\ ms$
	Max-imum	$t_{FS\text{-}Reaction\ max} = (2 \times t_{FS\text{-}Cycle}) + 2\ ms$	$= 10\ ms$

System description
Reaction times

Output		Reaction time	
Stand-ard	Typical	$t_{ST\text{-}Reaction\ typ} = t_{ST\text{-}Cycle\ typ} + t_{Processing\ Out}$	$= 1\ ms + t_{Processing\ Out}$
	Max-imum	$t_{ST\text{-}Reaction\ max} = (2 \times t_{ST\text{-}Scan\ max}) + t_{Processing\ Out}$	$= 8\ ms + t_{Processing\ Out}$

([1]) Special case: Digital FS outputs that are driven via the local enable principle. The processing time is a constant 2 ms when the FS output is enabled.



System description

System description

System description
Modular structure

A PSSu system is assembled from a variety of modules, to suit the functions required. The modular structure makes it easier to react to modifications and adjustments. With a PSSu system, not only is it possible to adapt the scope retrospectively (e.g. extend the number of I/Os, extend/modify the I/O technology, such as using relay outputs, adding I/O functions such as analogue evaluation, counter functions, temperature evaluation), it's also possible to convert a PSSu system with a lower performance rating (e.g. decentralised system PSSuniversal I/O) into a PSSu system with a higher performance rating (e.g. control system PSSuniversal PLC).
A PSSu system is configured in the PSSu Module Editor of the PAS4000.

A PSSu system consists of:

- A head module with integrated supply voltage
- Input/output modules for standard and failsafe applications
- Supply voltage modules (only if necessary)
- End bracket to secure the system at the start
- Terminating plate with integrated bus terminating resistors and end bracket to secure the system at the end

Head module

The head module co-ordinates a PSSu system's entire data traffic and determines its performance class. There are three different performance classes:

- Decentralised system PSSu I/O
  - PSSu system without control functionality
  - Consists of head module, electronic modules and/or compact modules
  - I/Os are controlled via SafetyNET p by means of a control system PSSu PLC/PSSu multi
- Control system PSSu multi
  - PSSu system with the functionality of a compact safety control system
  - Consists of head module, electronic modules and/or compact modules
  - FS resource available
  - One task only can be configured
  - Programmed via the PAS 4000 Multi Editor
- Control system PSSu PLC
  - PSSu system to control automation plants
  - Consists of head module, electronic modules and/or compact modules; however, the electronic modules/compact modules are not needed if the PSSu system is used exclusively to control decentralised I/Os with SafetyNET p
  - Control of I/Os from decentralised PSSu systems of all performance classes when networking with SafetyNET p
  - ST resource and FS resource available

- Max. of 9 tasks can be configured per resource
- Programmed via the PAS4000 Multi Editor or programmed in PAS4000 in accordance with IEC 61131

Input/output modules

Input/output modules are available in different designs:

- Electronic module and base module
- Compact module

The input/output modules are available for a wide range of input/output functions.

Supply voltage modules

The head module provides the supply voltage for the remaining modules. Additional power supplies may also be required (e.g. potential isolation, voltage refresh).

Supply voltage modules consist of an electronic module and base module.

Designs

Electronic modules and base modules:

The electronic modules determine the function of the supply voltage or input/output module.

- Electronic modules
  - Are plugged into the base modules
  - Communicate with the head module via the module bus

The base modules are the carrier units for the electronic modules.

- Base modules
  - Are used to connect the field wiring
  - Are available with the following connection types:
    Cage clamp terminals or screw terminals

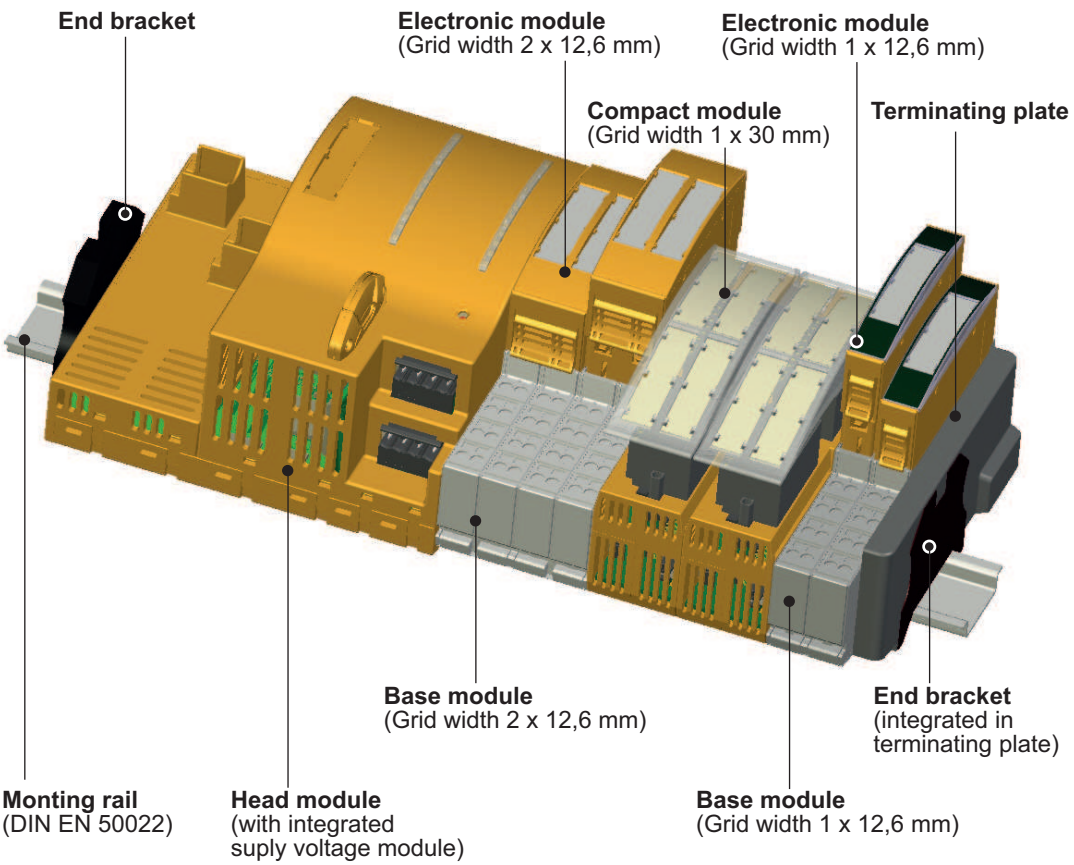
System description
Modular structure

Compact modules:

The compact modules combine the function unit (inputs and/or outputs) and connection levels in one housing. Wiring is via multi-pin connectors with spring-loaded terminals, which are plugged into the connector strips on the module.

Compact modules

- Do not need base modules
- Are used to connect the field wiring
- Communicate with the head module via the module bus



System description
Module descriptions

The module descriptions provide information on their function. The descriptions are made up of multi-stage combinations of letters and numbers. All module names begin with **PSSu**. This is followed by:

- **H** for head modules,
  e.g.: PSSu **H** PLC1 FS DP SN SD
- **E** for electronic modules, then:
  - **S** for standard module,
    e.g.: PSSu **E S** 4DI
  - **F** for failsafe module,
    e.g.: PSSu **E F** 4DI
- **K** for compact modules, then:
  - **S** for standard module,
    e.g.: PSSu **K S** 16DI
  - **F** for failsafe module,
    e.g.: PSSu **K F** 16DI
- **B** for base modules,
  e.g.: PSSu **B**P 1/8S

Base modules	Basic function	Size	Connection type	Additional function
PSSu B...	PSSu **BP**... – Base module for periphery (input/output) PSSu **BP-C**… – Base module for periphery with C-rail PSSu **BS**... – Base module for power supply PSSu **BS-R**... – Base module for refreshing the power supply	PSSu BP-C **1/8…** – 1 x grid width, 8 connections PSSu BP-C **1/12…** – 1 x grid width, 12 connections PSSu BP-C **2/16…** – 2 x grid width, 16 connections PSSu BP-C **2/8…** – 2 x grid width, 8 connections	PSSu BP-C 1/8**C** – Cage clamp terminals PSSu BP-C 1/8**S** – Screw terminals	PSSu BP 1/8S-**J** – Integrated cold junction compensation

Link modules have individual letter codes, depending on their application, e. g.:

- PSSu **X**B F-T, PSSu **X**R F-T
  (for cable-based subdivision)

Accessories for the PSSu system are identified by **PSSu A...** (A for "Accessory").

System description
Module descriptions

PSSu modules are available as different product types:

- Base type
  The basic versions of PSSu modules are called base type modules (e.g. PSSu E F DI OZ 2).
- T-type
  PSSu modules that are suitable for use where there are increased environmental requirements on temperature and humidity are called T-type modules. Their functionality is no different from that of the base type modules. They are identified by a "**-T**" at the end of the product name, e.g.: PSSu E F DI OZ 2**-T.**
- R-type
  PSSu modules that are specifically designed for railway applications and have railway approval are called R-type modules. They are identified by an "**-R**" in the product name (e.g. PSSu E F DI OZ 2-**R**).

In the following text, the designation "PSSu E F DI OZ 2**(-T)**", with "**-T**" in brackets, is used when the information specifically refers to both modules. In function descriptions and diagrams, "PSSu E F DI OZ 2" is used to represent both modules.

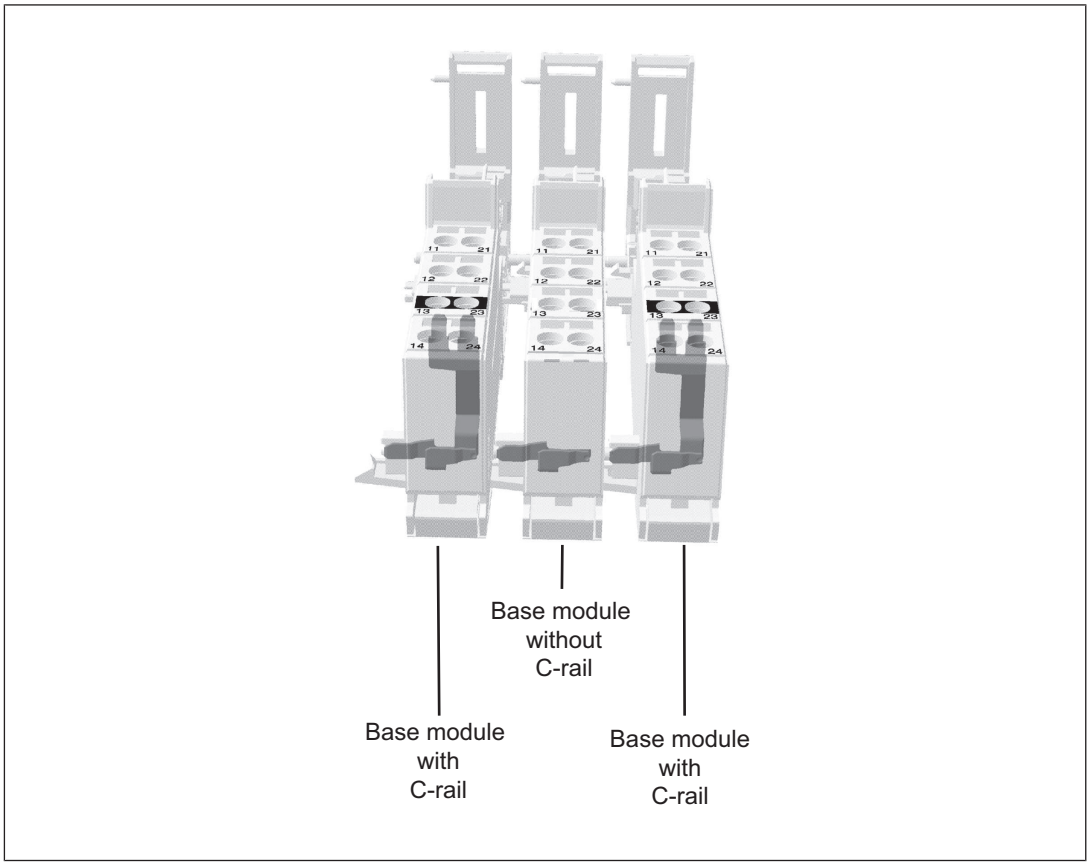
System description
Module bus

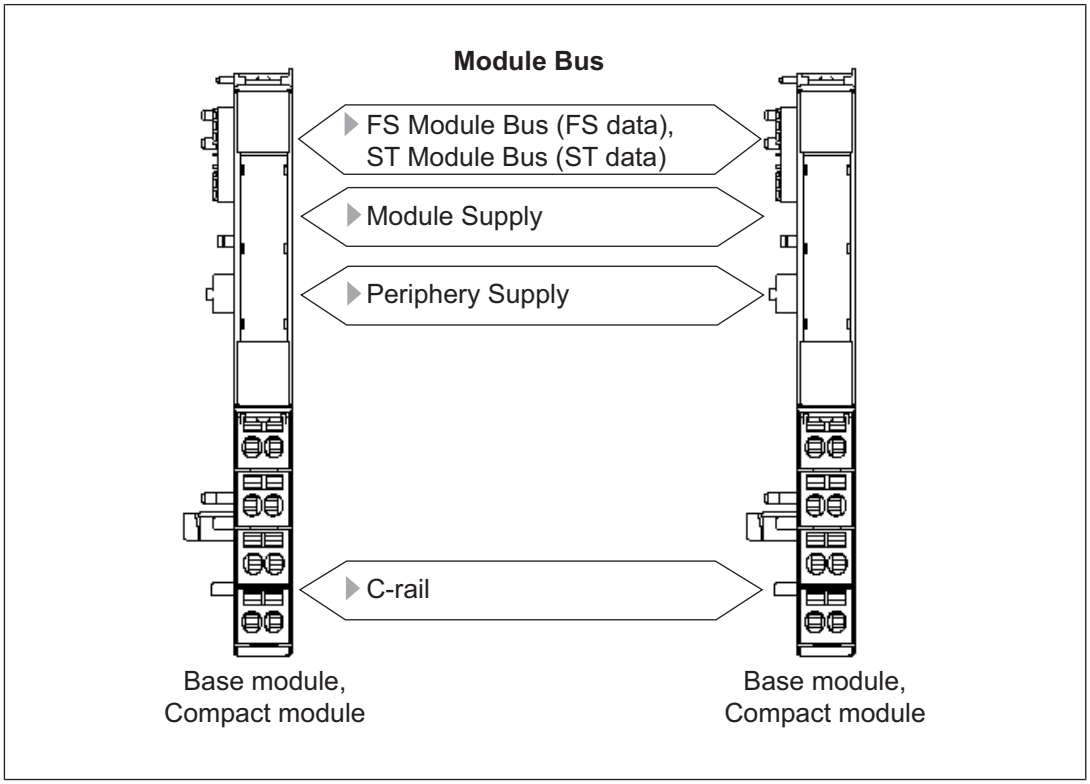
The module bus supplies the modules of a PSSu system with voltage and transfers data between the head module and the electronic/compact modules. The module bus is formed by arranging the base modules/compact modules together and connecting them via a mechanical latch.

The module bus is structured as follows:

- Data bus
  two separate bus systems for failsafe data (FS module bus) and standard data (ST module bus).
- Supply voltage for:
  - Module Supply
    The module supply is the internal supply voltage for the head module and electronic modules.
  - Periphery Supply
    The periphery supply supplies 24 VDC to the sensors and actuators on digital input/outputs on electronic modules. On compact modules, the supply for the inputs is generated from the periphery supply; the supply for the outputs must be fed to the module terminals. The connection on the module bus can be disconnected in order to form supply groups.
- C-rail ("cross connection")
  The C-rail is an additional, free power rail. Access to the C-rail is available via base modules that contain the letter "**-C**" in their description (e.g. PSSu BP**-C** 1/8 S, PSSu BP**-C** 1/8 C).
  The C-rail supply must belong to the same circuit as the other base module connections. Connecting PE to the C-rail provides a simple form of shield. On the compact modules, the C-rail is not looped through and is not available at the terminals.

System description
Module bus





System description
Maximum system expansion

The PSSu Module Editor on PAS4000 provides support in assembling a PSSu system. The tool checks the system limits as the data is entered.

The expansion of a PSSu system is limited by the following values

- Number of modules
- Number of FS modules
- Number of ST modules
- Number of failsafe inputs/outputs
- Number of standard inputs/outputs
- Current load of module bus

The system limits are listed and explained below.

Number of modules and number of inputs/outputs on a PSSu system

The following system limits apply:

Module type	Max. number per PSSu system
- - -	Total of 64 modules
ST modules	64 modules
FS modules	64 modules
PSSu E F DIOZ 2	64 modules
ST bit modules	256 ST input bits
	240 ST output bits
FS bit modules	256 FS input bits
	256 FS output bits
ST byte modules	16 modules
FS byte modules	16 modules
PSSu E S RS232	16 modules
PSSu E S RS485	16 modules
PSSu K S RS232	16 modules
PSSu K S RS232 Modbus ASCII	16 modules
PSSu K F FAU	2 modules

System description
Maximum system expansion

Module type	Max. number per PSSu system
PSSu K F EI	8 modules Please note: When used simultaneously with modules of type PSSu K F EI CV, a total of maximum 8 modules, comprising both module types, may be used. However, the upper limit of maximum 4 modules of type PSSu K F EI CV must be maintained. For example, the following combination is permitted: 6 modules of type PSSu K F EI and 2 modules of type PSSu K F EI CV.
PSSu K F EI CV	4 modules
PSSu K F FCU	12 modules

A PSSu system may have a max. 64 modules. When counting up the modules, please note the following peculiarities:

- The head module and passive junction modules (e.g. PSSu E PD, PSSu E PD1) are not counted.
- The following modules in a PSSu system are included in the count:
  - Supply voltage modules
    (identifier: PSSu E F PS...)
  - Standard modules
    (identifier: PSSu E S..., PSSu K S…)
  - Failsafe modules
    (identifier: PSSu E F..., PSSu K F…)

Maximum current load capacity of the supply voltage modules

System supply	Max. current load
Module supply when supplied via - PSSu E F PS(-T)	1.5 A
Module supply when supplied via - PSSu E F PS1(-T)	2 A
Module supply when supplied via - PSSu E F PS2(-T -R)	1.0 A
Periphery supply	10 A
C-rail	10 A

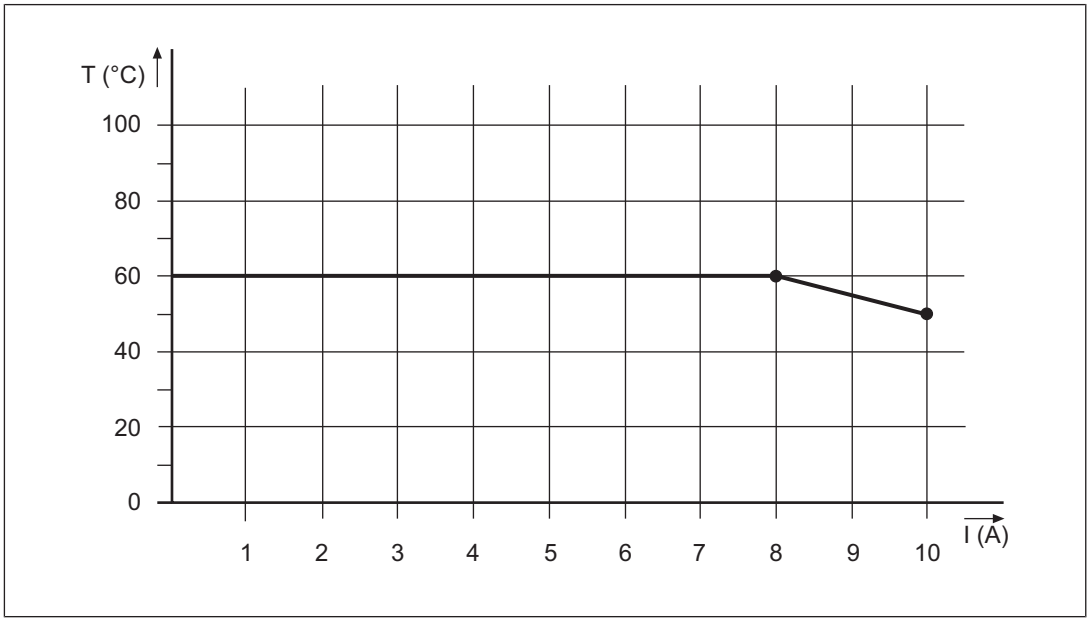
System description
Maximum system expansion

- Module supply
  The module supply's current load is the total current consumption resulting from the electronic modules and compact modules. If the total current consumption is higher than the supply module's current load capacity, the module supply must be refreshed with an additional supply module (see modules' technical details). The system software takes this into account.
- Periphery supply
  Maximum current load: 10 A
  The current load of the periphery supply is the sum of the current consumption of the sensors and actuators supplied via the input/output modules. If the current load is higher, the periphery supply must be refreshed with an additional supply module to prevent overload. Please refer to the derating diagram.
- C-rail
  Maximum current load: 10 A
  If the current load is higher, the C-rail must use a different supply to prevent overload. Please refer to the derating diagram.

Maximum current load capacity based on temperature

The maximum current load capacity of the module bus with regard to the periphery supply and C-rail can only be achieved if the max. permitted ambient temperature is adhered to.

Derating diagram for periphery supply and C-rail: Temperature T dependent on load current I



System description
Maximum system expansion

T-type: Derating diagram for periphery supply and C-rail: Temperature T dependent on load current I

System description
Diagnostics

Effective diagnostics are required in order to keep machine downtimes to a minimum. Diagnostics must provide all the information necessary to rectify faults quickly, prevent faults and analyse machine conditions.

The PSS 4000 distinguishes between system diagnostics and process diagnostics.

- System diagnostics

  Diagnostics on hardware and firmware, including errors in the hardware configuration or user program.

  The system diagnostics are provided by Pilz in full. Only a few adjustments can be made by the user, e.g. entering additional information for location information.

- Process diagnostics

  Diagnostics on procedures and conditions. The process diagnostics are created by the user within the user program. Pilz blocks are supplied with process diagnostics, which users can adapt to suit their own requirements.

Application area of a PSSu system

PSSu systems of all performance classes are designed for use in an industrial environment, as follows:

- Safety-related applications via the FS resource of a control system PSSu PLC/PSSu multi, including connection to SafetyNET p for decentralised tasks.
- Non-safety-related applications via the ST resource of a control system PSSu PLC, including connection to SafetyNET p and/or other standard bus systems for decentralised tasks.

PSSu systems of all performance classes are primarily suitable for use in machine safety circuits in which a safe condition is brought about by the removal of power.

Examples:

- Presses
- Transfer lines
- Tank storage facilities
- E-STOP functions
- Burner control systems
- Cable cars/traction operations
- Stage technology

Foreseeable misuse and abuse

- Without additional measures, the automation system PSS 4000 is not suitable for use in areas with increased environmental requirements (e.g. potentially explosive areas).
- The automation system PSS 4000 is not suitable for plants in which the removal of power does not lead to a safe condition.
- On passenger transportation systems, appropriate evacuation measures must be made or self-contained rescue equipment installed, should the plant come to a standstill due to a fault.
- Where locked zones have an electrical release, emergency release devices should be provided.
- Safety devices may not be overridden until appropriate measures of equal value are put in place (e.g. muting function). Measures of equal value may only be used if the preceding safety assessment permits it.
  Examples:
  - The safety gates may be open in setup mode provided there is a muting function, which is triggered by the operating mode selector switch.
  - A light curtain can be interrupted by transported materials provided there is a muting function with the corresponding components (e.g. muting sensors including control and muting monitoring of the muting sensors via a muting block in the user program, for example).

System description
Safety

Achieving a safety class

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

Safety automation system PSS 4000

PSSu systems are safety components in accordance with Annex V of the Machinery Directive 2006/42/EC. Depending on the application area and its respective regulations, PSSu systems of all performance classes can be used up to SIL 3 of EN 62061 and up to PL e (Cat. 4) of EN ISO 13849-1. The relevant technical details for a risk assessment can be found in the respective operating manual.

SafetyNET p is used for networked automation functions. This safe communication was developed in accordance with relevant standards, such as EN IEC 61508. Independent certification bodies such as BG have confirmed the security of the concept and the suitability of SafetyNET p in safety-related applications up to PL e (Cat. 4) of EN ISO 13849-1 or SIL 3 of EN/IEC 62061. The relevant technical details for the modules, as required for the risk assessment, can be found in the operating manual for the respective module.

Before using a PSSu system it is necessary to perform a safety assessment in accordance with the Machinery Directive. A PSSu system as an individual component is a safety-related system for the purposes of EN/IEC 61508. It guarantees functional safety against hardware and firmware errors, for example. However, it does not guarantee the safety of the overall process and design, nor of the project.

The user is responsible for the safety of the project. Pay special attention when programming and observe local standards and regulations.

A faulty user program can jeopardize the safety of the entire process!

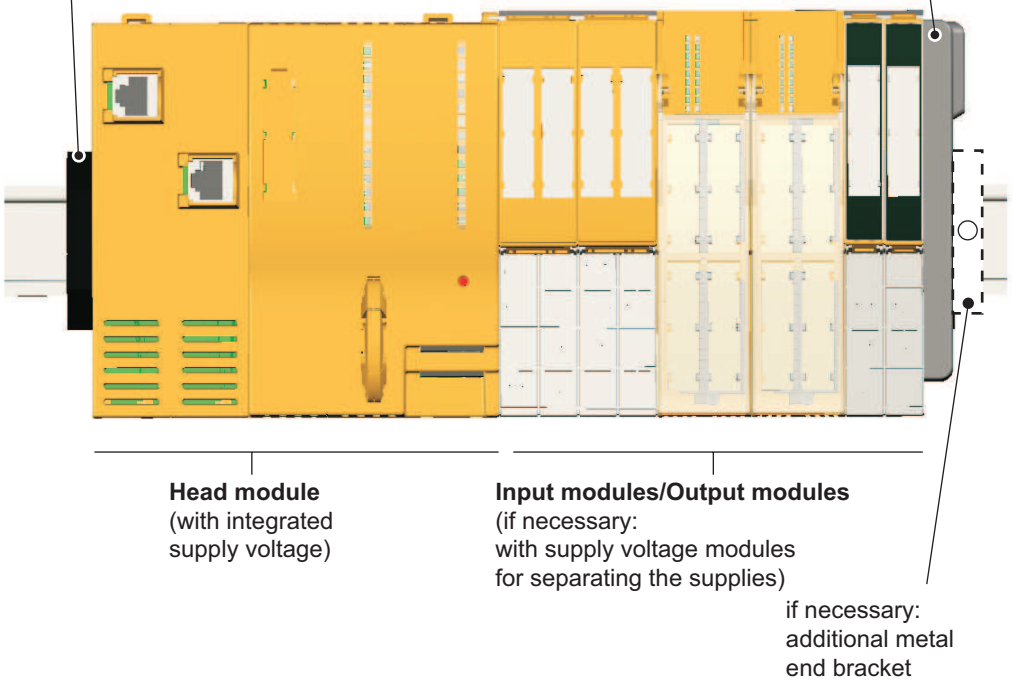
Define the safety requirements for the entire plant, for all phases of the service life and the entire safety lifecycle, and also define how these will be implemented from a technical and organisational standpoint.

System description
Module layout

- The first module on a PSSu system is always a head module. The supply voltage is integrated within the head module:
  - Module supply (to supply the head module and input/output modules)
  - Periphery supply (to supply the sensors and actuators)
- Input/output modules for FS and ST applications may follow on to the right:
  - The input/output modules may be installed in any order.
  - Input/output modules for FS applications and ST applications may be combined as required.
  - If modules of the same function are combined into groups it makes things clearer and simplifies the wiring.
  - Base modules with screw terminals cannot be mixed in one PSSu system with base modules with cage clamp terminals.
  - A base module with screw terminals may not be installed to the left of a compact module.
  - The maximum number of input/output modules is determined by the system limits.
  - Input/output modules for FS applications may not be used with head modules that are only designed for ST applications.
- Additional supply voltage modules may be required in order to refresh the module supply or periphery supply.
- Supply groups require an additional voltage supply module at the start of each group. The modules belonging to the supply group will then follow to the right.
- The final element in a PSSu system is always a terminating plate containing the terminating resistors for the module bus.
- The system is attached to the mounting rail using fastening elements at the start and end of the system. The following end brackets are available, depending on vibration and shock stress:
  - Plastic version (standard)
  - Metal version (where there is increased stress)

System description
Module layout

Layout of the fastening elements



Connections on the base modules

The connections on the base modules are divided into connection levels and connection columns. The connections have a two-digit number.

- The first digit denotes a base module's connection column (e.g.: connection **2**3 is in the second column).
- The second digit denotes a base module's connection level (e.g.: connection 2**3** is in the third level).

The function of the base module connections depends on the electronic module.

On input/output modules, the connection levels are typically arranged as follows:

- Connection level 1 and 4
  Input and output connections
- Connection levels 2 and 3
  Connections for the common supplies (periphery supply, analogue inputs/outputs or screening)

Many input/output modules may have two more connection levels:

- Connection level 5 and 6
  Connections for the common supplies (periphery supply, analogue inputs/outputs or screening)

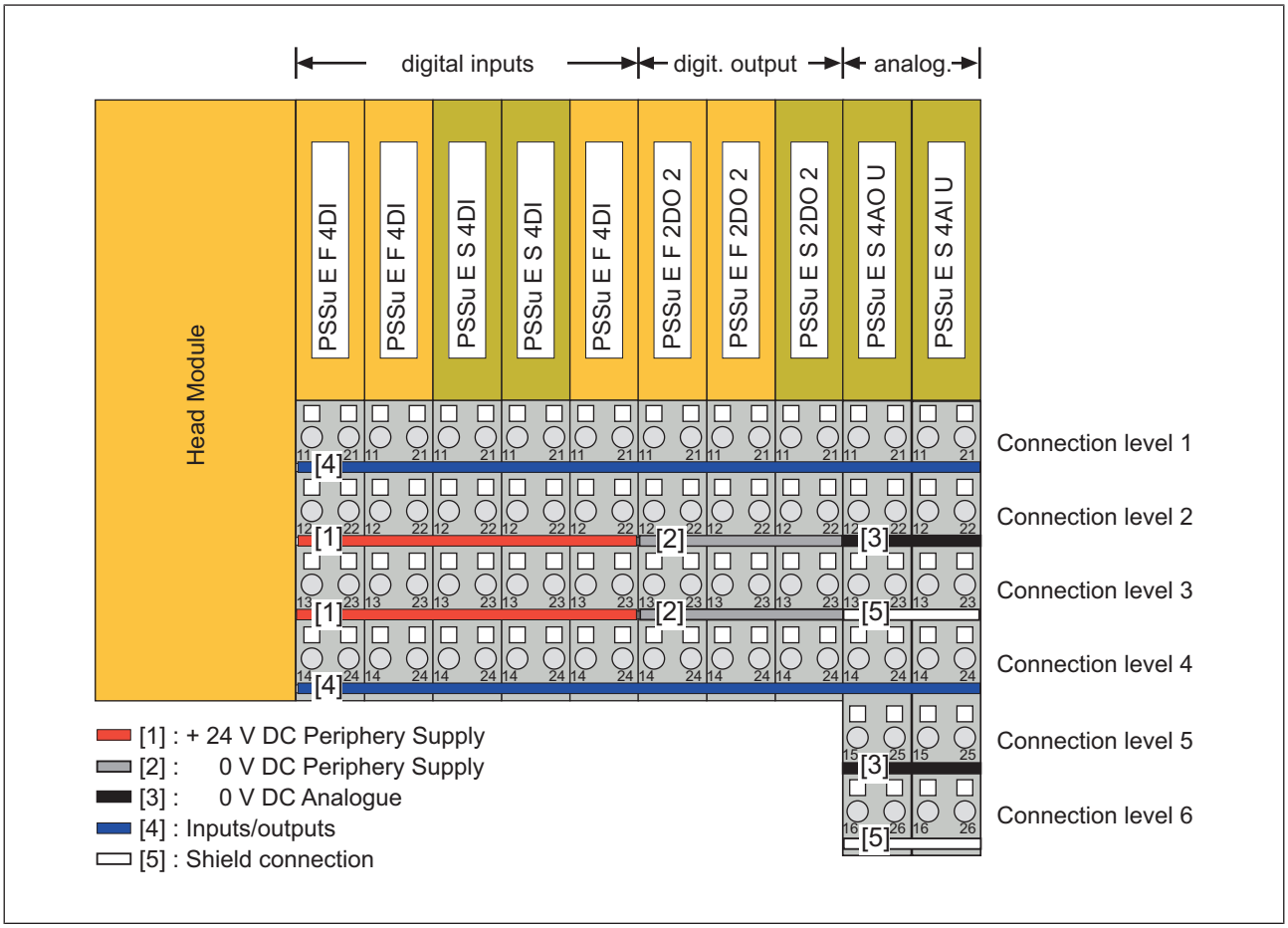
Input/output modules can be installed in any order. However, for the connection diagram to be consistent it makes sense to arrange input/output modules of the same type into groups and not have them interrupted by compact modules (see example).

System description
Connections

Colour marking on the connection levels

The colour marking on the connection levels is a wiring aid. Various colour markers are available for labelling. The colour markers can be used to label different supplies. This way the connection levels remain clearly visible, even after wiring.

Example:



System description
Connections

Connections on the compact modules

The connections on the compact modules are divided into terminal rows. Single or three-row connectors with spring-loaded terminals can be plugged into the device's single-row 10-pin connector strip.

The function of the connections depends on the compact module.

- Terminal row 1

  Connection of the inputs and outputs, periphery supply (24 V and 0 V).

- Terminal row 2

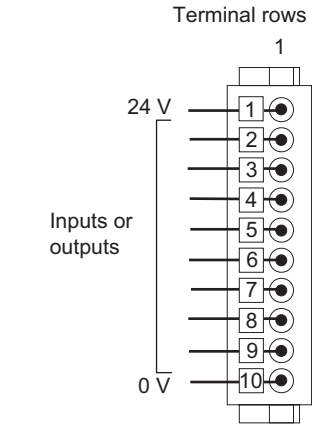
  All connections are linked; bridged to the 24 V periphery supply connection from the first connection level

- Terminal row 3

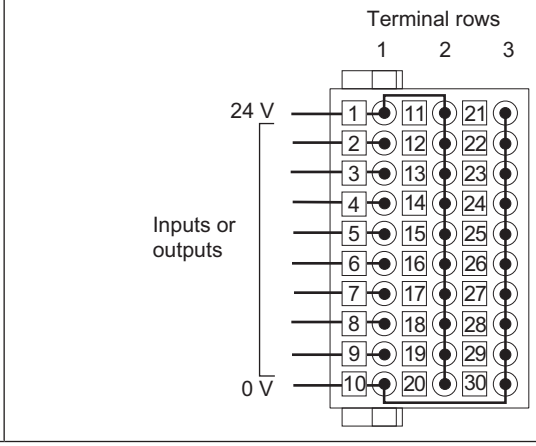
  All connections are linked; bridged to the 0 V periphery supply connection from the first connection level

Input/output modules can be installed in any order. However, for the connection diagram to be consistent it makes sense to arrange input/output modules of the same type into groups.

Single-row connector



Three-row connector



System description
Installing within the control cabinet

The PSSu system must be installed in a protected environment, e.g. in a control cabinet or a protected interior compartment. The interior compartment must provide protection against environmental influences such as dust and humidity, as well as mechanical damage and manipulation. Please refer to the relevant standards for details of the conditions that must be met for the application.

Use a zinc-plated DIN rail as the mounting rail. Dimensions:

- 35 x 7.5 mm or 35 x 15 mm

When installing, please note the following:

- Where vibration and shock stress place increased requirements on the system fastenings, we recommend that the mounting rail is screwed to the mounting plate approximately every 200 mm.
- We strongly recommend that you comply with the mounting distances stated in the chapter entitled Mounting distances. This will enable modules to be exchanged and guarantee sufficient heat dissipation.
- We recommend that it is installed horizontally on a vertical wall.
- If you wish to install the system vertically, optimum upward heat dissipation is no longer guaranteed. Please note the following restrictions:
  - Reduce the maximum ambient temperature by 10°C compared with the values stated in the technical data.
  - Install the head module downwards.
  - You should use additional metallic end brackets in order to comply with the higher requirements on the system fastenings due to vibration and shock stress.

The T-type PSSu modules are suitable for use where there are increased environmental requirements on temperature and humidity. Please refer to the technical details. With some T-type output modules, please also note the derating at higher temperatures.

System description
Installing within the control cabinet

Mounting distances

The values shown in the diagram for mounting distances are minimum specifications.

The ambient temperature of the PSSu system in the control cabinet must not exceed the figure stated in the technical details for the modules, Air conditioning may otherwise be required.

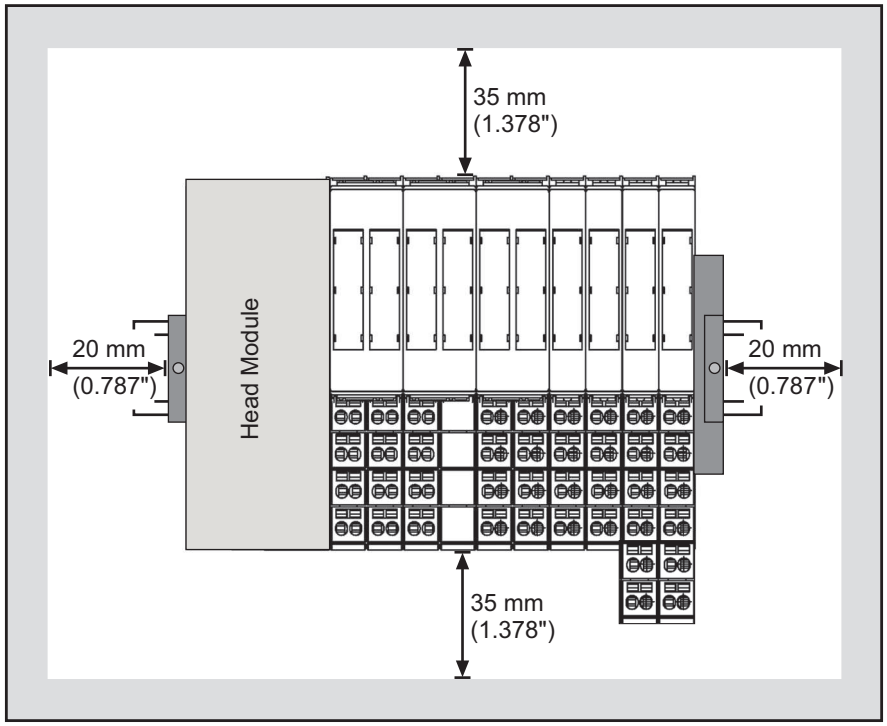


Fig.: Mounting distances when installed horizontally

System description
Installing within the control cabinet

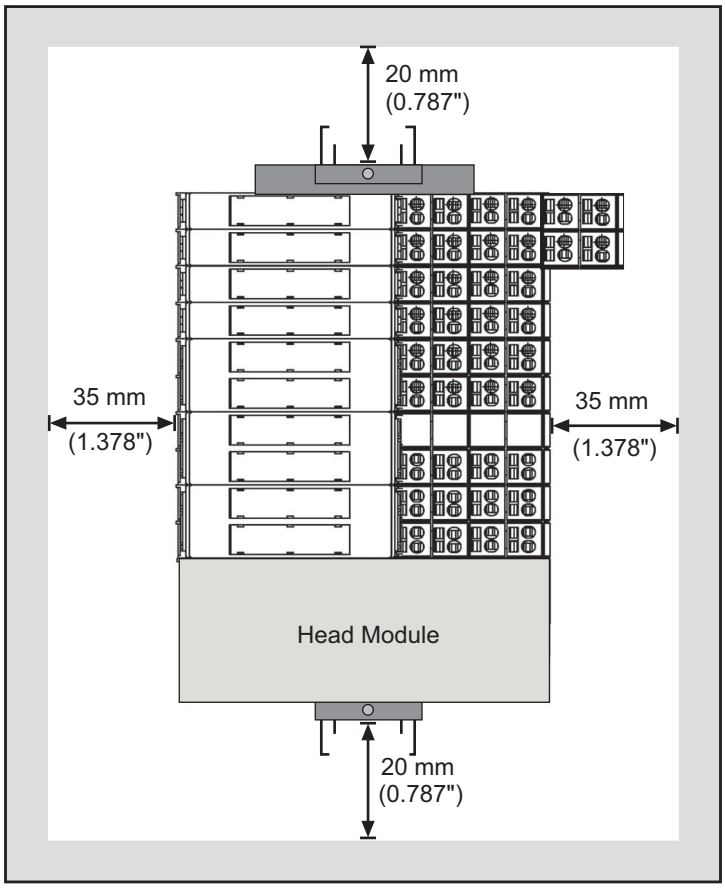
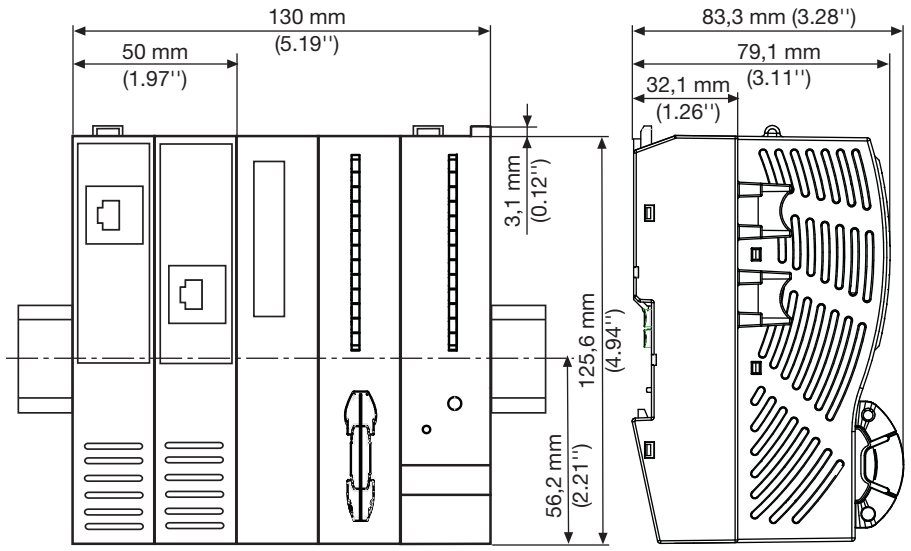


Fig.: Mounting distances when installed vertically

System description
Installing within the control cabinet

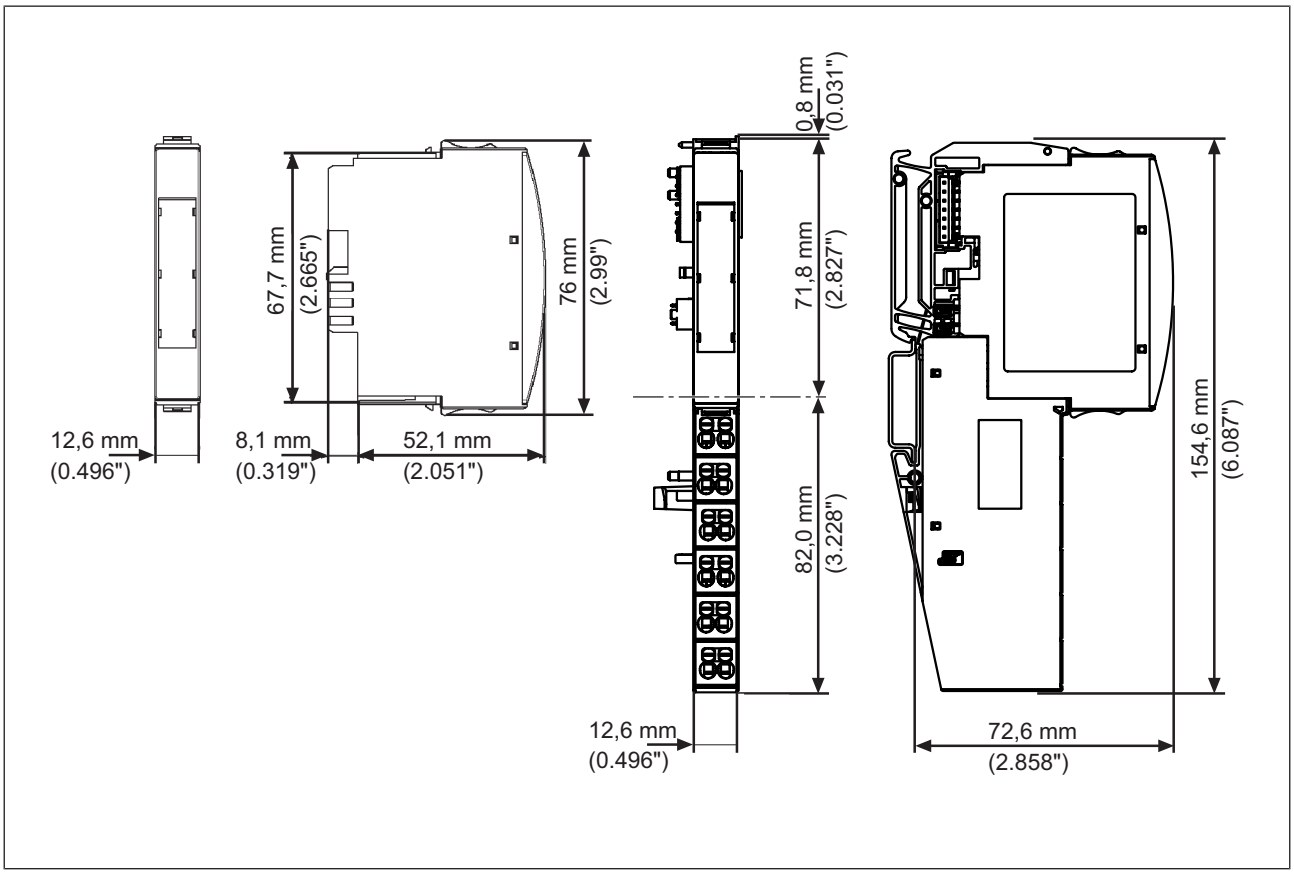
Dimensions of the head modules



System description
Installing within the control cabinet

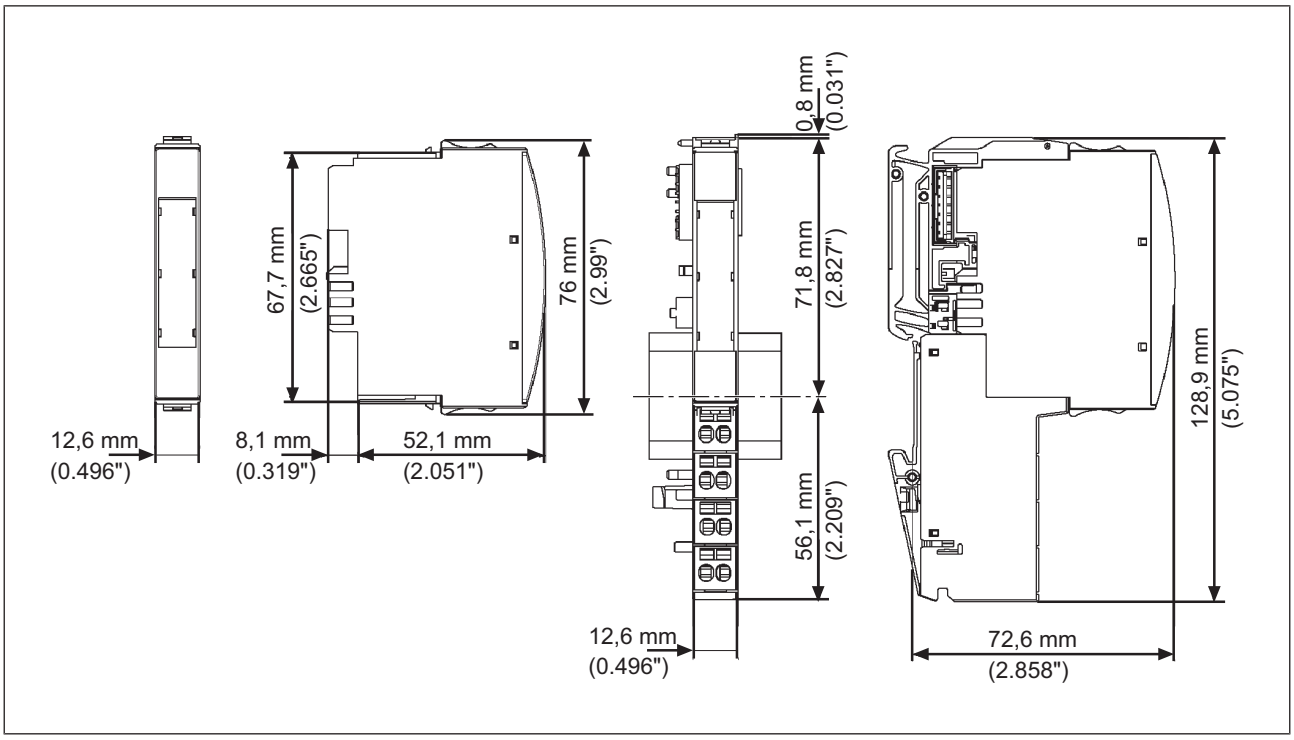
Dimensions of the electronic modules

Base modules with six connection levels:

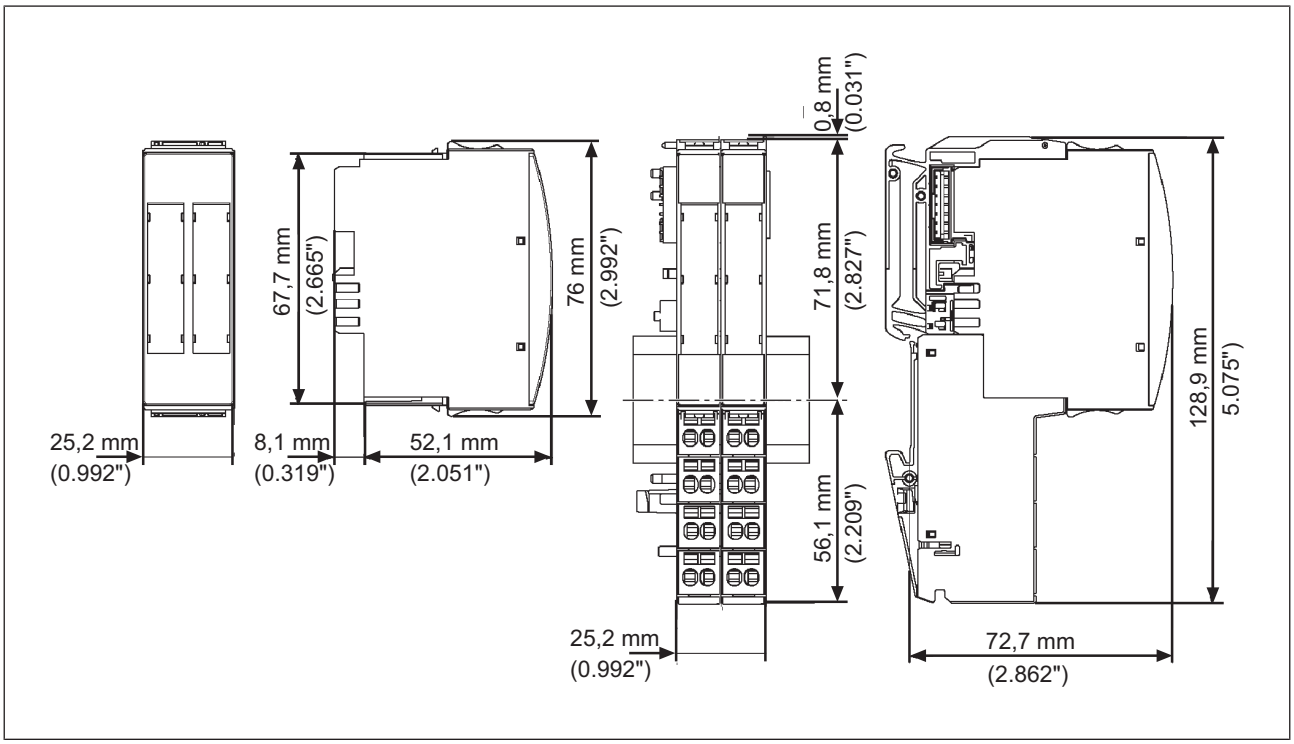


System description
Installing within the control cabinet

Single-width base modules with four connection levels:



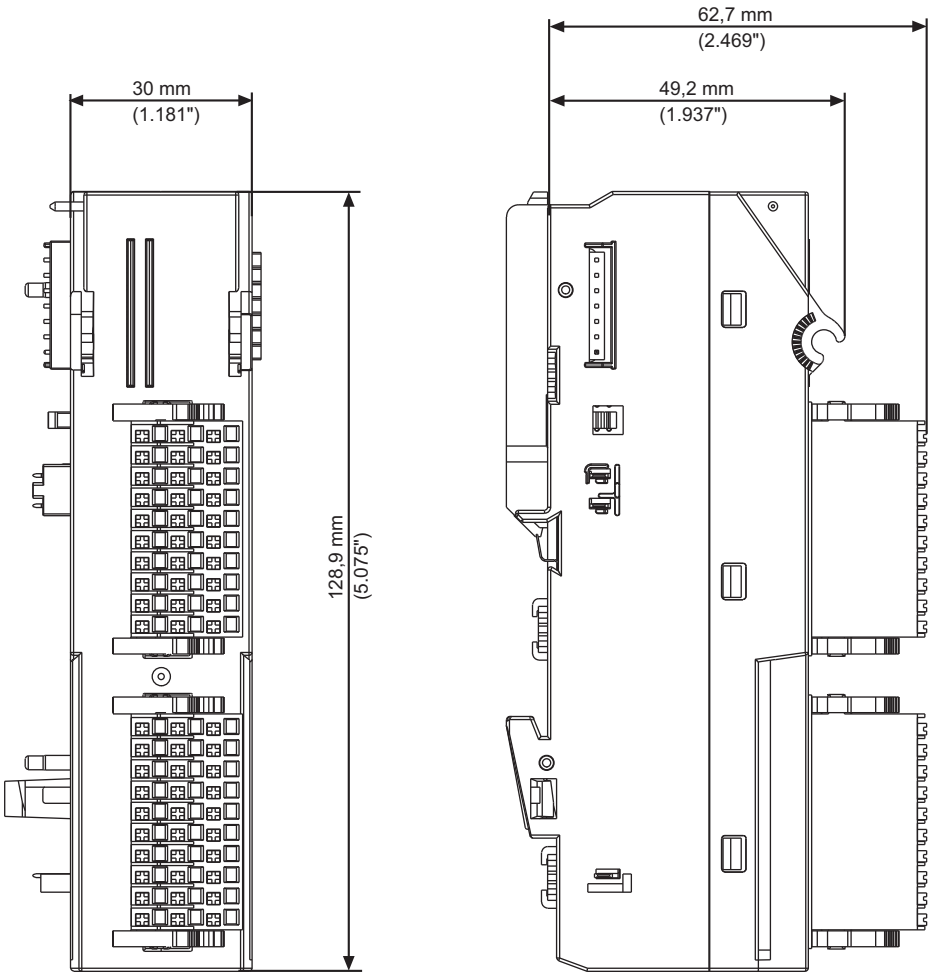
Double-width base modules with four connection levels:



System description
Installing within the control cabinet

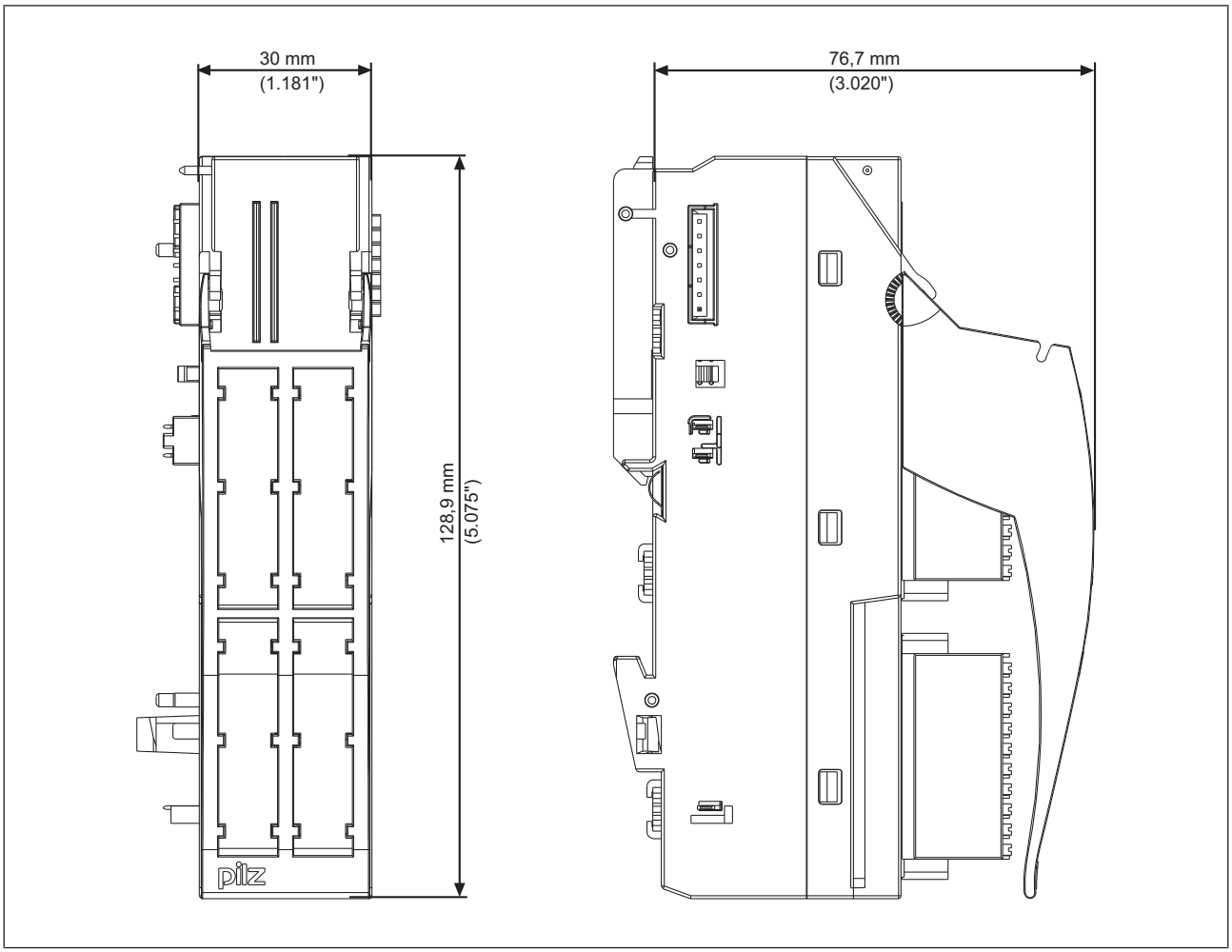
Dimensions of compact modules

Module with connector:



System description
Installing within the control cabinet

Module with connector and labelling bracket:



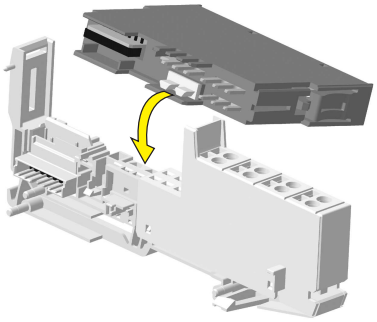
System description
Mechanical coding

Electronic modules are supplied with a two-part coding element.

When an electronic module is plugged into a base module for the first time, one part of the coding element remains on the electronic module, while its counterpart is fixed on to the base module. This is how the base module is coded.

The coding element is designed to help prevent plugging errors (e.g. when exchanging an electronic module). Once a base module has been coded, it will only take electronic modules with the same mechanical coding.

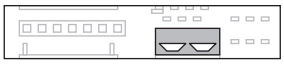
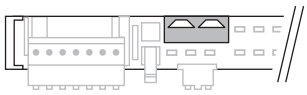
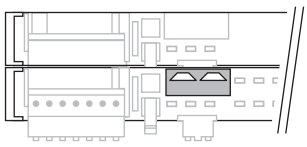
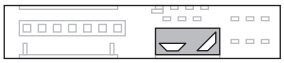
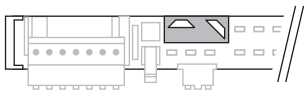
The coding is identified by a letter and a colour. Codings with the same letters are mechanically identical and are distinguished through a different colour.



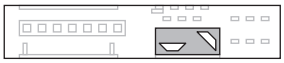
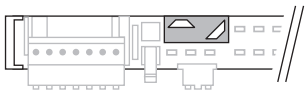
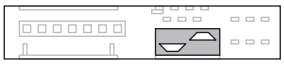
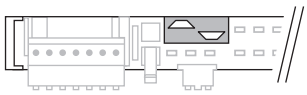
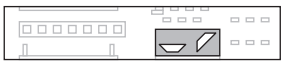
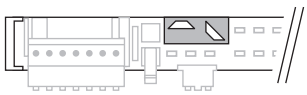
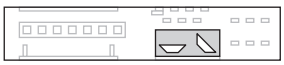
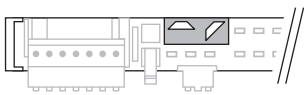
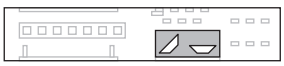
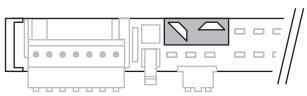
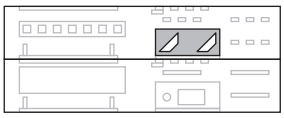
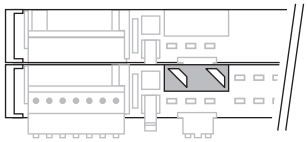
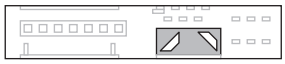
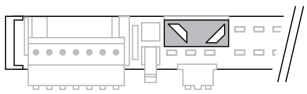
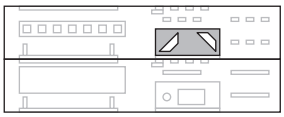
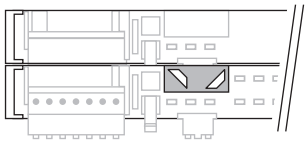
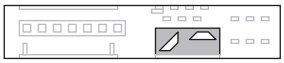
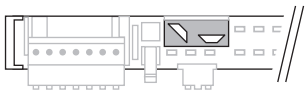
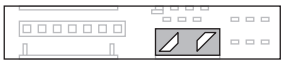
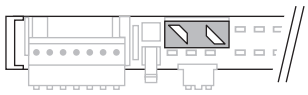
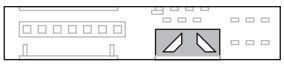
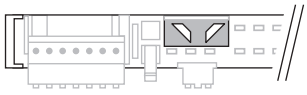
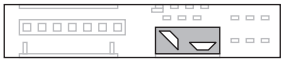
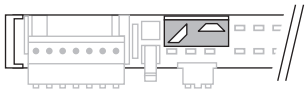
Overview of the mechanical coding elements

The types of coding elements are listed in the table below.

Please note:
Details of the mechanical coding of the electronic modules (type and colour) can be found in the technical details in the data sheet and operating manual.

Type	Coding element Electronic module	Coding element on counterpart Base module
A		
		
B		

System description
Mechanical coding

Type	Coding element Electronic module	Coding element on counterpart Base module
C		
D		
E		
F		
G		
H		
I		
		
J		
K		
L		
M		

System description
Supply voltage and insulation

All voltages are supplied via the head module. If more voltages are needed (voltage refresh, potential isolation etc.), these will be supplied via additional supply voltage modules. The voltages are distributed to the modules via the module bus.

- Module supply

  The module supply is the internal supply voltage for the head module, the compact modules and the electronic modules.

- Periphery supply

  The periphery supply supplies 24 VDC to the sensors and actuators on digital input/outputs on electronic modules. On compact modules, the supply for the inputs is generated from the periphery supply; the supply for the outputs must be fed to the module terminals.

  The connection on the module bus can be disconnected in order to form supply groups. On digital failsafe modules, the periphery supply is used to provide test pulses. Failsafe input/output modules will not start until the periphery supply is connected correctly. On analogue input/output modules, the periphery supply is galvanically isolated from the inputs/outputs.

- C-rail

  The C-rail is an additional, free power rail. Access to the C-rail is available via base modules that contain the letter "**-C**" in their description (e.g. PSSu BP-**C** 1/8 S, PSSu BP-**C** 1/8 C).
  The C-rail supply must belong to the same circuit as the other base module connections. Connecting PE to the C-rail provides a simple form of shield. On the compact modules, the C-rail is not looped through and is not available at the terminals. Permitted infeed at the C-rail:

  – PE
  – 0 V
  – Screen
  – - 30 VDC ... + 30 VDC
  – - 48 VAC ... + 48 VAC

- Inputs/outputs on the analogue modules and counter modules

  The inputs and outputs on the analogue modules and counter modules are galvanically isolated from the periphery supply. On the base modules, the supply for the outputs is generated from the periphery supply.

- Earth (Ground)

  The module supply and periphery supply have separate connections for the respective earth potential (Ground).

- Functional earth

  A contact spring on the base modules and compact modules connects the modules' functional earth to the mounting rail.

System description
Supply voltage and insulation

The supply voltages for module supply and periphery supply must be extra low voltages with protective electrical separation (PELV or SELV) in accordance with VDE 0100, Part 410. Further requirements of the power supplies can be found in the data sheets for the supply voltage modules or head modules.

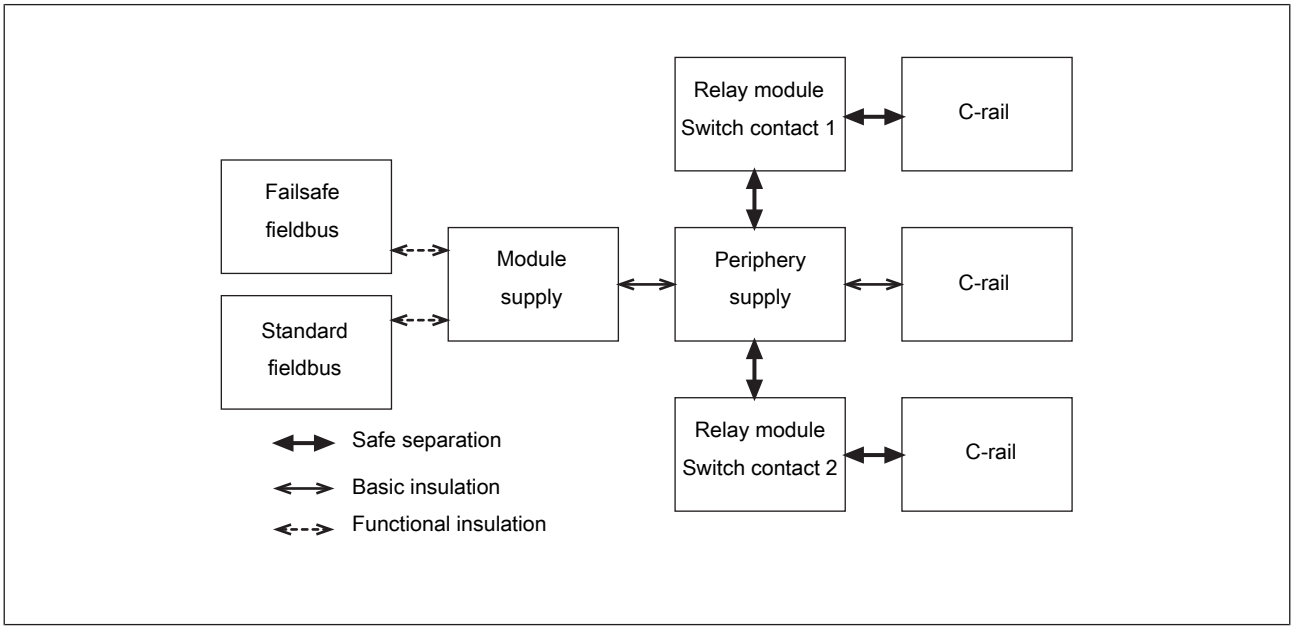
When the voltages are fed separately using two power supplies, the module supply and periphery supply are galvanically isolated. If galvanic isolation is not required, a common power supply may be used for the periphery supply and module supply.

Separate power supplies for module supply and periphery supply increase availability: In the case of a short circuit in the periphery supply, the module supply is maintained and the head module can continue to exchange data with fieldbus systems, e.g. for diagnostic purposes.

If voltages higher than 50 VAC or 120 VDC are connected to the PSSu system, e.g. to switch contacts on relay modules, please note the following:

- Specific accident prevention regulations apply.
- For safety reasons, only the protective earth (PE) may be connected to the C-rail of the supply group.

Insulation of supplies in a PSSu installation:



System description
Earthing and connection

Earthing of the system

When modules are attached to the mounting rail, a contact spring makes the electrical contact between the modules' functional earth and the mounting rail.

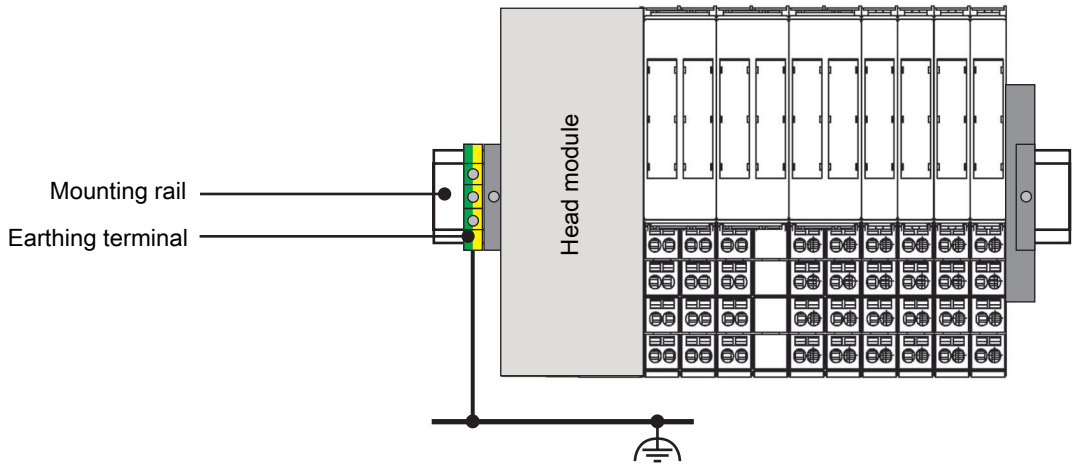
- Always connect the mounting rail to the protective earth via an earthing terminal. This will be used to dissipate hazardous voltages in the case of a fault.

The earthing terminal is available as an accessory. The mounting rail must be properly earthed to ensure interference-free operation in accordance with EMC regulations.

The supplies on the PSSuniversal module bus (module supply, periphery supply, C-rail) are not connected to the functional earth through the contact spring.

On analogue modules and counter modules with base modules without a C-rail, the contact spring also connects the shielding connections to the mounting rail.

Earthing the mounting rail:



Cable requirements with base modules

Please note:

- The minimum cable cross section for field connection terminals on the base modules is 0.14 mm² (AWG26).
- The maximum cable cross section for field connection terminals is:
  - Digital inputs: 1.5 mm² (AWG16)
  - Digital outputs: 2.0 mm² (AWG14)
  - Inputs/outputs on the counter modules: 1.5 mm² (AWG16)
  - Analogue inputs/outputs: 1.5 mm² (AWG16)
  - Communication cables: 1.5 mm² (AWG16)

  - Test pulse outputs: 1.5 mm^2 (AWG16)
  - Power supply: 2.5 mm^2 (AWG12)
  - Functional earth: 2.5 mm^2 (AWG12)
- On base modules with screw terminals:
  - If you use a multi-strand cable to connect the I/Os, it is recommended that you use ferrules conforming to Parts 1 and 2 of DIN 46228, 0.14 ... 1.5 mm^2, Form A or C, although this is not essential. To crimp the ferrules you can use crimp pliers (crimp form A or C) conforming to EN 60947-1, such as the PZ 1.5 or PZ 6.5 from Weidmüller, for example.
  - Maximum torque setting: 0.8 Nm
- Use copper wiring.

Cable requirements with compact modules

Please note:

- The cable cross section with spring-loaded terminals without ferrules is 0.20 – 1 mm^2, 22 -16 AWG.
- If you are using multi-core or fine-core cables we recommend ferrules in accordance with DIN 46228/Part 1 or DIN 46228/Part 4, 0.2 ... 1 mm^2. To crimp the ferrules we recommend crimping pliers (crimp form A) conforming to EN 60947-1, such as the PZ 6/5 from Weidmüller, for example.
- Terminal points per connection: 1
- Stripping length: 8 mm

System description
Electromagnetic compatibility (EMC)

EMC-compatible application

The PSSu system is designed for use in an industrial environment. It is not suitable for use in a domestic environment, as this can lead to interference.

Connecting the earth cables

Please note:

- A cable cross section of at least 2.5 mm^2 should be used for the connection to the central earth bar. Connections should be kept as short as possible.
- Connections to the earth bar should always be in star form.
- Connect together the 0V connections on all the 24 V power supplies and earth the 0 V mains at a single point, or ensure that measures are in place to monitor for earth faults.
  - Earthed supply voltages offer the best noise immunity.
- The connection of the 0 V supply to the central earth bar or earth fault monitor must be in accordance with relevant national regulations (such as EN 60204-1, NFPA 79:17-7, NEC: Article 250, for example).
- 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.

Equipotential bonding

Potential differences may occur if the system and its periphery devices are connected to different earth connections. Equalising currents can flow through cable shields that are connected at either end and have different earth connections. These equalising currents can cause interference or destroy the cable shield. In order to avoid interference, equipotential bonding cables must be installed. Please note:

- Select a low impedance equipotential bonding cable.
- Select the following as standard values for the cross section of the equipotential bonding cables:
  - 16 mm^2 for equipotential bonding cable up to 200 m in length
  - 25 mm^2 for equipotential bonding cable over 200 m in length
- If the system and periphery devices are connected with shielded signal cables which are earthed at either end, the impedance is calculated as follows:
  - Impedance equipotential bonding cable = 10 % of shield impedance
- Use copper or galvanised steel equipotential bonding cable.
- Connect equipotential bonding cables to the earth bar 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.

System description
Electromagnetic compatibility (EMC)

Suppression of inductive loads

Suppression should not be used to protect the digital semiconductor outputs.

Control cabinet lighting

Use low interference panel lighting for inside the control cabinet.

Shielded cables

Digital inputs and outputs on the PSSu system do not need shielded cables. However, if the connection cables have a shield, it should be connected at one end.

Analogue inputs and outputs plus the inputs and outputs on the counter modules should always be connected using shielded cables.

- On base modules with C-rail:
  - Connect the shield to the terminals on the C-rail.
  - Connect the C-rail with low impedance to the functional earth.
- On analogue modules and base modules without C-rail:
  - Connect the shield as shown in the terminal configuration section of the configuration data sheets.
  - The module connects the shield to the functional earth via the mounting rail.

Fieldbuses

Please note:

- SafetyNET p

  See System Description PSS 4000

ESD

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

System description
Supply groups

When used with the relevant base module, any electronic supply voltage module is suitable to separate supplies and form supply groups.

To separate supplies, the supply (periphery supply and C-rail supply) to the preceding (left-hand) modules is disconnected and a new supply provided for subsequent (right-hand) modules.

With a new supply group it is also possible to refresh the module supply by providing a new supply voltage. The 0 V supply on the module supply is never interrupted, but is always looped through across the whole module bus.

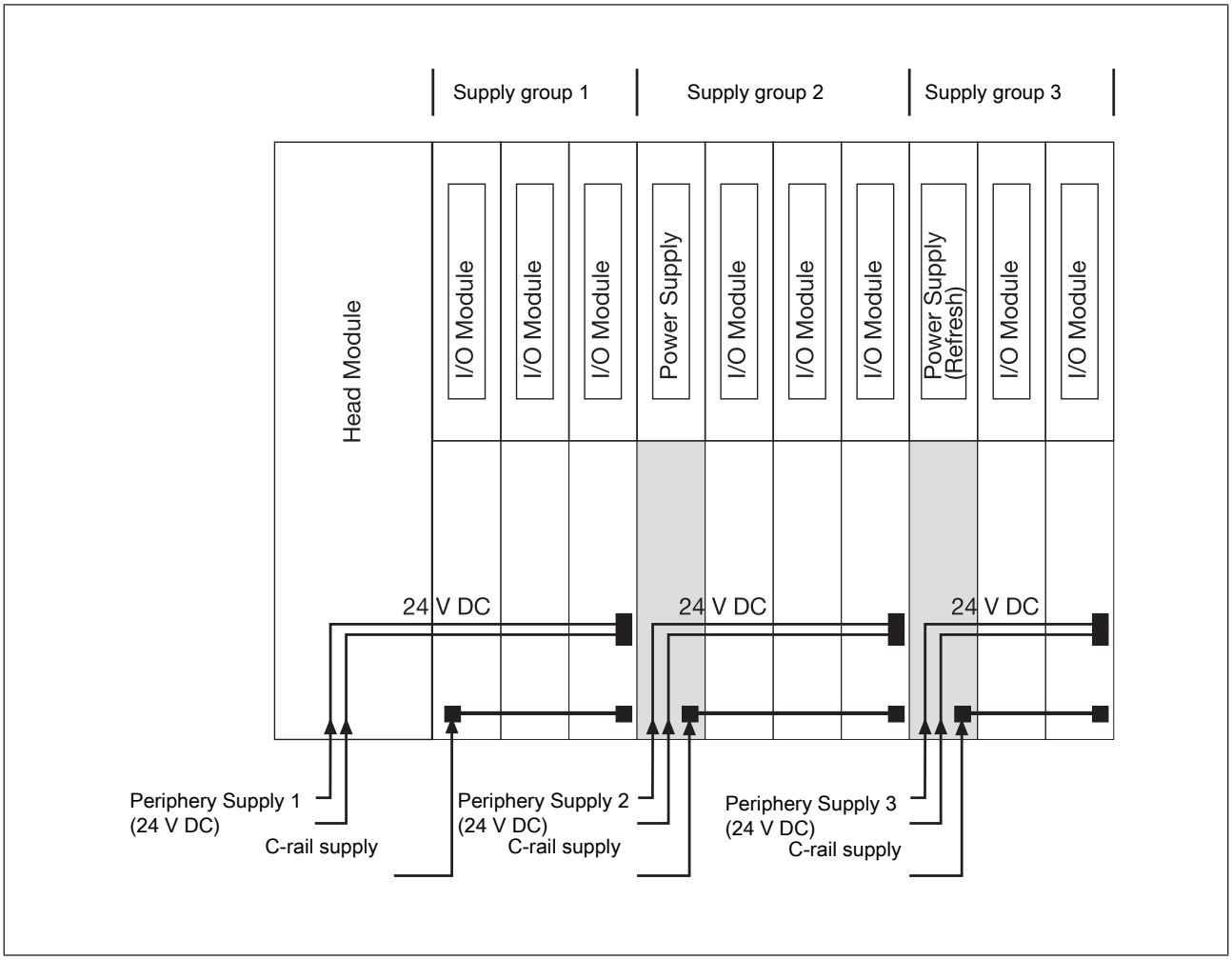
You should always refer to the description of the relevant electronic supply voltage module.

The following modules are suitable for separating supplies, for example:

Electronic module	Base module	Module supply	Periphery supply and C-rail
PSSu E F PS	PSSu BS-R 1/8 S PSSu BS-R 1/8 C	Refreshing (new supply voltage is provided, 0 V supply is not interrupted).	Supply of the left-hand modules is interrupted and a new supply is provided for the right-hand modules.
PSSu E F PS1	PSSu BS-R 2/8 S PSSu BS-R 2/8 C		
PSSu E F PS2	PSSu BS-R 2/8 S PSSu BS-R 2/8 C		
PSSu E F PS-P	PSSu BS 1/8 S PSSu BS 1/8 C	No refreshing (5 V is not separated).	

The 0 V terminal from X1 (module supply) of the PSS 4000 head module represents the reference potential for the module bus. If PSSu E F PS or PSSu E F PS1 are used without separating supplies as an expansion power supply, there is the risk of compensating currents between the 0 V terminal on the head module and the 0 V terminal on the PSSu E F PS or PSSu E F PS1 module. This can cause interferences during the transfer of module bus data.
To avoid compensating currents via the module bus, all the 0 V terminals of the module supply should be connected by a short route.
When using the electrically isolated PSSu E F PS2 power supply, compensating currents are avoided.

System description
Supply groups



System description
System software

Design, configuration, programming, commissioning and diagnostics take place centrally via PAS4000 (Pilz Automation Suite 4000).

PAS4000 is a collection of various tools which can be used to create and edit a project, e.g.:

- PSSu Module Editor

  The required PSSu systems are assembled and configured in the PSSu Module Editor.
- I/O Mapping Editor

  The connection between the user program and hardware is established in the I/O Mapping Editor.
- IL Editor

  In the IL Editor, the user program is programmed in the instruction list (IL) programming language.

System description
SafetyNET p

SafetyNET p is used for networked automation functions. SafetyNET p is an Ethernet-based multi-master bus system suitable for industrial use.

The SafetyNET p protocol contains a safe data channel for safety-related data. This channel is certified for data transfer in accordance with SIL 3 of IEC 61508. On SafetyNET p, safety and non-safety-related data is transferred via different data channels, but using the same connection cable.

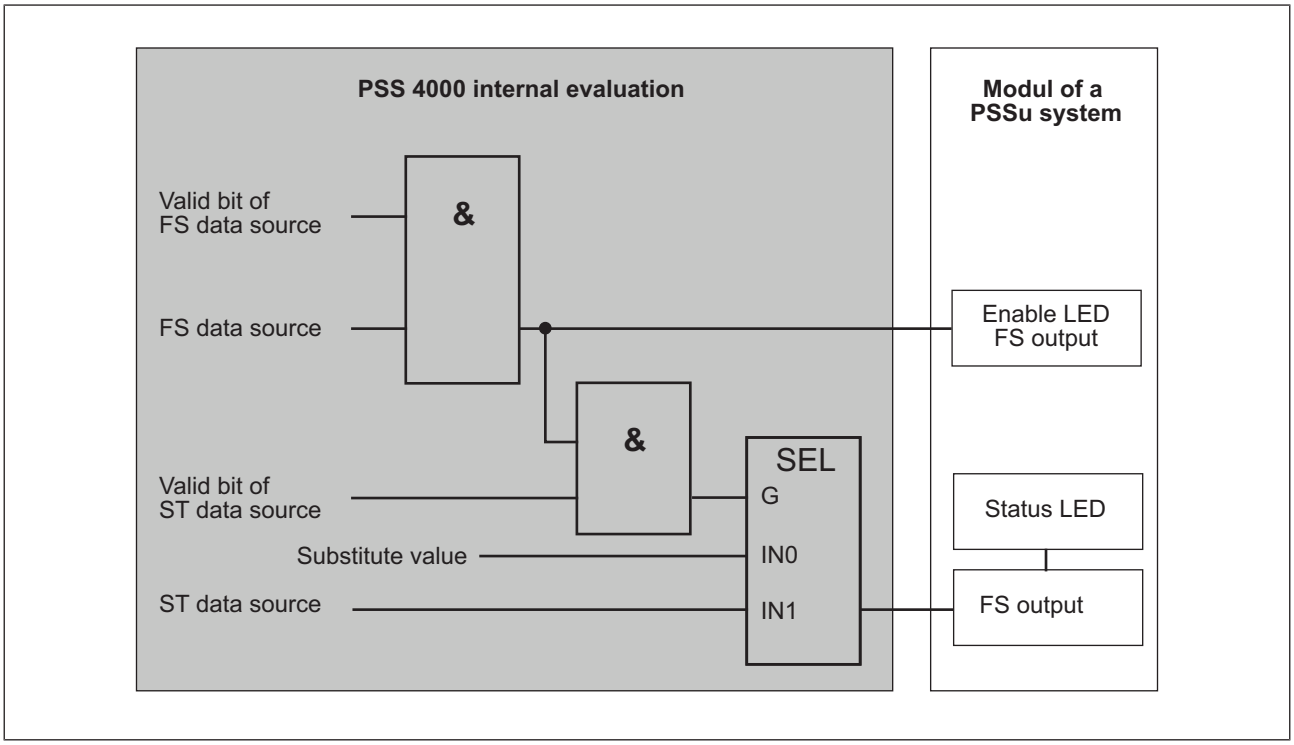
In terms of the topology, SafetyNET p supports various familiar Ethernet architectures. So modular system architectures and individual subnetworks can be implemented. If necessary, this method can be used to divide automation functions into decentralised and largely independent function units. The main benefits of this type of architecture lie in the reusability, modification and availability of function units.

System description
Enable principle

In safety technology, the FS section is usually separated from the ST section without feedback.

With the enable principle, an ST data source can control an FS hardware output, provided there is an enable from an FS data source. In the event of an error, the FS data source must ensure that the FS hardware output controlled by the ST data source can no longer be set.

Enable principle:



System description
Reaction times

Detailed information on the reaction times is available in the "System description PSS 4000".

Contents	Page

Selection guide
Automation system PSS 4000 - Head modules (system environment B)

Device type	Order No. Base type	Order No. T-type	Order No. R-type	Scope of failsafe functions	Automation functions	Communication interfaces	Features
PSSu H DP	312 045	314 045			♦	▸ PROFIBUS-DP (Slave)	▸ PSSuniversal module bus for connection of up to 64 I/O modules for safety-related and non-safety-related functions
PSSu H DN	312 046	314 046			♦	▸ DeviceNet (Slave)	
PSSu H CAN	312 047	314 047			♦	▸ CANopen (Slave)	
PSSu H F PN	312 043			♦	♦	▸ Optical PROFINET interface with PROFIsafe profile	
PSSu H F PN o	312 042			♦	♦	▸ Optical PROFINET interface with PROFIsafe profile	
PSSu H S PN	312 041				♦	▸ Optical PROFINET interface	

Device type	Order No. Base type	Order No. T-type	Order No. R-type	Scope of failsafe functions	Automation functions	Communication interfaces	Features
PSSuniversal I/O							
PSSu H FS SN SD	312 085*	314 085*	315 085	♦	♦	▸ SafetyNET p	▸ Communication with other SafetyNET p devices (RTFN) ▸ Standard module bus for standard I/O modules
Control system PSSu PLC							
PSSu H PLC1 FS SN SD	312 070*	314 070*	315 070	♦	♦	▸ SafetyNET p	▸ Configuration with the graphics Program Editor PAS-multi ▸ Programming in PAS IL (Instruction List), PAS LD (Ladder Diagram) and PAS STL (Structured Text) in accordance with EN/IEC 61131-3 ▸ Programming via Ethernet TCP/IP ▸ Max. number of failsafe tasks: 9 ▸ Max. number of standard tasks: 9
PSSu H PLC1 FS DP SN SD	312 071			♦	♦	▸ SafetyNET p ▸ PROFIBUS-DP (Slave)	
Control system PSSu multi							
PSSu H m F DP ETH SD	312 060			♦	♦	▸ Ethernet ▸ PROFIBUS-DP (Slave)	▸ Local safety functions ▸ Configuration with the graphics Program Editor PAS-multi ▸ Max. number of failsafe tasks: 1 ▸ Devices with SafetyNET p interface: Max. number of SafetyNET p connections: 5
PSSu H m F DP SN SD	312 065			♦	♦	▸ SafetyNET p ▸ PROFIBUS-DP (Slave)	
PSSu H m F DPsafe SN SD	312 066			♦	♦	▸ SafetyNET p ▸ PROFIBUS-DP interface with PROFIsafe	

*The module may be used as a safety component in accordance with the Lifts Directive 95/16/EC and in accordance with the requirements of EN 81-1, EN 81-2 and EN 115-1.

Selection guide
Electronic modules

Device type	Order No. Base type	Order No. T-type	Order No. R-type	Function	Application in system environment A	Application in system environment B
Voltage supply						
PSSu E F PS	312 190	314 190		Power supply	♦	♦
PSSu E F PS1	312 191	314 191		Power supply, buffered	♦	♦
PSSu E F PS2	312 192*	314 192*	315 192	Power supply, buffered. For increased EMC requirements (see Supply groups)		♦
PSSu E F PS-P	312 185	314 185	315 185	Power supply, periphery	♦	♦
PSSu E F BSW	312 230	314 230		Block switching function	♦	
Voltage distribution						
PSSu E PD	312 195	314 195		Voltage distribution	♦	♦
PSSu E S PD-D	312 197			Voltage distribution	♦	♦
PSSu E PD1	312 196	314 196		Voltage distribution	♦	♦
PSSu E PS-P 5V	312 590			Voltage distribution	♦	♦
PSSu E PS-P +/- 10V	312 591			Voltage distribution	♦	♦
PSSu E PS-P +/- 15V	312 592			Voltage distribution	♦	♦
Digital input/output (standard)						
PSSu E F 2DI 60-R			315 201	2 digital inputs		♦
PSSu E S 4DI	312 400*	314 400*		4 digital inputs	♦	♦
PSSu E S 4DI-D	312 401			4 digital inputs	♦	♦
PSSu E S 4DO 0.5	312 405	314 405		4 digital outputs	♦	♦
PSSu E S 4DO 0.5-D	312 406	314 406		4 digital outputs	♦	♦
PSSu E S 2DO 2	312 410	314 410		2 digital outputs	♦	♦
PSSu E S 2DO 2-D	312 411	314 411		2 digital outputs	♦	♦
PSSu E S 2DOR 2	312 511	314 511		2 relay outputs	♦	♦
PSSu E S 2DOR 10	312 510	314 510		2 relay outputs	♦	♦
PSSu K S 8DI 8DO 0.5	312 431*			8 digital inputs, 8 digital outputs	♦	♦
PSSu K S 16DI	312 430*			16 digital inputs	♦	♦
PSSu K S 16DO 0.5	312 432*			16 digital outputs	♦	♦
Digital input/output (failsafe)						
PSSu E F 4DI	312 200*	314 200*	315 200	4 digital inputs	♦	♦
PSSu E F 4DO 0.5	312 210*	314 210*	315 210	4 digital outputs	♦	♦
PSSu E F 2DO 2	312 215*	314 215*	315 215	2 digital outputs	♦	♦
PSSu E F 2DOR 8	312 225*	314 225*	315 225	2 relay outputs	♦	♦

Selection guide
Elektronic modules

Device type	Order No. Base type	Order No. T-type	Order No. R-type	Function	Application in system environment A	Application in system environment B
PSSu E F DI OZ 2	312 220*	314 220*	315 220	1 digital input, 1 digital output	♦	♦
PSSu K F FCU	312 435			12 digital inputs, 2 digital outputs (single-pole), 2 digital outputs (dual-pole), Fast Control Unit		♦
Analogue input/output (standard)						
PSSu E S 2AI I se	312 450*	314 450*		2 analogue inputs	♦	♦
PSSu E S 4AI U	312 445	314 445		4 analogue inputs	♦	♦
PSSu E S 2AI U	312 440*	314 440*		2 analogue inputs	♦	♦
PSSu E S 2AO I	312 470	314 470		2 analogue outputs	♦	♦
PSSu E S 4AO U	312 465	314 465		4 analogue outputs	♦	♦
PSSu E S 2AO U	312 460*	314 460*		2 analogue outputs	♦	♦
PSSu E S 2AI RTD	312 490*	314 490*		2 analogue inputs	♦	♦
PSSu E S 2AI TC	312 500*	314 500*		2 analogue inputs	♦	♦
PSSu E AI SHT1	312 261	314 261		1 analogue input, 2 analogue outputs	♦	♦
PSSu E AI SHT2	312 262			1 analogue input, 2 analogue outputs	♦	♦
Analogue input/output (failsafe)						
PSSu E F AI I	312 260*	314 260*	315 260	1 analogue input		♦
PSSu E F AI U	312 265*	314 265*	315 265	1 analogue input		♦
Counter modules (standard)						
PSSu E S ABS SSI	312 480*	314 480*		Absolute encoder SSI	♦	♦
PSSu E S INC	312 485	314 485		Incremental encoder	♦	♦
PSSu E S INC 24V se	312 486*	314 486*		Incremental encoder	♦	♦
Counter modules (failsafe)						
PSSu E F ABS SSI	312 275*	314 275*		Absolute encoder SSI		♦
PSSu E F INC	312 280*	314 280*		Incremental encoder		♦
PSSu K F INC	312 437*			Incremental encoder		♦
PSSu K F EI	312 433*			Encoder interface, to connect evaluation of proximity switches and encoders		♦
PSSu K F EI CV	312 434			Encoder interface, to connect evaluation of proximity switches and encoders		♦
Serial interfaces						
PSSu E S RS232	312 515	314 515		RS232 interface	♦	♦

Selection guide
Electronic modules with base modules

Device type	Order No. Base type	Order No. T-type	Order No. R-type	Function	Application in system environment A	Application in system environment B
PSSu E S RS485	312 516	314 516		RS485 interface	♦	♦
PSSu K S RS232	312 439			RS232 interface		♦
PSSu K S RS232 Modbus ASCII	312 438			RS232 interface		♦
Link modules						
PSSu XB F-T		314 092		Base station used to extend the PSSu module bus via a cable connection	♦	♦
PSSu XR F-T		314 093		Remote station used to extend the PSSu module bus via a cable connection	♦	♦
Special modules						
PSSu K F FAU B	312 420			Monitoring of detection zone between PSENvip transmitter and PSENvip receiver		♦
PSSu K F FAU P	312 421			Monitoring of detection zone between PSENvip transmitter and PSENvip receiver		♦

*The module may be used as a safety component in accordance with the Lifts Directive 95/16/EC and in accordance with the requirements of EN 81-1, EN 81-2 and EN 115-1.

Base module with cage clamp terminals Base module with screw terminals	PSSu BP 1/8 C (Order No. 312 601) PSSu BP 1/8 S (Order No. 312 600)	PSSu BP-C 1/8 C (Order No. 312 611) PSSu BP-C 1/8 S (Order No. 312 610)	PSSu BP 1/12 C (Order No. 312 619) PSSu BP 1/12 S (Order No. 312 618)	PSSu BP-C 1/12 C (Order No. 312 621) PSSu BP-C 1/12 S (Order No. 312 620)	PSSu BP-C1 1/12 C (Order No. 312 623) PSSu BP-C1 1/12 S (Order No. 312 622)	PSSu BP 2/16 C (Order No. 312 629) PSSu BP 2/16 S (Order No. 312 628)	PSSu BP-C 2/16 C (Order No. 312 631) PSSu BP-C 2/16 S (Order No. 312 630)	PSSu BP 1/8C-J (Order No. 312 603) PSSu BP 1/8S-J (Order No. 312 602)	PSSu BP-C 1/8C-J (Order No. 312 613) PSSu BP-C 1/8S-J (Order No. 312 612)	PSSu BS 1/8 C (Order No. 312 651) PSSu BS 1/8 S (Order No. 312 650)	PSSu BS-R 1/8 C (Order No. 312 653) PSSu BS-R 1/8 S (Order No. 312 652)	PSSu BS 2/8 C (Order No. 312 657) PSSu BS 2/8 S (Order No. 312 656)	PSSu BS-R 2/8 C (Order No. 312 655) PSSu BS-R 2/8 S (Order No. 312 654)
Supply voltage													
PSSu E F PS										♦	♦		
PSSu E F PS1												♦	♦
PSSu E F PS2													♦
PSSu E F PS-P										♦			
PSSu E F BSW												♦	
Voltage distribution													
PSSu E PD	♦	♦	♦		♦								
PSSu E S PD-D	♦	♦	♦		♦								
PSSu E PD1						♦	♦						
PSSu E PS-P 5V	♦		♦		♦								
PSSu E PS-P +/- 10V	♦		♦		♦								
PSSu E PS-P +/- 15V	♦		♦		♦								
Digital input/output (standard)													
PSSu E S 4DI	♦	♦	♦		♦								

Selection guide

Electronic modules with base modules

Base module with cage clamp terminals Base module with screw terminals	PSSu BP 1/8 C (Order No. 312 601) PSSu BP 1/8 S (Order No. 312 600)	PSSu BP-C 1/8 C (Order No. 312 611) PSSu BP-C 1/8 S (Order No. 312 610)	PSSu BP 1/12 C (Order No. 312 619) PSSu BP 1/12 S (Order No. 312 618)	PSSu BP-C 1/12 C (Order No. 312 621) PSSu BP-C 1/12 S (Order No. 312 620)	PSSu BP-C1 1/12 C (Order No. 312 623) PSSu BP-C1 1/12 S (Order No. 312 622)	PSSu BP 2/16 C (Order No. 312 629) PSSu BP 2/16 S (Order No. 312 628)	PSSu BP-C 2/16 C (Order No. 312 631) PSSu BP-C 2/16 S (Order No. 312 630)	PSSu BP 1/8C-J (Order No. 312 603) PSSu BP 1/8S-J (Order No. 312 602)	PSSu BP-C 1/8C-J (Order No. 312 613) PSSu BP-C 1/8S-J (Order No. 312 612)	PSSu BS 1/8 C (Order No. 312 651) PSSu BS 1/8 S (Order No. 312 650)	PSSu BS-R 1/8 C (Order No. 312 653) PSSu BS-R 1/8 S (Order No. 312 652)	PSSu BS 2/8 C (Order No. 312 657) PSSu BS 2/8 S (Order No. 312 656)	PSSu BS-R 2/8 C (Order No. 312 655) PSSu BS-R 2/8 S (Order No. 312 654)
PSSu E S 4DI-D	♦		♦		♦								
PSSu E S 4DO 0.5	♦	♦	♦		♦								
PSSu E S 4DO 0.5-D	♦	♦	♦		♦								
PSSu E S 2DO 2	♦	♦	♦		♦								
PSSu E S 2DO 2-D	♦	♦	♦		♦								
PSSu E S 2DOR 2	♦	♦	♦		♦								
PSSu E S 2DOR 10						♦	♦						
PSSu K S 8DI 8DO 0.5													
PSSu K S 16DI													
PSSu K S 16DO 0.5													
Digital input/output (failsafe)													
PSSu E F 4DI	♦		♦		♦								
PSSu E F 4DO 0.5	♦	♦	♦		♦								
PSSu E F 2DO 2	♦	♦	♦		♦								
PSSu E F 2DOR 8						♦	♦						
PSSu E F DI OZ 2	♦	♦	♦		♦								
PSSu K F FCU													
Analogue input/output (standard)													
PSSu E S 2AI I se	♦	♦	♦	♦									
PSSu E S 4AI U	♦	♦	♦	♦									
PSSu E S 2AI U	♦	♦	♦	♦									
PSSu E S 2 AO I	♦	♦	♦	♦									
PSSu E S 4AO U	♦	♦	♦	♦									
PSSu E S 2AO U	♦	♦	♦	♦									
PSSu E S 2AI RTD			♦	♦									
PSSu E S 2AI TC								♦	♦				
PSSu E AI SHT1	♦	♦	♦	♦									
PSSu E AI SHT2	♦	♦	♦	♦									
Analogue input/output (failsafe)													

Selection guide

Electronic modules with base modules

Base module with cage clamp terminals Base module with screw terminals	PSSu BP 1/8 C (Order No. 312 601) PSSu BP 1/8 S (Order No. 312 600)	PSSu BP-C 1/8 C (Order No. 312 611) PSSu BP-C 1/8 S (Order No. 312 610)	PSSu BP 1/12 C (Order No. 312 619) PSSu BP 1/12 S (Order No. 312 618)	PSSu BP-C 1/12 C (Order No. 312 621) PSSu BP-C 1/12 S (Order No. 312 620)	PSSu BP-C1 1/12 C (Order No. 312 623) PSSu BP-C1 1/12 S (Order No. 312 622)	PSSu BP 2/16 C (Order No. 312 629) PSSu BP 2/16 S (Order No. 312 628)	PSSu BP-C 2/16 C (Order No. 312 631) PSSu BP-C 2/16 S (Order No. 312 630)	PSSu BP 1/8C-J (Order No. 312 603) PSSu BP 1/8S-J (Order No. 312 602)	PSSu BP-C 1/8C-J (Order No. 312 613) PSSu BP-C 1/8S-J (Order No. 312 612)	PSSu BS 1/8 C (Order No. 312 651) PSSu BS 1/8 S (Order No. 312 650)	PSSu BS-R 1/8 C (Order No. 312 653) PSSu BS-R 1/8 S (Order No. 312 652)	PSSu BS 2/8 C (Order No. 312 657) PSSu BS 2/8 S (Order No. 312 656)	PSSu BS-R 2/8 C (Order No. 312 655) PSSu BS-R 2/8 S (Order No. 312 654)
PSSu E F AI I	♦	♦	♦	♦									
PSSu E F AI U	♦	♦	♦	♦									
Counter modules (standard)													
PSSu E S ABS SSI	♦	♦	♦		♦								
PSSu E S INC						♦	♦						
PSSu E S INC 24V se						♦	♦						
Counter modules (failsafe)													
PSSu E F ABS SSI	♦	♦	♦		♦								
PSSu E F INC						♦	♦						
PSSu K F INC													
Serial interfaces													
PSSu E S RS232	♦	♦	♦	♦									
PSSu E S RS485	♦	♦	♦	♦									
PSSu K S RS232 Modbus ASCII													
PSSu K S RS232													
Link modules													
PSSu XB F-T						♦	♦						
PSSu XR F-T													
Special modules													
PSSu K F FAU B													
PSSu K F FAU P													

♦ can be used with this base module

The base modules are also available as T-type for increased environmental requirements. The order numbers for the T-type base modules are 314... rather than 312...

Head modules

Head modules

Head modules
PSSu H DP

Overview

Module features

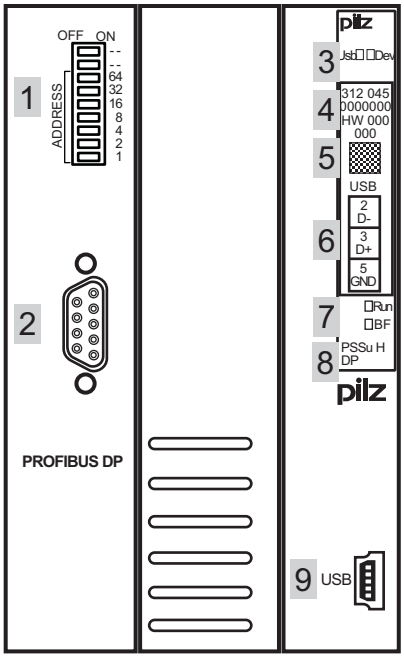
The product has the following features:

- PROFIBUS-DP-Interface for switching
  - Standard inputs/outputs
- USB port for connection to a PC for
  - Commissioning
  - Service
- LEDs for:
  - System status
  - USB status
  - Status of the PROFIBUS-DP interface
- Electronic modules that can be used for input/output:
  - All standard modules
    (PSSu E S...)
- T-type:

  PSSu H DP-T: for increased environmental requirements

Head modules
PSSu H DP

Front view



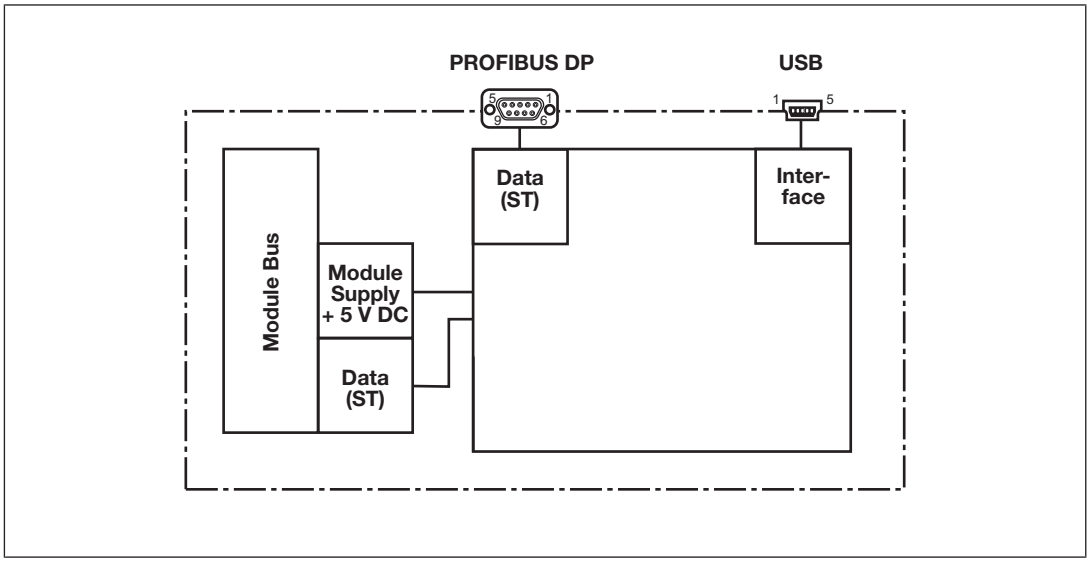
Legend:

- 1: Selector switch for setting the station address (PROFIBUS-DP)
- 2: PROFIBUS-DP interface
- 3: LEDs for system diagnostics
- 4: Labelling strip with:
  - Order number
  - Serial number
  - Hardware version number
  - Firmware version number on delivery
- 5: Field for 2D code
- 6: Labelling strip with interface configuration of the USB port
- 7: LEDs for PROFIBUS-DP diagnostics
- 8: Description of head module
- 9: USB interface (Mini-B)

Head modules
PSSu H DP

Function description

Block diagram



Supply voltage

Module supply

- The module supply provides the module with voltage.

Integrated protection mechanisms

The module has the following protection mechanisms:

- Potentially isolated PROFIBUS-DP interface
- When the PSSu E F PS1(-T) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

PROFIBUS

A PSSu system with PROFIBUS interface is a passive subscriber (Slave) of the PROFIBUS-DP fieldbus. The basic functions of communication with PROFIBUS-DP conform to EN 50170.

The specifications of the PROFIBUS User Group (PNO) apply for a PSSu.

The data length of the output data may be a max. of 1536 Bytes because the memory of the PROFIBUS protocol chips is 1.5 kByte. The max. data length is calculated as:

- 3 x length of the input data
- + 3 x length of the output data
- + 2 x length of the diagnostic data
- + 4 x length of the configuration data

Head modules
PSSu H DP

- + 64 Byte

The station address is set via the "ADDRESS" DIP switch. The DIP switch is binary coded. Permitted station addresses are in the range 0_D ... 125_D. If station address 126_D is set via the DIP switch, the address can be assigned via the Master. The Set Slave Address command (SSA) must be run for this purpose.

The station address is set as follows:

"ADDRESS" DIP switch	**Meaning**		**Example:**
Switch designation	**OFF**	**ON**	**Station address** **PSSu: 26 $_D$** **F-device: 52 $_D$**
- -	Not connected		
- -			
64	0	64_D	
32	0	32_D	
16	0	16_D	
8	0	8_D	
4	0	4_D	
2	0	2_D	
1	0	1_D	

USB port

The following functions are available via the USB port:

- Show actual hardware
- Comparison of actual/registered hardware
- Display and update firmware versions
- Setting the parameters for the ST section

Parameters for the module's ST section can either be set via the fieldbus interface or via the USB port. Parameter setting via the USB port has priority over parameter setting via the fieldbus interface. Once parameters for the the head module have been set via the USB port, the ability to set parameters for the module via the fieldbus interface is disabled. The disable can be lifted in the PSSuniversal Assistant.

Head modules
PSSu H DP

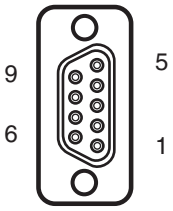
Procedure for connecting the head module via the USB port:

1. Connect PC to head module via USB cable.
2. Install USB driver.
3. View the actual hardware registry in the PSSuniversal Assistant and call up other functions.

This way it is possible to copy and edit an existing configuration in the PSSuniversal Assistant.

Interfaces

Interface configuration

PROFIBUS-DP	Assignment	
Female 9-pin D-SUB connector conforms to the guidelines of the PROFIBUS User Group (PNO)	1: n.c. 2: n.c. 3: RxD/TxD-P (B-line) 4: CNTR-P (RTS) 5: DGND (GND ext.) 6: VP (+5 V ext.) 7: n.c. 8: RxD/TxD-N (A-line) 9: n.c.	

USB	Assignment	
Mini-B USB connector	1: n.c. 2: D- USB Data – 3: D+ USB Data + 4: n.c. 5: GND Ground	

- n.c. = not connected

The PSSu is connected to PROFIBUS-DP via RS 485 communication. The PSSu supplies the PROFIBUS DP bus terminating resistors with voltage (+5 VDC).

- Connect the connector housing to the shielding on the PROFIBUS cable. The connector housing should be connected with low impedance to the mounting rail.

Please note the requirements of the USB standard for USB 2.0 and for Mini-B USB ports.

The maximum cable runs for USB connection cable are 5 m.

Head modules
PSSu H DP

Technical details

General	312045	314045
Approvals	**CE, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0201h**	**0201h**
Electrical data	**312045**	**314045**
Potential isolation between module supply and PROFIBUS-DP	**700 V**	**700 V**
Internal supply voltage (module supply)		
Module's power consumption	**2,15 W**	**2,15 W**
Max. power dissipation of module	**2,15 W**	**2,15 W**
USB interface	**312045**	**314045**
Connection	**Mini-B connector**	**Mini-B connector**
Number of USB Slaves	**1**	**1**
PROFIBUS-DP interface	**312045**	**314045**
Number	**1**	**1**
Device type	**Slave**	**Slave**
Station address	**0 ... 126d**	**0 ... 126d**
Station address selectable via	**DIP-Schalter**	**DIP-Schalter**
Maximum data length of PROFIBUS interface		
Input device	**64 Byte**	**64 Byte**
Output	**64 Byte**	**64 Byte**
Diagnostics	**64 Byte**	**64 Byte**
Transmission rates	**1,5 MBit/s, 12 MBit/s, 187,5 kBits/s, 19,2 kBit/s, 3 MBit/s, 45,45 kBit/s, 500 kBit/s, 6 MBit/s, 9,6 kBit/s, 93,75 kBit/s**	**1,5 MBit/s, 12 MBit/s, 187,5 kBits/s, 19,2 kBit/s, 3 MBit/s, 45,45 kBit/s, 500 kBit/s, 6 MBit/s, 9,6 kBit/s, 93,75 kBit/s**
Transmission rate selectable via	**automatic**	**automatic**
Connection	**9-pin D-Sub female connector**	**9-pin D-Sub female connector**
Log	**DPV0**	**DPV0**
Operating modes	**AutoBaud, Freeze Mode, Set Slave Address, Sync Mode**	**AutoBaud, Freeze Mode, Set Slave Address, Sync Mode**
Certification	**PNO**	**PNO**
Description file	**PILZ0A94.GSD**	**PILZ0A94.GSD**
Manufacturer’s ID	**0A94h**	**0A94h**
Environmental data	**312045**	**314045**
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**

Head modules
PSSu H DP

Environmental data	312045	314045
Ambient temperature		
Temperature range	**0 - 60 °C**	**-40 - 70 °C**
Storage temperature		
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-78**	**EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Mechanical data	**312045**	**314045**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**

Head modules
PSSu H DP

Mechanical data	312045	314045
Dimensions		
Height	**128,4 mm**	**128,4 mm**
Width	**75,2 mm**	**75,2 mm**
Depth	**79,4 mm**	**79,4 mm**
Weight	**160 g**	**165 g**

Where standards are undated, the 2015-02 latest editions shall apply.

Order reference

Product type	Features	Order No.
PSSu H DP	Head module with PROFIBUS-DP interface, base type	312 045
PSSu H DP-T	Head module with PROFIBUS-DP interface, T-type	314 045

Head modules
PSSu H DN

Overview

Module features

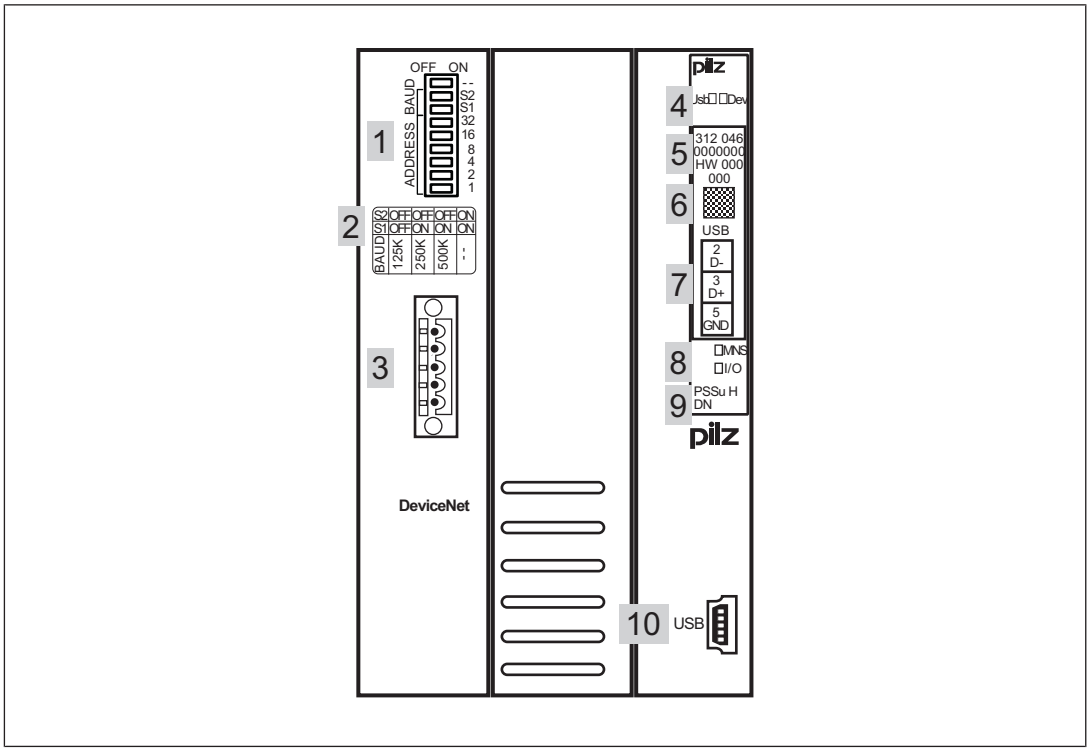
The product has the following features:

- DeviceNet-Interface for switching
  - Standard inputs/outputs
- USB port for connection to a PC for
  - Commissioning
  - Service
- LEDs for:
  - System status
  - USB status
  - Status of the DeviceNet interface
- Electronic modules that can be used for input/output:
  - All standard modules
    (PSSu E S...)
- T-type:

  PSSu H DN-T: for increased environmental requirements

Head modules
PSSu H DN

Front view



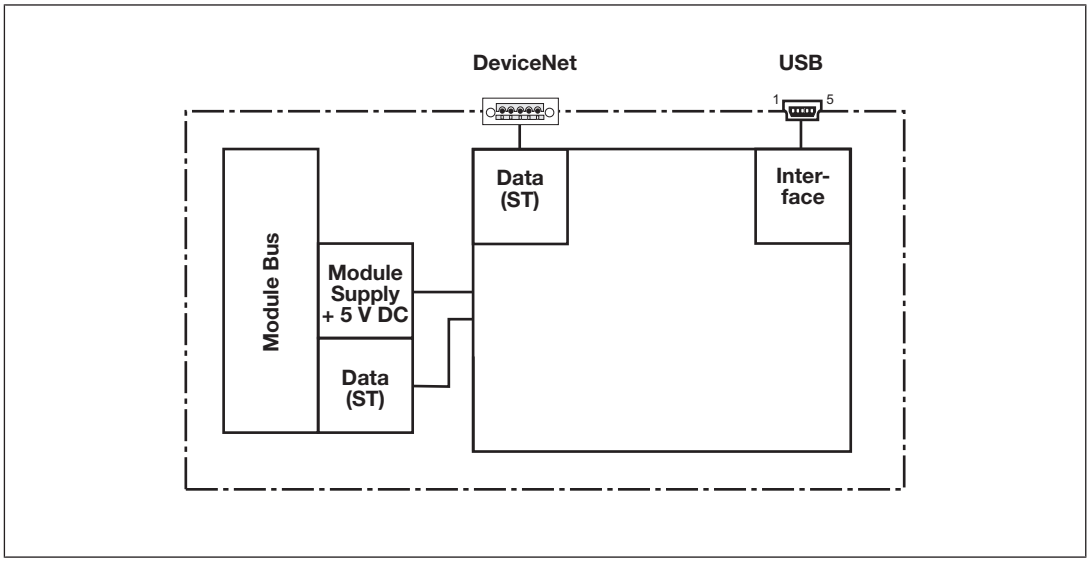
Legend:

- 1: Selector switch for setting the node address and transmission rate (DeviceNet)
- 2: Labelling strip with guidelines for setting the transmission rate (DeviceNet)
- 3: DeviceNet interface
- 4: LEDs for system diagnostics
- 5: Labelling strip with:
  - Order number
  - Serial number
  - Hardware version number
  - Firmware version number on delivery
- 6: Field for 2D code
- 7: Labelling strip with interface configuration of the USB port
- 8: LEDs for DeviceNet diagnostics
- 9: Description of head module
- 10: USB port (Mini-B)

Head modules
PSSu H DN

Function description

Block diagram



Supply voltage

Module supply

- The module supply provides the module with voltage.

Integrated protection mechanisms

The module has the following protection mechanisms:

- Potentially isolated DeviceNet interface
- When the PSSu E F PS1(-T) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

DeviceNET

A PSSu system with DeviceNet interface operates as a DeviceNet Slave on DeviceNet (Group 2 Only Device). The interface supports the exchange of polled I/O messages. This must be taken into account on the master module settings. The specifications of the Open DeviceNet Vendor Association (ODVA) apply for a PSSu.

The transmission rate of a PSSu is set via the “BAUD” DIP switches S1 and S2.

Head modules
PSSu H DN

“BAUD” DIP switch	Key				Example:
Switch designation	**125 kBit/s**	**250 kBit/s**	**500 kBit/s**	**- - -**	**Transmission rate 250 kBit/s**
- -	Not connected				
S2	OFF	OFF	ON	ON	
S1	OFF	ON	OFF	ON	
32	Station address				
16					
8					
4					
2					
1					

The station address of a PSSu is set via the “ADDRESS” DIP switches (“1”, “2”, “4” “8” “16” and “32”). The DIP switches are binary coded. Permitted station addresses are in the range 0_D ... 63_D.

A station address is set via a combination of the relevant binary coded switches:

“ADDRESS” DIP switch	Key		Example
Switch designation	**OFF**	**ON**	**Station address 52_D**
- -	Not connected		
S2	Transmission rate		
S1			
32	0	32_D	
16	0	16_D	
8	0	8_D	
4	0	4_D	
2	0	2_D	
1	0	1_D	

Head modules
PSSu H DN

USB port

The following functions are available via the USB port:

- Show actual hardware
- Comparison of actual/registered hardware
- Display and update firmware versions
- Setting the parameters for the ST section

Parameters for the module's ST section can either be set via the fieldbus interface or via the USB port. Parameter setting via the USB port has priority over parameter setting via the fieldbus interface. Once parameters for the the head module have been set via the USB port, the ability to set parameters for the module via the fieldbus interface is disabled. The disable can be lifted in the PSSuniversal Assistant.

Procedure for connecting the head module via the USB port:

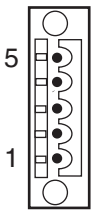
1. Connect PC to head module via USB cable.
2. Install USB driver.
3. View the actual hardware registry in the PSSuniversal Assistant and call up other functions.

This way it is possible to copy and edit an existing configuration in the PSSuniversal Assistant.

Head modules
PSSu H DN

Interfaces

Interface configuration

DeviceNet	Layout	
5-pin Combicon plug-in connector	1: V- 2: CAN_Low 3: Shield 4: CAN_High 5: V+	

USB	Layout	
Mini-B USB connector	1: n.c. 2: D- USB Data – 3: D+ USB Data + 4: n.c. 5: GND Ground	

- n.c. = not connected

Please refer to the “DeviceNET Specification” from the Open DeviceNet Vendor Association (ODVA).

The PSSu is connected to DeviceNET via a 5-pin Combicon plug-in connector.

Please note the requirements of the USB standard for USB 2.0 and for Mini-B USB ports.

The maximum cable runs for USB connection cable are 5 m.

Head modules
PSSu H DN

Technical details

General	312046	314046
Approvals	**CE, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0202h**	**0202h**
Electrical data	**312046**	**314046**
Potential isolation between module supply and fieldbus interface	**700 V**	**700 V**
Internal supply voltage (module supply)		
Module's power consumption	**1,35 W**	**1,35 W**
Max. power dissipation of module	**1,35 W**	**1,35 W**
USB interface	**312046**	**314046**
Connection	**Mini-B connector**	**Mini-B connector**
Number of USB Slaves	**1**	**1**
Fieldbus interface	**312046**	**314046**
Fieldbus interface	**DeviceNet**	**DeviceNet**
External supply (DC)	**24 V**	**24 V**
Device type	**Slave**	**Slave**
Log	**Group 2 Only Device**	**Group 2 Only Device**
Station address	**0 ... 63d**	**0 ... 63d**
Station address selectable via	**DIP switch**	**DIP switch**
Maximum data length of fieldbus interface		
Input device	**64 Byte**	**64 Byte**
Output	**64 Byte**	**64 Byte**
Diagnostics	**6 Byte**	**6 Byte**
Transmission rates	**125 kBit/s, 250 kBit/s, 500 kBit/s**	**125 kBit/s, 250 kBit/s, 500 kBit/s**
Transmission rate selectable via	**DIP switch**	**DIP switch**
Connection	**5-pin Combicon plug-in connector**	**5-pin Combicon plug-in connector**
Certification	**ODVA**	**ODVA**
Description file	**PSSu.EDS**	**PSSu.EDS**
Manufacturer’s ID	**181d**	**181d**
Environmental data	**312046**	**314046**
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		
Temperature range	**0 - 60 °C**	**-40 - 70 °C**

Head modules
PSSu H DN

Environmental data	312046	314046
Storage temperature		
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-78**	**EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Mechanical data	**312046**	**314046**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Dimensions		
Height	**128,4 mm**	**128,4 mm**
Width	**75,2 mm**	**75,2 mm**
Depth	**79,4 mm**	**79,4 mm**

Head modules
PSSu H DN

Mechanical data	312046	314046
Weight	**160 g**	**165 g**

Where standards are undated, the 2015-02 latest editions shall apply.

Order reference

Product type	Features	Order no.
PSSu H DN	Head module with DeviceNet interface, base type	312 046
PSSu H DN-T	Head module with DeviceNet interface, T-type	314 046

Head modules
PSSu H CAN

Overview

Module features

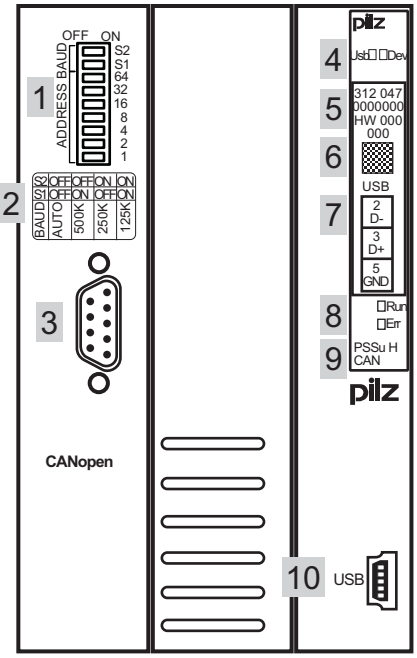
The product has the following features:

- CANopen-Interface for switching
  - Standard inputs/outputs
- USB port for connection to a PC for
  - Commissioning
  - Service
- LEDs for:
  - System status
  - USB status
  - Status of the CANopen interface
- Electronic modules that can be used for input/output:
  - All standard modules
    (PSSu E S...)
- T-type:

  PSSu H CAN-T: for increased environmental requirements

Head modules
PSSu H CAN

Front view



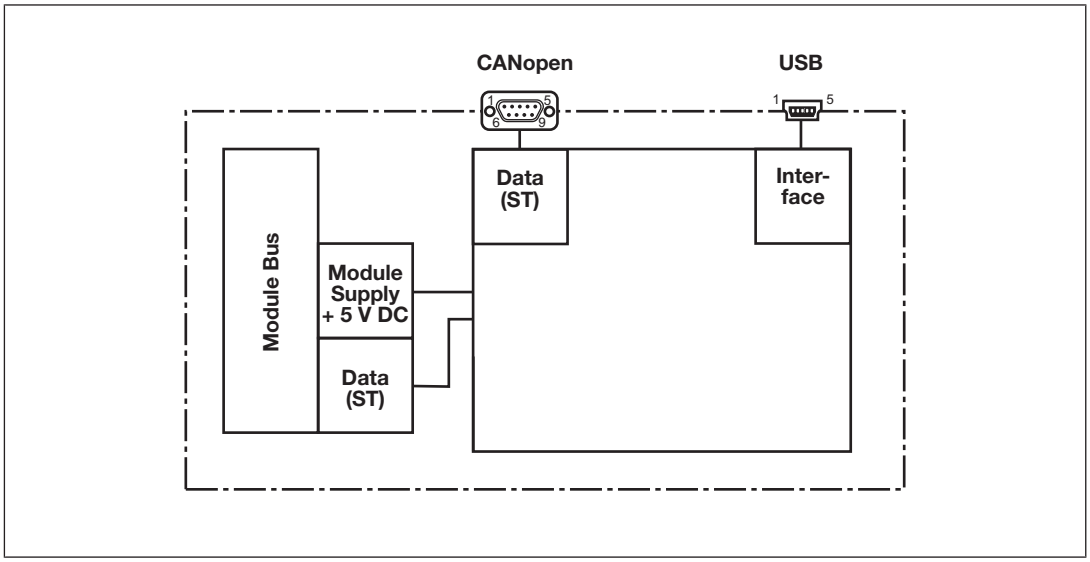
Legend:

- 1: Selector switch for setting the station address and transmission rate (CANopen)
- 2: Labelling strip with guidelines for setting the transmission rate (CANopen)
- 3: CANopen interface
- 4: LEDs for system diagnostics
- 5: Labelling strip with:
  - Order number
  - Serial number
  - Hardware version number
  - Firmware version number on delivery
- 6: Field for 2D code
- 7: Labelling strip with interface configuration of the USB port
- 8: LEDs for CANopen diagnostics
- 9: Description of head module
- 10: USB port (Mini-B)

Head modules
PSSu H CAN

Function description

Block diagram



Supply voltage

Module supply

- The module supply provides the module with voltage.

Integrated protection mechanisms

The module has the following protection mechanisms:

- Potentially isolated CANopen interface
- When the PSSu E F PS1(-T) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

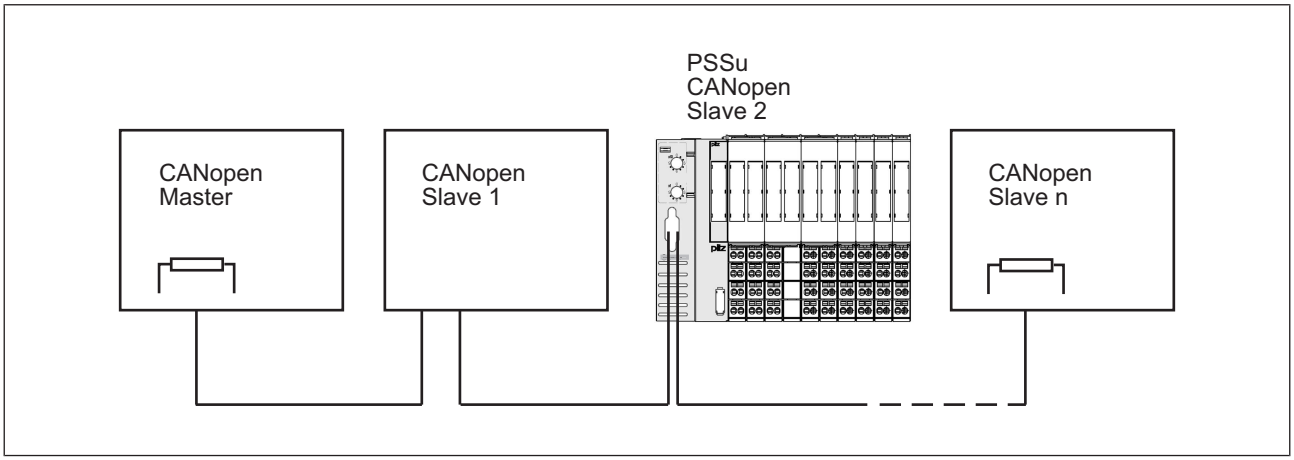
Head modules
PSSu H CAN

CANopen

A PSSu system with CANopen interface is a passive subscriber (Slave) of the CANopen fieldbus.

The basic communication functions with CANopen conform to CiA DS-301 V3.0. The central controller (Master) reads input information from the slaves and writes output information to the slaves as part of each cycle.

Bus termination must be activated on both ends of the bus.



The transmission rate of a PSSu is set via the “BAUD” DIP switches S1 and S2.

“BAUD” DIP switch	**Key**				**Example:**
Switch designation	**AUTO**	**500 KBit/s**	**250 kBit/s**	**125 kBit/s**	**Transmission rate 500 kBit/s**
S2	OFF	OFF	ON	ON	
S1	OFF	ON	OFF	ON	
64	Station address				
32					
16					
8					
4					
2					
1					

If the PSSu station has lots of telegrams to send via the CANopen fieldbus, make sure that the transmission rate is high enough, e.g. when several analogue input/output modules are used. If the transmission rate is too low, the PSSu may not be able to establish a connection to the CANopen fieldbus.

The station address of a PSSu (“Node ID”) is set via the “ADDRESS” DIP switches (“1”, “2”, “4”, “8”, “16”, “32” and “64”). The DIP switches are binary coded. Permitted station addresses are in the range 0_D ... 127_D.

Head modules
PSSu H CAN

A station address is set via a combination of the relevant binary coded switches:

"ADDRESS" DIP switch	Key		Example
Switch designation	**OFF**	**ON**	**Station address 116_D**
S2	Transmission rate		
S1			
64	0	64_D	
32	0	32_D	
16	0	16_D	
8	0	8_D	
4	0	4_D	
2	0	2_D	
1	0	1_D	

USB port

The following functions are available via the USB port:

- Show actual hardware
- Comparison of actual/registered hardware
- Display and update firmware versions
- Setting the parameters for the ST section

Parameters for the module's ST section can either be set via the fieldbus interface or via the USB port. Parameter setting via the USB port has priority over parameter setting via the fieldbus interface. Once parameters for the the head module have been set via the USB port, the ability to set parameters for the module via the fieldbus interface is disabled. The disable can be lifted in the PSSuniversal Assistant.

Procedure for connecting the head module via the USB port:

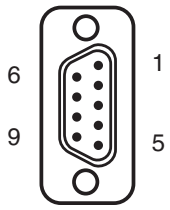
1. Connect PC to head module via USB cable.
2. Install USB driver.
3. View the actual hardware registry in the PSSuniversal Assistant and call up other functions.

This way it is possible to copy and edit an existing configuration in the PSSuniversal Assistant.

Head modules
PSSu H CAN

Interfaces

Interface configuration

CANopen	Layout	
Male 9-pin D-SUB connector	1: n.c. 2: CAN_L 3: CAN_GND 4: n.c. 5: CAN_SHLD 6: GND (1) 7: CAN_H 8: n.c. 9: n.c.	

USB	Layout	
Mini-B USB connector	1: n.c. 2: D- USB Data – 3: D+ USB Data + 4: n.c. 5: GND Ground	

- n.c. = not connected
- (1) Not required for operation

The connection cable must conform to the requirements of CiA DS 102 V2.0.

Only shielded cable should be used as the CANopen connection cable. Connect the cable shield on the CANopen connection cable to Pin 5 of the 9-pin D-Sub connector. The relationship of the cable runs to the bit rate must be maintained.

Please note the requirements of the USB standard for USB 2.0 and for Mini-B USB ports.

The maximum cable runs for USB connection cable are 5 m.

Head modules
PSSu H CAN

Technical details

General	312047	314047
Approvals	**CE, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0204h**	**0204h**
Electrical data	**312047**	**314047**
Potential isolation between module supply and fieldbus interface	**700 V**	**700 V**
Internal supply voltage (module supply)		
Module's power consumption	**1,35 W**	**1,35 W**
Max. power dissipation of module	**1,35 W**	**1,35 W**
USB interface	**312047**	**314047**
Connection	**Mini-B connector**	**Mini-B connector**
Number of USB Slaves	**1**	**1**
Fieldbus interface	**312047**	**314047**
Fieldbus interface	**CANopen**	**CANopen**
Device type	**Slave**	**Slave**
Log	**CiA DS301 V3.0**	**CiA DS301 V3.0**
Station address	**1 .. 127d**	**1 .. 127d**
Station address selectable via	**DIP switch**	**DIP switch**
Maximum data length of fieldbus interface		
Input device	**64 Byte**	**64 Byte**
Output	**64 Byte**	**64 Byte**
Diagnostics	**5 Byte**	**5 Byte**
Transmission rates	**1 MBit/s, 10 kbit/s, 100 kBit/s, 125 kBit/s, 20 kbit/s, 250 kBit/s, 50 kbit/s, 500 kBit/s, 800 kbit/s**	**1 MBit/s, 10 kbit/s, 100 kBit/s, 125 kBit/s, 20 kbit/s, 250 kBit/s, 50 kbit/s, 500 kBit/s, 800 kbit/s**
Transmission rate selectable via	**Automatic/DIP switch**	**Automatic/DIP switch**
Connection	**9-pin D-Sub female connector**	**9-pin D-Sub female connector**
Operating modes	**Slave Mode**	**Slave Mode**
Certification	**CiA**	**CiA**
Description file	**PSSuCOST.eds**	**PSSuCOST.eds**
Manufacturer’s ID	**0189h**	**0189h**
Environmental data	**312047**	**314047**
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		
Temperature range	**0 - 60 °C**	**-40 - 70 °C**

Head modules
PSSu H CAN

Environmental data	312047	314047
Storage temperature		
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-78**	**EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Mechanical data	**312047**	**314047**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Dimensions		
Height	**128,4 mm**	**128,4 mm**
Width	**75,2 mm**	**75,2 mm**
Depth	**79,4 mm**	**79,4 mm**

Head modules
PSSu H CAN

Mechanical data	312047	314047
Weight	**160 g**	**165 g**

Where standards are undated, the 2015-02 latest editions shall apply.

Order reference

Product type	Features	Order no.
PSSu H CAN	Head module with CANopen interface, base type	312 047
PSSu H CAN-T	Head module with CANopen interface, T-type	314 047

Head modules
PSSu H F PN

Overview

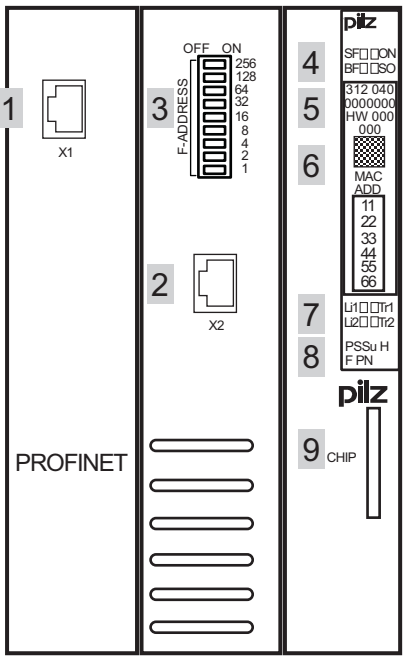
Module features

The product has the following features:

- **PROFINET** interface with PROFIsafe profile
- LEDs for:
  - System status
  - **PROFINET** status
  - **PROFIsafe** status
  - **PROFIenergy** status
- IRT/RT
- MRP
- Shared-Device
- iPar-Server
- PROFIenergy in conjunction with all digital ST output modules plus the following modules:
  - PSSu E S 4DI-D
  - PSSu E S PD-D
- Electronic modules that can be used for input/output:
  - All failsafe modules (PSSu E F...)
  - All standard modules (PSSu E S...)

Head modules
PSSu H F PN

Front view



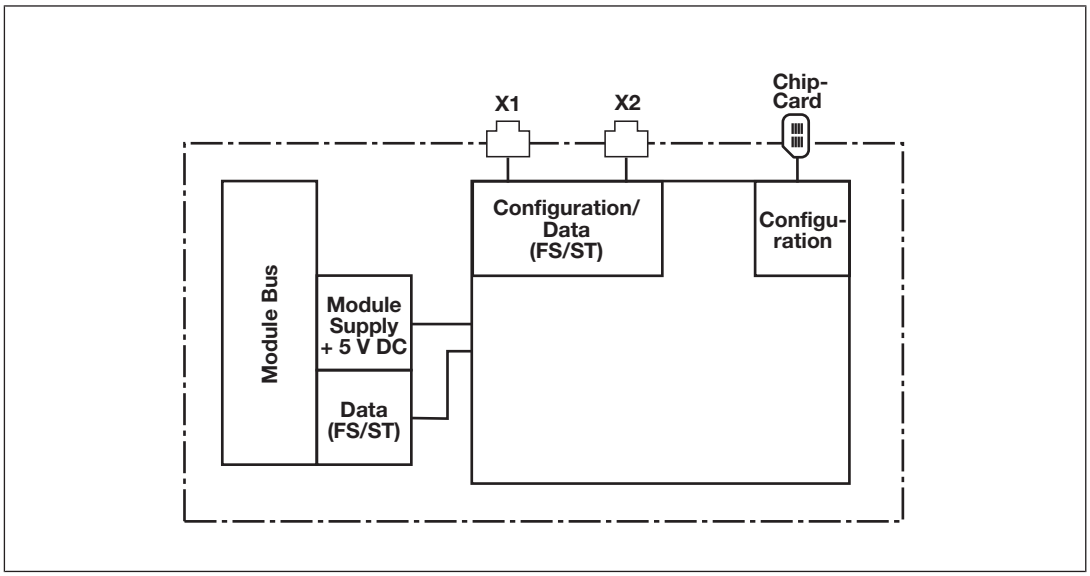
Legend:

- 1: PROFINET interface X1
- 2: PROFINET interface X2
- 3: DIP switch for setting the F address
- 4 LEDs for PROFINET diagnostics
- 5: Labelling strip with:
  - Order number
  - Serial number
  - Hardware version number
  - Firmware version number on delivery
- 6: Field for 2D code
- 7: LEDs for diagnostics on the PROFINET connection
- 8: Description of head module
- 9: Chip card slot

Head modules
PSSu H F PN

Function description

Block diagram



Supply voltage

Module supply

- The module supply provides the module with voltage.

Integrated protection mechanisms

The module has the following protection mechanisms:

- Multi-channel diverse processor section
- Cyclical self tests
- Potentially isolated **PROFINET** interface

Projects

To configure the head module you will need the STEP 7 software from Siemens and the PSSuniversal Configurator. The PSSuniversal Configurator can be called up directly from STEP 7.

There are two options for downloading a project to the head module:

- Using the PSSuniversal Configurator
  - Connect the head module to the programming device.
  - If the head module contains a chip card, the current project will always be written to the chip card as a PROFINET project chip card. A chip card is not required in order to save the project in the head module.

Head modules
PSSu H F PN

- Using the PROFINET project chip card
  - If the head module already contains a project, you will need to delete this project first (see below).
  - Create a PROFINET project chip card using the PSSuniversal Configurator.
  - Insert the PROFINET project chip card into the chip card slot on the head module and start up the head module.

You will need a PROFINET reset chip card in order to delete a project on the head module.

- Create a PROFINET reset chip card using the PSSuniversal Configurator.
- Insert the PROFINET reset chip card into the head module and start up the head module.
- The PROFINET reset chip card deletes the existing project on the head module.
  - The PROFINET reset chip card does not download a project to the head module.

Further information on this procedure is available in the PSSuniversal Configurator's online help.

PROFINET

Decentralised input/output

- The head module enables the PSSuniversal to be used as a modular, decentralised input/output module.
- The head module receives signals from a higher level control system; it processes these signals and passes them on to the connected input/output modules.
- The head module receives signals from the connected input/output modules; it processes these signals and passes them on to a higher level control system.

Interfaces

- PROFINET interface with PROFIsafe profile
  - The PROFINET interface enables standard data to be exchanged with a higher level control system.
  - The PROFINET interface with PROFIsafe profile enables data to be transferred safely between the PSSuniversal and a master controller.
  - If a fault occurs, the module switches off the connected failsafe output modules.
  - The station address is set via a DIP switch.

All the project data is stored in the head module. The project data can also be stored on a chip card.

The station address of a PSSu is set via the “F-ADDRESS” DIP switches. The DIP switches are binary coded. Permitted station addresses are in the range 0_D ... 511_D.

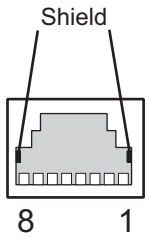
Head modules
PSSu H F PN

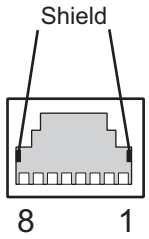
A station address is set via a combination of the relevant binary coded switches:

"F-ADDRESS" DIP switch	Meaning		Example
Switch designation	**OFF**	**ON**	**Station address 52_D**
256	0	256_D	
128	0	128_D	
64	0	64_D	
32	0	32_D	
16	0	16_D	
8	0	8_D	
4	0	4_D	
2	0	2_D	
1	0	1_D	

Interfaces

Interface configuration

X1		
Female RJ45 connector in accordance with the guidelines of the PROFINET User Group (PNO)	8-core CAT-5 Ethernet patch cable	

X2		
Female RJ45 connector in accordance with the guidelines of the PROFINET User Group (PNO)	8-core CAT-5 Ethernet patch cable	

Head modules
PSSu H F PN

Technical Details

General	
Approvals	**CE, EAC (Eurasian), TÜV, cULus Listed**
Application range	**Standard/failsafe**
Module's device code	**0229h**
Electrical data	
Internal supply voltage (module supply)	
Module's power consumption	**2,5 W**
Max. power dissipation of module	**2,5 W**
PROFINET interface	
Number	**2**
Input device	**64 Byte**
Output	**64 Byte**
Transmission rates	**100 MBit/s**
Transmission rate selectable via	**Automatic**
Certification	**PNO**
Manufacturer’s ID	**092Fh**
Connection	**RJ45**
Device type	**Slave**
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	
Temperature range	**0 - 60 °C**
Storage temperature	
Temperature range	**-25 - 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 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 150 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**

Head modules
PSSu H F PN

Environmental data	
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**25g**
Duration	**6 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
Housing	**IP20**
Mounting area (e.g. control cabinet)	**IP54**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Dimensions	
Height	**128,4 mm**
Width	**75,2 mm**
Depth	**79,4 mm**
Weight	**170 g**

Where standards are undated, the 2012-04 latest editions shall apply.

Head modules
PSSu H F PN

Safety characteristic data

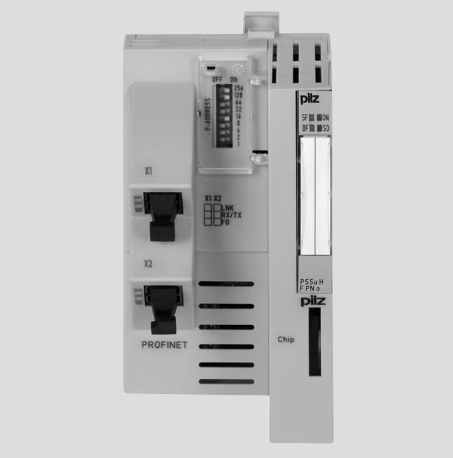
Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 4	SIL CL 3	2,88E-09	SIL 3	3,95E-05	20

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

Order reference

Product type	Features	Order No.
PSSu H F PN	Head module with PROFIsafe interface, base type	312 043

Head modules
PSSu H F PN o



Overview

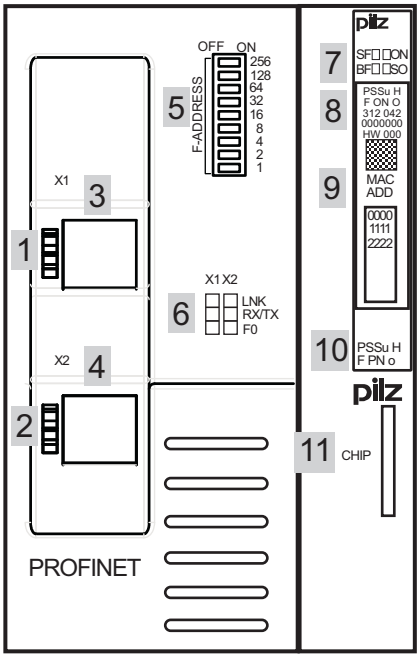
Module features

The product has the following features:

- **PROFINET** interface with PROFIsafe profile
- LEDs for:
  - System status
  - **PROFINET** status
  - **PROFIsafe** status
  - **PROFIenergy** status
- IRT/RT
- MRP
- Shared-Device
- iPar-Server
- PROFIenergy in conjunction with all digital ST output modules plus the following modules:
  - PSSu E S 4DI-D
  - PSSu E S PD-D
- Electronic modules that can be used for input/output:
  - All failsafe modules (PSSu E F...)
  - All standard modules (PSSu E S...)

Head modules
PSSu H F PN o

Front view



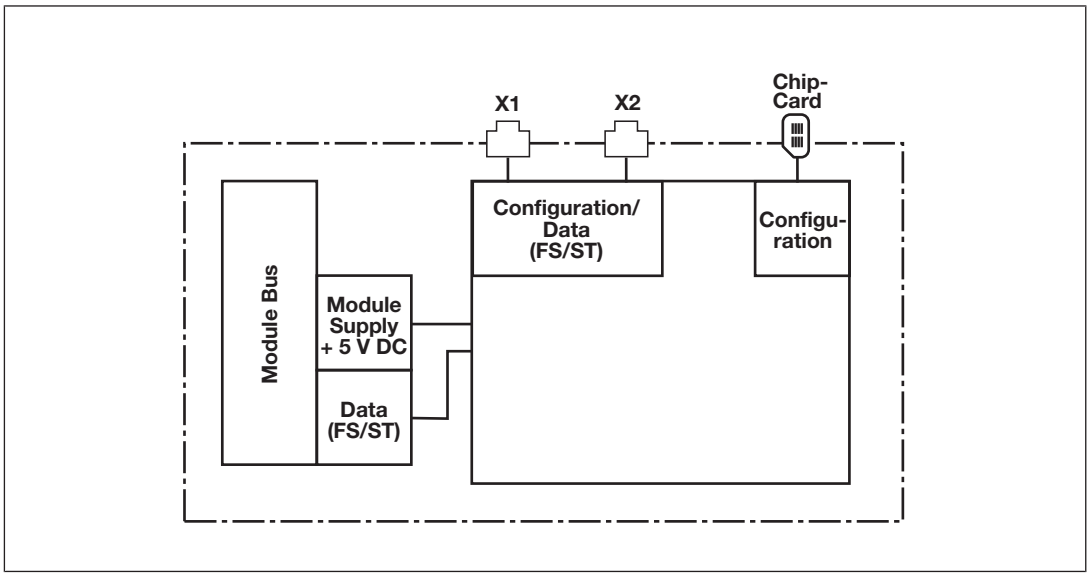
Legend:

- 1: LEDs for diagnostics of the PROFINET connection of the PROFINET interface X1
- 2: LEDs for diagnostics of the PROFINET connection of the PROFINET interface X2
- 3: Optical PROFINET interface X1
- 4: Optical PROFINET interface X2
- 5: DIP switch for setting the F address
- 6: Labelling of LEDs for diagnostics on the PROFINET connection
- 7 LEDs for PROFINET diagnostics
- 8: Labelling strip with:
  - Order number
  - Serial number
  - Hardware version number
  - Firmware version number on delivery
- 9: Field for 2D code
- 10: Description of head module
- 11: Chip card slot

Head modules
PSSu H F PN o

Function description

Block diagram



Supply voltage

Module supply

- The module supply provides the module with voltage.

Integrated protection mechanisms

The module has the following protection mechanisms:

- Multi-channel diverse processor section
- Cyclical self tests
- Potentially isolated **PROFINET** interface

Projects

To configure the head module you will need the STEP 7 software from Siemens and the PSSuniversal Configurator. The PSSuniversal Configurator can be called up directly from STEP 7.

There are two options for downloading a project to the head module:

- Using the PSSuniversal Configurator
  - Connect the head module to the programming device.
  - If the head module contains a chip card, the current project will always be written to the chip card as a PROFINET project chip card. A chip card is not required in order to save the project in the head module.

Head modules
PSSu H F PN o

- Using the PROFINET project chip card
  - If the head module already contains a project, you will need to delete this project first (see below).
  - Create a PROFINET project chip card using the PSSuniversal Configurator.
  - Insert the PROFINET project chip card into the chip card slot on the head module and start up the head module.

You will need a PROFINET reset chip card in order to delete a project on the head module.

- Create a PROFINET reset chip card using the PSSuniversal Configurator.
- Insert the PROFINET reset chip card into the head module and start up the head module.
- The PROFINET reset chip card deletes the existing project on the head module.
  - The PROFINET reset chip card does not download a project to the head module.

Further information on this procedure is available in the PSSuniversal Configurator's online help.

PROFINET

Decentralised input/output

- The head module enables the PSSuniversal to be used as a modular, decentralised input/output module.
- The head module receives signals from a higher level control system; it processes these signals and passes them on to the connected input/output modules.
- The head module receives signals from the connected input/output modules; it processes these signals and passes them on to a higher level control system.

Interfaces

- PROFINET interface with PROFIsafe profile
  - The PROFINET interface enables standard data to be exchanged with a higher level control system.
  - The PROFINET interface with PROFIsafe profile enables data to be transferred safely between the PSSuniversal and a master controller.
  - If a fault occurs, the module switches off the connected failsafe output modules.
  - The station address is set via a DIP switch.

All the project data is stored in the head module. The project data can also be stored on a chip card.

The station address of a PSSu is set via the “F-ADDRESS” DIP switches. The DIP switches are binary coded. Permitted station addresses are in the range 0_D ... 511_D.

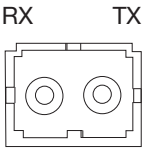
Head modules
PSSu H F PN o

A station address is set via a combination of the relevant binary coded switches:

"F-ADDRESS" DIP switch	Meaning		Example
Switch designation	**OFF**	**ON**	**Station address 52_D**
256	0	256_D	
128	0	128_D	
64	0	64_D	
32	0	32_D	
16	0	16_D	
8	0	8_D	
4	0	4_D	
2	0	2_D	
1	0	1_D	

Interfaces

Interface configuration

X1, X2		
Female SC-RJ-connector in accordance with the guidelines of the PROFINET User Group (PNO)	100Base-FX POF-FO	

Head modules
PSSu H F PN o

Technical Details

General	
Approvals	**CE, EAC (Eurasian), TÜV, cULus Listed**
Application range	**Standard/failsafe**
Module's device code	**0228h**
Electrical data	
Internal supply voltage (module supply)	
Module's power consumption	**4 W**
Max. power dissipation of module	**4 W**
PROFINET interface	
Number	**2**
Input device	**64 Byte**
Output	**64 Byte**
Transmission rates	**100 MBit/s**
Certification	**PNO**
Manufacturer’s ID	**092Fh**
Connection	**SC-RJ**
Device type	**Slave**
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	
Temperature range	**0 - 60 °C**
Storage temperature	
Temperature range	**-25 - 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 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 150 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**

Head modules
PSSu H F PN o

Environmental data	
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**25g**
Duration	**6 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
Housing	**IP20**
Mounting area (e.g. control cabinet)	**IP54**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Dimensions	
Height	**128,4 mm**
Width	**75,2 mm**
Depth	**79,4 mm**
Weight	**197 g**

Where standards are undated, the 2012-04 latest editions shall apply.

Order reference

Product type	Features	Order No.
PSSu H F PN o	Head module with optical PROFIsafe interface, base type	312 042

Head modules
PSSu H S PN

Overview

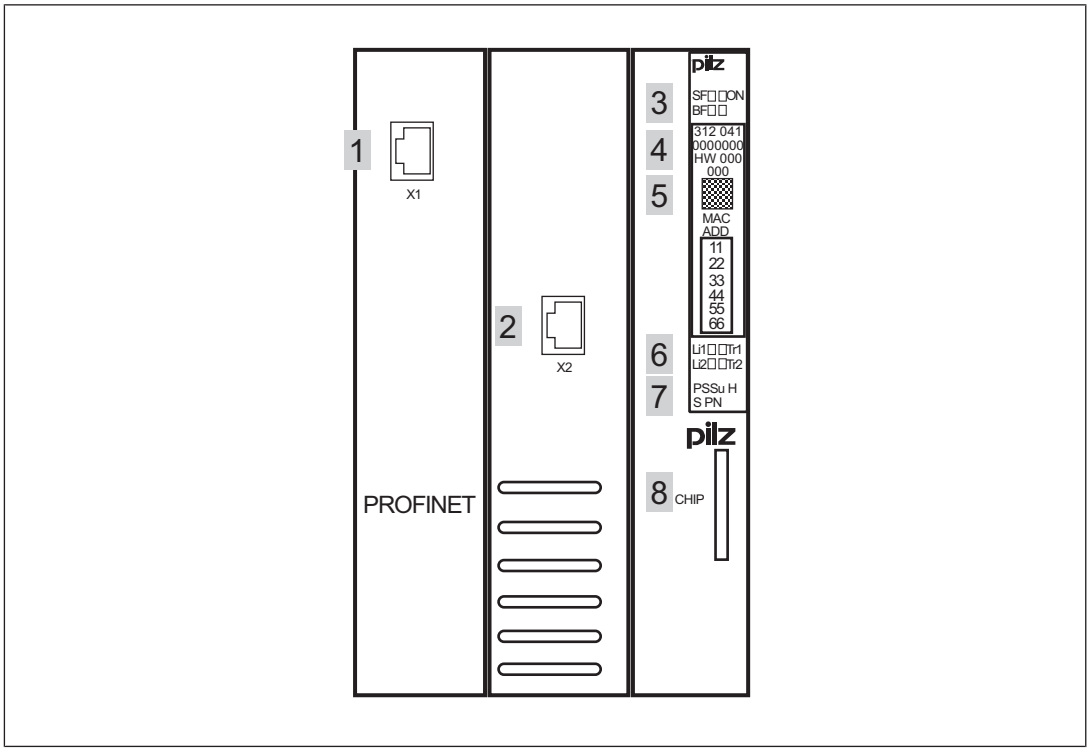
Module features

The product has the following features:

- **PROFINET** interface
- LEDs for:
  - System status
  - **PROFINET** status
- **PROFIenergy** status
- IRT/RT
- MRP
- Shared Device
- PROFIenergy in conjunction with all digital output modules plus the following input modules:
  - PSSu E S 4DI-D
  - PSSu E S PD-D
- Electronic modules that can be used for input/output:
  - All standard modules (PSSu E S...)

Head modules
PSSu H S PN

Front view



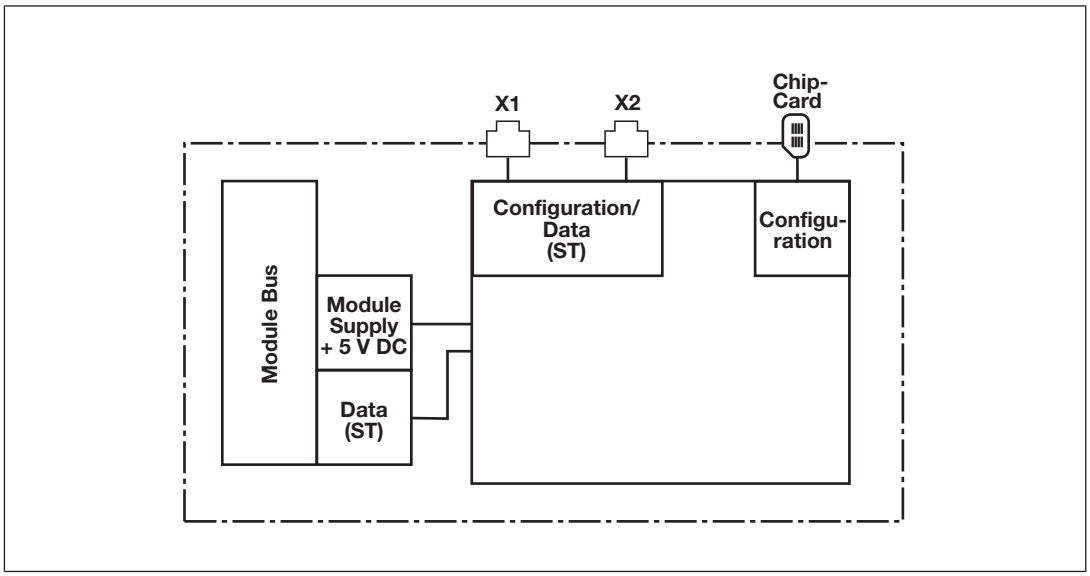
Legend:

- 1: PROFINET interface X1
- 2: PROFINET interface X2
- 3 LEDs for PROFINET diagnostics
- 4: Labelling strip with:
  - Order number
  - Serial number
  - Hardware version number
- 5: Field for 2D code
- 6: LEDs for diagnostics on the PROFINET connection
- 7: Description of head module
- 8: Chip card slot

Head modules
PSSu H S PN

Function description

Block diagram



Supply voltage

Module supply

- The module supply provides the module with voltage.

Integrated protection mechanisms

The module has the following protection mechanisms:

- Potentially isolated PROFINET IO interface
- When the PSSu E F PS1(-T) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

Projects

To configure the head module you will need the STEP 7 software from Siemens and the PSSuniversal Configurator. The PSSuniversal Configurator can be called up directly from STEP 7.

There are two options for downloading a project to the head module:

- Using the PSSuniversal Configurator
  - Connect the head module to the programming device.
  - If the head module contains a chip card, the current project will always be written to the chip card as a PROFINET project chip card. A chip card is not required in order to save the project in the head module.

- Using the PROFINET project chip card
  - If the head module already contains a project, you will need to delete this project first (see below).
  - Create a PROFINET project chip card using the PSSuniversal Configurator.
  - Insert the PROFINET project chip card into the chip card slot on the head module and start up the head module.

You will need a PROFINET reset chip card in order to delete a project on the head module.

- Create a PROFINET reset chip card using the PSSuniversal Configurator.
- Insert the PROFINET reset chip card into the head module and start up the head module.
- The PROFINET reset chip card deletes the existing project on the head module.
  - The PROFINET reset chip card does not download a project to the head module.

Further information on this procedure is available in the PSSuniversal Configurator's online help.

PROFINET

Decentralised input/output

- The head module enables the PSSuniversal to be used as a modular, decentralised input/output module.
- The head module receives signals from a higher level control system; it processes these signals and passes them on to the connected input/output modules.
- The head module receives signals from the connected input/output modules; it processes these signals and passes them on to a higher level control system.

Interfaces

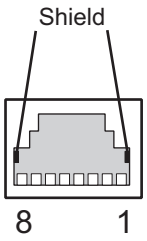
- The PROFINET interface enables standard data to be exchanged with a higher level control system.

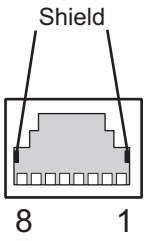
All the project data is stored in the head module. The project data can also be stored on a chip card.

Head modules
PSSu H S PN

Interfaces

Interface configuration

X1		
Female RJ45 connector in accordance with the guidelines of the PROFINET User Group (PNO)	8-core CAT-5 Ethernet patch cable	

X2		
Female RJ45 connector in accordance with the guidelines of the PROFINET User Group (PNO)	8-core CAT-5 Ethernet patch cable	

Technical Details

General	
Approvals	**CE, cULus Listed**
Application range	**Standard**
Module's device code	**0206h**
Electrical data	
Internal supply voltage (module supply)	
Module's power consumption	**2,50 W**
Max. power dissipation of module	**2,50 W**
PROFINET interface	
Input device	**64 Byte**
Output	**64 Byte**
Transmission rates	**100 MBit/s**
Certification	**PNO**
Manufacturer’s ID	**092Fh**
Connection	**RJ45**
Device type	**Slave**

Head modules
PSSu H S PN

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	
Temperature range	**0 - 60 °C**
Storage temperature	
Temperature range	**-25 - 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 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**25g**
Duration	**6 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
Mounting area (e.g. control cabinet)	**IP54**
Housing	**IP20**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**

Head modules
PSSu H S PN

Mechanical data	
Dimensions	
Height	**128,4 mm**
Width	**75,2 mm**
Depth	**79,4 mm**
Weight	**170 g**

Where standards are undated, the 2015-03 latest editions shall apply.

Order reference

Product type	Features	Order No.
PSSu H S PN	Head module with PROFINET interface, base type	312 041

Head modules
PSSu H FS SN SD

Overview

Module features

The head module belongs to the performance class "Decentralised system PSSu I/O". It can be used to connect a PSSu system to SafetyNET p. The head module has the following features:

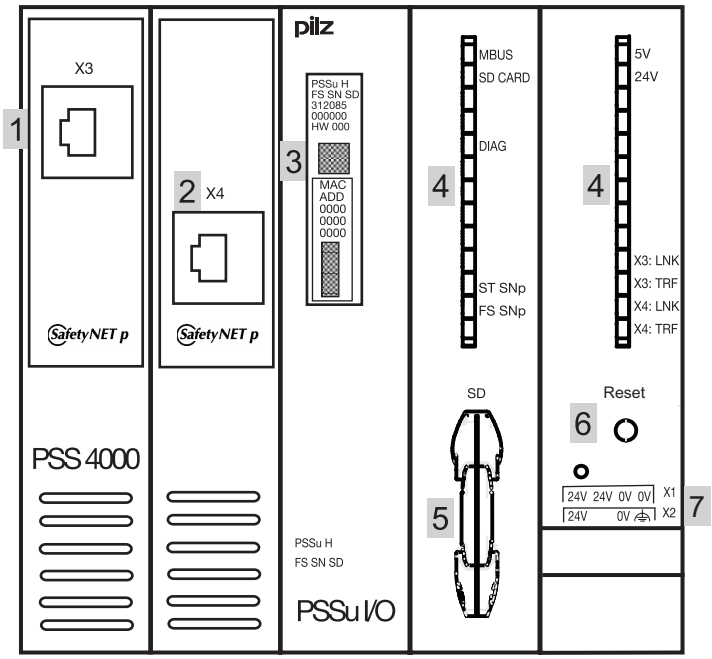
- 2 free switch ports for connection to SafetyNET p
- Standard module bus for standard I/O modules
- Safety module bus for safety I/O modules
- SD card used to store the device project and the naming data
- Reset pushbutton
  - For warm reset
  - To transfer the naming data and/or device project from the SD card to the device memory
- Supply voltage
  - Integrated supply voltage for periphery supply and module supply
  - Module supply is buffered for 20 ms if the supply voltage is interrupted
  - Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- Status LEDs
- T-type:

  PSSu H FS SN SD-T: for increased environmental requirements
- R-type:

  PSSu H FS SN SD-R: for railway applications

Head modules
PSSu H FS SN SD

Front view

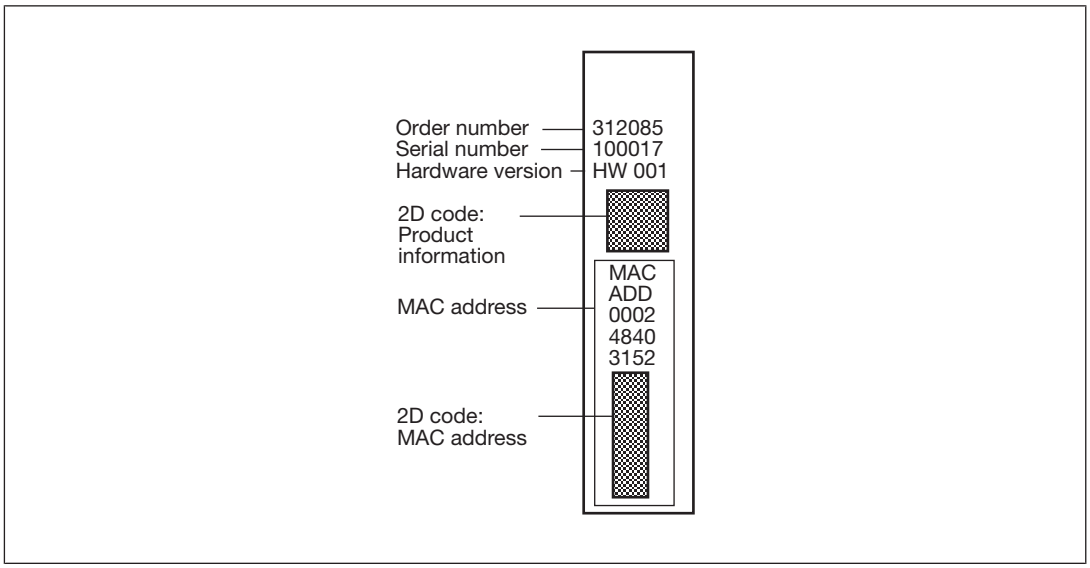


Legend:

- 1: SafetyNET p interface
- 2: SafetyNET p interface
- 3: Labelling strip (see below for details)
- 4: Status LEDs
- 5: SD card
- 6: Reset pushbutton
- 7: Supply voltage connection (module and periphery supply)

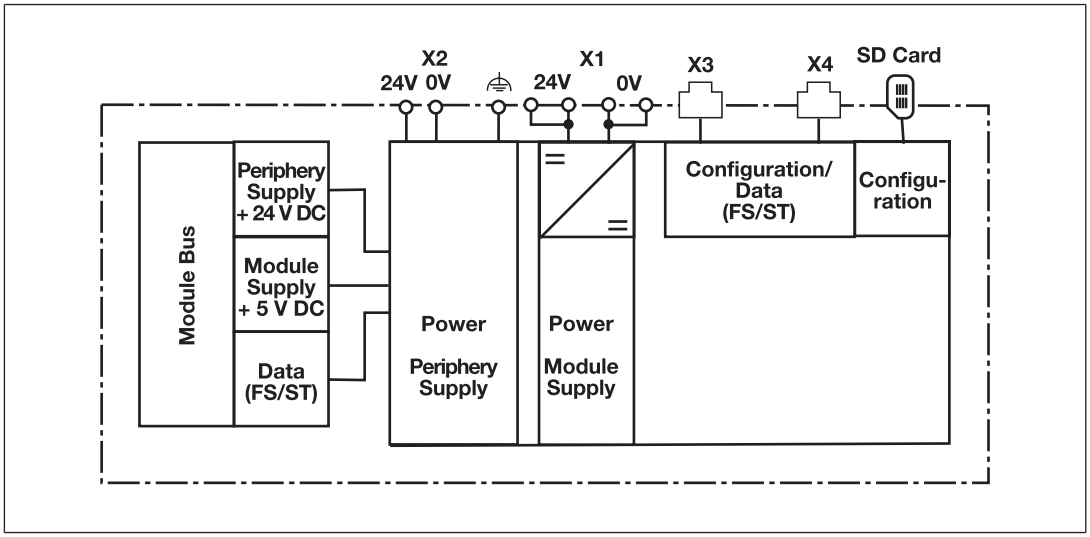
Head modules
PSSu H FS SN SD

The labelling strip contains the following information:



Function description

Block diagram



Head modules
PSSu H FS SN SD

Supply voltage

The product provides the module supply and periphery supply for the modules on the module bus:

- Module supply

  Supply voltage for subsequent module (right-hand side)

- Periphery supply

  Supply voltage for sensors, actuators and test pulses

When the supply voltage is fed in separately, the module supply and periphery supply are galvanically isolated. If galvanic isolation is not required, a common power supply may be used for the periphery supply and module supply.

Ensure you comply with the current load capacity of the module and periphery supply (see "Technical Details"). If the current load is higher, an additional supply voltage module is required to refresh the module supply and periphery supply.

- Module supply

  The current load is the total current consumption of all the electronic and compact modules.

  The module supply does not automatically switch off if values exceed or drop below their limits. However, the "5 V" LED will light and a message will be entered in the diagnostic list.

- Periphery supply

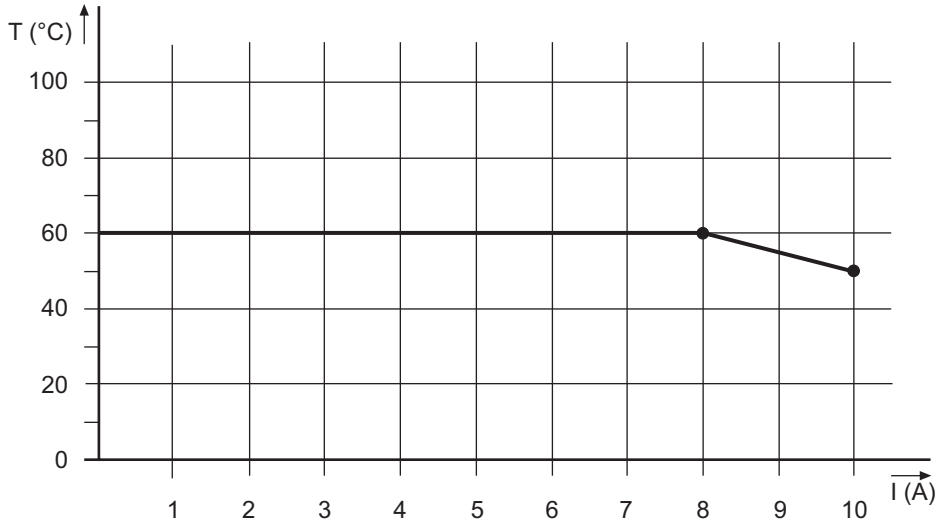
  The current load is the total current consumption of the sensors, actuators and test pulses supplied via the input/output modules.

  The periphery supply does not automatically switch off if values exceed or drop below their limits. However, the "24 V" LED will light and a message will be entered in the diagnostic list.

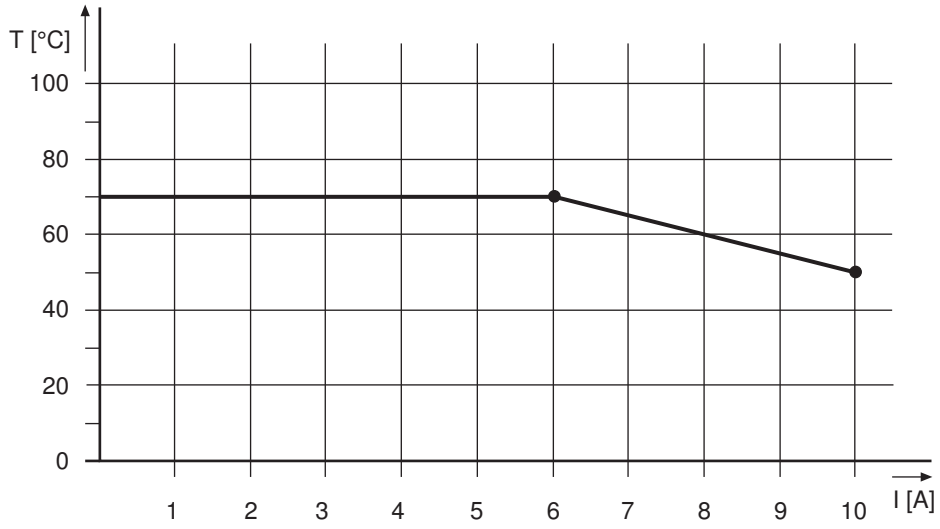
  Please refer to the derating diagrams.

Head modules
PSSu H FS SN SD

PSSu H FS SN SD: Derating diagram for periphery supply: Temperature T dependent on load current I

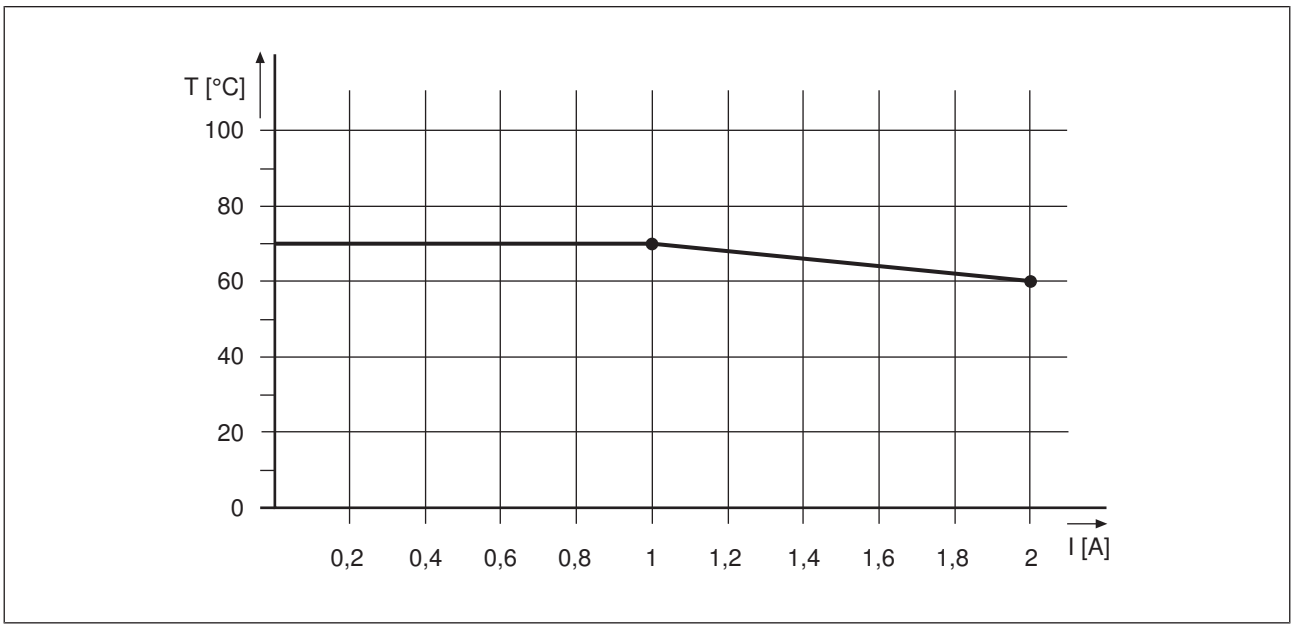


PSSu H FS SN SD(-T)(-R): Derating diagram for periphery supply: Permitted ambient temperature T dependent on load current I



Head modules
PSSu H FS SN SD

PSSu H FS SN SD(-T)(-R): Derating diagram for infeed for module supply: Permitted ambient temperature T dependent on load current I



Integrated protection mechanisms

The module has the following protection mechanisms:

- Multi-channel diverse processor section
- Cyclical self tests
- Potentially isolated **SafetyNET p** interface
- Infeed for module supply
  - Polarity protection
  - Voltage monitoring
  - Transient voltage limitation
  - 20 ms voltage buffer if the supply voltage is interrupted
- Module supply
  - Short circuit-proof
- Periphery supply
  - Voltage monitoring (exceeding upper/lower limit)

Head modules
PSSu H FS SN SD

SafetyNET p

Functions

- The SafetyNET p interface enables I/Os to be controlled by means of a higher level control system (e.g. PSSu PLC).
- The head module receives signals from a higher level control system and forwards them to the connected input/output modules.
- The head module receives signals from the connected input/output modules and forwards them to a higher level control system.
- If a fault occurs, the module switches the connected failsafe outputs to a safe condition.

MAC address

- The MAC address is a factory-set default. It can found on the labelling strip on the front of the module.

Decentralised inputs and outputs

The head module belongs to the performance class "Decentralised system PSSu I/O". It enables the PSSuniversal to be used as a modular, decentralised input/output module:

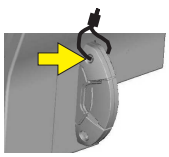
- PSSu system without control functionality
- Electronic modules and/or compact modules must be added to the head module
- I/Os are controlled via SafetyNET p by means of a control system (e.g. PSSu PLC)

SD card

The SD card has the following functions:

- The SD card is used to store the naming data and the device project; see PSS 4000 System Description.
- The SD card is part of the safety concept on PSS 4000. If the SD card is missing or has been swapped, the next time the PSSu system is booted it will be unable to achieve the operating status "PSSu System in RUN condition without error". The SD card has a locking mechanism, which protects it from being removed from the card holder unintentionally. The SD card can also be sealed to protect it from manipulation, whether accidental or intentional.

Sealing the SD card for additional protection:



Head modules
PSSu H FS SN SD

Reset button

The "Reset" pushbutton on the head module has various functions:

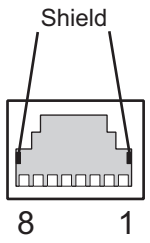
- Perform a warm reset for the PSSu system.

  The reset pushbutton can be used to perform a warm reset for the PSSu system.
- Transfer the naming data and/or device project from the SD card (deliberate operator action to transfer the naming data and/or device project from the SD card to the device memory).

Interfaces

Interface configuration

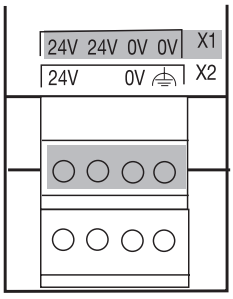
SafetyNET p is an Ethernet interface. Further information can be found in the System Description PSS 4000.

SafetyNET p	Assignment	
RJ45 female connector	1: TD+ 2: TD- 3: RD+ 4: n.c. 5: n.c. 6: RD- 7: n.c. 8: n.c.	

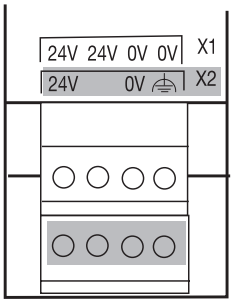
- n.c. = not connected

Wiring

Terminal configuration

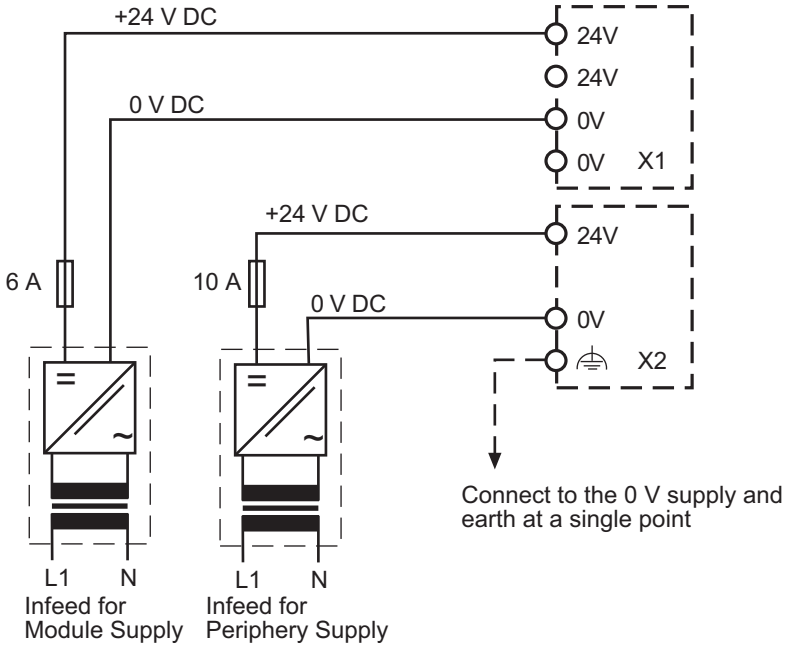
Module supply	Terminal configuration		X1
4-pin female connector	24V	+24 V infeed for module supply	
	0V	0 V infeed for module supply	

Head modules
PSSu H FS SN SD

Periphery supply	Terminal configuration		X2
4-pin female connector	24V:	+24 V infeed for periphery supply	
	0V	0 V infeed for periphery supply	
	⏚	Functional earth	

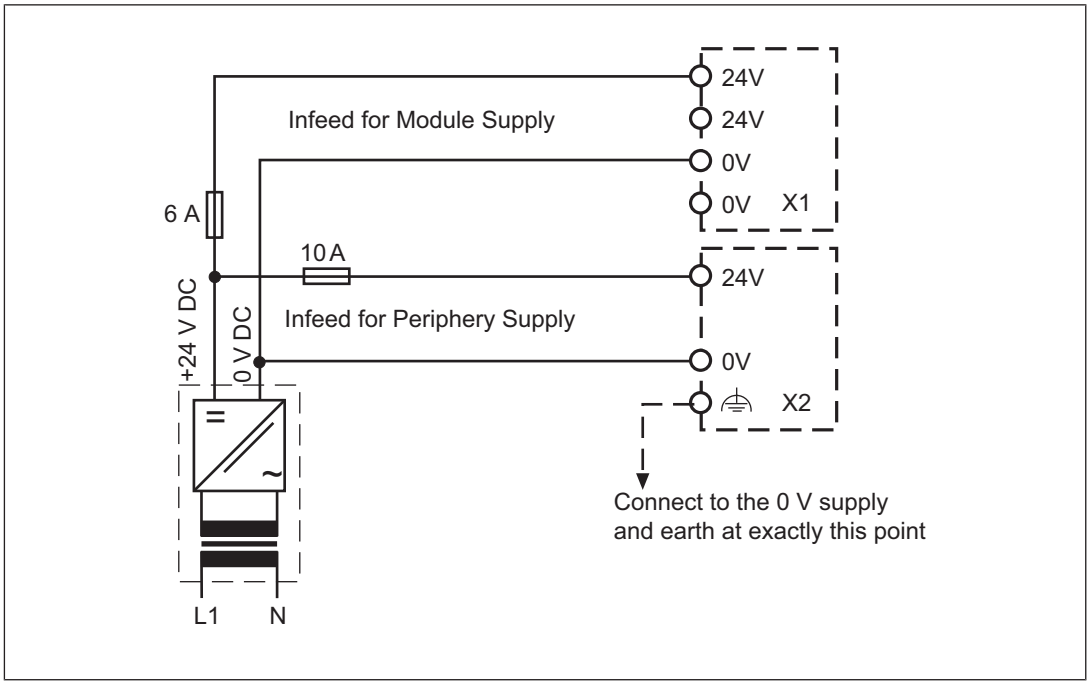
Connecting the module

Separate power supplies for module supply and periphery supply:



Head modules
PSSu H FS SN SD

Common power supply for module supply and periphery supply:



Technical details

General	312085	314085	315085
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, EAC (Eurasian), TÜV, cULus Listed**	**CE, TÜV**
Application range	**Standard/failsafe**	**Standard/failsafe**	**Standard/failsafe**
System sections	**312085**	**314085**	**315085**
ST resource	**No**	**No**	**No**
FS resource	**No**	**No**	**No**
ST module bus	**yes**	**yes**	**yes**
FS module bus	**yes**	**yes**	**yes**
ST SNp interface	**yes**	**yes**	**yes**
FS SNp interface	**yes**	**yes**	**yes**
PROFIBUS-DP Slave	**No**	**No**	**No**
PROFINET IO DEVICE	**No**	**No**	–
IP connections	**No**	**No**	**No**
Diagnostic Server	**No**	**No**	**No**
OPC Server	**No**	**No**	**No**
Programming	**312085**	**314085**	**315085**
IEC 61131 programming	**No**	**No**	**No**

Head modules
PSSu H FS SN SD

Programming	312085	314085	315085
Multi programming	**No**	**No**	**No**
Non-volatile variables	**No**	**No**	**No**
Electrical data	**312085**	**314085**	**315085**
Supply voltage			
for	**Module supply**	**Module supply**	**Module supply**
Voltage	**24 V**	**24 V**	**24 V**
Kind	**DC**	**DC**	–
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**1 A**	**1 A**	**1 A**
Output of external power supply (DC)	**16 W**	**16 W**	**16 W**
Supply voltage			
for	**Periphery supply**	**Periphery supply**	**Periphery supply**
Voltage	**24 V**	**24 V**	**24 V**
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**10 A**	**10 A**	**10 A**
Potential isolation between module supply and periphery supply	**3050 V**	**3050 V**	**3050 V**
Internal supply voltage (module supply)			
Output voltage	**int. system**	**int. system**	**int. system**
Voltage	**5 V**	**5 V**	**5 V**
Voltage tolerance	**-2 %/+3 %**	**-2 %/+3 %**	**-2 %/+3 %**
Potential isolation	**3050 V**	**3050 V**	**3050 V**
Current load capacity	**2 A**	**2 A**	**2 A**
Buffer in the case of supply interruptions in accordance with	**EN 61131-2, EN 61496-1**	**EN 61131-2, EN 61496-1**	**EN 61131-2, EN 61496-1**
Short circuit-proof	**yes**	**yes**	**yes**
CPU	**312085**	**314085**	**315085**
Real-time clock for time and date functions			
Resolution	**1 s**	**1 s**	**1 s**
Deviation	**+/- 10s/day**	**+/- 10s/day**	**+/- 10s/day**
Buffer time	**10 days**	**10 days**	**10 days**

Head modules
PSSu H FS SN SD

CPU	312085	314085	315085
Working memory (RAM)	**64 MB**	**64 MB**	**64 MB**
Removable data medium	**312085**	**314085**	**315085**
Type	**SD card**	**SD card**	**SD card**
SafetyNET p interface	**312085**	**314085**	**315085**
Number	**2**	**2**	**2**
IP address (automatically off)	**169.254.X.Y**	**169.254.X.Y**	**169.254.X.Y**
Connection	**RJ45**	**RJ45**	**RJ45**
Transmission rates	**100 MBit/s**	**100 MBit/s**	**100 MBit/s**
Set via	**Automatic**	**Automatic**	**Automatic**
Max. number of ST-Tx and ST-Rx connections	**64**	**64**	**64**
Max. number of FS-Tx and FS-Rx connections	**64**	**64**	**64**
Cycle time (t_SNp RTFN)	**2 ... 60 000 ms**	**2 ... 60 000 ms**	**2 ... 60 000 ms**
Max. number of variables with elementary ST data types	**5000**	**5000**	**5000**
Max. number of variables with elementary FS data types	**4000**	**4000**	**4000**
Environmental data	**312085**	**314085**	**315085**
Application site			
In accordance with the standard	–	–	**EN 50125-3**
Application site	–	–	**Track area (1 m - 3 m)**
In accordance with the standard	–	–	**EN 61373**
Application site	–	–	**Category 1, Class A + B**
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**	**EN 50125-1, EN 50125-3, EN 50155, EN 60068-2-1, EN 60068-2-14, EN 60068-2-2**

Head modules
PSSu H FS SN SD

Environmental data	312085	314085	315085
Ambient temperature			
In accordance with the standard	–	–	**EN 50155**
Temperature range	**0 - 60 °C**	**-40 - 70 °C**	**-40 - 70 °C**
In accordance with the standard	–	–	**EN 50125-1**
Temperature range	–	–	**-40 ... +70 °C**
In accordance with the standard	–	–	**EN 50125-3**
Temperature range	–	–	**-40 ... +70 °C**
Storage temperature			
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**	–
Climatic suitability			
In accordance with the standard	**EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**	–
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	–
Condensation during operation	**Not permitted**	**Short-term**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**	**2000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 50125-3**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**5 - 2000 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	–
Acceleration	**1g**	**1g**	**0,23g**
Broadband noise			
In accordance with the standard	–	**EN 60068-2-64**	**EN 61373**
Frequency	–	**5 - 500 Hz**	**5 - 150 Hz**
Acceleration	–	**1,9grms**	**0,79 g RMS**

Head modules
PSSu H FS SN SD

Environmental data	312085	314085	315085
Shock stress			
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 50125-3**
Number of shocks	**6**	**6**	**20**
Acceleration	**15g**	**15g**	**2g**
Duration	**11 ms**	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 61373**
Number of shocks	**1000**	**1000**	**20**
Acceleration	**10g**	**10g**	**5g**
Duration	**16 ms**	**16 ms**	**30 ms**
Supply interruptions			
In accordance with the standard	–	–	**EN 50155**
Class	–	–	**S2, C1, C2**
Airgap creepage			
In accordance with the standard	**EN 60664-1**	**EN 60664-1**	**EN 50124-1**
Overvoltage category	**II**	**II**	**OV2**
Pollution degree	**2**	**2**	**PD1**
Protection type			
In accordance with the standard	–	–	**EN 60529**
Housing	**IP20**	**IP20**	**IP20**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP51**
Mechanical data	**312085**	**314085**	**315085**
Material			
Bottom	**PC**	**PC**	**PC**
Connection type	**Spring-loaded terminal, screw terminal**	**Spring-loaded terminal, screw terminal**	**Spring-loaded terminal, screw terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**

Head modules
PSSu H FS SN SD

Mechanical data	312085	314085	315085
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	**0,5 Nm**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 2,5 mm², 24 - 12 AWG**	**0,2 - 2,5 mm², 24 - 12 AWG**	**0,2 - 2,5 mm², 24 - 12 AWG**
Stripping length with spring-loaded terminals	**9 mm**	**9 mm**	**9 mm**
Dimensions			
Height	**125,6 mm**	**125,6 mm**	**125,6 mm**
Width	**130 mm**	**130 mm**	**130 mm**
Depth	**83,7 mm**	**83,7 mm**	**83,7 mm**
Weight	**365 g**	**378 g**	**350 g**

Where standards are undated, the 2009-07 latest editions shall apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**4,14E-09**	**SIL 3**	**3,51E-05**	**20**

If the module is operated at an ambient temperature above 60° C, the values stated in the table for PFH_D and PFD will need to be doubled when a safety function is calculated.

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

Head modules
PSSu H FS SN SD

Order reference

Product type	Features	Order no.
PSSu H FS SN SD	Head module with SafetyNET p interface, base type	312 085
PSSu H FS SN SD-T	Head module with SafetyNET p interface, T-type	314 085
PSSu H FS SN SD-R	Head module with SafetyNET p interface, R-type	315 085

Head modules
PSSu H PLC1 FS SN SD

Overview

Module features

The head module belongs to the performance class "Control system PSSu PLC". It can be used to connect a PSSu system to SafetyNET p or for non-safety-related applications it can be incorporated into a PROFINET project as an IO device.

The head module has the following features:

- 2 free switch ports for connection to SafetyNET p
- External connections:
  - Modbus/TCP
  - Raw UDP
  - Raw TCP
  - EtherNet/IP
  - PROFINET
- One FS resource and one ST resource
- SD card used to store the device project and the naming data
- Reset button
  - For warm reset
  - To transfer the naming data and/or device project from the SD card to the device memory
- Supply voltage
  - Integrated supply voltage for periphery supply and module supply
  - Module supply is buffered for 20 ms if the supply voltage is interrupted
  - Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- Status LEDs

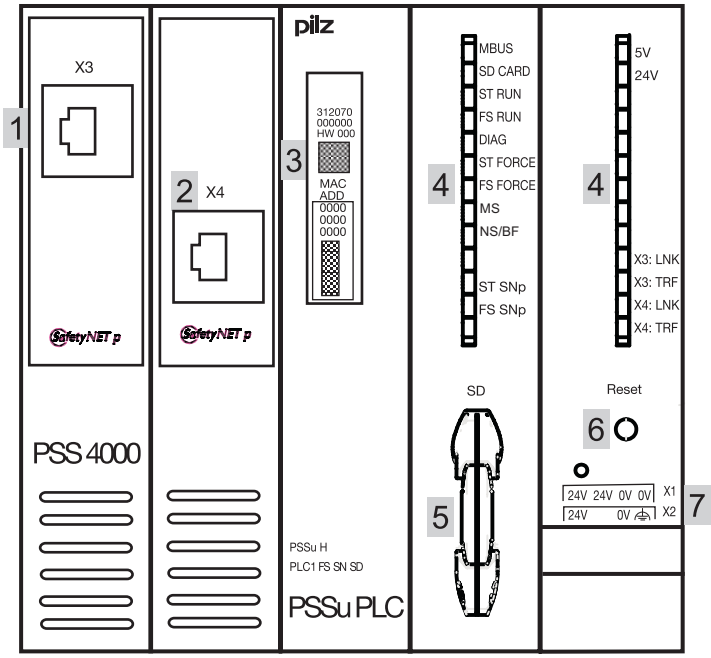
Head modules
PSSu H PLC1 FS SN SD

- Supports FS and ST modules
- T-type:

  PSSu H PLC1 FS SN SD-T: for increased environmental requirements
- R-type:

  PSSu H PLC1 FS SN SD-R: for railway applications

Front view

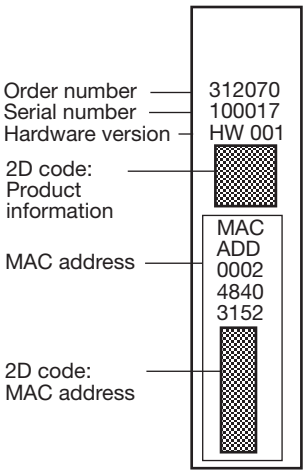


Legend:

- 1: Ethernet Port
- 2: Ethernet Port
- 3: Labelling strip (see below for details)
- 4: Status LEDs
- 5: SD card
- 6: Reset pushbutton
- 7: Supply voltage connection (module and periphery supply)

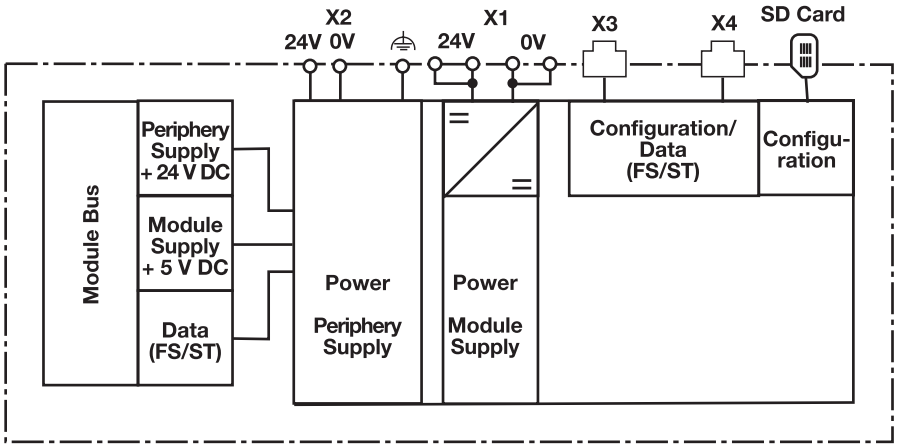
Head modules
PSSu H PLC1 FS SN SD

The labelling strip contains the following information:



Function description

Block diagram



Head modules
PSSu H PLC1 FS SN SD

Control system

The head module is a programmable logic controller (PLC), which can be used in safety-related and non-safety-related applications. The control system has memory areas for the operating system, the data and the device project with the user program.

The head module has a non-volatile memory for the non-volatile variables.

User programs can be created in IEC 61131 programming and/or Multi programming.

For safety-related applications, the processor section is designed with multi-channel diversity.

The control system communicates with the input and output modules via the local module bus and with the decentralised input and output modules via SafetyNET p or for non-safety-related applications as PROFINET IO-DEVICE. LEDs provide information on the status of the control system and indicate any errors.

Supply voltage

The product provides the module supply and periphery supply for the modules on the module bus:

- Module supply

  Supply voltage for subsequent module (right-hand side)
- Periphery supply

  Supply voltage for sensors, actuators and test pulses

When the supply voltage is fed in separately, the module supply and periphery supply are galvanically isolated. If galvanic isolation is not required, a common power supply may be used for the periphery supply and module supply.

Ensure you comply with the current load capacity of the module and periphery supply (see "Technical Details"). If the current load is higher, an additional supply voltage module is required to refresh the module supply and periphery supply.

- Module supply

  The current load is the total current consumption of all the electronic and compact modules.

  The module supply does not automatically switch off if values exceed or drop below their limits. However, the "5 V" LED will light and a message will be entered in the diagnostic list.
- Periphery supply

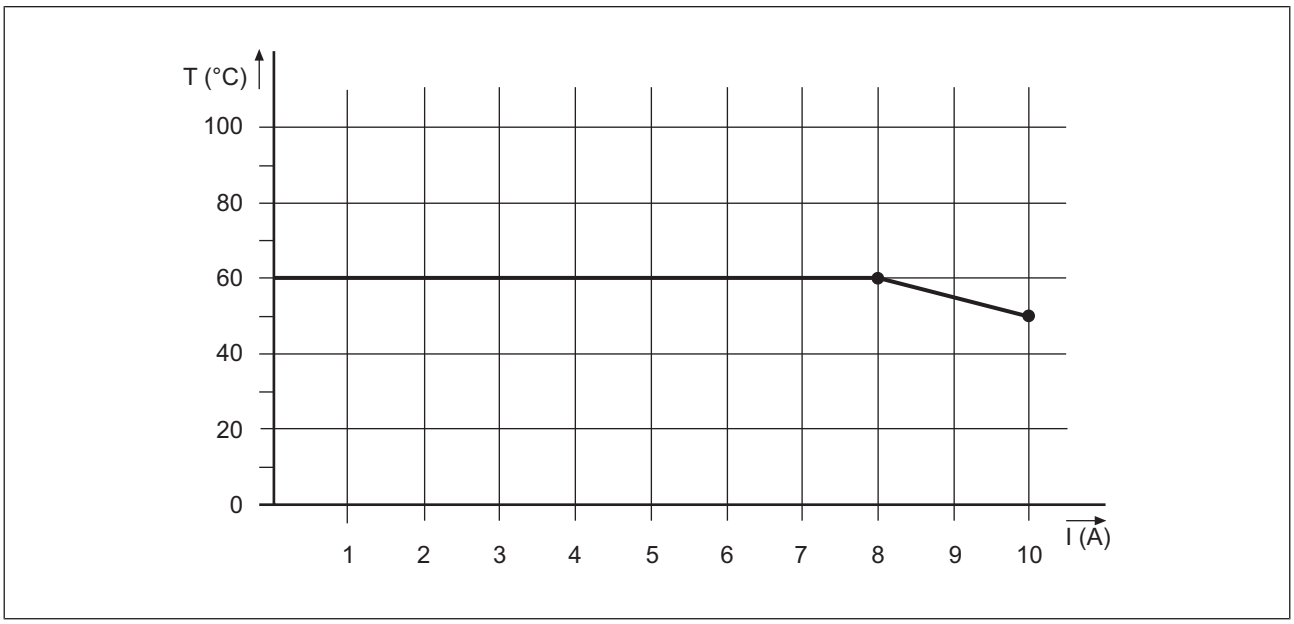
  The current load is the total current consumption of the sensors, actuators and test pulses supplied via the input/output modules.

  The periphery supply does not automatically switch off if values exceed or drop below their limits. However, the "24 V" LED will light and a message will be entered in the diagnostic list.

  Please refer to the derating diagrams.

Head modules
PSSu H PLC1 FS SN SD

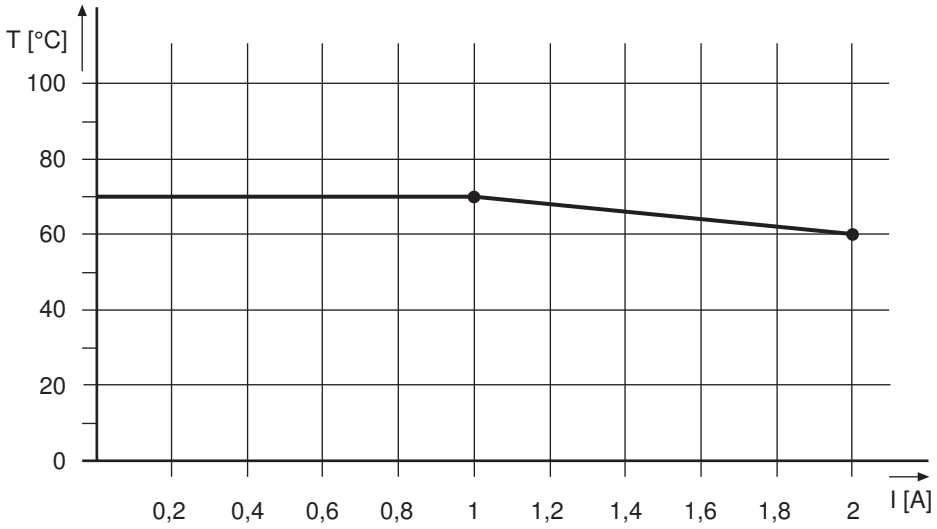
PSSu H PLC1 FS SN SD: Derating diagram for periphery supply: Temperature T dependent on load current I



PSSu H PLC1 FS SN SD(-T)(-R): Derating diagram for periphery supply: Permitted ambient temperature T dependent on load current I

Head modules
PSSu H PLC1 FS SN SD

PSSu H PLC1 FS SN SD(-T)(-R): Derating diagram for infeed for module supply: Permitted ambient temperature T dependent on load current I



Integrated protection mechanisms

The module has the following protection mechanisms:

- Multi-channel diverse processor section
- Cyclical self tests
- Potentially isolated **SafetyNET p** interface
- Infeed for module supply
  - Polarity protection
  - Voltage monitoring
  - Transient voltage limitation
  - 20 ms voltage buffer if the supply voltage is interrupted
- Module supply
  - Short circuit-proof
- Periphery supply
  - Voltage monitoring (exceeding upper/lower limit)

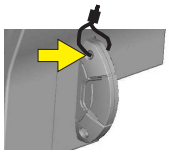
Head modules
PSSu H PLC1 FS SN SD

SD card

The SD card has the following functions:

- The SD card is used to store the naming data and the device project; see PSS 4000 System Description.
- The SD card is part of the safety concept on PSS 4000. If the SD card is missing or has been swapped, the next time the PSSu system is booted it will be unable to achieve the operating status "PSSu System in RUN condition without error". The SD card has a locking mechanism, which protects it from being removed from the card holder unintentionally. The SD card can also be sealed to protect it from manipulation, whether accidental or intentional.

Sealing the SD card for additional protection:



Reset button

The "Reset" pushbutton on the head module has various functions:

- Perform a warm reset for the PSSu system.

  The reset pushbutton can be used to perform a warm reset for the PSSu system.
- Transfer the naming data and/or device project from the SD card (deliberate operator action to transfer the naming data and/or device project from the SD card to the device memory).

Head modules
PSSu H PLC1 FS SN SD

SafetyNET p

Functions

- The SafetyNET p interface enables safety-related and non-safety-related data transfer between the PSSu system and other network subscribers.
- The head module receives signals from other network subscribers; it processes these signals in the user program and passes them on to the connected input/output modules.
- The head module receives signals from the connected input/output modules; it processes these signals in the user program and passes them on to the other network subscribers.
- If a fault occurs, the module switches the connected failsafe outputs to a safe condition.

MAC address

- The MAC address is a factory-set default. It can found on the labelling strip on the front of the module.

External communication

For non-safety-related applications the following IP connections are supported:

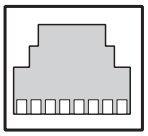
- Modbus/TCP
- Raw UDP
- Raw TCP

For non-safety-related applications the following fieldbuses are supported:

- PROFINET
- EtherNet/IP

Detailed information is available in the "System description PSS 4000".

Interfaces

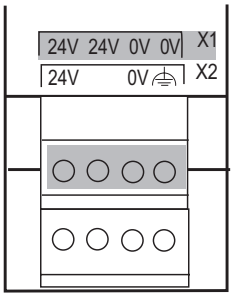
RJ45 socket 8-pin	PIN	Standard
	1	TD+ (Transmit+)
	2	TD- (Transmit-)
	3	RD+ (Receive+)
	4	n.c.
	5	n.c.
	6	RD- (Receive-)
	7	n.c.
	8	n.c.

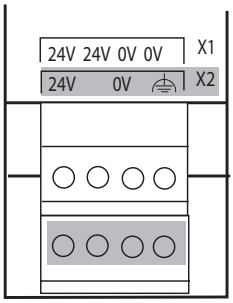
n.c.: Not connected

Head modules
PSSu H PLC1 FS SN SD

Wiring

Terminal configuration

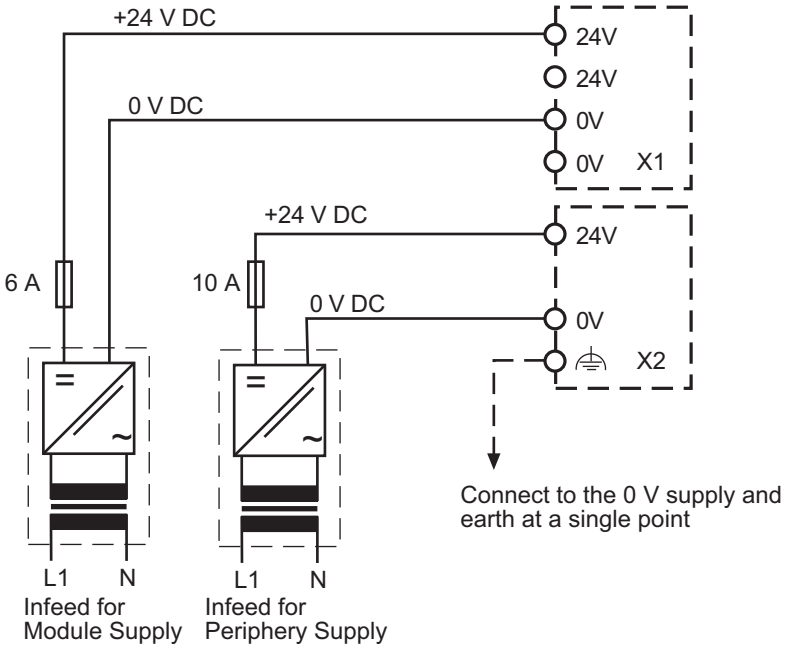
Module supply	Terminal configuration		X1
4-pin female connector	24V	+24 V infeed for module supply	
	0V	0 V infeed for module supply	

Periphery supply	Terminal configuration		X2
4-pin female connector	24V:	+24 V infeed for periphery supply	
	0V	0 V infeed for periphery supply	
	⏚	Functional earth	

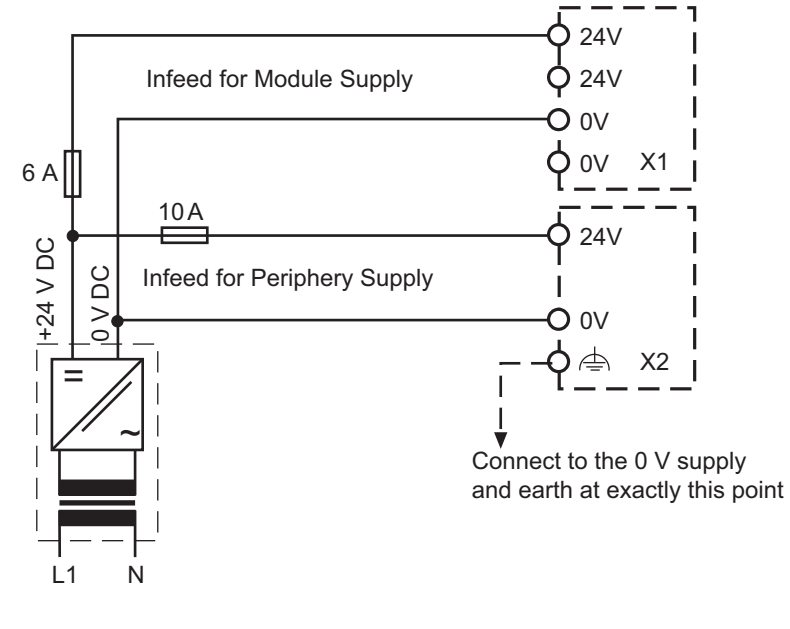
Head modules
PSSu H PLC1 FS SN SD

Connecting the module

Separate power supplies for module supply and periphery supply:



Common power supply for module supply and periphery supply:



Head modules
PSSu H PLC1 FS SN SD

Technical Details

General	312070	314070	315070
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, EAC (Eurasian), TÜV, cULus Listed**	**CE, TÜV**
Application range	**Standard/failsafe**	**Standard/failsafe**	**Standard/failsafe**
System sections	**312070**	**314070**	**315070**
ST resource	**yes**	**yes**	**yes**
FS resource	**yes**	**yes**	**yes**
ST module bus	**yes**	**yes**	**yes**
FS module bus	**yes**	**yes**	**yes**
ST SNp interface	**yes**	**yes**	**yes**
FS SNp interface	**yes**	**yes**	**yes**
PROFIBUS-DP Slave	**No**	**No**	**No**
PROFINET IO DEVICE	**yes**	**yes**	–
IP connections	**yes**	**yes**	**yes**
EtherNet/IP adapter	**yes**	**yes**	**yes**
Diagnostic Server	**No**	**No**	**No**
OPC Server	**No**	**No**	**No**
Programming	**312070**	**314070**	**315070**
IEC 61131 programming	**yes**	**yes**	**yes**
Multi programming	**yes**	**yes**	**yes**
Non-volatile variables	**yes**	**yes**	**yes**
Electrical data	**312070**	**314070**	**315070**
Supply voltage			
for	**Module supply**	**Module supply**	**Module supply**
Voltage	**24 V**	**24 V**	**24 V**
Kind	**DC**	**DC**	–
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**1 A**	**1 A**	**1 A**
Output of external power supply (DC)	**16 W**	**16 W**	**16 W**

Head modules
PSSu H PLC1 FS SN SD

Electrical data	312070	314070	315070
Supply voltage			
for	**Periphery supply**	**Periphery supply**	**Periphery supply**
Voltage	**24 V**	**24 V**	**24 V**
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**10 A**	**10 A**	**10 A**
Potential isolation between module supply and periphery supply	**3050 V**	**3050 V**	**3050 V**
Internal supply voltage (module supply)			
Output voltage	**int. system**	**int. system**	**int. system**
Voltage	**5 V**	**5 V**	**5 V**
Voltage tolerance	**-2 %/+3 %**	**-2 %/+3 %**	**-2 %/+3 %**
Potential isolation	**3050 V**	**3050 V**	**3050 V**
Current load capacity	**2 A**	**2 A**	**2 A**
Buffer in the case of supply interruptions in accordance with	**EN 61131-2, EN 61496-1**	**EN 61131-2, EN 61496-1**	**EN 61131-2, EN 61496-1**
Short circuit-proof	**yes**	**yes**	**yes**
CPU	**312070**	**314070**	**315070**
Real-time clock for time and date functions			
Resolution	**1 s**	**1 s**	**1 s**
Deviation	**+/- 10s/day**	**+/- 10s/day**	**+/- 10s/day**
Buffer time	**10 days**	–	**10 days**
Max. number of FS tasks	**9**	**9**	**9**
Max. number of ST tasks	**9**	**9**	**9**
Max. number of variables with elementary data types on the FS resource	**10.000**	**10.000**	**10.000**
Max. number of variables with elementary data types on the ST resource	**10.000**	**10.000**	**10.000**
Min. cycle time of FS tasks	**6 ms**	**6 ms**	**6 ms**
Min. cycle time of ST tasks	**2 ms**	**2 ms**	**2 ms**
Working memory (RAM)	**128 MB**	**128 MB**	**128 MB**
Memory for the user program per resource	**4 MB**	**4 MB**	**4 MB**

Head modules
PSSu H PLC1 FS SN SD

CPU	312070	314070	315070
Non-volatile FS memory	**382 kB**	**382 kB**	**382 kB**
Non-volatile ST memory	**128 kB**	**128 kB**	**128 kB**
Removable data medium	**312070**	**314070**	**315070**
Type	**SD card**	**SD card**	**SD card**
SafetyNET p interface	**312070**	**314070**	**315070**
Number	**2**	**2**	**2**
IP address (automatically off)	**169.254.X.Y**	**169.254.X.Y**	**169.254.X.Y**
Connection	**RJ45**	**RJ45**	**RJ45**
Transmission rates	**100 MBit/s**	**100 MBit/s**	**100 MBit/s**
Set via	**Automatic**	**Automatic**	**Automatic**
Max. number of ST-Tx and ST-Rx connections	**64**	**64**	**64**
Max. number of FS-Tx and FS-Rx connections	**64**	**64**	**64**
Cycle time (t_SNp RTFN)	**2 ... 60 000 ms**	**2 ... 60 000 ms**	**2 ... 60 000 ms**
Max. number of variables with elementary ST data types	**5000**	**5000**	**5000**
Max. number of variables with elementary FS data types	**4000**	**4000**	**4000**
PROFINET interface	**312070**	**314070**	**315070**
Input device	**1.440 Byte**	**1.440 Byte**	–
Output	**1.440 Byte**	**1.440 Byte**	–
Transmission rates	**100 MBit/s**	**100 MBit/s**	–
Transmission rate selectable via	**Automatic**	**Automatic**	–
Certification	**PNO**	**PNO**	–
Manufacturer’s ID	**092Fh**	**092Fh**	–
Connection	**RJ45**	**RJ45**	–
Device type	**Slave**	**Slave**	–
Cycle time (t_ExtCo)	**4 ... 512 ms**	**4 ... 512 ms**	–
Modbus/TCP	**312070**	**314070**	**315070**
Cycle time (t_ExtCo)	**2 ... 2 000 000 ms**	**2 ... 2 000 000 ms**	**2 ... 2 000 000 ms**
EtherNet/IP adapter	**312070**	**314070**	**315070**
Cycle time (tExtCo)	**4...655 000 ms**	**4...655 000 ms**	**4...655 000 ms**
Manufacturer’s ID	**181**	**181**	**181**
Product ID	**1**	**1**	**1**
EDS file	**00B5000C00010100.eds**	**00B5000C00010100.eds**	**00B5000C00010100.eds**
Device type	**Adapter**	**Adapter**	**Adapter**

Head modules
PSSu H PLC1 FS SN SD

EtherNet/IP adapter	**312070**	**314070**	**315070**
Cycle time (RPI)	**4...655 000 ms**	**4...655 000 ms**	**4...655 000 ms**
Maximum data length	**508 Byte**	**508 Byte**	**508 Byte**
Maximum number of I/O connections	**1**	**1**	**1**
Raw UDP	**312070**	**314070**	**315070**
Memory size	**8 Kbyte**	**8 Kbyte**	**8 Kbyte**
Cycle time (t_ExtCo)	**2 ... 2 000 000 ms**	**2 ... 2 000 000 ms**	**2 ... 2 000 000 ms**
Environmental data	**312070**	**314070**	**315070**
Application site			
In accordance with the standard	–	–	**EN 50125-3**
Application site	–	–	**Track area (1 m - 3 m)**
In accordance with the standard	–	–	**EN 61373**
Application site	–	–	**Category 1, Class A + B**
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**	**EN 50155, 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 50155**
Temperature range	**0 - 60 °C**	**-40 - 70 °C**	**-40 - 70 °C**
In accordance with the standard	–	–	**EN 50125-1**
Temperature range	–	–	**-40 ... +70 °C**
In accordance with the standard	–	–	**EN 50125-3**
Temperature range	–	–	**-40 ... +70 °C**
Storage temperature			
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**	–
Climatic suitability			
In accordance with the standard	**EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**	–
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	–
Condensation during operation	**Not permitted**	**Short-term**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**	**2000 m**

Head modules
PSSu H PLC1 FS SN SD

Environmental data	312070	314070	315070
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 50125-3**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**5 - 2000 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	–
Acceleration	**1g**	**1g**	**0,23g**
Broadband noise			
In accordance with the standard	–	**EN 60068-2-64**	**EN 61373**
Frequency	–	**5 - 500 Hz**	**5 - 150 Hz**
Acceleration	–	**1,9grms**	**0,79 g RMS**
Shock stress			
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 50125-3**
Number of shocks	**6**	**6**	**20**
Acceleration	**15g**	**15g**	**2g**
Duration	**11 ms**	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 61373**
Number of shocks	**1000**	**1000**	**20**
Acceleration	**10g**	**10g**	**5g**
Duration	**16 ms**	**16 ms**	**30 ms**
Supply interruptions			
In accordance with the standard	–	–	**EN 50155**
Class	–	–	**S2, C1, C2**
Airgap creepage			
In accordance with the standard	**EN 60664-1**	**EN 60664-1**	**EN 50124-1**
Overvoltage category	**II**	**II**	**OV2**
Pollution degree	**2**	**2**	**PD1**
Protection type			
In accordance with the standard	–	–	**EN 60529**
Housing	**IP20**	**IP20**	**IP20**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP51**

Head modules
PSSu H PLC1 FS SN SD

Mechanical data	312070	314070	315070
Material			
Bottom	**PC**	**PC**	**PC**
Connection type	**Spring-loaded terminal, screw terminal**	**Spring-loaded terminal, screw terminal**	**Spring-loaded terminal, screw terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	**0,5 Nm**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 2,5 mm², 24 - 12 AWG**	**0,2 - 2,5 mm², 24 - 12 AWG**	**0,2 - 2,5 mm², 24 - 12 AWG**
Stripping length with spring-loaded terminals	**9 mm**	**9 mm**	**9 mm**
Dimensions			
Height	**125,6 mm**	**125,6 mm**	**125,6 mm**
Width	**130 mm**	**130 mm**	**130 mm**
Depth	**83,7 mm**	**83,7 mm**	**83,7 mm**
Weight	**365 g**	**378 g**	**350 g**

Where standards are undated, the 2009-07 latest editions shall apply.

Head modules
PSSu H PLC1 FS SN SD

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 4	SIL CL 3	4,14E-09	SIL 3	3,51E-05	20

If the module is operated at an ambient temperature above 60° C, the values stated in the table for PFH_D and PFD will need to be doubled when a safety function is calculated.

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

Order reference

Product

Product type	Features	Order no.
PSSu H PLC1 FS SN SD	Head module with SafetyNET p, base type	312 070
PSSu H PLC1 FS SN SD-T	Head module with SafetyNET p, T-type	314 070
PSSu H PLC1 FS SN SD-R	Head module with SafetyNET p, R-type	315 070

Accessories

Terminals

Product type	Features	Order no.
PSSu A Con 1/4 S	2 x screw terminals	313 110
PSSu A Con 2/8 C	2 x spring-loaded terminals	313 111

Head modules
PSSu H PLC1 FS DP SN SD

Overview

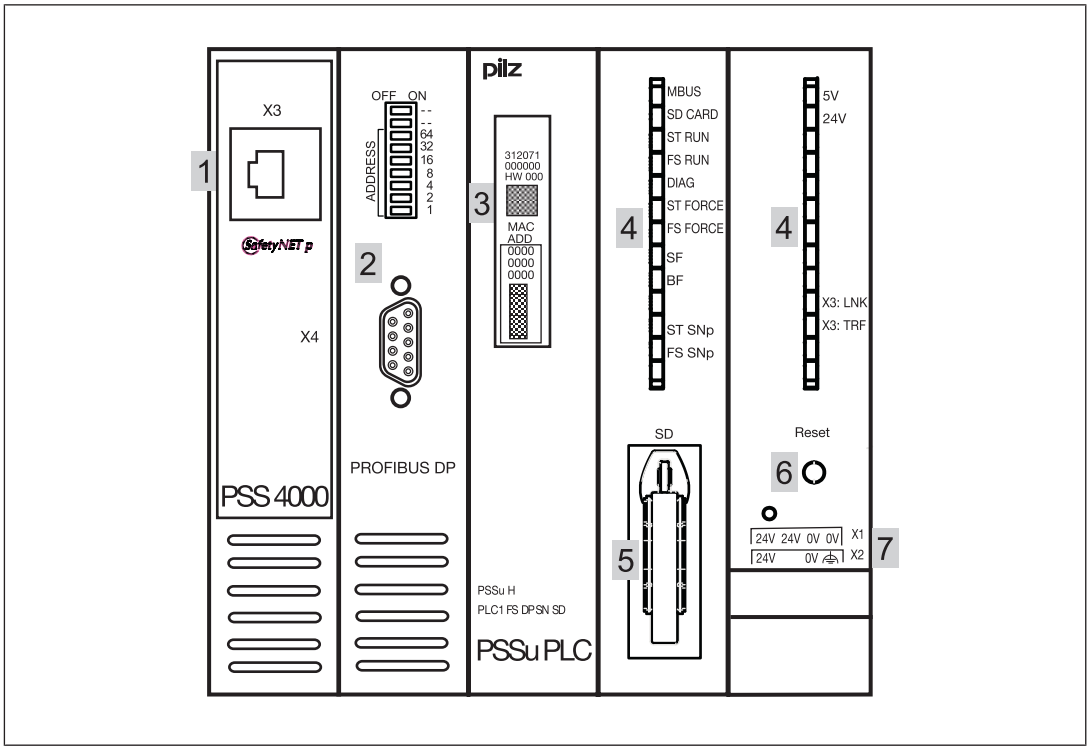
Module features

The head module belongs to the performance class "Control system PSSu PLC". It can be used to connect a PSSu system to SafetyNET p. The head module has the following features:

- 1 free Ethernet port for:
  - Connection to SafetyNET p
  - Project download
  - Read the diagnostic data
- PROFIBUS DP interface
- One FS resource and one ST resource
- SD card used to store the device project and the naming data
- Reset button
  - For warm reset
  - To transfer the naming data and/or device project from the SD card to the device memory
- Supply voltage
  - Integrated supply voltage for periphery supply and module supply
  - Module supply is buffered for 20 ms if the supply voltage is interrupted
  - Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- Status LEDs
- Supports FS and ST modules

Head modules
PSSu H PLC1 FS DP SN SD

Front view

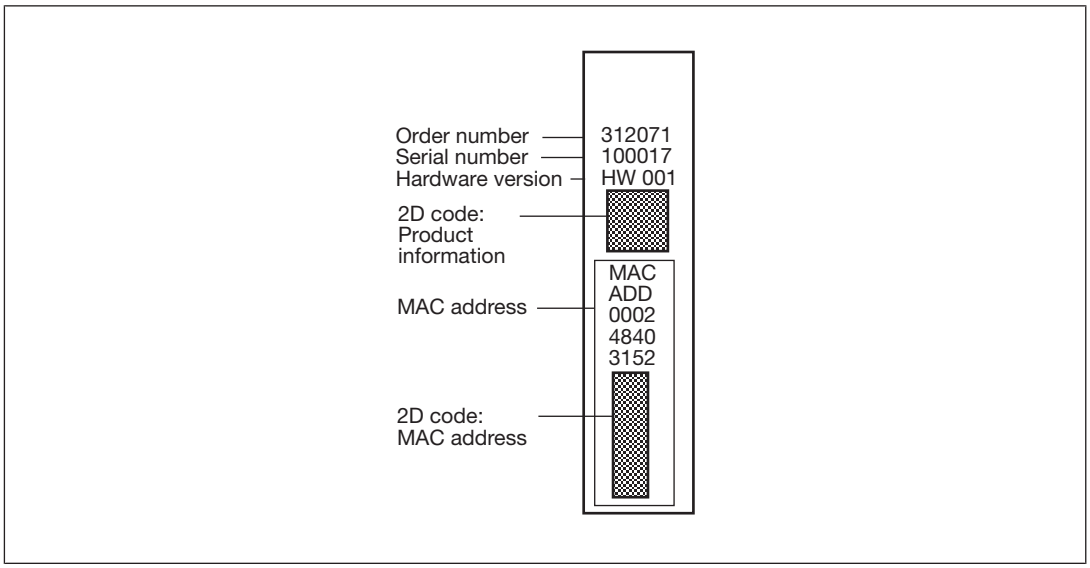


Legend:

- 1: SafetyNET p interface
- 2: PROFIBUS-DP interface
- 3: Labelling strip (see below for details)
- 4: Status LEDs
- 5: SD card
- 6: Reset button
- 7: Supply voltage connection (module and periphery supply)

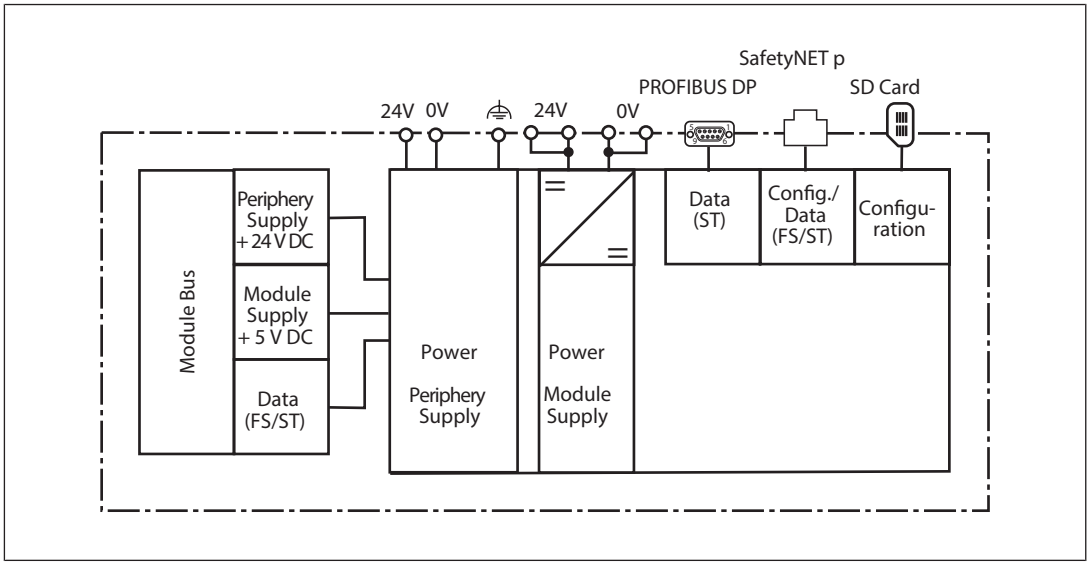
Head modules
PSSu H PLC1 FS DP SN SD

The labelling strip contains the following information:



Function description

Block diagram



Head modules
PSSu H PLC1 FS DP SN SD

Control system

The head module is a programmable logic controller (PLC), which can be used in safety-related and non-safety-related applications. The control system has memory areas for the operating system, the data and the device project with the user program.

The head module has a non-volatile memory for the non-volatile variables.

User programs can be created in IEC 61131 programming and/or Multi programming.

For safety-related applications, the processor section is designed with multi-channel diversity.

The control system communicates with the input and output modules via the local module bus and with the decentralised input and output modules via SafetyNET p. LEDs provide information on the status of the safety system and indicate any errors.

Supply voltage

The product provides the module supply and periphery supply for the modules on the module bus:

- Module supply

  Supply voltage for subsequent module (right-hand side)
- Periphery supply

  Supply voltage for sensors, actuators and test pulses

When the supply voltage is fed in separately, the module supply and periphery supply are galvanically isolated. If galvanic isolation is not required, a common power supply may be used for the periphery supply and module supply.

Ensure you comply with the current load capacity of the module and periphery supply (see "Technical Details"). If the current load is higher, an additional supply voltage module is required to refresh the module supply and periphery supply.

- Module supply

  The current load is the total current consumption of all the electronic and compact modules.

  The module supply does not automatically switch off if values exceed or drop below their limits. However, the "5 V" LED will light and a message will be entered in the diagnostic list.
- Periphery supply

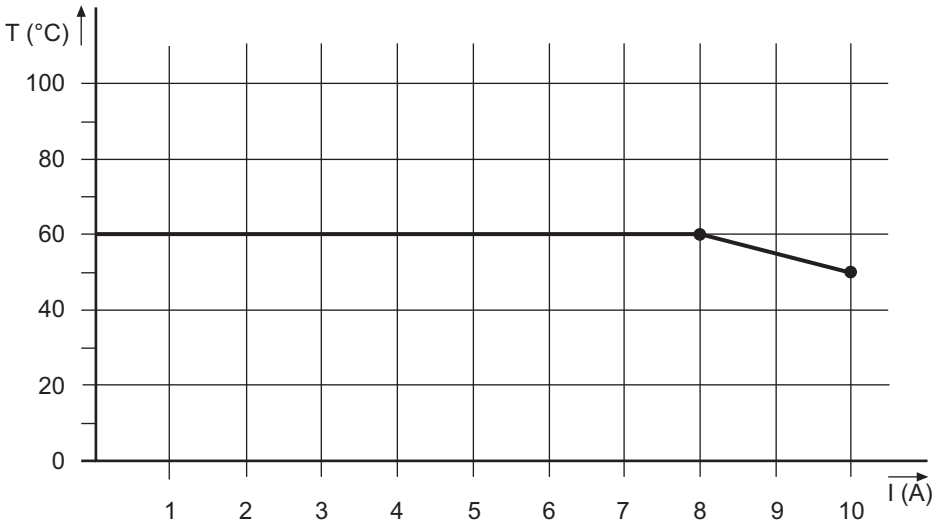
  The current load is the total current consumption of the sensors, actuators and test pulses supplied via the input/output modules.

  The periphery supply does not automatically switch off if values exceed or drop below their limits. However, the "24 V" LED will light and a message will be entered in the diagnostic list.

  Please refer to the derating diagram.

Head modules
PSSu H PLC1 FS DP SN SD

Derating diagram for periphery supply: Temperature T dependent on load current I



Integrated protection mechanisms

The module has the following protection mechanisms:

- Multi-channel diverse processor section
- Cyclical self tests
- Potentially isolated **SafetyNET p** interface
- Potentially isolated PROFIBUS DP interface
- Infeed for module supply
  - Polarity protection
  - Voltage monitoring
  - Transient voltage limitation
  - 20 ms voltage buffer if the supply voltage is interrupted
- Module supply
  - Short circuit-proof
- Periphery supply
  - Voltage monitoring (exceeding upper/lower limit)

SD card

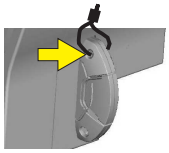
The SD card has the following functions:

- The SD card is used to store the naming data and the device project; see PSS 4000 System Description.

Head modules
PSSu H PLC1 FS DP SN SD

- The SD card is part of the safety concept on PSS 4000. If the SD card is missing or has been swapped, the next time the PSSu system is booted it will be unable to achieve the operating status "PSSu System in RUN condition without error". The SD card has a locking mechanism, which protects it from being removed from the card holder unintentionally. The SD card can also be sealed to protect it from manipulation, whether accidental or intentional.

Sealing the SD card for additional protection:



Reset button

The "Reset" pushbutton on the head module has various functions:

- Perform a warm reset for the PSSu system.

  The reset pushbutton can be used to perform a warm reset for the PSSu system.
- Transfer the naming data and/or device project from the SD card (deliberate operator action to transfer the naming data and/or device project from the SD card to the device memory).

SafetyNET p

Functions

- The SafetyNET p interface enables safety-related and non-safety-related data transfer between the PSSu system and other network subscribers.
- The head module receives signals from other network subscribers; it processes these signals in the user program and passes them on to the connected input/output modules.
- The head module receives signals from the connected input/output modules; it processes these signals in the user program and passes them on to the other network subscribers.
- If a fault occurs, the module switches the connected failsafe outputs to a safe condition.

MAC address

- The MAC address is a factory-set default. It can found on the labelling strip on the front of the module.

Head modules
PSSu H PLC1 FS DP SN SD

PROFIBUS DP

PROFIBUS is an open fieldbus standard whose communication is defined in the international standards IEC 61158 and IEC 61784. Further provisions have been defined in specifications published by the PROFIBUS User Group. These specifications are available from PROFIBUS International (see www.profibus.com).

The station address is set via the "ADDRESS" DIP switch. The DIP switch is binary coded. Permitted station addresses are in the range 0_D ... 125_D. If station address 126_D is set via the DIP switch, the address can be assigned via the Master. The Set Slave Address command (SSA) must be run for this purpose.

The station address is set as follows:

"ADDRESS" DIP switch	**Meaning**		**Example:**
Switch designation	**OFF**	**ON**	**Station address** **PSSu: 26** $_D$ **F-device: 52** $_D$
- -	Not connected		
- -			
64	0	64_D	
32	0	32_D	
16	0	16_D	
8	0	8_D	
4	0	4_D	
2	0	2_D	
1	0	1_D	

IP connections

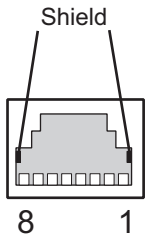
Various Ethernet-based communication modes are supported (e. g. Modbus/TCP, Raw UDP). Detailed information is available in the "System description PSS 4000".

Head modules
PSSu H PLC1 FS DP SN SD

Interfaces

SafetyNET p

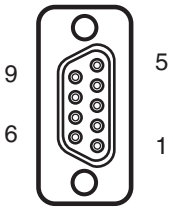
SafetyNET p is an Ethernet interface. Further information can be found in the System Description PSS 4000.

SafetyNET p	Assignment	
RJ45 female connector	1: TD+ 2: TD- 3: RD+ 4: n.c. 5: n.c. 6: RD- 7: n.c. 8: n.c.	

- n.c. = not connected

PROFIBUS DP

The head module can be incorporated into the PROFIBUS as slave.

PROFIBUS DP	Layout	
Female 9-pin D-SUB connector conforms to the guidelines of the PROFIBUS User Group (PNO)	1: n.c. 2: n.c. 3: RxD/TxD-P (B-line) 4: CNTR-P (RTS) 5: DGND (GND ext.) 6: VP (+5 V ext.) 7: n.c. 8: RxD/TxD-N (A-line) 9: n.c.	

- n.c. = not connected

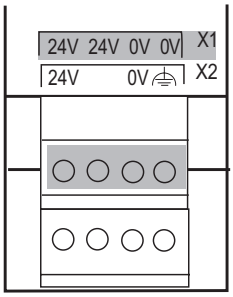
The PSSu is connected to PROFIBUS-DP via RS 485 communication. The PSSu supplies the PROFIBUS DP bus terminating resistors with voltage (+5 VDC).

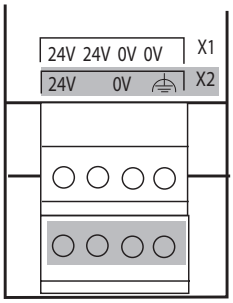
- Connect the connector housing to the shielding on the PROFIBUS cable. The connector housing should be connected with low impedance to the mounting rail.

Head modules
PSSu H PLC1 FS DP SN SD

Wiring

Terminal configuration

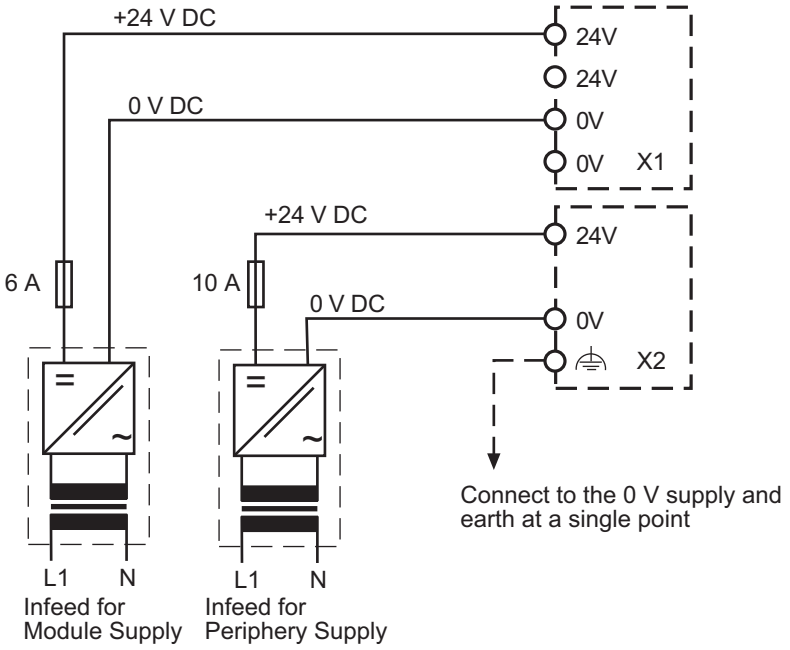
Module supply	Terminal configuration		X1
4-pin female connector	24V	+24 V infeed for module supply	
	0V	0 V infeed for module supply	

Periphery supply	Terminal configuration		X2
4-pin female connector	24V:	+24 V infeed for periphery supply	
	0V	0 V infeed for periphery supply	
	⏚	Functional earth	

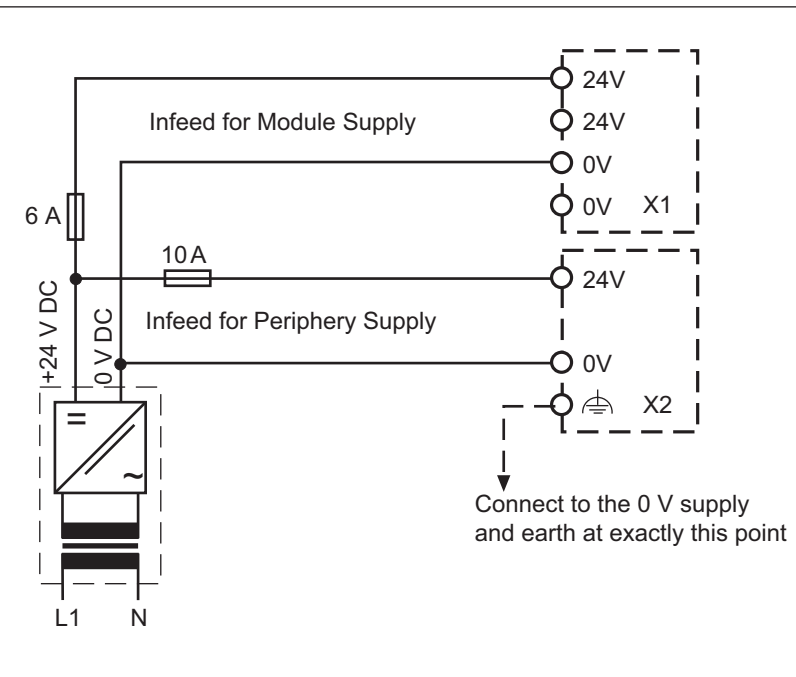
Head modules
PSSu H PLC1 FS DP SN SD

Connecting the module

Separate power supplies for module supply and periphery supply:



Common power supply for module supply and periphery supply:



Head modules
PSSu H PLC1 FS DP SN SD

Technical details

General	
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Application range	**Standard/failsafe**
System sections	
ST resource	**yes**
FS resource	**yes**
ST module bus	**yes**
FS module bus	**yes**
ST SNp interface	**yes**
FS SNp interface	**yes**
PROFIBUS-DP Slave	**yes**
PROFINET IO DEVICE	**No**
IP connections	**yes**
Diagnostic Server	**No**
OPC Server	**No**
Programming	
IEC 61131 programming	**yes**
Multi programming	**yes**
Non-volatile variables	**yes**
Electrical data	
Supply voltage	
for	**Module supply**
Voltage	**24 V**
Kind	**DC**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**1 A**
Output of external power supply (DC)	**16,1 W**
Supply voltage	
for	**Periphery supply**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**10 A**
Potential isolation between module supply and periphery supply	**3050 V**
Potential isolation between module supply and PROFIBUS-DP	**700 V**

Head modules
PSSu H PLC1 FS DP SN SD

Electrical data	
Internal supply voltage (module supply)	
Output voltage	**int. system**
Voltage	**5 V**
Voltage tolerance	**-2 %/+3 %**
Potential isolation	**3050 V**
Current load capacity	**2 A**
Buffer in the case of supply interruptions in accordance with	**EN 61131-2, EN 61496-1**
Short circuit-proof	**yes**
CPU	
Real-time clock for time and date functions	
Resolution	**1 s**
Deviation	**+/- 10s/day**
Buffer time	**10 days**
Max. number of FS tasks	**9**
Max. number of ST tasks	**9**
Max. number of variables with elementary data types on the FS resource	**10.000**
Max. number of variables with elementary data types on the ST resource	**10.000**
Min. cycle time of FS tasks	**6 ms**
Min. cycle time of ST tasks	**2 ms**
Working memory (RAM)	**128 MB**
Memory for the user program per resource	**4 MB**
Non-volatile FS memory	**382 kB**
Non-volatile ST memory	**128 kB**
Removable data medium	
Type	**SD card**
SafetyNET p interface	
Number	**1**
IP address (automatically off)	**169.254.X.Y**
Connection	**RJ45**
Transmission rates	**10 MBit/s, 100 MBit/s**
Set via	**Automatic**
Max. number of ST-Tx and ST-Rx connections	**64**
Max. number of FS-Tx and FS-Rx connections	**64**
Cycle time (t_SNp RTFN)	**2 ... 60 000 ms**
Max. number of variables with elementary ST data types	**5000**
Max. number of variables with elementary FS data types	**4000**

Head modules
PSSu H PLC1 FS DP SN SD

PROFIBUS-DP interface	
Number	**1**
Device type	**Slave**
Station address	**0 ... 126d**
Station address selectable via	**DIP switch**
Maximum data length of PROFIBUS interface	
Input device	**244 Byte**
Output	**244 Byte**
Diagnostics	**2 Byte**
Transmission rates	**1,5 MBit/s, 12 MBit/s, 185,5 kBit/s, 19,2 kBit/s, 3 MBit/s, 45,45 kBit/s, 500 kBit/s, 6 MBit/s, 9,6 kBit/s, 93,75 kBit/s**
Transmission rate selectable via	**automatic**
Connection	**9-pin D-Sub female connector**
Log	**DPV0**
Operating modes	**AutoBaud, Freeze Mode, Set Slave Address, Sync Mode**
Certification	**PNO**
Description file	**Pilz0CB0.gsd**
Manufacturer's ID	**0CB0h**
Cycle time (t_ExtCo)	**2 ... 300 000 ms**
Modbus/TCP	
Cycle time (t_ExtCo)	**2 ... 2 000 000 ms**
Raw UDP	
Memory size	**8 Kbyte**
Cycle time (t_ExtCo)	**2 ... 2 000 000 ms**
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	
Temperature range	**0 - 60 °C**
Storage temperature	
Temperature range	**-25 - 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 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**

Head modules
PSSu H PLC1 FS DP SN SD

Environmental data	
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 55 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
Housing	**IP20**
Mounting area (e.g. control cabinet)	**IP54**
Mechanical data	
Material	
Bottom	**PC**
Connection type	**Spring-loaded terminal, screw terminal**
Mounting type	**plug-in**
Conductor cross section with screw terminals	
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 2,5 mm², 24 - 12 AWG**
Stripping length with spring-loaded terminals	**9 mm**
Dimensions	
Height	**125,6 mm**
Width	**130 mm**
Depth	**83,7 mm**
Weight	**375 g**

Head modules
PSSu H PLC1 FS DP SN SD

Where standards are undated, the 2009-07 latest editions shall apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 4	SIL CL 3	4,14E-09	SIL 3	3,51E-05	20

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

Order reference

Product

Product type	Features	Order No.
PSSu H PLC1 FS DP SN SD	Head module with SafetyNET p and PROFIBUS-DP, base type	312 071

Accessories

Terminals

Product type	Features	Order no.
PSSu A Con 1/4 S	2 x screw terminals	313 110
PSSu A Con 2/8 C	2 x spring-loaded terminals	313 111

Head modules
PSSu H m F DP ETH SD

Overview

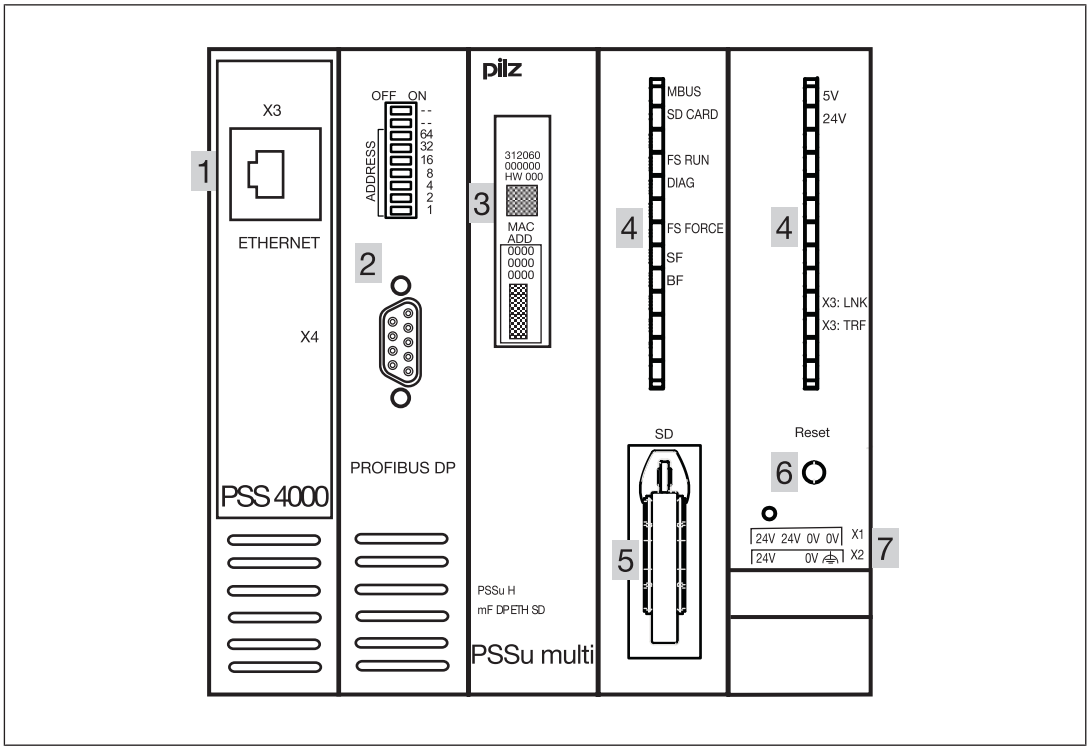
Module features

The head module belongs to the performance class "Control system PSSu multi". The head module has the following features:

- Ethernet interface for
  - Project download
  - Read the diagnostic data
- PROFIBUS DP interface
- an FS resource
- SD card used to store the device project and the naming data
- Reset button
  - For warm reset
  - To transfer the naming data and/or device project from the SD card to the device memory
- Supply voltage
  - Integrated supply voltage for periphery supply and module supply
  - Module supply is buffered for 20 ms if the supply voltage is interrupted
  - Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- Status LEDs
- Supports FS and ST modules

Head modules
PSSu H m F DP ETH SD

Front view

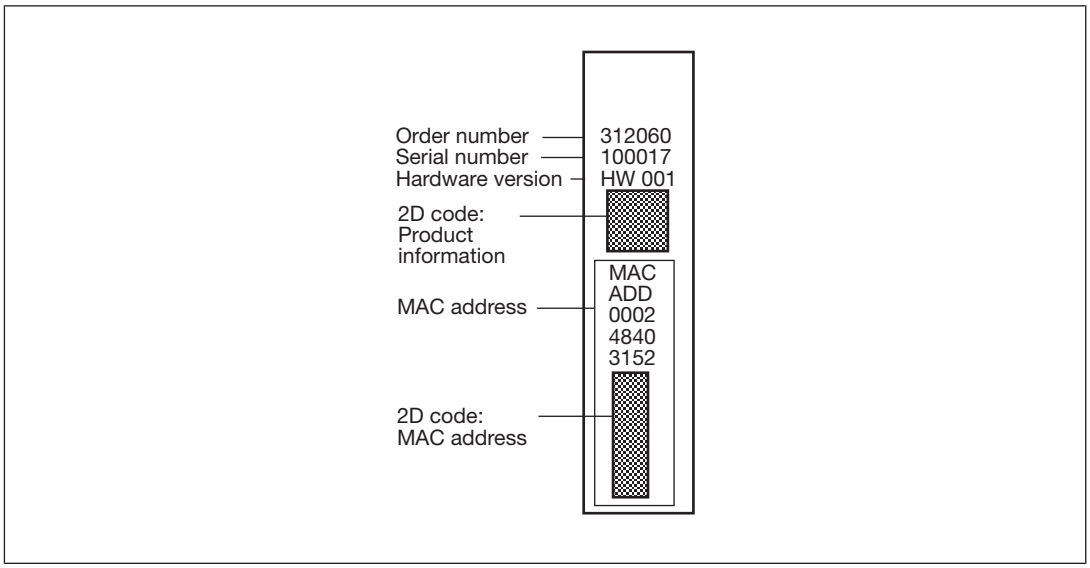


Legend:

- 1: ETHERNET interface
- 2: PROFIBUS-DP interface
- 3: Labelling strip (see below for details)
- 4: Status LEDs
- 5: SD card
- 6: Reset button
- 7: Supply voltage connection (module and periphery supply)

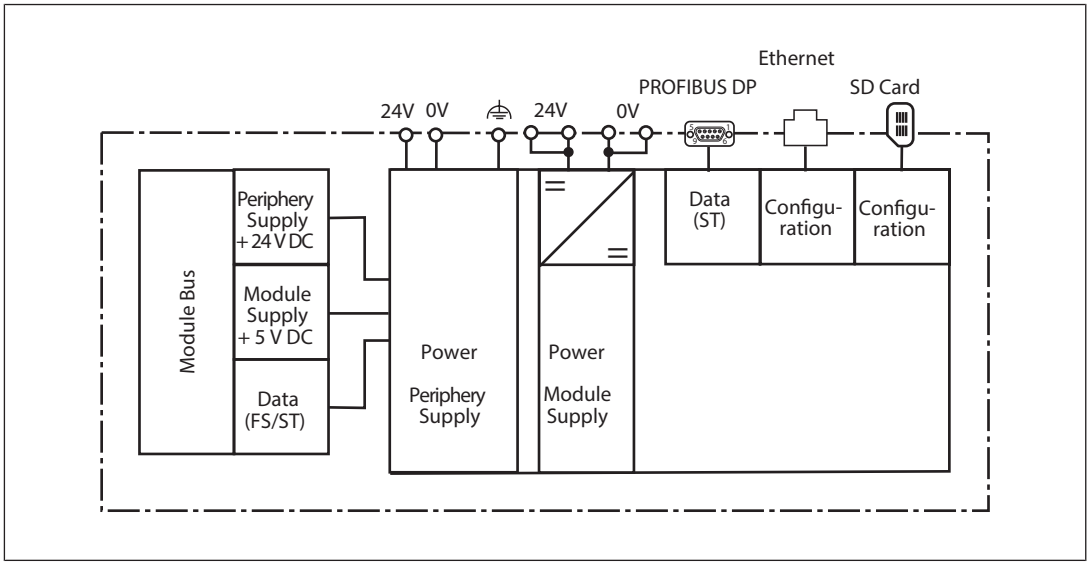
Head modules
PSSu H m F DP ETH SD

The labelling strip contains the following information:



Function description

Block diagram



Head modules
PSSu H m F DP ETH SD

Control system

The head module is a programmable logic controller (PLC), which can be used in safety-related and non-safety-related applications. The control system has memory areas for the operating system, the data and the device project with the user program.

User programs can be created in Multi programming.

For safety-related applications, the processor section is designed with multi-channel diversity.

The control system communicates with the input and output modules via the local module bus.

LEDs provide information on the status of the control system and indicate any errors.

Supply voltage

The product provides the module supply and periphery supply for the modules on the module bus:

- Module supply

  Supply voltage for subsequent module (right-hand side)
- Periphery supply

  Supply voltage for sensors, actuators and test pulses

When the supply voltage is fed in separately, the module supply and periphery supply are galvanically isolated. If galvanic isolation is not required, a common power supply may be used for the periphery supply and module supply.

Ensure you comply with the current load capacity of the module and periphery supply (see "Technical Details"). If the current load is higher, an additional supply voltage module is required to refresh the module supply and periphery supply.

- Module supply

  The current load is the total current consumption of all the electronic and compact modules.

  The module supply does not automatically switch off if values exceed or drop below their limits. However, the "5 V" LED will light and a message will be entered in the diagnostic list.

Head modules
PSSu H m F DP ETH SD

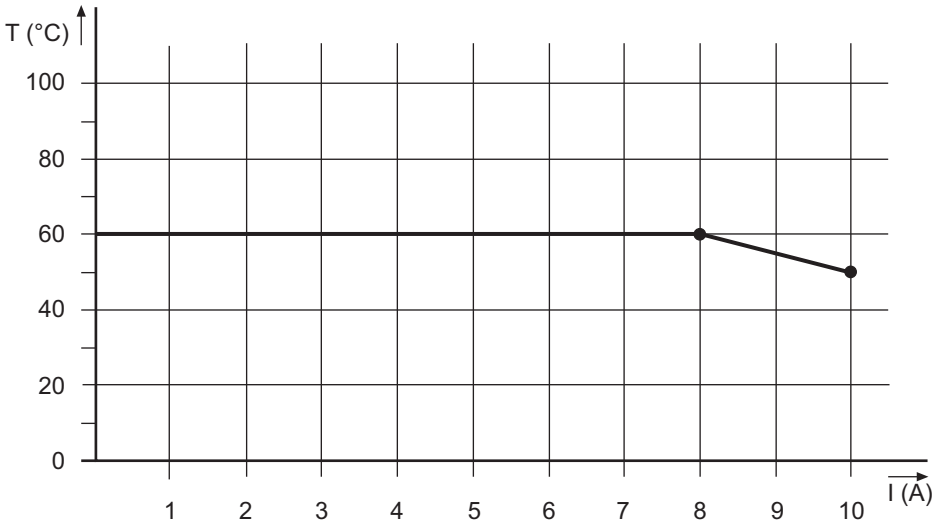
- Periphery supply

  The current load is the total current consumption of the sensors, actuators and test pulses supplied via the input/output modules.

  The periphery supply does not automatically switch off if values exceed or drop below their limits. However, the "24 V" LED will light and a message will be entered in the diagnostic list.

  Please refer to the derating diagram.

Derating diagram for periphery supply: Temperature T dependent on load current I



Integrated protection mechanisms

The module has the following protection mechanisms:

- Multi-channel diverse processor section
- Cyclical self tests
- Potentially isolated PROFIBUS DP interface
- Infeed for module supply
  - Polarity protection
  - Voltage monitoring
  - Transient voltage limitation
  - 20 ms voltage buffer if the supply voltage is interrupted
- Module supply
  - Short circuit-proof
- Periphery supply
  - Voltage monitoring (exceeding upper/lower limit)

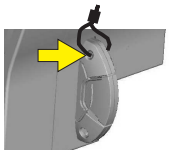
Head modules
PSSu H m F DP ETH SD

SD card

The SD card has the following functions:

- The SD card is used to store the naming data and the device project; see PSS 4000 System Description.
- The SD card is part of the safety concept on PSS 4000. If the SD card is missing or has been swapped, the next time the PSSu system is booted it will be unable to achieve the operating status "PSSu System in RUN condition without error". The SD card has a locking mechanism, which protects it from being removed from the card holder unintentionally. The SD card can also be sealed to protect it from manipulation, whether accidental or intentional.

Sealing the SD card for additional protection:



Reset button

The "Reset" pushbutton on the head module has various functions:

- Perform a warm reset for the PSSu system.

  The reset pushbutton can be used to perform a warm reset for the PSSu system.
- Transfer the naming data and/or device project from the SD card (deliberate operator action to transfer the naming data and/or device project from the SD card to the device memory).

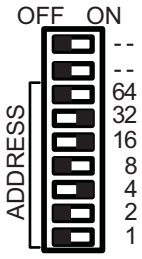
PROFIBUS DP

PROFIBUS is an open fieldbus standard whose communication is defined in the international standards IEC 61158 and IEC 61784. Further provisions have been defined in specifications published by the PROFIBUS User Group. These specifications are available from PROFIBUS International (see www.profibus.com).

The station address is set via the "ADDRESS" DIP switch. The DIP switch is binary coded. Permitted station addresses are in the range 0_D ... 125_D. If station address 126_D is set via the DIP switch, the address can be assigned via the Master. The Set Slave Address command (SSA) must be run for this purpose.

Head modules
PSSu H m F DP ETH SD

The station address is set as follows:

"ADDRESS" DIP switch	Meaning		Example:
Switch designation	**OFF**	**ON**	**Station address** **PSSu: 26 $_D$** **F-device: 52 $_D$**
- -	Not connected		
- -			
64	0	64_D	
32	0	32_D	
16	0	16_D	
8	0	8_D	
4	0	4_D	
2	0	2_D	
1	0	1_D	

Head modules
PSSu H m F DP ETH SD

Ethernet Interface

The Ethernet interface can be used for the following online actions:

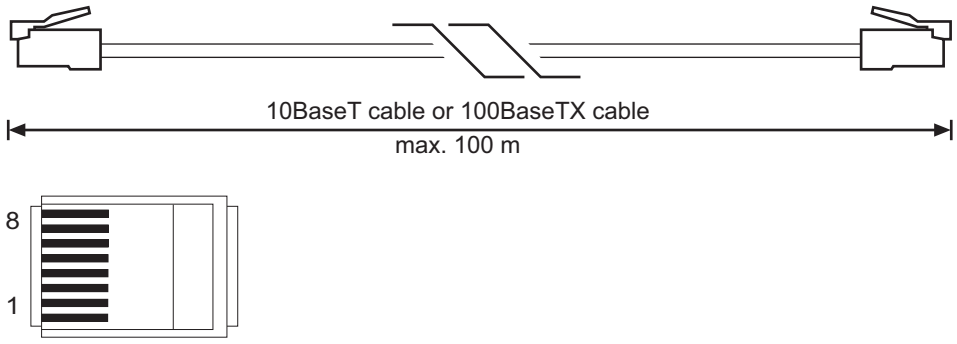
- Download the project
- Read the diagnostic data
- Firmware update

The connection is established via a RJ45 socket.

The Ethernet interface is configured in PAS4000 (see description in chapter "Network" in PAS4000's online help).

RJ45 connector

8-pin

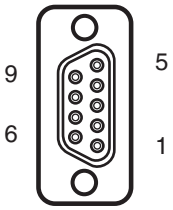


Head modules
PSSu H m F DP ETH SD

Interfaces

Interface configuration

The head module can be incorporated into the PROFIBUS as slave.

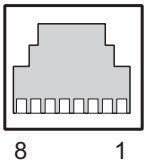
PROFIBUS DP	Layout	
Female 9-pin D-SUB connector conforms to the guidelines of the PROFIBUS User Group (PNO)	1: n.c. 2: n.c. 3: RxD/TxD-P (B-line) 4: CNTR-P (RTS) 5: DGND (GND ext.) 6: VP (+5 V ext.) 7: n.c. 8: RxD/TxD-N (A-line) 9: n.c.	

- n.c. = not connected

The PSSu is connected to PROFIBUS-DP via RS 485 communication. The PSSu supplies the PROFIBUS DP bus terminating resistors with voltage (+5 VDC).

- Connect the connector housing to the shielding on the PROFIBUS cable. The connector housing should be connected with low impedance to the mounting rail.

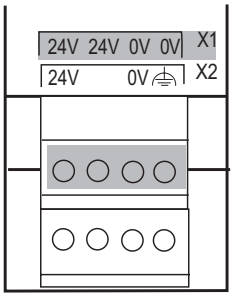
Ethernet Interface

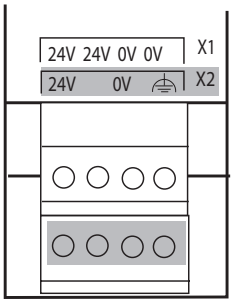
RJ45 socket 8-pin	PIN	Standard	Crossover
	1	TD+ (Transmit+)	RD+ (Receive+)
	2	TD- (Transmit-)	RD- (Receive-)
	3	RD+ (Receive+)	TD+ (Transmit+)
	4	n.c.	n.c.
	5	n.c.	n.c.
	6	RD- (Receive-)	TD- (Transmit-)
	7	n.c.	n.c.
	8	n.c.	n.c.

Head modules
PSSu H m F DP ETH SD

Wiring

Terminal configuration

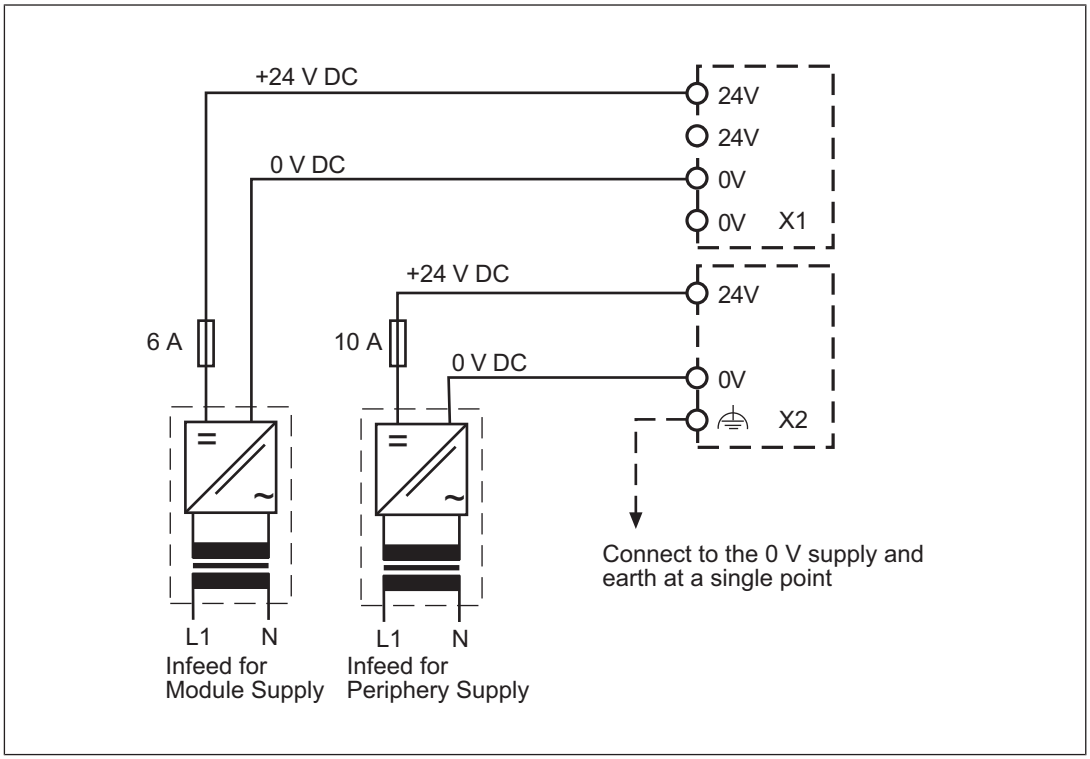
Module supply	Terminal configuration		X1
4-pin female connector	24V	+24 V infeed for module supply	
	0V	0 V infeed for module supply	

Periphery supply	Terminal configuration		X2
4-pin female connector	24V:	+24 V infeed for periphery supply	
	0V	0 V infeed for periphery supply	
	⏚	Functional earth	

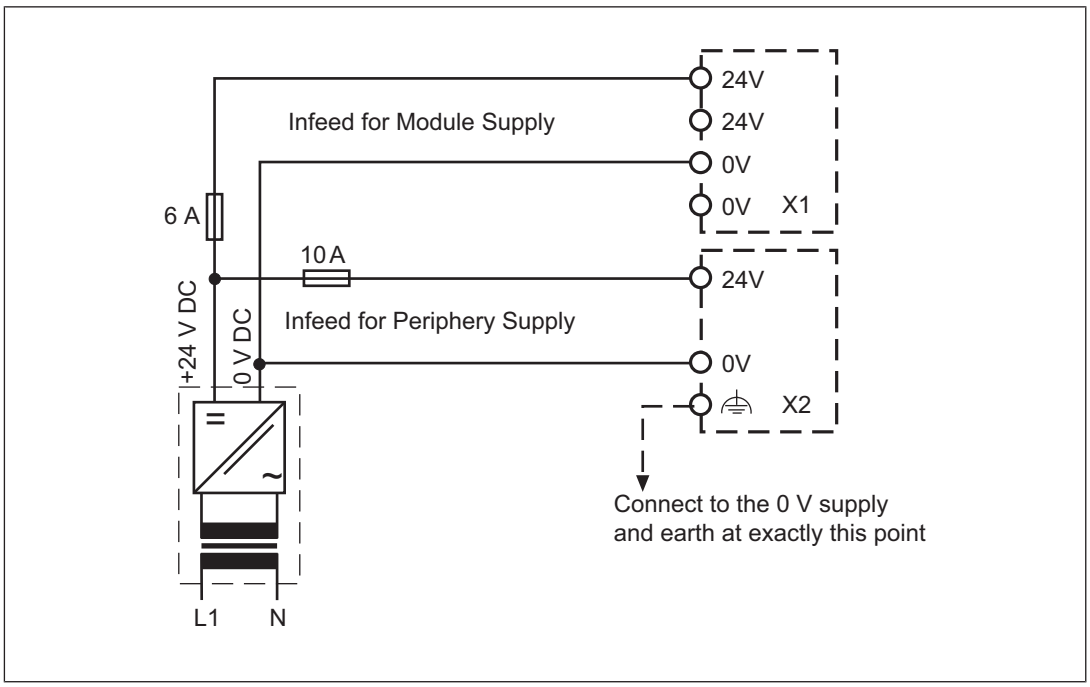
Head modules
PSSu H m F DP ETH SD

Connecting the module

Separate power supplies for module supply and periphery supply:



Common power supply for module supply and periphery supply:



Head modules
PSSu H m F DP ETH SD

Technical details

General	
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Application range	**Standard/failsafe**
System sections	
ST resource	**No**
FS resource	**yes**
ST module bus	**yes**
FS module bus	**yes**
ST SNp interface	**No**
FS SNp interface	**No**
PROFIBUS-DP Slave	**yes**
PROFINET IO DEVICE	**No**
IP connections	**yes**
Diagnostic Server	**No**
OPC Server	**No**
Programming	
IEC 61131 programming	**No**
Multi programming	**yes**
Non-volatile variables	**No**
Electrical data	
Supply voltage	
for	**Module supply**
Voltage	**24 V**
Kind	**DC**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**1 A**
Output of external power supply (DC)	**16,1 W**
Supply voltage	
for	**Periphery supply**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**10 A**
Potential isolation between module supply and periphery supply	**3050 V**
Potential isolation between module supply and PROFIBUS-DP	**700 V**

Head modules
PSSu H m F DP ETH SD

Electrical data	
Internal supply voltage (module supply)	
Output voltage	**int. system**
Voltage	**5 V**
Voltage tolerance	**-2 %/+3 %**
Potential isolation	**3050 V**
Current load capacity	**2 A**
Buffer in the case of supply interruptions in accordance with	**EN 61131-2, EN 61496-1**
Short circuit-proof	**yes**
CPU	
Real-time clock for time and date functions	
Resolution	**1 s**
Deviation	**+/- 10s/day**
Buffer time	**10 days**
Max. number of FS tasks	**1**
Max. number of variables with elementary data types on the FS resource	**10.000**
Min. cycle time of FS tasks	**10 ms**
Working memory (RAM)	**64 MB**
Memory for the user program per resource	**2 MB**
Removable data medium	
Type	**SD card**
SafetyNET p interface	
Number	**1**
IP address (automatically off)	**169.254.X.Y**
Connection	**RJ45**
Transmission rates	**100 MBit/s**
Set via	**Automatic**
PROFIBUS-DP interface	
Number	**1**
Device type	**Slave**
Station address	**0 ... 126d**
Station address selectable via	**DIP switch**
Maximum data length of PROFIBUS interface	
Input device	**244 Byte**
Output	**244 Byte**
Diagnostics	**2 Byte**
Transmission rates	**1,5 MBit/s, 12 MBit/s, 185,5 kBit/s, 19,2 kBit/s, 3 MBit/s, 45,45 kBit/s, 500 kBit/s, 6 MBit/s, 9,6 kBit/s, 93,75 kBit/s**
Transmission rate selectable via	**automatic**

Head modules
PSSu H m F DP ETH SD

PROFIBUS-DP interface	
Connection	**9-pin D-Sub female connector**
Log	**DPV0**
Operating modes	**AutoBaud, Freeze Mode, Set Slave Address, Sync Mode**
Certification	**PNO**
Description file	**Pilz0CB0.gsd**
Manufacturer's ID	**0CB0h**
Cycle time (t_ExtCo)	**2 ... 300 000 ms**
Ethernet interface	
Number	**1**
IP address (automatically off)	**169.254.X.Y**
Connection type	**RJ45**
Transmission rate	**100 MBit/s**
Modbus/TCP	
Cycle time (t_ExtCo)	**2 ... 2 000 000 ms**
Raw UDP	
Cycle time (t_ExtCo)	**2 ... 2 000 000 ms**
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	
Temperature range	**0 - 60 °C**
Storage temperature	
Temperature range	**-25 - 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 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 55 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**

Head modules
PSSu H m F DP ETH SD

Environmental data	
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
Housing	**IP20**
Mounting area (e.g. control cabinet)	**IP54**
Mechanical data	
Material	
Bottom	**PC**
Connection type	**Spring-loaded terminal, screw terminal**
Mounting type	**plug-in**
Conductor cross section with screw terminals	
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 2,5 mm², 24 - 12 AWG**
Stripping length with spring-loaded terminals	**9 mm**
Dimensions	
Height	**125,6 mm**
Width	**130 mm**
Depth	**83,7 mm**
Weight	**375 g**

Where standards are undated, the 2009-07 latest editions shall apply.

Head modules
PSSu H m F DP ETH SD

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 4	SIL CL 3	4,14E-09	SIL 3	3,51E-05	20

Order reference

Product

Product type	Features	Order No.
PSSu H m F DP ETH SD	Head module with PROFIBUS-DP and an Ethernet interface, base type	312 060

Accessories

Terminals

Product type	Features	Order no.
PSSu A Con 1/4 S	2 x screw terminals	313 110
PSSu A Con 2/8 C	2 x spring-loaded terminals	313 111

Head modules
PSSu H m F DP SN SD

Overview

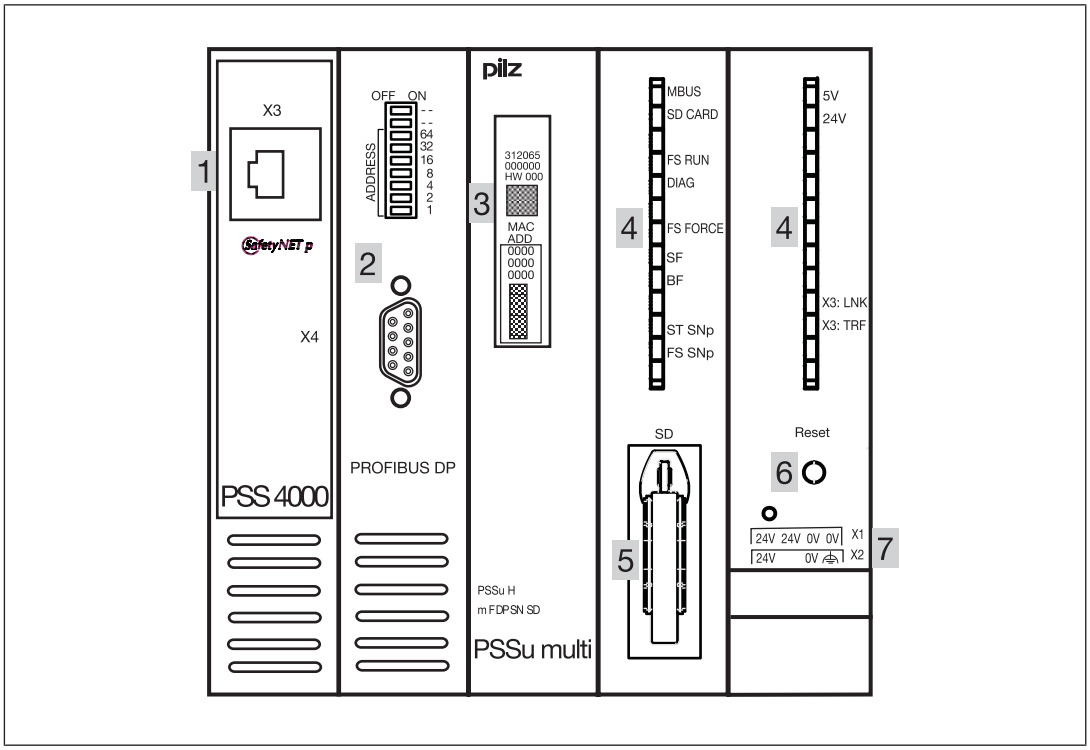
Module features

The head module belongs to the performance class "Control system PSSu multi". The head module has the following features:

- 1 free switch ports for connection to SafetyNET p
- PROFIBUS DP interface
- an FS resource
- SD card used to store the device project and the naming data
- Reset button
  - For warm reset
  - To transfer the naming data and/or device project from the SD card to the device memory
- Supply voltage
  - Integrated supply voltage for periphery supply and module supply
  - Module supply is buffered for 20 ms if the supply voltage is interrupted
  - Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- Status LEDs
- Supports FS and ST modules

Head modules
PSSu H m F DP SN SD

Front view

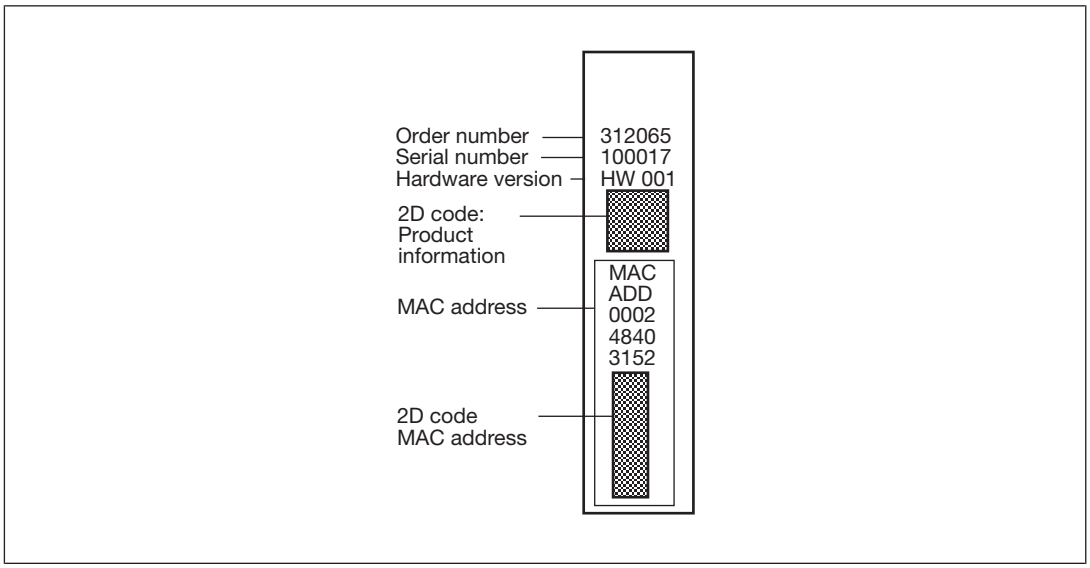


Legend:

- 1: SafetyNET p interface
- 2: PROFIBUS DP interface
- 3: Labelling strip (see below for details)
- 4: Status LEDs
- 5: SD card
- 6: Reset button
- 7: Supply voltage connection (module and periphery supply)

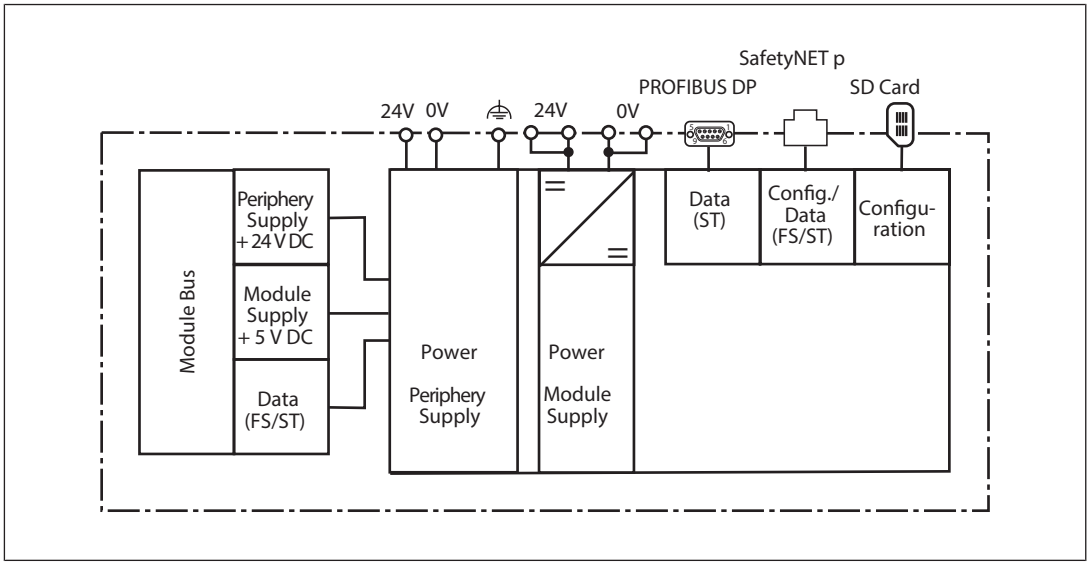
Head modules
PSSu H m F DP SN SD

The labelling strip contains the following information:



Function description

Block diagram



Head modules
PSSu H m F DP SN SD

Control system

The head module is a programmable logic controller (PLC), which can be used in safety-related and non-safety-related applications. The control system has memory areas for the operating system, the data and the device project with the user program.

User programs can be created in Multi programming.

For safety-related applications, the processor section is designed with multi-channel diversity.

The control system communicates with the input and output modules via the local module bus.

LEDs provide information on the status of the control system and indicate any errors.

Supply voltage

The product provides the module supply and periphery supply for the modules on the module bus:

- Module supply

  Supply voltage for subsequent module (right-hand side)
- Periphery supply

  Supply voltage for sensors, actuators and test pulses

When the supply voltage is fed in separately, the module supply and periphery supply are galvanically isolated. If galvanic isolation is not required, a common power supply may be used for the periphery supply and module supply.

Ensure you comply with the current load capacity of the module and periphery supply (see "Technical Details"). If the current load is higher, an additional supply voltage module is required to refresh the module supply and periphery supply.

- Module supply

  The current load is the total current consumption of all the electronic and compact modules.

  The module supply does not automatically switch off if values exceed or drop below their limits. However, the "5 V" LED will light and a message will be entered in the diagnostic list.
- Periphery supply

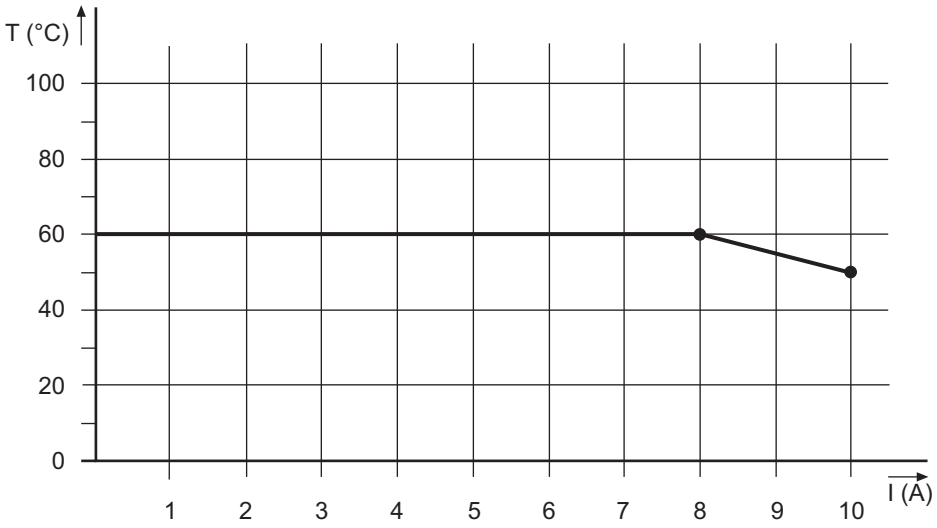
  The current load is the total current consumption of the sensors, actuators and test pulses supplied via the input/output modules.

  The periphery supply does not automatically switch off if values exceed or drop below their limits. However, the "24 V" LED will light and a message will be entered in the diagnostic list.

  Please refer to the derating diagram.

Head modules
PSSu H m F DP SN SD

Derating diagram for periphery supply: Temperature T dependent on load current I



Integrated protection mechanisms

The module has the following protection mechanisms:

- Multi-channel diverse processor section
- Cyclical self tests
- Potentially isolated **SafetyNET p** interface
- Potentially isolated PROFIBUS DP interface
- Infeed for module supply
  - Polarity protection
  - Voltage monitoring
  - Transient voltage limitation
  - 20 ms voltage buffer if the supply voltage is interrupted
- Module supply
  - Short circuit-proof
- Periphery supply
  - Voltage monitoring (exceeding upper/lower limit)

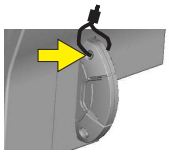
Head modules
PSSu H m F DP SN SD

SD card

The SD card has the following functions:

- The SD card is used to store the naming data and the device project; see PSS 4000 System Description.
- The SD card is part of the safety concept on PSS 4000. If the SD card is missing or has been swapped, the next time the PSSu system is booted it will be unable to achieve the operating status "PSSu System in RUN condition without error". The SD card has a locking mechanism, which protects it from being removed from the card holder unintentionally. The SD card can also be sealed to protect it from manipulation, whether accidental or intentional.

Sealing the SD card for additional protection:



Reset button

The "Reset" pushbutton on the head module has various functions:

- Perform a warm reset for the PSSu system.

  The reset pushbutton can be used to perform a warm reset for the PSSu system.
- Transfer the naming data and/or device project from the SD card (deliberate operator action to transfer the naming data and/or device project from the SD card to the device memory).

SafetyNET p

Functions

- The SafetyNET p interface enables safety-related and non-safety-related data transfer between the PSSu system and other network subscribers.
- The head module receives signals from other network subscribers; it processes these signals in the user program and passes them on to the connected input/output modules.
- The head module receives signals from the connected input/output modules; it processes these signals in the user program and passes them on to the other network subscribers.
- If a fault occurs, the module switches the connected failsafe outputs to a safe condition.

Head modules
PSSu H m F DP SN SD

MAC address

- The MAC address is a factory-set default. It can found on the labelling strip on the front of the module.

PROFIBUS DP

PROFIBUS is an open fieldbus standard whose communication is defined in the international standards IEC 61158 and IEC 61784. Further provisions have been defined in specifications published by the PROFIBUS User Group. These specifications are available from PROFIBUS International (see www.profibus.com).

The station address is set via the "ADDRESS" DIP switch. The DIP switch is binary coded. Permitted station addresses are in the range 0_D ... 125_D. If station address 126_D is set via the DIP switch, the address can be assigned via the Master. The Set Slave Address command (SSA) must be run for this purpose.

The station address is set as follows:

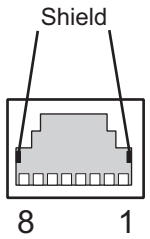
"ADDRESS" DIP switch	**Meaning**		**Example:**
Switch designation	**OFF**	**ON**	**Station address** **PSSu: 26** $_D$ **F-device: 52** $_D$
- -	Not connected		
- -			
64	0	64_D	
32	0	32_D	
16	0	16_D	
8	0	8_D	
4	0	4_D	
2	0	2_D	
1	0	1_D	

Head modules
PSSu H m F DP SN SD

Interfaces

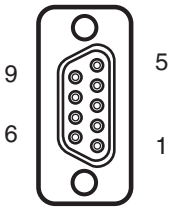
Interface configuration

SafetyNET p is an Ethernet interface. Further information can be found in the System Description PSS 4000.

SafetyNET p	Assignment	
RJ45 female connector	1: TD+ 2: TD- 3: RD+ 4: n.c. 5: n.c. 6: RD- 7: n.c. 8: n.c.	

- n.c. = not connected

The head module can be incorporated into the PROFIBUS as slave.

PROFIBUS DP	Layout	
Female 9-pin D-SUB connector conforms to the guidelines of the PROFIBUS User Group (PNO)	1: n.c. 2: n.c. 3: RxD/TxD-P (B-line) 4: CNTR-P (RTS) 5: DGND (GND ext.) 6: VP (+5 V ext.) 7: n.c. 8: RxD/TxD-N (A-line) 9: n.c.	

- n.c. = not connected

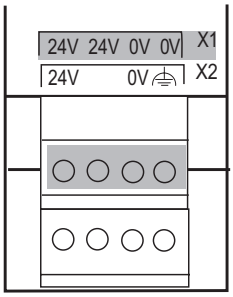
The PSSu is connected to PROFIBUS-DP via RS 485 communication. The PSSu supplies the PROFIBUS DP bus terminating resistors with voltage (+5 VDC).

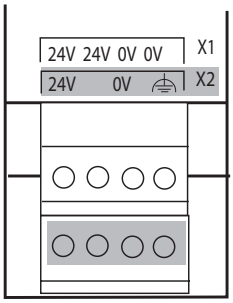
- Connect the connector housing to the shielding on the PROFIBUS cable. The connector housing should be connected with low impedance to the mounting rail.

Head modules
PSSu H m F DP SN SD

Wiring

Terminal configuration

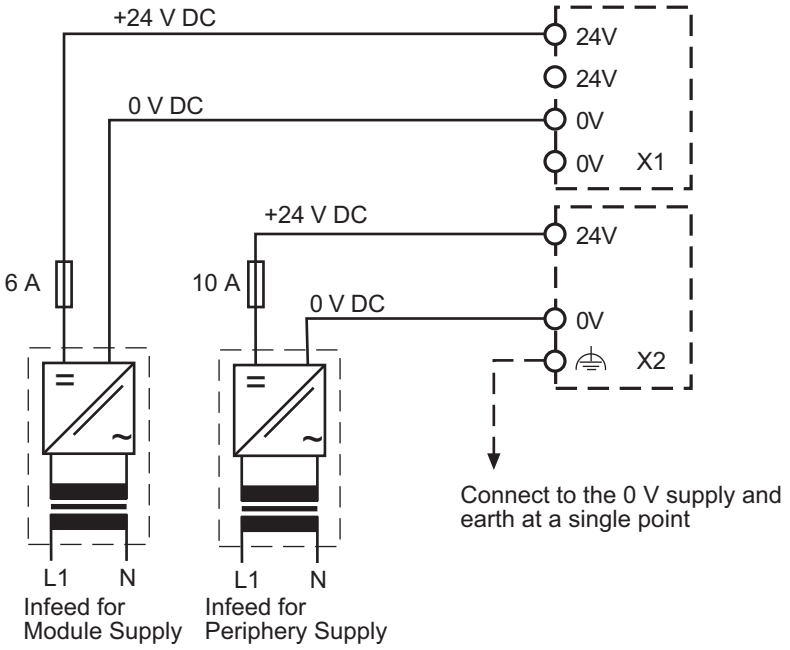
Module supply	Terminal configuration		X1
4-pin female connector	24V	+24 V infeed for module supply	
	0V	0 V infeed for module supply	

Periphery supply	Terminal configuration		X2
4-pin female connector	24V:	+24 V infeed for periphery supply	
	0V	0 V infeed for periphery supply	
	⏚	Functional earth	

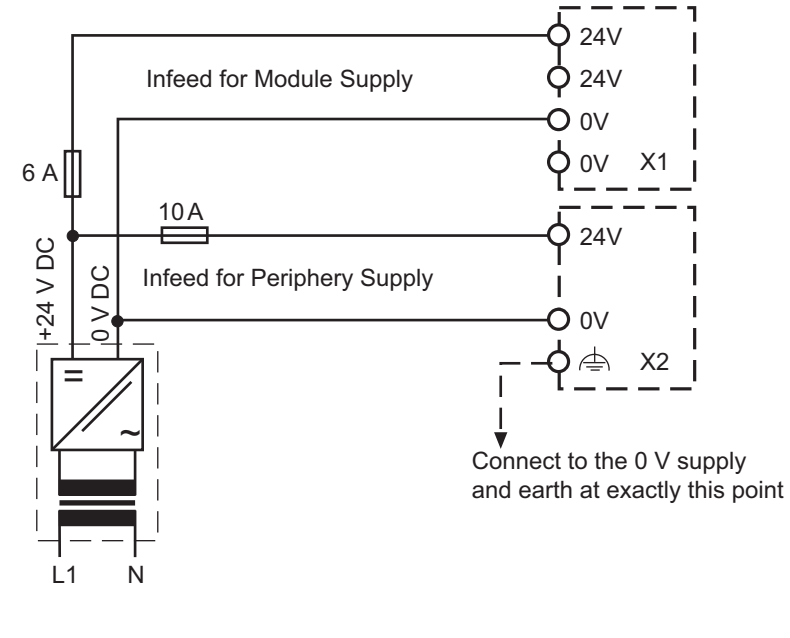
Head modules
PSSu H m F DP SN SD

Connecting the module

Separate power supplies for module supply and periphery supply:



Common power supply for module supply and periphery supply:



Head modules
PSSu H m F DP SN SD

Technical details

General	
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Application range	**Standard/failsafe**
System sections	
ST resource	**No**
FS resource	**yes**
ST module bus	**yes**
FS module bus	**yes**
ST SNp interface	**yes**
FS SNp interface	**yes**
PROFIBUS-DP Slave	**yes**
PROFINET IO DEVICE	**No**
IP connections	**yes**
Diagnostic Server	**No**
OPC Server	**No**
Programming	
IEC 61131 programming	**No**
Multi programming	**yes**
Non-volatile variables	**No**
Electrical data	
Supply voltage	
for	**Module supply**
Voltage	**24 V**
Kind	**DC**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**1 A**
Output of external power supply (DC)	**16,1 W**
Supply voltage	
for	**Periphery supply**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**10 A**
Potential isolation between module supply and periphery supply	**3050 V**
Potential isolation between module supply and PROFIBUS-DP	**700 V**

Head modules
PSSu H m F DP SN SD

Electrical data	
Internal supply voltage (module supply)	
Output voltage	**int. system**
Voltage	**5 V**
Voltage tolerance	**-2 %/+3 %**
Potential isolation	**3050 V**
Current load capacity	**2 A**
Buffer in the case of supply interruptions in accordance with	**EN 61131-2, EN 61496-1**
Short circuit-proof	**yes**
CPU	
Real-time clock for time and date functions	
Resolution	**1 s**
Deviation	**+/- 10s/day**
Buffer time	**10 days**
Max. number of FS tasks	**1**
Max. number of variables with elementary data types on the FS resource	**10.000**
Min. cycle time of FS tasks	**10 ms**
Working memory (RAM)	**64 MB**
Memory for the user program per resource	**2 MB**
Removable data medium	
Type	**SD card**
SafetyNET p interface	
Number	**1**
IP address (automatically off)	**169.254.X.Y**
Connection	**RJ45**
Transmission rates	**100 MBit/s**
Set via	**Automatic**
Max. number of ST-Tx and ST-Rx connections	**5**
Max. number of FS-Tx and FS-Rx connections	**5**
Cycle time (t_SNp RTFN)	**10 ... 60 000 ms**
Max. number of variables with elementary ST data types	**2500**
Max. number of variables with elementary FS data types	**2000**
PROFIBUS-DP interface	
Number	**1**
Device type	**Slave**
Station address	**0 ... 126d**
Station address selectable via	**DIP switch**

Head modules
PSSu H m F DP SN SD

PROFIBUS-DP interface	
Maximum data length of PROFIBUS interface	
Input device	**244 Byte**
Output	**244 Byte**
Diagnostics	**2 Byte**
Transmission rates	**1,5 MBit/s, 12 MBit/s, 185,5 kBit/s, 19,2 kBit/s, 3 MBit/s, 45,45 kBit/s, 500 kBit/s, 6 MBit/s, 9,6 kBit/s, 93,75 kBit/s**
Transmission rate selectable via	**automatic**
Connection	**9-pin D-Sub female connector**
Log	**DPV0**
Operating modes	**AutoBaud, Freeze Mode, Set Slave Address, Sync Mode**
Certification	**PNO**
Description file	**Pilz0CB0.gsd**
Manufacturer's ID	**0CB0h**
Cycle time (t_ExtCo)	**2 ... 300 000 ms**
Ethernet interface	
Number	**1**
IP address (automatically off)	**169.254.X.Y**
Connection type	**RJ45**
Transmission rate	**100 MBit/s**
Modbus/TCP	
Cycle time (t_ExtCo)	**2 ... 2 000 000 ms**
Raw UDP	
Cycle time (t_ExtCo)	**2 ... 2 000 000 ms**
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	
Temperature range	**0 - 60 °C**
Storage temperature	
Temperature range	**-25 - 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 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**

Head modules
PSSu H m F DP SN SD

Environmental data	
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 55 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
Housing	**IP20**
Mounting area (e.g. control cabinet)	**IP54**
Mechanical data	
Material	
Bottom	**PC**
Connection type	**Spring-loaded terminal, screw terminal**
Mounting type	**plug-in**
Conductor cross section with screw terminals	
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 2,5 mm², 24 - 12 AWG**
Stripping length with spring-loaded terminals	**9 mm**
Dimensions	
Height	**125,6 mm**
Width	**130 mm**
Depth	**83,7 mm**
Weight	**375 g**

Head modules
PSSu H m F DP SN SD

Where standards are undated, the 2009-07 latest editions shall apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 4	SIL CL 3	4,14E-09	SIL 3	3,51E-05	20

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

Order reference

Product

Product type	Features	Order No.
PSSu H m F DP SN SD	Head module with SafetyNET p and PROFIBUS-DP, base type	312 065

Accessories

Terminals

Product type	Features	Order no.
PSSu A Con 1/4 S	2 x screw terminals	313 110
PSSu A Con 2/8 C	2 x spring-loaded terminals	313 111

Head modules
PSSu H m F DPsafe SN SD

Overview

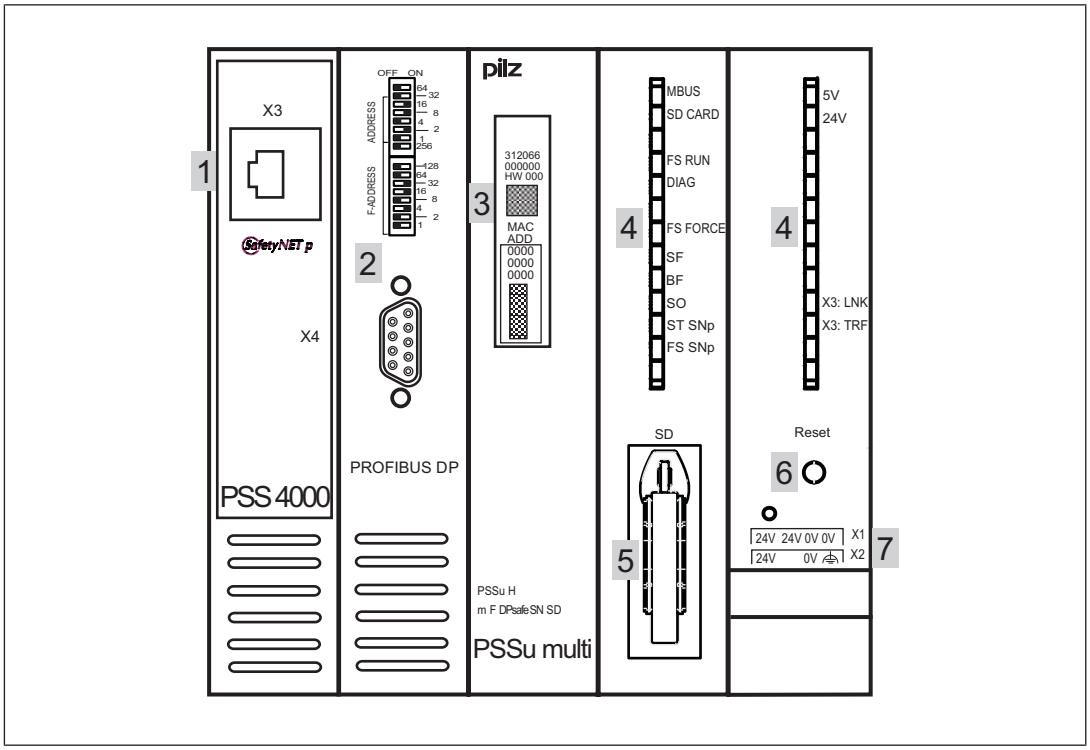
Module features

The head module belongs to the performance class "Control system PSSu multi". The head module has the following features:

- 1 free switch ports for connection to SafetyNET p
- Modbus TCP
- Raw UDP
- PROFIBUS-DP interface with PROFIsafe
- an FS resource
- SD card used to store the device project and the naming data
- Reset button
  - For warm reset
  - To transfer the naming data and/or device project from the SD card to the device memory
- Supply voltage
  - Integrated supply voltage for periphery supply and module supply
  - Module supply is buffered for 20 ms if the supply voltage is interrupted
  - Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- Status LEDs
- Supports FS and ST modules

Head modules
PSSu H m F DPsafe SN SD

Front view

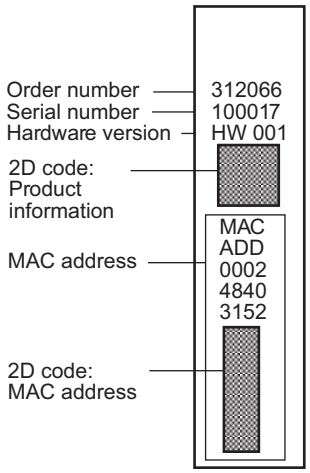


Legend:

- 1: SafetyNET p interface
- 2: PROFIBUS-DP interface with PROFIsafe
- 3: Labelling strip (see below for details)
- 4: Status LEDs
- 5: SD card
- 6: Reset button
- 7: Supply voltage connection (module and periphery supply)

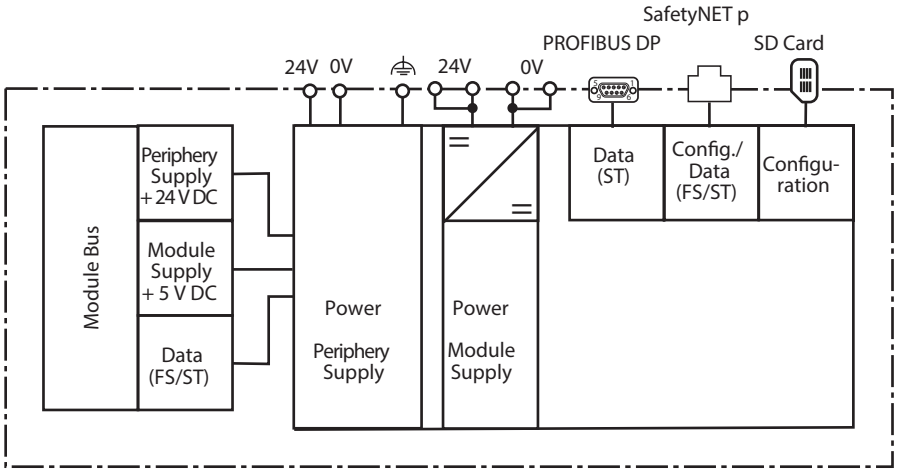
Head modules
PSSu H m F DPsafe SN SD

The labelling strip contains the following information:



Function description

Block diagram



Head modules
PSSu H m F DPsafe SN SD

Control system

The head module is a programmable logic controller (PLC), which can be used in safety-related and non-safety-related applications. The control system has memory areas for the operating system, the data and the device project with the user program.

User programs can be created in Multi programming.

For safety-related applications, the processor section is designed with multi-channel diversity.

The control system communicates with the input and output modules via the local module bus.

LEDs provide information on the status of the control system and indicate any errors.

Supply voltage

The product provides the module supply and periphery supply for the modules on the module bus:

- Module supply

  Supply voltage for subsequent module (right-hand side)
- Periphery supply

  Supply voltage for sensors, actuators and test pulses

When the supply voltage is fed in separately, the module supply and periphery supply are galvanically isolated. If galvanic isolation is not required, a common power supply may be used for the periphery supply and module supply.

Ensure you comply with the current load capacity of the module and periphery supply (see "Technical Details"). If the current load is higher, an additional supply voltage module is required to refresh the module supply and periphery supply.

- Module supply

  The current load is the total current consumption of all the electronic and compact modules.

  The module supply does not automatically switch off if values exceed or drop below their limits. However, the "5 V" LED will light and a message will be entered in the diagnostic list.
- Periphery supply

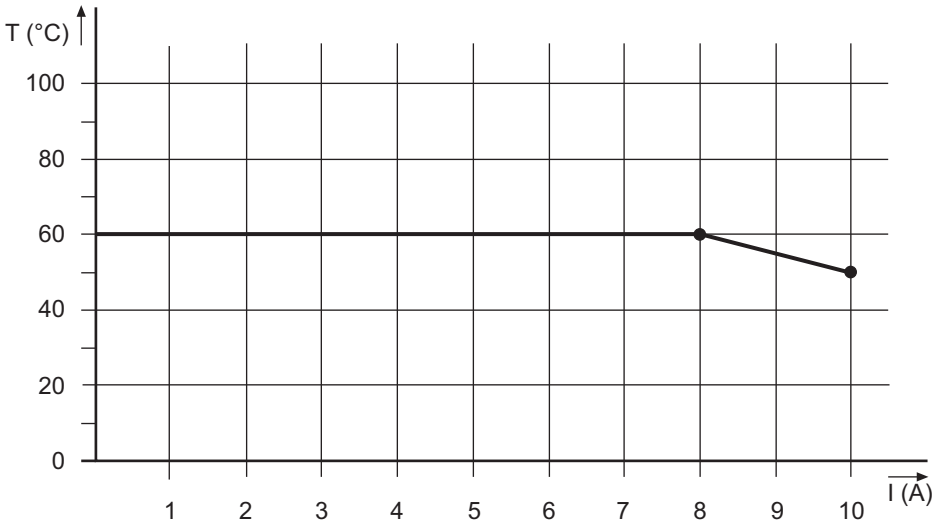
  The current load is the total current consumption of the sensors, actuators and test pulses supplied via the input/output modules.

  The periphery supply does not automatically switch off if values exceed or drop below their limits. However, the "24 V" LED will light and a message will be entered in the diagnostic list.

  Please refer to the derating diagram.

Head modules
PSSu H m F DPsafe SN SD

Derating diagram for periphery supply: Temperature T dependent on load current I



Integrated protection mechanisms

The module has the following protection mechanisms:

- Multi-channel diverse processor section
- Cyclical self tests
- Potentially isolated **SafetyNET p** interface
- Potentially isolated PROFIBUS DP interface
- Infeed for module supply
  - Polarity protection
  - Voltage monitoring
  - Transient voltage limitation
  - 20 ms voltage buffer if the supply voltage is interrupted
- Module supply
  - Short circuit-proof
- Periphery supply
  - Voltage monitoring (exceeding upper/lower limit)

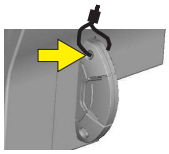
Head modules
PSSu H m F DPsafe SN SD

SD card

The SD card has the following functions:

- The SD card is used to store the naming data and the device project; see PSS 4000 System Description.
- The SD card is part of the safety concept on PSS 4000. If the SD card is missing or has been swapped, the next time the PSSu system is booted it will be unable to achieve the operating status "PSSu System in RUN condition without error". The SD card has a locking mechanism, which protects it from being removed from the card holder unintentionally. The SD card can also be sealed to protect it from manipulation, whether accidental or intentional.

Sealing the SD card for additional protection:



Reset button

The "Reset" pushbutton on the head module has various functions:

- Perform a warm reset for the PSSu system.

  The reset pushbutton can be used to perform a warm reset for the PSSu system.
- Transfer the naming data and/or device project from the SD card (deliberate operator action to transfer the naming data and/or device project from the SD card to the device memory).

SafetyNET p

Functions

- The SafetyNET p interface enables safety-related and non-safety-related data transfer between the PSSu system and other network subscribers.
- The head module receives signals from other network subscribers; it processes these signals in the user program and passes them on to the connected input/output modules.
- The head module receives signals from the connected input/output modules; it processes these signals in the user program and passes them on to the other network subscribers.
- If a fault occurs, the module switches the connected failsafe outputs to a safe condition.

Head modules
PSSu H m F DPsafe SN SD

MAC address

- The MAC address is a factory-set default. It can found on the labelling strip on the front of the module.

PROFIBUS-DP with PROFIsafe

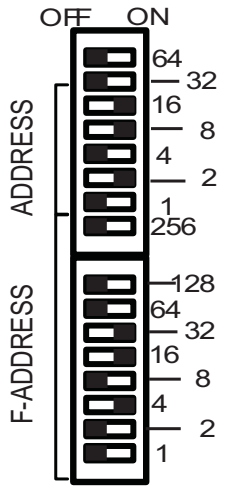
PROFIBUS is an open fieldbus standard whose communication is defined in the international standards IEC 61158 and IEC 61784. Further provisions have been defined in specifications published by the PROFIBUS User Group. These specifications are available from PROFIBUS International (see www.profibus.com).

The head module has a PROFIBUS-DP interface with PROFIsafe. Communication via PROFIsafe is defined in the international standard IEC 61784-3-3.

- The station address of a PSSu is set via the "ADDRESS" DIP switch. The DIP switch is binary coded. Permitted station addresses are in the range 0_D ... 125_D. If station address 126_D is set via the DIP switch, the address can be assigned via the Master. The Set Slave Address command (SSA) must be run for this purpose.
- The station address of an F-device is set via the "F-ADDRESS" DIP switch. The DIP switch is binary coded. Permitted station addresses are in the range 1_D ... 511_D

Head modules
PSSu H m F DPsafe SN SD

The station address is set as follows:

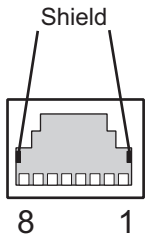
"ADDRESS" DIP switch	Meaning		Example:
Switch designation	**OFF**	**ON**	**Station address** **PSSu: 26** $_D$ **F-device: 52** $_D$
64	0	64_D	
32	0	32_D	
16	0	16_D	
8	0	8_D	
4	0	4_D	
2	0	2_D	
1	0	1_D	
"F-ADDRESS" DIP switch			
256	0	256_D	
128	0	128_D	
64	0	64_D	
32	0	32_D	
16	0	16_D	
8	0	8_D	
4	0	4_D	
2	0	2_D	
1	0	1_D	

Head modules
PSSu H m F DPsafe SN SD

Interfaces

SafetyNET p

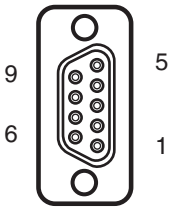
SafetyNET p is an Ethernet interface. Further information can be found in the System Description PSS 4000.

SafetyNET p	Assignment	
RJ45 female connector	1: TD+ 2: TD- 3: RD+ 4: n.c. 5: n.c. 6: RD- 7: n.c. 8: n.c.	

- n.c. = not connected

PROFIBUS DP

The head module can be incorporated into the PROFIBUS as slave.

PROFIBUS DP	Layout	
Female 9-pin D-SUB connector conforms to the guidelines of the PROFIBUS User Group (PNO)	1: n.c. 2: n.c. 3: RxD/TxD-P (B-line) 4: CNTR-P (RTS) 5: DGND (GND ext.) 6: VP (+5 V ext.) 7: n.c. 8: RxD/TxD-N (A-line) 9: n.c.	

- n.c. = not connected

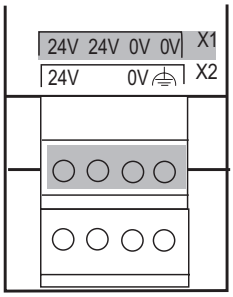
The PSSu is connected to PROFIBUS-DP via RS 485 communication. The PSSu supplies the PROFIBUS DP bus terminating resistors with voltage (+5 VDC).

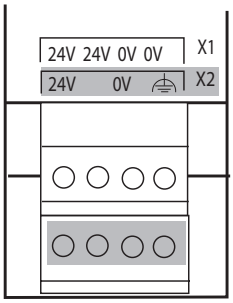
- Connect the connector housing to the shielding on the PROFIBUS cable. The connector housing should be connected with low impedance to the mounting rail.

Head modules
PSSu H m F DPsafe SN SD

Wiring

Terminal configuration

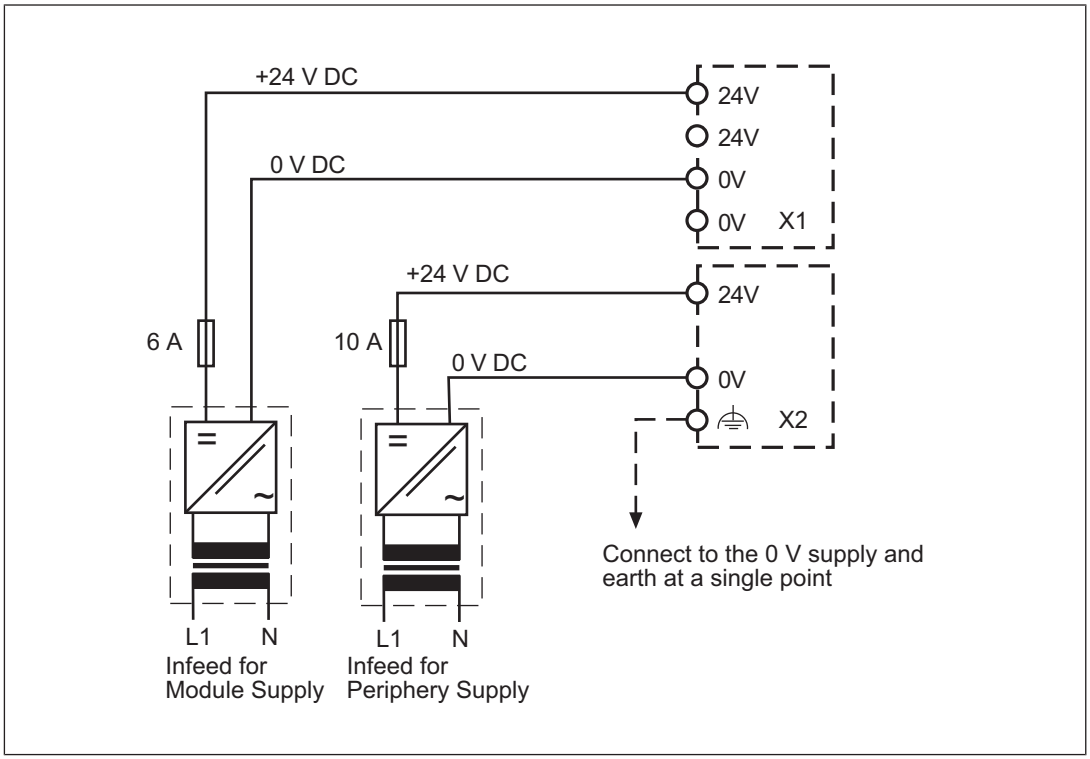
Module supply	Terminal configuration		X1
4-pin female connector	24V	+24 V infeed for module supply	
	0V	0 V infeed for module supply	

Periphery supply	Terminal configuration		X2
4-pin female connector	24V:	+24 V infeed for periphery supply	
	0V	0 V infeed for periphery supply	
	⏚	Functional earth	

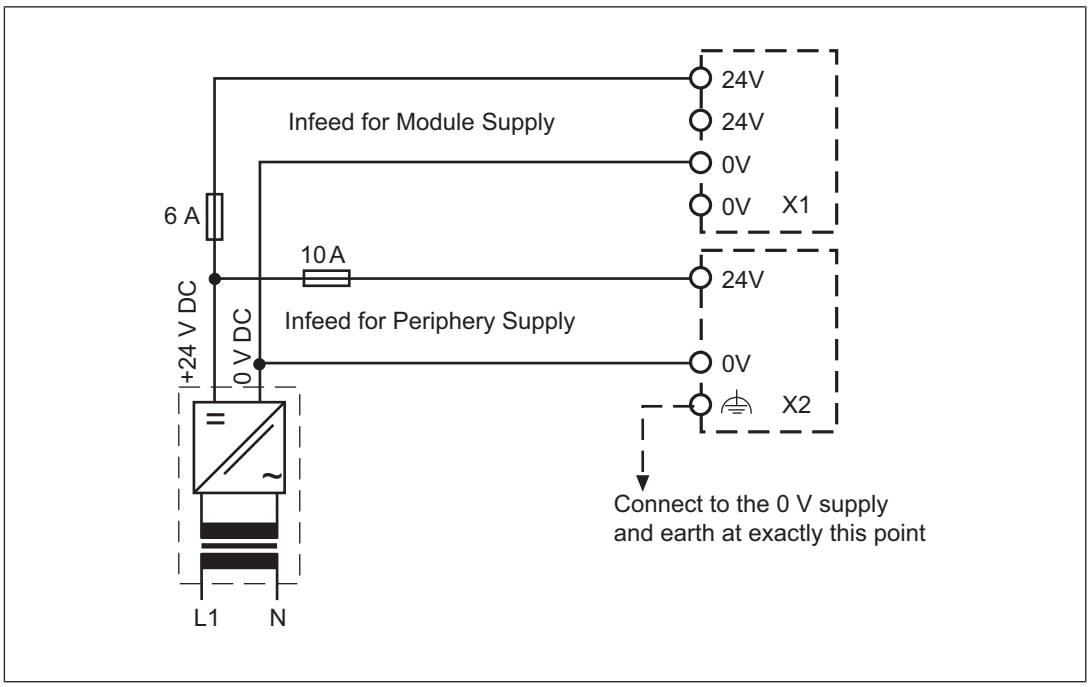
Head modules
PSSu H m F DPsafe SN SD

Connecting the module

Separate power supplies for module supply and periphery supply:



Common power supply for module supply and periphery supply:



Head modules
PSSu H m F DPsafe SN SD

Technical details

General	
Approvals	**CE, EAC (Eurasian), TÜV, cULus Listed**
Application range	**Standard/failsafe**
System sections	
ST resource	**No**
FS resource	**yes**
ST module bus	**yes**
FS module bus	**yes**
ST SNp interface	**yes**
FS SNp interface	**yes**
PROFIBUS-DP Slave	**yes**
PROFINET IO DEVICE	**No**
IP connections	**yes**
Diagnostic Server	**No**
OPC Server	**No**
Programming	
IEC 61131 programming	**No**
Multi programming	**yes**
Non-volatile variables	**No**
Electrical data	
Supply voltage	
for	**Module supply**
Voltage	**24 V**
Kind	**DC**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**1 A**
Output of external power supply (DC)	**16,1 W**
Supply voltage	
for	**Periphery supply**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**10 A**
Potential isolation between module supply and periphery supply	**3050 V**
Potential isolation between module supply and PROFIBUS-DP	**700 V**

Head modules
PSSu H m F DPsafe SN SD

Electrical data	
Internal supply voltage (module supply)	
Output voltage	**int. system**
Voltage	**5 V**
Voltage tolerance	**-2 %/+3 %**
Potential isolation	**3050 V**
Current load capacity	**2 A**
Buffer in the case of supply interruptions in accordance with	**EN 61131-2, EN 61496-1**
Short circuit-proof	**yes**
CPU	
Real-time clock for time and date functions	
Resolution	**1 s**
Deviation	**+/- 10s/day**
Buffer time	**10 days**
Max. number of FS tasks	**1**
Max. number of variables with elementary data types on the FS resource	**10.000**
Min. cycle time of FS tasks	**10 ms**
Working memory (RAM)	**64 MB**
Memory for the user program per resource	**2 MB**
Removable data medium	
Type	**SD card**
SafetyNET p interface	
Number	**1**
IP address (automatically off)	**169.254.X.Y**
Connection	**RJ45**
Transmission rates	**10 MBit/s, 100 MBit/s**
Set via	**Automatic**
Max. number of ST-Tx and ST-Rx connections	**5**
Max. number of FS-Tx and FS-Rx connections	**5**
Cycle time (t_SNp RTFN)	**10 ... 60 000 ms**
Max. number of variables with elementary ST data types	**2500**
Max. number of variables with elementary FS data types	**2000**
PROFIBUS-DP interface	
Number	**1**
Device type	**Slave**
Station address	**0 ... 126d**
Station address selectable via	**DIP switch**
F-address	**1 ... 511d**

Head modules
PSSu H m F DPsafe SN SD

PROFIBUS-DP interface	
Maximum data length of PROFIBUS interface	
Input device	**244 Byte**
Output	**244 Byte**
Diagnostics	**244 Byte**
Transmission rates	**1,5 MBit/s, 12 MBit/s, 185,5 kBit/s, 19,2 kBit/s, 3 MBit/s, 45,45 kBit/s, 500 kBit/s, 6 MBit/s, 9,6 kBit/s, 93,75 kBit/s**
Transmission rate selectable via	**automatic**
Connection	**9-pin D-Sub female connector**
Log	**DPV1, PROFIsafe V2.4**
Operating modes	**AutoBaud, Freeze Mode, Set Slave Address, Sync Mode**
Certification	**PNO**
Description file	**Pilz0D9A.gsd**
Manufacturer's ID	**0CB0h**
Cycle time (t_ExtCo)	**2 ... 300 000 ms**
Cycle time (t_ExtCo) with PROFIsafe	**4 ... 32000 ms**
Modbus/TCP	
Cycle time (t_ExtCo)	**2 ... 2 000 000 ms**
Raw UDP	
Memory size	**8 Kbyte**
Cycle time (t_ExtCo)	**2 ... 2 000 000 ms**
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	
Temperature range	**0 - 60 °C**
Storage temperature	
Temperature range	**-25 - 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 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**

Head modules
PSSu H m F DPsafe SN SD

Environmental data	
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 55 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
Housing	**IP20**
Mounting area (e.g. control cabinet)	**IP54**
Mechanical data	
Material	
Bottom	**PC**
Connection type	**Spring-loaded terminal, screw terminal**
Mounting type	**plug-in**
Conductor cross section with screw terminals	
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 2,5 mm², 24 - 12 AWG**
Stripping length with spring-loaded terminals	**9 mm**
Dimensions	
Height	**125,6 mm**
Width	**130 mm**
Depth	**83,7 mm**
Weight	**405 g**

Head modules
PSSu H m F DPsafe SN SD

Where standards are undated, the 2009-07 latest editions shall apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 4	SIL CL 3	4,14E-09	SIL 3	3,51E-05	20

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

Order reference

Product

Product type	Features	Order no.
PSSu H m F DPsafe SN SD	Head module with SafetyNET p and PROFIBUS-DP with PROFIsafe, base type	312 066

Accessories

Terminals

Product type	Features	Order no.
PSSu A Con 1/4 S	2 x screw terminals	313 110
PSSu A Con 2/8 C	2 x spring-loaded terminals	313 111

Supply voltage

Supply voltage

Supply voltage
PSSu E F PS

Overview

Module features

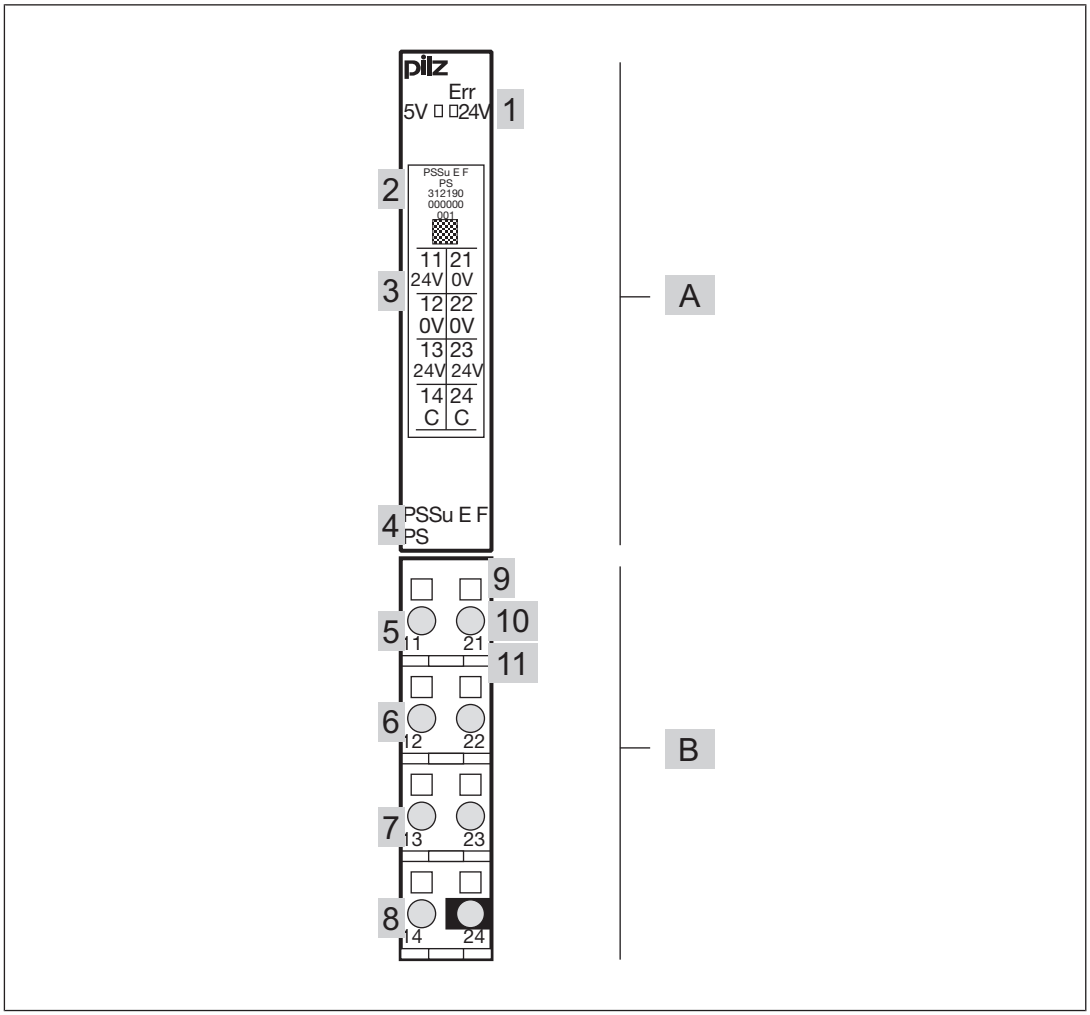
The product has the following features:

- Current load capacity of module supply max. 1,5 A
- The module supply is not buffered if the supply voltage is interrupted
- Separate infeed for periphery supply
- Separate infeed for module supply
- Infeed for C-rail supply
- LEDs for:
  - Module supply
  - Periphery supply
  - Module error
- Application range depends on the base module
- T-type:

  PSSu E F PS-T: for increased environmental requirements

Supply voltage
PSSu E F PS

Front view



Key:

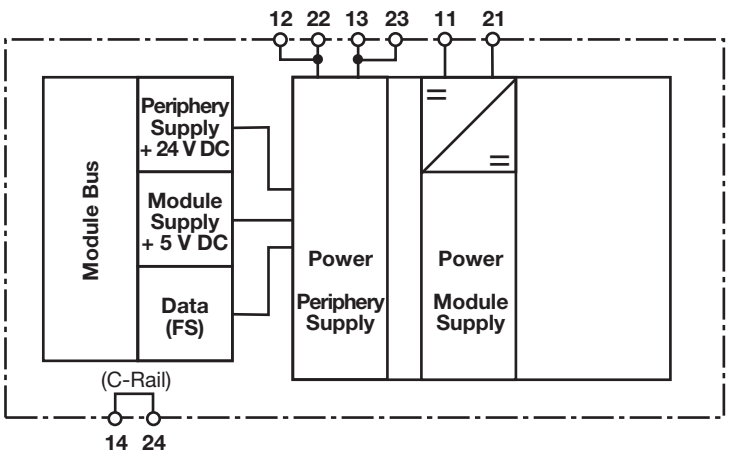
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1

Supply voltage
PSSu E F PS

- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Supply voltage
PSSu E F PS

Module features

The product provides the module supply and periphery supply for the modules on the module bus:

- Module supply

  Supply voltage for subsequent module (right-hand side)
- Periphery supply

  Supply voltage for sensors, actuators and test pulses
- C-rail

  Infeed of the permitted additional supplies for the C-rail; a detailed description of how to use the C-rail can be found in the system description.

When the supply voltage is fed in separately, the module supply and periphery supply are galvanicaly isolated. If galvanic isolation is not required, a common power supply may be used for the periphery supply and module supply.

The module enables

- The module supply and periphery supply to be refreshed:

  The relevant base module interrupts the connection to the incoming (left-hand) module supply, periphery supply and C-rail on the module bus. The 0 V supply on the module supply is connected to the left and right.
- Supply groups to be formed

  The relevant base module interrupts the connection to the incoming (left-hand) periphery supply and C-rail on the module bus. Each supply group requires its own supply module.

Ensure you comply with the current load capacity of the module and periphery supply (see "Technical Details"). If the current load is higher, an additional supply voltage module is required to refresh the module supply and periphery supply.

- Module supply

  The current load is the total current consumption of all the electronic and compact modules.

  The module supply does not automatically switch off if values exceed or drop below their limits. However, the "5 V" LED will light and a message will be entered in the error stack or diagnostic log.

Supply voltage
PSSu E F PS

- Periphery supply

  The current load is the total current consumption of the sensors, actuators and test pulses supplied via the input/output modules.

  The periphery supply does not automatically switch off if values exceed or drop below their limits. However, the "24 V" LED will light and a message will be entered in the error stack or diagnostic log.

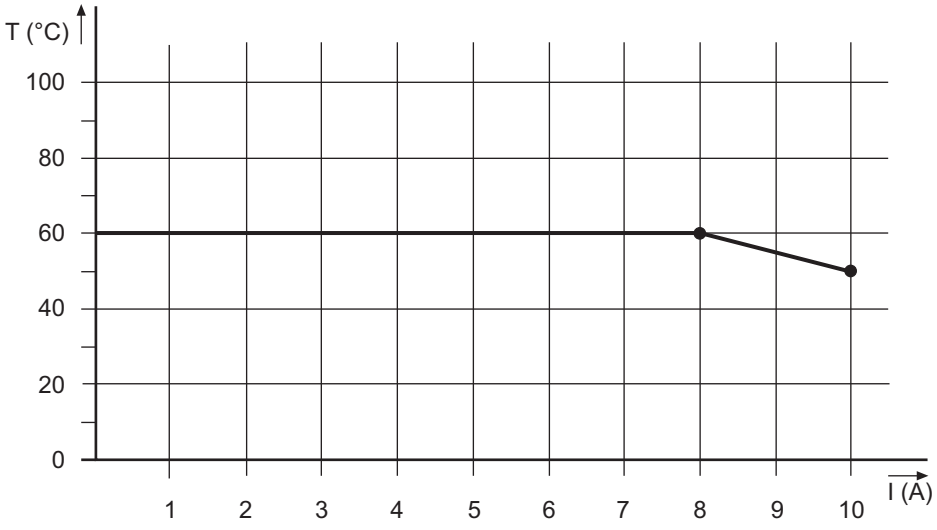
  Please refer to the derating diagram.

- C-rail

  If the current load is higher, the C-rail must use a different supply to prevent overload.

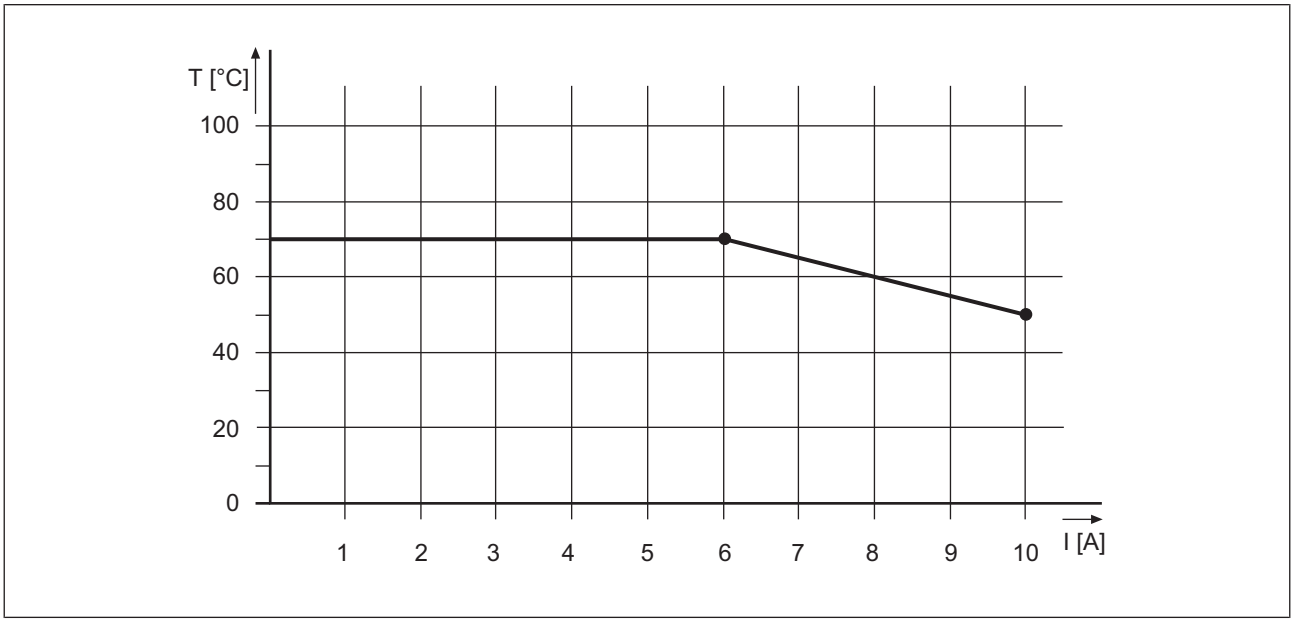
  Please refer to the derating diagram.

PSSu E F PS: Derating diagram for periphery supply and C-rail: Temperature T dependent on load current I

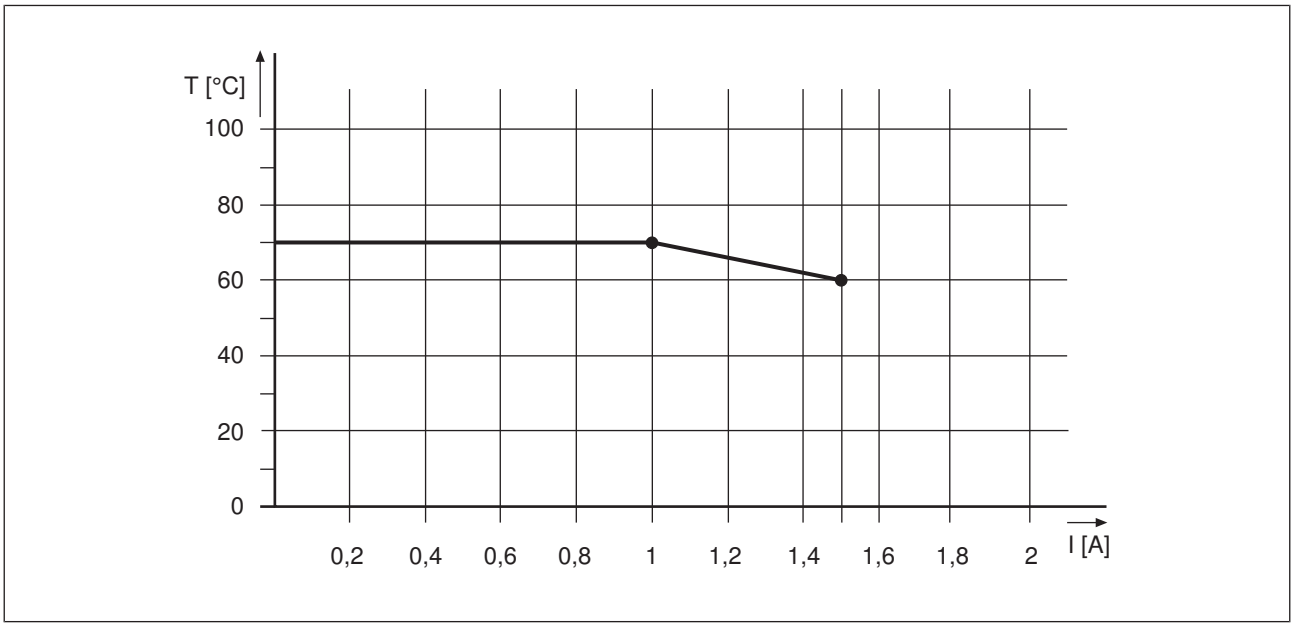


Supply voltage
PSSu E F PS

PSSu E F PS-T: Derating diagram for infeed for periphery supply: Permitted ambient temperature T dependent on load current I



PSSu E F PS-T: Derating diagram for infeed for module supply: Permitted ambient temperature T dependent on load current I



The module has the following protection mechanisms:

- Infeed for module supply
  - Polarity protection
  - Voltage monitoring
  - Transient voltage limitation

Supply voltage
PSSu E F PS

- Module supply
  - Short circuit-proof
- Periphery supply
  - Voltage monitoring (exceeding upper/lower limit)

The module registers the following errors:

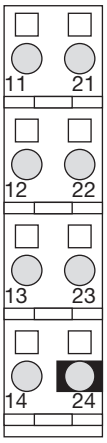
- Start-up error
- Configuration error
- FS communication error
- Bus termination error
- Temperature error: too warm
- Overvoltage error
- Undervoltage error
- Error in the overvoltage protection diodes

Supply voltage
PSSu E F PS

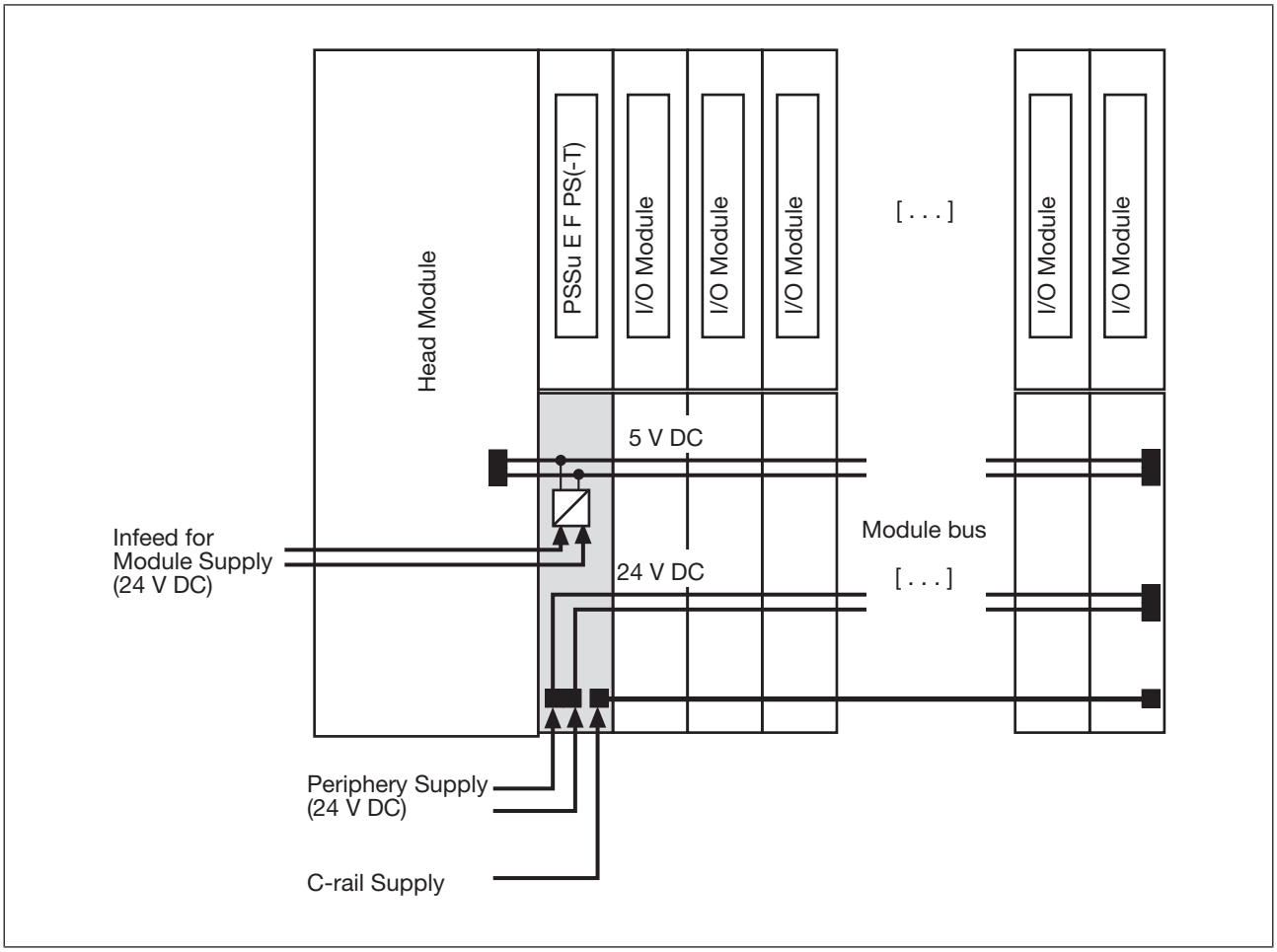
Wiring

Terminal configuration

- For use as a general supply module, supplying a head module and subsequent modules

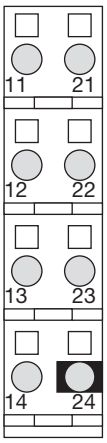
Base module	Terminal configuration	
Screw terminals: PSSu BS 1/8 S PSSu BS 1/8 S-T Cage clamp terminals: PSSu BS 1/8 C PSSu BS 1/8 C-T	11: +24 V infeed for module supply 21: 0 V infeed for module supply 12 -22: 0 V periphery supply, interrupted to the left (12-22 linked within the base module) 13 -23: +24 V periphery supply, interrupted to the left (13-23 linked within the base module) 14-24 C-rail supply, interrupted to the left (14-24 linked within the base module)	

Supply voltage
PSSu E F PS

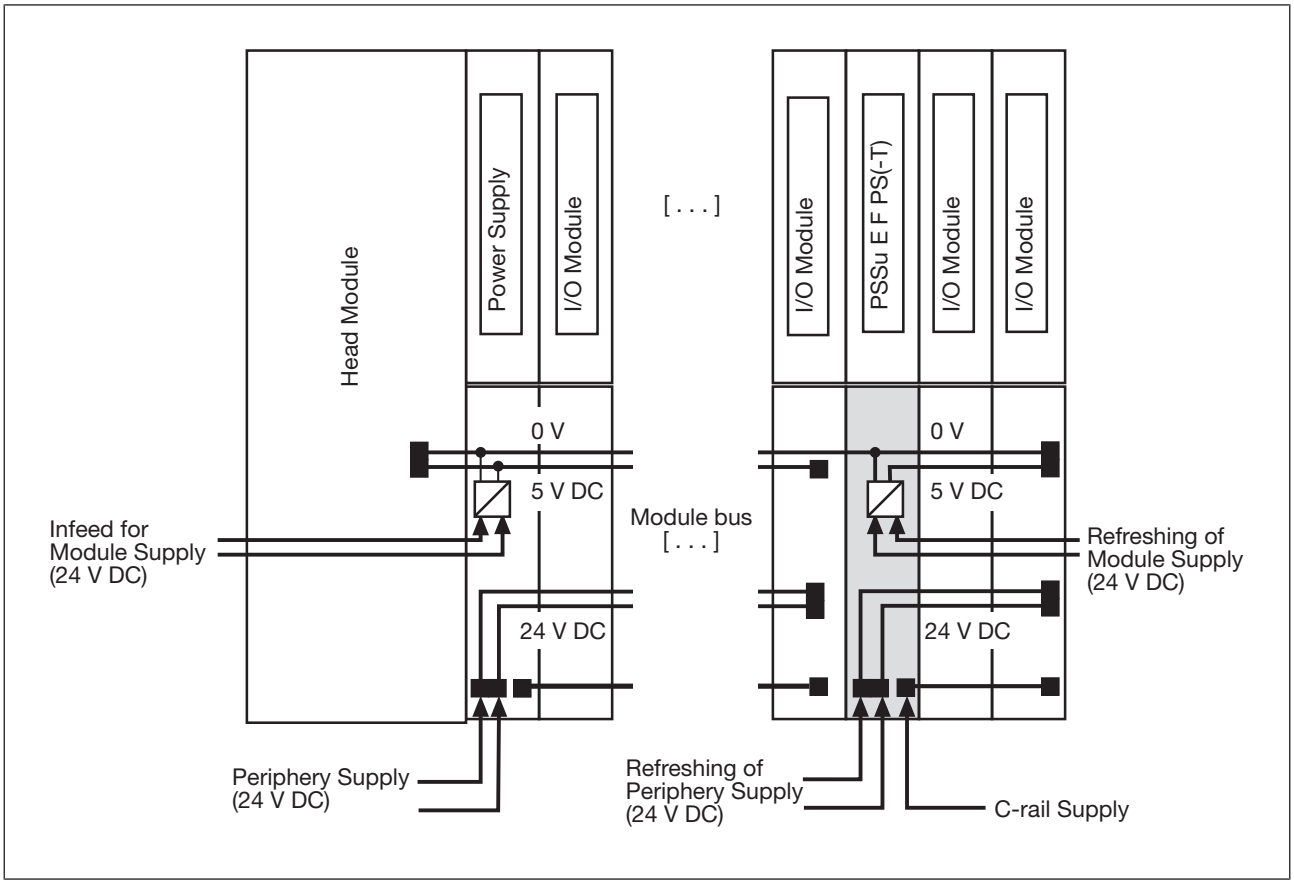


Supply voltage
PSSu E F PS

- For use as a supply module to refresh the module supply and periphery supply
- For use as a supply module to form supply groups
  - To interrupt the incoming periphery supply and C-rail
  - To provide subsequent modules with the module supply, periphery supply and C-rail supply
- With these base modules the supply module cannot be used as the first module after the head module.

Base module	Terminal configuration	
Screw terminals: PSSu BS-R 1/8 S PSSu BS-R 1/8 S-T Cage clamp terminals: PSSu BS-R 1/8 C PSSu BS-R 1/8 C-T	11: +24 V infeed for module supply, interrupted to the left 21: 0 V infeed for module supply 12 -22: 0 V periphery supply, interrupted to the left (12-22 linked within the base module) 13 -23: +24 V periphery supply, interrupted to the left (13-23 linked within the base module) 14-24 C-rail supply, interrupted to the left (14-24 linked within the base module)	

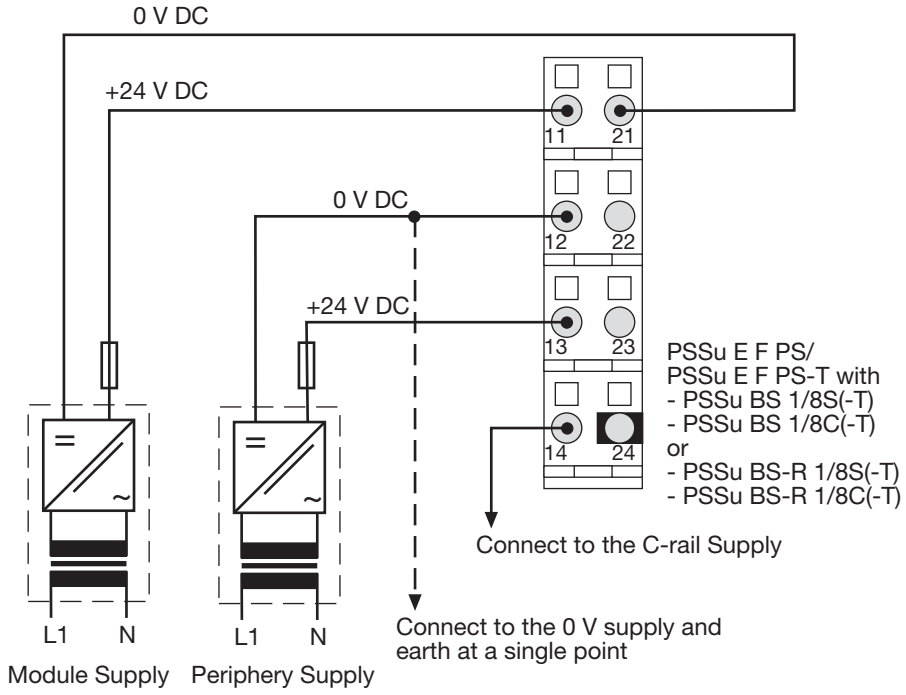
Supply voltage
PSSu E F PS



Supply voltage
PSSu E F PS

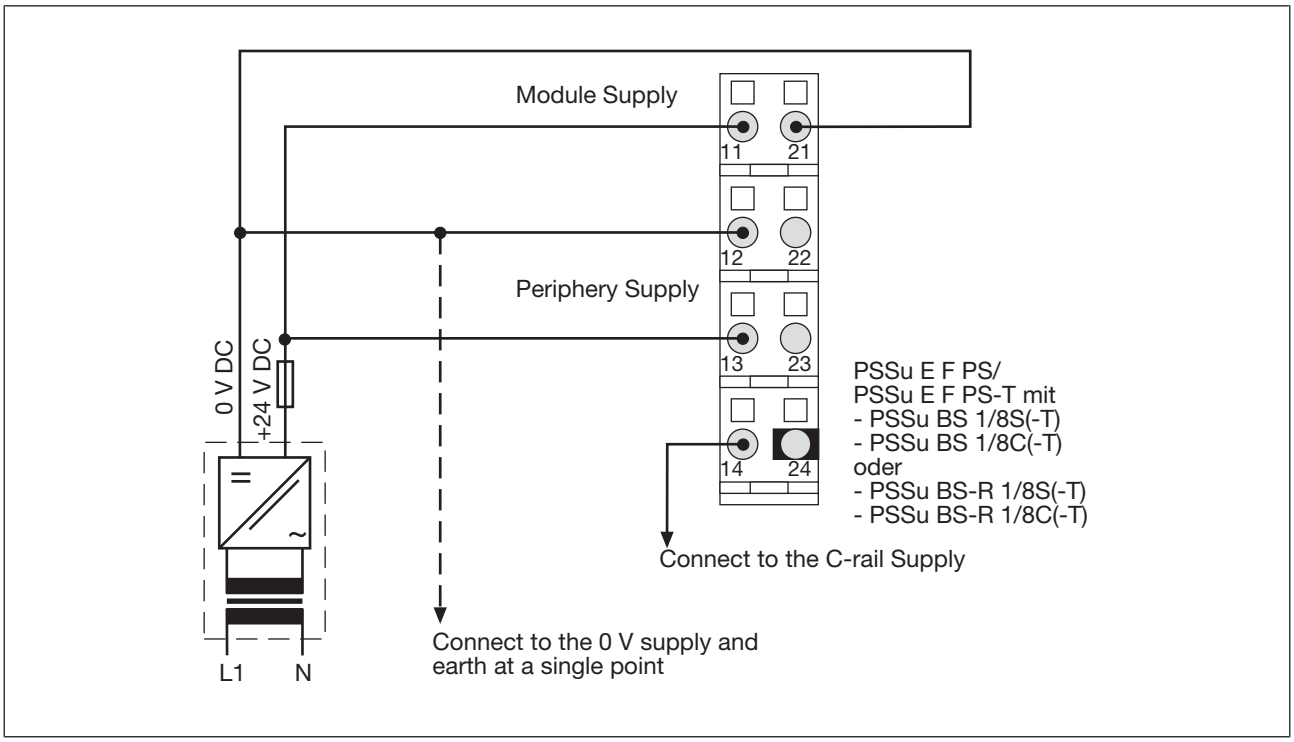
Connecting the module

Separate power supplies for module supply and periphery supply



Supply voltage
PSSu E F PS

Common power supply for module supply and periphery supply



Technical details

General	312190	314190
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Application range	**Standard/failsafe**	**Standard/failsafe**
Module's device code	**0801h**	**0801h**
Application in system environment A		
From FS firmware version, other head modules	**4**	**4**
From ST firmware version, other head modules	**5**	**5**
From FS firmware version PSSu H F PN	**1**	**1**
From ST firmware version PSSu H S PN	**1**	**1**
From ST firmware version PSSu WR S IDN	**6**	**6**

Supply voltage
PSSu E F PS

General	312190	314190
Application in system environment B		
From FS firmware version, head modules	**1.0.0**	**1.0.0**
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312190**	**314190**
Supply voltage		
for	**Module supply**	**Module supply**
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**
Current load capacity at UB	**0,6 A**	**0,6 A**
Inrush current that the external power supply must provide	**4 A**	**4 A**
Output of external power supply (DC)	**9 W**	**9 W**
Supply voltage		
for	**Periphery supply**	**Periphery supply**
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**
Current load capacity at UB	**10 A**	**10 A**
Rated surge voltage	**3050 V**	**3050 V**
Potential isolation between module supply and periphery supply	**3050 V**	**3050 V**
Internal supply voltage (module supply)		
Output voltage	**int. system**	**int. system**
Voltage	**5 V**	**5 V**
Voltage tolerance	**-2 %/+3 %**	**-2 %/+3 %**
Module's power consumption	**0,12 W**	**0,12 W**
Potential isolation	**3050 V**	**3050 V**
Current load capacity	**1,5 A**	**1,5 A**
Short circuit-proof	**yes**	**yes**
Periphery's supply voltage (periphery supply)		
Module's current consumption with no load	**5 mA**	**5 mA**
Module's power consumption with no load	**0,12 W**	**0,12 W**
Max. power dissipation of module	**1,5 W**	**1,5 W**

Supply voltage
PSSu E F PS

Environmental data	312190	314190
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		
Temperature range	**0 - 60 °C**	**-40 - 70 °C**
Max. temperature in accordance with UL	–	**0 ... 60 °C**
Storage temperature		
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 150 Hz**	**10 - 1000 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**5g**
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**25g**
Duration	**16 ms**	**6 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**

Supply voltage
PSSu E F PS

Environmental data	312190	314190
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Mechanical data	**312190**	**314190**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76 mm**	**76 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**39 g**	**40 g**
Mechanical coding		
Type	**B**	**B**
Colour	**Yellow**	**Yellow**

Where standards are undated, the 2015-03 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E F PS	Electronic module, base type	312 190
PSSu E F PS-T	Electronic module, T-type	314 190

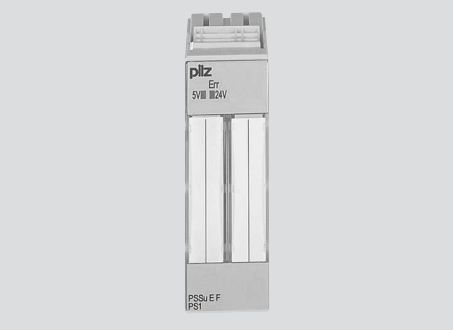
Supply voltage
PSSu E F PS

Accessories

Base modules

Product type	Features	Order No.
PSSu BS 1/8 S	Base module with screw terminals, for use only as the first module after the head module	312 650
PSSu BS 1/8 S-T	Base module with screw terminals, for use only as the first module after the head module, T-type	314 650
PSSu BS 1/8 C	Base module with cage clamp terminals, for use only as the first module after the head module	312 651
PSSu BS 1/8 C-T	Base module with cage clamp terminals, for use only as the first module after the head module, T-type	314 651
PSSu BS-R 1/8 S	Base module with screw terminals, for use only to refresh the voltage and form supply groups	312 652
PSSu BS-R 1/8 S-T	Base module with screw terminals, for use only to refresh the voltage and form supply groups, T-type	314 652
PSSu BS-R 1/8 C	Base module with cage clamp terminals, for use only to refresh the voltage and form supply groups	312 653
PSSu BS-R 1/8 C-T	Base module with cage clamp terminals, for use only to refresh the voltage and form supply groups, T-type	314 653

Supply voltage
PSSu E F PS1



Overview

Module features

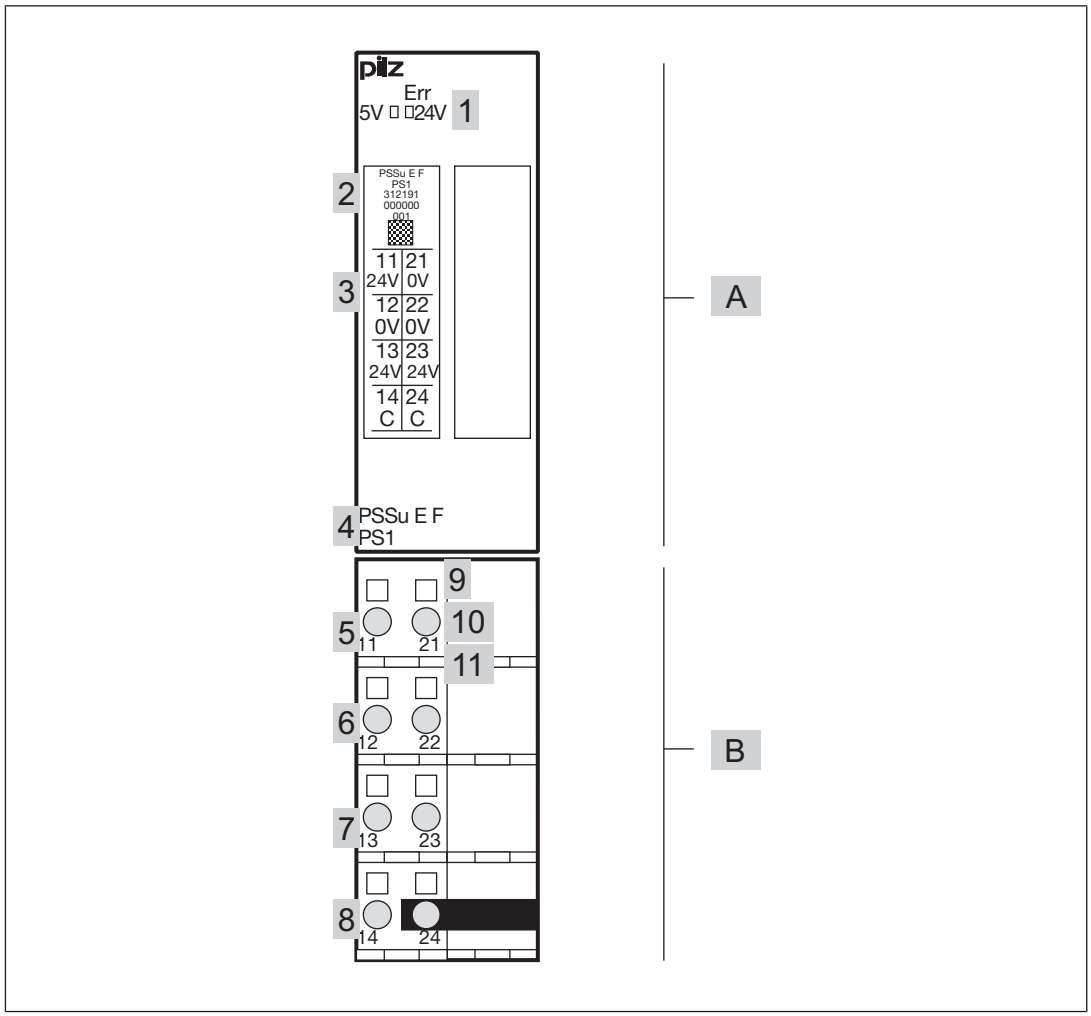
The product has the following features:

- Current load capacity of module supply [max. 2 A
- When the supply voltage is interrupted, the module supply is buffered for 20 ms.
- Separate infeed for periphery supply
- Separate infeed for module supply
- Infeed for C-rail supply
- LEDs for:
  - Module supply
  - Periphery supply
  - Module error
- Application range depends on the base module
- T-type:

  PSSu E F PS1-T: for increased environmental requirements

Supply voltage
PSSu E F PS1

Front view



Key:

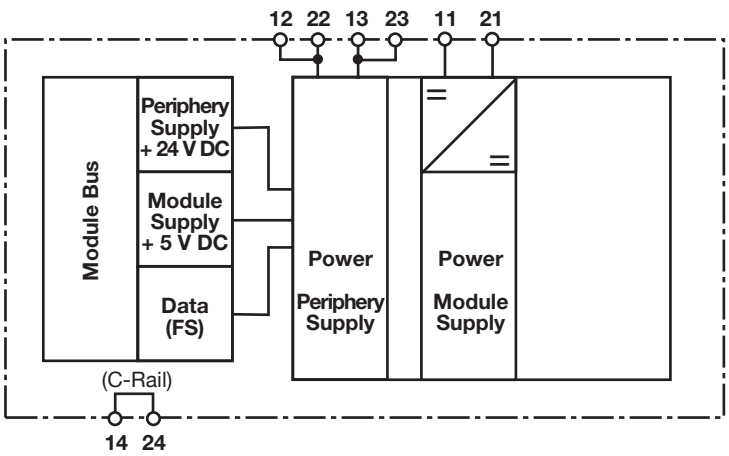
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1

Supply voltage
PSSu E F PS1

- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Supply voltage
PSSu E F PS1

Module features

The product provides the module supply and periphery supply for the modules on the module bus:

- Module supply

  Supply voltage for subsequent module (right-hand side)
- Periphery supply

  Supply voltage for sensors, actuators and test pulses
- C-rail

  Infeed of the permitted additional supplies for the C-rail; a detailed description of how to use the C-rail can be found in the system description.

When the supply voltage is fed in separately, the module supply and periphery supply are galvanicaly isolated. If galvanic isolation is not required, a common power supply may be used for the periphery supply and module supply.

The module enables

- The module supply and periphery supply to be refreshed:

  The relevant base module interrupts the connection to the incoming (left-hand) module supply, periphery supply and C-rail on the module bus. The 0 V supply on the module supply is connected to the left and right.
- Supply groups to be formed

  The relevant base module interrupts the connection to the incoming (left-hand) periphery supply and C-rail on the module bus. Each supply group requires its own supply module.

Ensure you comply with the current load capacity of the module and periphery supply (see "Technical Details"). If the current load is higher, an additional supply voltage module is required to refresh the module supply and periphery supply.

- Module supply

  The current load is the total current consumption of all the electronic and compact modules.

  The module supply does not automatically switch off if values exceed or drop below their limits. However, the "5 V" LED will light and a message will be entered in the error stack or diagnostic log.

Supply voltage
PSSu E F PS1

- Periphery supply

  The current load is the total current consumption of the sensors, actuators and test pulses supplied via the input/output modules.

  The periphery supply does not automatically switch off if values exceed or drop below their limits. However, the "24 V" LED will light and a message will be entered in the error stack or diagnostic log.

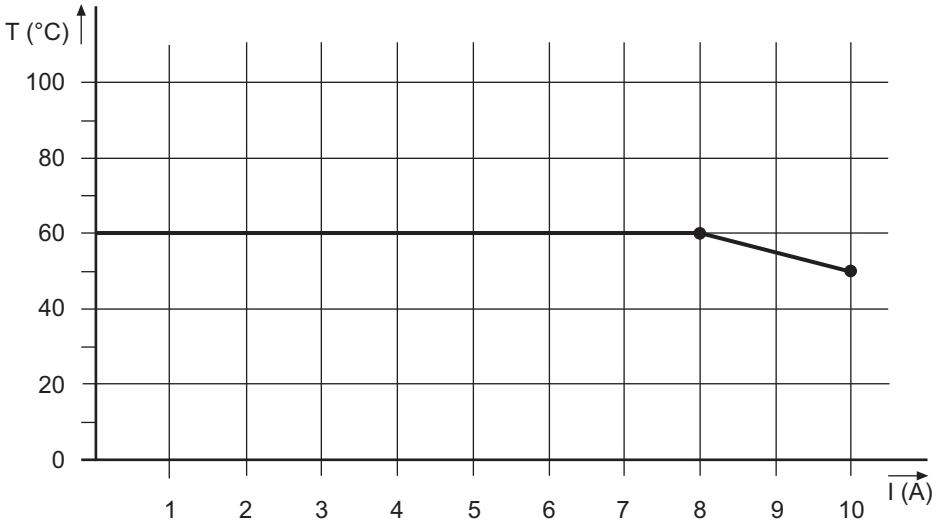
  Please refer to the derating diagram.

- C-rail

  If the current load is higher, the C-rail must use a different supply to prevent overload.

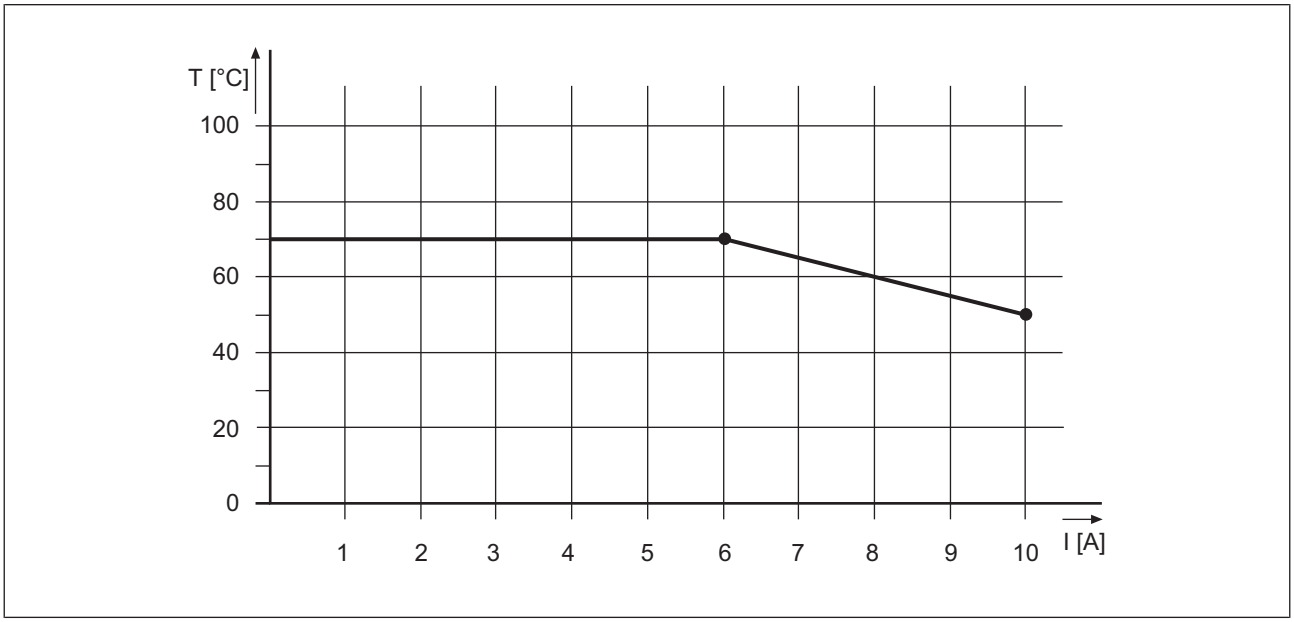
  Please refer to the derating diagram.

PSSu E F PS1: Derating diagram for periphery supply and C-rail: Temperature T dependent on load current I

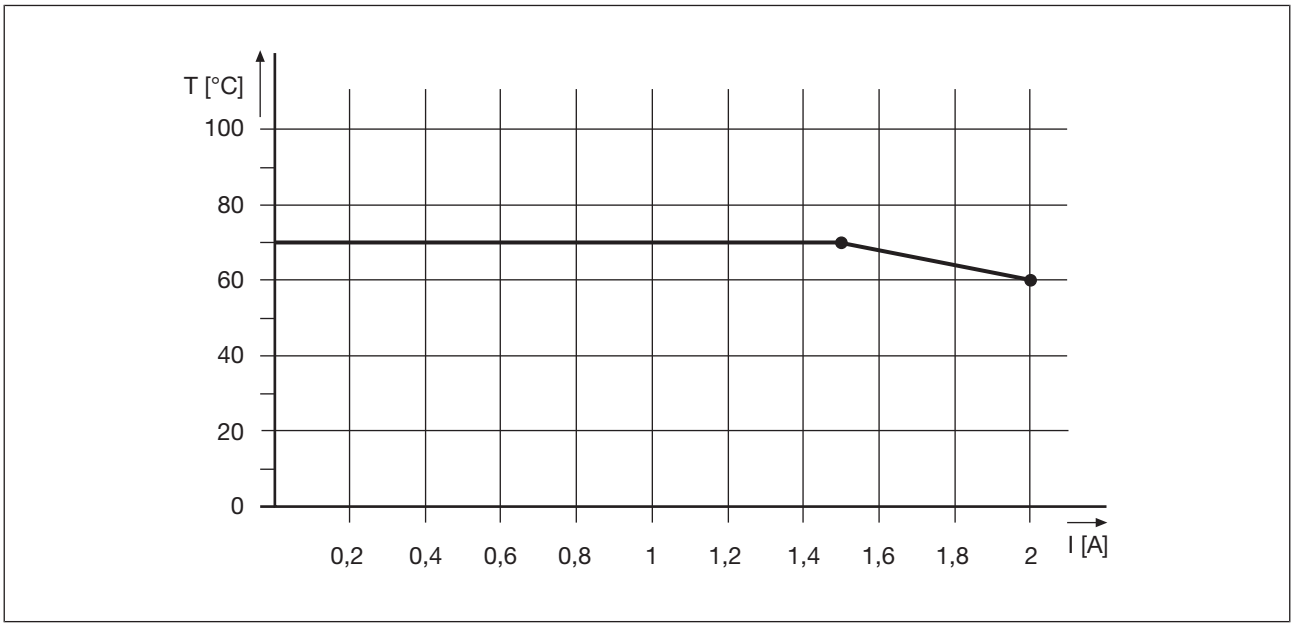


Supply voltage
PSSu E F PS1

PSSu E F PS1-T: Derating diagram for infeed for periphery supply: Permitted ambient temperature T dependent on load current I



PSSu E F PS1-T: Derating diagram for infeed for module supply: Permitted ambient temperature T dependent on load current I



The module has the following protection mechanisms:

- Infeed for module supply
  - Polarity protection
  - Voltage monitoring
  - Transient voltage limitation

Supply voltage
PSSu E F PS1

- Module supply
  - Short circuit-proof
- Periphery supply
  - Voltage monitoring (exceeding upper/lower limit)

The module registers the following errors:

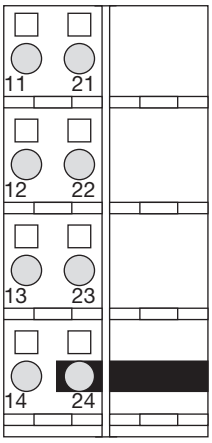
- Start-up error
- Configuration error
- FS communication error
- Bus termination error
- Temperature error: too warm
- Overvoltage error
- Undervoltage error
- Error in the overvoltage protection diodes

Supply voltage
PSSu E F PS1

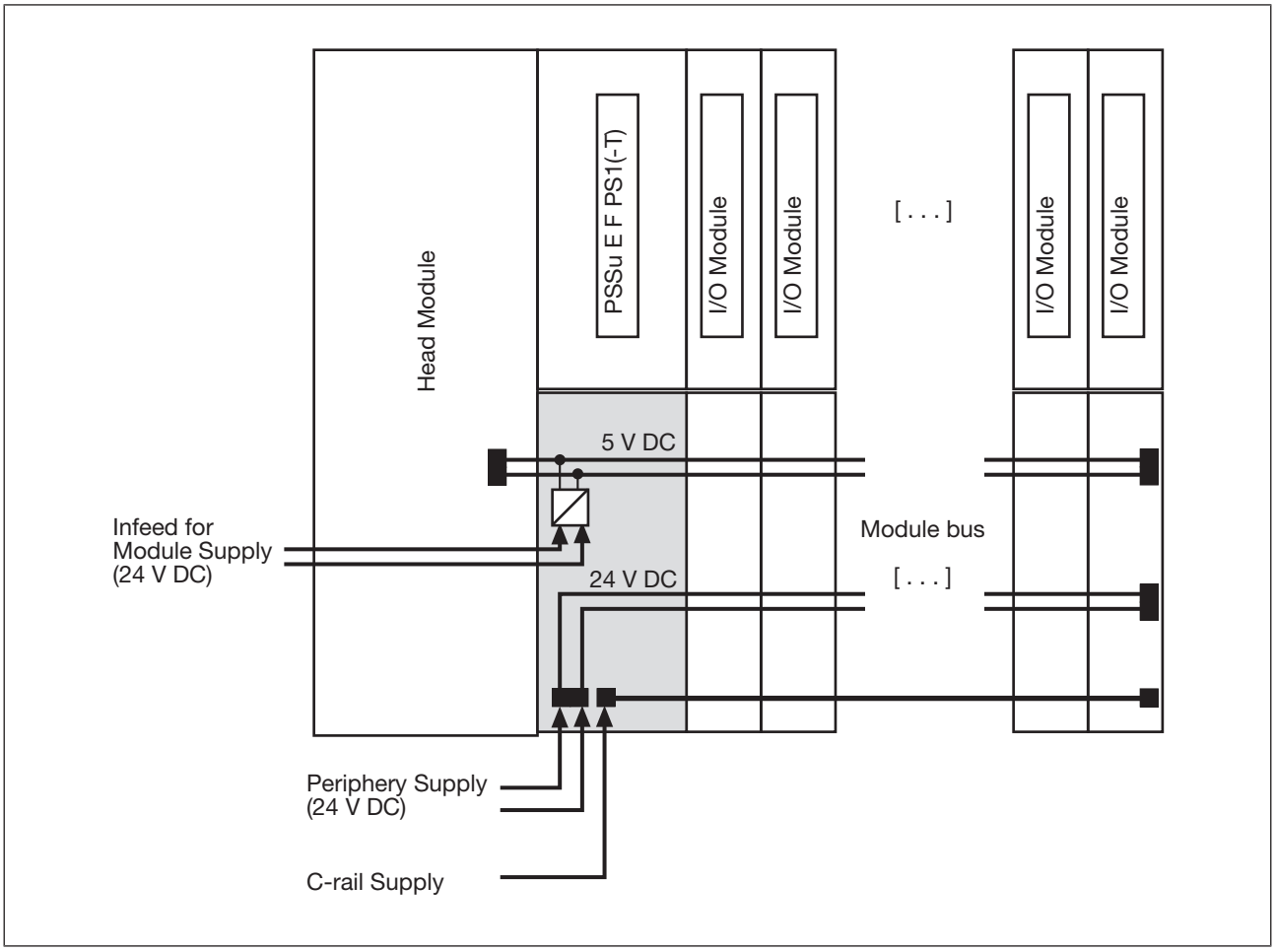
Wiring

Terminal configuration

- For use as a general supply module, supplying the head module and subsequent modules

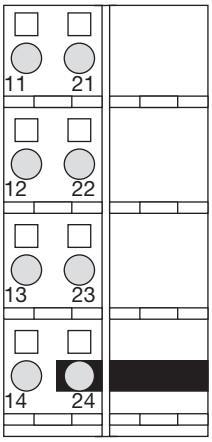
Base module	Terminal configuration	
Screw terminals: PSSu BS 2/8 S PSSu BS 2/8 S-T Cage clamp terminals: PSSu BS 2/8 C PSSu BS 2/8 C-T	11: +24 V infeed for module supply 21: 0 V infeed for module supply 12 -22: 0 V periphery supply, interrupted to the left (12-22 linked within the base module) 13 -23: +24 V periphery supply, interrupted to the left (13-23 linked within the base module) 14-24 C-rail supply, interrupted to the left (14-24 linked within the base module)	

Supply voltage
PSSu E F PS1

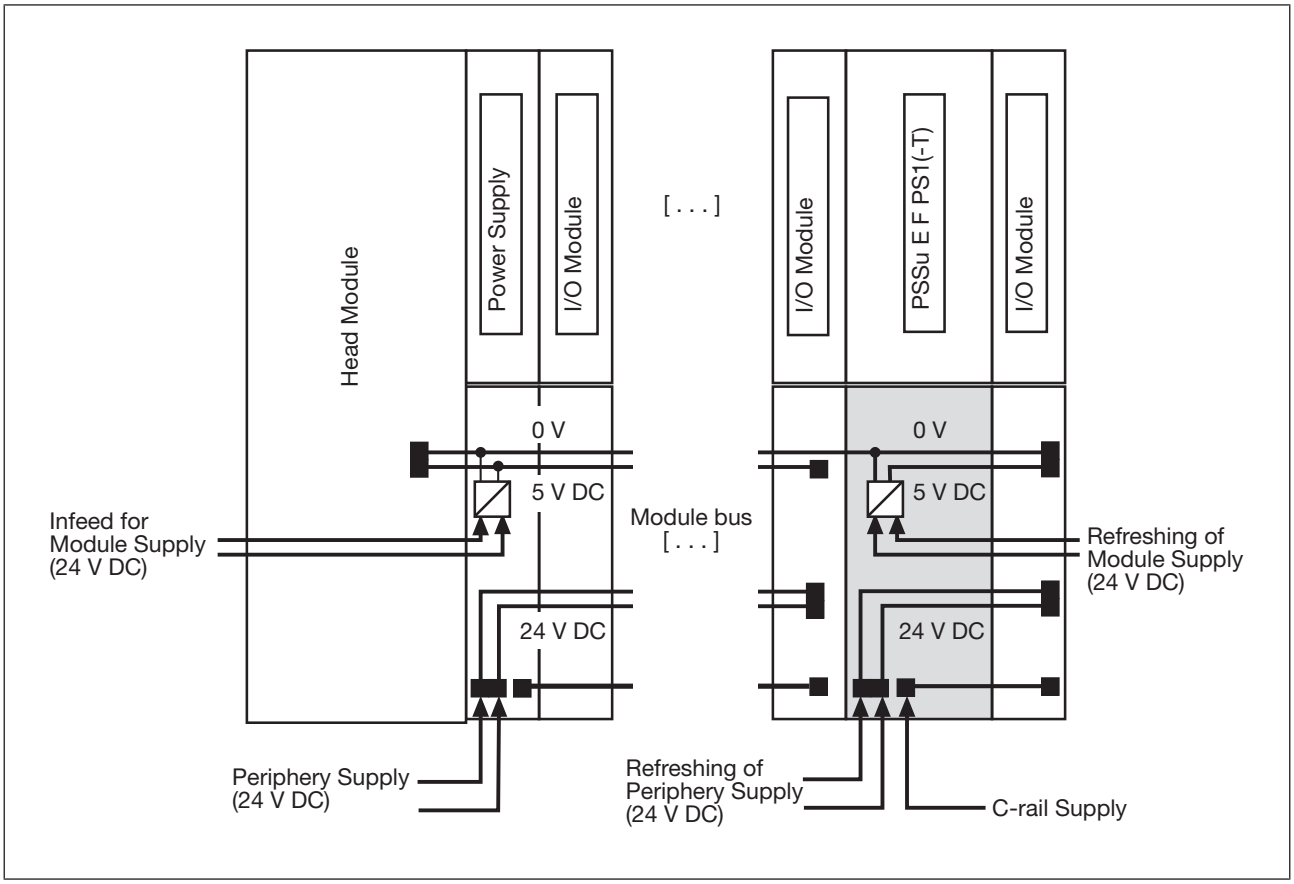


- For use as a supply module to refresh the module supply and periphery supply
- For use as a supply module to form supply groups
  - To interrupt the incoming periphery supply and C-rail
  - To provide subsequent modules with the module supply, periphery supply and C-rail supply
- With these base modules the supply module cannot be used as the first module after the head module.

Supply voltage
PSSu E F PS1

Base module	Terminal configuration	
Screw terminals: PSSu BS-R 2/8 S PSSu BS-R 2/8 S-T Cage clamp terminals: PSSu BS-R 2/8 C PSSu BS-R 2/8 C-T	11: +24 V infeed for module supply, interrupted to the left 21: 0 V infeed for module supply 12 -22: 0 V periphery supply, interrupted to the left (12-22 linked within the base module) 13 -23: +24 V periphery supply, interrupted to the left (13-23 linked within the base module) 14-24 C-rail supply, interrupted to the left (14-24 linked within the base module)	

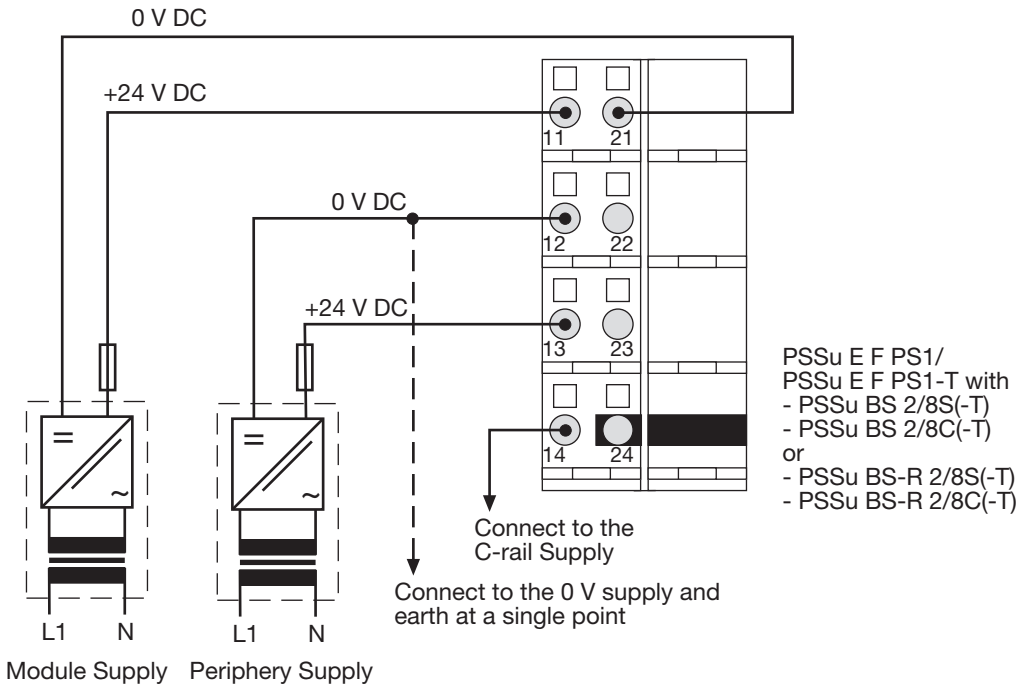
Supply voltage
PSSu E F PS1



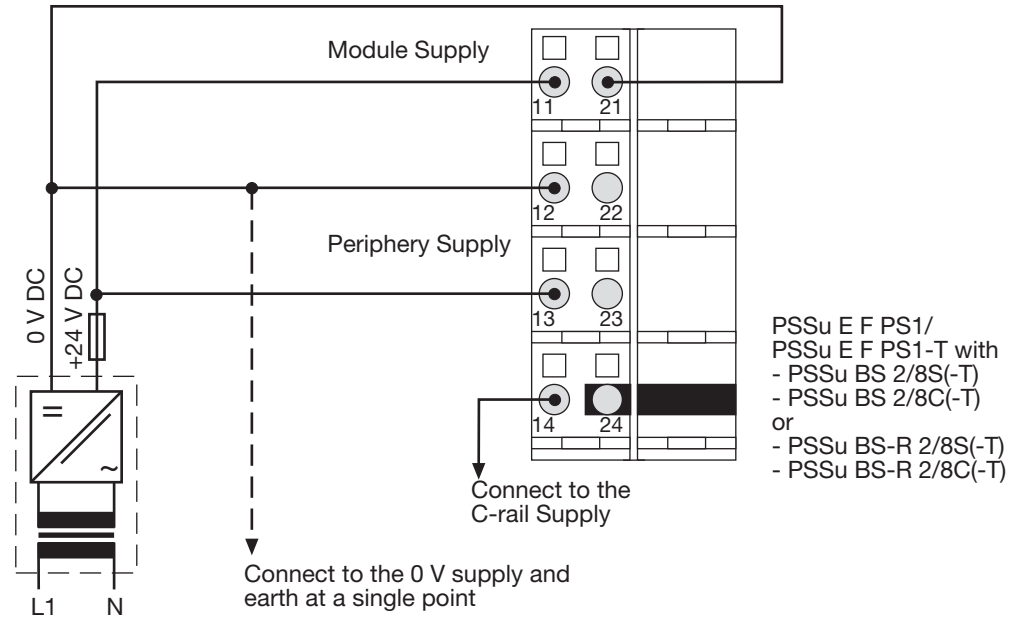
Supply voltage
PSSu E F PS1

Connecting the module

Separate power supplies for module supply and periphery supply



Common power supply for module supply and periphery supply



Supply voltage
PSSu E F PS1

Technical details

General	312191	314191
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Application range	**Standard/failsafe**	**Standard/failsafe**
Module's device code	**0800h**	**0800h**
Application in system environment A		
From FS firmware version, other head modules	**4**	**4**
From ST firmware version, other head modules	**5**	**5**
From FS firmware version PSSu H F PN	**1**	**1**
From ST firmware version PSSu H S PN	**1**	**1**
From ST firmware version PSSu WR S IDN	**6**	**6**
Application in system environment B		
From FS firmware version, head modules	**1.0.0**	**1.0.0**
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312191**	**314191**
Supply voltage		
for	**Module supply**	**Module supply**
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**
Current load capacity at UB	**0,8 A**	**0,8 A**
Inrush current that the external power supply must provide	**4 A**	**4 A**
Output of external power supply (DC)	**12 W**	**12 W**
Supply voltage		
for	**Periphery supply**	**Periphery supply**
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**
Current load capacity at UB	**10 A**	**10 A**
Rated surge voltage	**3050 V**	**3050 V**

Supply voltage
PSSu E F PS1

Electrical data	312191	314191
Potential isolation between module supply and periphery supply	**3050 V**	**3050 V**
Internal supply voltage (module supply)		
Output voltage	**int. system**	**int. system**
Voltage	**5 V**	**5 V**
Voltage tolerance	**-2 %/+3 %**	**-2 %/+3 %**
Module's power consumption	**0,12 W**	**0,12 W**
Potential isolation	**3050 V**	**3050 V**
Current load capacity	**2 A**	**2 A**
Buffer in the case of supply interruptions in accordance with	**DIN V EN V 1954, EN61131-2, EN61496-1**	**DIN V EN V 1954, EN61131-2, EN61496-1**
Short circuit-proof	**yes**	**yes**
Periphery's supply voltage (periphery supply)		
Module's current consumption with no load	**5 mA**	**5 mA**
Module's power consumption with no load	**0,12 W**	**0,12 W**
Max. power dissipation of module	**2,5 W**	**2 W**
Environmental data	**312191**	**314191**
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		
Temperature range	**0 - 60 °C**	**-40 - 70 °C**
Storage temperature		
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 150 Hz**	**10 - 1000 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**5g**

Supply voltage
PSSu E F PS1

Environmental data	312191	314191
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**25g**
Duration	**16 ms**	**6 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Mechanical data	**312191**	**314191**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76 mm**	**76 mm**
Width	**25,2 mm**	**25,2 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**57 g**	**60 g**
Mechanical coding		
Type	**C**	**C**
Colour	**Yellow**	**Yellow**

Where standards are undated, the 2015-03 latest editions shall apply.

Supply voltage
PSSu E F PS1

Order reference

Product

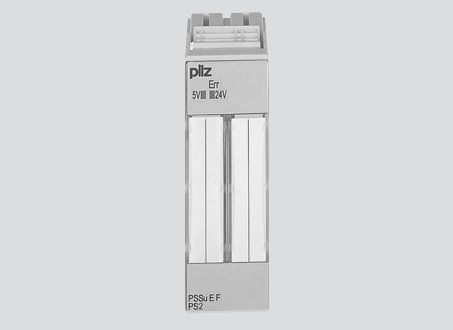
Product type	Features	Order No.
PSSu E F PS1	Electronic module, base type	312 191
PSSu E F PS1-T	Electronic module, T-type	314 191

Accessories

Base modules

Product type	Features	Order No.
PSSu BS 2/8 S	Base module with screw terminals, for use only as the first module after the head module	312 656
PSSu BS 2/8 S-T	Base module with screw terminals, for use only as the first module after the head module, T-type	314 656
PSSu BS 2/8 C	Base module with cage clamp terminals, for use only as the first module after the head module	312 657
PSSu BS 2/8 C-T	Base module with cage clamp terminals, for use only as the first module after the head module, T-type	314 657
PSSu BS-R 2/8 S	Base module with screw terminals, for use only to refresh the voltage and form supply groups	312 654
PSSu BS-R 2/8 S-T	Base module with screw terminals, for use only to refresh the voltage and form supply groups, T-type	314 654
PSSu BS-R 2/8 C	Base module with cage clamp terminals, for use only to refresh the voltage and form supply groups	312 655
PSSu BS-R 2/8 C-T	Base module with cage clamp terminals, for use only to refresh the voltage and form supply groups, T-type	314 655

Supply voltage
PSSu E F PS2



Overview

Module features

The product has the following features:

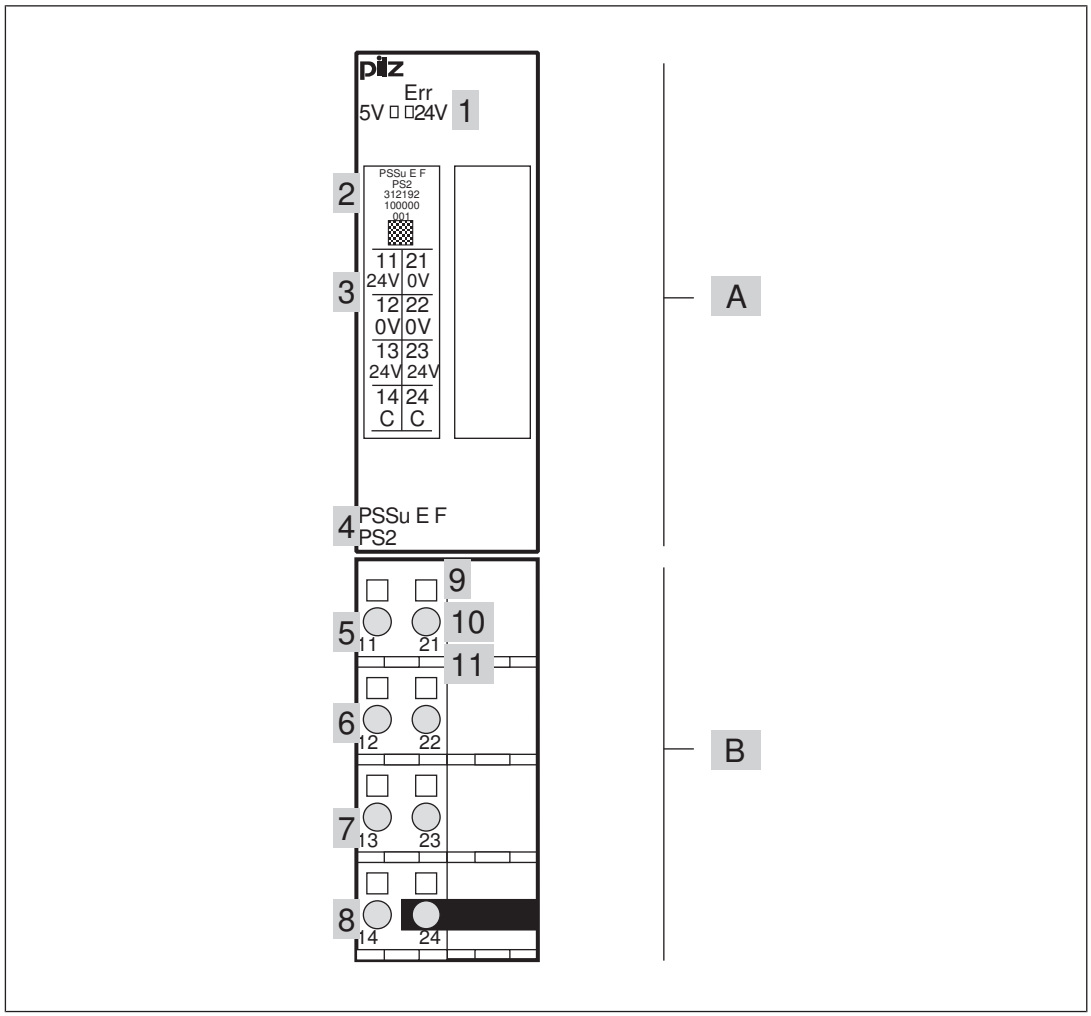
- Current load capacity of module supply [max. 1 A
- When the supply voltage is interrupted, the module supply is buffered for 20 ms.
- Separate infeed for periphery supply
- Separate infeed for module supply
- Infeed for C-rail supply
- Potential isolation from module supply
- High EMC immunity
- LEDs for:
  - Module supply
  - Periphery supply
  - Module error
- T-type:

  PSSu E F PS2-T: for increased environmental requirements
- R-type:

  PSSu E F PS2-R: for railway applications

Supply voltage
PSSu E F PS2

Front view



Key:

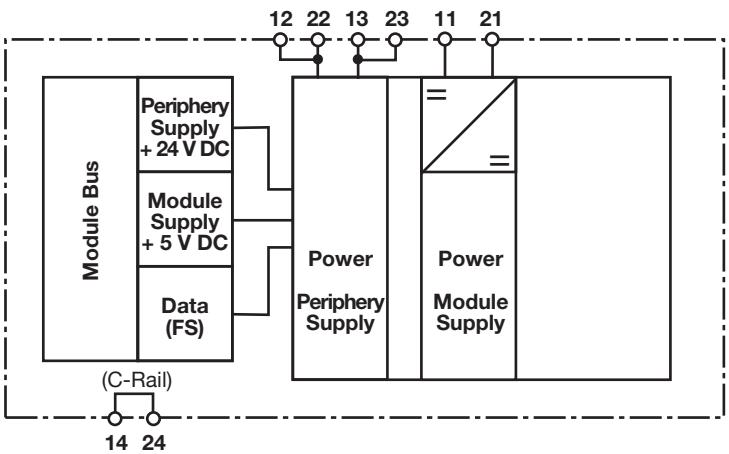
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1

Supply voltage
PSSu E F PS2

- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Supply voltage
PSSu E F PS2

Module features

The product provides the module supply and periphery supply for the modules on the module bus:

- Module supply

  Supply voltage for subsequent module (right-hand side)
- Periphery supply

  Supply voltage for sensors, actuators and test pulses
- C-rail

  Infeed of the permitted additional supplies for the C-rail; a detailed description of how to use the C-rail can be found in the system description.

When the supply voltage is fed in separately, the module supply and periphery supply are galvanicaly isolated. If galvanic isolation is not required, a common power supply may be used for the periphery supply and module supply.

The module enables

- The module supply and periphery supply to be refreshed:

  The relevant base module interrupts the connection to the incoming (left-hand) module supply, periphery supply and C-rail on the module bus. The 0 V supply on the module supply is connected to the left and right.
- Supply groups to be formed

  The relevant base module interrupts the connection to the incoming (left-hand) periphery supply and C-rail on the module bus. Each supply group requires its own supply module.

Ensure you comply with the current load capacity of the module and periphery supply (see "Technical Details"). If the current load is higher, an additional supply voltage module is required to refresh the module supply and periphery supply.

- Module supply

  The current load is the total current consumption of all the electronic and compact modules.

  The module supply does not automatically switch off if values exceed or drop below their limits. However, the "5 V" LED will light and a message will be entered in the diagnostic log.

Supply voltage
PSSu E F PS2

- Periphery supply

  The current load is the total current consumption of the sensors, actuators and test pulses supplied via the input/output modules.

  The periphery supply does not automatically switch off if values exceed or drop below their limits. However, the "24 V" LED will light and a message will be entered in the diagnostic log.

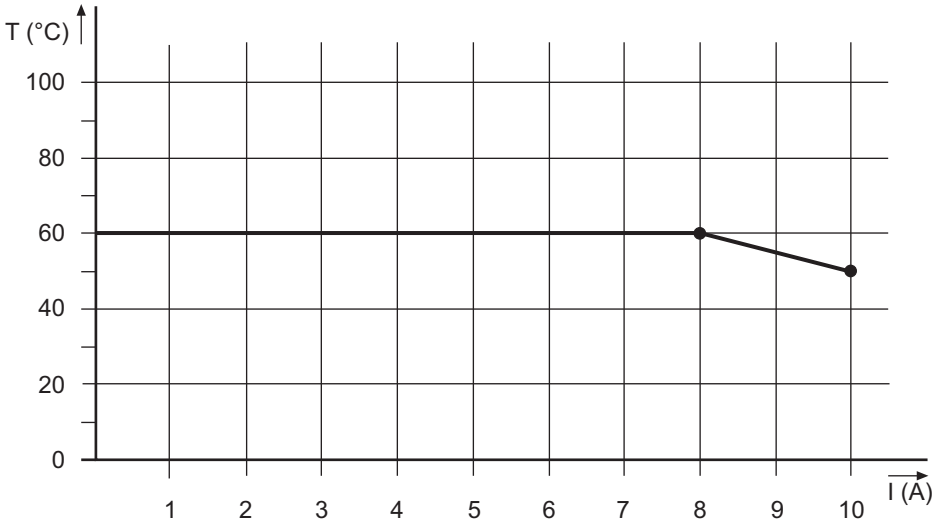
  Please refer to the derating diagram.

- C-rail

  If the current load is higher, the C-rail must use a different supply to prevent overload.

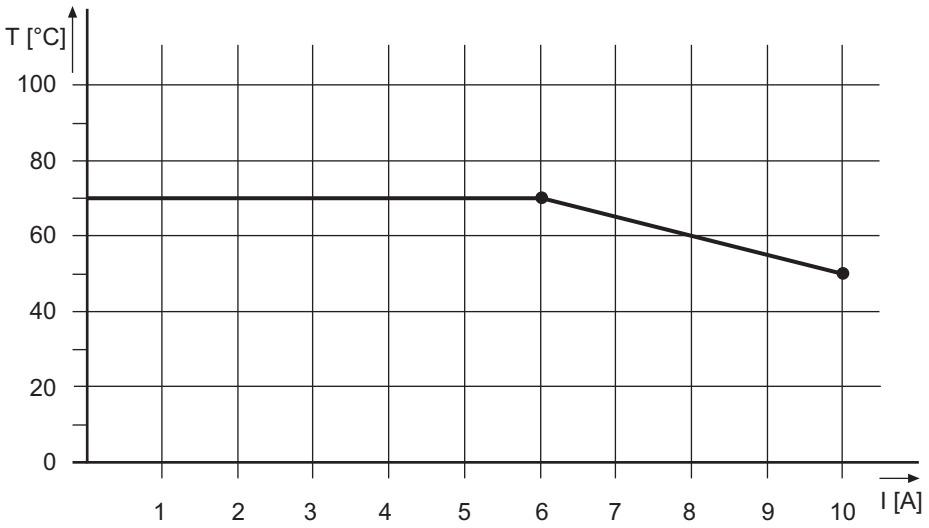
  Please refer to the derating diagram.

PSSu E F PS2: Derating diagram for periphery supply and C-rail: Temperature T dependent on load current I



Supply voltage
PSSu E F PS2

PSSu E F PS2(-T)(-R): Derating diagram for periphery supply and C-rail: Temperature T dependent on load current I



The module has the following protection mechanisms:

- Infeed for module supply
  - Polarity protection
  - Voltage monitoring
  - Transient voltage limitation
  - Potential isolation
- Module supply
  - Short circuit-proof
- Periphery supply
  - Voltage monitoring (exceeding upper/lower limit)

The module registers the following errors:

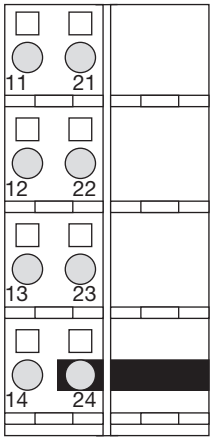
- Start-up error
- Configuration error
- FS communication error
- Bus termination error
- Temperature error: too warm
- Overvoltage error
- Undervoltage error
- Error in the overvoltage protection diodes

Supply voltage
PSSu E F PS2

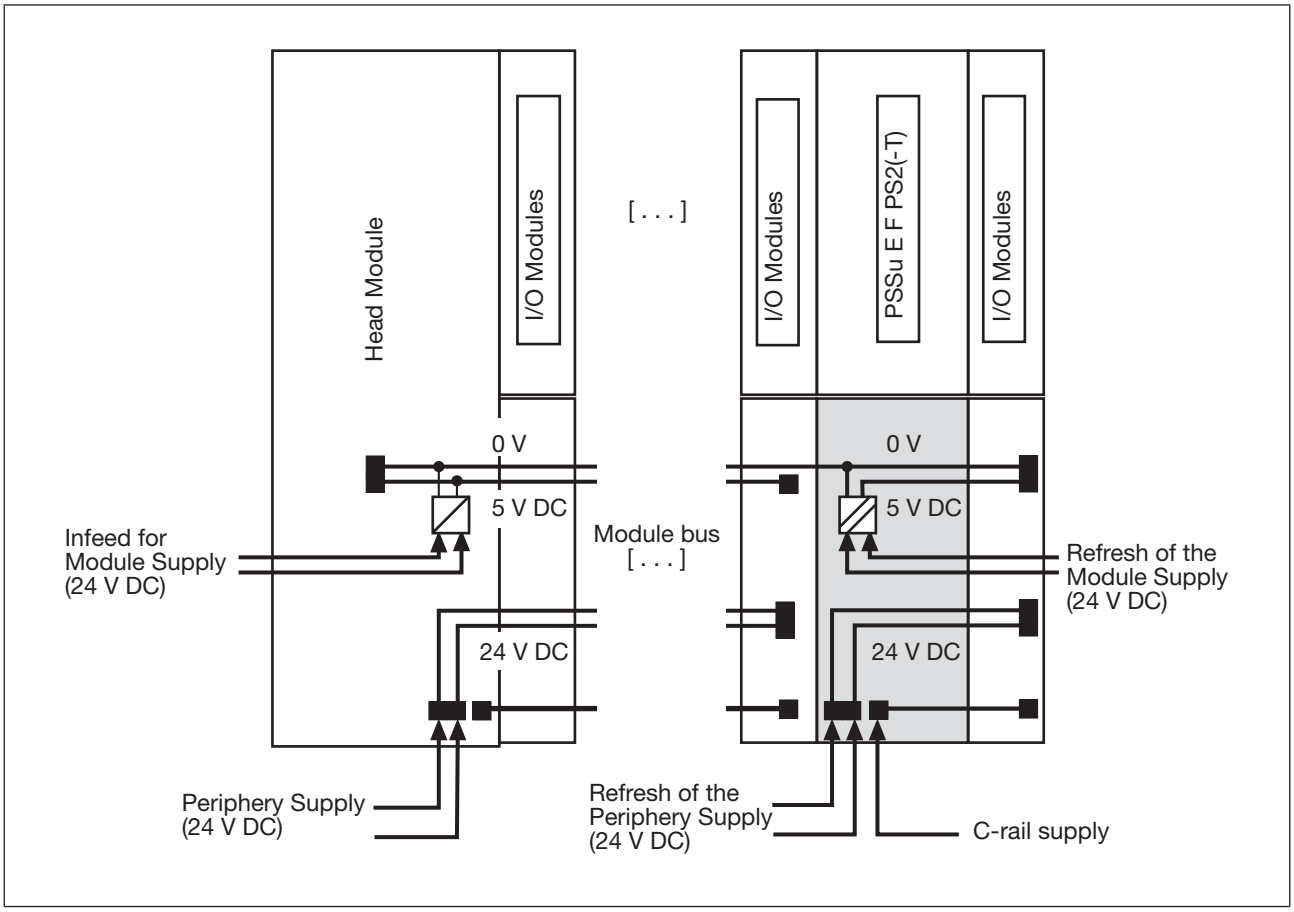
Wiring

Terminal configuration

- For use as a supply module to refresh the module supply and periphery supply
- For use as a supply module to form supply groups
  - To interrupt the incoming periphery supply and C-rail
  - To provide subsequent modules with the module supply, periphery supply and C-rail supply

Base module	Terminal configuration	
Screw terminals: PSSu BS-R 2/8 S PSSu BS-R 2/8 S-T Cage clamp terminals: PSSu BS-R 2/8 C PSSu BS-R 2/8 C-T	11: +24 V infeed for module supply, interrupted to the left 21: 0 V infeed for module supply 12 -22: 0 V periphery supply, interrupted to the left (12-22 linked within the base module) 13 -23: +24 V periphery supply, interrupted to the left (13-23 linked within the base module) 14-24 C-rail supply, interrupted to the left (14-24 linked within the base module)	

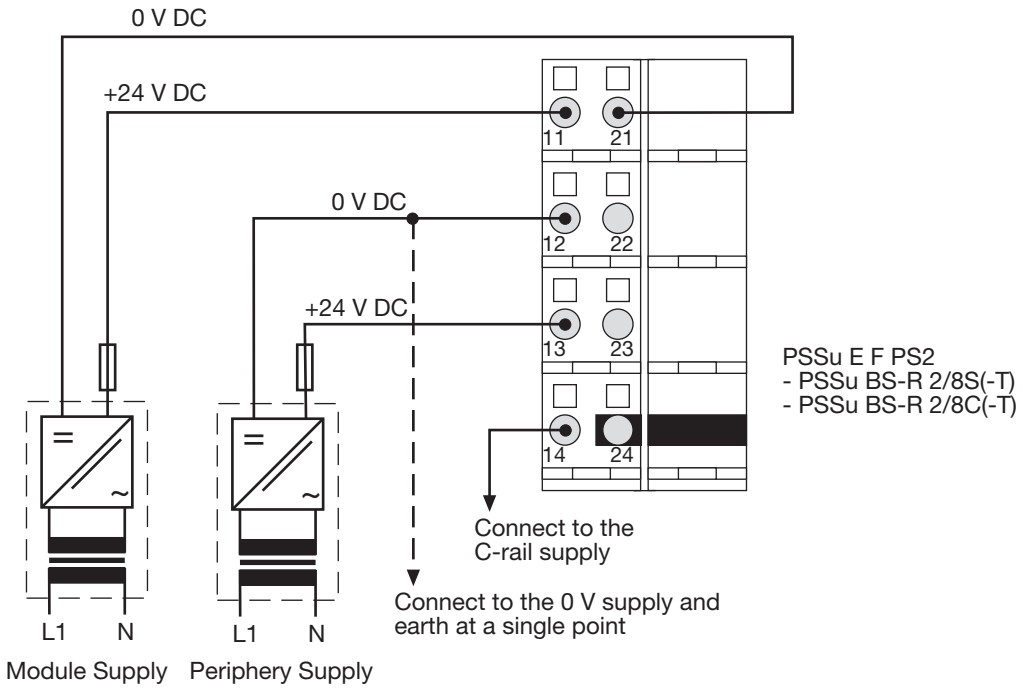
Supply voltage
PSSu E F PS2



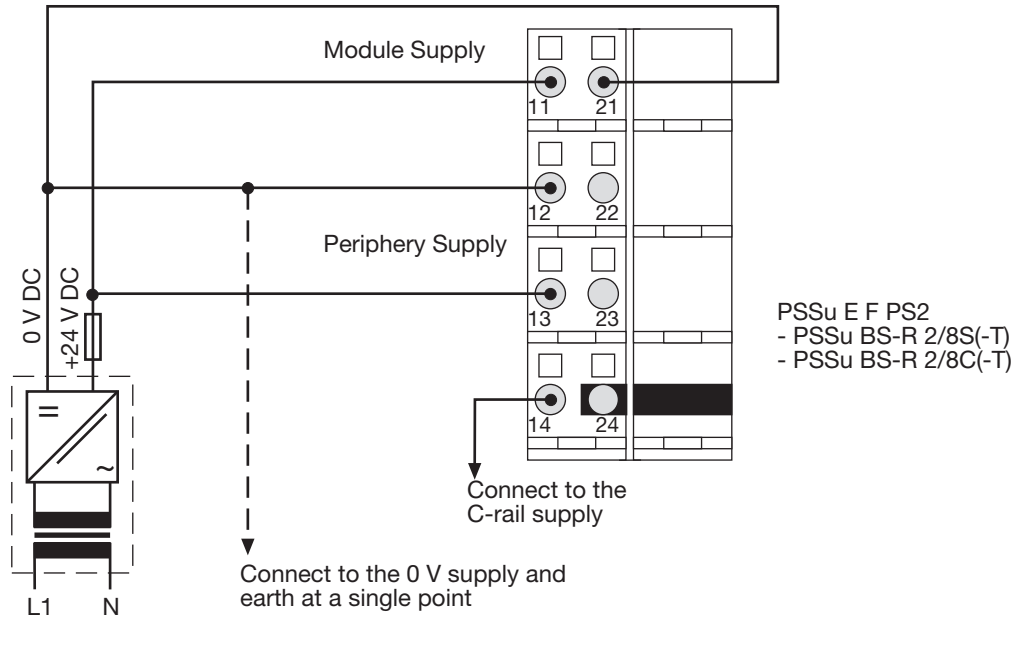
Supply voltage
PSSu E F PS2

Connecting the module

Separate power supplies for module supply and periphery supply



Common power supply for module supply and periphery supply



Supply voltage
PSSu E F PS2

Technical details

General	312192	314192	315192
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE**
Application range	**Standard/failsafe**	**Standard/failsafe**	**Standard/failsafe**
Module's device code	**0803h**	**0803h**	**0803h**
Application in system environment B			
From FS firmware version, head modules	**1.3.0**	**1.3.0**	**1.5.0**
From ST firmware version, head modules	**1.3.0**	**1.3.0**	**1.5.0**
Electrical data	**312192**	**314192**	**315192**
Supply voltage			
for	**Module supply**	**Module supply**	**Module supply**
Voltage	**24 V**	**24 V**	**24 V**
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**	**-30 %/+25 %**
Current load capacity at UB	**0,5 A**	**0,5 A**	**0,5 A**
Inrush current that the external power supply must provide	**4 A**	**4 A**	**4 A**
Output of external power supply (DC)	**7 W**	**7 W**	**7 W**
Supply voltage			
for	**Periphery supply**	**Periphery supply**	**Periphery supply**
Voltage	**24 V**	**24 V**	**24 V**
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**	**-30 %/+25 %**
Current load capacity at UB	**10 A**	**10 A**	**10 A**
Rated surge voltage	**3050 V**	**3050 V**	–
Potential isolation between module supply and periphery supply	**3050 V**	**3050 V**	**3050 V**

Supply voltage
PSSu E F PS2

Electrical data	312192	314192	315192
Internal supply voltage (module supply)			
Output voltage	**int. system**	**int. system**	**int. system**
Voltage	**5 V**	**5 V**	**5 V**
Voltage tolerance	**-2 %/+3 %**	**-2 %/+3 %**	**-2 %/+3 %**
Module's power consumption	**0,2 W**	**0,2 W**	**0,2 W**
Potential isolation	**3050 V**	**3050 V**	**3050 V**
Current load capacity	**1 A**	**1 A**	**1 A**
Buffer in the case of supply interruptions in accordance with	**DIN V EN V 1954, EN 61131-2, EN 61496-1**	**DIN V EN V 1954, EN 61131-2, EN 61496-1**	**DIN V EN V 1954, EN 61131-2, EN 61496-1**
Short circuit-proof	**yes**	**yes**	**yes**
Periphery's supply voltage (periphery supply)			
Module's current consumption with no load	**5 mA**	**5 mA**	**5 mA**
Module's power consumption with no load	**0,12 W**	**0,12 W**	**0,12 W**
Max. power dissipation of module	**2 W**	**2 W**	**2 W**
Environmental data	**312192**	**314192**	**315192**
Application site			
In accordance with the standard	–	–	**EN 50125-3**
Application site	–	–	**Track area (1 m - 3 m)**
In accordance with the standard	–	–	**EN 61373**
Application site	–	–	**Category 1, Class A + B**
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**	**EN 50155, 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 50155**
Temperature range	**0 - 60 °C**	**-40 - 70 °C**	**-40 - 70 °C**
In accordance with the standard	–	–	**EN 50125-1**
Temperature range	–	–	**-40 ... +70 °C**
In accordance with the standard	–	–	**EN 50125-3**
Temperature range	–	–	**-40 ... +70 °C**

Supply voltage
PSSu E F PS2

Environmental data	312192	314192	315192
Storage temperature			
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**	–
Climatic suitability			
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**	–
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	–
Condensation during operation	**Not permitted**	**Short-term**	–
Max. operating height above sea level	**2000 m**	**5000 m**	**2000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 50125-3**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**5 - 2000 Hz, 10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**	**0,23g**
Broadband noise			
In accordance with the standard	–	**EN 60068-2-64**	**EN 61373**
Frequency	–	**5 - 500 Hz**	**5 - 150 Hz**
Acceleration	–	**1,9grms**	**0,79 g RMS**
Shock stress			
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 50125-3**
Number of shocks	**6**	**6**	**20**
Acceleration	**15g**	**15g**	**2g**
Duration	**11 ms**	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 61373**
Number of shocks	**1000**	**1000**	**20**
Acceleration	**10g**	**10g**	**5g**
Duration	**16 ms**	**16 ms**	**30 ms**
Supply interruptions			
In accordance with the standard	–	–	**EN 50155**
Class	–	–	**S2, C1, C2**

Supply voltage
PSSu E F PS2

Environmental data	312192	314192	315192
Airgap creepage			
In accordance with the standard	**EN 60664-1**	**EN 60664-1**	**EN 50124-1**
Overvoltage category	**II**	**II**	**OV2**
Pollution degree	**2**	**2**	**PD2**
Protection type			
In accordance with the standard	**EN 60529**	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**	**IP20**
Terminals	**IP20**	**IP20**	–
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP51**
Mechanical data	**312192**	**314192**	**315192**
Material			
Bottom	**PC**	**PC**	**PC**
Front	**PC**	**PC**	**PC**
Coding	**PA**	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Dimensions			
Height	**76 mm**	**76 mm**	**76 mm**
Width	**25,2 mm**	**25,2 mm**	**25,2 mm**
Depth	**60,2 mm**	**60,2 mm**	**60,2 mm**
Weight	**49 g**	**51 g**	**53 g**
Mechanical coding			
Type	**B**	**B**	**B**
Colour	**Yellow**	**Yellow**	**Yellow**

Where standards are undated, the 2015-03 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E F PS2	Electronic module, base type	312 192
PSSu E F PS2-T	Electronic module, T-type	314 192
PSSu E F PS2-R	Electronic module, R-type	315 192

Supply voltage
PSSu E F PS2

Accessories

Base modules

Product type	Features	Order No.
PSSu BS-R 2/8 S	Base module with screw terminals, for use only to refresh the voltage and form supply groups	312 654
PSSu BS-R 2/8 S-T	Base module with screw terminals, for use only to refresh the voltage and form supply groups, T-type	314 654
PSSu BS-R 2/8 C	Base module with cage clamp terminals, for use only to refresh the voltage and form supply groups	312 655
PSSu BS-R 2/8 C-T	Base module with cage clamp terminals, for use only to refresh the voltage and form supply groups, T-type	314 655

Supply voltage
PSSu E F PS-P

Overview

Module features

The product has the following features:

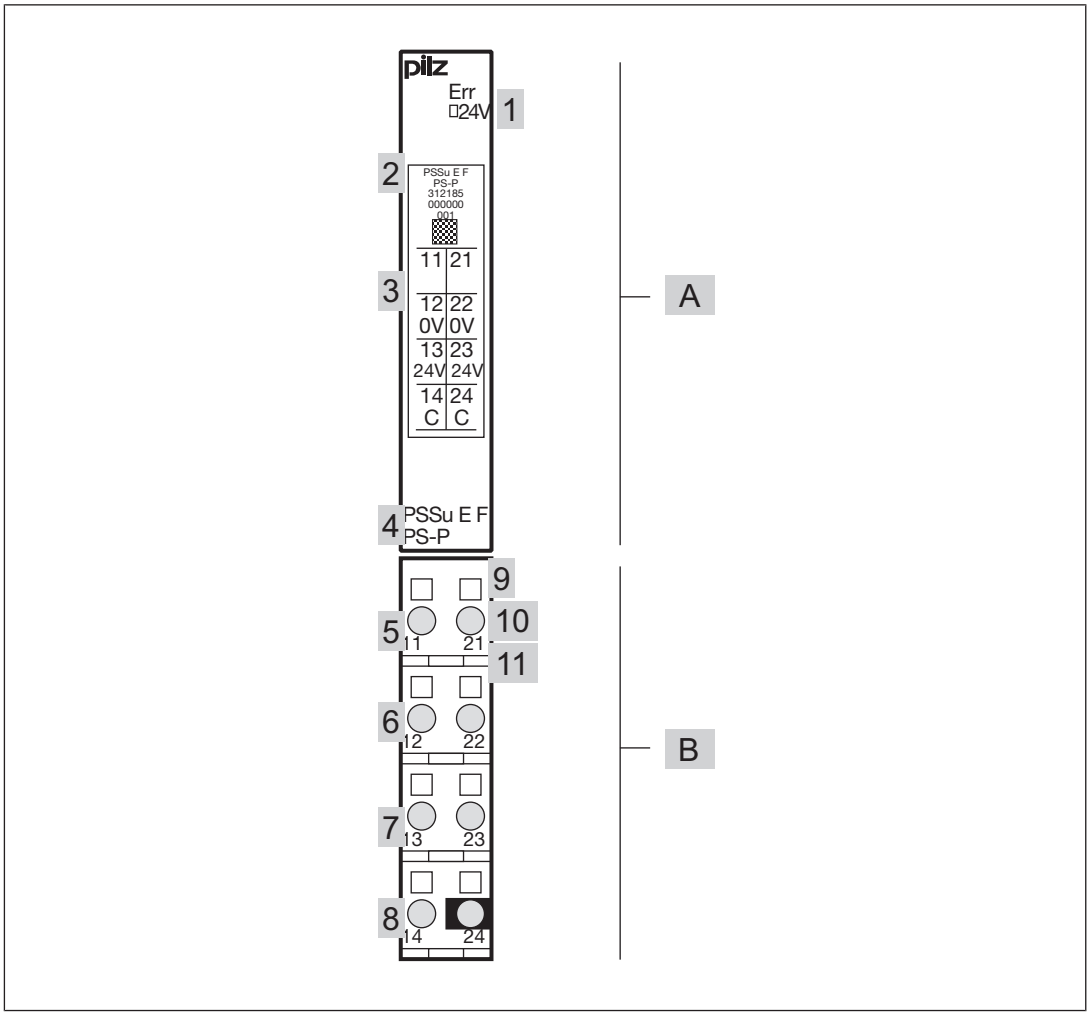
- Infeed for periphery supply
- Infeed for C-rail supply
- LEDs for:
  - Periphery supply
  - Module error
- Application range depends on the base module
- T-type:

  PSSu E F PS-P-T: for increased environmental requirements
- R-type:

  PSSu E F PS-P-R: for railway applications

Supply voltage
PSSu E F PS-P

Front view



Key:

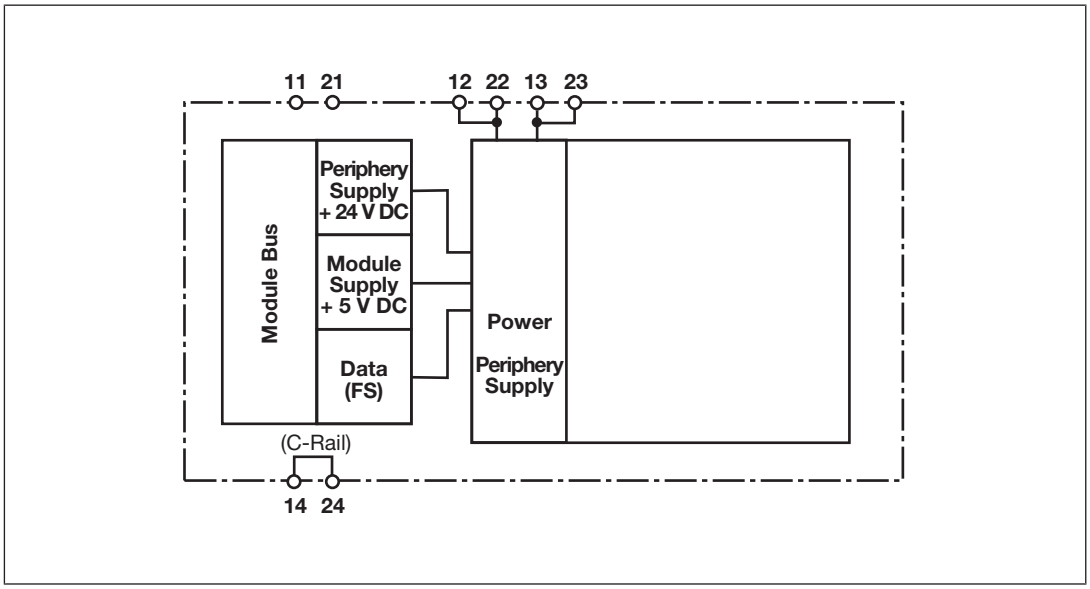
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1

Supply voltage
PSSu E F PS-P

- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Supply voltage
PSSu E F PS-P

Module features

Module supply

- The module supply provides the module with voltage.

The product provides the periphery supply for the modules on the module bus:

- Refreshing the periphery supply: The relevant base module interrupts the connection to the incoming (left-hand) periphery supply and C-rail on the module bus.
- Supply to the module bus:
  - Periphery supply for subsequent modules (right-hand side)
  - C-rail supply for subsequent modules (right-hand side)
- The periphery supply does not automatically switch off if values exceed or drop below their limits. However, the "24V" LED will light and a message will be entered in the error stack or diagnostic log.

Ensure you comply with the current load capacity of the periphery supply (see "Technical Details"). If the current load is higher, an additional supply voltage module is required to refresh the periphery supply.

- Periphery supply

  The current load is the total current consumption of the sensors, actuators and test pulses supplied via the input/output modules.

  The periphery supply does not automatically switch off if values exceed or drop below their limits. However, the "24 V" LED will light and a message will be entered in the error stack or diagnostic log.

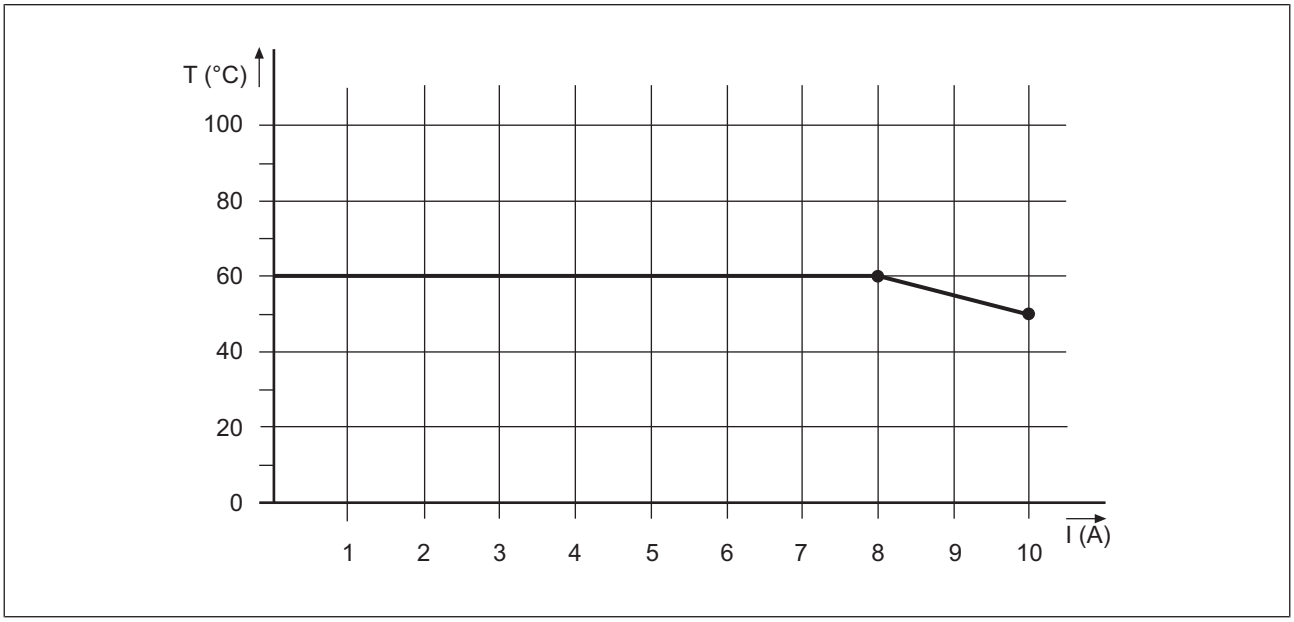
  Please refer to the derating diagram.
- C-rail

  If the current load is higher, the C-rail must use a different supply to prevent overload.

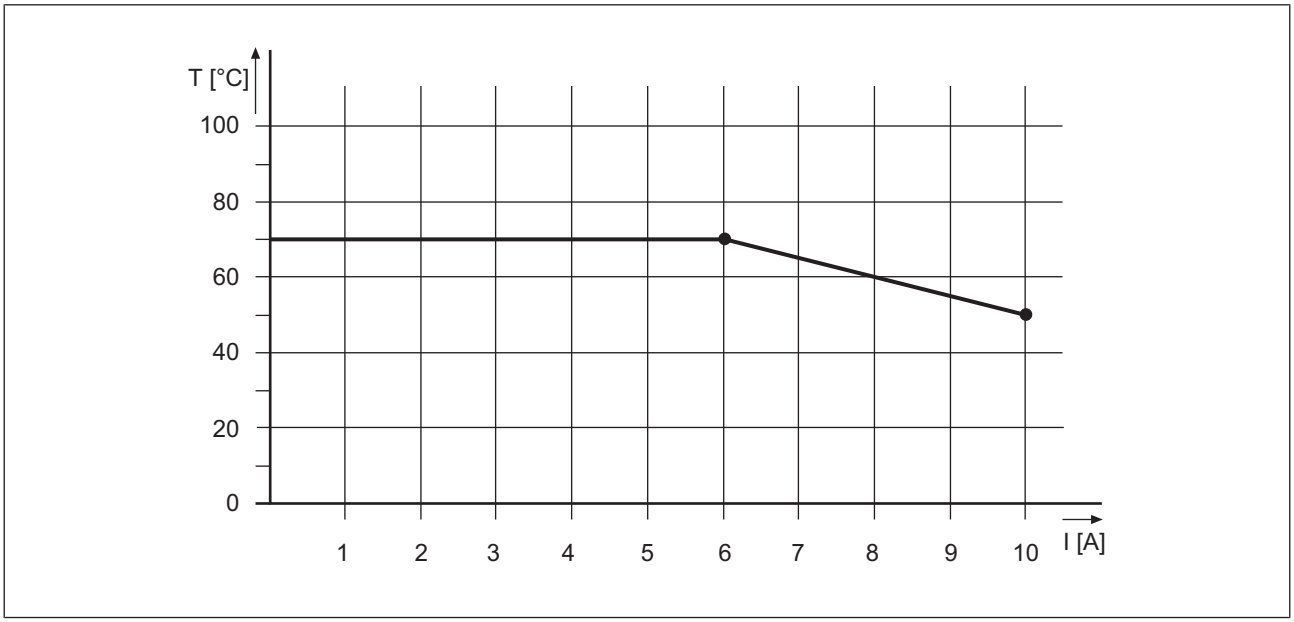
  Please refer to the derating diagram.

Supply voltage
PSSu E F PS-P

PSSu E F PS-P**:** Derating diagram for periphery supply and C-rail: Temperature T dependent on load current I



PSSu E F PS-P(-T)(-R): Derating diagram for periphery supply and C-rail: Temperature T dependent on load current I



The module has the following protection mechanisms:

- Periphery supply
  - Voltage monitoring (exceeding upper/lower limit)

The module registers the following errors:

- Start-up error

Supply voltage
PSSu E F PS-P

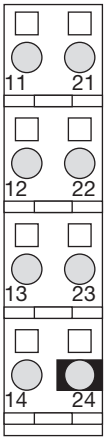
- Configuration error
- FS communication error
- Bus termination error
- Temperature error: too warm
- Overvoltage error
- Undervoltage error
- Error in the overvoltage protection diodes

Supply voltage
PSSu E F PS-P

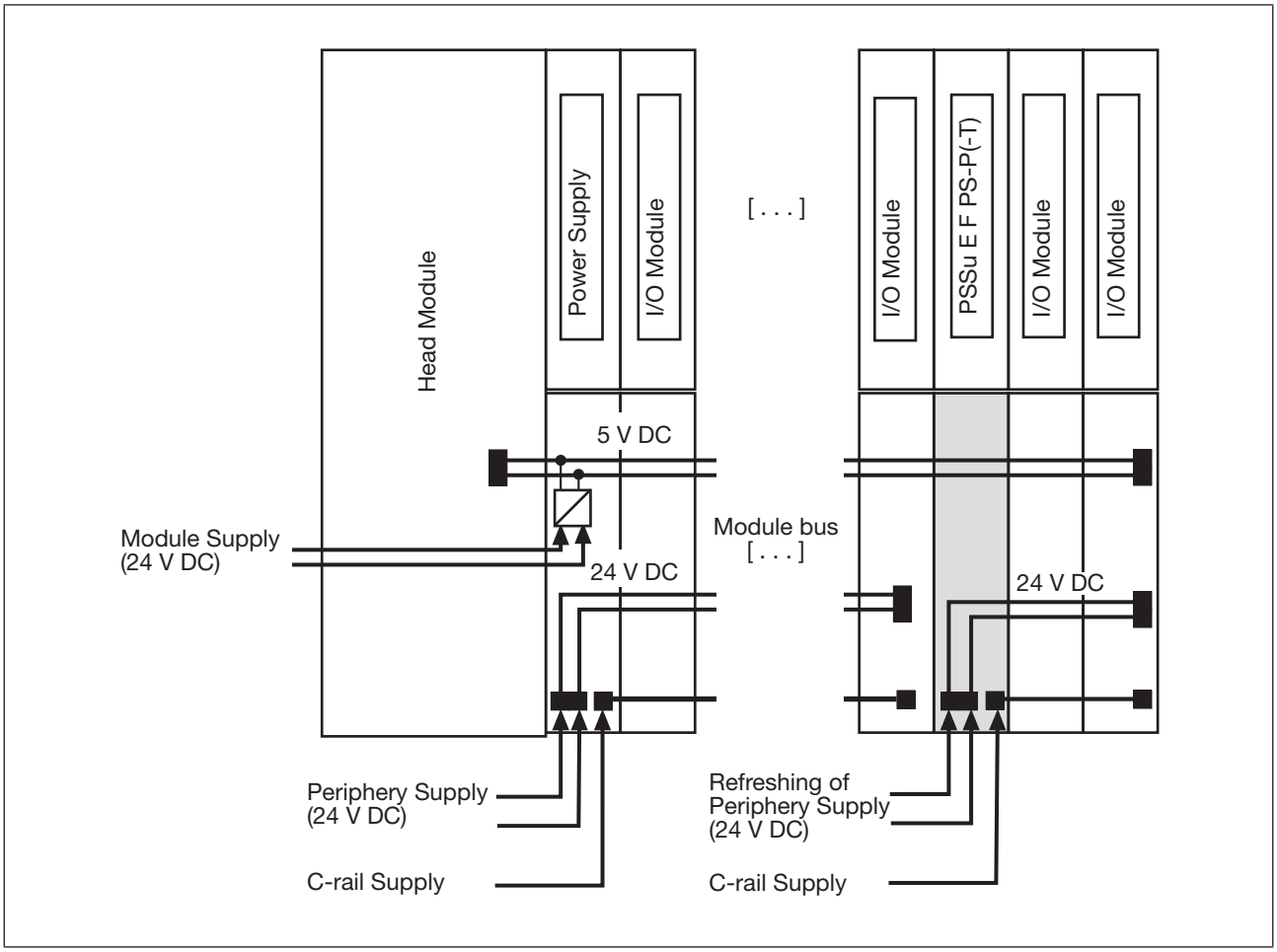
Wiring

Terminal configuration

- Supply module
  - To refresh the periphery supply
  - To interrupt the incoming periphery supply and C-rail
  - To provide subsequent modules with the periphery supply and C-rail supply
  - To form supply groups

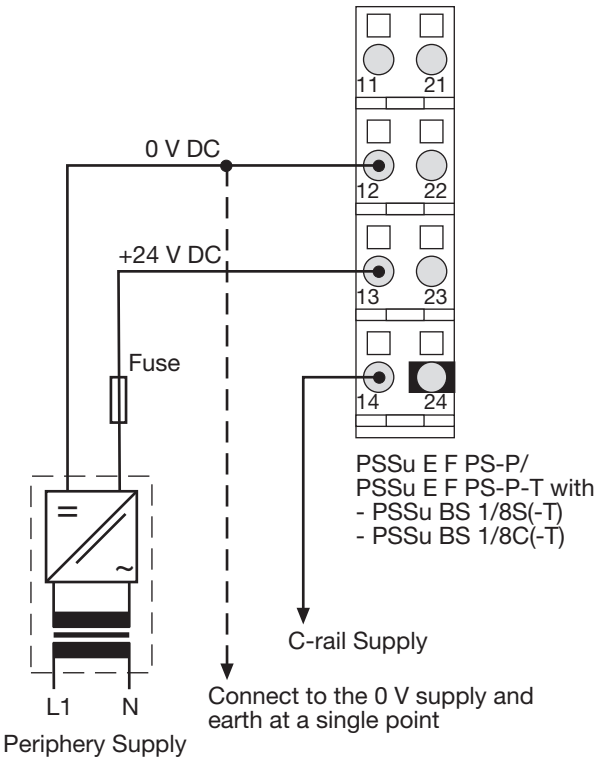
Base module	Terminal configuration	
Screw terminals: PSSu BS 1/8 S PSSu BS 1/8 S-T Cage clamp terminals: PSSu BS 1/8 C PSSu BS 1/8 C-T	11: Not connected 21: Not connected 12 -22: 0 V periphery supply, interrupted to the left (12-22 linked within the base module) 13 -23: +24 V periphery supply, interrupted to the left (13-23 linked within the base module) 14-24 C-rail supply, interrupted to the left (14-24 linked within the base module)	

Supply voltage
PSSu E F PS-P



Supply voltage
PSSu E F PS-P

Connecting the module



Supply voltage
PSSu E F PS-P

Technical details

General	312185	314185	315185
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, TÜV**
Application range	**Standard/failsafe**	**Standard/failsafe**	**Standard/failsafe**
Module's device code	**0802h**	**0802h**	**0802h**
Application in system environment A			
From FS firmware version, other head modules	**4**	**4**	–
From ST firmware version, other head modules	**5**	**5**	–
From FS firmware version PSSu H F PN	**1**	**1**	–
From ST firmware version PSSu H S PN	**1**	**1**	–
From ST firmware version PSSu WR S IDN	**6**	**6**	–
Application in system environment B			
From FS firmware version, head modules	**1.0.0**	**1.0.0**	**1.5.0**
From ST firmware version, head modules	**1.0.0**	**1.0.0**	**1.0.0**
Electrical data	**312185**	**314185**	**315185**
Supply voltage			
for	**Periphery supply**	**Periphery supply**	**Periphery supply**
Voltage	**24 V**	**24 V**	**24 V**
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**	**-30 %/+25 %**
Current load capacity at UB	**10 A**	**10 A**	**10 A**
Rated surge voltage	**3050 V**	**3050 V**	–
Internal supply voltage (module supply)			
Module's power consumption	**0,12 W**	**0,12 W**	**0,12 W**
Potential isolation	**3050 V**	**3050 V**	**3050 V**

Supply voltage
PSSu E F PS-P

Electrical data	312185	314185	315185
Periphery's supply voltage (periphery supply)			
Module's current consumption with no load	**5 mA**	**5 mA**	**5 mA**
Module's power consumption with no load	**0,12 W**	**0,12 W**	**0,12 W**
Max. power dissipation of module	**0,5 W**	**0,5 W**	**0,5 W**
Environmental data	**312185**	**314185**	**315185**
Application site			
In accordance with the standard	–	–	**EN 50125-3**
Application site	–	–	**Track area (1 m - 3 m)**
In accordance with the standard	–	–	**EN 61373**
Application site	–	–	**Category 1, Class A + B**
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**	**EN 50125-1, EN 50125-3, EN 50155, EN 60068-2-1, EN 60068-2-14, EN 60068-2-2**
Ambient temperature			
In accordance with the standard	–	–	**EN 50155**
Temperature range	**0 - 60 °C**	**-40 - 70 °C**	**-40 - 70 °C**
Max. temperature in accordance with UL	–	**0 ... 60 °C**	–
In accordance with the standard	–	–	**EN 50125-1**
Temperature range	–	–	**-40 ... +70 °C**
In accordance with the standard	–	–	**EN 50125-3**
Temperature range	–	–	**-40 ... +70 °C**
Storage temperature			
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**	–
Climatic suitability			
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**	–
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	–
Condensation during operation	**Not permitted**	**Short-term**	–
Max. operating height above sea level	**2000 m**	**5000 m**	**2000 m**

Supply voltage
PSSu E F PS-P

Environmental data	312185	314185	315185
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 50125-3**
Frequency	**10 - 150 Hz**	**10 - 1000 Hz**	**5 - 2000 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	–
Acceleration	**1g**	**5g**	**0,23g**
Broadband noise			
In accordance with the standard	–	**EN 60068-2-64**	**EN 61373**
Frequency	–	**5 - 500 Hz**	**5 - 150 Hz**
Acceleration	–	**1,9grms**	**0,79 g RMS**
Shock stress			
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 50125-3**
Number of shocks	**6**	**6**	**20**
Acceleration	**15g**	**15g**	**2g**
Duration	**11 ms**	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 61373**
Number of shocks	**1000**	**1000**	**20**
Acceleration	**10g**	**25g**	**5g**
Duration	**16 ms**	**6 ms**	**30 ms**
Supply interruptions			
In accordance with the standard	–	–	**EN 50155**
Class	–	–	**S2, C1, C2**
Airgap creepage			
In accordance with the standard	**EN 60664-1**	**EN 60664-1**	**EN 50124-1**
Overvoltage category	**II**	**II**	**OV2**
Pollution degree	**2**	**2**	**PD2**
Protection type			
In accordance with the standard	**EN 60529**	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**	**IP20**
Terminals	**IP20**	**IP20**	–
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP51**

Supply voltage
PSSu E F PS-P

Mechanical data	312185	314185	315185
Material			
Bottom	**PC**	**PC**	**PC**
Front	**PC**	**PC**	**PC**
Coding	**PA**	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Dimensions			
Height	**76 mm**	**76 mm**	**76 mm**
Width	**12,6 mm**	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**	**60,2 mm**
Weight	**33 g**	**34 g**	**35 g**
Mechanical coding			
Type	**A**	**A**	**A**
Colour	**Yellow**	**Yellow**	**Yellow**

Where standards are undated, the 2015-03 latest editions shall apply.

Order reference

Product

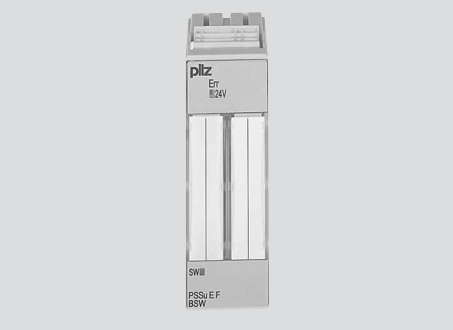
Product type	Features	Order No.
PSSu E F PS-P	Electronic module, base type	312 185
PSSu E F PS-P-T	Electronic module, T-type	314 185
PSSu E F PS-P-R	Electronic module, R-type	315 185

Accessories

Base modules

Product type	Features	Order No.
PSSu BS 1/8 S	Base module with screw terminals, for use only as the first module after the head module	312 650
PSSu BS 1/8 S-T	Base module with screw terminals, for use only as the first module after the head module, T-type	314 650
PSSu BS 1/8 C	Base module with cage clamp terminals, for use only as the first module after the head module	312 651
PSSu BS 1/8 C-T	Base module with cage clamp terminals, for use only as the first module after the head module, T-type	314 651

Supply voltage
PSSu E F BSW



Overview

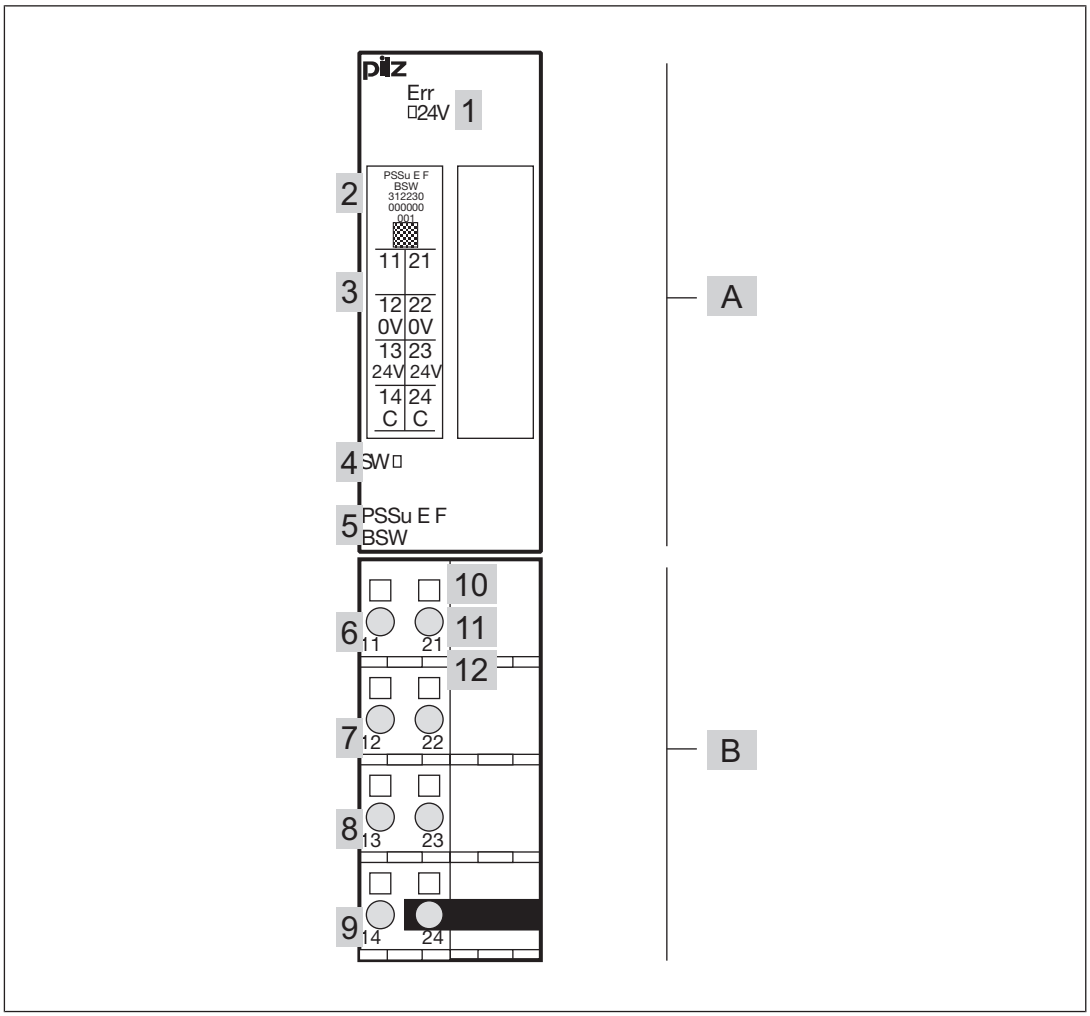
Module features

The product has the following features:

- Infeed for periphery supply
- Infeed for C-rail supply
- Failsafe switching off of the periphery supply (block switching)
- LEDs for:
  - Switch status of periphery supply
  - Periphery supply
  - Module error
- Application range depends on the base module
- T-type:
  PSSu E F BSW-T: for increased environmental requirements

Supply voltage
PSSu E F BSW

Front view



Legend:

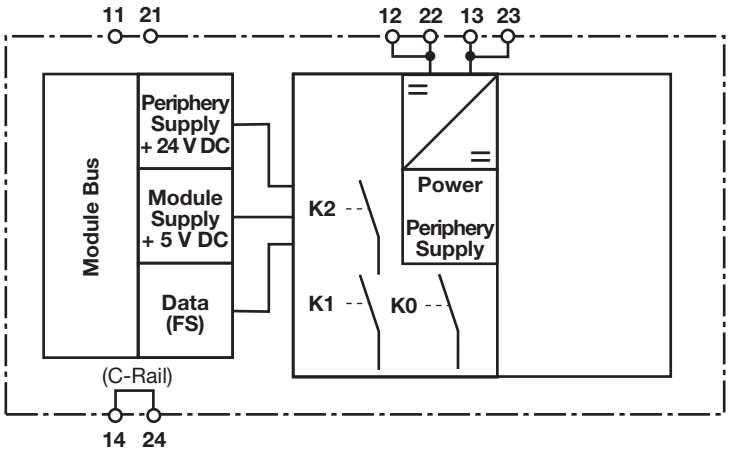
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order Number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module

Supply voltage
PSSu E F BSW

- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Supply voltage
PSSu E F BSW

Module features

The module has the following protection mechanisms:

- Periphery supply
  - Voltage monitoring (exceeding upper/lower limit)
- 2 relay contacts connected in series to feed the periphery supply: +24 V DC
- 1 relay contact to feed the periphery supply: 0 V DC
- Thermistor monitor

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- FS communication error
- Bus termination error
- Temperatur error: Too warm
- Temperatur error: Too hot
- Relay control error
- Relay error
- Block switching output error
- Overvoltage error
- Undervoltage error
- Error in the overvoltage protection diodes

Module supply

- The module supply provides the module with voltage.

Voltage infeed

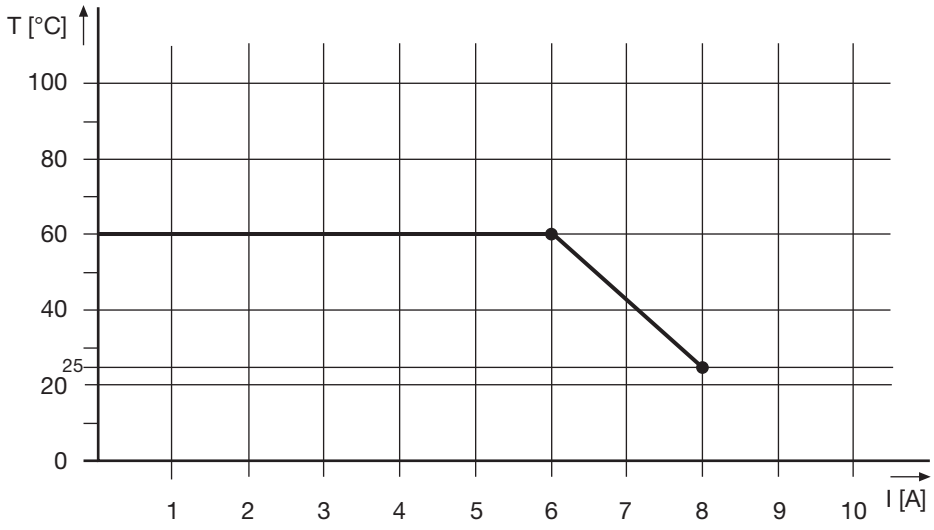
- Refreshing the periphery supply: The relevant base module interrupts the connection to the incoming (left-hand) periphery supply and C-rail on the module bus.
- Supply to the module bus:
  - Periphery supply for subsequent modules (right-hand side)
  - C-rail supply for subsequent modules (right-hand side)
- The module does not automatically switch off the periphery supply in the case of under or overvoltage. However, there will be a visual signal (“24 V” LED) and a message will be sent to the head module (entry in the error stack).

Supply voltage
PSSu E F BSW

Block switching

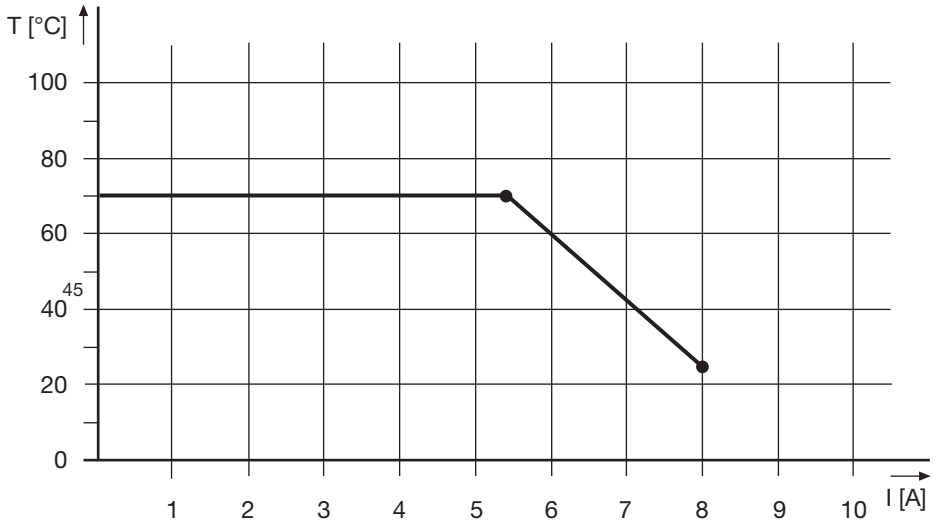
- The module is used to switch off the periphery supply safely on standard modules that are arranged in blocks.
- Each output block requires its own block switching module.
- The periphery supply can be switched off via the controller's failsafe user program.
- The periphery supply is switched off if a module error is detected.
- A new supply voltage module or a terminating plate signifies the end of an output block.
- The relationship between the load current and the operating temperature is illustrated in the following derating diagram. The operating point should be below the characteristic curve.

Derating diagram (PSSu E F BSW): Permitted ambient temperature T dependent on load current I



Supply voltage
PSSu E F BSW

Derating diagram (PSSu E F BSW-T): Permitted ambient temperature T dependent on load current I

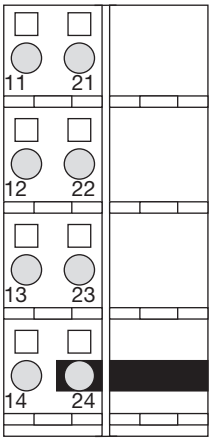


Supply voltage
PSSu E F BSW

Wiring

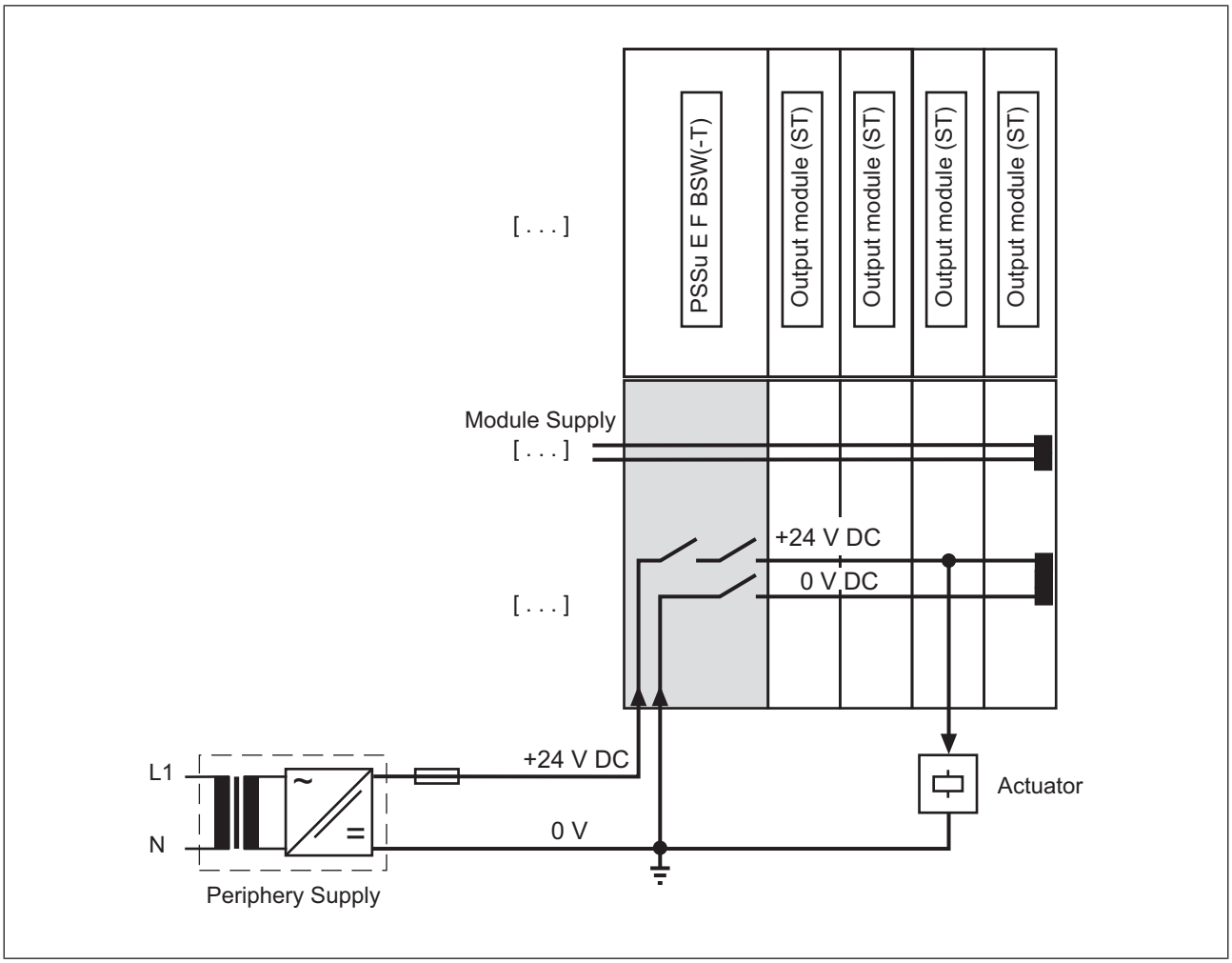
Terminal configuration

- Supply module
  - To switch on/off the periphery supply to input/output blocks (block switching)
  - To interrupt the incoming (left-hand) periphery supply and C-rail supply
  - To provide subsequent (right-hand) modules with the periphery supply and C-rail supply

Base module	Terminal configuration	
Screw terminals: PSSu BS 2/8 S PSSu BS 2/8 S-T Cage clamp terminals: PSSu BS 2/8 C PSSu BS 2/8 C-T	11: Not connected 21: Not connected 12 -22: 0 V periphery supply, interrupted to the left (12-22 linked within the base module) 13 -23: +24 V periphery supply interrupted to the left (13-23 linked within the base module) 14 -24: C-rail supply, interrupted to the left (14-24 linked within the base module)	

Supply voltage
PSSu E F BSW

Switching an earthed actuator



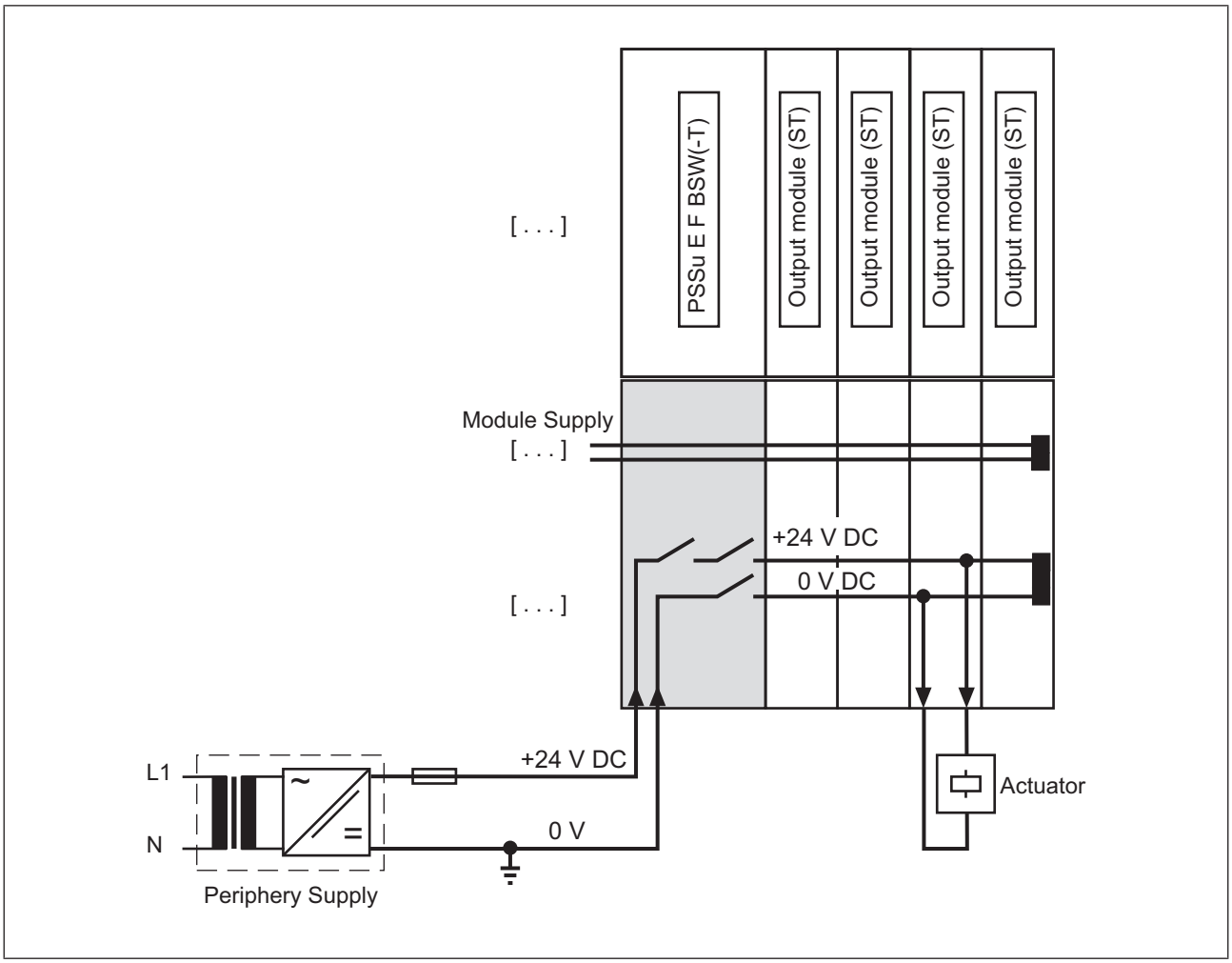
On earthed actuators, the actuator's 0 V connection must be connected to 0 V of the periphery supply (external supply voltage).

Reason: The switch (0 V periphery supply) in the PSSu E F BSW module is bridged when the actuator's earthed 0 V connection is connected to 0 V on the connected periphery supply. In this case, the PSSu E F BSW registers a short circuit between 0 V of the external supply voltage and 0 V of the connected periphery supply.

Error reaction: The PSSu will not start and all affected I/O-Groups (SafetyBUS p) remain in a STOP condition.

Supply voltage
PSSu E F BSW

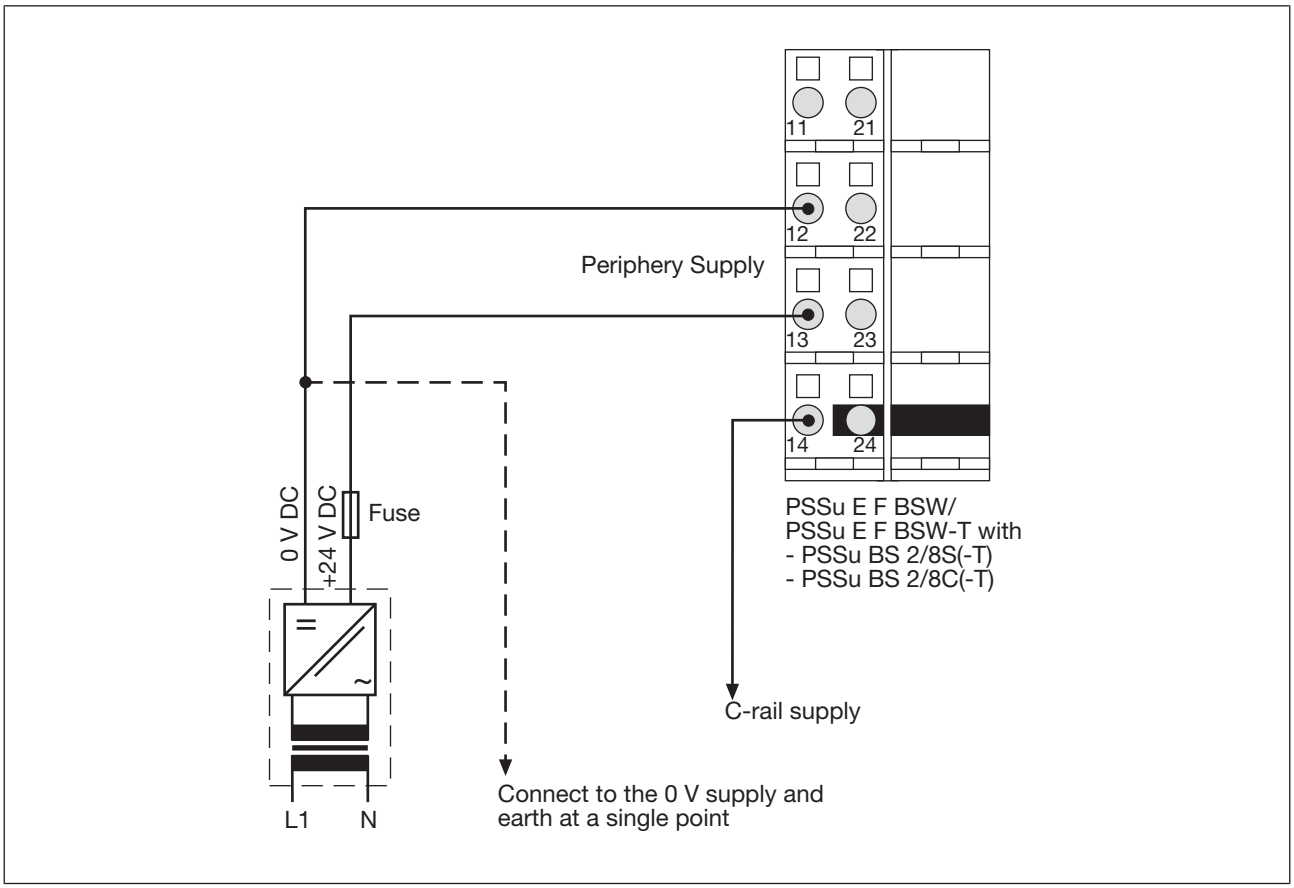
Switching a floating actuator



A floating actuator must be connected to the 0 V connection and to the 24 V connection of the connected periphery supply.

Supply voltage
PSSu E F BSW

Connecting the module



If you are using actuators for safety-related functions, it is essential that you note the following:

- A safety assessment must be made for each individual application.
- Input modules may not be used within an output block. If an error occurs, input modules could supply an external voltage which cannot be switched off.
- The position of each single actuator must be monitored, e.g. via an FS feedback loop with test pulses.
- To prevent contact welding, a fuse should be connected before the periphery supply infeed (see Technical details).
- The following applies for floating actuators:
  All actuator masses must be fed back to the output modules.
- The following applies for earthed actuators:
  The possibility of a short circuit to + 24 V of the external supply voltage must be excluded.

Supply voltage
PSSu E F BSW

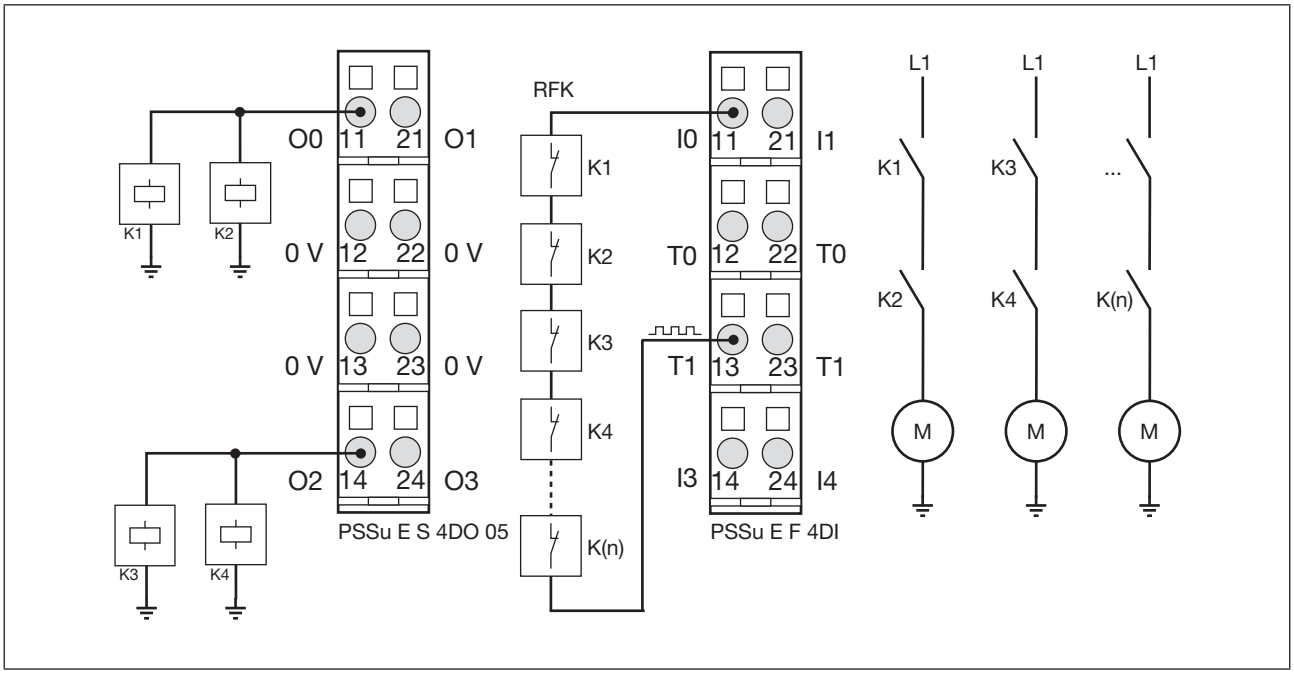
When using modules of type PSSu E PD in an output block, please note the following:

- Do not connect capacitive loads.
- During the power-up test, the relay contacts are tested with pulses of up to 60 ms.

Connection example

- Block switching with dual-channel operation and redundant actuator.
- The ST output module PSSu E S 4DO 0.5 belongs to the output block of the PSSu E F BSW module.
- The FS input module for forming the feedback loop (PSSu E F 4DI with test pulses) belongs to another supply group, which is not shut down.
- A maximum of SIL2 of EN IEC 61508 can be achieved.

Connection example for block switching:



Supply voltage
PSSu E F BSW

Technical Details

General	312230	314230
Approvals	**BG, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**BG, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Application range	**Standard/failsafe**	**Standard/failsafe**
Module's device code	**0C02h**	**0C02h**
Number of FS output bits	**1**	**1**
Application in system environment A		
From FS firmware version, other head modules	**4**	**4**
From FS firmware version PSSu H F PN	**1**	**1**
Electrical data	**312230**	**314230**
Supply voltage		
for	**Periphery supply**	**Periphery supply**
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**
Current load capacity at UB	**8,0 A**	**8,0 A**
Rated surge voltage	**3050 V**	**3050 V**
Internal supply voltage (module supply)		
Module's power consumption	**1,65 W**	**1,65 W**
Potential isolation	**3050 V**	**3050 V**
Periphery's supply voltage (periphery supply)		
Module's current consumption with no load	**40 mA**	**40 mA**
Module's power consumption with no load	**0,96 W**	**0,96 W**
Max. power dissipation of module	**2,50 W**	**2,50 W**
Relay outputs	**312230**	**314230**
Utilisation category in accordance with UL		
In accordance with	**UL**	**UL**
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**3,0 A**	**3,0 A**
Voltage	**24 V DC G. P. Resistive**	**24 V DC G. P. Resistive**
With current	**3,0 A**	**3,0 A**
Pilot Duty	**3,0 A**	**3,0 A**

Supply voltage
PSSu E F BSW

Relay outputs	312230	314230
Contact fuse protection		
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**
Max. processing time of block switching when signal changes from "0" to "1"	**120 ms**	**120 ms**
Max. processing time of block switching when signal changes from "1" to "0"	**850 ms**	**850 ms**
Environmental data	**312230**	**314230**
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**
Max. temperature in accordance with UL	**60 °C**	**60 °C**
Storage temperature		
In accordance with the standard	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**

Supply voltage
PSSu E F BSW

Environmental data	312230	314230
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312230**	**314230**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**25,2 mm**	**25,2 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**89 g**	**88 g**
Mechanical coding		
Type	**I**	**I**
Colour	**Yellow**	**Yellow**

Where standards are undated, the 2015-03 latest editions shall apply.

Supply voltage
PSSu E F BSW

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 3	SIL CL 3	7,48E-10	SIL 3	1,13E-05	20

If the module is operated at an ambient temperature above 60° C, the values stated in the table for PFH_D and PFD will need to be doubled when a safety function is calculated.

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

Service life table

Service life of BSW module based on the number of downstream modules

Number of ST modules	Cycles x1000
1	200
2	80
3	30
4	25
5	22
6	20
7	18
8	16

The safety-related characteristic data applies provided the number of cycles is not exceeded (see technical details). Once the number of cycles is exceeded, the module must be exchanged.

Supply voltage
PSSu E F BSW

Order reference

Product

Product type	Features	Order No.
PSSu E F BSW	Electronic module, base type	312 230
PSSu E F BSW-T	Electronic module, T-type	314 230

Accessories

Base modules

Product type	Features	Order No.
PSSu BS 2/8 S	Base module with screw terminals, for use only as the first module after the head module	312 656
PSSu BS 2/8 S-T	Base module with screw terminals, for use only as the first module after the head module, T-type	314 656
PSSu BS 2/8 C	Base module with cage clamp terminals, for use only as the first module after the head module	312 657
PSSu BS 2/8 C-T	Base module with cage clamp terminals, for use only as the first module after the head module, T-type	314 657

Voltage distribution

Voltage distribution

Voltage distribution
PSSu E PD

Overview

Module features

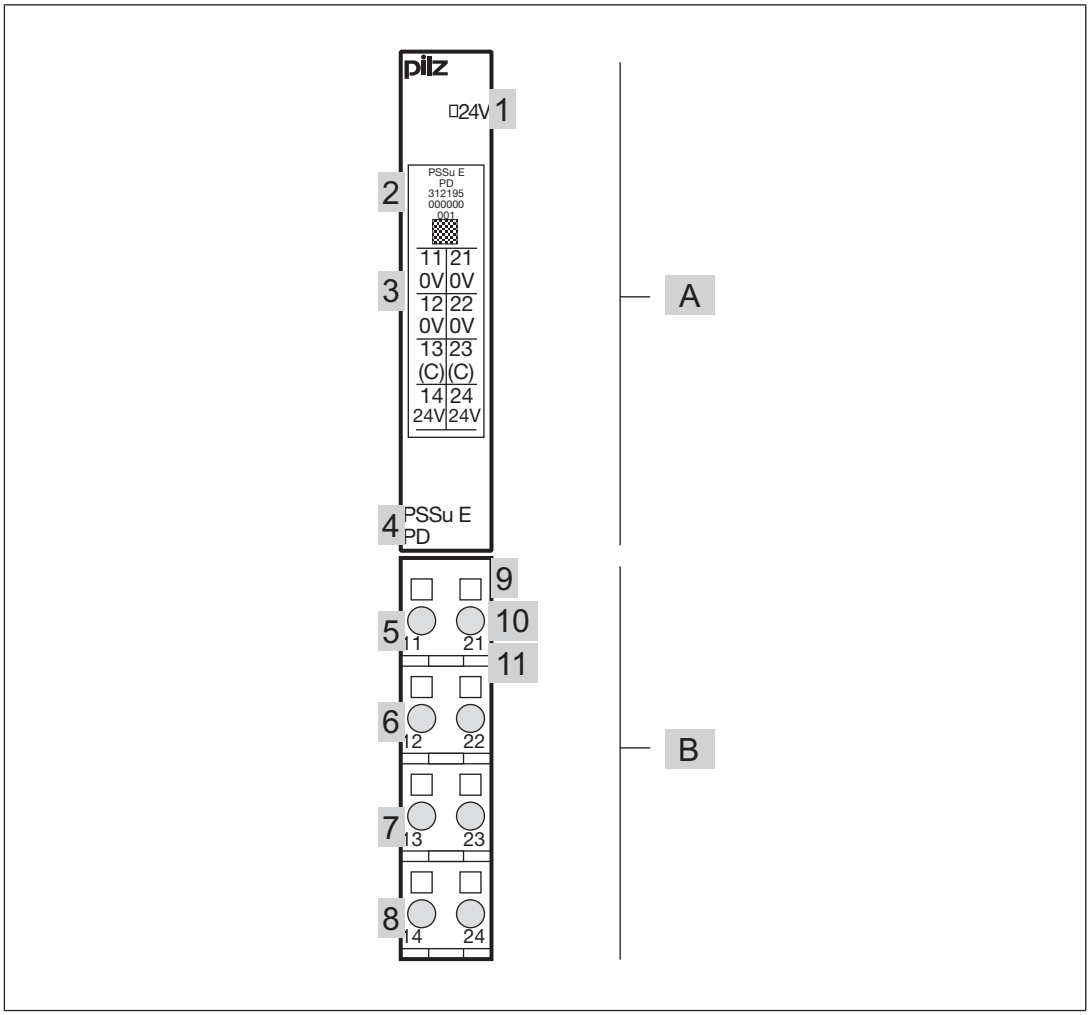
The product has the following features:

- The module routes the periphery supply from the module bus to the base module terminals.
- LED for:
  - Periphery supply
- Application range depends on the base module
- T-type:

  PSSu E PD-T: for increased environmental requirements

Voltage distribution
PSSu E PD

Front view



Key:

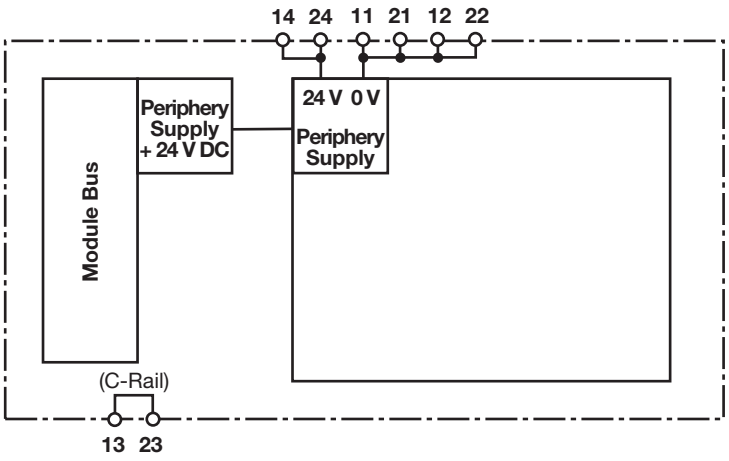
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1

Voltage distribution
PSSu E PD

- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



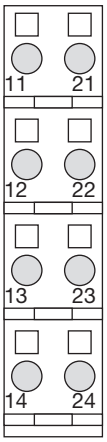
Voltage distribution
PSSu E PD

Module features

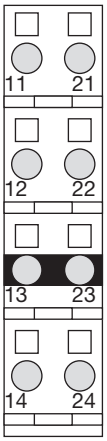
- The module routes the periphery supply from the module bus to the base module terminals.
- The module does not switch the periphery supply.
- The periphery supply has no current limitation.

Wiring

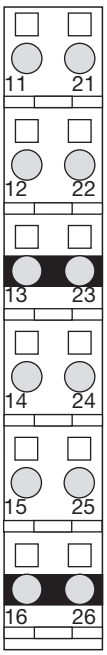
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11 -21: 0 V periphery supply (11-21 linked internally) 12 -22: 0 V periphery supply (12-22 linked within the base module) 13 -23: +24 V periphery supply (13-23 linked within the base module) 14 -24: +24 V periphery supply (14-24 linked internally)	

Voltage distribution
PSSu E PD

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11 -21: 0 V periphery supply (11-21 linked internally) 12 -22: 0 V periphery supply (12-22 linked within the base module) 13 -23: C-rail supply (13-23 linked within the base module) 14 -24: +24 V periphery supply (14-24 linked internally)	

Voltage distribution
PSSu E PD

Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12S PSSu BP-C1 1/12S-T Cage clamp terminals: PSSu BP-C1 1/12C PSSu BP-C1 1/12C-T	With C-rail: 11 -21: 0 V periphery supply (11-21 linked internally) 12 -22: 0 V periphery supply (12-22 linked within the base module) 13 -23: C-rail supply (13-23 linked within the base module) 14 -24: +24 V periphery supply (14-24 linked internally) 15 -25: 0 V periphery supply (15-25 linked within the base module) 16 -26: C-rail supply (16-26 linked within the base module)	

Voltage distribution
PSSu E PD

Technical details

General	312195	314195
Approvals	**CE, cULus Listed**	**CE, TÜV, cULus Listed**
Application range	**Standard**	**Standard**
Application in system environment A		
From FS firmware version, other head modules	**1**	**1**
From ST firmware version, other head modules	**1**	**1**
From FS firmware version PSSu H F PN	**1**	**1**
From ST firmware version PSSu H S PN	**1**	**1**
From ST firmware version PSSu WR S IDN	**1**	**1**
Application in system environment B		
From FS firmware version, head modules	**1.0.0**	**1.0.0**
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312195**	**314195**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**10 mA**	**10 mA**
Module's power consumption with no load	**0,24 W**	**0,24 W**
Environmental data	**312195**	**314195**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**

Voltage distribution
PSSu E PD

Environmental data	312195	314195
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312195**	**314195**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**28 g**	**28 g**

Voltage distribution
PSSu E PD

Mechanical data	312195	314195
Mechanical coding		
Type	**A**	**A**
Colour	**Light grey**	**Light grey**

Where standards are undated, the 2015-03 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E PD	Electronic module, base type	312 195
PSSu E PD-T	Electronic module, T-type	314 195

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623
PSSu BP-C1 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 623

Voltage distribution
PSSu E S PD-D

Overview

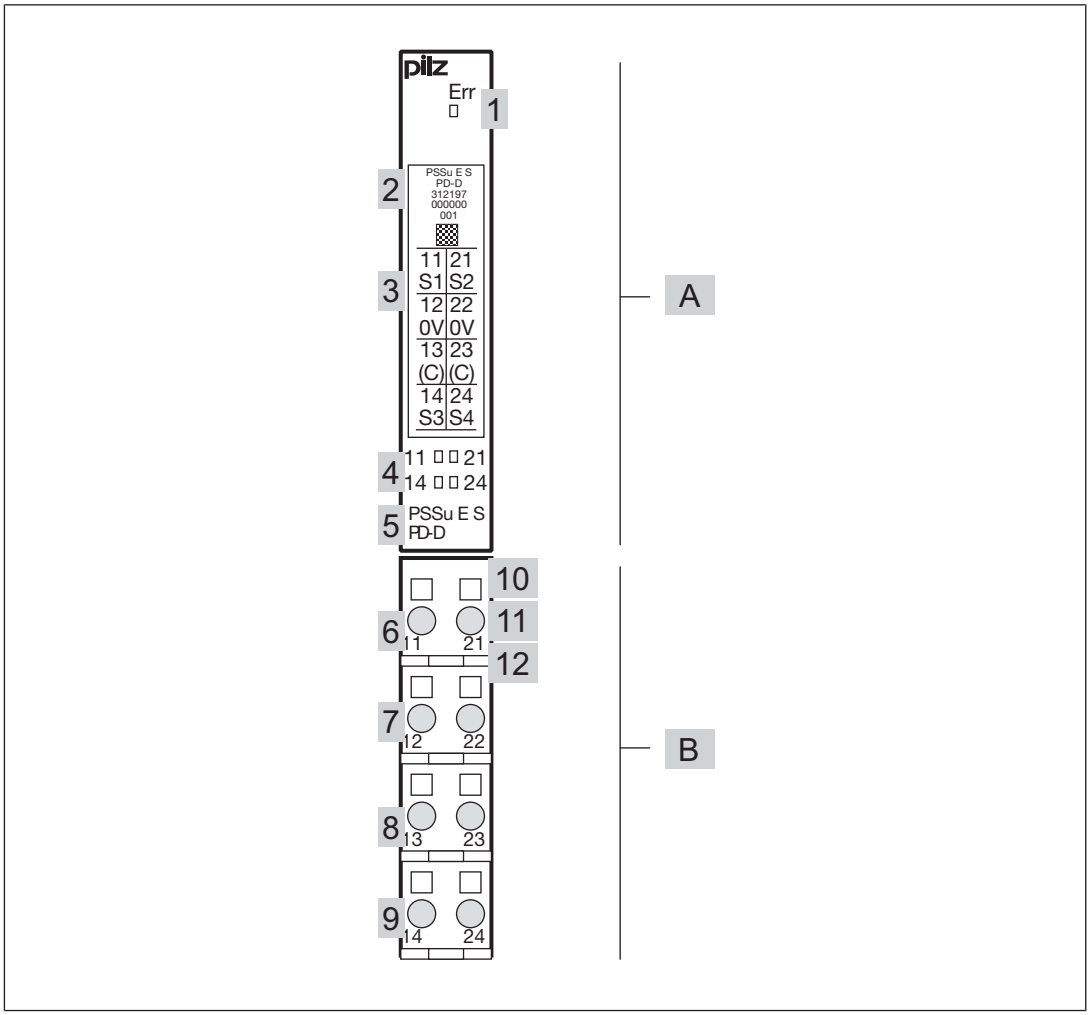
Module features

The product has the following features:

- Outputs for periphery supply: 4
- Current load capacity per output: 1,50 A
  - Short circuit-proof
  - Overload-proof
- LEDs for:
  - Switch status of each output
  - Module error
- The module provides advanced diagnostic data.
- Optional access to the advanced diagnostic data in the process image (system environment A only)

Voltage distribution
PSSu E S PD-D

Front view



Legend:

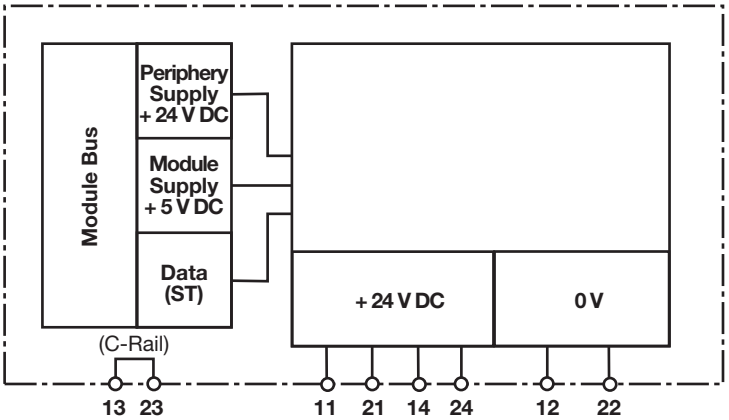
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module

Voltage distribution
PSSu E S PD-D

- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Voltage distribution
PSSu E S PD-D

Module features

- The module routes the periphery supply from the module bus to the base module terminals.
- The periphery supply is available at the outputs.

The module provides advanced diagnostic data, which is also available in a status byte in the ST-PII (not in system environment B):

- Output overload/short circuit
- Excess module temperature

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

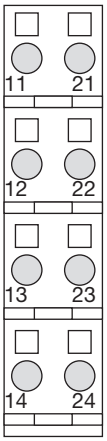
The module provides the following diagnostic data:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error
- Output overload
- Temperature error: too warm
- Temperature error: too hot

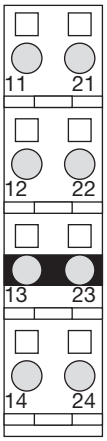
Voltage distribution
PSSu E S PD-D

Wiring

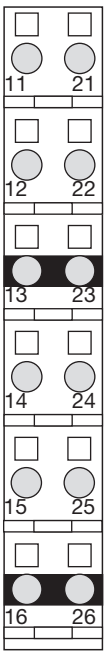
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S Cage clamp terminals: PSSu BP 1/8 C	Without C-rail: 11: Output S1 21: Output S2 12 -22: 0 V periphery supply (12-22 linked within the base module) 13 -23: 0 V periphery supply (13-23 linked within the base module) 14: Output S3 24: Output S4	

Voltage distribution
PSSu E S PD-D

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S Cage clamp terminals: PSSu BP-C 1/8 C	With C-rail: 11: Output S1 21: Output S2 12 -22: 0 V periphery supply (12-22 linked within the base module) 13 -23: C-rail supply (13-23 linked within the base module) 14: Output S3 24: Output S4	

Voltage distribution
PSSu E S PD-D

Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12 S Cage clamp terminals: PSSu BP-C1 1/12 C	With C-rail: 11: Output S1 21: Output S2 12 -22: 0 V periphery supply (12-22 linked within the base module) 13 -23: C-rail supply (13-23-16-26 linked within the base module) 14: Output S3 24: Output S4 15 -25: 0 V periphery supply (15-25 linked within the base module) 16 -26: C-rail supply (13-23-16-26 linked within the base module)	

Voltage distribution
PSSu E S PD-D

Technical Details

General	
Approvals	**CE, cULus Listed**
Application range	**Standard**
Module's device code	**000Ah**
Application in system environment A	
From ST firmware version, other head modules	**16**
From ST firmware version PSSu H S PN	**1**
Application in system environment B	
From ST firmware version, head modules	**1.8.0**
Electrical data	
Internal supply voltage (module supply)	
Module's power consumption	**0,30 W**
Periphery's supply voltage (periphery supply)	
Voltage range	**16,8 - 30,0 V**
Module's current consumption with no load	**30 mA**
Module's power consumption with no load	**0,72 W**
Max. power dissipation of module	**1,50 W**
Semiconductor outputs	
Rated voltage	**24 V DC**
Typ. threshold value for overload	**8 A**
Permitted loads	**inductive, capacitive, resistive**
Voltage outputs	
Number of outputs for periphery supply	**4**
Max. output current at rated voltage	**1,50 A**
Short circuit-proof	**yes**
Potential isolation between output and voltage for the internal module bus	**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 - 60 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**
Climatic suitability	
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**

Voltage distribution
PSSu E S PD-D

Environmental data	
Condensation during operation	**Not permitted**
Max. operating height above sea level	**2000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1, EN 61131-2**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
In accordance with the standard	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**
Housing	**IP20**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Coding	**PA**
Dimensions	
Height	**76,0 mm**
Width	**12,6 mm**
Depth	**60,2 mm**
Weight	**34 g**
Mechanical coding	
Type	**J**
Colour	**Dark grey**

Where standards are undated, the 2008-04 latest editions shall apply.

Voltage distribution
PSSu E S PD-D

Order reference

Product

Product type	Features	Order No.
PSSu E S PD-D	Electronic module, base type	312 197

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623

Voltage distribution
PSSu E PD1

Overview

Module features

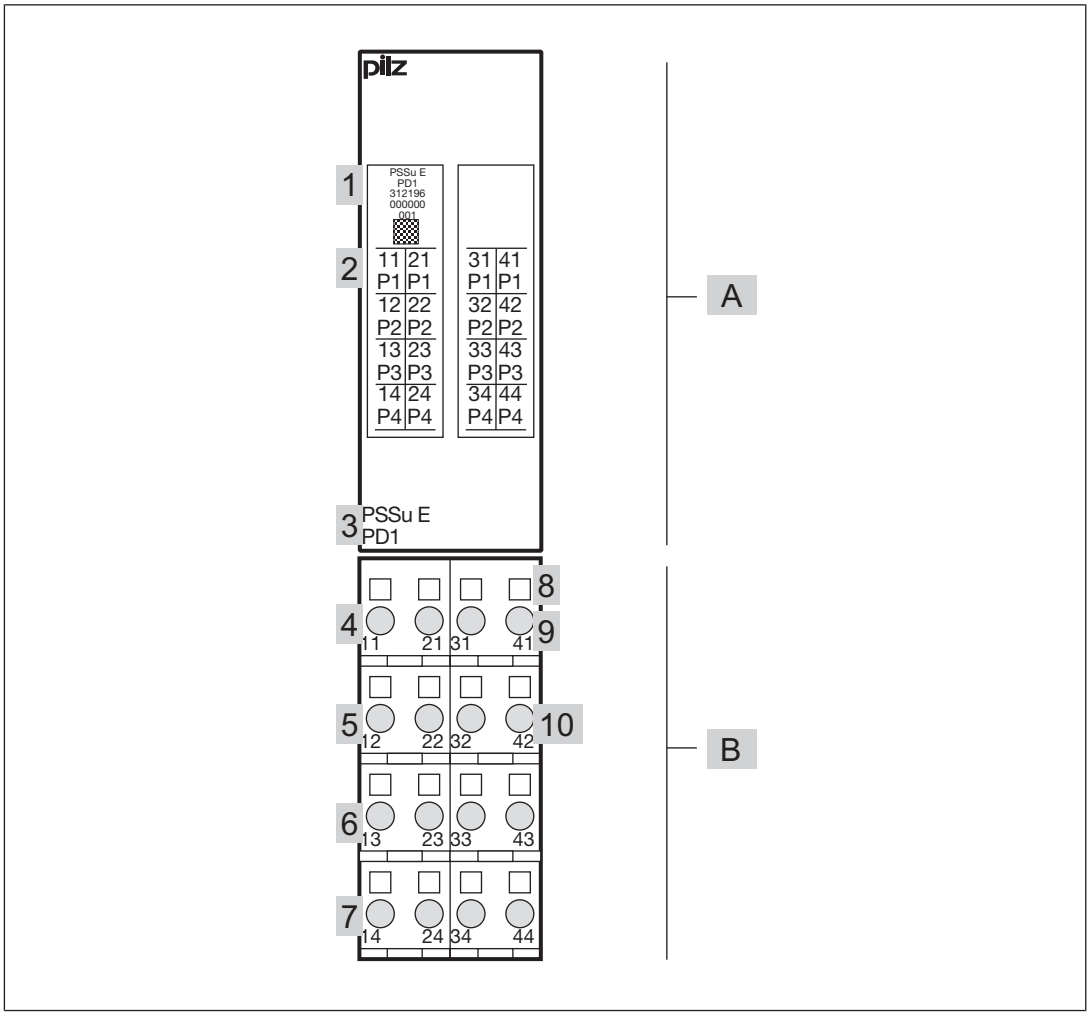
The product has the following features:

- The module provides connections for external supplies.
- The external supplies are galvanically isolated from the module bus supplies.
- T-type:

  PSSu E PD1-T: for increased environmental requirements

Voltage distribution
PSSu E PD1

Front view



Legend:

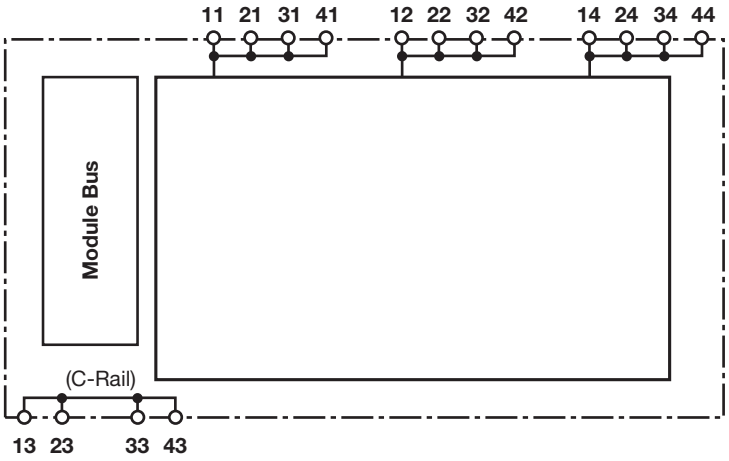
- A: Electronic module
- B: Base module
- 1: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 2: Labelling strip for the terminal configuration on the base module
- 3: Name of electronic module
- 4: Connection level 1
- 5: Connection level 2

Voltage distribution
PSSu E PD1

- 6: Connection level 3
- 7: Connection level 4
- 8: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 9: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 10: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Voltage distribution
PSSu E PD1

Module features

Module supply

- The module needs no supply from the module supply.

Periphery supply

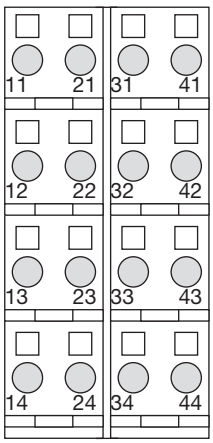
- The module distributes the periphery supply on the module bus.
- The periphery supply is not available on the module's connection terminals.

External supplies

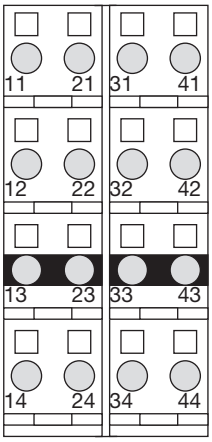
- The module provides connections for external supplies.
- The module does not switch the external supplies.
- The external supplies are galvanically isolated from the module bus supplies and from each other.
- The module has no current limitation on the external supplies.

Wiring

Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 2/16 S PSSu BP 2/16 S-T Cage clamp terminals: PSSu BP 2/16 C PSSu BP 2/16 C-T	11-21-31-41: P1 supply (11-21-31-41 linked internally) 12-22-32-42: P2 supply (12-22-32-42 linked within the base module) 13-23-33-43: P3 supply (13-23-33-43 linked within the base module) 14-24-34-44: P4 supply (14-24-34-44 linked internally)	

Voltage distribution
PSSu E PD1

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 2/16 S PSSu BP-C 2/16 S-T Cage clamp terminals: PSSu BP-C 2/16 C PSSu BP-C 2/16 C-T	11-21-31-41: P1 supply (11-21-31-41 linked internally) 12-22-32-42: P2 supply (12-22-32-42 linked within the base module) 13-23-33-43: C-rail supply (13-23-33-43 linked within the base module) 14-24-34-44: P4 supply (14-24-34-44 linked internally)	

Technical details

General	312196	314196
Approvals	**CE, cULus Listed**	**BG, CE, TÜV, cULus Listed**
Application range	**Standard**	**Standard**
Application in system environment A		
From FS firmware version, other head modules	**1**	**1**
From ST firmware version, other head modules	**1**	**1**
From FS firmware version PSSu H F PN	**1**	**1**
From ST firmware version PSSu H S PN	**1**	**1**
From ST firmware version PSSu WR S IDN	**1**	**1**

Voltage distribution
PSSu E PD1

General	312196	314196
Application in system environment B		
From FS firmware version, head modules	**1.0.0**	**1.0.0**
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312196**	**314196**
Max. power dissipation of module	**0,60 W**	**0,60 W**
Environmental data	**312196**	**314196**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**

Voltage distribution
PSSu E PD1

Environmental data	312196	314196
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312196**	**314196**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**25,2 mm**	**25,2 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**49 g**	**43 g**
Mechanical coding		
Type	**A**	**A**
Colour	**Light grey**	**Light grey**

Where standards are undated, the 2005-04 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E PD1	Electronic module, base type	312 196
PSSu E PD1-T	Electronic module, T-type	314 196

Voltage distribution
PSSu E PD1

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 2/16 S	Base module without C-rail with screw terminals	312 628
PSSu BP 2/16 S-T	Base module without C-rail with screw terminals, T-type	314 628
PSSu BP 2/16 C	Base module without C-rail with cage clamp terminals	312 629
PSSu BP 2/16 C-T	Base module without C-rail with cage clamp terminals, T-type	314 629
PSSu BP-C 2/16 S	Base module with C-rail and screw terminals	312 630
PSSu BP-C 2/16 S-T	Base module with C-rail and screw terminals, T-type	314 630
PSSu BP-C 2/16 C	Base module with C-rail and cage clamp terminals	312 631
PSSu BP-C 2/16 C-T	Base module with C-rail and cage clamp terminals, T-type	314 631

Voltage distribution
PSSu E PS-P 5V

Overview

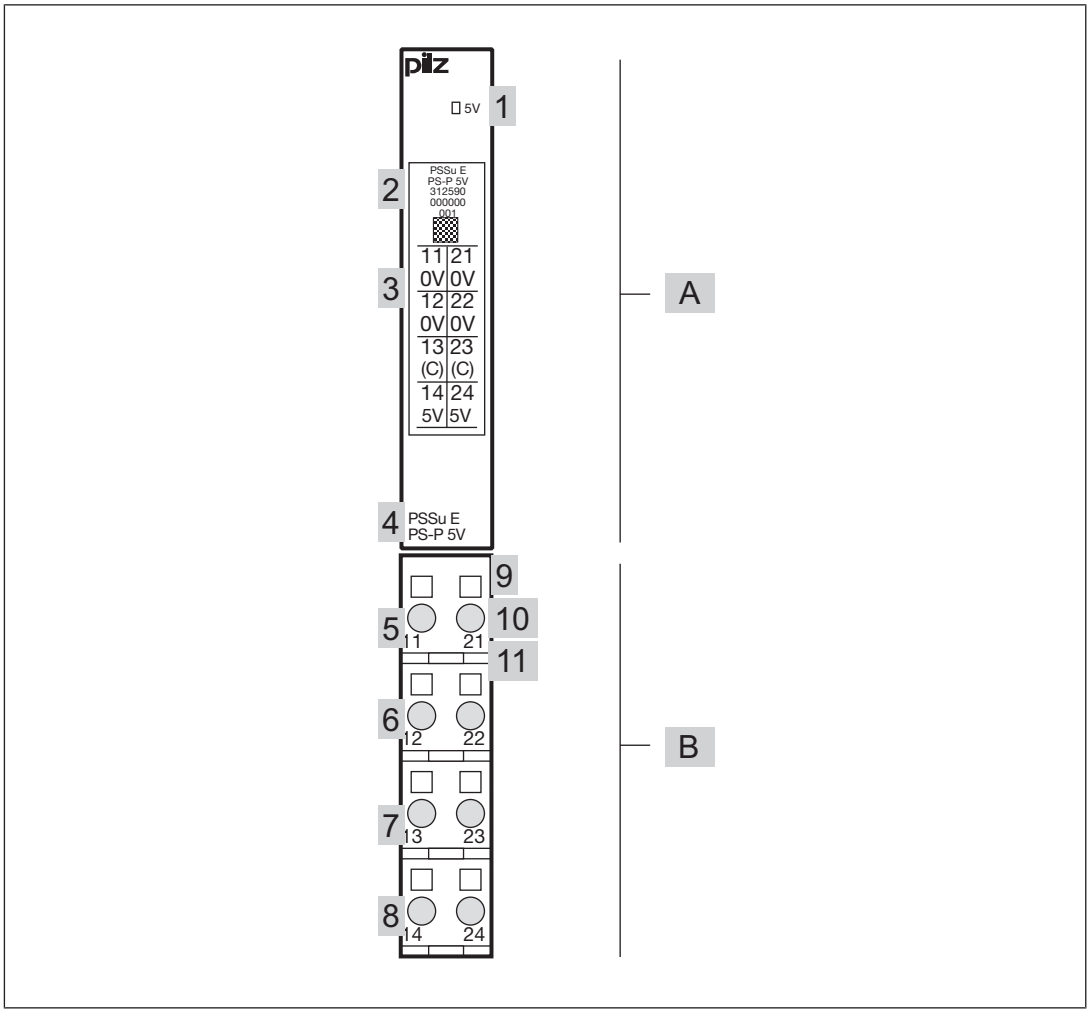
Module features

The product has the following features:

- Primary side of power supply
  - The external supply is fed to the base module terminals.
  - Voltage: 24 V
- Secondary side of power supply
  - The module supplies the output voltage to the base module terminals.
  - No buffer when the supply voltage is interrupted
  - Voltage: 5 V
  - Max. continuous output: 10,0 W
  - Max. current at 5 V: 2,0 A
- LED for:
  - External voltage

Voltage distribution
PSSu E PS-P 5V

Front view



Key:

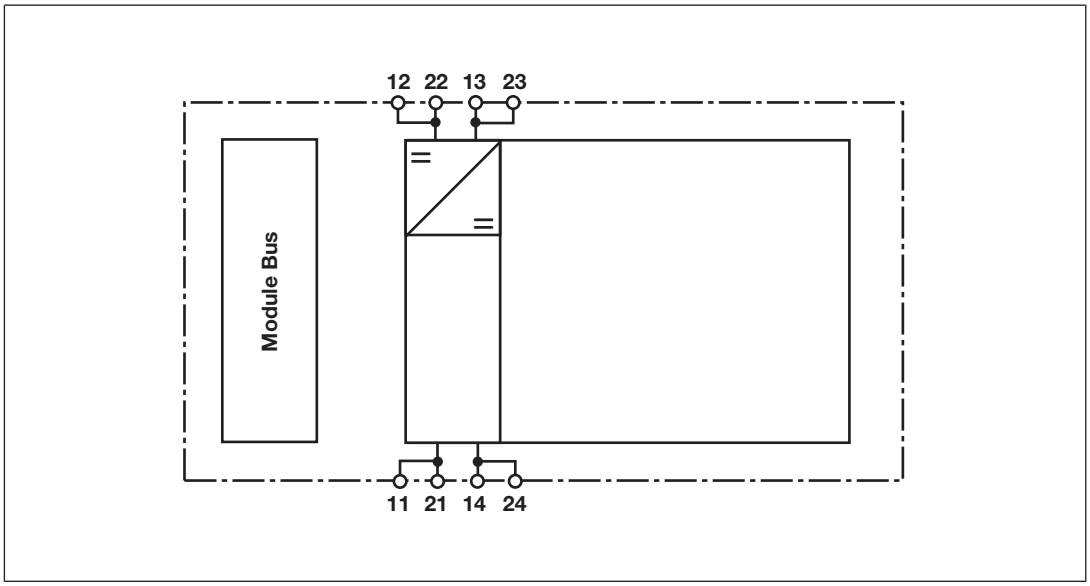
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1

Voltage distribution
PSSu E PS-P 5V

- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Voltage distribution
PSSu E PS-P 5V

Module features

The module has the following protection mechanisms:

- Short circuit-proof
- Temperature monitoring
  - Shutdown in the case of overload
  - Restart when the module has cooled down.
- The external supply and the module bus supplies are galvanically isolated.

The modules are typically used to supply periphery devices, such as:

- Encoder
- Pressure gauges
- Transducers
- Potentiometer

Module supply

- The module needs no supply from the module supply.
- The module distributes the module supply on the module bus.

Periphery supply

- The module needs no supply from the periphery supply.
- The periphery supply is not available on the module's connection terminals.
- The module distributes the periphery supply on the module bus.

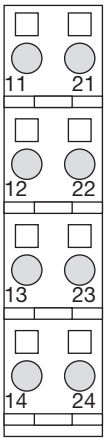
External supplies

- The module provides connections for external supplies. The external supplies are fed to the base module terminals.
- Please refer to the derating diagram.
- Primary side of power supply
  - Voltage: 24,0 V
  - Max. power consumption: 12,0 W
- Secondary side of power supply
  - The module supplies the output voltage to the base module terminals.
  - No buffer when the supply voltage is interrupted
  - Voltage: 5 V
  - Max. continuous output: 10,0 W
  - Max. current at 5 V: 2,0 A

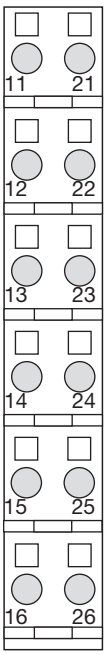
Voltage distribution
PSSu E PS-P 5V

Wiring

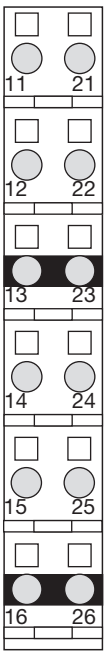
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11 -21: 0 V extraction (11-21 linked internally) 12 -22: 0 V infeed (12-22 linked within the base module) 13 -23: +24 V infeed (13-23 linked within the base module) 14 -24: +5 V extraction (14-24 linked internally)	

Voltage distribution
PSSu E PS-P 5V

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/12 S PSSu BP 1/12 S-T Cage clamp terminals: PSSu BP 1/12 C PSSu BP 1/12 C-T	Without C-rail: 11 -21: 0 V extraction (11-21 linked internally) 12 -22: 0 V infeed (12-22-15-25 linked within the base module) 13 -23: +24 V infeed (13-23-16-26 linked within the base module) 14 -24: +5 V extraction (14-24 linked internally) 15 -25: 0 V infeed (12-22-15-25 linked within the base module) 16 -26: +24 V infeed (13-23-16-26 linked within the base module)	

Voltage distribution
PSSu E PS-P 5V

Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12 S PSSu BP-C1 1/12 S-T Cage clamp terminals: PSSu BP-C 1/12 C PSSu BP-C 1/12 C-T	With C-rail: 11 -21: 0 V extraction (11-21 linked internally) 12 -22: 0 V infeed (12-22 linked within the base module) 13 -23: C-rail supply (13-23-16-26 linked within the base module) 14-24: +5 V extraction (14-24 linked internally) 15-25: +24 V infeed (15-25 linked within the base module) 16-26: C-rail supply (13-23-16-26 linked within the base module)	

Voltage distribution
PSSu E PS-P 5V

Technical details

General	
Approvals	**BG, CE, TÜV, cULus Listed**
Application range	**Standard**
Application in system environment A	
From FS firmware version, other head modules	**1**
From ST firmware version, other head modules	**1**
From FS firmware version PSSu H F PN	**1**
From ST firmware version PSSu H S PN	**1**
From ST firmware version PSSu WR S IDN	**1**
Application in system environment B	
From FS firmware version, head modules	**1.0.0**
From ST firmware version, head modules	**1.0.0**
Electrical data	
Supply voltage	
for	**Input**
Voltage	**24,0 V**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Output of external power supply (DC)	**12,0 W**
Secondary side (output voltage)	
Voltage tolerance	**-2 %/+2 %**
Output voltage	**5 V**
Max. current	**2,0 A**
Output power	**10,0 W**
Max. power dissipation of module	**1,50 W**
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 - 60 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**
Climatic suitability	
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**
Max. operating height above sea level	**2000 m**

Voltage distribution
PSSu E PS-P 5V

Environmental data	
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10,0 - 55,0 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
In accordance with the standard	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**
Housing	**IP20**
Terminals	**IP20**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Coding	**PA**
Mounting type	**plug-in**
Dimensions	
Height	**76,0 mm**
Width	**12,6 mm**
Depth	**60,2 mm**
Weight	**34 g**
Mechanical coding	
Type	**B**
Colour	**Light grey**

Where standards are undated, the 2015-03 latest editions shall apply.

Voltage distribution
PSSu E PS-P 5V

Order reference

Product

Product type	Features	Order No.
PSSu E PS-P 5V	Electronic module, base type	312 590

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623

Voltage distribution
PSSu E PS-P +/-10V

Overview

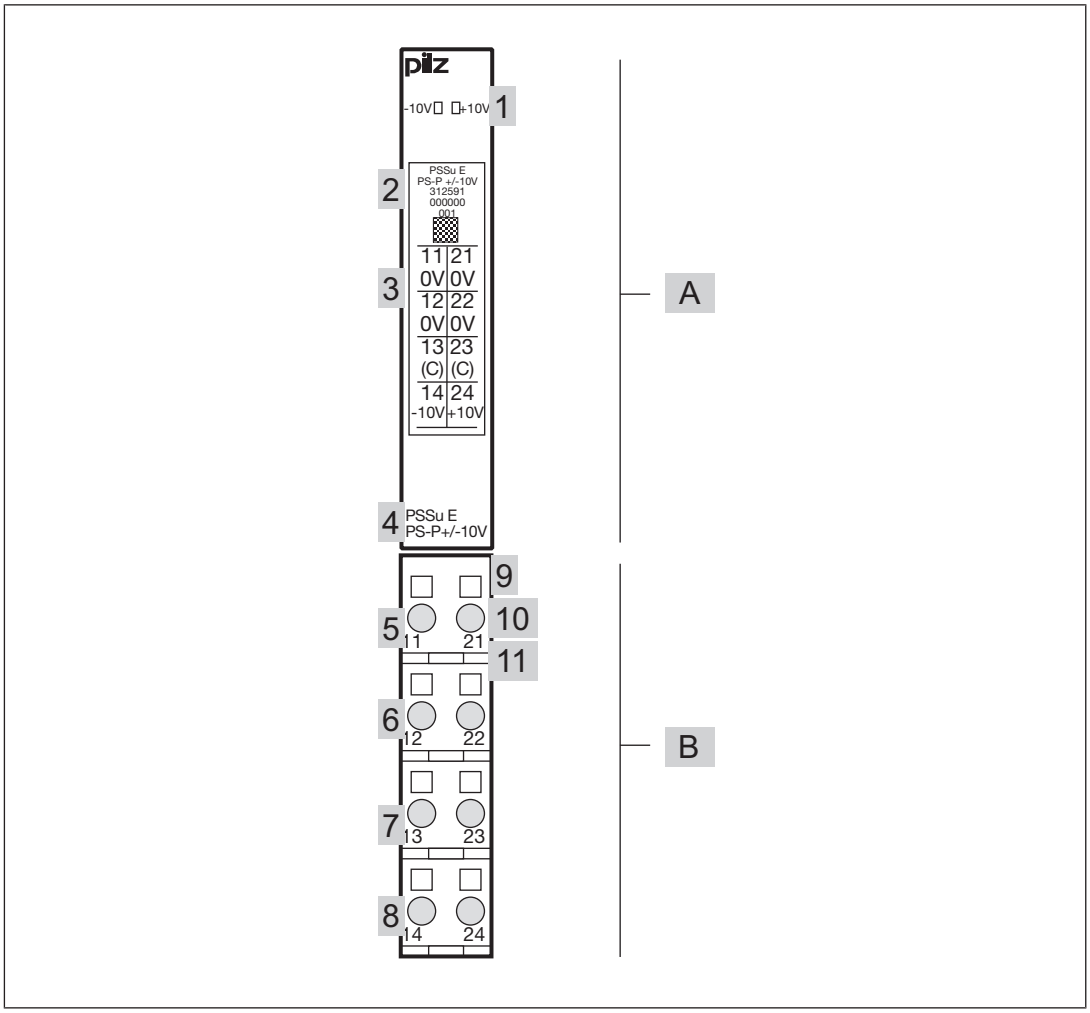
Module features

The product has the following features:

- Primary side of power supply
  - The external supply is fed to the base module terminals.
  - Voltage: 24 V
- Secondary side of power supply
  - The module supplies the output voltage to the base module terminals.
  - No buffer when the supply voltage is interrupted
  - Voltage: 10 V/-10 V
  - Max. continuous output: 10,0 W
  - Max. current at 10 V: 1,0 A
  - Max. current at -10 V: 0,50 A
- LED for:
  - External voltage

Voltage distribution
PSSu E PS-P +/-10V

Front view



Key:

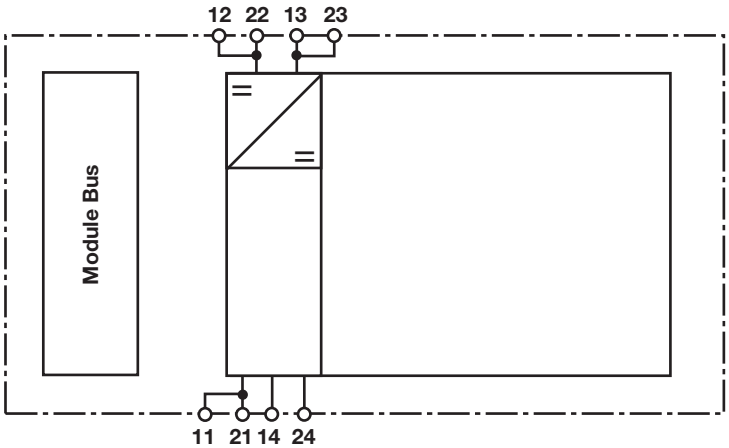
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1

Voltage distribution
PSSu E PS-P +/-10V

- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Voltage distribution
PSSu E PS-P +/-10V

Module features

The module has the following protection mechanisms:

- Short circuit-proof
- Temperature monitoring
  - Shutdown in the case of overload
  - Restart when the module has cooled down.
- The external supply and the module bus supplies are galvanically isolated.

The modules are typically used to supply periphery devices, such as:

- Encoder
- Pressure gauges
- Transducers
- Potentiometer

Module supply

- The module needs no supply from the module supply.
- The module distributes the module supply on the module bus.

Periphery supply

- The module needs no supply from the periphery supply.
- The periphery supply is not available on the module's connection terminals.
- The module distributes the periphery supply on the module bus.

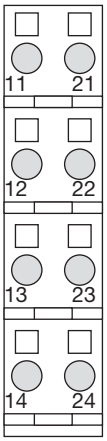
External supplies

- The module provides connections for external supplies. The external supplies are fed to the base module terminals.
- Please refer to the derating diagram.
- Primary side of power supply
  - Voltage: 24,0 V
  - Max. power consumption: 12,0 W
- Secondary side of power supply
  - The module supplies the output voltage to the base module terminals.
  - No buffer when the supply voltage is interrupted
  - Voltage: 10 V/-10 V
  - Max. continuous output: 10,0 W
  - Max. current at 10 V: 1,0 A
  - Max. current at -10 V: 0,50 A

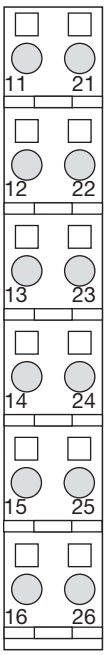
Voltage distribution
PSSu E PS-P +/-10V

Wiring

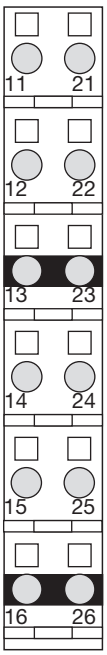
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11-21: 0 V extraction (11-21 linked internally) 12-22: 0 V infeed (12-22 linked within the base module) 13-23: +24 V infeed (13-23 linked within the base module) 14: -10 V extraction 24: +10 V extraction	

Voltage distribution
PSSu E PS-P +/-10V

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/12 S PSSu BP 1/12 S-T Cage clamp terminals: PSSu BP 1/12 C PSSu BP 1/12 C-T	Without C-rail: 11-21: 0 V extraction (11-21 linked internally) 12-22: 0 V infeed (12-22-15-25 linked within the base module) 13-23: +24 V infeed (13-23-16-26 linked within the base module) 14: -10 V extraction 24: +10 V extraction 15-25: 0 V infeed (12-22-15-25 linked within the base module) 16-26: +24 V infeed (13-23-16-26 linked within the base module)	

Voltage distribution
PSSu E PS-P +/-10V

Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12 S PSSu BP-C1 1/12 S-T Cage clamp terminals: PSSu BP-C1 1/12 C PSSu BP-C1 1/12 C-T	With C-rail: 11-21: 0 V extraction (11-21 linked internally) 12-22: 0 V infeed (12-22 linked within the base module) 13-23: C-rail supply (13-23-16-26 linked within the base module) 14: -10 V extraction 24: +10 V extraction 15-25: +24 V infeed (15-25 linked within the base module) 16-26: C-rail supply (13-23-16-26 linked within the base module)	

Voltage distribution
PSSu E PS-P +/-10V

Technical details

General	
Approvals	**BG, CE, TÜV, cULus Listed**
Application range	**Standard**
Application in system environment A	
From FS firmware version, other head modules	**1**
From ST firmware version, other head modules	**1**
From FS firmware version PSSu H F PN	**1**
From ST firmware version PSSu H S PN	**1**
From ST firmware version PSSu WR S IDN	**1**
Application in system environment B	
From FS firmware version, head modules	**1.0.0**
From ST firmware version, head modules	**1.0.0**
Electrical data	
Supply voltage	
for	**Input**
Voltage	**24,0 V**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Output of external power supply (DC)	**12,0 W**
Secondary side (output voltage)	
Voltage tolerance	**-2 %/+2 %**
Output voltage	**10 V**
Negative output voltage	**-10 V**
Max. current	**1,0 A**
Max. current of negative voltage	**0,50 A**
Output power	**10,0 W**
Max. power dissipation of module	**1,50 W**
Environmental data	
Climatic suitability	**EN 60068-2-14, EN 60068-2-30, EN 60068-2-78**
Ambient temperature	
In accordance with the standard	**EN 60068-2-14**
Temperature range	**0 - 60 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**
Climatic suitability	
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**

Voltage distribution
PSSu E PS-P +/-10V

Environmental data	
Max. operating height above sea level	**2000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10,0 - 55,0 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
In accordance with the standard	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**
Housing	**IP20**
Terminals	**IP 20**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Coding	**PA**
Mounting type	**plug-in**
Dimensions	
Height	**76,0 mm**
Width	**12,6 mm**
Depth	**60,2 mm**
Weight	**38 g**
Mechanical coding	
Type	**C**
Colour	**Light grey**

Where standards are undated, the 2015-03 latest editions shall apply.

Voltage distribution
PSSu E PS-P +/-10V

Order reference

Product

Product type	Features	Order No.
PSSu E PS-P +/-10V	Electronic module, base type	312 591

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623

Voltage distribution
PSSu E PS-P +/-15V

Overview

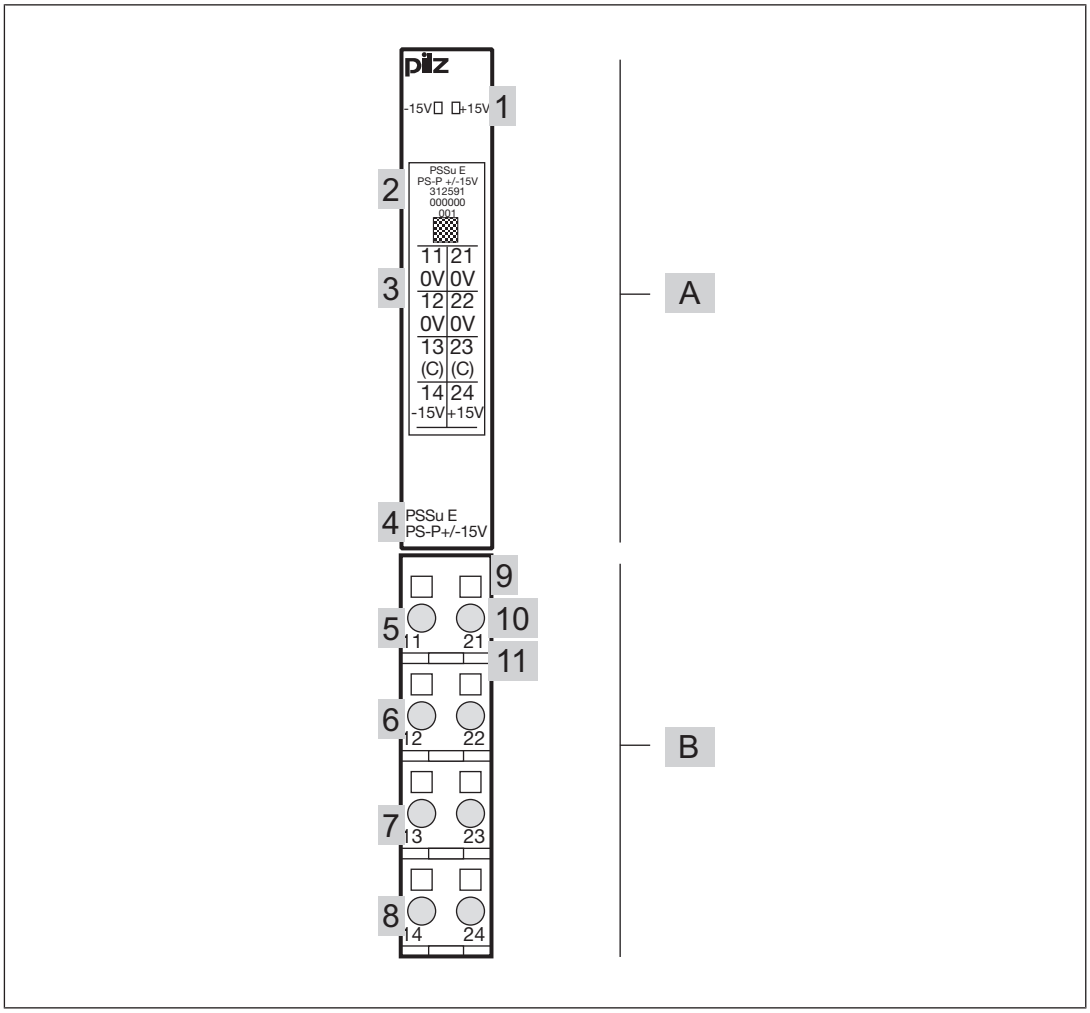
Module features

The product has the following features:

- Primary side of power supply
  - The external supply is fed to the base module terminals.
  - Voltage: 24 V
- Secondary side of power supply
  - The module supplies the output voltage to the base module terminals.
  - No buffer when the supply voltage is interrupted
  - Voltage: 15 V/-15 V
  - Max. continuous output: 10,0 W
  - Max. current at 15 V: 0,6 A
  - Max. current at -15 V: 0,30 A
- LED for:
  - External voltage

Voltage distribution
PSSu E PS-P +/-15V

Front view



Key:

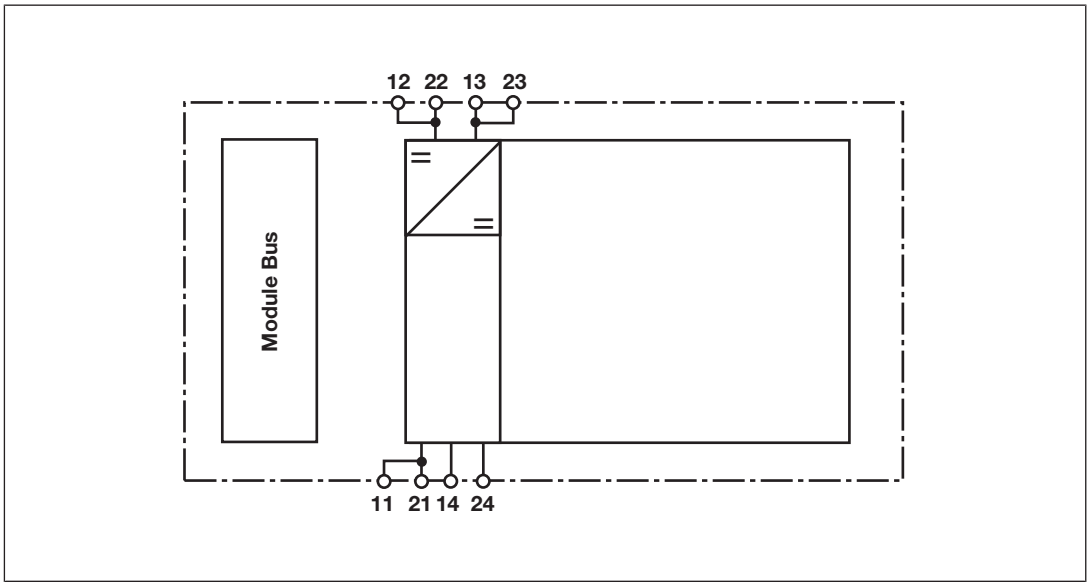
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1

Voltage distribution
PSSu E PS-P +/-15V

- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Voltage distribution
PSSu E PS-P +/-15V

Module features

The module has the following protection mechanisms:

- Short circuit-proof
- Temperature monitoring
  - Shutdown in the case of overload
  - Restart when the module has cooled down.
- The external supply and the module bus supplies are galvanically isolated.

The modules are typically used to supply periphery devices, such as:

- Encoder
- Pressure gauges
- Transducers
- Potentiometer

Module supply

- The module needs no supply from the module supply.
- The module distributes the module supply on the module bus.

Periphery supply

- The module needs no supply from the periphery supply.
- The periphery supply is not available on the module's connection terminals.
- The module distributes the periphery supply on the module bus.

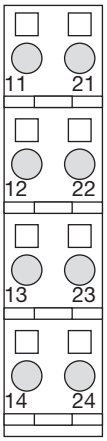
External supplies

- The module provides connections for external supplies. The external supplies are fed to the base module terminals.
- Please refer to the derating diagram.
- Primary side of power supply
  - Voltage: 24,0 V
  - Max. power consumption: 12,0 W
- Secondary side of power supply
  - The module supplies the output voltage to the base module terminals.
  - No buffer when the supply voltage is interrupted
  - Voltage: 15 V/-15 V
  - Max. continuous output: 10,0 W
  - Max. current at 15 V: 0,6 A
  - Max. current at -15 V: 0,30 A

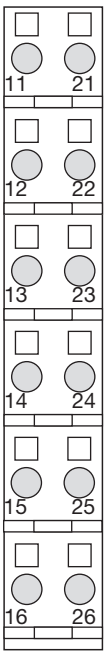
Voltage distribution
PSSu E PS-P +/-15V

Wiring

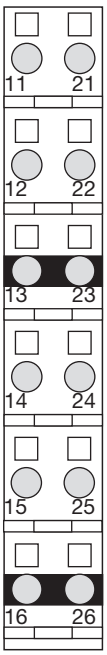
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11-21: 0 V extraction (11-21 linked internally) 12-22: 0 V infeed (12-22 linked within the base module) 13-23: +24 V infeed (13-23 linked within the base module) 14: -15 V extraction 24: +15 V extraction	

Voltage distribution
PSSu E PS-P +/-15V

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/12 S PSSu BP 1/12 S-T Cage clamp terminals: PSSu BP 1/12 C PSSu BP 1/12 C-T	Without C-rail: 11-21: 0 V extraction (11-21 linked internally) 12-22: 0 V infeed (12-22-15-25 linked within the base module) 13-23: +24 V infeed (13-23-16-26 linked within the base module) 14: -15 V extraction 24: +15 V extraction 15-25: 0 V infeed (12-22-15-25 linked within the base module) 16-26: +24 V infeed (13-23-16-26 linked within the base module)	

Voltage distribution
PSSu E PS-P +/-15V

Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12 S PSSu BP-C1 1/12 S-T Cage clamp terminals: PSSu BP-C1 1/12 C PSSu BP-C1 1/12 C-T	With C-rail: 11-21: 0 V extraction (11-21 linked internally) 12-22: 0 V infeed (12-22 linked within the base module) 13-23: C-rail supply (13-23-16-26 linked within the base module) 14: -15 V extraction 24: +15 V extraction 15-25: +24 V infeed (15-25 linked within the base module) 16-26: C-rail supply (13-23-16-26 linked within the base module)	

Voltage distribution
PSSu E PS-P +/-15V

Technical details

General	
Approvals	**BG, CE, TÜV, cULus Listed**
Application range	**Standard**
Application in system environment A	
From FS firmware version, other head modules	**1**
From ST firmware version, other head modules	**1**
From FS firmware version PSSu H F PN	**1**
From ST firmware version PSSu H S PN	**1**
From ST firmware version PSSu WR S IDN	**1**
Application in system environment B	
From FS firmware version, head modules	**1.0.0**
From ST firmware version, head modules	**1.0.0**
Electrical data	
Supply voltage	
for	**Input**
Voltage	**24,0 V**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Output of external power supply (DC)	**12,0 W**
Secondary side (output voltage)	
Voltage tolerance	**-2 %/+2 %**
Output voltage	**15 V**
Negative output voltage	**-15 V**
Max. current	**0,6 A**
Max. current of negative voltage	**0,30 A**
Output power	**10,0 W**
Max. power dissipation of module	**1,50 W**
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 - 60 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**
Climatic suitability	
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**

Voltage distribution
PSSu E PS-P +/-15V

Environmental data	
Condensation during operation	**Not permitted**
Max. operating height above sea level	**2000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10,0 - 55,0 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
In accordance with the standard	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**
Housing	**IP20**
Terminals	**IP20**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Coding	**PA**
Mounting type	**plug-in**
Dimensions	
Height	**76,0 mm**
Width	**12,6 mm**
Depth	**60,2 mm**
Weight	**40 g**
Mechanical coding	
Type	**D**
Colour	**Light grey**

Voltage distribution
PSSu E PS-P +/-15V

Where standards are undated, the 2015-03 latest editions shall apply.

Voltage distribution
PSSu E PS-P +/-15V

Order reference

Product

Product type	Features	Order No.
PSSu E PS-P +/-15V	Electronic module, base type	312 592

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623

Digital input/output (standard)

Digital input/output (standard)

Digital input/output (standard)
PSSu E S 4DI

Overview

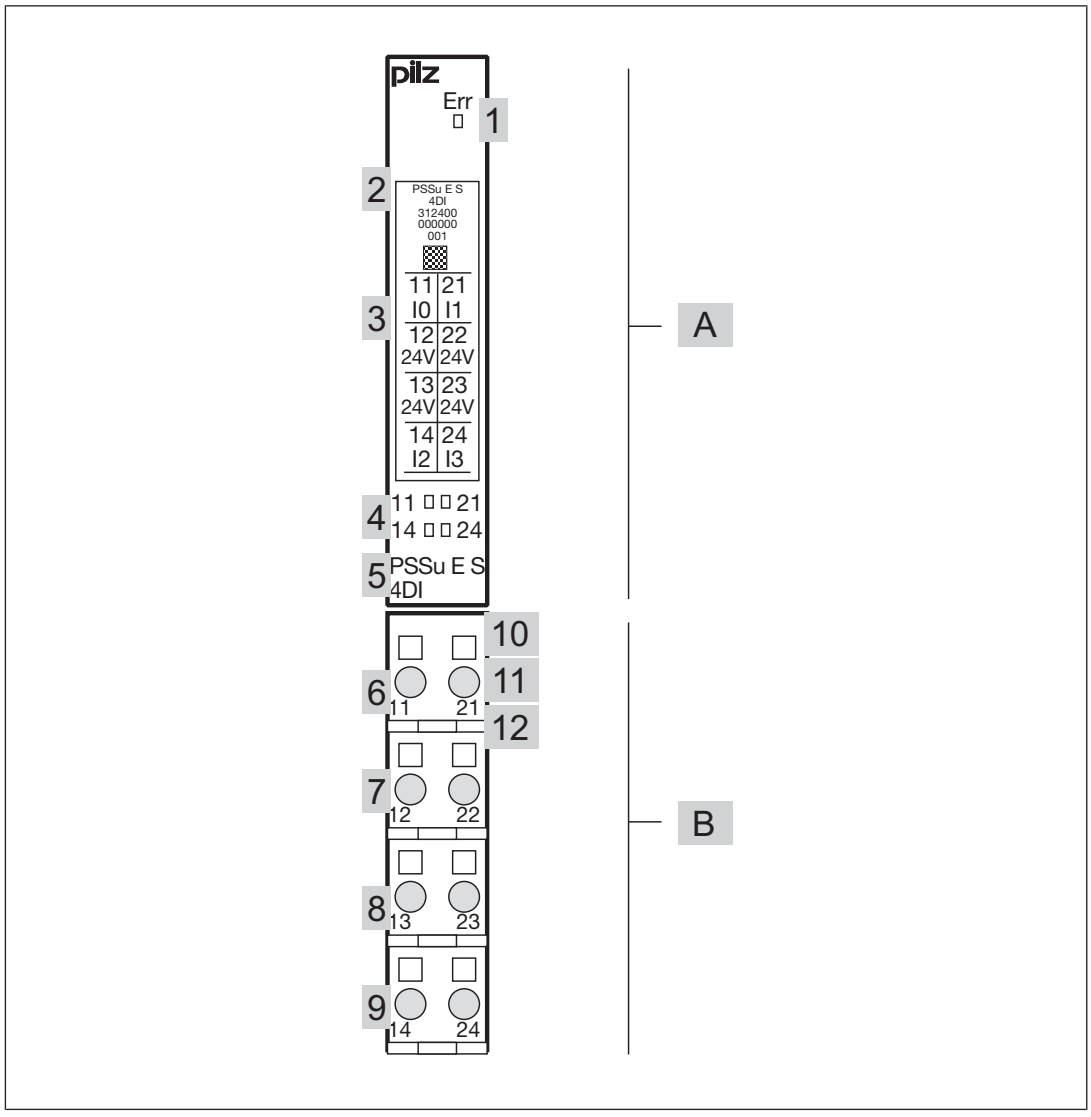
Module features

The product has the following features:

- 4 Digital inputs
- LEDs for:
  - Switch status of each input
  - Module error
- For standard applications in system environment A and B
- T-type:
  PSSu E S 4DI-T: for increased environmental requirements

Digital input/output (standard)
PSSu E S 4DI

Front view



Legend:

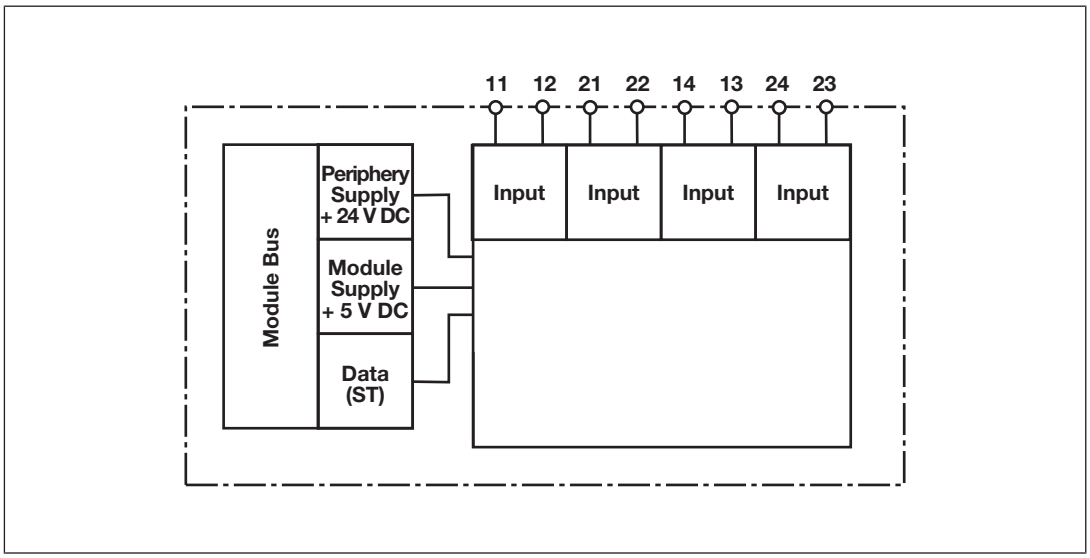
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order Number
  - Serial number
  - Hardware version number
  - 2D code

Digital input/output (standard)
PSSu E S 4DI

- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module
- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Digital input/output (standard)
PSSu E S 4DI

Module features

Module supply

- The module supply provides the module with voltage.

Periphery supply

- The module routes the periphery supply from the module bus to the base module terminals.
- The periphery supply is used to supply the input devices.
- The module does not switch the periphery supply.
- The periphery supply has no current limitation.

Inputs

- The input status is signalled to the head module via the module bus.
- The inputs have input filters.

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Information on the reaction times of the inputs can be found in the "PSSuniversal" System Description and the System Description "Automation system PSS 4000".

Configuration

It is not necessary to configure ST inputs in the PSSuniversal Configurator on the PSS WIN-PRO system software, but ST modules can be selected and displayed.

The ST process image can be optimised by combining adjacent bits of the same type into bytes.

Further information on configuration is available in the PSSuniversal Configurator's online help.

The module occupies 4 consecutive bit addresses in the process image.

Configuration	SafetyBUS p	Standard bus system	
	FS-PII	ST-PII	ST-PIO
None	- - -	4 Bit	- - -

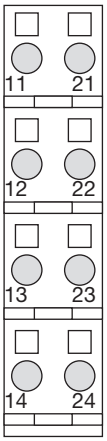
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
I0(11), I1(21), I2(14), I3(24)	ST_I_DI	Data: BOOL	Input data I0 ... I3

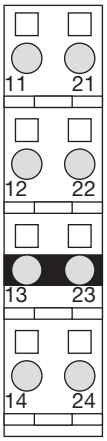
Digital input/output (standard)
PSSu E S 4DI

Wiring

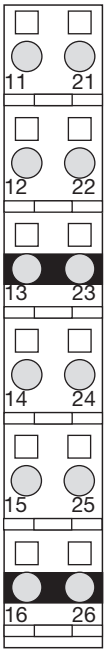
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Input I0 21: Input I1 12-22: +24 V output (periphery supply, 12-22 linked within the base module) 13-23: +24 V output (periphery supply, 13-23 linked within the base module) 14: Input I2 24: Input I3	

Digital input/output (standard)
PSSu E S 4DI

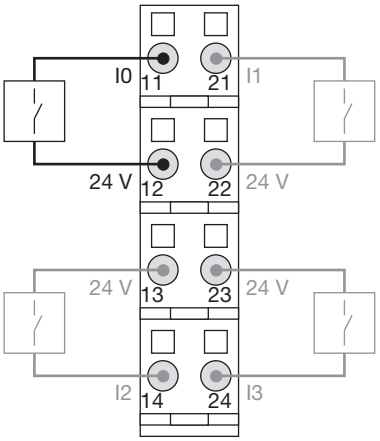
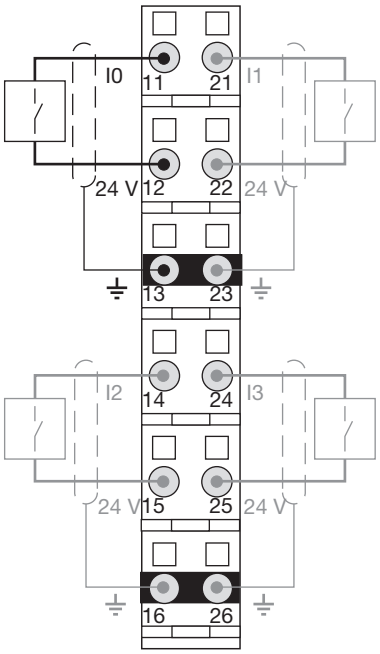
Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Input I0 21: Input I1 12-22: +24 V output (periphery supply, 12-22 linked within the base module) 13-23: C-rail supply (13-23 linked within the base module) 14: Input I2 24: Input I3	

Digital input/output (standard)
PSSu E S 4DI

Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12 S PSSu BP-C1 1/12 S-T Cage clamp terminals: PSSu BP-C1 1/12 C PSSu BP-C1 1/12 C-T	With C-rail: 11: Input I0 21: Input I1 12-22: +24 V output (periphery supply, 12-22 linked within the base module) 13-23: C-rail supply (13-23-16-26 linked within the base module) 14: Input I2 24: Input I3 15-25: +24 V output (periphery supply, 15-25 linked within the base module) 16-26: C-rail supply (13-23-16-26 linked within the base module)	

Digital input/output (standard)
PSSu E S 4DI

Connecting the module

Input circuit	Single-channel input device	Single-channel input device
Input devices supplied via the periphery supply		

Technical details

General	312400	314400
Approvals	**BG, CE, TÜV, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0200h**	**0200h**
Number of ST input bits	**4**	**4**
Application in system environment A		
From ST firmware version, other head modules	**5**	**5**
From ST firmware version PSSu H S PN	**1**	–
From ST firmware version PSSu WR S IDN	**1**	**1**
Application in system environment B		
From ST firmware version, head modules	**1.0.0**	**1.3.0**

Digital input/output (standard)
PSSu E S 4DI

Electrical data	312400	314400
Internal supply voltage (module supply)		
Module's power consumption	**0,12 W**	**0,12 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30 V**	**16,8 - 30 V**
Module's current consumption with no load	**0 mA**	**0 mA**
Module's power consumption with no load	**0,00 W**	**0,00 W**
Max. power dissipation of module	**1,5 W**	**1,5 W**
Inputs	**312400**	**314400**
Number	**4**	**4**
Voltage at inputs	**24 V DC**	**24 V DC**
Input current at rated voltage	**6 mA**	**6 mA**
Input current range	**3 - 10 mA**	**3 - 10 mA**
Min. threshold voltage when signal changes from "1" to "0"	**8 V**	**8 V**
Max. threshold voltage when signal changes from "0" to "1"	**10 V**	**10 V**
Max. processing time of input when signal changes from "1" to "0"	**4 ms**	**4 ms**
Max. processing time of input when signal changes from "0" to "1"	**4 ms**	**4 ms**
Min. processing time of input when signal changes from "1" to "0"	**3 ms**	**3 ms**
Min. processing time of input when signal changes from "0" to "1"	**3 ms**	**3 ms**
Potential isolation between input and internal module bus voltage	**yes**	**yes**
Environmental data	**312400**	**314400**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**

Digital input/output (standard)
PSSu E S 4DI

Environmental data	312400	314400
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 150 Hz**	**10 - 150 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Mechanical data	**312400**	**314400**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**

Digital input/output (standard)
PSSu E S 4DI

Mechanical data	312400	314400
Dimensions		
Height	**76 mm**	**76 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**31 g**	**31 g**
Mechanical coding		
Type	**A**	**A**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2005-04 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E S 4DI	Electronic module, base type	312 400
PSSu E S 4DI-T	Electronic module, T-type	314 400

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 622

Digital input/output (standard)
PSSu E S 4DI

Product type	Features	Order No.
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623
PSSu BP-C1 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 623

Digital input/output (standard)
PSSu E S 4DI-D

Overview

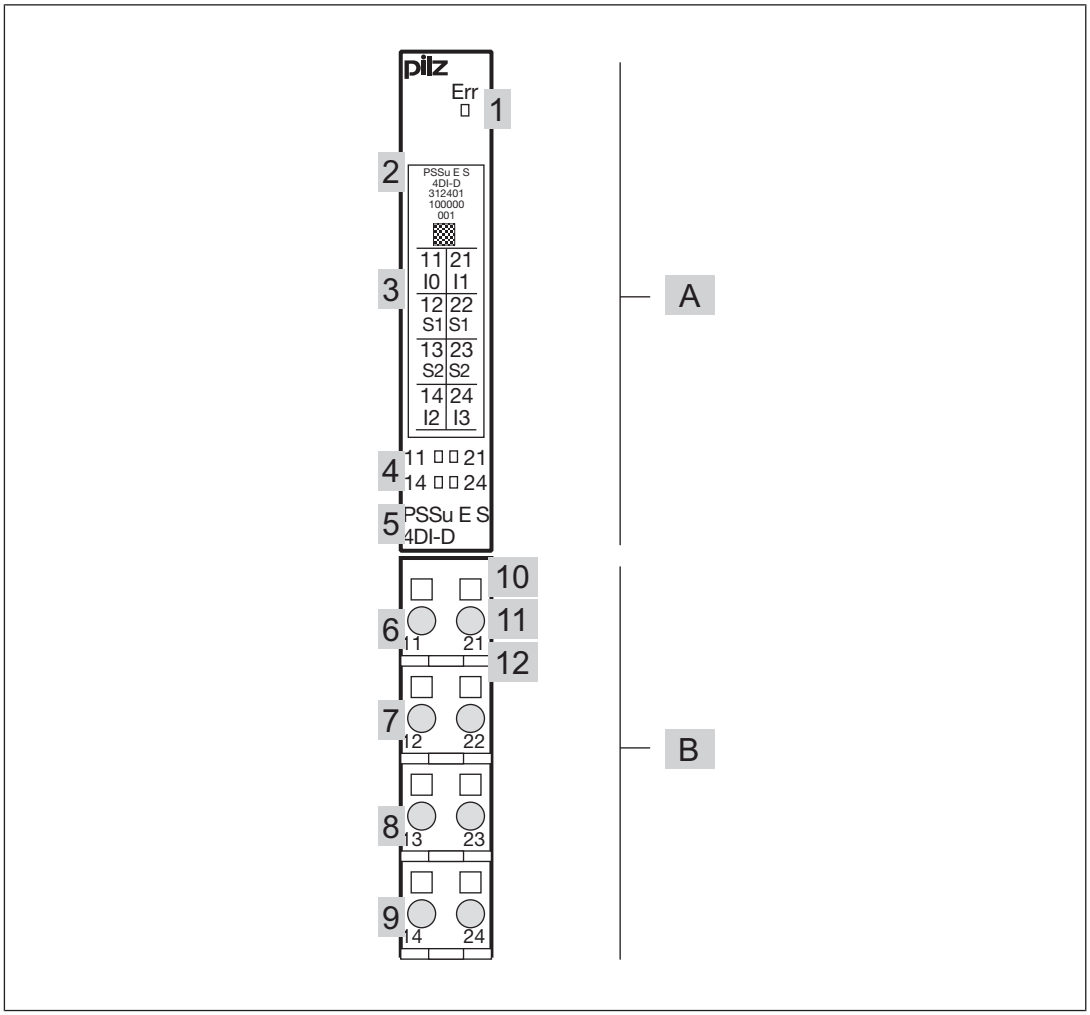
Module features

The product has the following features:

- 4 Digital inputs
- Outputs for periphery supply: 2
- Current load capacity per output: 0,25 A
  - Short circuit-proof
  - Overload-proof
- LEDs for:
  - Switch status of each input
  - Module error
- The module provides advanced diagnostic data.
- Optional access to the advanced diagnostic data in the process image (system environment A only)
- For standard applications in system environment A and B

Digital input/output (standard)
PSSu E S 4DI-D

Front view



Legend:

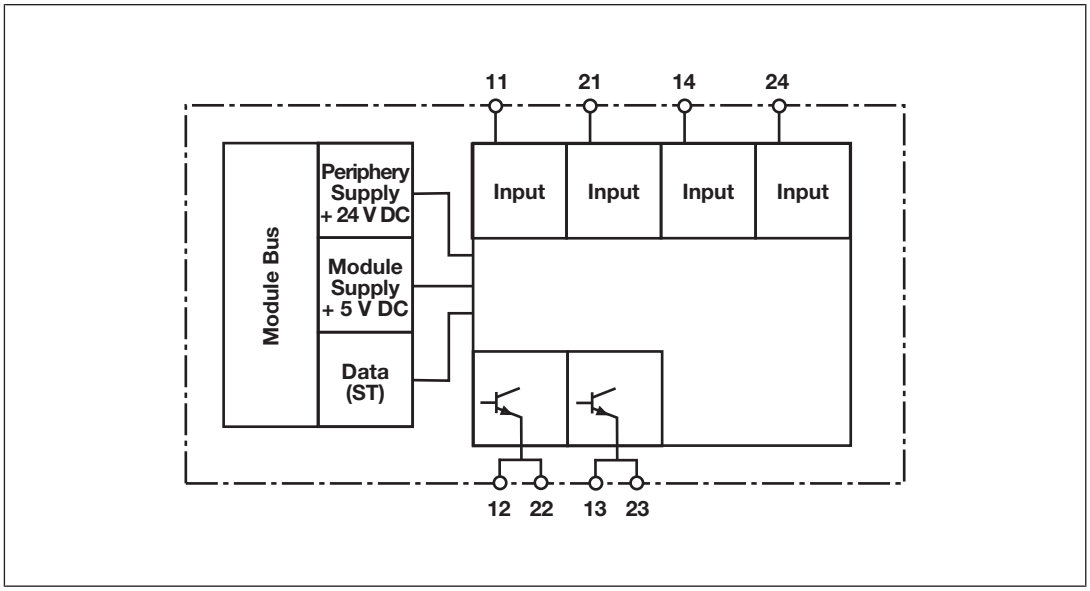
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module

Digital input/output (standard)
PSSu E S 4DI-D

- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Digital input/output (standard)
PSSu E S 4DI-D

Module features

Module supply

- The module supply provides the module with voltage.

Periphery supply

- The module routes the periphery supply from the module bus to the base module terminals.
- The periphery supply is available at the supply outputs S1 and S2.

Inputs

- The input status is signalled to the head module via the module bus.
- The inputs have input filters.

Supply outputs S1 and S2

- The supply outputs supply the sensors at the inputs.
- The supply outputs are protected against overload and reverse polarity.
- The supply outputs cannot be controlled via the process image (PIO).

The module provides advanced diagnostic data, which is also available in a status byte in the ST-PII (not in system environment B):

- Output overload/short circuit
- Excess module temperature

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error
- Output overload
- Temperature error: too warm
- Temperature error: too hot

Information on the reaction times of the inputs can be found in the "PSSuniversal" System Description and the System Description "Automation system PSS 4000".

Digital input/output (standard)
PSSu E S 4DI-D

Configuration

It is not necessary to configure ST inputs in the PSSuniversal Configurator on the PSS WIN-PRO system software, but ST modules can be selected and displayed.

The ST process image can be optimised by combining adjacent bits of the same type into bytes.

If the status byte is configured, the ST process image cannot be optimised.

Further information on configuration is available in the PSSuniversal Configurator's online help.

The module occupies 4 consecutive bit addresses in the process image.

Configuration	SafetyBUS p	Standard bus system	
	FS-PII	ST-PII	ST-PIO
Without status byte	- - -	4 Bit	- - -
With status byte ("S")	- - -	8 + 4 Bit	- - -

The status byte contains the information on overload and overtemperature.

Structure and contents of the status byte:

Bit number	Signal	Meaning
0	0	No overload on supply output S1
	1	Overload on supply output S1
1	0	No overload on supply output S2
	1	Overload on supply output S2
2	0	Reserved
	1	Reserved
3	0	Reserved
	1	Reserved
4	0	No temperature error
	1	Temperature error: too warm
5	0	Switch-off temperature not reached.
	1	Temperature error: too hot. Supply outputs switch off.
6	0	Reserved
	1	Reserved
7	0	Reserved
	1	Reserved

Digital input/output (standard)
PSSu E S 4DI-D

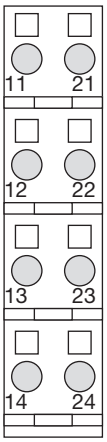
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
I0(11), I1(21), I2(14), I3(24)	ST_I_DI	Data: BOOL	Input data I0 ... I3

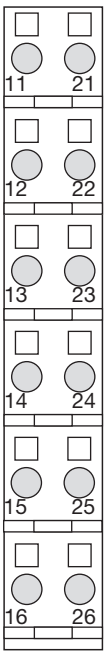
The status byte is not available in the process image.

Wiring

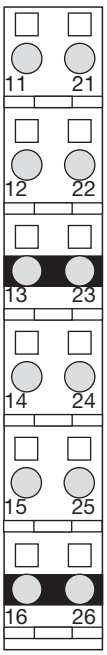
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Input I0 21: Input I1 12-22: Supply output S1 (12-22 linked within the base module) 13-23: Supply output S2 (13-23 linked within the base module) 14: Input I2 24: Input I3	

Digital input/output (standard)
PSSu E S 4DI-D

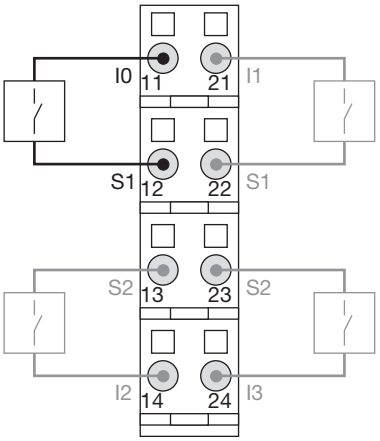
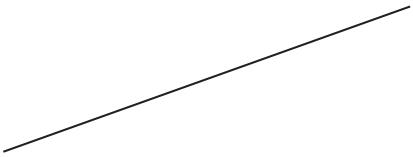
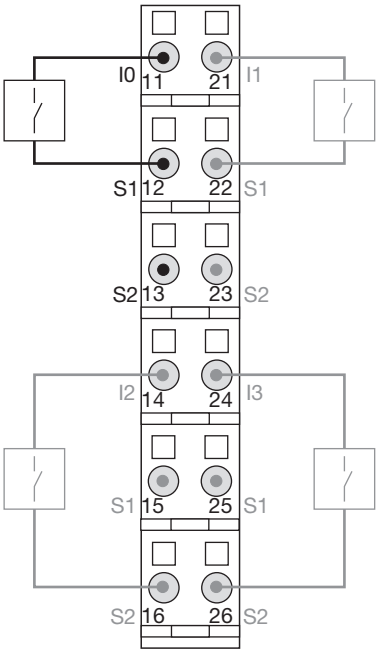
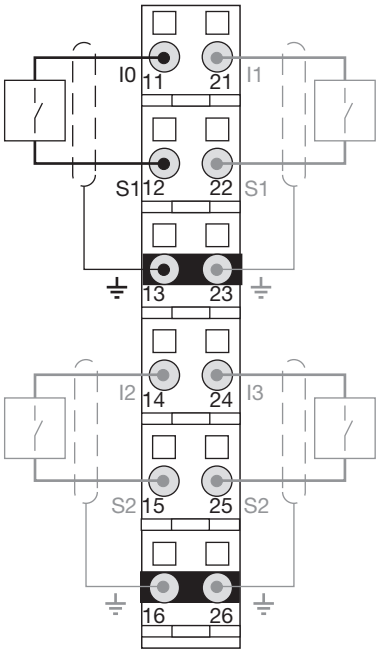
Base module	Terminal configuration	
Screw terminals: PSSu BP 1/12 S PSSu BP 1/12 S-T Cage clamp terminals: PSSu BP 1/12 C PSSu BP 1/12 C-T	Without C-rail: 11: Input I0 21: Input I1 12-22: Supply output S1 (12-22-15-25 linked within the base module) 13-23: Supply output S2 (13-23-16-26 linked within the base module) 14: Input I2 24: Input I3 15-25: Supply output S1 (12-22-15-25 linked within the base module) 16-26: Supply output S2 (13-23-16-26 linked within the base module)	

Digital input/output (standard)
PSSu E S 4DI-D

Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12 S PSSu BP-C1 1/12 S-T Cage clamp terminals: PSSu BP-C1 1/12 C PSSu BP-C1 1/12 C-T	With C-rail: 11: Input I0 21: Input I1 12-22: Supply output S1 (12-22 linked within the base module) 13-23: C-rail supply (13-23-16-26 linked within the base module) 14: Input I2 24: Input I3 15-25: Supply output S2 (15-25 linked within the base module) 16-26: C-rail supply (13-23-16-26 linked within the base module)	

Digital input/output (standard)
PSSu E S 4DI-D

Connecting the module

Input circuit	Without C-rail	With C-rail
Sensors supplied via the supply outputs S1 and S2 with four connection levels Assignment: Supply output S1: I0 + I1 Supply output S2: I2 + I3		
Sensors supplied via the supply outputs S1 and S2 with six connection levels Assignment: Supply output S1: I0 + I1 Supply output S2: I2 + I3		

Digital input/output (standard)
PSSu E S 4DI-D

Technical Details

General	
Approvals	**CE, cULus Listed**
Application range	**Standard**
Module's device code	**0210h**
Number of ST input bits	**4**
Number of ST status bits	**8**
Application in system environment A	
From ST firmware version, other head modules	**17**
From ST firmware version PSSu H S PN	**2**
Application in system environment B	
From ST firmware version, head modules	**1.8.0**
Electrical data	
Internal supply voltage (module supply)	
Module's power consumption	**0,3 W**
Periphery's supply voltage (periphery supply)	
Voltage range	**16,8 - 30 V**
Module's current consumption with no load	**25 mA**
Module's power consumption with no load	**0,6 W**
Max. power dissipation of module	**1,5 W**
Inputs	
Number	**4**
Voltage at inputs	**24 V DC**
Input current at rated voltage	**6 mA**
Input current range	**3 - 10 mA**
Min. threshold voltage when signal changes from "1" to "0"	**8 V**
Max. threshold voltage when signal changes from "0" to "1"	**10 V**
Max. processing time of input when signal changes from "1" to "0"	**4 ms**
Max. processing time of input when signal changes from "0" to "1"	**4 ms**
Min. processing time of input when signal changes from "1" to "0"	**3 ms**
Min. processing time of input when signal changes from "0" to "1"	**3 ms**
Potential isolation between input and internal module bus voltage	**yes**
Semiconductor outputs	
Rated voltage	**24 V DC**

Digital input/output (standard)
PSSu E S 4DI-D

Semiconductor outputs	
Permitted loads	**inductive, capacitive, resistive**
Voltage outputs	
Number of outputs for periphery supply	**2**
Function of outputs for periphery supply	**Sensor supply**
Max. output current at rated voltage	**0,25 A**
Short circuit-proof	**yes**
Potential isolation between output and voltage for the internal module bus	**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 - 60 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**
Climatic suitability	
In accordance with the standard	**EN 60068-2-30, 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 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 55 Hz**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1, EN 61131-2**
Overvoltage category	**II**
Pollution degree	**2**

Digital input/output (standard)
PSSu E S 4DI-D

Environmental data	
Protection type	
In accordance with the standard	**EN 60529**
Housing	**IP20**
Mounting area (e.g. control cabinet)	**IP54**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Coding	**PA**
Dimensions	
Height	**76 mm**
Width	**12,6 mm**
Depth	**60,2 mm**
Weight	**31 g**
Mechanical coding	
Type	**A**
Colour	**Dark grey**

Where standards are undated, the 2008-03 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E S 4DI-D	Electronic module, base type	312 401

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623

Digital input/output (standard)
PSSu E S 4DO 0.5

Overview

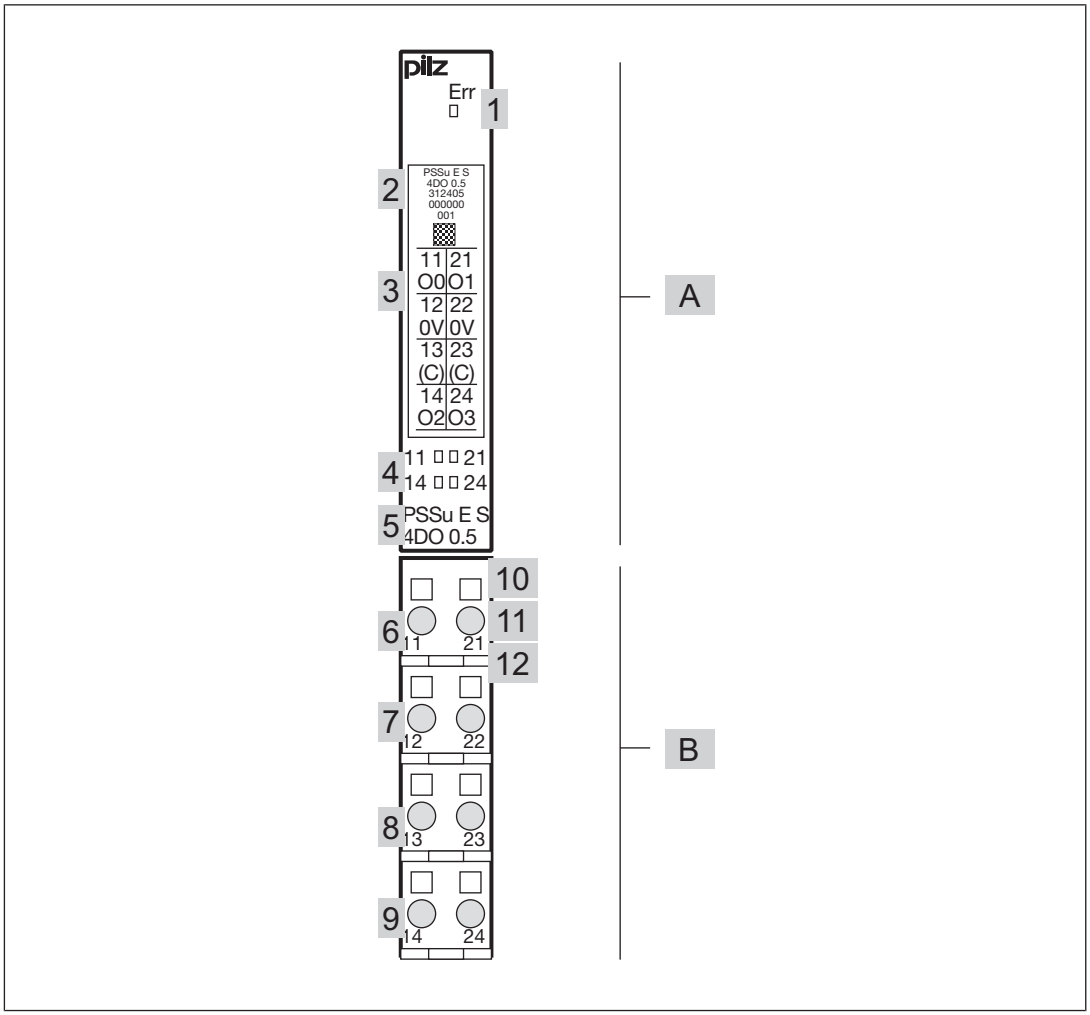
Module features

The product has the following features:

- 4 Digital outputs
  - Semiconductor technology
  - Single-pole
  - Positive-switching
  - Current load capacity per output: 0,50 A
  - Short circuit-proof
  - Overload-proof
- LEDs for:
  - Switch status of each output
  - Module error
- For standard applications in system environment A and B
- T-type:
  PSSu E S 4DO 0.5-T: for increased environmental requirements

Digital input/output (standard)
PSSu E S 4DO 0.5

Front view



Legend:

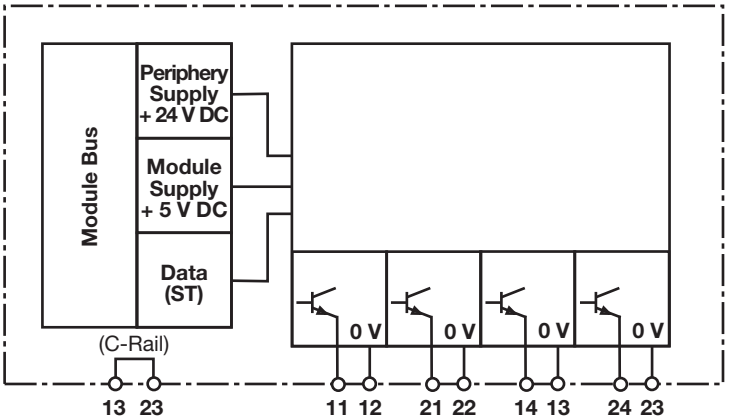
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order Number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module

Digital input/output (standard)
PSSu E S 4DO 0.5

- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Digital input/output (standard)
PSSu E S 4DO 0.5

Module features

Module supply

- The module supply provides the module with voltage.

Signals at the output

- "0" signal (0 V) at the output:
  - Output is high impedance
  - No current to the load
- "1" signal (+24 V) at the output:
  - Output is low impedance
  - Current is supplied to the load

Periphery supply

- The module routes the periphery supply from the module bus to the base module terminals.
- The periphery supply is used to supply the outputs.

Outputs

- The head module sets the output status via the module bus.

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Information on the reaction times of the outputs can be found in the PSSuniversal System Description.

Digital input/output (standard)
PSSu E S 4DO 0.5

Configuration

It is not necessary to configure ST outputs in the PSSuniversal Configurator on the PSS WIN-PRO system software, but ST modules can be selected and displayed.

The ST process image can be optimised by combining adjacent bits of the same type into bytes.

Further information on configuration is available in the PSSuniversal Configurator's online help.

The module occupies 4 consecutive bit addresses in the process image.

Configuration	SafetyBUS p	Standard bus system	
	FS-PIO	ST-PII	ST-PIO
None	- - -	- - -	4 Bit

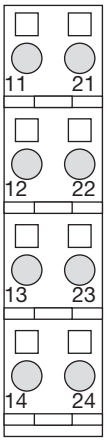
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
O0(11), O1(21), O2(14), O3(24)	ST_O_DO	Data: BOOL	Output data O0 ... O3

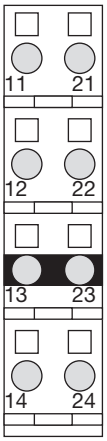
Digital input/output (standard)
PSSu E S 4DO 0.5

Wiring

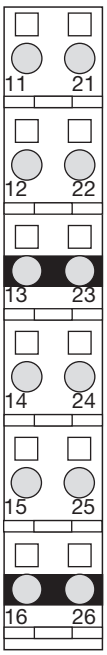
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: 0 V periphery supply (13-23 linked within the base module) 14: Output O2 24: Output O3	

Digital input/output (standard)
PSSu E S 4DO 0.5

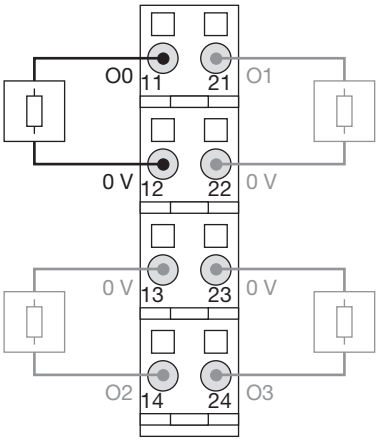
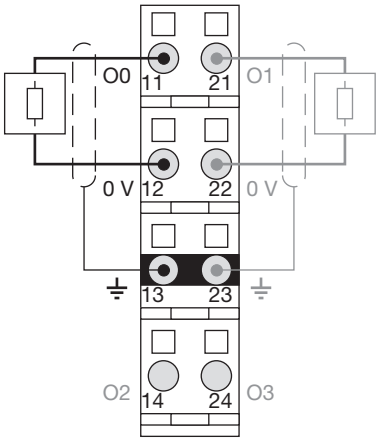
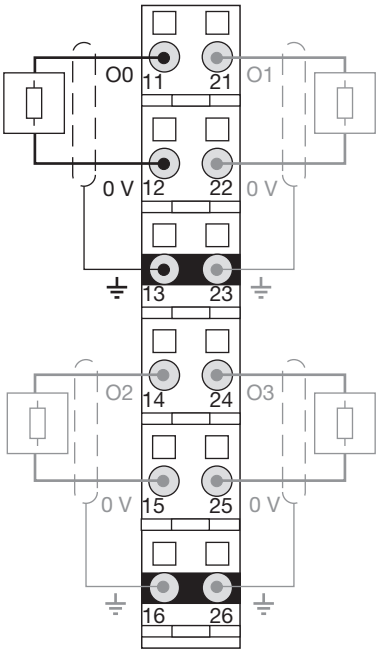
Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: C-rail supply (13-23 linked within the base module) 14: Output O2 24: Output O3	

Digital input/output (standard)
PSSu E S 4DO 0.5

Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12 S PSSu BP-C1 1/12 S-T Cage clamp terminals: PSSu BP-C1 1/12 C PSSu BP-C1 1/12 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: C-rail supply (13-23-16-26 linked within the base module) 14: Output O2 24: Output O3 15-25: 0 V periphery supply (15-25 linked within the base module) 16-26: C-rail supply (13-23-16-26 linked within the base module)	

Digital input/output (standard)
PSSu E S 4DO 0.5

Connecting the module

Output circuit	Without C-rail	With C-rail
Single-channel actuator Base modules with four connection levels		
Single-channel actuator Base modules with six connection levels		

Digital input/output (standard)
PSSu E S 4DO 0.5

Technical details

General	312405	314405
Approvals	**BG, CE, TÜV, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0401h**	**0401h**
Number of ST output bits	**4**	**4**
Application in system environment A		
From ST firmware version, other head modules	**5**	**5**
From ST firmware version PSSu H S PN	**1**	**1**
From ST firmware version PSSu WR S IDN	**1**	**1**
Application in system environment B		
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312405**	**314405**
Internal supply voltage (module supply)		
Module's power consumption	**0,10 W**	**0,10 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**18 mA**	**18 mA**
Module's power consumption with no load	**0,43 W**	**0,43 W**
Max. power dissipation of module	**1,50 W**	**1,50 W**
Terminal voltage when switching off inductive loads	**U2 - 50 V**	**U2 - 50 V**
Permitted loads	**inductive, capacitive, resistive**	**inductive, capacitive, resistive**
Semiconductor outputs	**312405**	**314405**
Number of positive-switching single-pole semiconductor outputs	**4**	**4**
Rated voltage	**24 V DC**	**24 V DC**
Typ. output current at "1" signal and rated voltage of semiconductor output	**0,50 A**	**0,50 A**
Permitted current range	**0,00 - 0,62 A**	**0,00 - 0,62 A**
Residual current at "0" signal	**0,02 mA**	**0,02 mA**
Max. transient pulsed current	**6 A**	**6 A**

Digital input/output (standard)
PSSu E S 4DO 0.5

Semiconductor outputs	312405	314405
Max. internal voltage drop	**60 mV**	**60 mV**
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,500 ms**	**0,500 ms**
Max. processing time of semiconductor output when signal changes from "0" to "1"	**0,010 ms**	**0,010 ms**
Potential isolation from system voltage	**yes**	**yes**
Short circuit-proof	**yes**	**yes**
Environmental data	**312405**	**314405**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**

Digital input/output (standard)
PSSu E S 4DO 0.5

Environmental data	312405	314405
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312405**	**314405**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**34 g**	**33 g**
Mechanical coding		
Type	**B**	**B**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2005-04 latest editions shall apply.

Digital input/output (standard)
PSSu E S 4DO 0.5

Order reference

Product

Product type	Features	Order No.
PSSu E S 4DO 0.5	Electronic module, base type	312 405
PSSu E S 4DO 0.5-T	Electronic module, T-type	314 405

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623
PSSu BP-C1 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 623

Digital input/output (standard)
PSSu E S 4DO 0.5-D

Overview

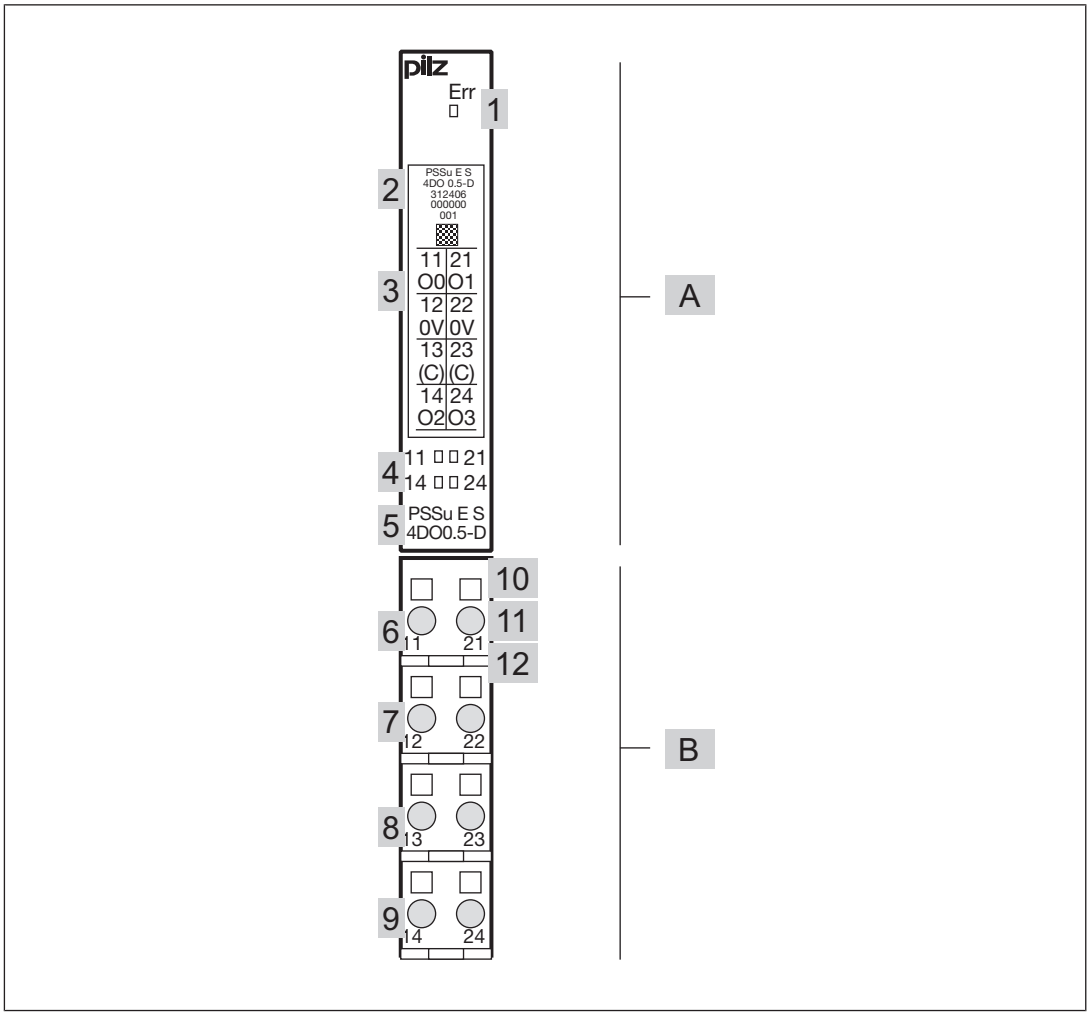
Module features

The product has the following features:

- 4 Digital outputs
  - Semiconductor technology
  - Single-pole
  - Positive-switching
  - Current load capacity per output: 0,50 A
  - Short circuit-proof
  - Overload-proof
- LEDs for:
  - Switch status of each output
  - Module error
- The module provides advanced diagnostic data.
- Optional access to the advanced diagnostic data in the process image (system environment A only)
- For standard applications in system environment A and B
- T-type:
  PSSu E S 4DO 0.5-TD: for increased environmental requirements

Digital input/output (standard)
PSSu E S 4DO 0.5-D

Front view



Legend:

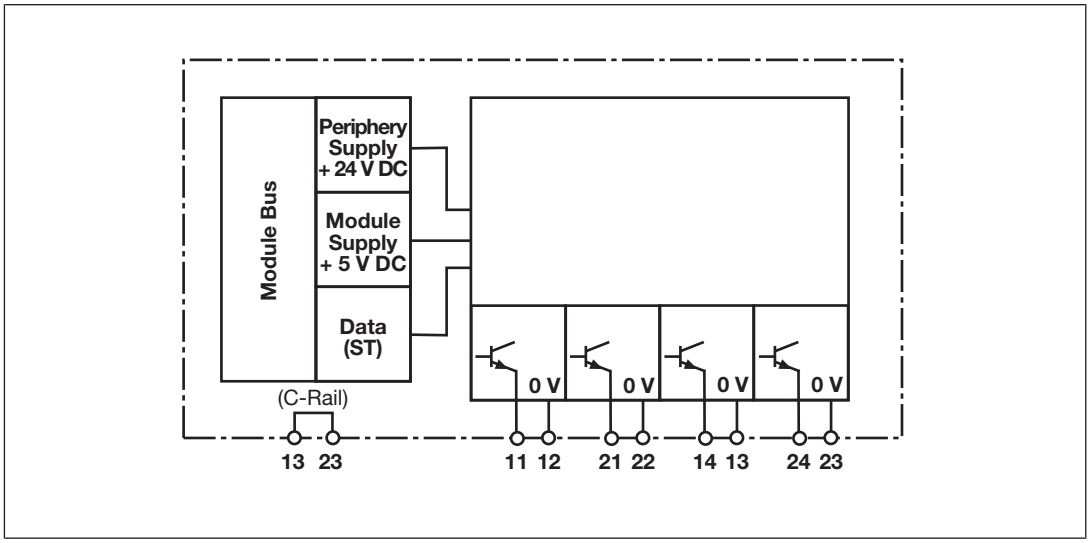
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module

Digital input/output (standard)
PSSu E S 4DO 0.5-D

- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Digital input/output (standard)
PSSu E S 4DO 0.5-D

Module features

Module supply

- The module supply provides the module with voltage.

Signals at the output

- "0" signal (0 V) at the output:
  - Output is high impedance
  - No current to the load
- "1" signal (+24 V) at the output:
  - Output is low impedance
  - Current is supplied to the load

Periphery supply

- The module routes the periphery supply from the module bus to the base module terminals.
- The periphery supply is used to supply the outputs.

Outputs

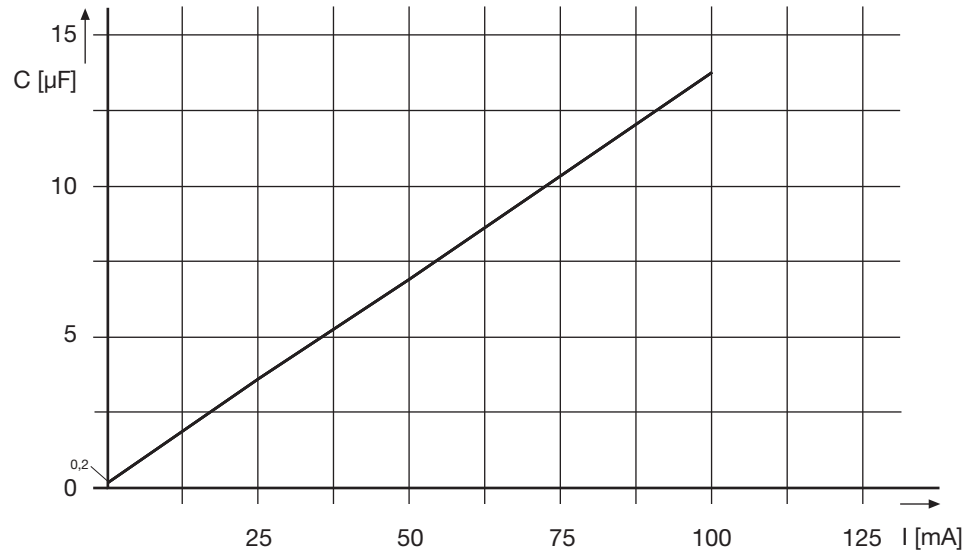
- The head module sets the output status via the module bus.

The module provides advanced diagnostic data, which is also available in a status byte in the ST-PII (not in system environment B):

- Output overload/short circuit
- Excess module temperature

Digital input/output (standard)
PSSu E S 4DO 0.5-D

Permitted capacitive load based on output current



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error
- Output overload
- Temperature error: too warm
- Temperature error: too hot

Information on the reaction times of the outputs can be found in the PSSuniversal System Description.

Configuration

It is not necessary to configure ST outputs in the PSSuniversal Configurator on the PSS WIN-PRO system software. Overload detection and temperature monitoring can be configured: The entries in the status byte can be deactivated.

The ST process image can be optimised by combining adjacent bits of the same type into bytes.

Further information on configuration is available in the PSSuniversal Configurator's online help.

Digital input/output (standard)
PSSu E S 4DO 0.5-D

The module occupies 4 consecutive bit addresses for the outputs in the process image of outputs. If the status byte is activated, it occupies an additional 8 consecutive bit addresses in the process image of inputs.

Configuration	SafetyBUS p	Standard bus system	
	FS-PIO	ST-PII	ST-PIO
Without status byte	- - -	- - -	4 Bit
With status byte ("S")	- - -	8 Bit	4 Bit

The status byte contains the information on overload and overtemperature.

Structure and contents of the status byte:

Bit number	Signal	Meaning
0	0	No overload on output 0
	1	Overload on output 0
1	0	No overload on output 1
	1	Overload on output 1
2 (1)	0	No overload on output 2
	1	Overload on output 2
3 (1)	0	No overload on output 3
	1	Overload on output 3
4	0	No temperature error
	1	Temperature error: too warm
5	0	Switch-off temperature not reached
	1	Temperature error: too hot, outputs switch off
6	0	Reserved
	1	Reserved
7	0	Reserved
	1	Reserved

(1) Only on modules with four outputs

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

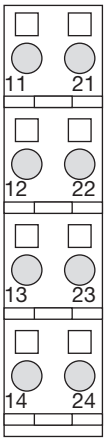
I/O data name	I/O data type	I/O data element	Meaning
O0(11), O1(21), O2(14), O3(24)	ST_O_DO	Data: BOOL	Output data O0 ... O3

The status byte is not available in the process image.

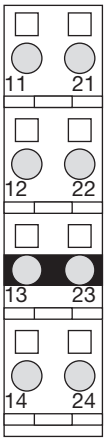
Digital input/output (standard)
PSSu E S 4DO 0.5-D

Wiring

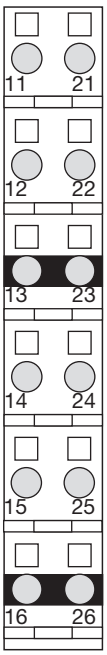
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: 0 V periphery supply (13-23 linked within the base module) 14: Output O2 24: Output O3	

Digital input/output (standard)
PSSu E S 4DO 0.5-D

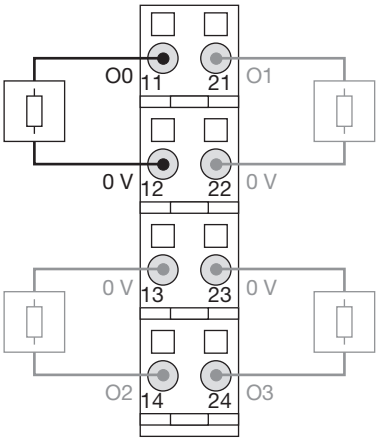
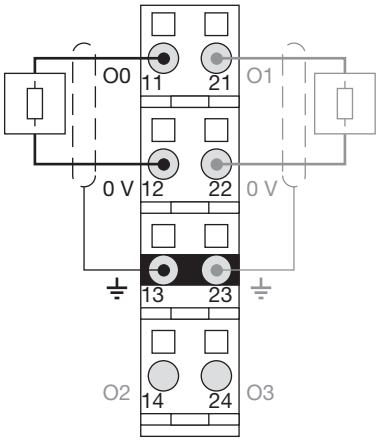
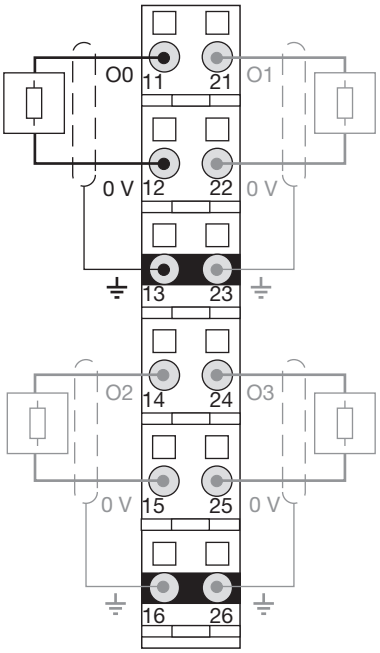
Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: C-rail supply (13-23 linked within the base module) 14: Output O2 24: Output O3	

Digital input/output (standard)
PSSu E S 4DO 0.5-D

Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12 S PSSu BP-C1 1/12 S-T Cage clamp terminals: PSSu BP-C1 1/12 C PSSu BP-C1 1/12 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: C-rail supply (13-23-16-26 linked within the base module) 14: Output O2 24: Output O3 15-25: 0 V periphery supply (15-25 linked within the base module) 16-26: C-rail supply (13-23-16-26 linked within the base module)	

Digital input/output (standard)
PSSu E S 4DO 0.5-D

Connecting the module

Output circuit	Without C-rail	With C-rail
Single-channel actuator Base modules with four connection levels		
Single-channel actuator Base modules with six connection levels		

Digital input/output (standard)
PSSu E S 4DO 0.5-D

Technical details

General	312406	314406
Approvals	**CE, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0411h**	**0411h**
Number of ST output bits	**4**	**4**
Number of ST status bits	**8**	**8**
Application in system environment A		
From ST firmware version, other head modules	**16**	**16**
From ST firmware version PSSu H S PN	**1**	**1**
Application in system environment B		
From ST firmware version, head modules	**1.8.0**	**1.8.0**
Electrical data	**312406**	**314406**
Internal supply voltage (module supply)		
Module's power consumption	**0,25 W**	**0,25 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**30 mA**	**30 mA**
Module's power consumption with no load	**0,72 W**	**0,72 W**
Max. power dissipation of module	**1,50 W**	**1,50 W**
Semiconductor outputs	**312406**	**314406**
Number of positive-switching single-pole semiconductor outputs	**4**	**4**
Rated voltage	**24 V DC**	**24 V DC**
Typ. output current at "1" signal and rated voltage of semiconductor output	**0,50 A**	**0,50 A**
Max. output current with 1 output under load	**2,0 A**	**2,0 A**
Max. output current with 2 outputs under load	**1,5 A**	**1,5 A**
Permitted current range	**0,00 - 0,62 A**	**0,00 - 0,62 A**
Residual current at "0" signal	**0,02 mA**	**0,02 mA**
Max. transient pulsed current	**6 A**	**6 A**

Digital input/output (standard)
PSSu E S 4DO 0.5-D

Semiconductor outputs	312406	314406
Typ. threshold value for overload	**8 A**	**8 A**
Max. internal voltage drop	**60 mV**	**60 mV**
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,500 ms**	**0,500 ms**
Max. processing time of semiconductor output when signal changes from "0" to "1"	**0,010 ms**	**0,010 ms**
Potential isolation from system voltage	**yes**	**yes**
Short circuit-proof	**yes**	**yes**
Permitted loads	**inductive, capacitive, resistive**	**inductive, capacitive, resistive**
Environmental data	**312406**	**314406**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 1000,0 Hz**
Acceleration	**1g**	**5g**

Digital input/output (standard)
PSSu E S 4DO 0.5-D

Environmental data	312406	314406
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**25g**
Duration	**16 ms**	**6 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1, EN 61131-2**	**EN 60664-1, EN 61131-2**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Mechanical data	**312406**	**314406**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**34 g**	**34 g**
Mechanical coding		
Type	**B**	**B**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2008-04 latest editions shall apply.

Digital input/output (standard)
PSSu E S 4DO 0.5-D

Order reference

Product

Product type	Features	Order No.
PSSu E S 4DO 0.5-D	Electronic module, base type	312 406
PSSu E S 4DO 0.5-TD	Electronic module, T-type	314 406

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623
PSSu BP-C1 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 623

Digital input/output (standard)
PSSu E S 2DO 2

Overview

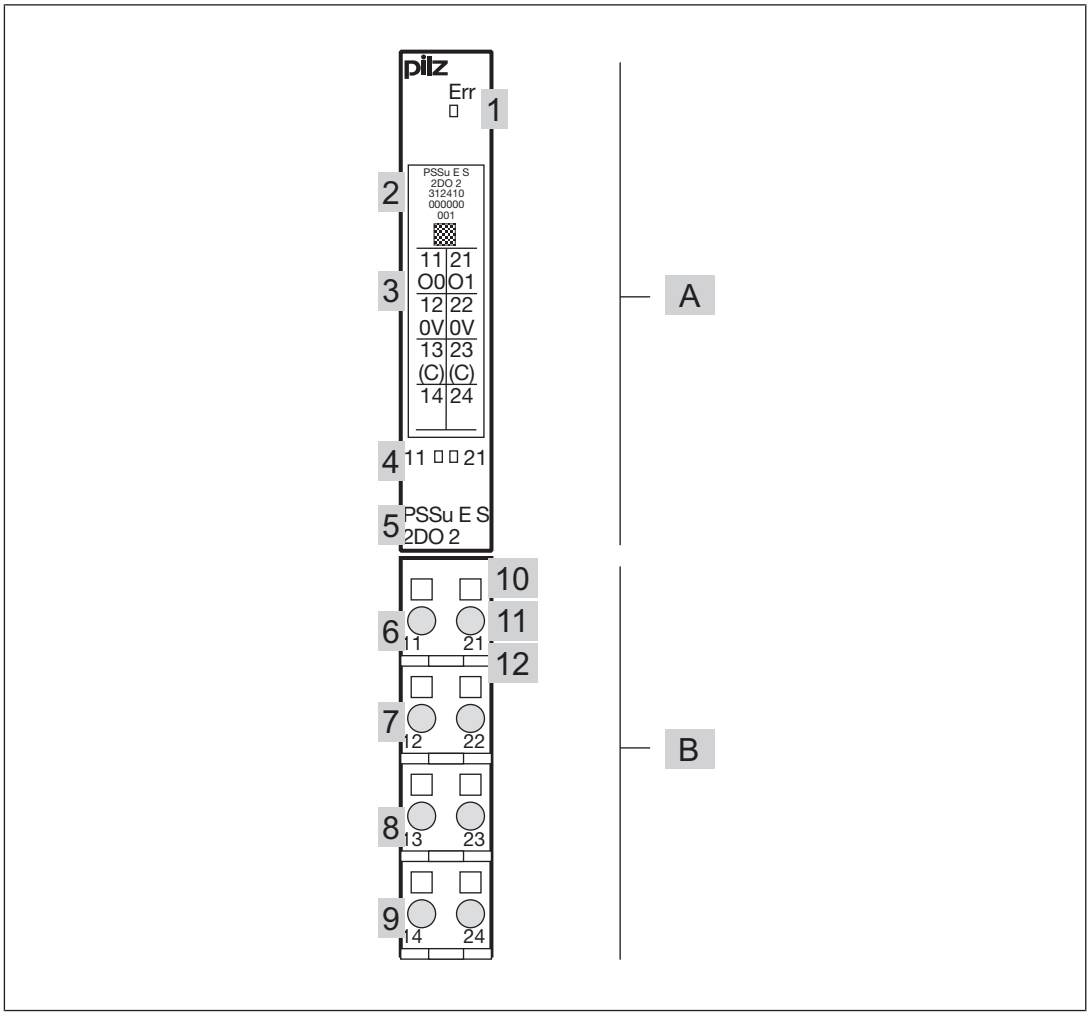
Module features

The product has the following features:

- 2 Digital outputs
  - Semiconductor technology
  - Single-pole
  - Positive-switching
  - Current load capacity per output: 2,00 A
  - Short circuit-proof
  - Overload-proof
- LEDs for:
  - Switch status of each output
  - Module error
- For standard applications in system environment A and B
- T-type:
  PSSu E S 2DO 2-T: for increased environmental requirements

Digital input/output (standard)
PSSu E S 2DO 2

Front view



Legend:

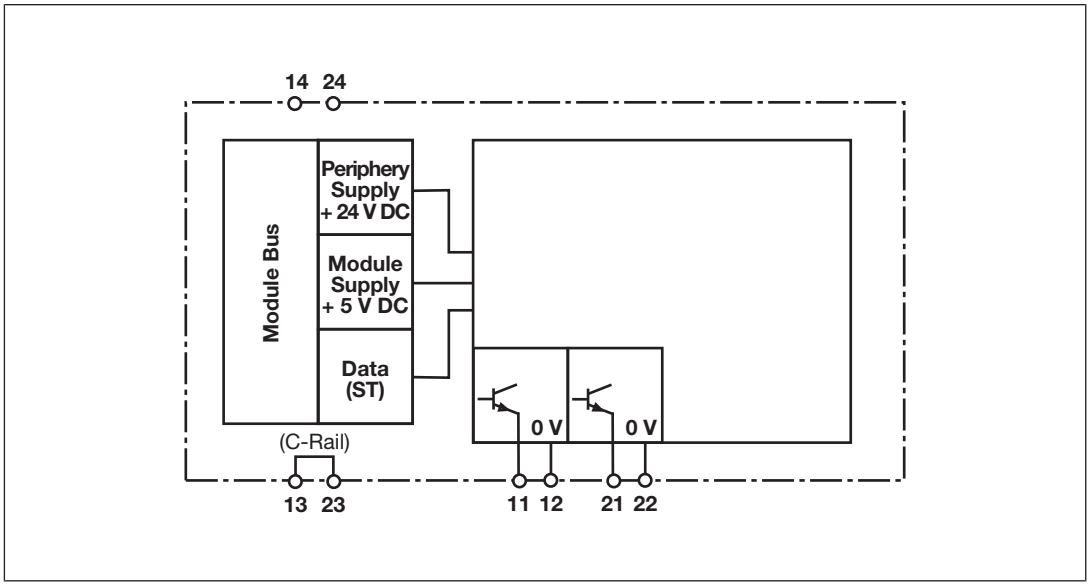
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order Number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module

Digital input/output (standard)
PSSu E S 2DO 2

- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Digital input/output (standard)
PSSu E S 2DO 2

Module features

Module supply

- The module supply provides the module with voltage.

Signals at the output

- "0" signal (0 V) at the output:
  - Output is high impedance
  - No current to the load
- "1" signal (+24 V) at the output:
  - Output is low impedance
  - Current is supplied to the load

Periphery supply

- The module routes the periphery supply from the module bus to the base module terminals.
- The periphery supply is used to supply the outputs.

Outputs

- The head module sets the output status via the module bus.

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Information on the reaction times of the outputs can be found in the PSSuniversal System Description.

Digital input/output (standard)
PSSu E S 2DO 2

Configuration

It is not necessary to configure ST outputs in the PSSuniversal Configurator on the PSS WIN-PRO system software, but ST modules can be selected and displayed.

The ST process image can be optimised by combining adjacent bits of the same type into bytes.

Further information on configuration is available in the PSSuniversal Configurator's online help.

The module occupies 2 consecutive bit addresses in the process image.

Configuration	SafetyBUS p	Standard bus system	
	FS-PIO	ST-PII	ST-PIO
None	- - -	- - -	2 Bit

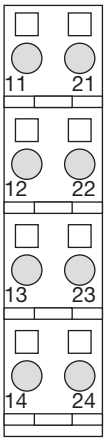
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
O0(11), O1(21)	ST_O_DO	Data: BOOL	Output data O0, O1

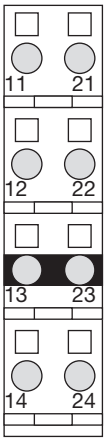
Digital input/output (standard)
PSSu E S 2DO 2

Wiring

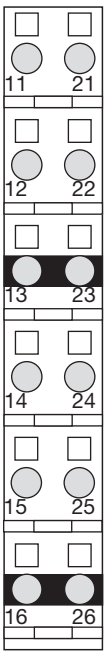
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: 0 V periphery supply (13-23 linked within the base module) 14: Not connected 24: Not connected	

Digital input/output (standard)
PSSu E S 2DO 2

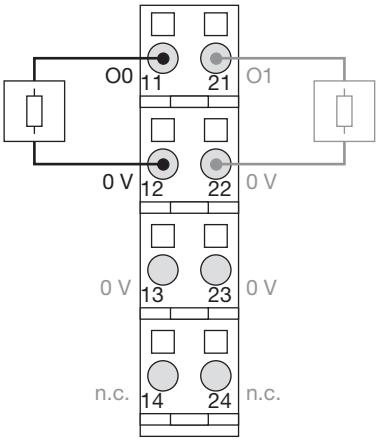
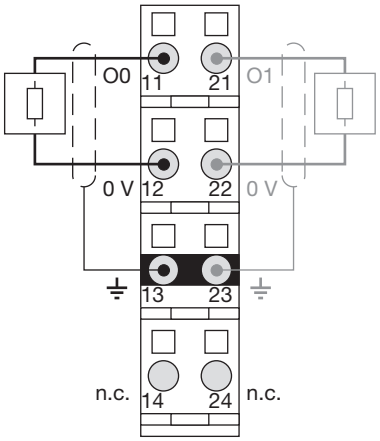
Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: C-rail supply (13-23 linked within the base module) 14: Not connected 24: Not connected	

Digital input/output (standard)
PSSu E S 2DO 2

Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12 S PSSu BP-C1 1/12 S-T Cage clamp terminals: PSSu BP-C1 1/12 C PSSu BP-C1 1/12 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: C-rail supply (13-23-16-26 linked within the base module) 14: Not connected 24: Not connected 15-25: 0 V periphery supply (15-25 linked within the base module) 16-26: C-rail supply (13-23-16-26 linked within the base module)	

Digital input/output (standard)
PSSu E S 2DO 2

Connecting the module

Output circuit	Without C-rail	With C-rail
Single-channel actuator		

Technical details

General	312410	314410
Approvals	**BG, CE, TÜV, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0400h**	**0400h**
Number of ST output bits	**2**	**2**
Application in system environment A		
From ST firmware version, other head modules	**5**	**5**
From ST firmware version PSSu H S PN	**1**	**1**
From ST firmware version PSSu WR S IDN	**1**	**1**
Application in system environment B		
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312410**	**314410**
Internal supply voltage (module supply)		
Module's power consumption	**0,09 W**	**0,09 W**

Digital input/output (standard)
PSSu E S 2DO 2

Electrical data	312410	314410
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**10 mA**	**10 mA**
Module's power consumption with no load	**0,24 W**	**0,24 W**
Max. power dissipation of module	**1,50 W**	**1,50 W**
Terminal voltage when switching off inductive loads	**U2 - 50 V**	**U2 - 50 V**
Permitted loads	**inductive, capacitive, resistive**	**inductive, capacitive, resistive**
Semiconductor outputs	**312410**	**314410**
Number of positive-switching single-pole semiconductor outputs	**2**	**2**
Rated voltage	**24 V DC**	**24 V DC**
Typ. output current at "1" signal and rated voltage of semiconductor output	**2,00 A**	**2,00 A**
Permitted current range	**0,00 - 2,50 A**	**0,00 - 2,50 A**
Residual current at "0" signal	**0,01 mA**	**0,01 mA**
Max. transient pulsed current	**12 A**	**12 A**
Max. internal voltage drop	**140 mV**	**140 mV**
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,600 ms**	**0,600 ms**
Max. processing time of semiconductor output when signal changes from "0" to "1"	**0,010 ms**	**0,010 ms**
Potential isolation from system voltage	**yes**	**yes**
Short circuit-proof	**yes**	**yes**
Environmental data	**312410**	**314410**
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	**-25 - 70 °C**	**-40 - 70 °C**

Digital input/output (standard)
PSSu E S 2DO 2

Environmental data	312410	314410
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**

Digital input/output (standard)
PSSu E S 2DO 2

Mechanical data	312410	314410
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**33 g**	**32 g**
Mechanical coding		
Type	**C**	**C**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2005-04 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E S 2DO 2	Electronic module, base type	312 410
PSSu E S 2DO 2-T	Electronic module, T-type	314 410

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618

Digital input/output (standard)
PSSu E S 2DO 2

Product type	Features	Order No.
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623
PSSu BP-C1 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 623

Digital input/output (standard)
PSSu E S 2DO 2-D

Overview

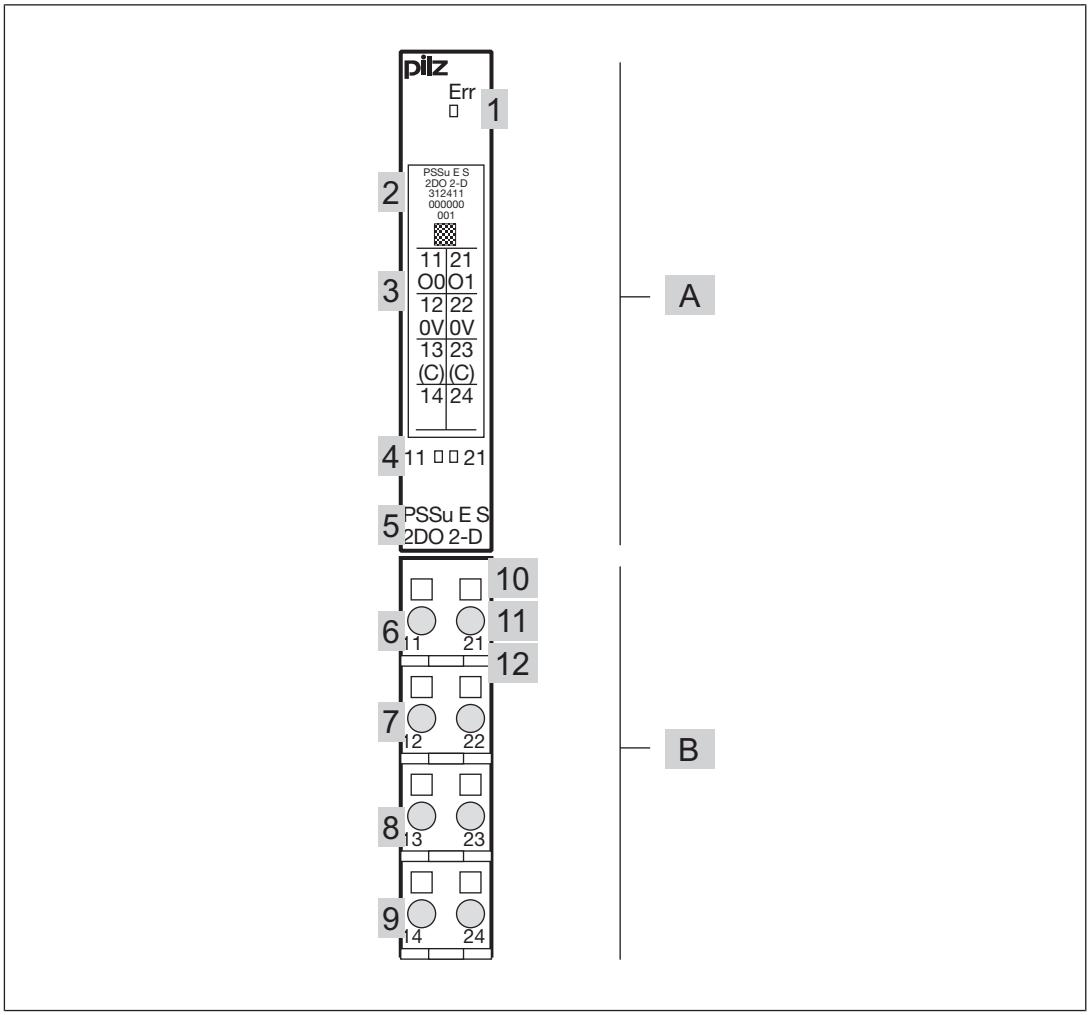
Module features

The product has the following features:

- 2 Digital outputs
  - Semiconductor technology
  - Single-pole
  - Positive-switching
  - Current load capacity per output: 2,00 A
  - Short circuit-proof
  - Overload-proof
- LEDs for:
  - Switch status of each output
  - Module error
- The module provides advanced diagnostic data.
- Optional access to the advanced diagnostic data in the process image (system environment A only)
- For standard applications in system environment A and B
- T-type:
  PSSu E S 2DO 2-TD: for increased environmental requirements

Digital input/output (standard)
PSSu E S 2DO 2-D

Front view



Legend:

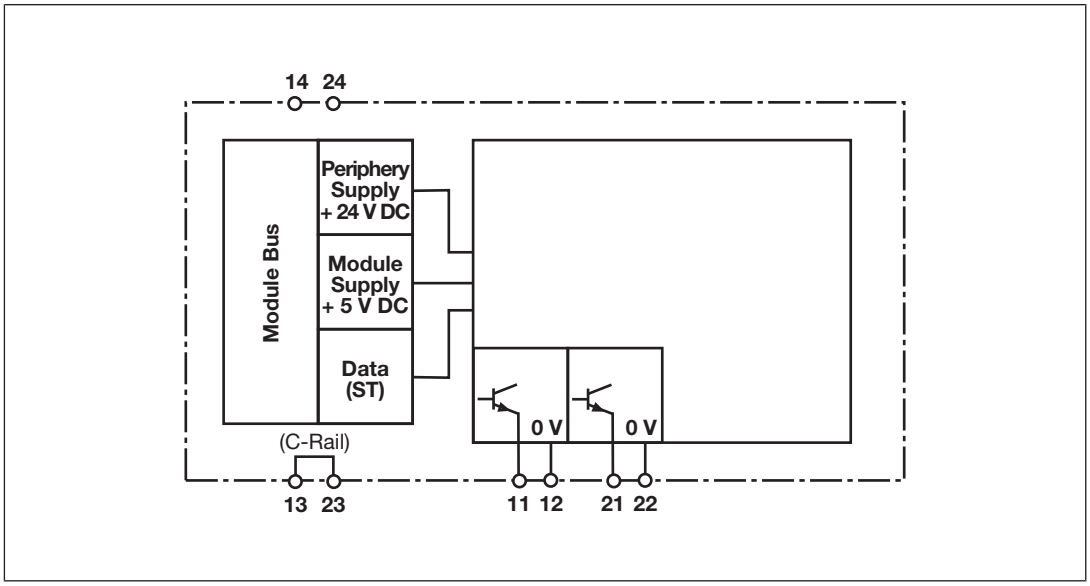
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module

Digital input/output (standard)
PSSu E S 2DO 2-D

- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Digital input/output (standard)
PSSu E S 2DO 2-D

Module features

Module supply

- The module supply provides the module with voltage.

Signals at the output

- "0" signal (0 V) at the output:
  - Output is high impedance
  - No current to the load
- "1" signal (+24 V) at the output:
  - Output is low impedance
  - Current is supplied to the load

Periphery supply

- The module routes the periphery supply from the module bus to the base module terminals.
- The periphery supply is used to supply the outputs.

Outputs

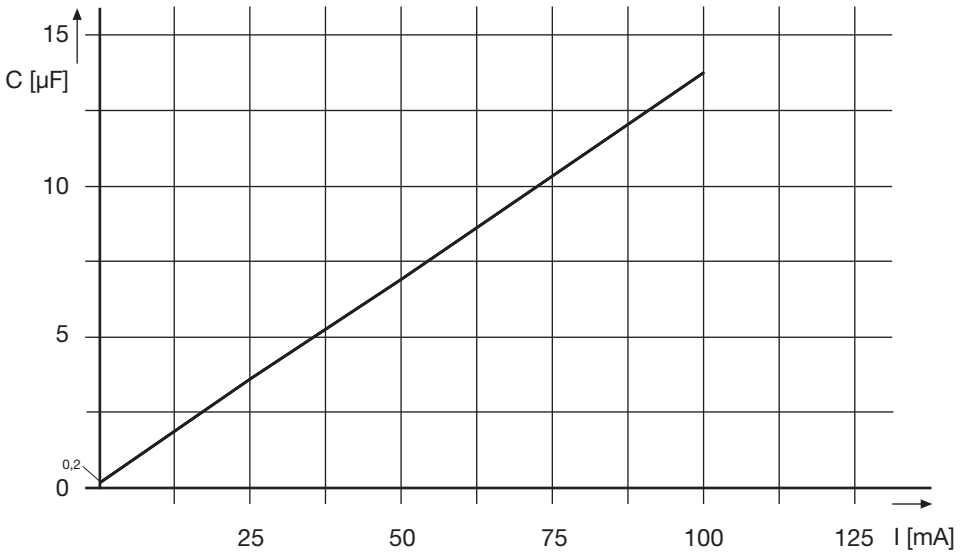
- The head module sets the output status via the module bus.

The module provides advanced diagnostic data, which is also available in a status byte in the ST-PII (not in system environment B):

- Output overload/short circuit
- Excess module temperature

Digital input/output (standard)
PSSu E S 2DO 2-D

Permitted capacitive load based on output current



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error
- Output overload
- Temperature error: too warm
- Temperature error: too hot

Information on the reaction times of the outputs can be found in the PSSuniversal System Description.

Configuration

It is not necessary to configure ST outputs in the PSSuniversal Configurator on the PSS WIN-PRO system software. Overload detection and temperature monitoring can be configured: The entries in the status byte can be deactivated.

The ST process image can be optimised by combining adjacent bits of the same type into bytes.

Further information on configuration is available in the PSSuniversal Configurator's online help.

Digital input/output (standard)
PSSu E S 2DO 2-D

The module occupies 2 consecutive bit addresses for the outputs in the process image of outputs. If the status byte is activated, it occupies an additional 8 consecutive bit addresses in the process image of inputs.

Configuration	SafetyBUS p	Standard bus system	
	FS-PIO	ST-PII	ST-PIO
Without status byte	- - -	- - -	2 Bit
With status byte ("S")	- - -	8 Bit	2 Bit

The status byte contains the information on overload and overtemperature.

Structure and contents of the status byte:

Bit number	Signal	Meaning
0	0	No overload on output 0
	1	Overload on output 0
1	0	No overload on output 1
	1	Overload on output 1
2 (1)	0	No overload on output 2
	1	Overload on output 2
3 (1)	0	No overload on output 3
	1	Overload on output 3
4	0	No temperature error
	1	Temperature error: too warm
5	0	Switch-off temperature not reached
	1	Temperature error: too hot, outputs switch off
6	0	Reserved
	1	Reserved
7	0	Reserved
	1	Reserved

(1) Only on modules with four outputs

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

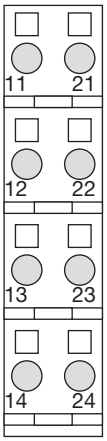
I/O data name	I/O data type	I/O data element	Meaning
O0(11), O1(21)	ST_O_DO	Data: BOOL	Output data O0, O1

The status byte is not available in the process image.

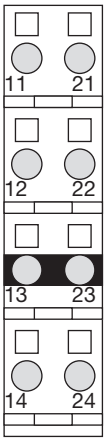
Digital input/output (standard)
PSSu E S 2DO 2-D

Wiring

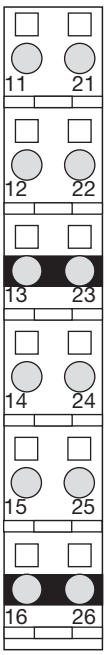
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: 0 V periphery supply (13-23 linked within the base module) 14: Not connected 24: Not connected	

Digital input/output (standard)
PSSu E S 2DO 2-D

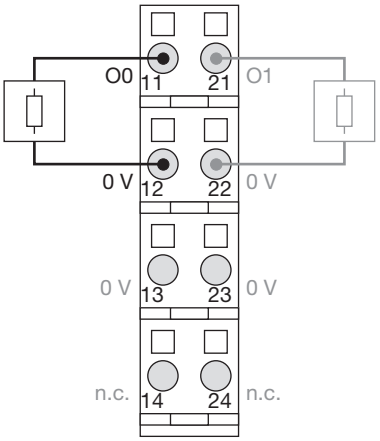
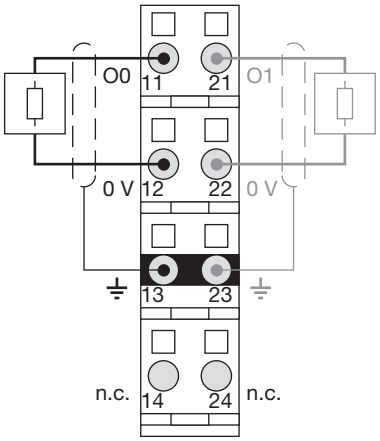
Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: C-rail supply (13-23 linked within the base module) 14: Not connected 24: Not connected	

Digital input/output (standard)
PSSu E S 2DO 2-D

Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12 S PSSu BP-C1 1/12 S-T Cage clamp terminals: PSSu BP-C1 1/12 C PSSu BP-C1 1/12 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: C-rail supply (13-23-16-26 linked within the base module) 14: Not connected 24: Not connected 15-25: 0 V periphery supply (15-25 linked within the base module) 16-26: C-rail supply (13-23-16-26 linked within the base module)	

Digital input/output (standard)
PSSu E S 2DO 2-D

Connecting the module

Output circuit	Without C-rail	With C-rail
Single-channel actuator		

Technical details

General	312411	314411
Approvals	**CE, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0410h**	**0410h**
Number of ST output bits	**2**	**2**
Number of ST status bits	**8**	**8**
Application in system environment A		
From ST firmware version, other head modules	**16**	**16**
From ST firmware version PSSu H S PN	**1**	**1**
Application in system environment B		
From ST firmware version, head modules	**1.8.0**	**1.8.0**
Electrical data	**312411**	**314411**
Internal supply voltage (module supply)		
Module's power consumption	**0,20 W**	**0,20 W**

Digital input/output (standard)
PSSu E S 2DO 2-D

Electrical data	312411	314411
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**20 mA**	**20 mA**
Module's power consumption with no load	**0,48 W**	**0,48 W**
Max. power dissipation of module	**1,50 W**	**1,50 W**
Semiconductor outputs	**312411**	**314411**
Number of positive-switching single-pole semiconductor outputs	**2**	**2**
Rated voltage	**24 V DC**	**24 V DC**
Typ. output current at "1" signal and rated voltage of semiconductor output	**2,00 A**	**2,00 A**
Max. output current with 1 output under load	**3,5 A**	**3,5 A**
Permitted current range	**0,00 - 2,50 A**	**0,00 - 2,50 A**
Residual current at "0" signal	**0,01 mA**	**0,01 mA**
Max. transient pulsed current	**12 A**	**12 A**
Typ. threshold value for overload	**13 A**	**13 A**
Max. internal voltage drop	**140 mV**	**140 mV**
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,600 ms**	**0,600 ms**
Max. processing time of semiconductor output when signal changes from "0" to "1"	**0,010 ms**	**0,010 ms**
Potential isolation from system voltage	**yes**	**yes**
Short circuit-proof	**yes**	**yes**
Permitted loads	**inductive, capacitive, resistive**	**inductive, capacitive, resistive**
Environmental data	**312411**	**314411**
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	**-25 - 70 °C**	**-40 - 70 °C**

Digital input/output (standard)
PSSu E S 2DO 2-D

Environmental data	312411	314411
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 1000,0 Hz**
Acceleration	**1g**	**5g**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**25g**
Duration	**16 ms**	**6 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1, EN 61131-2**	**EN 60664-1, EN 61131-2**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Mechanical data	**312411**	**314411**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**33 g**	**33 g**

Digital input/output (standard)
PSSu E S 2DO 2-D

Mechanical data	312411	314411
Mechanical coding		
Type	**C**	**C**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2008-04 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E S 2DO 2-D	Electronic module, base type	312 411
PSSu E S 2DO 2-TD	Electronic module, T-type	314 411

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623
PSSu BP-C1 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 623

Digital input/output (standard)
PSSu E S 2DOR 2

Overview

Module features

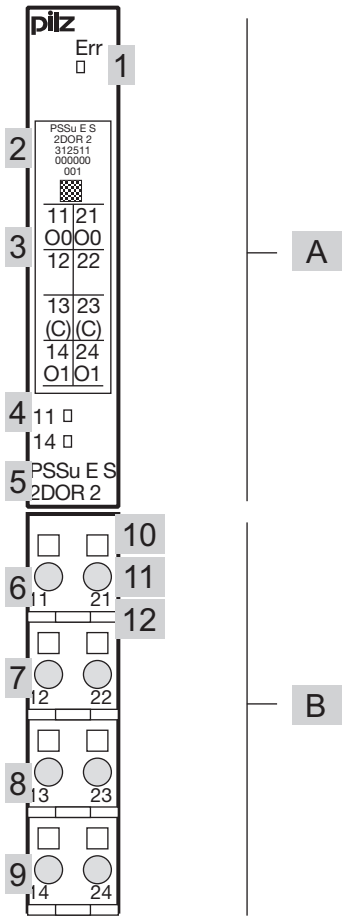
The product has the following features:

- Relay contacts
  - Normally open contact
  - Volt-free
  - Current load capacity per output: 2 A
- LEDs for:
  - Switch status of each output
  - Module error
- For standard applications in system environment A and B
- T-type:

  PSSu E S 2DOR 2-T: for increased environmental requirements

Digital input/output (standard)
PSSu E S 2DOR 2

Front view



Legend:

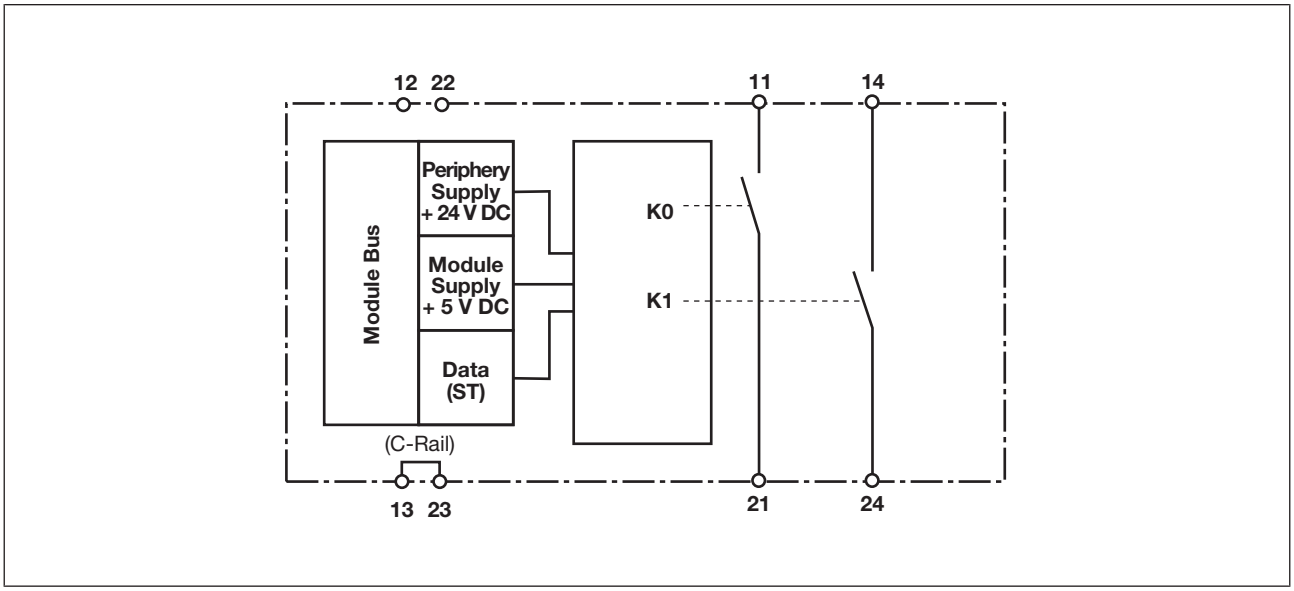
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order Number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module

Digital input/output (standard)
PSSu E S 2DOR 2

- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Digital input/output (standard)
PSSu E S 2DOR 2

Module features

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module has the following protection mechanisms:

- Protective separation between both relay contacts (see Technical details)
- Protective separation between both relay contacts and the periphery supply as well as the module supply, in accordance with DIN VDE 0110 overvoltage category 2 in a protected industrial network
- Temperature monitoring

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error
- Temperature error: too warm
- Temperature error: too hot

Module supply

- The module supply provides the module with voltage.

Outputs

- The head module sets the output status via the module bus.

Information on the reaction times of the outputs can be found in the PSSuniversal System Description.

Configuration

It is not necessary to configure ST outputs in the PSSuniversal Configurator on the PSS WIN-PRO system software, but ST modules can be selected and displayed.

The ST process image can be optimised by combining adjacent bits of the same type into bytes.

Further information on configuration is available in the PSSuniversal Configurator's online help.

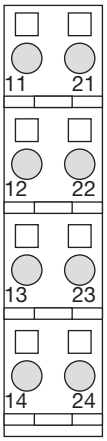
The module occupies 2 consecutive bit addresses in the process image.

Configuration	SafetyBUS p	Standard bus system	
	FS-PIO	ST-PII	ST-PIO
None	- - -	- - -	2 Bit

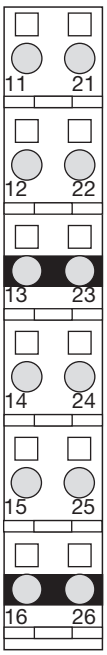
Digital input/output (standard)
PSSu E S 2DOR 2

Wiring

Terminal configuration

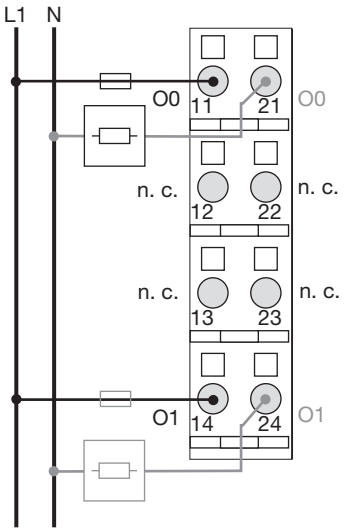
Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Output O0 Relay contact 1 21: Output O0 Relay contact 1 12-22: Not connected 13-23: Not connected (13-23 linked within the base module) 14: Output O1 Relay contact 2 24: Output O1 Relay contact 2	

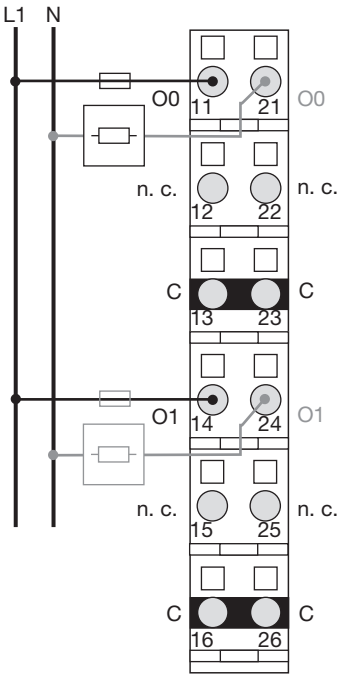
Digital input/output (standard)
PSSu E S 2DOR 2

Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12 S PSSu BP-C1 1/12 S-T Cage clamp terminals: PSSu BP-C1 1/12 C PSSu BP-C1 1/12 C-T	With C-rail: 11: Output O0 Relay contact 1 21: Output O0 Relay contact 1 12-22: Not connected 13-23: C-rail supply (13-23-16-26 linked within the base module) 14: Output O1 Relay contact 2 24: Output O1 Relay contact 2 15-25: Not connected 16-26: C-rail supply (13-23-16-26 linked within the base module)	

Digital input/output (standard)
PSSu E S 2DOR 2

Connecting the module

Output circuit	Without C-rail
Resistive load Switches 230 VAC	

Output circuit	With C-rail
Resistive load Switches 230 VAC	

Digital input/output (standard)
PSSu E S 2DOR 2

Technical details

General	312511	314511
Approvals	**CE, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0404h**	**0404h**
Number of ST output bits	**2**	**2**
Application in system environment A		
From ST firmware version, other head modules	**16**	**16**
From ST firmware version PSSu H S PN	**2**	**2**
From ST firmware version PSSu WR S IDN	**9**	**9**
Application in system environment B		
From ST firmware version, head modules	**1.7.0**	**1.7.0**
Electrical data	**312511**	**314511**
Internal supply voltage (module supply)		
Module's power consumption	**0,09 W**	**0,09 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30 V**	**16,8 - 30 V**
Module's current consumption with no load	**42 mA**	**42 mA**
Module's power consumption with no load	**1 W**	**1 W**
Max. power dissipation of module	**1,5 W**	**1,5 W**
Permitted loads	**inductive, resistive**	**inductive, resistive**
Relay outputs	**312511**	**314511**
Number of relay outputs	**2**	**2**

Digital input/output (standard)
PSSu E S 2DOR 2

Relay outputs	312511	314511
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Relay contacts, AC1 at	**250 V**	**250 V**
Min. current	**15 mA**	**15 mA**
Max. current	**2 A**	**2 A**
Max. power	**480 VA**	**480 VA**
Relay contacts, DC1 at	**24 V**	**24 V**
Min. current	**15 mA**	**15 mA**
Max. current	**2 A**	**2 A**
Max. power	**48 W**	**48 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Relay contacts AC15 at	**230 V**	**230 V**
Max. current	**1,5 A**	**1,5 A**
Relay contacts, DC13 (6 cycles/ min) at	**24 V**	**24 V**
Max. current	**1,5 A**	**1,5 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**2 A**	**2 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**2 A**	**2 A**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Max. processing time for relay output tProcOM when signal changes from "1" to "0"	**20 ms**	**20 ms**
Max. processing time for relay output tProcOM when signal changes from "0" to "1"	**15 ms**	**15 ms**
Contact material	**AgSnO2**	**AgSnO2**
Potential isolation between relay contact and module supply	**4900 V (prot. separation)**	**4900 V (prot. separation)**
Potential isolation between relay contact and periphery supply	**4900 V (prot. separation)**	**4900 V (prot. separation)**
Potential isolation between relay contact and C-rail	**3050 V (basic insulation)**	**3050 V (basic insulation)**
Potential isolation between relay contact 1 and relay contact 2	**4900 V (prot. separation)**	**4900 V (prot. separation)**

Digital input/output (standard)
PSSu E S 2DOR 2

Environmental data	312511	314511
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**
Max. temperature in accordance with UL	**60 °C**	**60 °C**
Storage temperature		
In accordance with the standard	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 150 Hz**	**10 - 1000 Hz**
Acceleration	**1g**	**5g**
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1, EN 61131-2**	**EN 60664-1, EN 61131-2**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**

Digital input/output (standard)
PSSu E S 2DOR 2

Environmental data	312511	314511
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312511**	**314511**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76 mm**	**76 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**42 g**	**44 g**
Mechanical coding		
Type	**I**	**I**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2008-07 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E S 2DOR 2	Electronic module, base type	312 511
PSSu E S 2DOR 2-T	Electronic module, T-type	314 511

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601

Digital input/output (standard)
PSSu E S 2DOR 2

Product type	Features	Order No.
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623
PSSu BP-C1 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 623

Digital input/output (standard)
PSSu E S 2DOR 10

Overview

Module features

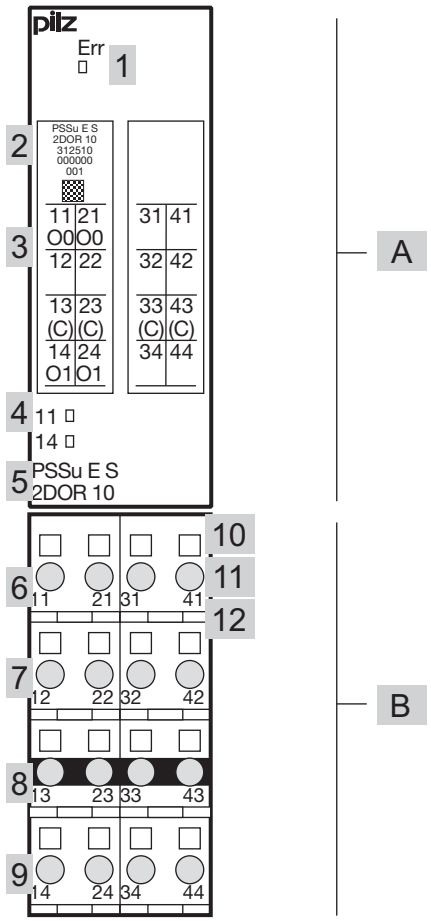
The product has the following features:

- Relay contacts
  - Normally open contact
  - Volt-free
  - Current load capacity per output: 10 A
- LEDs for:
  - Switch status of each output
  - Module error
- For standard applications in system environment A and B
- T-type:

  PSSu E S 2DOR 10-T: for increased environmental requirements

Digital input/output (standard)
PSSu E S 2DOR 10

Front view



Legend:

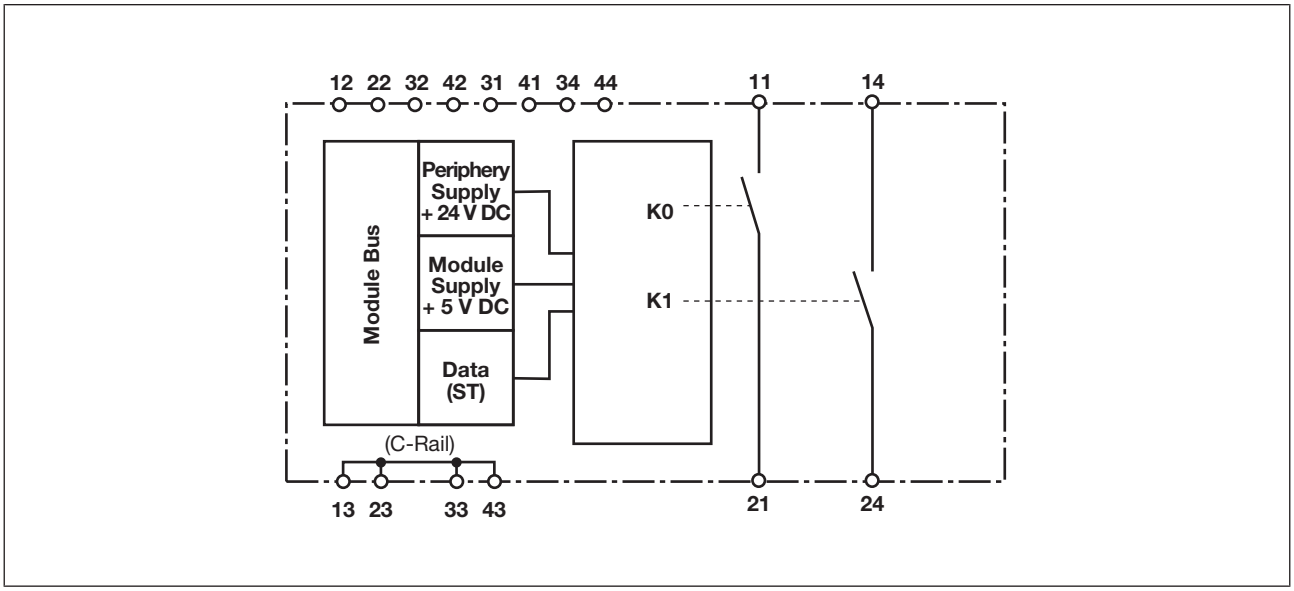
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order Number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module

Digital input/output (standard)
PSSu E S 2DOR 10

- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Digital input/output (standard)
PSSu E S 2DOR 10

Module features

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module has the following protection mechanisms:

- Protective separation between both relay contacts (see Technical details)
- Protective separation between both relay contacts and the periphery supply as well as the module supply, in accordance with DIN VDE 0110 overvoltage category 2 in a protected industrial network
- Temperature monitoring

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error
- Temperature error: too warm
- Temperature error: too hot

Module supply

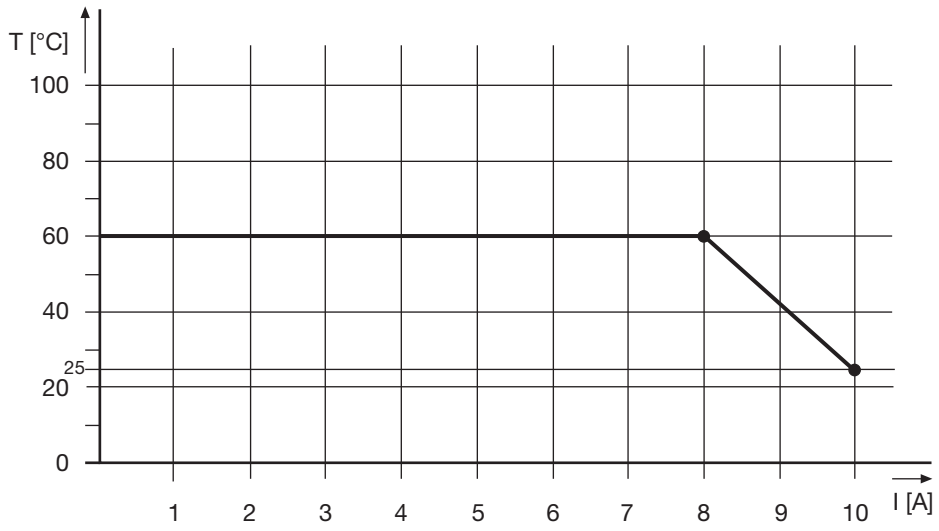
- The module supply provides the module with voltage.

Outputs

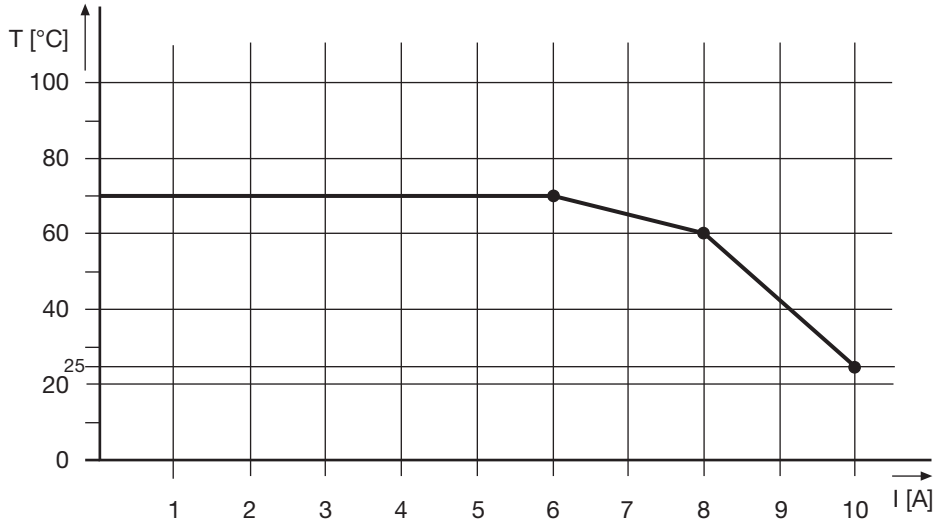
- The head module sets the output status via the module bus.
- The relationship between the load current and the operating temperature is illustrated in the following derating diagram. The operating point should be below the characteristic curve.

Digital input/output (standard)
PSSu E S 2DOR 10

PSSu E S 2DOR 10: Derating diagram for the permitted ambient temperature T dependent on load current I



PSSu E S 2DOR 10-T: Derating diagram for the permitted ambient temperature T dependent on load current I



Information on the reaction times of the outputs can be found in the PSSuniversal System Description.

Digital input/output (standard)
PSSu E S 2DOR 10

Configuration

It is not necessary to configure ST outputs in the PSSuniversal Configurator on the PSS WIN-PRO system software, but ST modules can be selected and displayed.

The ST process image can be optimised by combining adjacent bits of the same type into bytes.

Further information on configuration is available in the PSSuniversal Configurator's online help.

The module occupies 2 consecutive bit addresses in the process image.

Configuration	SafetyBUS p	Standard bus system	
	FS-PIO	ST-PII	ST-PIO
None	- - -	- - -	2 Bit

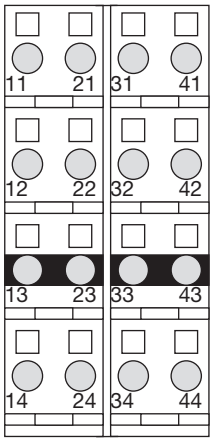
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
O0(11,21)	ST_O_DO	Data: BOOL	Output data O0
O1(14,24)	ST_O_DO	Data: BOOL	Output data O1

Digital input/output (standard)
PSSu E S 2DOR 10

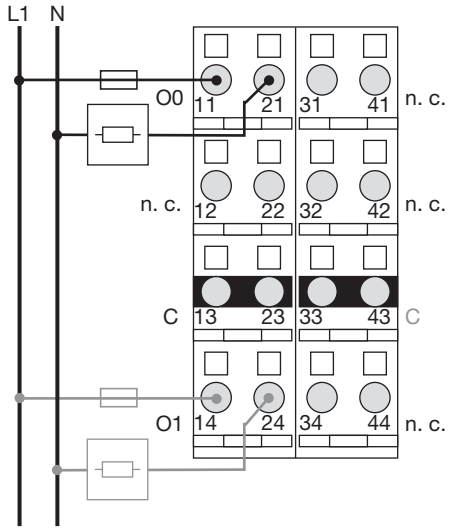
Wiring

Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 2/16 S PSSu BP-C 2/16 S-T Cage clamp terminals: PSSu BP-C 2/16 C PSSu BP-C 2/16 C-T	With C-rail: 11: Output O0 Relay contact 1 21: Output O0 Relay contact 1 12-22: Not connected 13-23: C-rail supply (13-23-33-43 linked within the base module) 14: Output O1 Relay contact 2 24: Output O1 Relay contact 2 31–41, 32–42: Not connected 33-43: C-rail supply 34-44: Not connected	

Digital input/output (standard)
PSSu E S 2DOR 10

Connecting the module

Output circuit	With C-rail
Resistive load Switches 230 VAC	

Technical details

General	312510	314510
Approvals	**BG, CE, TÜV, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0403h**	**0403h**
Number of ST output bits	**2**	**2**
Application in system environment A		
From ST firmware version, other head modules	**16**	**16**
From ST firmware version PSSu H S PN	**2**	**2**
From ST firmware version PSSu WR S IDN	**9**	**9**
Application in system environment B		
From ST firmware version, head modules	**1.7.0**	**1.7.0**
Electrical data	**312510**	**314510**
Internal supply voltage (module supply)		
Module's power consumption	**0,09 W**	**0,09 W**

Digital input/output (standard)
PSSu E S 2DOR 10

Electrical data	312510	314510
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30 V**	**16,8 - 30 V**
Module's current consumption with no load	**60 mA**	**60 mA**
Module's power consumption with no load	**1,5 W**	**1,5 W**
Max. power dissipation of module	**2,5 W**	**2,5 W**
Permitted loads	**inductive, resistive**	**inductive, resistive**
Relay outputs	**312510**	**314510**
Number of relay outputs	**2**	**2**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Relay contacts, AC1 at	**250 V**	**250 V**
Min. current	**10 mA**	**10 mA**
Max. current	**10 A**	**10 A**
Max. power	**2400 VA**	**2400 VA**
Relay contacts, DC1 at	**24 V**	**24 V**
Min. current	**10 mA**	**10 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**
Relay contacts AC15 at	**240 V**	**240 V**
Max. current	**6 A**	**6 A**
Relay contacts, DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**2 A**	**2 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**4 A**	**4 A**
Voltage	**24 V DC G. P. Resistive**	**24 V DC G. P. Resistive**
With current	**4 A**	**4 A**
Pilot Duty	**3,0 A**	**3,0 A**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Max. processing time for relay output tProcOM when signal changes from "1" to "0"	**25 ms**	**25 ms**

Digital input/output (standard)
PSSu E S 2DOR 10

Relay outputs	312510	314510
Max. processing time for relay output tProcOM when signal changes from "0" to "1"	**15 ms**	**15 ms**
Contact material	**AgCuNi**	**AgCuNi**
Potential isolation between relay contact and module supply	**4900 V (prot. separation)**	**4900 V (prot. separation)**
Potential isolation between relay contact and periphery supply	**4900 V (prot. separation)**	**4900 V (prot. separation)**
Potential isolation between relay contact and C-rail	**3050 V (basic insulation)**	**3050 V (basic insulation)**
Potential isolation between relay contact 1 and relay contact 2	**4900 V (prot. separation)**	**4900 V (prot. separation)**
Environmental data	**312510**	**314510**
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**
Max. temperature in accordance with UL	**60 °C**	**60 °C**
Storage temperature		
In accordance with the standard	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 150 Hz**	**10 - 1000 Hz**
Acceleration	**1g**	**5g**

Digital input/output (standard)
PSSu E S 2DOR 10

Environmental data	312510	314510
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1, EN 61131-2**	**EN 60664-1, EN 61131-2**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312510**	**314510**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76 mm**	**76 mm**
Width	**25,2 mm**	**25,2 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**62 g**	**64 g**
Mechanical coding		
Type	**I**	**I**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2008-07 latest editions shall apply.

Digital input/output (standard)
PSSu E S 2DOR 10

Order reference

Product

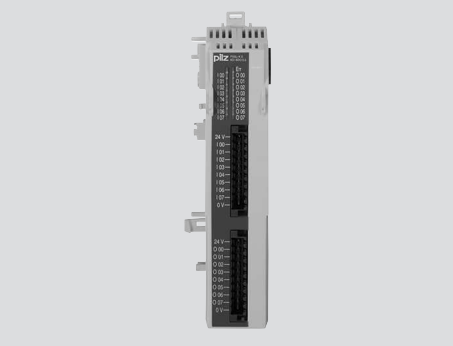
Product type	Features	Order No.
PSSu E S 2DOR 10	Electronic module, base type	312 510
PSSu E S 2DOR 10-T	Electronic module, T-type	314 510

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 2/16 S	Base module without C-rail with screw terminals	312 628
PSSu BP 2/16 S-T	Base module without C-rail with screw terminals, T-type	314 628
PSSu BP 2/16 C	Base module without C-rail with cage clamp terminals	312 629
PSSu BP 2/16 C-T	Base module without C-rail with cage clamp terminals, T-type	314 629
PSSu BP-C 2/16 S	Base module with C-rail and screw terminals	312 630
PSSu BP-C 2/16 S-T	Base module with C-rail and screw terminals, T-type	314 630
PSSu BP-C 2/16 C	Base module with C-rail and cage clamp terminals	312 631
PSSu BP-C 2/16 C-T	Base module with C-rail and cage clamp terminals, T-type	314 631

Digital input/output (standard)
PSSu K S 8DI 8DO 0.5



Overview

Module features

The product has the following features:

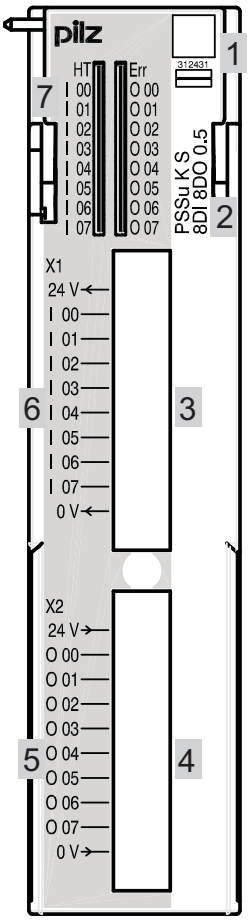
- 8 Digital inputs
- 8 Digital outputs
  - Semiconductor technology
  - Single-pole
  - Positive-switching
  - Current load capacity per output: 0,5 A
  - Short circuit-proof
  - Overload-proof
- LEDs for:
  - Switch status of each input/output
  - Module error
- 2 x 10-pin connector strip
- For standard applications in system environment A and B

Accessories:

- Connector with spring-loaded terminals (necessary for operation)
- Labelling bracket
- Labelling strips (sheets)

Digital input/output (standard)
PSSu K S 8DI 8DO 0.5

Front view



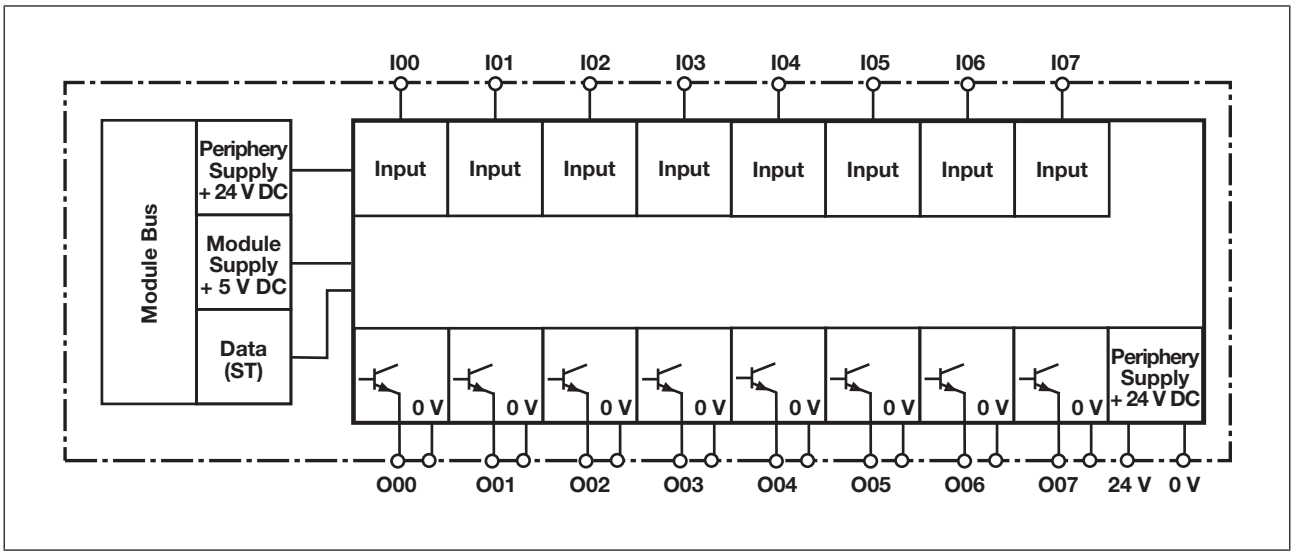
Key:

- 1: Labelling strip with:
  - 2D code
  - Order Number
  - Serial Number
  - Hardware version number
- 2: Name of compact module
- 3: Connector strip X1 for connectors with spring-loaded terminals
- 4: Connector strip X2 for connectors with spring-loaded terminals
- 5: Labelling strip for connector strip X2
- 6: Labelling strip for connector strip X1
- 7: LEDs for status display and module diagnostics

Digital input/output (standard)
PSSu K S 8DI 8DO 0.5

Function description

Block diagram



Module features

Module supply

- The module supply provides the module with voltage.

Periphery supply

- The module routes the periphery supply from the module bus to the module's connector strips.
- The periphery supply is used to supply the sensors.
- The module does not switch the periphery supply.
- The periphery supply has no current limitation.

Inputs

- The input status is signalled to the head module via the module bus.
- The inputs have input filters.

Module supply

- The module supply provides the module with voltage.

Signals at the output

- "0" signal (0 V) at the output:
  - Output is high impedance
  - No current to the load
- "1" signal (+24 V) at the output:
  - Output is low impedance

Digital input/output (standard)
PSSu K S 8DI 8DO 0.5

– Current is supplied to the load

Periphery supply

- The Periphery Supply is not provided via the module bus, but it has to be fed via the connectors.
- The periphery supply is used to supply the outputs.

Outputs

- The head module sets the output status via the module bus.

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error
- Temperature error

Information on the reaction times of the inputs/outputs can be found in the "PSSuniversal" System Description and the System Description "Automation system PSS 4000".

Configuration

It is not necessary to configure ST inputs/outputs in the PSSuniversal Configurator on the PSS WIN-PRO system software, but ST modules can be selected and displayed.

The ST process image can be optimised by combining adjacent bits of the same type into bytes.

Further information on configuration is available in the PSSuniversal Configurator's online help.

Each module occupies 8 consecutive bit addresses in the process image.

Configuration	SafetyBUS p	Standard bus system	
	FS-PII	ST-PII	ST-PIO
None	- - -	8 Bit	8 Bit

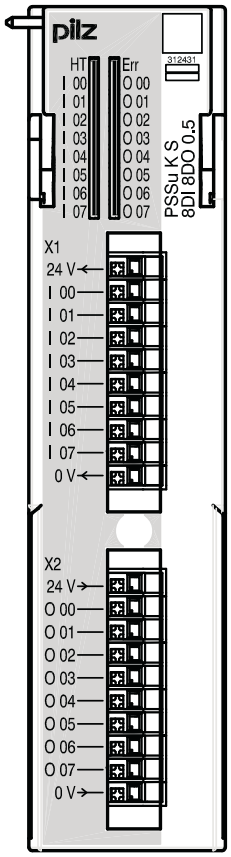
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
I00 … I07	ST_I_DI	Data: BOOL	Input data I00 ... I07
O00 … O07	ST_O_DO	Data: BOOL	Output data O00 ... O07

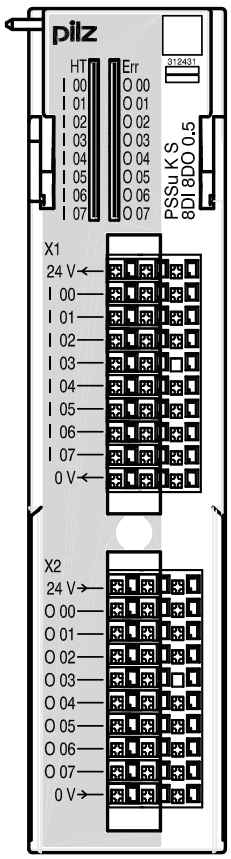
Digital input/output (standard)
PSSu K S 8DI 8DO 0.5

Wiring

Terminal configuration

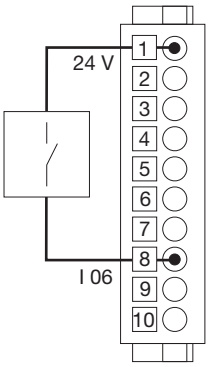
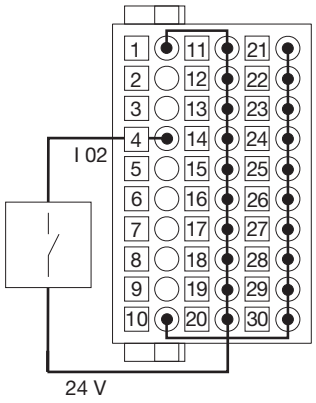
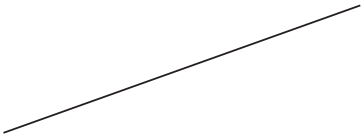
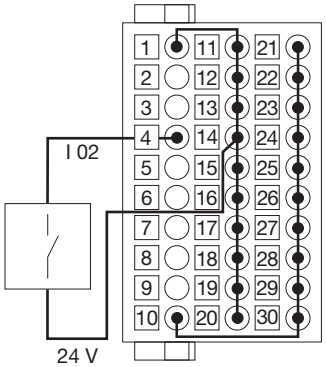
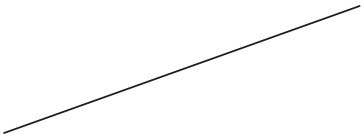
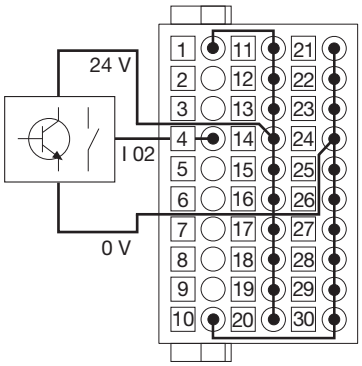
	Terminal configuration			
Connector with spring-loaded terminals (1-row/10-pin): PSSu A Con 1/10 C	1. connection level X1: 24 V: +24 V (periphery supply) I 00: Input 0 I 01: Input 1 I 02: Input 2 I 03: Input 3 I 04: Input 4 I 05: Input 5 I 06: Input 6 I 07: Input 7 0 V: 0 V (periphery supply) X2: 24 V: +24 V (external periphery supply) O 00: Output 0 O 01: Output 1 O 02: Output 2 O 03: Output 3 O 04: Output 4 O 05: Output 5 O 06: Output 6 O 07: Output 7 0 V: 0 V (external periphery supply)			

Digital input/output (standard)
PSSu K S 8DI 8DO 0.5

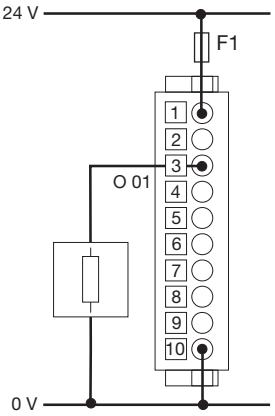
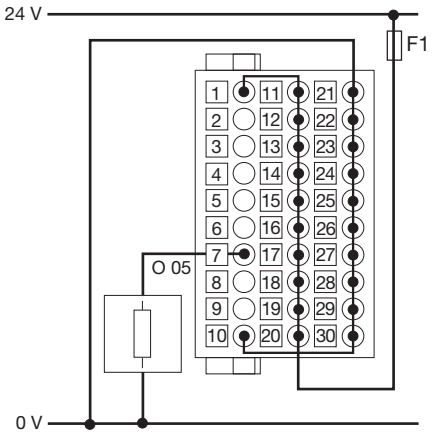
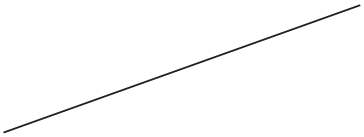
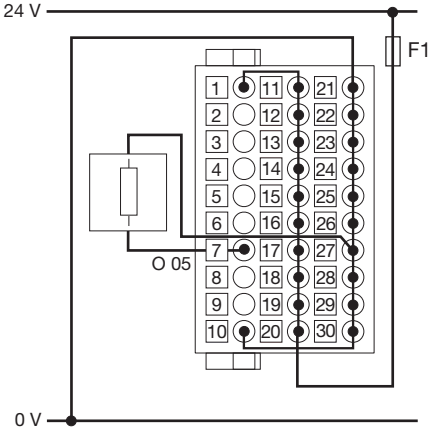
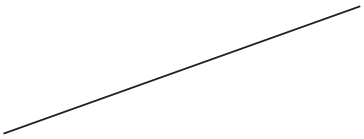
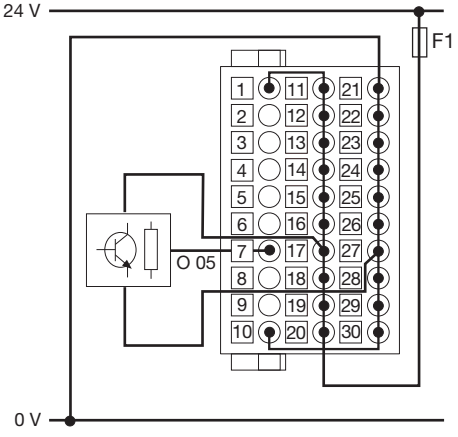
	Terminal configuration			
Connector with spring-loaded terminals (3-row/30-pin): PSSu A Con 3/30 C	1. connection level X1: 24 V: +24 V (periphery supply) I 00: Input 0 I 01: Input 1 I 02: Input 2 I 03: Input 3 I 04: Input 4 I 05: Input 5 I 06: Input 6 I 07: Input 7 0 V: 0 V (periphery supply) X2: 24 V: +24 V (external periphery supply) O 00: Output 0 O 01: Output 1 O 02: Output 2 O 03: Output 3 O 04: Output 4 O 05: Output 5 O 06: Output 6 O 07: Output 7 0 V: 0 V (external periphery supply)	2. connection level X1: +24 V (periphery supply) is present at all 10 spring-loaded terminals. X2: +24 V (external periphery supply) is present at all 10 spring-loaded terminals.	3. connection level X1: 0 V (periphery supply) is present at all 10 spring-loaded terminals. X2: 0 V (external periphery supply) is present at all 10 spring-loaded terminals.	

Digital input/output (standard)
PSSu K S 8DI 8DO 0.5

Connecting the module

Input circuit	1-row/10-pin connector PSSu A Con 1/10 C	3-row/30-pin connector PSSu A Con 3/30 C
Single-wire technology		
Two-wire technology		
Three-wire technology		

Digital input/output (standard)
PSSu K S 8DI 8DO 0.5

Input circuit	1-row/10-pin connector PSSu A Con 1/10 C	3-row/30-pin connector PSSu A Con 3/30 C
Single-wire technology		
Two-wire technology		
Three-wire technology		

Digital input/output (standard)
PSSu K S 8DI 8DO 0.5

Technical details

General	
Approvals	**BG, CE, TÜV, cULus Listed**
Application range	**Standard**
Module's device code	**0630h**
Number of ST input bits	**8**
Number of ST output bits	**8**
Application in system environment A	
From ST firmware version, other head modules	**17**
From ST firmware version PSSu H S PN	**2**
From ST firmware version PSSu WR S IDN	**9**
Application in system environment B	
From ST firmware version, head modules	**1.2.0**
Electrical data	
Supply voltage	
for	**Outputs**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**10 A**
Internal supply voltage (module supply)	
Module's power consumption	**0,13 W**
Periphery's supply voltage (periphery supply)	
Voltage range	**16,8 - 30 V**
Module's current consumption with no load	**0 mA**
Module's power consumption with no load	**0,00 W**
External unit fuse protection F1 max.	**10Y**
External unit fuse protection F1 max. in accordance with UL508	**4 A**
Permitted loads	**inductive, capacitive, resistive**
Inputs	
Number	**8**
Input voltage in accordance with EN 61131-2 Type 1	**24 V DC**
Input current at rated voltage	**3 mA**
Input current range	**2,5 - 4 mA**
Min. threshold voltage when signal changes from "1" to "0"	**11 V**
Max. threshold voltage when signal changes from "0" to "1"	**12 V**

Digital input/output (standard)
PSSu K S 8DI 8DO 0.5

Inputs	
Max. processing time of input when signal changes from "1" to "0"	**4 ms**
Max. processing time of input when signal changes from "0" to "1"	**4 ms**
Min. processing time of input when signal changes from "1" to "0"	**3 ms**
Min. processing time of input when signal changes from "0" to "1"	**3 ms**
Potential isolation between input and internal module bus voltage	**yes**
Semiconductor outputs	
Number of positive-switching single-pole semiconductor outputs	**8**
Rated voltage	**24 V DC**
Typ. output current at "1" signal and rated voltage of semiconductor output	**0,5 A**
Permitted current range	**0,000 - 0,620 A**
Residual current at "0" signal	**0,02 mA**
Max. transient pulsed current	**6 A**
Max. internal voltage drop	**60 mV**
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,5 ms**
Max. processing time of semiconductor output when signal changes from "0" to "1"	**0,01 ms**
Potential isolation between semiconductor output and input	**yes**
Short circuit-proof	**yes**
Voltage outputs	
Potential isolation between output and voltage for the internal module bus	**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 - 60 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**
Climatic suitability	
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**

Digital input/output (standard)
PSSu K S 8DI 8DO 0.5

Environmental data	
Max. operating height above sea level	**2000 m**
EMC	**EN 55011: class A, EN 61000-4-11, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-9**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 150 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1, 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**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Labelling bracket (accessories)	**PC**
Mounting type	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1 mm², 22 - 18 AWG**
Spring-loaded terminals: Terminal points per connection	**1**
Stripping length with spring-loaded terminals	**8 mm**

Digital input/output (standard)
PSSu K S 8DI 8DO 0.5

Mechanical data	
Dimensions	
Height	**128,9 mm**
Width	**30 mm**
Depth	**56 mm**
Depth incl. connector (accessories)	**69,5 mm**
Depth incl. labelling bracket (accessories)	**83,5 mm**
Weight	**89 g**

Where standards are undated, the 2005-04 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu K S 8DI 8DO 0.5	Compact module without connector, labelling bracket and labelling strips, base type	312 431

Accessories

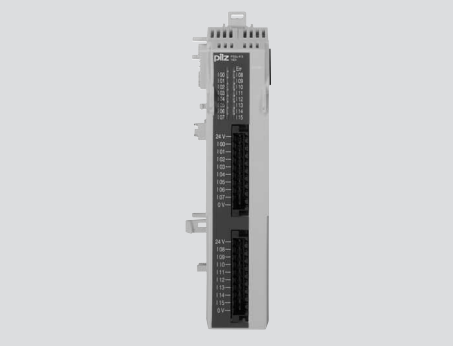
Terminals

Product type	Features	Order No.
PSSu A Con 1/10 C	Connector with spring-loaded terminals 1-row/10-pin, scope of supply: 2 pieces	313 115
PSSu A Con 3/30 C	Connector with spring-loaded terminals 3-row/30-pin, scope of supply: 2 pieces	313 116

Labelling

Product type	Features	Order No.
PSSu A LC 0.1	Labelling bracket, scope of supply: 5 pieces	312 966
PSSu A LA0	Labelling strips, laser printable, scope of supply: 1080 pieces (10 x DIN A4 sheet, 108 on each)	312 958

Digital input/output (standard)
PSSu K S 16DI



Overview

Module features

The product has the following features:

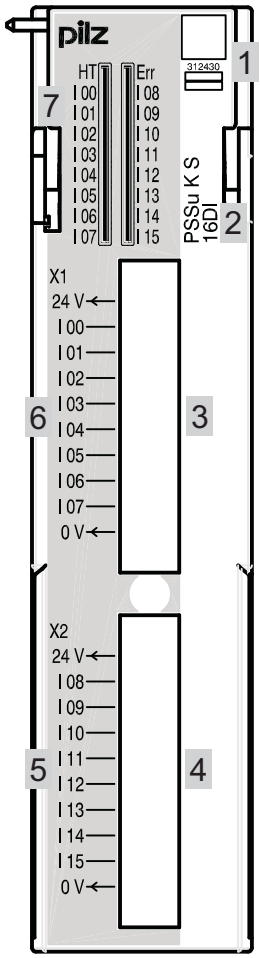
- 16 Digital inputs
- LEDs for:
  - Switch status of each input
  - Module error
- 2 x 10-pin connector strip
- Communication via:
  - Standard fieldbus
- For standard applications in system environment A and B

Accessories:

- Connector with spring-loaded terminals (necessary for operation)
- Labelling bracket
- Labelling strips (sheets)

Digital input/output (standard)
PSSu K S 16DI

Front view



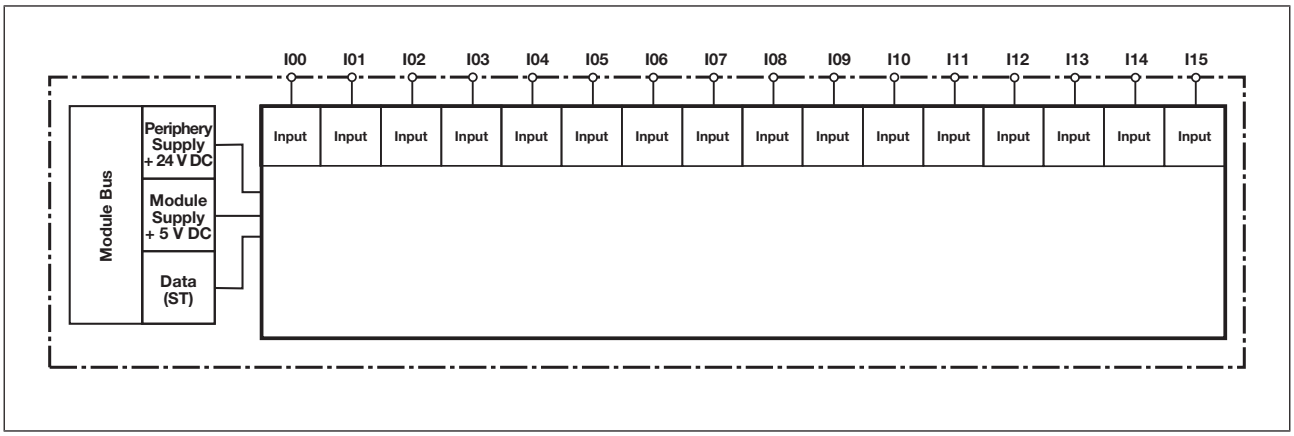
Key:

- 1: Labelling strip with:
  - 2D code
  - Order Number
  - Serial Number
  - Hardware version number
- 2: Name of compact module
- 3: Connector strip X1 for connectors with spring-loaded terminals
- 4: Connector strip X2 for connectors with spring-loaded terminals
- 5: Labelling strip for connector strip X2
- 6: Labelling strip for connector strip X1
- 7: LEDs for status display and module diagnostics

Digital input/output (standard)
PSSu K S 16DI

Function description

Block diagram



Module features

Module supply

- The module supply provides the module with voltage.

Periphery supply

- The module routes the periphery supply from the module bus to the module's connector strips.
- The periphery supply is used to supply the sensors.
- The module does not switch the periphery supply.
- The periphery supply has no current limitation.

Inputs

- The input status is signalled to the head module via the module bus.
- The inputs have input filters.

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error
- Temperature error

Information on the reaction times of the inputs can be found in the "PSSuniversal" System Description and the System Description "Automation system PSS 4000".

Digital input/output (standard)
PSSu K S 16DI

Configuration

It is not necessary to configure ST inputs in the PSSuniversal Configurator on the PSS WIN-PRO system software, but ST modules can be selected and displayed.

The ST process image can be optimised by combining adjacent bits of the same type into bytes.

Further information on configuration is available in the PSSuniversal Configurator's online help.

The module occupies 16 consecutive bit addresses in the process image.

Configuration	SafetyBUS p	Standard bus system	
	FS-PII	ST-PII	ST-PIO
None	- - -	16 Bit	- - -

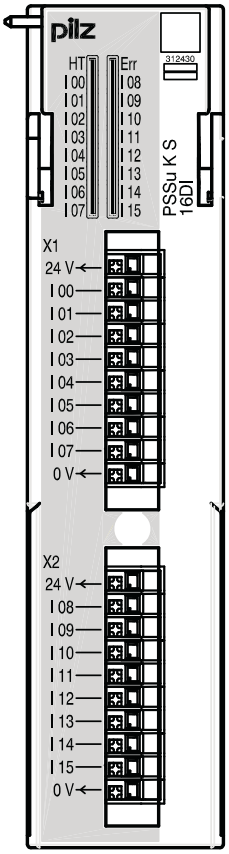
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
I00 … I07	ST_I_DI	Data: BOOL	Input data I00 ... I07
O00 … O07	ST_O_DO	Data: BOOL	Output data O00 ... O07

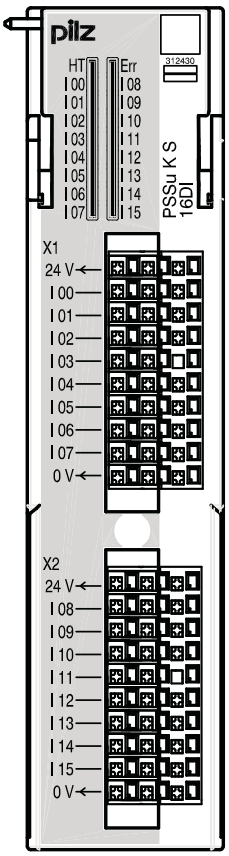
Digital input/output (standard)
PSSu K S 16DI

Wiring

Terminal configuration

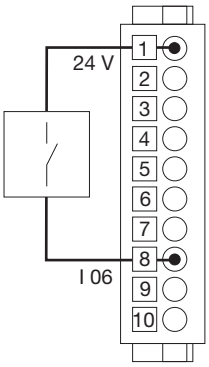
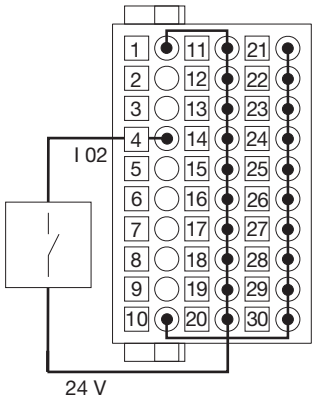
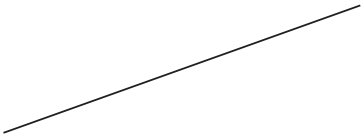
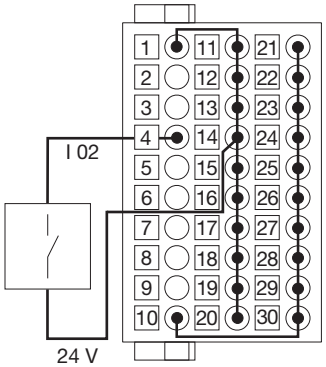
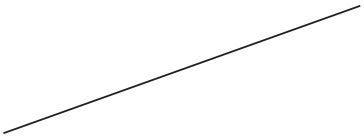
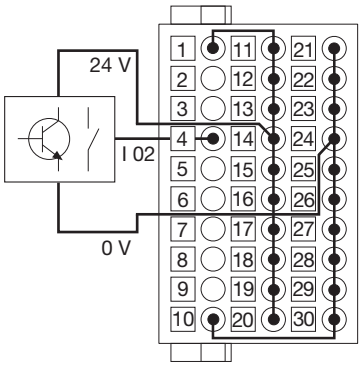
	Terminal configuration			
Connector with spring-loaded terminals (1-row/10-pin): PSSu A Con 1/10 C	1. connection level X1: 24 V: +24 V (periphery supply) I 00: Input 0 I 01: Input 1 I 02: Input 2 I 03: Input 3 I 04: Input 4 I 05: Input 5 I 06: Input 6 I 07: Input 7 0 V: 0 V (periphery supply) X2: 24 V: +24 V (periphery supply) I 08: Input 8 I 09: Input 9 I 10: Input 10 I 11: Input 11 I 12: Input 12 I 13: Input 13 I 14: Input 14 I 15: Input 15 0 V: 0 V (periphery supply)			

Digital input/output (standard)
PSSu K S 16DI

	Terminal configuration			
Connector with spring-loaded terminals (3-row/30-pin): PSSu A Con 3/30 C	1. connection level X1: 24 V: +24 V (periphery supply) I 00: Input 0 I 01: Input 1 I 02: Input 2 I 03: Input 3 I 04: Input 4 I 05: Input 5 I 06: Input 6 I 07: Input 7 0 V: 0 V (periphery supply) X2: 24 V: +24 V (periphery supply) I 08: Input 8 I 09: Input 9 I 10: Input 10 I 11: Input 11 I 12: Input 12 I 13: Input 13 I 14: Input 14 I 15: Input 15 0 V: 0 V (periphery supply)	2. connection level X1: +24 V (periphery supply) is present at all 10 spring-loaded terminals. X2: +24 V (periphery supply) is present at all 10 spring-loaded terminals.	3. connection level X1: 0 V (periphery supply) is present at all 10 spring-loaded terminals. X2: 0 V (periphery supply) is present at all 10 spring-loaded terminals.	

Digital input/output (standard)
PSSu K S 16DI

Connecting the module

Input circuit	1-row/10-pin connector PSSu A Con 1/10 C	3-row/30-pin connector PSSu A Con 3/30 C
Single-wire technology		
Two-wire technology		
Three-wire technology		

Digital input/output (standard)
PSSu K S 16DI

Technical details

General	
Approvals	**BG, CE, TÜV, cULus Listed**
Application range	**Standard**
Module's device code	**0230h**
Number of ST input bits	**16**
Application in system environment A	
From ST firmware version, other head modules	**17**
From ST firmware version PSSu H S PN	**2**
From ST firmware version PSSu WR S IDN	**9**
Application in system environment B	
From ST firmware version, head modules	**1.7.0**
Electrical data	
Internal supply voltage (module supply)	
Module's power consumption	**0,24 W**
Periphery's supply voltage (periphery supply)	
Voltage range	**16,8 - 30 V**
Module's current consumption with no load	**0 mA**
Module's power consumption with no load	**0,00 W**
Max. power dissipation of module	**2 W**
Inputs	
Number	**16**
Input voltage in accordance with EN 61131-2 Type 1	**24 V DC**
Input current at rated voltage	**3 mA**
Input current range	**2,5 - 4 mA**
Min. threshold voltage when signal changes from "1" to "0"	**11 V**
Max. threshold voltage when signal changes from "0" to "1"	**12 V**
Max. processing time of input when signal changes from "1" to "0"	**4 ms**
Max. processing time of input when signal changes from "0" to "1"	**4 ms**
Min. processing time of input when signal changes from "1" to "0"	**3 ms**
Min. processing time of input when signal changes from "0" to "1"	**3 ms**
Potential isolation between input and internal module bus voltage	**yes**

Digital input/output (standard)
PSSu K S 16DI

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 - 60 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**
Climatic suitability	
In accordance with the standard	**EN 60068-2-30, 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 55011: class A, EN 61000-4-11, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-9**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 55 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1, 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**

Digital input/output (standard)
PSSu K S 16DI

Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Labelling bracket (accessories)	**PC**
Mounting type	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1 mm², 22 - 18 AWG**
Spring-loaded terminals: Terminal points per connection	**1**
Stripping length with spring-loaded terminals	**8 mm**
Dimensions	
Height	**128,9 mm**
Width	**30 mm**
Depth	**56 mm**
Depth incl. connector (accessories)	**69,5 mm**
Depth incl. labelling bracket (accessories)	**83,5 mm**
Weight	**87 g**

Where standards are undated, the 2005-04 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu K S 16DI	Compact module without connector, labelling bracket and labelling strips, base type	312 430

Accessories

Terminals

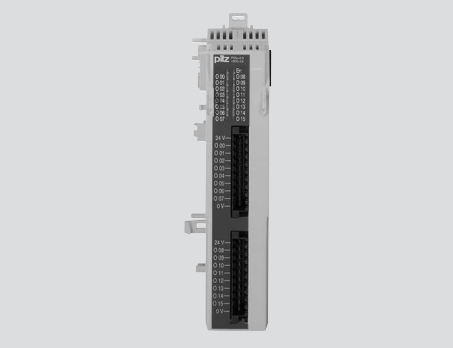
Product type	Features	Order No.
PSSu A Con 1/10 C	Connector with spring-loaded terminals 1-row/10-pin, scope of supply: 2 pieces	313 115
PSSu A Con 3/30 C	Connector with spring-loaded terminals 3-row/30-pin, scope of supply: 2 pieces	313 116

Digital input/output (standard)
PSSu K S 16DI

Labelling

Product type	Features	Order No.
PSSu A LC 0.1	Labelling bracket, scope of supply: 5 pieces	312 966
PSSu A LA0	Labelling strips, laser printable, scope of supply: 1080 pieces (10 x DIN A4 sheet, 108 on each)	312 958

Digital input/output (standard)
PSSu K S 16DO 0.5



Overview

Module features

The product has the following features:

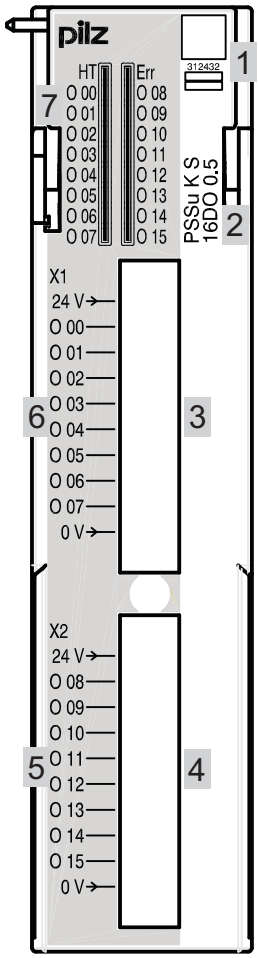
- 16 Digital outputs
  - Semiconductor technology
  - Single-pole
  - Positive-switching
  - Current load capacity per output: 0,50 A
  - Short circuit-proof
  - Overload-proof
- LEDs for:
  - Switch status of each output
  - Module error
- 2 x 10-pin connector strip
- Communication via:
  - Standard fieldbus
- For standard applications in system environment A and B

Accessories:

- Connector with spring-loaded terminals (necessary for operation)
- Labelling bracket
- Labelling strips (sheets)

Digital input/output (standard)
PSSu K S 16DO 0.5

Front view



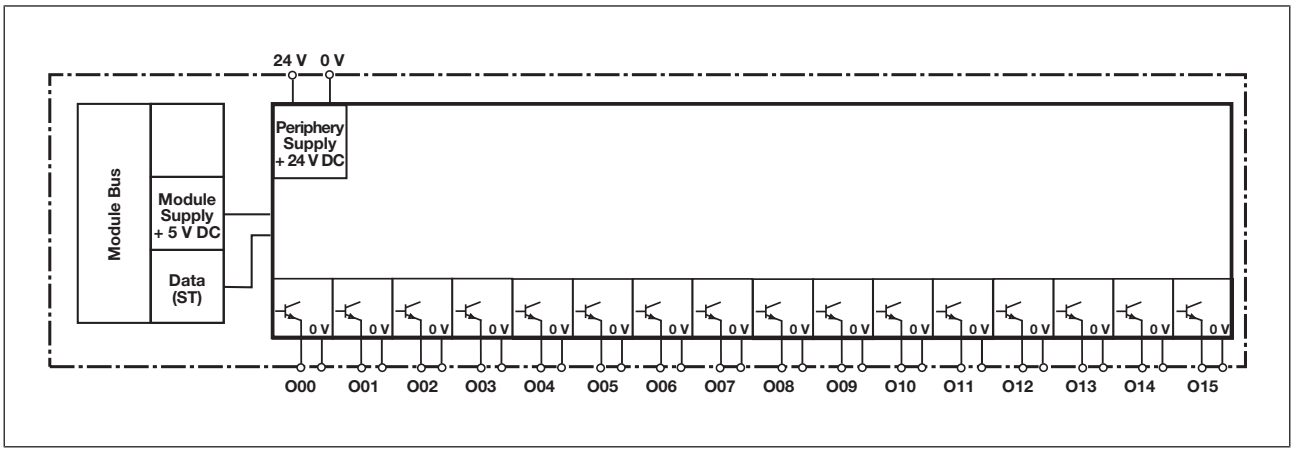
Key:

- 1: Labelling strip with:
  - 2D code
  - Order Number
  - Serial Number
  - Hardware version number
- 2: Name of compact module
- 3: Connector strip X1 for connectors with spring-loaded terminals
- 4: Connector strip X2 for connectors with spring-loaded terminals
- 5: Labelling strip for connector strip X2
- 6: Labelling strip for connector strip X1
- 7: LEDs for status display and module diagnostics

Digital input/output (standard)
PSSu K S 16DO 0.5

Function description

Block diagram



Module features

Module supply

- The module supply provides the module with voltage.

Signals at the output

- "0" signal (0 V) at the output:
  - Output is high impedance
  - No current to the load
- "1" signal (+24 V) at the output:
  - Output is low impedance
  - Current is supplied to the load

Periphery supply

- The Periphery Supply is not provided via the module bus, but it has to be fed via the connectors.
- The periphery supply is used to supply the outputs.

Outputs

- The head module sets the output status via the module bus.

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- ST communication error

Digital input/output (standard)
PSSu K S 16DO 0.5

- Bus termination error
- Temperature error

Information on the reaction times of the outputs can be found in the PSSuniversal System Description.

Configuration

It is not necessary to configure ST outputs in the PSSuniversal Configurator on the PSS WIN-PRO system software, but ST modules can be selected and displayed.

The ST process image can be optimised by combining adjacent bits of the same type into bytes.

Further information on configuration is available in the PSSuniversal Configurator's online help.

The module occupies 16 consecutive bit addresses in the process image.

Configuration	SafetyBUS p	Standard bus system	
	FS-PII	ST-PII	ST-PIO
None	- - -	- - -	16 Bit

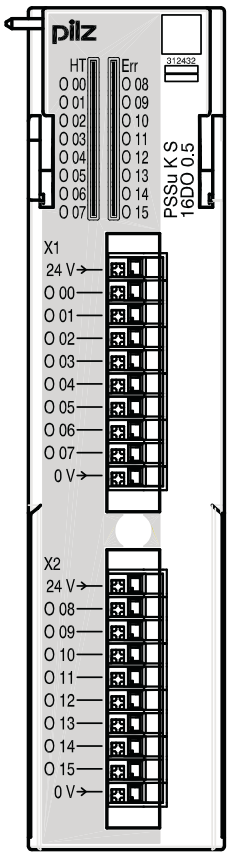
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
O00 … O15	ST_O_DO	Data: BOOL	Output data O00 ... O15

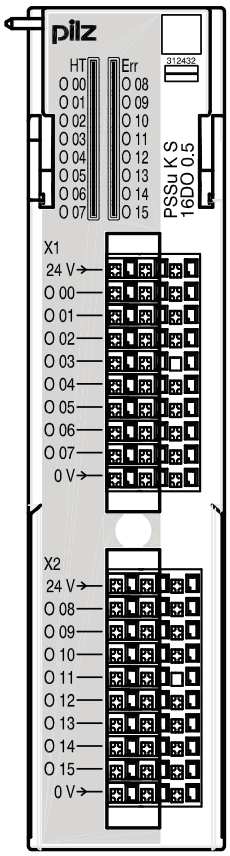
Digital input/output (standard)
PSSu K S 16DO 0.5

Wiring

Terminal configuration

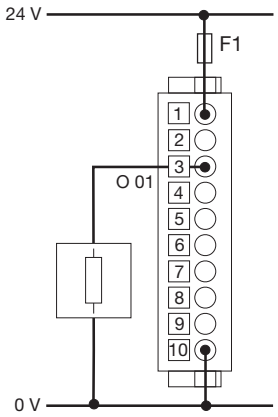
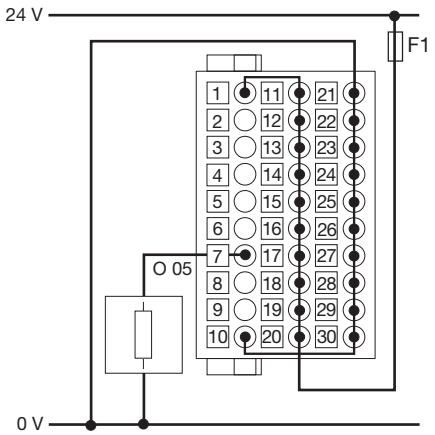
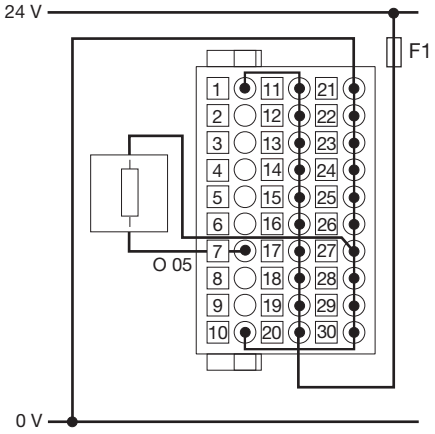
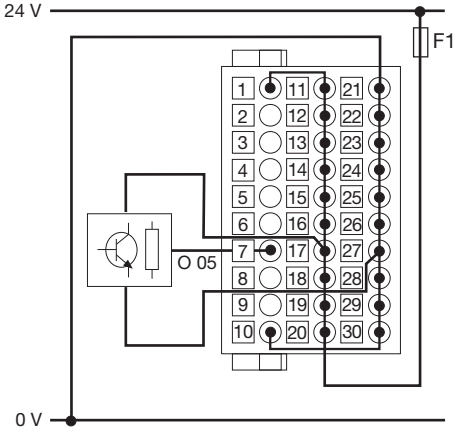
	Terminal configuration		
Connector with spring-loaded terminals (1-row/10-pin): PSSu A Con 1/10 C	1. connection level X1: 24 V: +24 V (external periphery supply) O 00: Output 0 O 01: Output 1 O 02: Output 2 O 03: Output 3 O 04: Output 4 O 05: Output 5 O 06: Output 6 O 07: Output 7 0 V: 0 V (external periphery supply) X2: 24 V: +24 V (external periphery supply) O 08: Output 8 O 09: Output 9 O 10: Output 10 O 11: Output 11 O 12: Output 12 O 13: Output 13 O 14: Output 14 O 15: Output 15 0 V: 0 V (external periphery supply)		

Digital input/output (standard)
PSSu K S 16DO 0.5

	Terminal configuration			
Connector with spring-loaded terminals (3-row/30-pin): PSSu A Con 3/30 C	1. connection level X1: 24 V: +24 V (external periphery supply) O 00: Output 0 O 01: Output 1 O 02: Output 2 O 03: Output 3 O 04: Output 4 O 05: Output 5 O 06: Output 6 O 07: Output 7 0 V: 0 V (external periphery supply) X2: 24 V: +24 V (external periphery supply) O 08: Output 8 O 09: Output 9 O 10: Output 10 O 11: Output 11 O 12: Output 12 O 13: Output 13 O 14: Output 14 O 15: Output 15 0 V: 0 V (external periphery supply)	2. connection level X1: +24 V (external periphery supply) is present at all 10 spring-loaded terminals. X2: +24 V (external periphery supply) is present at all 10 spring-loaded terminals.	3. connection level X1: 0 V (external periphery supply) is present at all 10 spring-loaded terminals. X2: 0 V (external periphery supply) is present at all 10 spring-loaded terminals.	

Digital input/output (standard)
PSSu K S 16DO 0.5

Connecting the module

Input circuit	1-row/10-pin connector PSSu A Con 1/10 C	3-row/30-pin connector PSSu A Con 3/30 C
Single-wire technology		
Two-wire technology		
Three-wire technology		

Digital input/output (standard)
PSSu K S 16DO 0.5

Technical details

General	
Approvals	**BG, CE, TÜV, cULus Listed**
Application range	**Standard**
Module's device code	**0430h**
Number of ST output bits	**16**
Application in system environment A	
From ST firmware version, other head modules	**17**
From ST firmware version PSSu H S PN	**2**
From ST firmware version PSSu WR S IDN	**9**
Application in system environment B	
From ST firmware version, head modules	**1.7.0**
Electrical data	
Supply voltage	
for	**Outputs**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**10,0 A**
Internal supply voltage (module supply)	
Module's power consumption	**0,20 W**
External unit fuse protection F1 max. in accordance with UL508	**4 A**
Permitted loads	**inductive, capacitive, resistive**
Semiconductor outputs	
Number of positive-switching single-pole semiconductor outputs	**16**
Rated voltage	**24 V DC**
Typ. output current at "1" signal and rated voltage of semiconductor output	**0,50 A**
Permitted current range	**0,00 - 0,62 A**
Residual current at "0" signal	**0,02 mA**
Max. transient pulsed current	**6 A**
Max. internal voltage drop	**60 mV**
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,500 ms**
Max. processing time of semiconductor output when signal changes from "0" to "1"	**0,010 ms**
Potential isolation from system voltage	**yes**
Short circuit-proof	**yes**

Digital input/output (standard)
PSSu K S 16DO 0.5

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 - 60 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**
Climatic suitability	
In accordance with the standard	**EN 60068-2-30, 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 55011: class A, EN 61000-4-11, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-9**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1, EN 61131-2**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
In accordance with the standard	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**
Housing	**IP20**

Digital input/output (standard)
PSSu K S 16DO 0.5

Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Labelling bracket (accessories)	**PC**
Mounting type	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,20 - 1,00 mm², 22 - 18 AWG**
Spring-loaded terminals: Terminal points per connection	**1**
Stripping length with spring-loaded terminals	**8,0 mm**
Dimensions	
Height	**128,9 mm**
Width	**30,0 mm**
Depth	**56,0 mm**
Depth incl. connector (accessories)	**69,5 mm**
Depth incl. labelling bracket (accessories)	**83,5 mm**
Weight	**88 g**

Where standards are undated, the 2005-04 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu K S 16DO 0.5	Compact module without connector, labelling bracket and labelling strips, base type	312 432

Accessories

Terminals

Product type	Features	Order No.
PSSu A Con 1/10 C	Connector with spring-loaded terminals 1-row/10-pin, scope of supply: 2 pieces	313 115
PSSu A Con 3/30 C	Connector with spring-loaded terminals 3-row/30-pin, scope of supply: 2 pieces	313 116

Digital input/output (standard)
PSSu K S 16DO 0.5

Labelling

Product type	Features	Order No.
PSSu A LC 0.1	Labelling bracket, scope of supply: 5 pieces	312 966
PSSu A LA0	Labelling strips, laser printable, scope of supply: 1080 pieces (10 x DIN A4 sheet, 108 on each)	312 958

Digital input/output (Failsafe)

Digital input/output (Failsafe)

Digital input/output (Failsafe)
PSSu E F 2DI 60-R

Overview

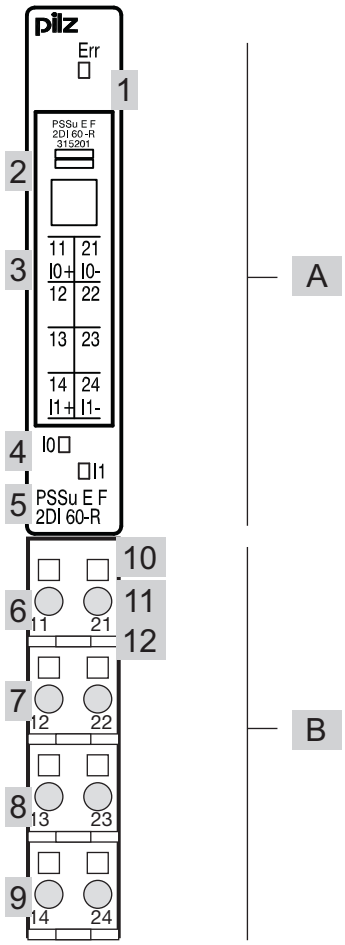
Module features

The product has the following features:

- 2 galvanically isolated digital inputs
- LEDs for:
  - Switch status of each input
  - Module error
- For failsafe applications in system environment B (automation system PSS 4000)

Digital input/output (Failsafe)
PSSu E F 2DI 60-R

Front view



Legend:

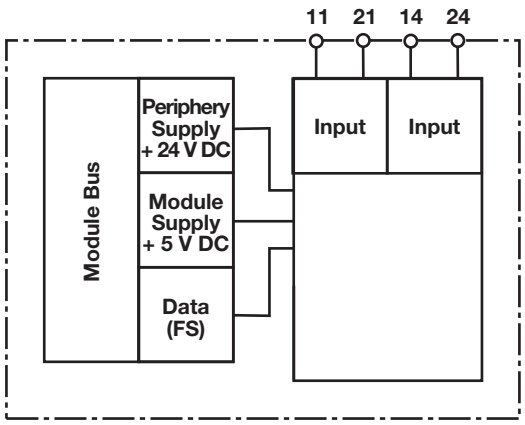
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order Number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs

Digital input/output (Failsafe)
PSSu E F 2DI 60-R

- 5: Name of electronic module
- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Digital input/output (Failsafe)
PSSu E F 2DI 60-R

Module features

Module supply

- The module supply provides the module with voltage.

Inputs

- The status of the inputs is signalled to the head module via the module bus.
- The module's inputs are galvanically isolated from each other and from the module supply.
- The inputs have input filters.

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- FS communication error
- Bus termination error
- Temperature error: too warm
- Input error

Information on the reaction times of the inputs can be found in the System Description "Automation system PSS 4000".

Configuration

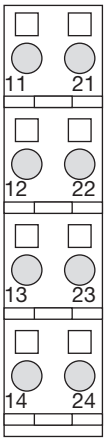
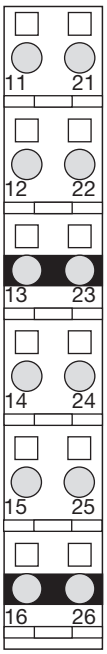
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Key
I0(11,21),I1(14,24)	FS_I_DI	Data: SAFEBOOL	Input data I0 ... I1

Digital input/output (Failsafe)
PSSu E F 2DI 60-R

Wiring

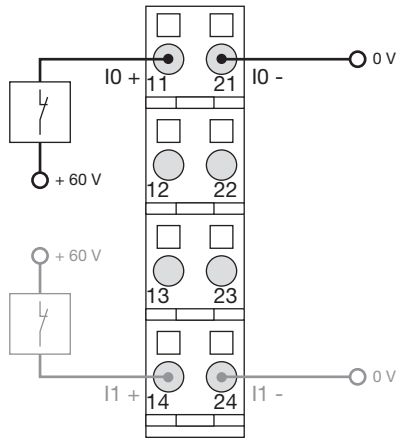
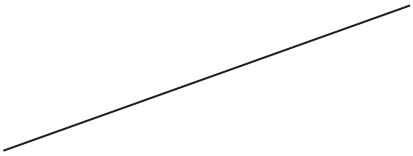
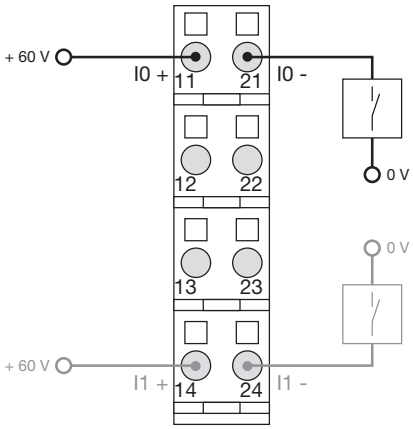
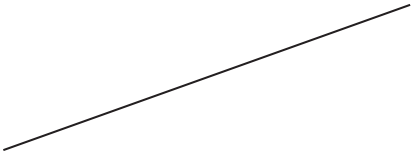
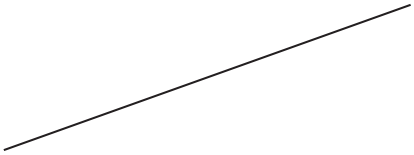
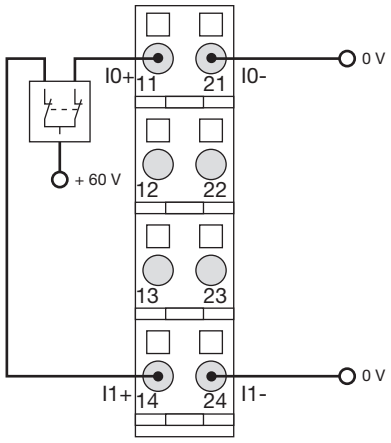
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C-T	Without C-rail: 11: Input I0+ 21: Input I0- 14: Input I1+ 24: Input I1-	
	With C-rail: 11: Input I0+ 21: Input I0- 12-22: n.c. 13-23: C-rail supply (13-23-16-26 linked within the base module) 14: Input I1+ 24: Input I1- 15-25: n.c 16-26: C-rail supply (13-23-16-26 linked within the base module)	

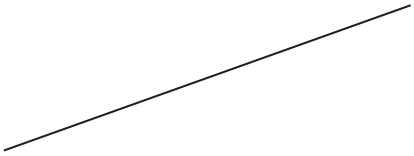
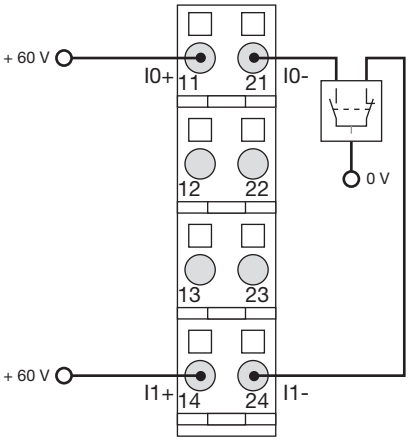
Digital input/output (Failsafe)
PSSu E F 2DI 60-R

- n.c. = not connected

Connecting the module

Input circuit	Single-channel input device	Dual-channel input device
		
		
Input device with homogenous channels		

Digital input/output (Failsafe)
PSSu E F 2DI 60-R

Input device with diverse channels		

Technical details

General	
Approvals	**CE, TÜV, cULus Listed**
Application range	**Failsafe**
Module's device code	**0A01h**
Application in system environment B	
From FS firmware version, head modules	**1.5.0**
Electrical data	
Internal supply voltage (module supply)	
Module's power consumption	**0,12 W**
Max. power dissipation of module	**1,5 W**
Inputs	
Number	**2**
Voltage at inputs	**24 - 72 V**
Input current range	**1,5 - 8,5 mA**
Min. threshold voltage when signal changes from "1" to "0"	**5 V**
Max. threshold voltage when signal changes from "0" to "1"	**19,2 V**
Typ. processing time of the input tProcIM	**2 ms**
Max. processing time of the input tProcIM in the event of an error	**4 ms**
Potential isolation between input and internal module bus voltage	**yes**

Digital input/output (Failsafe)
PSSu E F 2DI 60-R

Environmental data	
Application site	
In accordance with the standard	**EN 50125-3**
Application site	**Track area (1 m - 3 m)**
In accordance with the standard	**EN 61373**
Application site	**Category 1, Class A + B**
Climatic suitability	**EN 50125-1, EN 50125-3, EN 50155, EN 60068-2-1, EN 60068-2-14, EN 60068-2-2**
Ambient temperature	
In accordance with the standard	**EN 50155**
Temperature range	**-40 - 70 °C**
In accordance with the standard	**EN 50125-1**
Temperature range	**-40 ... +70 °C**
In accordance with the standard	**EN 50125-3**
Temperature range	**-40 ... +70 °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	**Short-term**
Max. operating height above sea level	**2000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration	
In accordance with the standard	**EN 50125-3**
Frequency	**5 - 2000 Hz**
Acceleration	**0,23g**
Broadband noise	
In accordance with the standard	**EN 61373**
Frequency	**5 - 150 Hz**
Acceleration	**0,79 g RMS**
Shock stress	
In accordance with the standard	**EN 50125-3**
Number of shocks	**20**
Acceleration	**2g**
Duration	**11 ms**
In accordance with the standard	**EN 61373**
Number of shocks	**20**
Acceleration	**5g**
Duration	**30 ms**

Digital input/output (Failsafe)
PSSu E F 2DI 60-R

Environmental data	
Supply interruptions	
In accordance with the standard	**EN 50155**
Airgap creepage	
In accordance with the standard	**EN 50124-1**
Overvoltage category	**OV2**
Pollution degree	**PD2**
Protection type	
In accordance with the standard	**EN 60529**
Housing	**IP20**
Terminals	**IP20**
Mounting area (e.g. control cabinet)	**IP51**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Coding	**PA**
Mounting type	**plug-in**
Dimensions	
Height	**76 mm**
Width	**12,6 mm**
Depth	**60,2 mm**
Weight	**45 g**
Mechanical coding	
Type	**N**
Colour	**Yellow**

Where standards are undated, the 2009-10 latest editions shall apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
1-channel	**PL d**	**Cat. 2**	**SIL CL 2**	**8,18E-09**	**SIL 2**	**6,88E-04**	**20**
2-channel	**PL e**	**Cat. 4**	**SIL CL 3**	**1,38E-09**	**SIL 3**	**1,95E-05**	**20**

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

Digital input/output (Failsafe)
PSSu E F 2DI 60-R

Order reference

Product

Product type	Features	Order no.
PSSu E F 2DI 60-R	Electronic module, R-type	315 201

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623
PSSu BP-C1 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 623

Digital input/output (Failsafe)
PSSu E F 4DI

Overview

Module features

The product has the following features:

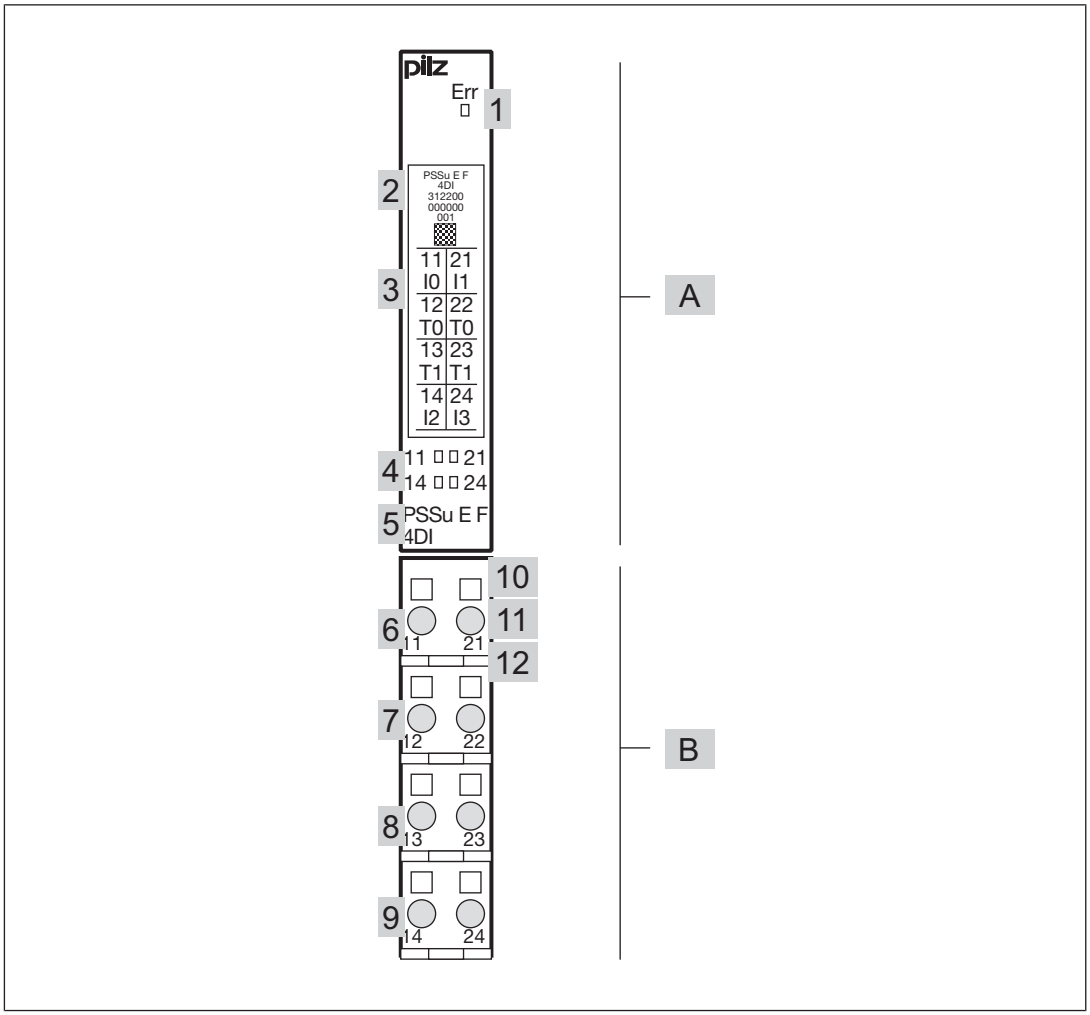
- 4 digital inputs
- 2 test pulse outputs, with the option to configure them as:
  - Independent test pulse outputs that use different test pulses (periphery supply)
  - Outputs with constant voltage (periphery supply)
- LEDs for:
  - Switch status of each input
  - Module error
- For failsafe applications in system environment A and B
- T-type:

  PSSu E F 4DI-T: for increased environmental requirements
- R-type:

  PSSu E F 4DI-R: for railway applications

Digital input/output (Failsafe)
PSSu E F 4DI

Front view



Legend:

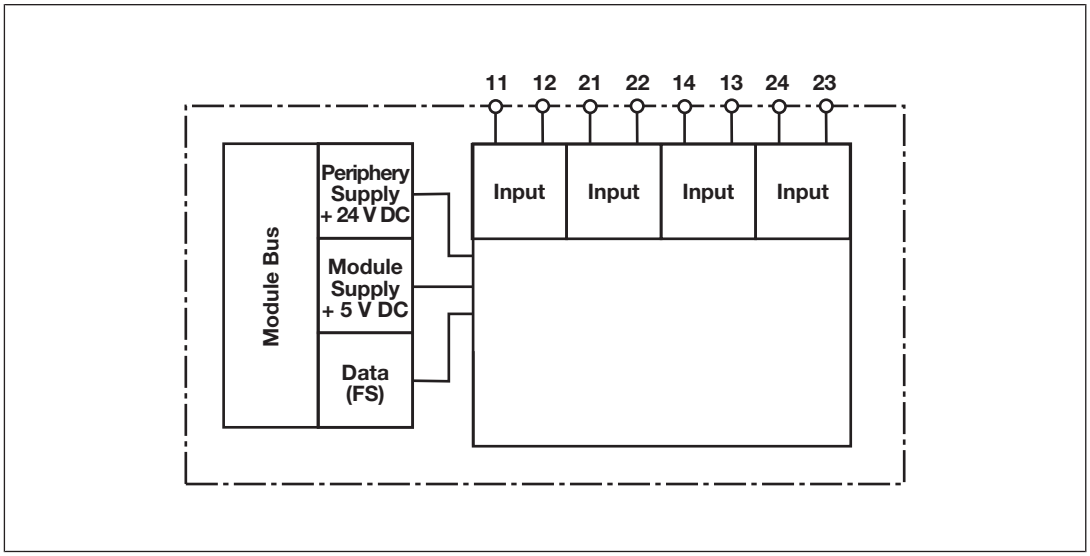
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order Number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module

Digital input/output (Failsafe)
PSSu E F 4DI

- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Digital input/output (Failsafe)
PSSu E F 4DI

Functions

Module supply

- The module supply provides the module with voltage.

Periphery supply

- The module switches the periphery supply from the module bus to the base module terminals.
- The periphery supply is used to supply or provide test pulses to the input devices.

Inputs

- The input status is signalled to the head module via the module bus.
- Test pulses can be used to check the inputs for shorts across contacts and correct functionality.
- The inputs have input filters.

Test pulse outputs

- 2 test pulse outputs that use different test pulses (test pulse 0, test pulse 1)
- Short circuit-proof
- Current limitation
- Test pulses can be switched on or off.
- Test pulses are switched on in the default setting.
- When test pulses are switched off, the periphery supply is constantly available at the outputs.

Detection of shorts across contacts

- The test pulses are used to detect shorts between inputs. Shorts between inputs are detected when
  - the test pulses are different (test pulse 0, test pulse 1) or when
  - the test pulses originate from other modules on a PSSu system.
- Shorts between inputs of the same module with the same test pulses will not be detected.

Integrated protection mechanisms

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

- Test pulse signals are always buffered for 20 ms.

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- FS communication error
- Bus termination error

Digital input/output (Failsafe)
PSSu E F 4DI

- Temperature error: Too warm
- Test pulse error
- Input error

Reaction times

Information on the reaction times of the inputs can be found in the "PSSuniversal" System Description and the System Description "Automation system PSS 4000".

Configuration

Functions for the FS inputs of a PSSu are defined in the PSSuniversal Configurator on the PSS WIN-PRO system software:

- Read access through the standard bus system (configured per module):
  “R” configuration
- Allocation of a test pulse output to an input (configured per input)
- Optimisation of ST process image by combining adjacent bits of the same type.
  “*” configuration

Further information on configuration is available in the PSSuniversal Configurator's online help.

The module occupies 4 consecutive bit addresses in the process image. The process image in which the inputs are shown depends on the configuration.

Configuration	SafetyBUS p	Standard bus system	
	FS-PII	ST-PII	ST-PIO
None	4 Bit (e. g.: 32.00 … 32.03)	- - -	- - -
Read ST (“R”)		4 Bit	- - -

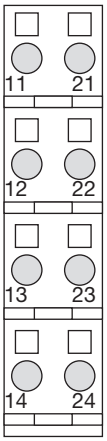
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
I0(11), I1(21), I2(14), I3(24)	FS_I_DI	Data: SAFEBOOL	Input data I0 ... I3

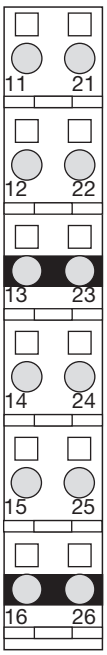
Digital input/output (Failsafe)
PSSu E F 4DI

Wiring

Terminal configuration

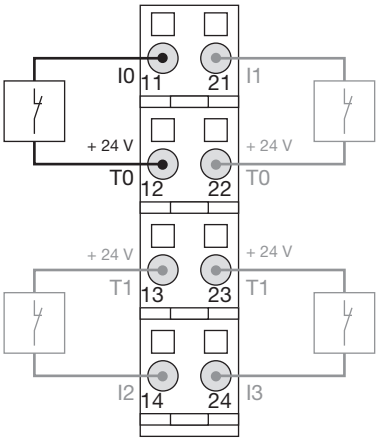
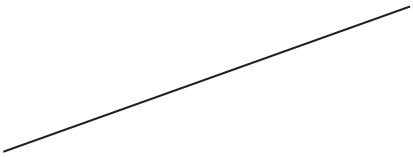
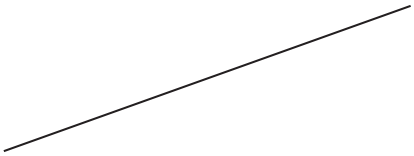
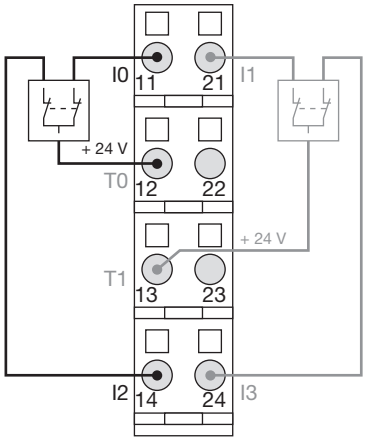
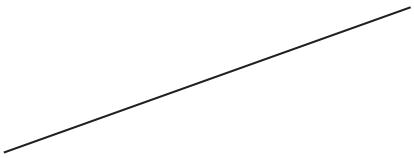
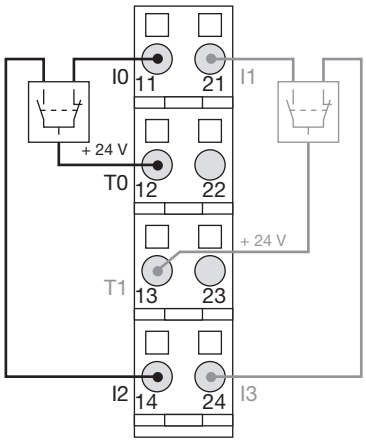
Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Input I0 21: Input I1 12 -22: Test pulse output T0 or +24 V output (periphery supply, 12-22 linked within the base module) 13 -23: Test pulse output T1 or +24 V output (periphery supply, 13-23 linked within the base module) 14: Input I2 24: Input I3	

Digital input/output (Failsafe)
PSSu E F 4DI

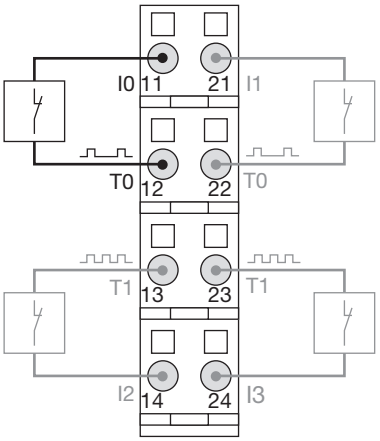
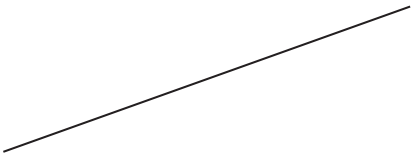
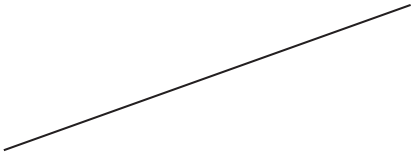
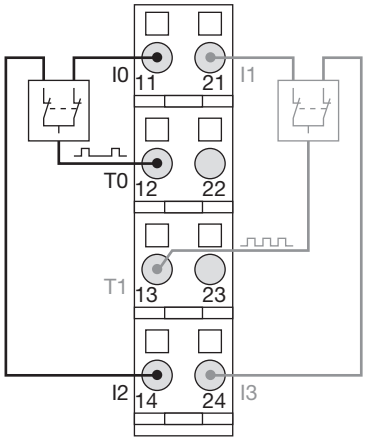
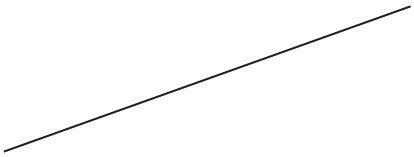
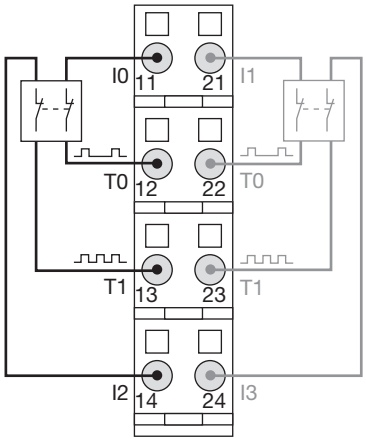
Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12 S PSSu BP-C1 1/12 S-T Cage clamp terminals: PSSu BP-C 1/12 C PSSu BP-C 1/12 C-T	With C-rail: 11: Input I0 21: Input I1 12 -22: Test pulse output T0 or +24 V output (periphery supply, 12-22 linked within the base module) 13 -23: C-rail supply (13-23-16-26 linked within the base module) 14: Input I2 24: Input I3 15 -25: Test pulse output T1 or +24 V output (periphery supply, 15-25 linked within the base module) 16 -26: C-rail supply (13-23-16-26 linked within the base module)	

Digital input/output (Failsafe)
PSSu E F 4DI

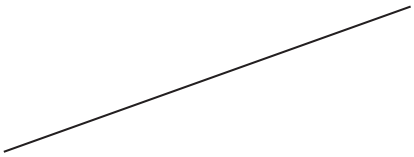
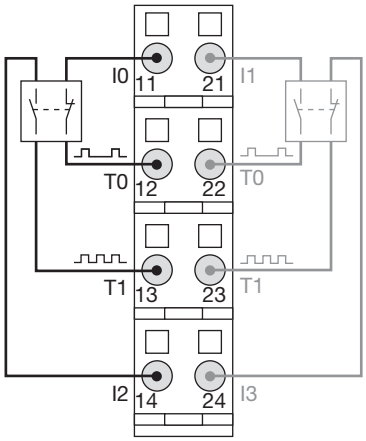
Connecting the module

Input circuit	Single-channel input device	Dual-channel input device
Without test pulses (unchecked)		
Without test pulses (unchecked) Input device with homogeneous channels		
Without test pulses (unchecked) Input device with diverse channels		

Digital input/output (Failsafe)
PSSu E F 4DI

Input circuit	Single-channel input device	Dual-channel input device
With test pulses (checked)		
With test pulses (checked) Input device with homogeneous channels		
With test pulses (checked) Input device with homogeneous channels		

Digital input/output (Failsafe)
PSSu E F 4DI

Input circuit	Single-channel input device	Dual-channel input device
With test pulses (checked) Input device with diverse channels		

Technical details

General	312200	314200	315200
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, TÜV**
Application range	**Failsafe**	**Failsafe**	**Failsafe**
Module's device code	**0A00h**	**0A00h**	**0A00h**
Number of FS input bits	**4**	**4**	**4**
Application in system environment A			
From FS firmware version, other head modules	**4**	**4**	–
From FS firmware version PSSu H F PN	**1**	**1**	–
Application in system environment B			
From FS firmware version, head modules	**1.0.0**	**1.0.0**	**1.5.0**
Electrical data	**312200**	**314200**	**315200**
Internal supply voltage (module supply)			
Module's power consumption	**0,12 W**	**0,12 W**	**0,12 W**

Digital input/output (Failsafe)
PSSu E F 4DI

Electrical data	312200	314200	315200
Periphery's supply voltage (periphery supply)			
Voltage range	**16,8 - 30 V**	**16,8 - 30 V**	**16,8 - 30 V**
Module's current consumption with no load	**8 mA**	**8 mA**	**8 mA**
Module's power consumption with no load	**0,19 W**	**0,19 W**	**0,19 W**
Max. power dissipation of module	**1,5 W**	**1,5 W**	**1,5 W**
Inputs	**312200**	**314200**	**315200**
Number	**4**	**4**	**4**
Voltage at inputs	**24 V DC**	**24 V DC**	**24 V DC**
Input current at rated voltage	**6 mA**	**6 mA**	**6 mA**
Input current range	**2,6 - 7,8 mA**	**2,6 - 7,8 mA**	**2,6 - 7,8 mA**
Min. threshold voltage when signal changes from "1" to "0"	**9 V**	**9 V**	**9 V**
Max. threshold voltage when signal changes from "0" to "1"	**10 V**	**10 V**	**10 V**
Max. processing time of input when signal changes from "1" to "0"	**1 ms**	**1 ms**	**1 ms**
Max. processing time of input when signal changes from "0" to "1"	**1 ms**	**1 ms**	**1 ms**
Min. processing time of input when signal changes from "1" to "0"	**0,5 ms**	**0,5 ms**	**0,5 ms**
Min. processing time of input when signal changes from "0" to "1"	**0,5 ms**	**0,5 ms**	**0,5 ms**
Potential isolation between input and internal module bus voltage	**yes**	**yes**	**yes**
Test pulse outputs	**312200**	**314200**	**315200**
Number of test pulse outputs	**2**	**2**	**2**
Voltage, test pulse outputs	**24 V DC**	**24 V DC**	**24 V DC**
Short circuit-proof	**yes**	**yes**	**yes**
Number of outputs that can be configured as test pulses	**2**	**2**	**2**

Digital input/output (Failsafe)
PSSu E F 4DI

Test pulse outputs	312200	314200	315200
Max. output current at "1" signal	**0,25 A**	**0,25 A**	**0,25 A**
Max. cable length between test pulse output and input	**200 m**	**200 m**	**200 m**
Standard for voltage interruptions	**EN61131-2, EN61496-1**	**EN61131-2, EN61496-1**	–
Environmental data	**312200**	**314200**	**315200**
Application site			
In accordance with the standard	–	–	**EN 50125-3**
Application site	–	–	**Track area (1 m - 3 m)**
In accordance with the standard	–	–	**EN 61373**
Application site	–	–	**Category 1, Class A + B**
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**	**EN 50125-1, EN 50125-3, EN 50155, EN 60068-2-1, EN 60068-2-14, EN 60068-2-2**
Ambient temperature			
In accordance with the standard	**EN 60068-2-14**	**EN 60068-2-14**	**EN 50155**
Temperature range	**0 - 60 °C**	**-40 - 70 °C**	**-40 - 70 °C**
In accordance with the standard	–	–	**EN 50125-1**
Temperature range	–	–	**-40 ... +70 °C**
In accordance with the standard	–	–	**EN 50125-3**
Temperature range	–	–	**-40 ... +70 °C**
Storage temperature			
In accordance with the standard	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**	–
Climatic suitability			
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**	–
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	–
Condensation during operation	**Not permitted**	**Short-term**	–
Max. operating height above sea level	**2000 m**	**5000 m**	**2000 m**

Digital input/output (Failsafe)
PSSu E F 4DI

Environmental data	312200	314200	315200
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 50125-3**
Frequency	**10 - 150 Hz**	**10 - 150 Hz**	**5 - 2000 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**	**0,23g**
Broadband noise			
In accordance with the standard	–	**EN 60068-2-64**	**EN 61373**
Frequency	–	**5 - 500 Hz**	**5 - 150 Hz**
Acceleration	–	**1,9grms**	**0,79 g RMS**
Shock stress			
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 50125-3**
Number of shocks	**6**	**6**	**20**
Acceleration	**15g**	**15g**	**2g**
Duration	**11 ms**	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 61373**
Number of shocks	**1000**	**1000**	**20**
Acceleration	**10g**	**10g**	**5g**
Duration	**16 ms**	**16 ms**	**30 ms**
Supply interruptions			
In accordance with the standard	–	–	**EN 50155**
Class	–	–	**S2, C1, C2**
Airgap creepage			
In accordance with the standard	**EN 60664-1**	**EN 60664-1**	**EN 50124-1**
Overvoltage category	**II**	**II**	**OV2**
Pollution degree	**2**	**2**	**PD2**
Protection type			
In accordance with the standard	**EN 60529**	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**	**IP20**
Terminals	**IP20**	**IP20**	–
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP51**

Digital input/output (Failsafe)
PSSu E F 4DI

Mechanical data	312200	314200	315200
Material			
Bottom	**PC**	**PC**	**PC**
Front	**PC**	**PC**	**PC**
Coding	**PA**	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Dimensions			
Height	**76 mm**	**76 mm**	**76 mm**
Width	**12,6 mm**	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**	**60,2 mm**
Weight	**35 g**	**37 g**	**36 g**
Mechanical coding			
Type	**D**	**D**	**D**
Colour	**Yellow**	**Yellow**	**Yellow**

Where standards are undated, the 2009-10 latest editions shall apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
1-channel	**PL d**	**Cat. 2**	**SIL CL 2**	**9,10E-09**	**SIL 2**	**7,25E-04**	**20**
2-channel	**PL e**	**Cat. 3**	**SIL CL 3**	**3,10E-09**	**SIL 3**	**1,85E-05**	**20**
2-ch. pulsed	**PL e**	**Cat. 4**	**SIL CL 3**	**3,10E-09**	**SIL 3**	**1,85E-05**	**20**
1-ch., pulsed light barrier	**PL e**	**Cat. 4**	**SIL CL 3**	**2,91E-09**	**SIL 3**	**7,52E-05**	**20**

If the module is operated at an ambient temperature above 60° C, the values stated in the table for PFH_D and PFD will need to be doubled when a safety function is calculated.

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

Digital input/output (Failsafe)
PSSu E F 4DI

Order reference

Product

Product type	Features	Order no.
PSSu E F 4DI	Electronic module, base type	312 200
PSSu E F 4DI-T	Electronic module, T-type	314 200
PSSu E F 4DI-R	Electronic module, R-type	315 200

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623
PSSu BP-C1 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 623

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

Overview

Module features

The product has the following features:

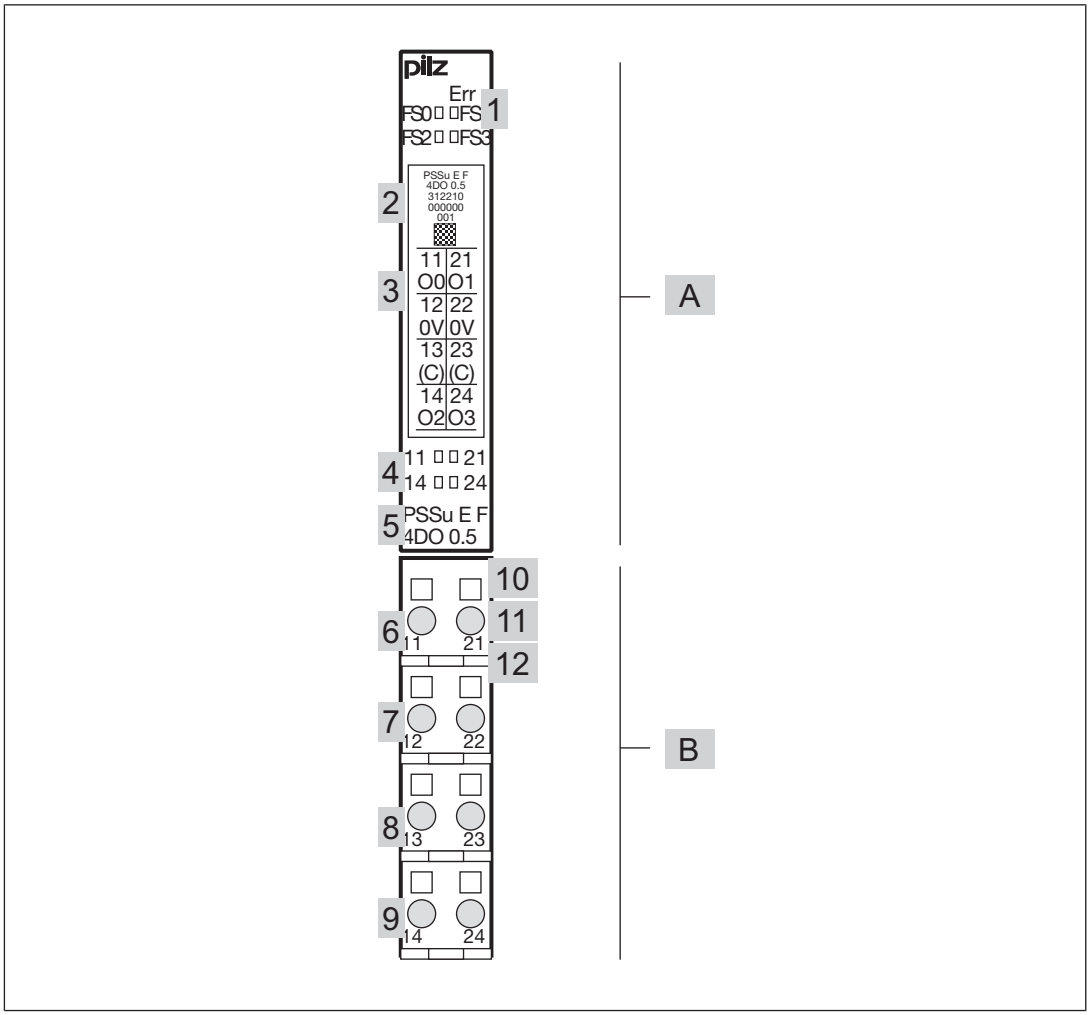
- 4 Digital outputs
  - Semiconductor technology
  - Single-pole
  - Positive-switching
  - Current load capacity per output: 0,5 A
  - Short circuit-proof
  - Overload-proof
  - Free from feedback
- LEDs for:
  - Switch status per output
  - FS enable per output
  - Module error
- For failsafe applications in system environment A and B
- T-type:

  PSSu E F 4DO 0.5-T: for increased environmental requirements
- R-type:

  PSSu E F 4DO 0.5-R: for railway applications

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

Front view



Legend:

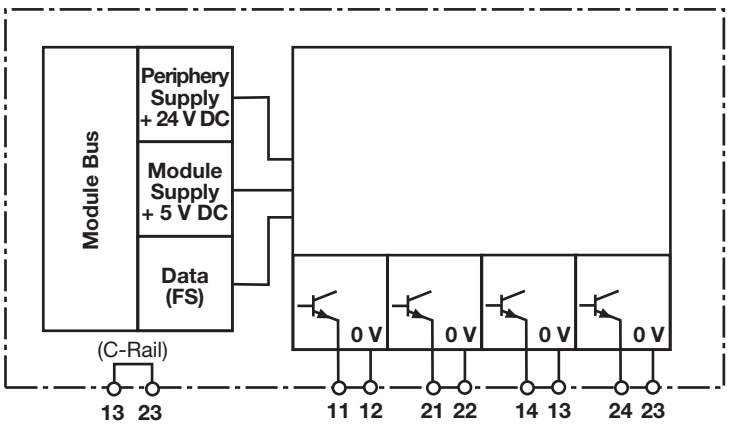
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Displaying an output's FS enable (enable principle)
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module
- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Digital input/output (Failsafe)
PSSu E F 4DO 0.5

Module features

Module supply

- The module supply provides the module with voltage.

Signals at the output

- "0" signal (0 V) at the output:
  - Output is high impedance
  - No current to the load
- "1" signal (+24 V) at the output:
  - Output is low impedance
  - Current is supplied to the load

Periphery supply

- The module routes the periphery supply from the module bus to the base module terminals.
- The periphery supply is used to supply the outputs.

Outputs

- The head module sets the output status via the module bus.
- The max. capacity at an output depends on the load (see characteristic). Connecting a higher capacity may lead to an error.
- Operation with electronic contactors has not been tested and may lead to errors. Please contact our Customer Support team if you are using electronic contactors.

Output test

- Outputs that are switched on are checked via regular off tests.
  - Test pulses for outputs that are switched on: see Technical details"
  - Outputs that are switched on are switched off for the duration of the test pulse.
  - The load must not switch off because of the test.
- Outputs that are switched off are checked via regular on tests.
  - Test pulses for outputs that are switched off: see Technical details"
  - Outputs that are switched off are switched on for the duration of the test pulse.
  - The load must not switch on because of the test.

Excluding individual outputs from the output test:

- If a plant is particularly sensitive to the test pulses, they may be switched off for individual outputs.
- The test must be replaced by other measures, depending on the safety requirement.

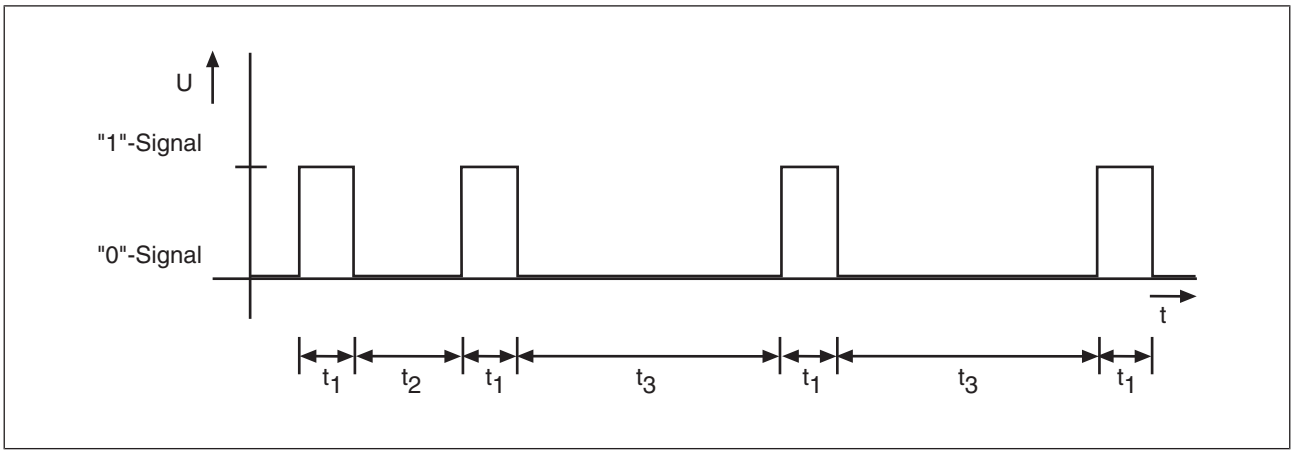
Digital input/output (Failsafe)
PSSu E F 4DO 0.5

- When test pulses are switched off:
  - The correct switch status is always checked.
  - The output's ability to switch will not be detected until the next time the output is switched on/off.

Testing for shorts

- A test is regularly carried out to check for shorts between the outputs.
- For applications in accordance with Category 4, PL e and SIL 3, detection of shorts between contacts must be guaranteed either via the on/off test or through other measures (e.g. asynchronous switching). A short between contacts must be simulated during commissioning.

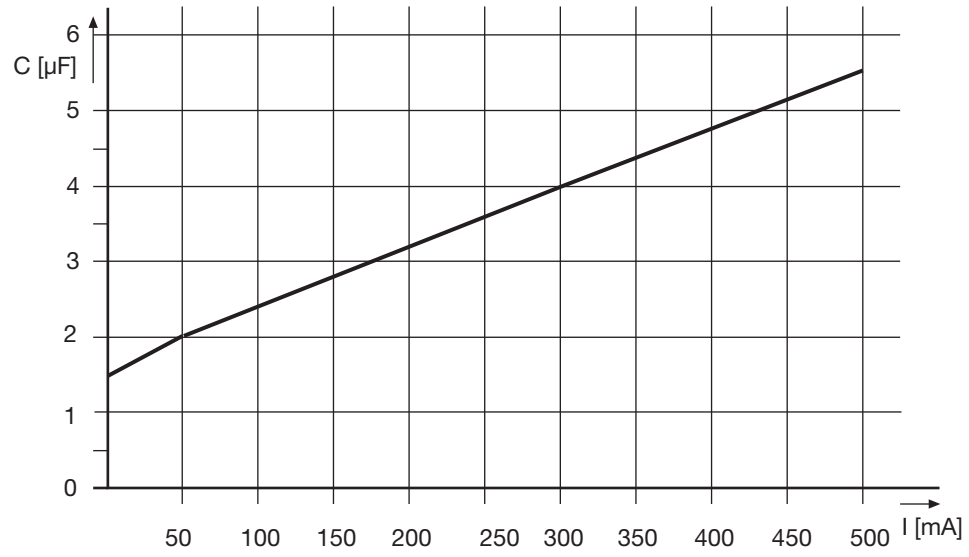
Timing diagram



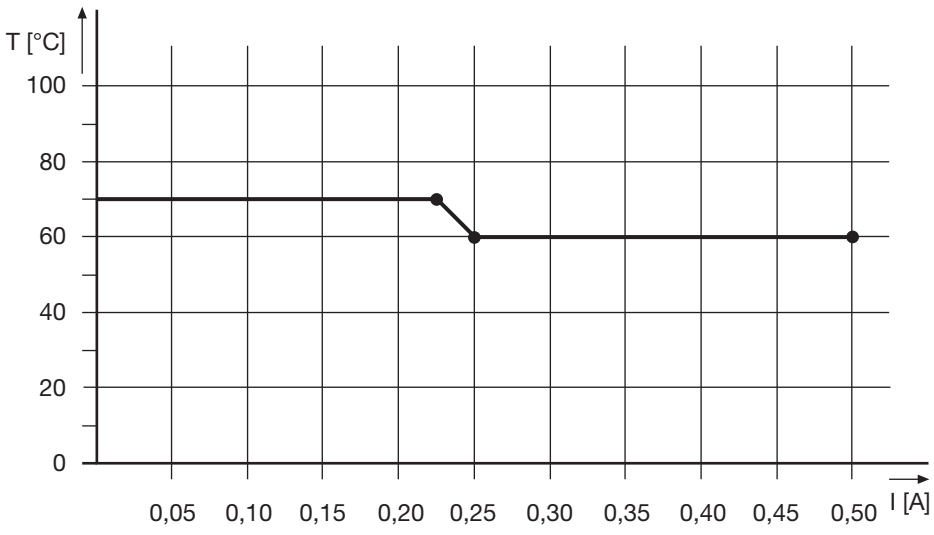
- t_1 Pulse duration on on test (see Technical details)
- t_2 Cycle time of on test when test is repeated (ca. 4 ms)
- t_3 Cycle time of on test in normal circumstances (approx. 5 min.)

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

Characteristic: Output capacitance C dependent on load current I



Derating diagram (PSSu E F 4DO 0.5(-T)(-R)): Permitted ambient temperature T dependent on load current I



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module has the following protection mechanisms:

- Common second shutdown route, tested regularly
- Cyclical output tests

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

- Tests for shorts between the outputs

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- FS communication error
- Bus termination error
- Temperature error: too warm
- Temperature error: too hot
- Output error

Information on the reaction times of the outputs can be found in the PSSuniversal System Description.

Configuration

Functions for the FS outputs of a PSSu are defined in the PSSuniversal Configurator on the PSS WIN-PRO system software:

- Read access through the standard bus system
  (configured per module):
  Configuration "R"
- Read/write access through the standard bus system
  (configured per FS output):
  "&" configuration (local enable principle)
- Optimisation of ST process image by combining adjacent bits of the same type.
  Configuration "*"
- Exclude individual outputs from the output test
  (configured per FS output).

The module occupies 4 consecutive bit addresses in the process image. The process image in which the outputs are shown depends on the configuration.

With write access ("&"), the Bits in the ST-PIO are used to switch the FS outputs with the local enable principle.

Configuration	SafetyBUS p	Standard bus system	
	FS-PIO	ST-PII	ST-PIO
None	4 Bit (e. g.: 32.00 … 32.03)	- - -	- - -
Read ST (“R”)		4 Bit	- - -
ST read and write (“&”)		4 Bit	4 Bit

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

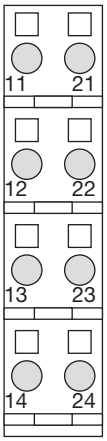
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
O0(11), O1(21), O2(14), O3(24)	FS_O_DO	Data: SAFEBOOL	Output data O0 ... O3

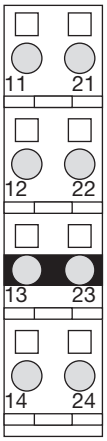
Digital input/output (Failsafe)
PSSu E F 4DO 0.5

Wiring

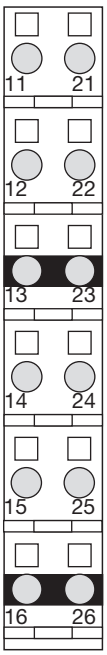
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: 0 V periphery supply (13-23 linked within the base module) 14: Output O2 24: Output O3	

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

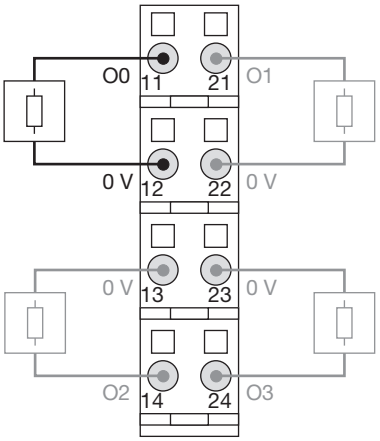
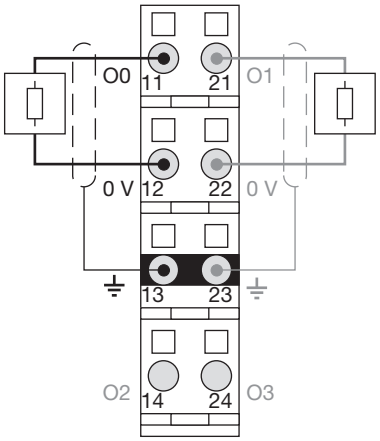
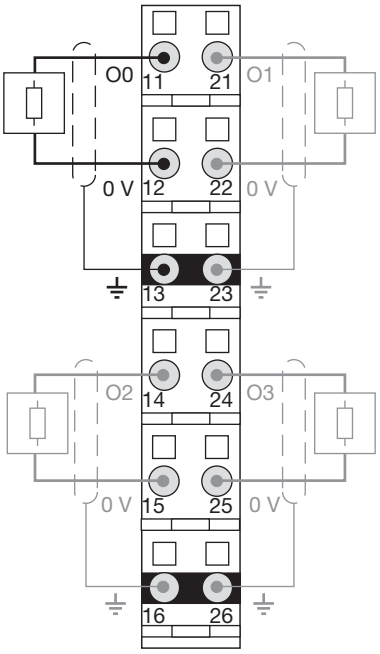
Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: C-rail supply (13-23 linked within the base module) 14: Output O2 24: Output O3	

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

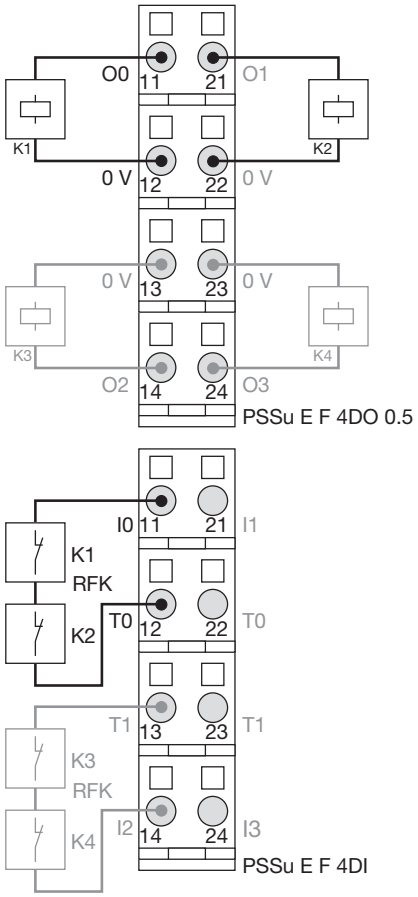
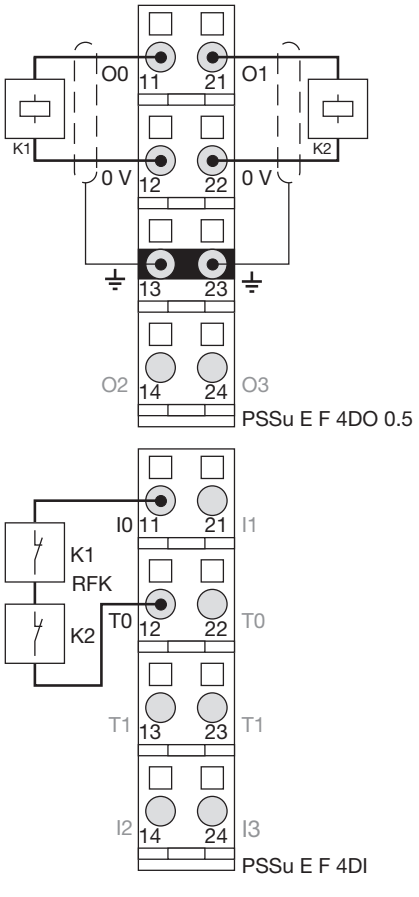
Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12 S PSSu BP-C1 1/12 S-T Cage clamp terminals: PSSu BP-C1 1/12 C PSSu BP-C1 1/12 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: C-rail supply (13-23-16-26 linked within the base module) 14: Output O2 24: Output O3 15-25: 0 V periphery supply (15-25 linked within the base module) 16-26: C-rail supply (13-23-16-26 linked within the base module)	

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

Connecting the module

Output circuit	Without C-rail	With C-rail
Single-channel actuator		
Single-channel actuator		

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

Output circuit	Without C-rail	With C-rail
Dual-channel operation Redundant actuator With feedback loop		

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 a short circuit to a supply voltage.

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

Technical details

General	312210	314210	315210
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, TÜV**
Application range	**Failsafe**	**Failsafe**	**Failsafe**
Module's device code	**0C01h**	**0C01h**	**0C01h**
Number of FS output bits	**4**	**4**	**4**
Application in system environment A			
From FS firmware version, other head modules	**4**	**4**	–
From FS firmware version PSSu H F PN	**1**	**1**	–
Application in system environment B			
From FS firmware version, head modules	**1.0.0**	**1.0.0**	**1.5.0**
Electrical data	**312210**	**314210**	**315210**
Internal supply voltage (module supply)			
Module's power consumption	**0,28 W**	**0,28 W**	**0,28 W**
Periphery's supply voltage (periphery supply)			
Voltage range	**16,8 - 30 V**	**16,8 - 30 V**	**16,8 - 30 V**
Module's current consumption with no load	**37 mA**	**37 mA**	**37 mA**
Module's power consumption with no load	**0,9 W**	**0,9 W**	**0,9 W**
Max. power dissipation of module	**1,5 W**	**1,5 W**	**1,5 W**
Terminal voltage when switching off inductive loads	**U2 - 50 V**	**U2 - 50 V**	**U2 - 50 V**
Permitted loads	**inductive, capacitive, resistive**	**inductive, capacitive, resistive**	**inductive, capacitive, resistive**
Semiconductor outputs	**312210**	**314210**	**315210**
Number of positive-switching single-pole semiconductor outputs	**4**	**4**	**4**
Rated voltage	**24 V DC**	**24 V DC**	**24 V DC**

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

Semiconductor outputs	312210	314210	315210
Typ. output current at "1" signal and rated voltage of semiconductor output	**0,5 A**	**0,5 A**	**0,5 A**
Permitted current range	**0,000 - 0,620 A**	**0,000 - 0,620 A**	**0,000 - 0,620 A**
Residual current at "0" signal	**0,02 mA**	**0,02 mA**	**0,02 mA**
Max. transient pulsed current	**6 A**	**6 A**	**6 A**
Max. internal voltage drop	**300 mV**	**300 mV**	**300 mV**
Monitoring threshold of semiconductor output	**6 V**	**6 V**	**6 V**
Max. duration of on time during self test	**200 µs**	**200 µs**	**200 µs**
Max. duration of off time during self test	**350 µs**	**350 µs**	**350 µs**
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,02 ms**	**0,02 ms**	**0,02 ms**
Max. processing time of semiconductor output when signal changes from "0" to "1"	**0,01 ms**	**0,01 ms**	**0,01 ms**
Potential isolation from system voltage	**yes**	**yes**	**yes**
Short circuit-proof	**yes**	**yes**	**yes**
Environmental data	**312210**	**314210**	**315210**
Application site			
In accordance with the standard	–	–	**EN 50125-3**
Application site	–	–	**Track area (1 m - 3 m)**
In accordance with the standard	–	–	**EN 61373**
Application site	–	–	**Category 1, Class A + B**
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**	**EN 50125-1, EN 50125-3, EN 50155, EN 60068-2-1, EN 60068-2-14, EN 60068-2-2**

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

Environmental data	312210	314210	315210
Ambient temperature			
In accordance with the standard	**EN 60068-2-14**	**EN 60068-2-14**	**EN 50155**
Temperature range	**0 - 60 °C**	**-40 - 70 °C**	**-40 - 70 °C**
In accordance with the standard	–	–	**EN 50125-1**
Temperature range	–	–	**-40 ... +70 °C**
In accordance with the standard	–	–	**EN 50125-3**
Temperature range	–	–	**-40 ... +70 °C**
Storage temperature			
In accordance with the standard	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**	–
Climatic suitability			
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**	–
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	–
Condensation during operation	**Not permitted**	**Short-term**	–
Max. operating height above sea level	**2000 m**	**5000 m**	**2000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 50125-3**
Frequency	**10 - 150 Hz**	**10 - 150 Hz**	**5 - 2000 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	–
Acceleration	**1g**	**1g**	**0,23g**
Broadband noise			
In accordance with the standard	–	**EN 60068-2-64**	**EN 61373**
Frequency	–	**5 - 500 Hz**	**5 - 150 Hz**
Acceleration	–	**1,9grms**	**0,79 g RMS**

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

Environmental data	312210	314210	315210
Shock stress			
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 50125-3**
Number of shocks	**6**	**6**	**20**
Acceleration	**15g**	**15g**	**2g**
Duration	**11 ms**	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 61373**
Number of shocks	**1000**	**1000**	**20**
Acceleration	**10g**	**10g**	**5g**
Duration	**16 ms**	**16 ms**	**30 ms**
Supply interruptions			
In accordance with the standard	–	–	**EN 50155**
Class	–	–	**S2, C1, C2**
Airgap creepage			
In accordance with the standard	**EN 60664-1**	**EN 60664-1**	**EN 50124-1**
Overvoltage category	**II**	**II**	**OV2**
Pollution degree	**2**	**2**	**PD2**
Protection type			
In accordance with the standard	**EN 60529**	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**	**IP20**
Terminals	**IP20**	**IP20**	–
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP51**
Mechanical data	**312210**	**314210**	**315210**
Material			
Bottom	**PC**	**PC**	**PC**
Front	**PC**	**PC**	**PC**
Coding	**PA**	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Dimensions			
Height	**76 mm**	**76 mm**	**76 mm**
Width	**12,6 mm**	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**	**60,2 mm**
Weight	**36 g**	**38 g**	**38 g**
Mechanical coding			
Type	**E**	**E**	**E**
Colour	**Yellow**	**Yellow**	**Yellow**

Where standards are undated, the 2009-10 latest editions shall apply.

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
1-channel	**PL d**	**Cat. 2**	**SIL CL 2**	**9,00E-09**	**SIL 2**	**7,89E-04**	**20**
2-channel	**PL e**	**Cat. 4**	**SIL CL 3**	**1,13E-09**	**SIL 3**	**1,66E-05**	**20**

If the module is operated at an ambient temperature above 60° C, the values stated in the table for PFH_D and PFD will need to be doubled when a safety function is calculated.

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

Order reference

Product

Product type	Features	Order No.
PSSu E F 4DO 0.5	Electronic module, base type	312 210
PSSu E F 4DO 0.5-T	Electronic module, T-type	314 210
PSSu E F 4DO 0.5-R	Electronic module, R-type	315 210

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618

Digital input/output (Failsafe)
PSSu E F 4DO 0.5

Product type	Features	Order No.
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623
PSSu BP-C1 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 623

Digital input/output (Failsafe)
PSSu E F 2DO 2

Overview

Module features

The product has the following features:

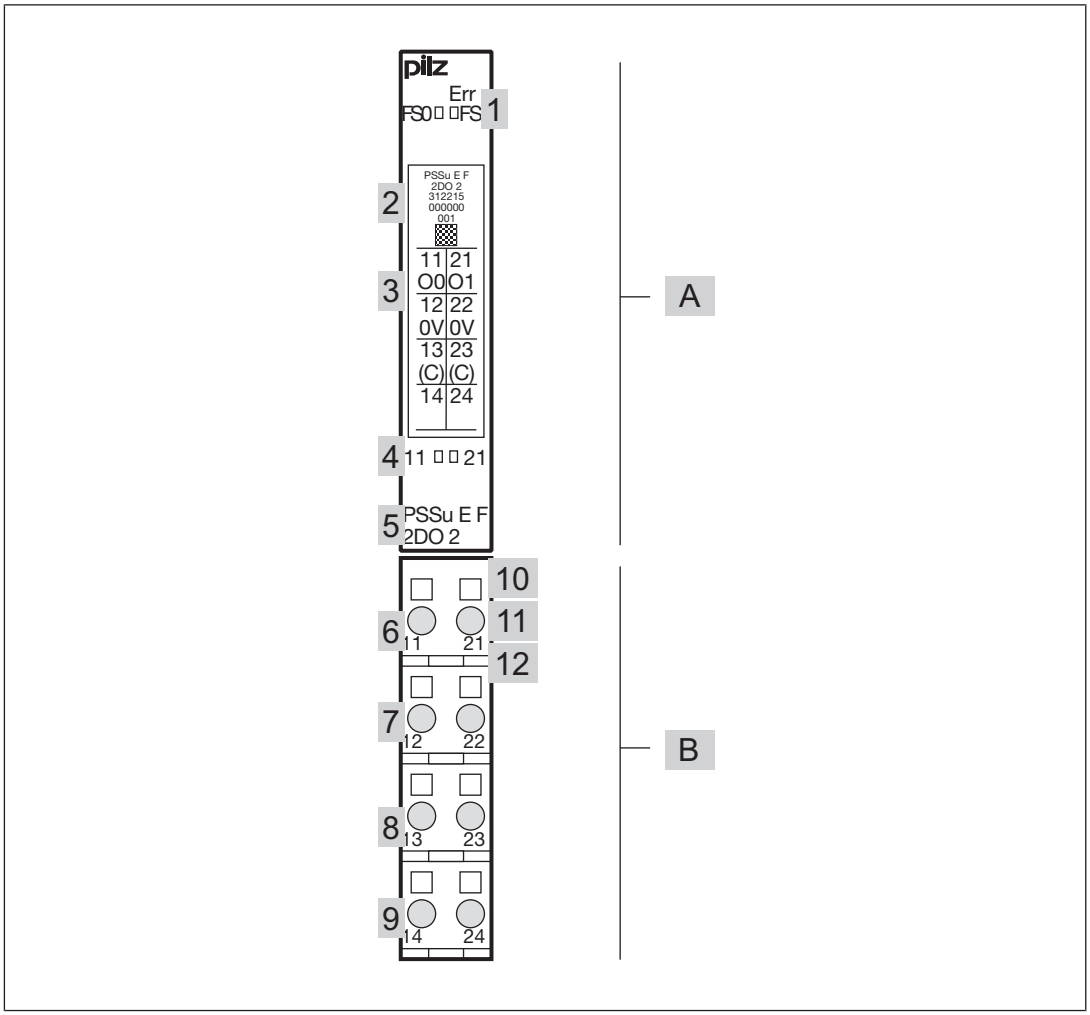
- 2 Digital outputs
  - Semiconductor technology
  - Single-pole
  - Positive-switching
  - Current load capacity per output: 2 A
  - Short circuit-proof
  - Overload-proof
  - Free from feedback
- LEDs for:
  - Switch status per output
  - FS enable per output
  - Module error
- For failsafe applications in system environment A and B
- T-type:

  PSSu E F 2DO 2-T: for increased environmental requirements
- R-type:

  PSSu E F 2DO 2-R: for railway applications

Digital input/output (Failsafe)
PSSu E F 2DO 2

Front view



Legend:

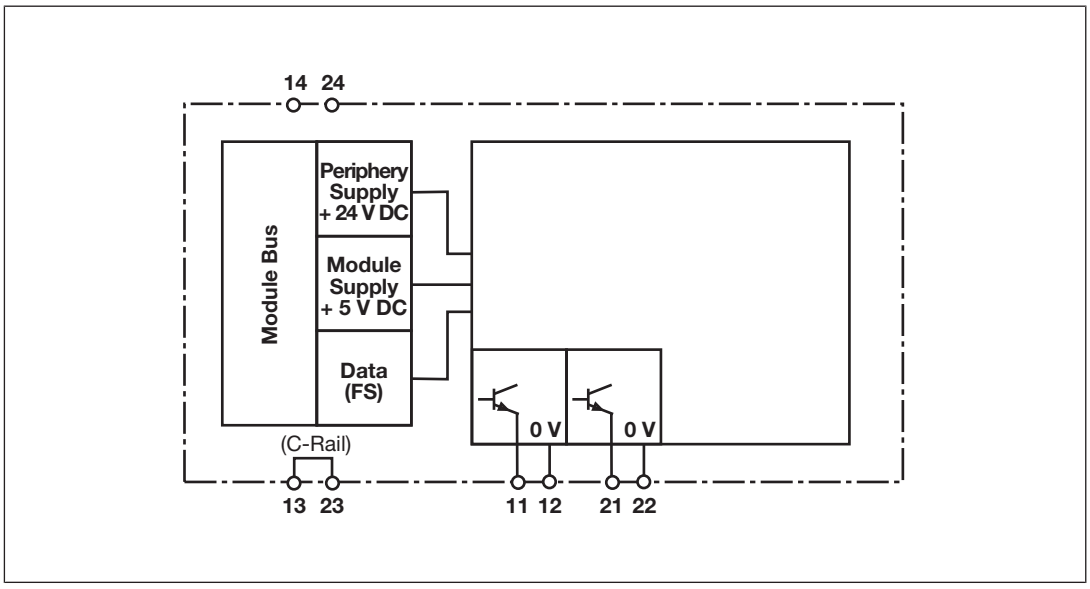
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Displaying an output's FS enable (enable principle)
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Digital input/output (Failsafe)
PSSu E F 2DO 2

- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module
- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Digital input/output (Failsafe)
PSSu E F 2DO 2

Module features

Module supply

- The module supply provides the module with voltage.

Signals at the output

- "0" signal (0 V) at the output:
  - Output is high impedance
  - No current to the load
- "1" signal (+24 V) at the output:
  - Output is low impedance
  - Current is supplied to the load

Periphery supply

- The module routes the periphery supply from the module bus to the base module terminals.
- The periphery supply is used to supply the outputs.

Outputs

- The head module sets the output status via the module bus.
- The max. capacity at an output depends on the load (see characteristic). Connecting a higher capacity may lead to an error.
- Operation with electronic contactors has not been tested and may lead to errors. Please contact our Customer Support team if you are using electronic contactors.

Output test

- Outputs that are switched on are checked via regular off tests.
  - Test pulses for outputs that are switched on: see Technical details"
  - Outputs that are switched on are switched off for the duration of the test pulse.
  - The load must not switch off because of the test.
- Outputs that are switched off are checked via regular on tests.
  - Test pulses for outputs that are switched off: see Technical details"
  - Outputs that are switched off are switched on for the duration of the test pulse.
  - The load must not switch on because of the test.

Excluding individual outputs from the output test:

- If a plant is particularly sensitive to the test pulses, they may be switched off for individual outputs.
- The test must be replaced by other measures, depending on the safety requirement.

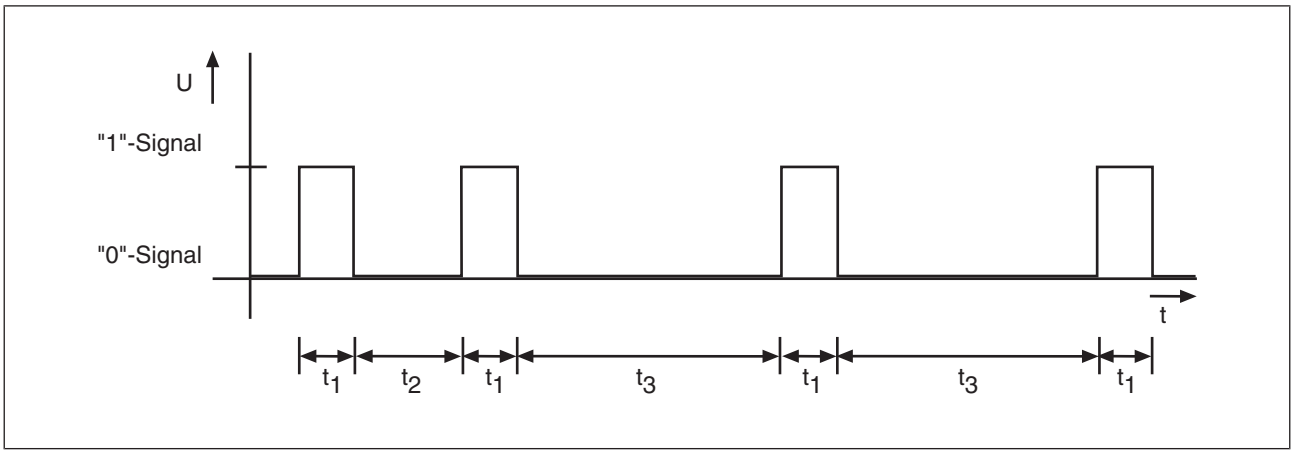
Digital input/output (Failsafe)
PSSu E F 2DO 2

- When test pulses are switched off:
  - The correct switch status is always checked.
  - The output's ability to switch will not be detected until the next time the output is switched on/off.

Testing for shorts

- A test is regularly carried out to check for shorts between the outputs.
- For applications in accordance with Category 4, PL e and SIL 3, detection of shorts between contacts must be guaranteed either via the on/off test or through other measures (e.g. asynchronous switching). A short between contacts must be simulated during commissioning.

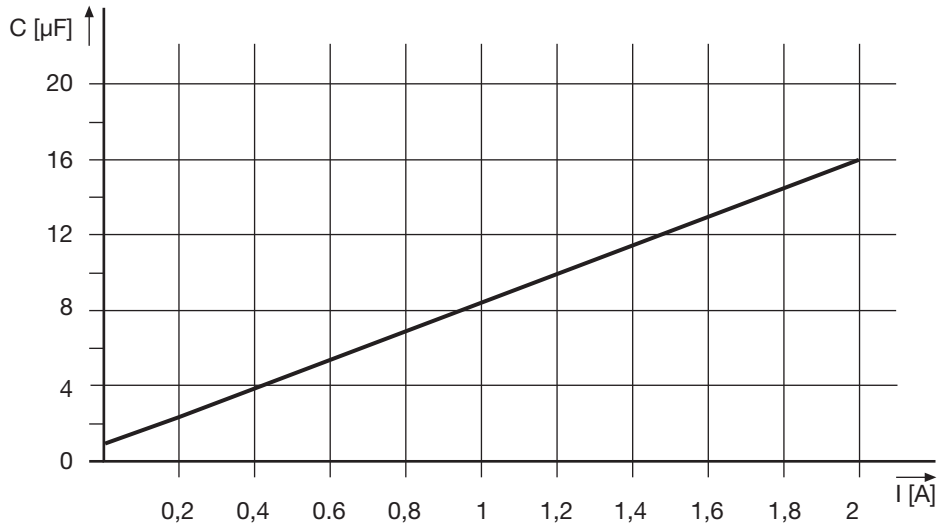
Timing diagram



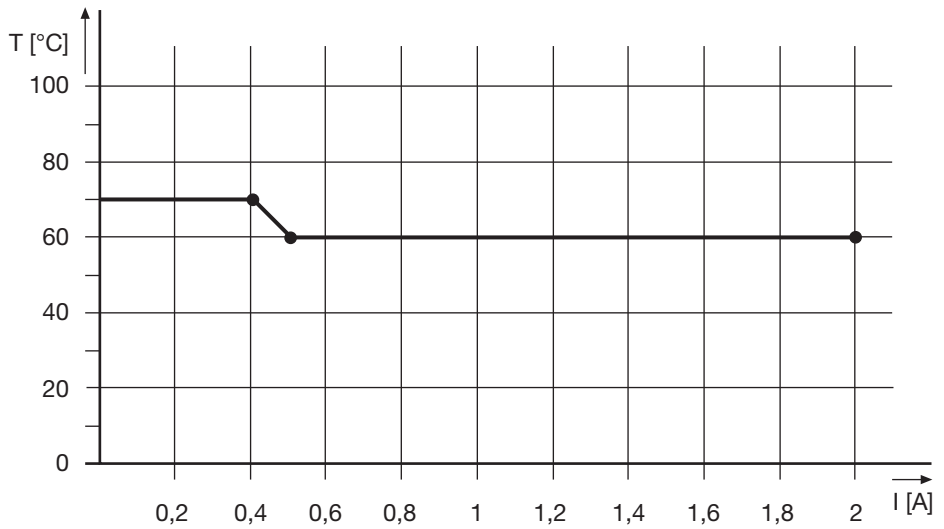
- t_1 Pulse duration on on test (see Technical details)
- t_2 Cycle time of on test when test is repeated (ca. 4 ms)
- t_3 Cycle time of on test in normal circumstances (approx. 5 min.)

Digital input/output (Failsafe)
PSSu E F 2DO 2

Characteristic: Output capacitance C dependent on load current I



Derating diagram (PSSu E F 2DO 2(-T)(-R)): Permitted ambient temperature T dependent on load current I



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module has the following protection mechanisms:

- Common second shutdown route, tested regularly
- Cyclical output tests
- Tests for shorts between the outputs

Digital input/output (Failsafe)
PSSu E F 2DO 2

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- FS communication error
- Bus termination error
- Temperature error: too warm
- Temperature error: too hot
- Output error

Information on the reaction times of the outputs can be found in the PSSuniversal System Description.

Configuration

Functions for the FS outputs of a PSSu are defined in the PSSuniversal Configurator on the PSS WIN-PRO system software:

- Read access through the standard bus system
  (configured per module):
  Configuration "R"
- Read/write access through the standard bus system
  (configured per FS output):
  "&" configuration (local enable principle)
- Optimisation of ST process image by combining adjacent bits of the same type.
  Configuration "*"
- Exclude individual outputs from the output test
  (configured per FS output).

The module occupies 2 consecutive bit addresses in the process image. The process image in which the outputs are shown depends on the configuration.

With write access ("&"), the Bits in the ST-PIO are used to switch the FS outputs with the local enable principle.

Configuration	SafetyBUS p	Standard bus system	
	FS-PIO	ST-PII	ST-PIO
None	2 Bit (e. g.: 32.00 … 32.01)	- - -	- - -
Read ST (“R”)		2 Bit	- - -
ST read and write (“&”)		2 Bit	2 Bit

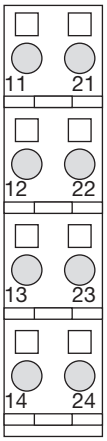
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
O0(11), O1(21)	FS_O_DO	Data: SAFEBOOL	Output data O0, O1

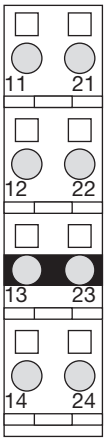
Digital input/output (Failsafe)
PSSu E F 2DO 2

Wiring

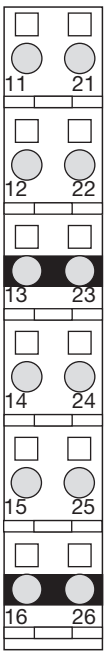
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: 0 V periphery supply (13-23 linked within the base module) 14: Not connected 24: Not connected	

Digital input/output (Failsafe)
PSSu E F 2DO 2

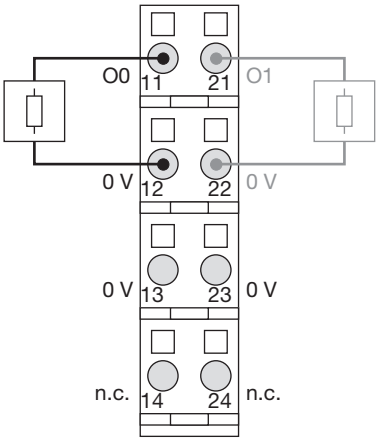
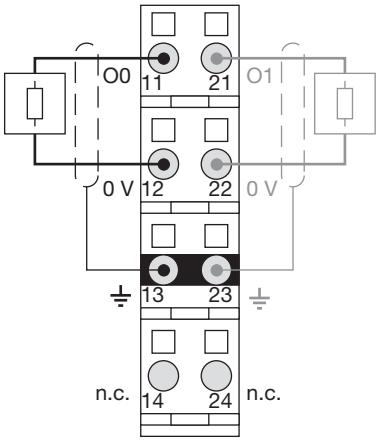
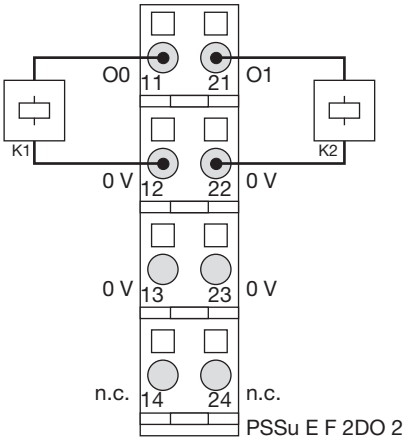
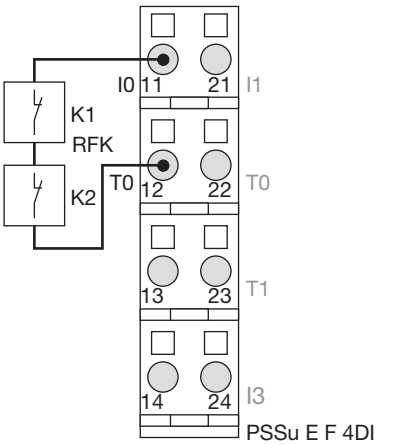
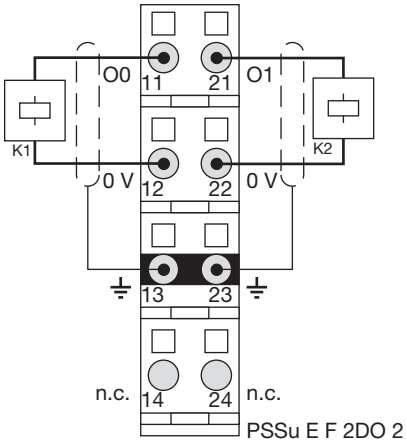
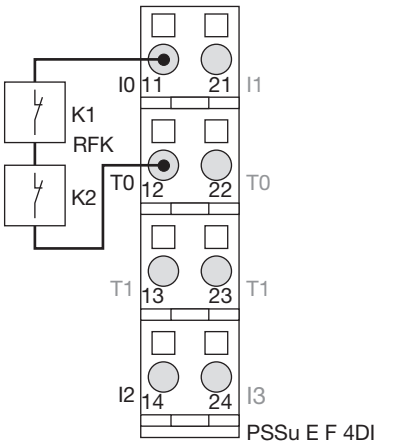
Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: C-rail supply (13-23 linked within the base module) 14: Not connected 24: Not connected	

Digital input/output (Failsafe)
PSSu E F 2DO 2

Base module	Terminal configuration	
Screw terminals: PSSu BP-C1 1/12 S PSSu BP-C1 1/12 S-T Cage clamp terminals: PSSu BP-C1 1/12 C PSSu BP-C1 1/12 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: C-rail supply (13-23-16-26 linked within the base module) 14: Not connected 24: Not connected 15-25: 0 V periphery supply (15-25 linked within the base module) 16-26: C-rail supply (13-23-16-26 linked within the base module)	

Digital input/output (Failsafe)
PSSu E F 2DO 2

Connecting the module

Output circuit	Without C-rail	With C-rail
Single-channel actuator		
Dual-channel operation Redundant actuator With feedback loop	 	 

Digital input/output (Failsafe)
PSSu E F 2DO 2

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 a short circuit to a supply voltage.

Technical details

General	312215	314215	315215
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, TÜV**
Application range	**Failsafe**	**Failsafe**	**Failsafe**
Module's device code	**0C00h**	**0C00h**	**0C00h**
Number of FS output bits	**2**	**2**	**2**
Application in system environment A			
From FS firmware version, other head modules	**4**	**4**	–
From FS firmware version PSSu H F PN	**1**	**1**	–
Application in system environment B			
From FS firmware version, head modules	**1.0.0**	**1.0.0**	**1.5.0**
Electrical data	**312215**	**314215**	**315215**
Internal supply voltage (module supply)			
Module's power consumption	**0,23 W**	**0,23 W**	**0,23 W**
Periphery's supply voltage (periphery supply)			
Voltage range	**16,8 - 30 V**	**16,8 - 30 V**	**16,8 - 30 V**
Module's current consumption with no load	**30 mA**	**30 mA**	**30 mA**
Module's power consumption with no load	**0,72 W**	**0,72 W**	**0,72 W**
Max. power dissipation of module	**1,5 W**	**1,5 W**	**1,5 W**
Terminal voltage when switching off inductive loads	**U2 - 50 V**	**U2 - 50 V**	**U2 - 50 V**
Permitted loads	**inductive, capacitive, resistive**	**inductive, capacitive, resistive**	**inductive, capacitive, resistive**

Digital input/output (Failsafe)
PSSu E F 2DO 2

Semiconductor outputs	312215	314215	315215
Number of positive-switching single-pole semiconductor outputs	**2**	**2**	**2**
Rated voltage	**24 V DC**	**24 V DC**	**24 V DC**
Typ. output current at "1" signal and rated voltage of semiconductor output	**2 A**	**2 A**	**2 A**
Permitted current range	**0,000 - 2,500 A**	**0,000 - 2,500 A**	**0,000 - 2,500 A**
Residual current at "0" signal	**0,02 mA**	**0,02 mA**	**0,02 mA**
Max. transient pulsed current	**12 A**	**12 A**	**12 A**
Max. internal voltage drop	**250 mV**	**250 mV**	**250 mV**
Monitoring threshold of semiconductor output	**6 V**	**6 V**	**6 V**
Max. duration of on time during self test	**200 µs**	**200 µs**	**200 µs**
Max. duration of off time during self test	**350 µs**	**350 µs**	**350 µs**
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,02 ms**	**0,02 ms**	**0,02 ms**
Max. processing time of semiconductor output when signal changes from "0" to "1"	**0,01 ms**	**0,01 ms**	**0,01 ms**
Potential isolation from system voltage	**yes**	**yes**	**yes**
Short circuit-proof	**yes**	**yes**	**yes**
Environmental data	**312215**	**314215**	**315215**
Application site			
In accordance with the standard	–	–	**EN 50125-3**
Application site	–	–	**Track area (1 m - 3 m)**
In accordance with the standard	–	–	**EN 61373**
Application site	–	–	**Category 1, Class A + B**
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**	**EN 50125-1, EN 50125-3, EN 50155, EN 60068-2-1, EN 60068-2-14, EN 60068-2-2**

Digital input/output (Failsafe)
PSSu E F 2DO 2

Environmental data	312215	314215	315215
Ambient temperature			
In accordance with the standard	**EN 60068-2-14**	**EN 60068-2-14**	**EN 50155**
Temperature range	**0 - 60 °C**	**-40 - 70 °C**	**-40 - 70 °C**
In accordance with the standard	–	–	**EN 50125-1**
Temperature range	–	–	**-40 ... +70 °C**
In accordance with the standard	–	–	**EN 50125-3**
Temperature range	–	–	**-40 ... +70 °C**
Storage temperature			
In accordance with the standard	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**	–
Climatic suitability			
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**	–
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	–
Condensation during operation	**Not permitted**	**Short-term**	–
Max. operating height above sea level	**2000 m**	**5000 m**	**2000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 50125-3**
Frequency	**10 - 150 Hz**	**10 - 150 Hz**	**5 - 2000 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	–
Acceleration	**1g**	**1g**	**0,23g**
Broadband noise			
In accordance with the standard	–	**EN 60068-2-64**	**EN 61373**
Frequency	–	**5 - 500 Hz**	**5 - 150 Hz**
Acceleration	–	**1,9grms**	**0,79 g RMS**

Digital input/output (Failsafe)
PSSu E F 2DO 2

Environmental data	312215	314215	315215
Shock stress			
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 50125-3**
Number of shocks	**6**	**6**	**20**
Acceleration	**15g**	**15g**	**2g**
Duration	**11 ms**	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 61373**
Number of shocks	**1000**	**1000**	**20**
Acceleration	**10g**	**10g**	**5g**
Duration	**16 ms**	**16 ms**	**30 ms**
Supply interruptions			
In accordance with the standard	–	–	**EN 50155**
Class	–	–	**S2, C1, C2**
Airgap creepage			
In accordance with the standard	**EN 60664-1**	**EN 60664-1**	**EN 50124-1**
Overvoltage category	**II**	**II**	**OV2**
Pollution degree	**2**	**2**	**PD2**
Protection type			
In accordance with the standard	**EN 60529**	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**	**IP20**
Terminals	**IP20**	**IP20**	–
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP51**
Mechanical data	**312215**	**314215**	**315215**
Material			
Bottom	**PC**	**PC**	**PC**
Front	**PC**	**PC**	**PC**
Coding	**PA**	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Dimensions			
Height	**76 mm**	**76 mm**	**76 mm**
Width	**12,6 mm**	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**	**60,2 mm**
Weight	**35 g**	**36 g**	**36 g**
Mechanical coding			
Type	**F**	**F**	**F**
Colour	**Yellow**	**Yellow**	**Yellow**

Where standards are undated, the 2009-10 latest editions shall apply.

Digital input/output (Failsafe)
PSSu E F 2DO 2

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
1-channel	**PL d**	**Cat. 2**	**SIL CL 2**	**9,00E-09**	**SIL 2**	**7,89E-04**	**20**
2-channel	**PL e**	**Cat. 4**	**SIL CL 3**	**1,13E-09**	**SIL 3**	**1,66E-05**	**20**

If the module is operated at an ambient temperature above 60° C, the values stated in the table for PFH_D and PFD will need to be doubled when a safety function is calculated.

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

Order reference

Product

Product type	Features	Order No.
PSSu E F 2DO 2	Electronic module, base type	312 215
PSSu E F 2DO 2-T	Electronic module, T-type	314 215
PSSu E F 2DO 2-R	Electronic module, R-type	315 215

Accessories

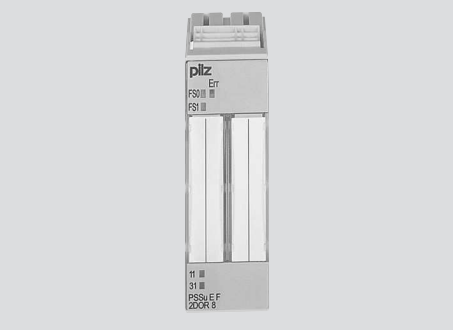
Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618

Digital input/output (Failsafe)
PSSu E F 2DO 2

Product type	Features	Order No.
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623
PSSu BP-C1 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 623

Digital input/output (Failsafe)
PSSu E F 2DOR 8



Overview

Module features

The product has the following features:

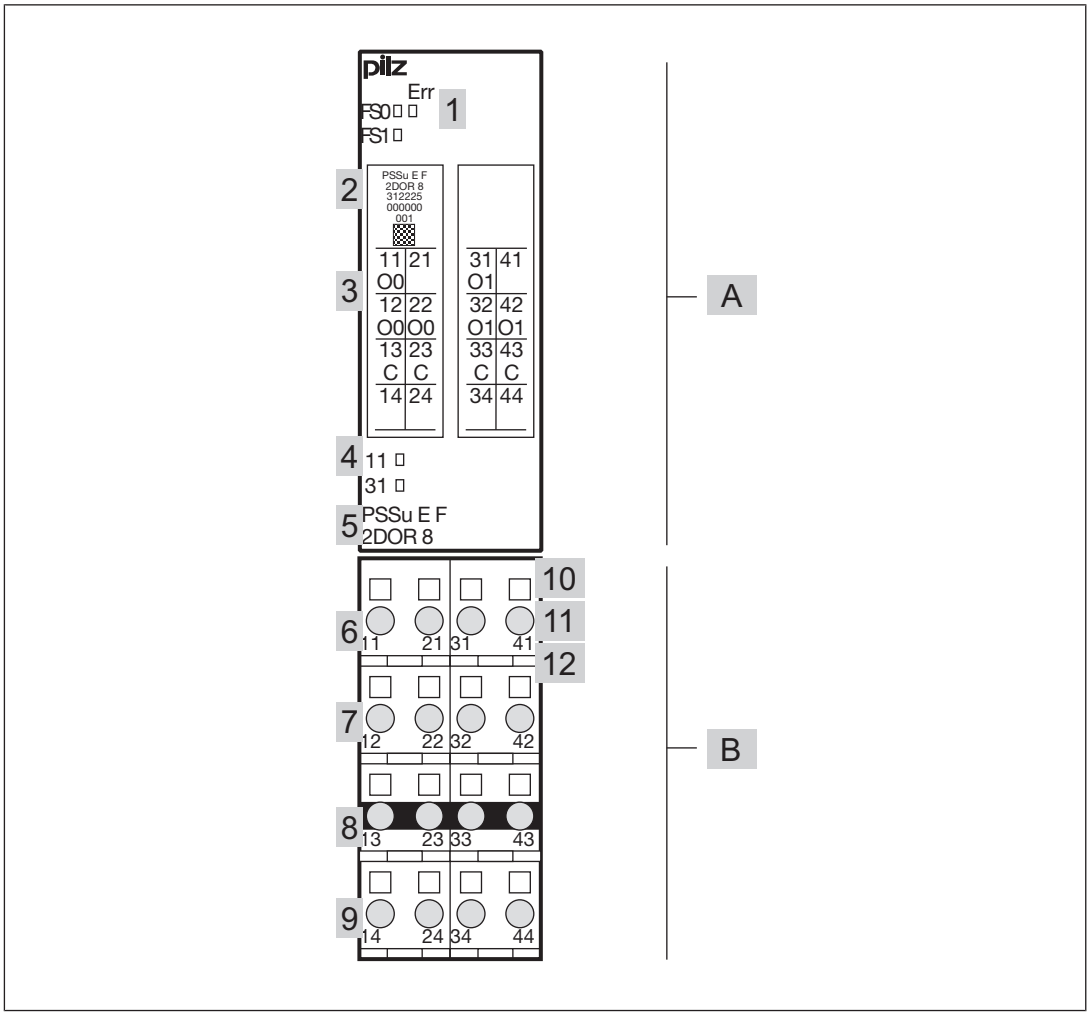
- Relay contacts
  - N/O contact
  - Volt-free
  - Current load capacity per output: 8 A
- LEDs for:
  - Switch status of each output
  - Module error
- For failsafe applications in system environment A and B
- T-type:

  PSSu E F 2DOR 8-T: for increased environmental requirements
- R-type:

  PSSu E F 2DOR 8-R: for railway applications

Digital input/output (Failsafe)
PSSu E F 2DOR 8

Front view



Legend:

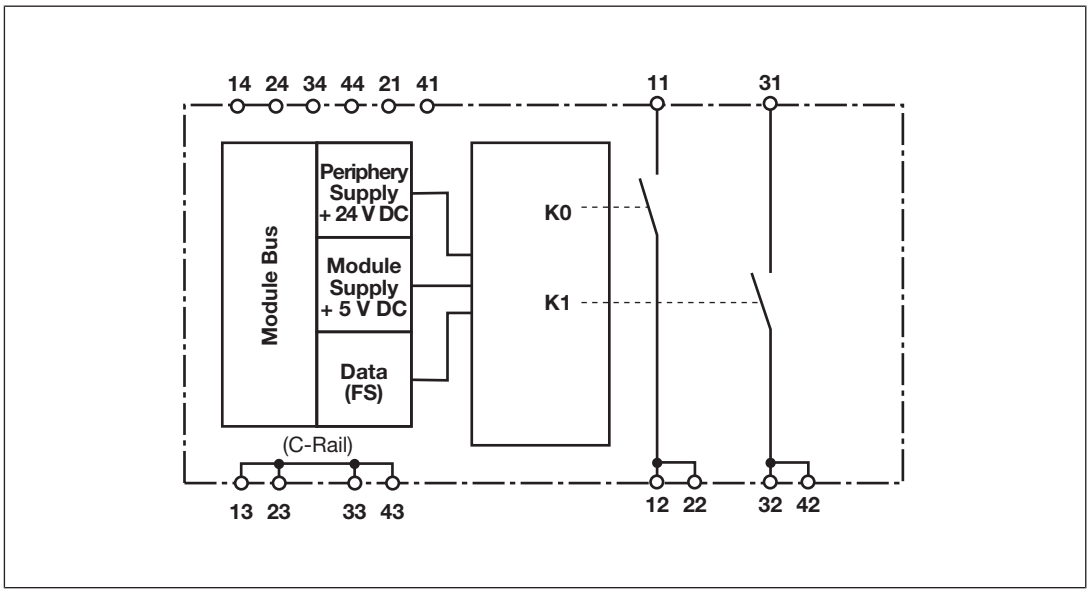
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Displaying an output's FS enable (enable principle)
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Digital input/output (Failsafe)
PSSu E F 2DOR 8

- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module
- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Digital input/output (Failsafe)
PSSu E F 2DOR 8

Module features

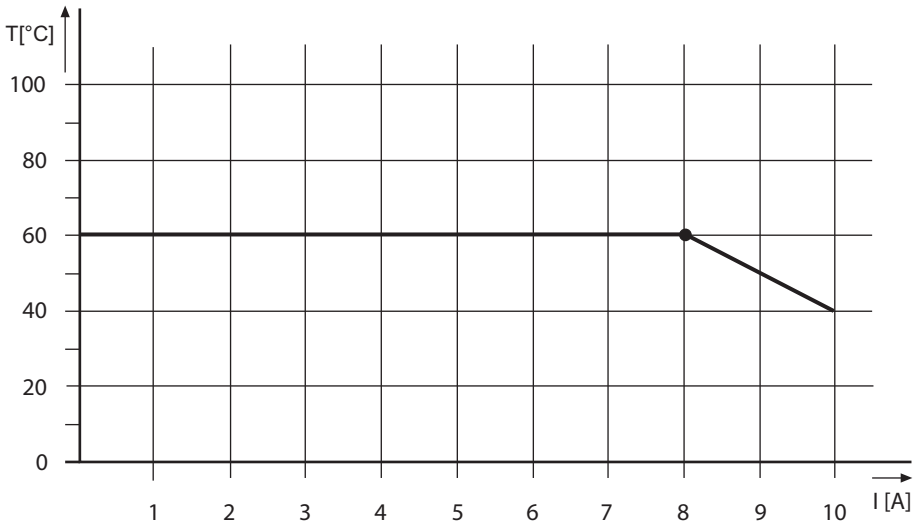
Module supply

- The module supply provides the module with voltage.

Outputs

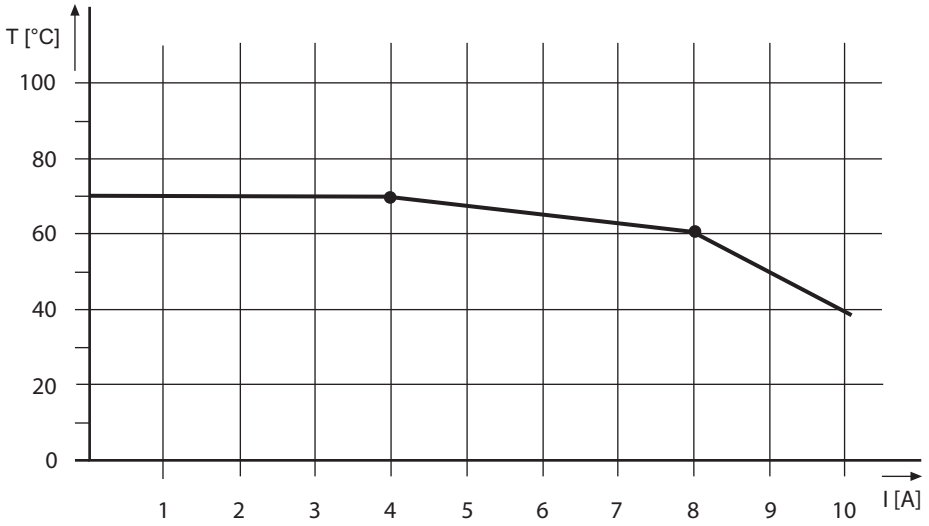
- The head module sets the output status via the module bus.
- The relationship between the load current and the operating temperature is illustrated in the following derating diagram. The operating point should be below the characteristic curve.

PSSu E F 2DOR 8: Derating diagram for the permitted ambient temperature T dependent on load current I



Digital input/output (Failsafe)
PSSu E F 2DOR 8

PSSu E F 2DOR 8(-T)(-R): Derating diagram for the permitted ambient temperature T dependent on load current I



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module has the following protection mechanisms:

- 1 monitored relay contact per output
- Protective separation between both relay contacts (see Technical details)
- Protective separation between both relay contacts and the periphery supply as well as the module supply, in accordance with DIN VDE 0110 overvoltage category 2 in a protected industrial network
- Temperature monitoring

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- FS communication error
- Bus termination error
- Temperature error: Too warm
- Temperature error: Too hot
- Relay control error
- Relay error

Information on the reaction times of the outputs can be found in the PSSuniversal System Description.

Digital input/output (Failsafe)
PSSu E F 2DOR 8

Configuration

Functions for the FS outputs of a PSSu are defined in the PSSuniversal Configurator on the PSS WIN-PRO system software:

- Read access through the standard bus system
  (configured per module):
  “R” configuration
- Read/write access through the standard bus system
  (configured per FS output):
  "&" configuration (local enable principle)
- Optimisation of ST process image by combining adjacent bits of the same type.
  “*” configuration

Further information on configuration is available in the PSSuniversal Configurator's online help.

The module occupies 2 consecutive bit addresses in the process image. The process image in which the outputs are shown depends on the configuration.

With write access ("&"), the Bits in the ST-PIO are used to switch the FS outputs with the local enable principle.

Configuration	SafetyBUS p	Standard bus system	
	FS-PIO	ST-PII	ST-PIO
None	2 Bit (e. g.: 32.00 … 32.01)	- - -	- - -
Read ST (“R”)		2 Bit	- - -
ST read and write (“&”)		2 Bit	2 Bit

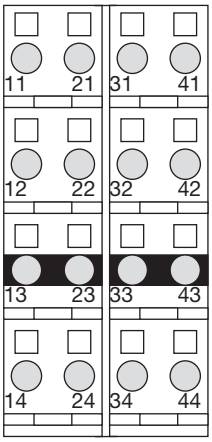
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
O0(11,21)	FS_O_DO	Data: SAFEBOOL	Output data O0
O1(31,32)	FS_O_DO	Data: SAFEBOOL	Output data O1

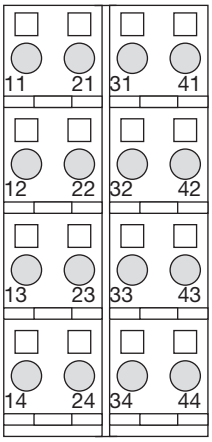
Digital input/output (Failsafe)
PSSu E F 2DOR 8

Wiring

Terminal configuration

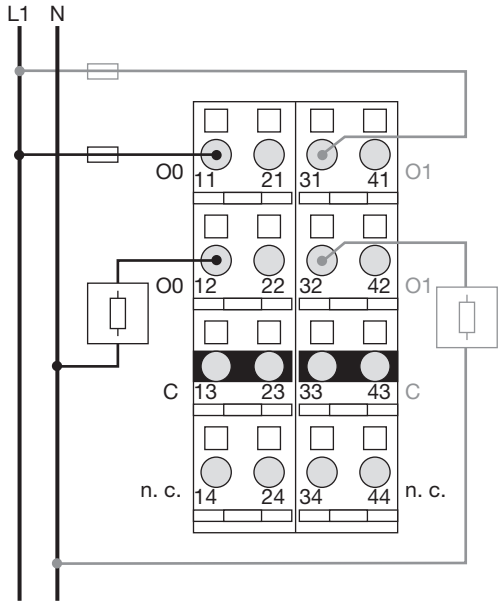
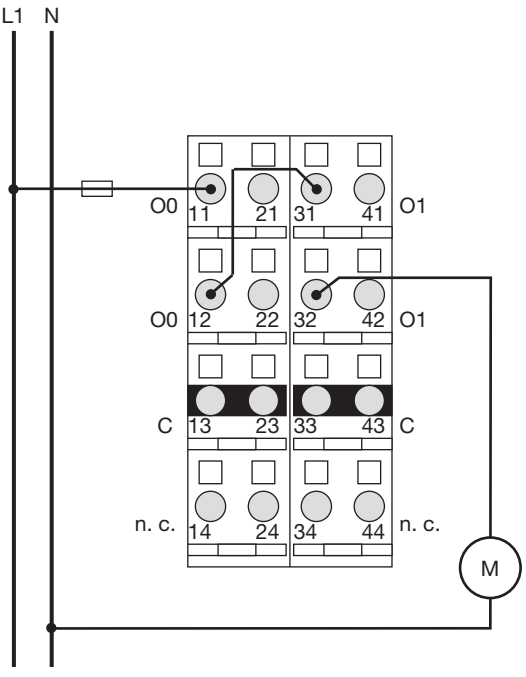
Base module	Terminal configuration	
With C-rail	11: Output O0 Relay contact 1 21: Not assigned 12-22: Output O0 Relay contact 2 (12-22 linked within the base module) 13-23: C-rail supply (13-23-33-43 linked within the base module) 14-24: Not assigned 31: Output O1 Relay contact 1 41: Not assigned 32-42: Output O1 Relay contact 2 (32-42 linked within the base module) 34-44: Not assigned	

Digital input/output (Failsafe)
PSSu E F 2DOR 8

Base module	Terminal configuration	
Without C-rail	11: Output O0 Relay contact 1 21: Not assigned 12-22: Output O0 Relay contact 2 (12-22 linked within the base module) 14-24: Not assigned 31: Output O1 Relay contact 1 41: Not assigned 32-42: Output O1 Relay contact 2 (32-42 linked within the base module) 34-44: Not assigned	

Digital input/output (Failsafe)
PSSu E F 2DOR 8

Connecting the module

Output circuit	With C-rail
Single-channel actuator Switches 230 VAC	
Dual-channel actuator Switches 230 VAC	

Digital input/output (Failsafe)
PSSu E F 2DOR 8

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 a short circuit to a supply voltage.

Technical details

General	312225	314225	315225
Approvals	CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CE, TÜV
Application range	Failsafe	Failsafe	Failsafe
Module's device code	0C03h	0C03h	0C03h
Number of FS output bits	2	2	2
Application in system environment A			
From FS firmware version, other head modules	4	4	–
From FS firmware version PSSu H F PN	1	1	–
Application in system environment B			
From FS firmware version, head modules	1.0.0	1.0.0	1.5.0
Electrical data	**312225**	**314225**	**315225**
Internal supply voltage (module supply)			
Module's power consumption	0,2 W	0,2 W	0,2 W
Periphery's supply voltage (periphery supply)			
Voltage range	16,8 - 30 V	16,8 - 30 V	16,8 - 30 V
Module's current consumption with no load	60 mA	60 mA	60 mA
Module's power consumption with no load	1,5 W	1,5 W	1,5 W
Max. power dissipation of module	2,5 W	2,5 W	2,5 W
Max. inrush current at UB	1 A	1 A	1 A
Permitted loads	inductive, resistive	inductive, resistive	inductive, resistive
Relay outputs	**312225**	**314225**	**315225**
Number of relay outputs	2	2	2

Digital input/output (Failsafe)
PSSu E F 2DOR 8

Relay outputs	312225	314225	315225
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**250 V**	**250 V**	**250 V**
Min. current	**10 mA**	**10 mA**	**10 mA**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
AC1 with condensation at	–	**30 V**	**30 V**
Min. current	–	**10 mA**	**10 mA**
Max. current	–	**8 A**	**8 A**
Max. power	–	**240 VA**	**240 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**10 mA**	**10 mA**	**10 mA**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**192 W**	**192 W**	**192 W**
DC1 at	–	–	**60 V**
Min. current	–	–	**10 mA**
Max. current	–	–	**1,66 A**
Max. power	–	–	**100 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**3 A**	**3 A**	**3 A**
AC15 with condensation at	–	**30 V**	**30 V**
Max. current	–	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 at	–	–	**60 V**
Max. current	–	–	**0,7 A**

Digital input/output (Failsafe)
PSSu E F 2DOR 8

Relay outputs	312225	314225	315225
Utilisation category in accordance with UL			
Voltage	**250 V AC G.U. (same polarity)**	**250 V AC G.U. (same polarity)**	–
With current	**3 A**	**3 A**	–
Voltage	**24 V DC G. P.**	**24 V DC G. P.**	–
With current	**3 A**	**3 A**	–
Pilot Duty	**B300, R300**	**B300, R300**	–
External contact fuse protection, safety contacts			
In accordance with the standard	**VDE 0660**	**VDE 0660**	**VDE 0660**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Max. processing time for relay output tProcOM when signal changes from "1" to "0"	**120 ms**	**120 ms**	**120 ms**
Typ. processing time of relay output tProcOM when signal changes from "0" to "1"	**20 - 60 ms**	**20 - 60 ms**	**20 - 60 ms**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Potential isolation between relay contact and module supply	**4900 V (prot. separation)**	**4900 V (prot. separation)**	**4900 V (prot. separation)**
Potential isolation between relay contact and periphery supply	**4900 V (prot. separation)**	**4900 V (prot. separation)**	**4900 V (prot. separation)**
Potential isolation between relay contact and C-rail	**3050 V (basic insulation)**	**3050 V (basic insulation)**	**3050 V (basic insulation)**
Potential isolation between relay contact 1 and relay contact 2	**4900 V (prot. separation)**	**4900 V (prot. separation)**	**4900 V (prot. separation)**
Environmental data	**312225**	**314225**	**315225**
Application site			
In accordance with the standard	–	–	**EN 50125-3**
Application site	–	–	**Track area (1 m - 3 m)**
In accordance with the standard	–	–	**EN 61373**
Application site	–	–	**Category 1, Class A + B**

Digital input/output (Failsafe)
PSSu E F 2DOR 8

Environmental data	312225	314225	315225
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**	**EN 50125-1, EN 50125-3, EN 50155, EN 60068-2-1, EN 60068-2-14, EN 60068-2-2**
Ambient temperature			
In accordance with the standard	**EN 60068-2-14**	**EN 60068-2-14**	**EN 50155**
Temperature range	**0 - 60 °C**	**-40 - 70 °C**	**-40 - 70 °C**
Max. temperature in accordance with UL	**60 °C**	**60 °C**	–
In accordance with the standard	–	–	**EN 50125-1**
Temperature range	–	–	**-40 ... +70 °C**
In accordance with the standard	–	–	**EN 50125-3**
Temperature range	–	–	**-40 ... +70 °C**
Storage temperature			
In accordance with the standard	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**	–
Climatic suitability			
In accordance with the standard	**EN 60068-2-78**	**EN 60068-2-78**	–
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	–
Condensation during operation	**Not permitted**	**Short-term (only with separated extra low voltage)**	**Short-term (only with separated extra low voltage)**
Max. operating height above sea level	**2000 m**	**2000 m**	**2000 m**
Max. operating height above sea level in accordance with EN 81-1, EN 81-2 and EN 115-1	**2000 m**	**2000 m**	–
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 50125-3**
Frequency	**10 - 150 Hz**	**10 - 150 Hz**	**5 - 2000 Hz**
Acceleration	**1g**	**1g**	**0,23g**

Digital input/output (Failsafe)
PSSu E F 2DOR 8

Environmental data	312225	314225	315225
Broadband noise			
In accordance with the standard	–	**EN 60068-2-64**	**EN 61373**
Frequency	–	**5 - 500 Hz**	**5 - 150 Hz**
Acceleration	–	**1,9grms**	**0,79 g RMS**
Shock stress			
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 50125-3**
Number of shocks	**6**	**6**	**20**
Acceleration	**15g**	**15g**	**2g**
Duration	**11 ms**	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 61373**
Number of shocks	**1000**	**1000**	**20**
Acceleration	**10g**	**10g**	**5g**
Duration	**16 ms**	**16 ms**	**30 ms**
Supply interruptions			
In accordance with the standard	–	–	**EN 50155**
Class	–	–	**S2, C1, C2**
Airgap creepage			
In accordance with the standard	**EN 60664-1**	**EN 60664-1**	**EN 50124-1**
Overvoltage category	**III**	**III**	**OV2**
Pollution degree	**2**	**2**	**PD2**
Protection type			
In accordance with the standard	**EN 60529**	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**	**IP20**
Terminals	**IP20**	**IP20**	–
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP51**
Mechanical data	**312225**	**314225**	**315225**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**
Material			
Bottom	**PC**	**PC**	**PC**
Front	**PC**	**PC**	**PC**
Coding	**PA**	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**	**plug-in**

Digital input/output (Failsafe)
PSSu E F 2DOR 8

Mechanical data	312225	314225	315225
Dimensions			
Height	**76 mm**	**76 mm**	**76 mm**
Width	**25,2 mm**	**25,2 mm**	**25,2 mm**
Depth	**60,2 mm**	**60,2 mm**	**60,2 mm**
Weight	**90 g**	**91 g**	**93 g**
Mechanical coding			
Type	**H**	**H**	**H**
Colour	**Yellow**	**Yellow**	**Yellow**

Where standards are undated, the 2009-10 latest editions shall apply.

Further information about the switching capability is available in the service life graphs.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
1-channel	**PL c**	**Cat. 1**	**-**	**7,60E-08**	**-**	**6,66E-03**	**20**
2-channel	**PL e**	**Cat. 4**	**SIL CL 3**	**7,78E-10**	**SIL 3**	**1,34E-06**	**20**

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

The PFH value depends on the switching frequency and the load on the relay output.
If the service life graphs are not accessible, the stated PFH value can be used irrespective of the switching 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.

Digital input/output (Failsafe)
PSSu E F 2DOR 8

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.

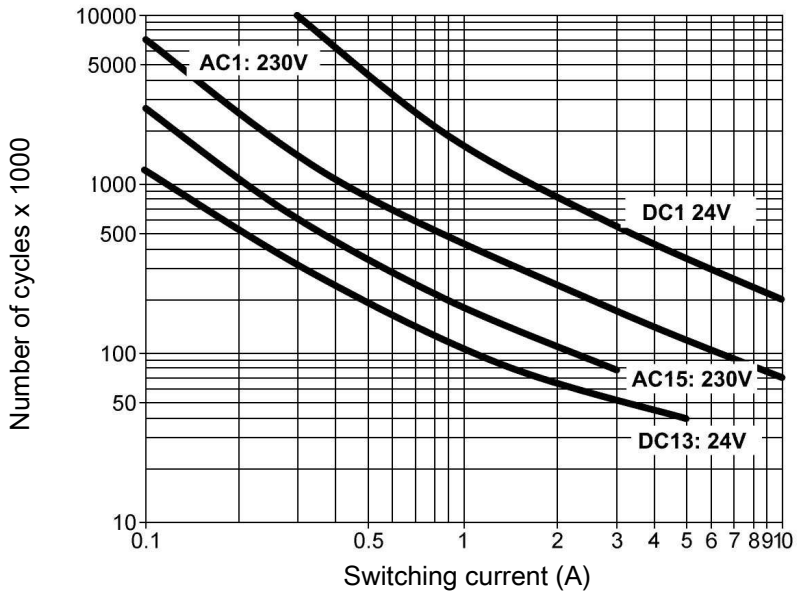


Fig.: Service life graph / Switching capability 24 VDC / 250 VAC

Digital input/output (Failsafe)
PSSu E F 2DOR 8

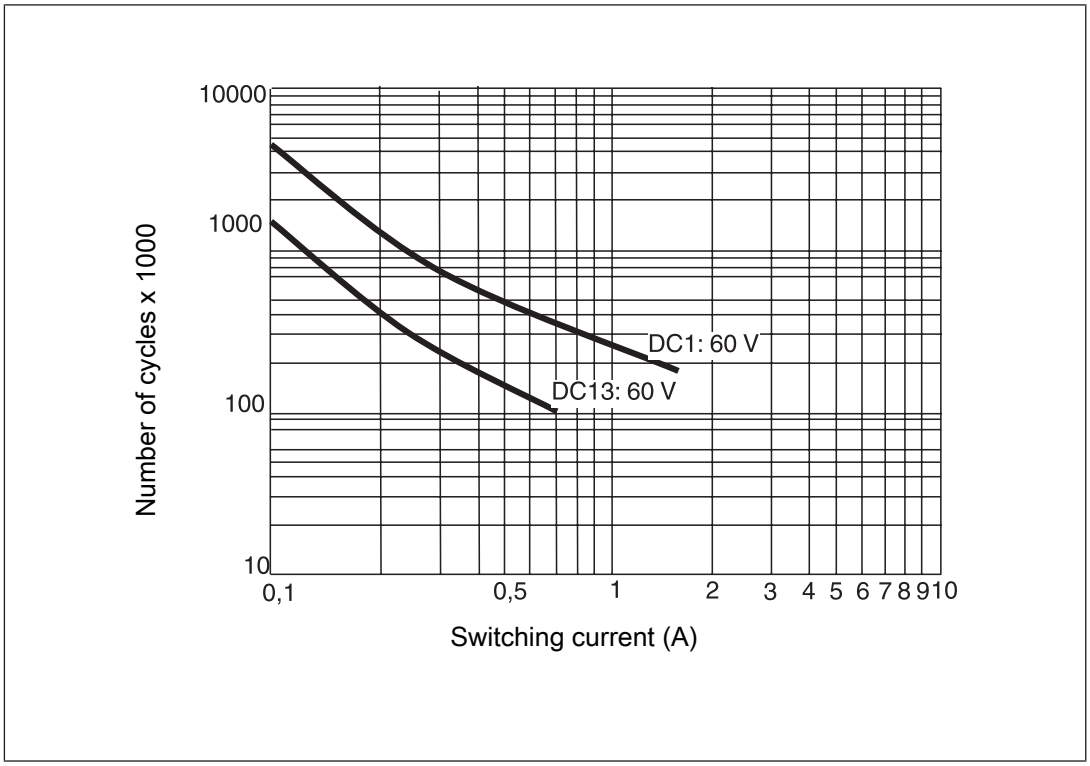


Fig.: Service life graph / Switching capability 60 VDC

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 [602]) 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.

Digital input/output (Failsafe)
PSSu E F 2DOR 8

Order reference

Product

Product type	Features	Order no.
PSSu E F 2DOR 8	Electronic module, base type	312 225
PSSu E F 2DOR 8-T	Electronic module, T-type	314 225
PSSu E F 2DOR 8-R	Electronic module, R-type	315 225

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 2/16 S	Base module without C-rail with screw terminals	312 628
PSSu BP 2/16 S-T	Base module without C-rail with screw terminals, T-type	314 628
PSSu BP 2/16 C	Base module without C-rail with cage clamp terminals	312 629
PSSu BP 2/16 C-T	Base module without C-rail with cage clamp terminals, T-type	314 629
PSSu BP-C 2/16 S	Base module with C-rail and screw terminals	312 630
PSSu BP-C 2/16 S-T	Base module with C-rail and screw terminals, T-type	314 630
PSSu BP-C 2/16 C	Base module with C-rail and cage clamp terminals	312 631
PSSu BP-C 2/16 C-T	Base module with C-rail and cage clamp terminals, T-type	314 631

Digital input/output (Failsafe)
PSSu E F DI OZ 2

Overview

Module features

The product has the following features:

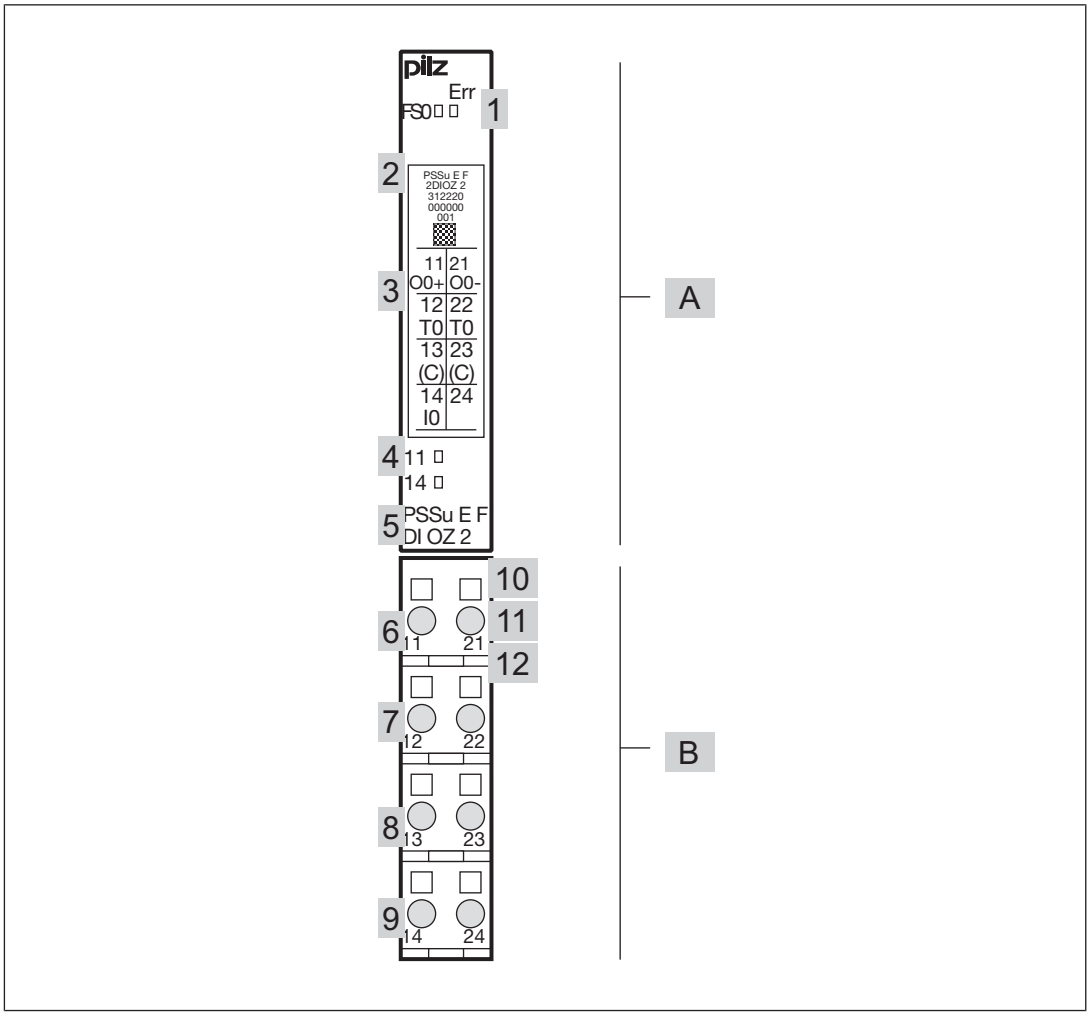
- 1 dual-pole digital output
  - Semiconductor technology
  - Switches to 24 V (O0+) and 0 V (O0-)
  - Current load capacity: 2 A
  - Short circuit-proof
  - Overload-proof
  - Free from feedback
- 1 digital input
  - Preferably used to form a feedback loop
- 1 output, which can be configured as:
  - Test pulse output (periphery supply)
  - Output with constant voltage (periphery supply)
- LEDs for:
  - Switch status of input
  - Switch status of output
  - FS enable per output
  - Module error
- For failsafe applications in system environment A and B
- T-type:

  PSSu E F DI OZ 2-T: for increased environmental requirements
- R-type:

  PSSu E F DI OZ 2-R: for railway applications

Digital input/output (Failsafe)
PSSu E F DI OZ 2

Front view



Legend:

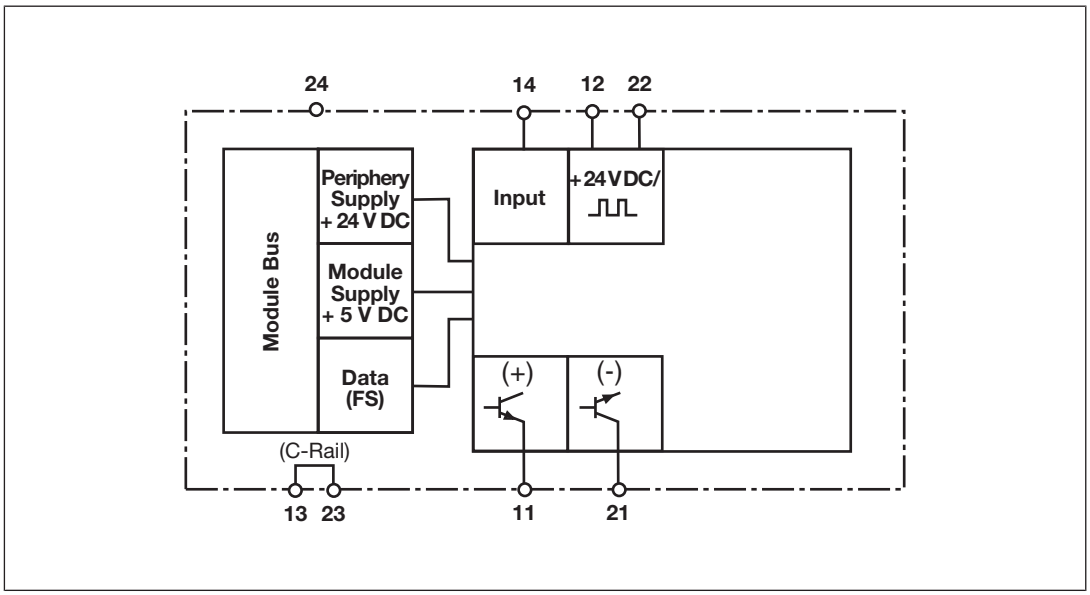
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Displaying an output's FS enable (enable principle)
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Digital input/output (Failsafe)
PSSu E F DI OZ 2

- 3: Labelling strip for the terminal configuration on the base module
- 4: Status LEDs
- 5: Name of electronic module
- 6: Connection level 1
- 7: Connection level 2
- 8: Connection level 3
- 9: Connection level 4
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Digital input/output (Failsafe)
PSSu E F DI OZ 2

Module features

Module supply

- The module supply provides the module with voltage.

Signals at the output

- “0” signal (0 V) at the output (O0+/O0-):
  - Output is high impedance
  - No current to the load
- “1” signal (+24 V) at the output (O0+/O0-):
  - Output is low impedance
  - Current is supplied to the load

Periphery supply

- The module routes the periphery supply from the module bus to the base module terminals.
- The periphery supply is used to supply the outputs.

Input

- The input status is signalled to the head module via the module bus.
- The input has an input filter.

Output

- The head module sets the output status via the module bus.
- The max. capacity at an output depends on the load (see characteristic). Connecting a higher capacity may lead to an error.
- Operation with electronic contactors has not been tested and may lead to errors. Please contact our Customer Support team if you are using electronic contactors.
- Open circuit detection
- Cannot be used as a single-pole output

Test pulse output

- Test pulses can be switched on or off.
- Test pulses are switched on in the default setting.
- When test pulses are switched off, the periphery supply is constantly available at the output.

Output test (not configurable)

- Outputs that are switched on are checked via regular off tests.
  - Test pulses for outputs that are switched on: see technical details
  - Outputs that are switched on are switched off for the duration of the test pulse.
  - The load must not switch off because of the test.

Digital input/output (Failsafe)
PSSu E F DI OZ 2

- Outputs that are switched off are checked via regular on tests.
  - Test pulses for outputs that are switched off: see technical details
  - Outputs that are switched off are switched on for the duration of the test pulse.
  - The load must not switch on because of the test.

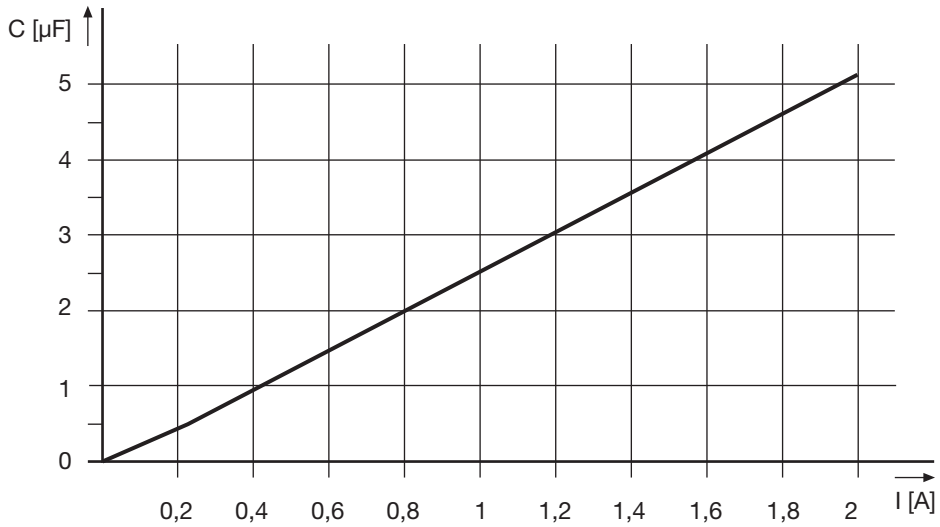
Testing for shorts

- A test is regularly carried out to check for shorts between the outputs.

Open circuit detection

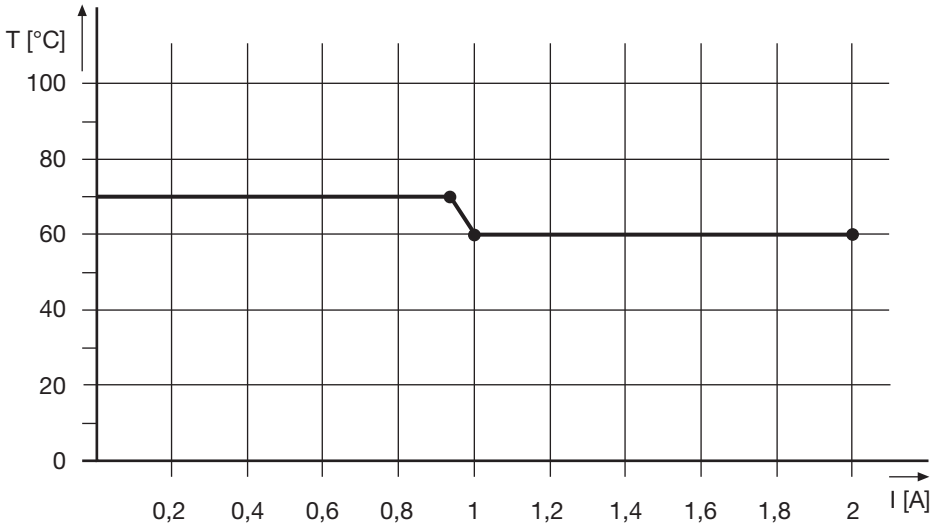
- The module will detect an open circuit between outputs O0+ and O0-.
- The result of open circuit detection is signalled to the head module via a virtual input. The result is available within the user program:
  - No open circuit detected: Status bit set
  - Open circuit detected: Status bit not set
- Loads over 3 kOhm may mistakenly be detected as an open circuit.

Characteristic: Output capacitance C dependent on load current I



Digital input/output (Failsafe)
PSSu E F DI OZ 2

Derating diagram (PSSu E F DI OZ 2(-T)(-R)): Permitted ambient temperature T dependent on load current I



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module has the following protection mechanisms:

- Cyclical output tests
- Tests for shorts across the output
- Test pulse signals are always buffered for 20 ms.

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- FS communication error
- Bus termination error
- Temperature error: too warm
- Temperature: too hot
- Output error
- Test pulse error
- Input error

Information on the reaction times of the inputs/outputs can be found in the "PSSuniversal" System Description and the System Description "Automation system PSS 4000".

Digital input/output (Failsafe)
PSSu E F DI OZ 2

Configuration

Functions for the FS outputs of a PSSu are defined in the PSSuniversal Configurator on the PSS WIN-PRO system software:

- Read access through the standard bus system (configured per module): “R” configuration
- Read/write access through the standard bus system (configured per output): "&" configuration (local enable principle)
- Optimisation of ST process image by combining adjacent bits of the same type. “*” configuration

Functions for the FS inputs of a PSSu are defined in the PSSuniversal Configurator on the PSS WIN-PRO system software:

- Read access through the standard bus system (configured per module): Configuration "R"
- Allocation of a test pulse to an input (configured per input):
- Optimisation of ST process image by combining adjacent bits of the same type. Configuration „*“

Further information on configuration is available in the PSSuniversal Configurator's online help.

The module occupies two consecutive bit addresses for the input in the FS-PII:

- Bit address 1: Input I0 for connecting the feedback loop (connection terminal).
- Bit address 2: Internal FS input I1 for transmitting open circuit detection (no connection terminal!).

The module occupies one bit address for the output in the FS-PIO.

The display in the ST process image depends on the configuration. With read access ("R"), the sequence in the ST-PII is:

- Bit address 1: FS output O0+
- Bit address 2: Input I0 for connecting the feedback loop
- Bit address 3: Internal FS input I1 for transmitting open circuit detection

With write access ("&"), the Bit in the ST-PIO is used to switch the FS output with the local enable principle.

Configuration	SafetyBUS p		Standard bus system	
	FS-PII	FS-PIO	ST-PII	ST-PIO
None	2 Bit (e. g.: 32.00 … 32.01) (e.g.: 32.00)	1 Bit (e. g.: 32.00)	- - -	- - -
Read ST (“R”)			3 Bit	- - -
ST read and write (“&”)			3 Bit	1 Bit

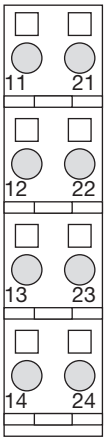
Digital input/output (Failsafe)
PSSu E F DI OZ 2

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

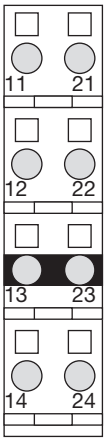
I/O data name	I/O data type	I/O data element	Meaning
I0(14)	FS_I_DI	Data: SAFEBOOL	Input data I0
I1	FS_I_DI	Data: SAFEBOOL	Open circuit
O0(11,21)	FS_O_DO	Data: SAFEBOOL	Output data O0

Wiring

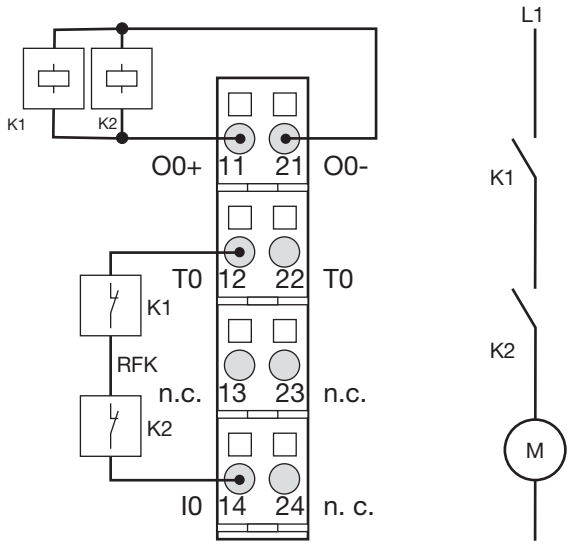
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: O0+ output, dual-pole positive-switching 21: O0+ output, dual-pole negative-switching 12-22: T0 test pulse output or +24 V output (periphery supply, 12-22 linked within the base module) 13-23: Not connected (13-23 linked within the base module) 14: Input I0 24: Not connected	

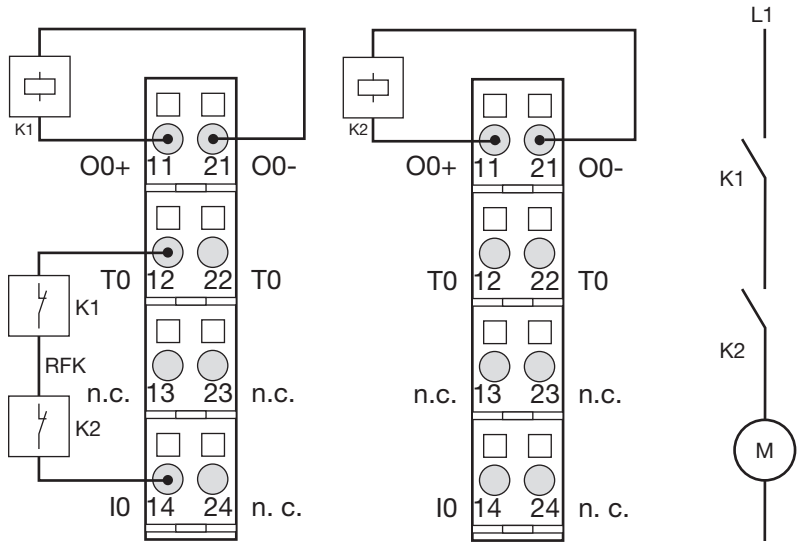
Digital input/output (Failsafe)
PSSu E F DI OZ 2

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: O0+ output, dual-pole positive-switching 21: O0- output, dual-pole negative-switching 12-22: T0 test pulse output or +24 V output (periphery supply, 12-22 linked within the base module) 13-23: C-rail supply (13-23 linked within the base module) 14: Input I0 24: Not connected	

Connecting the module

Output circuit	Without C-rail
Single-channel operation Redundant actuator	

Digital input/output (Failsafe)
PSSu E F DI OZ 2

Output circuit	Without C-rail
Dual-channel operation Redundant actuator	

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 a short circuit to a supply voltage.

Digital input/output (Failsafe)
PSSu E F DI OZ 2

Technical details

General	312220	314220	315220
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, TÜV**
Application range	**Failsafe**	**Failsafe**	**Failsafe**
Module's device code	**0E00h**	**0E00h**	**0E00h**
Number of FS input bits	**2**	**2**	**2**
Number of FS output bits	**1**	**1**	**1**
Application in system environment A			
From FS firmware version, other head modules	**4**	**4**	–
From FS firmware version PSSu H F PN	**1**	–	–
Application in system environment B			
From FS firmware version, head modules	**1.0.0**	**1.3.0**	**1.5.0**
Electrical data	**312220**	**314220**	**315220**
Internal supply voltage (module supply)			
Module's power consumption	**0,15 W**	**0,15 W**	**0,15 W**
Periphery's supply voltage (periphery supply)			
Voltage range	**16,8 - 30 V**	**16,8 - 30 V**	**16,8 - 30 V**
Module's current consumption with no load	**28 mA**	**28 mA**	**28 mA**
Module's power consumption with no load	**0,67 W**	**0,67 W**	**0,67 W**
Max. power dissipation of module	**1,5 W**	**1,5 W**	**1,5 W**
Inputs	**312220**	**314220**	**315220**
Number	**1**	**1**	**1**
Voltage at inputs	**24 V DC**	**24 V DC**	**24 V DC**
Input current at rated voltage	**6 mA**	**6 mA**	**6 mA**
Input current range	**2,6 - 7,8 mA**	**2,6 - 7,8 mA**	**2,6 - 7,8 mA**
Min. threshold voltage when signal changes from "1" to "0"	**9 V**	**9 V**	**9 V**

Digital input/output (Failsafe)
PSSu E F DI OZ 2

Inputs	312220	314220	315220
Max. threshold voltage when signal changes from "0" to "1"	**10 V**	**10 V**	**10 V**
Max. processing time of input when signal changes from "1" to "0"	**1 ms**	**1 ms**	**1 ms**
Max. processing time of input when signal changes from "0" to "1"	**1 ms**	**1 ms**	**1 ms**
Min. processing time of input when signal changes from "1" to "0"	**0,5 ms**	**0,5 ms**	**0,5 ms**
Min. processing time of input when signal changes from "0" to "1"	**0,5 ms**	**0,5 ms**	**0,5 ms**
Potential isolation between input and internal module bus voltage	**yes**	**yes**	**yes**
Semiconductor outputs	**312220**	**314220**	**315220**
Rated voltage	**24 V DC**	**24 V DC**	**24 V DC**
Semiconductor outputs, 2-pole	**312220**	**314220**	**315220**
Number of dual-pole semiconductor outputs	**1**	**1**	**1**
Permitted current range	**0,00 - 2,50 A**	**0,00 - 2,50 A**	**0,00 - 2,50 A**
Typ. output current at "1" signal and rated voltage of semiconductor output	**2 A**	**2 A**	**2 A**
Residual current at "0" signal	**0,02 mA**	**0,02 mA**	**0,02 mA**
Max. pulsed current for t < 100 ms	**12 A**	**12 A**	**12 A**
Potential isolation	**yes**	**yes**	**yes**
Short circuit-proof	**yes**	**yes**	**yes**
Permitted loads	**inductive, capacitive, resistive**	**inductive, capacitive, resistive**	**inductive, capacitive, resistive**
Max. duration of off time during self test	**800 µs**	**800 µs**	**800 µs**
Max. processing time of semiconductor output when signal changes from "0" to "1"	**0,02 ms**	**0,02 ms**	**0,02 ms**
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,02 ms**	**0,02 ms**	**0,02 ms**

Digital input/output (Failsafe)
PSSu E F DI OZ 2

Test pulse outputs	312220	314220	315220
Number of test pulse outputs	1	1	1
Voltage, test pulse outputs	24 V DC	24 V DC	24 V DC
Short circuit-proof	yes	yes	yes
Number of outputs that can be configured as test pulses	1	1	1
Max. output current at "1" signal	0,25 A	0,25 A	0,25 A
Max. cable length between test pulse output and input	200 m	200 m	200 m
Standard for voltage interruptions	DIN V EN V 1954, EN61131-2, EN61496-1	DIN V EN V 1954, EN61131-2, EN61496-1	–
Environmental data	**312220**	**314220**	**315220**
Application site			
In accordance with the standard	–	–	EN 50125-3
Application site	–	–	Track area (1 m - 3 m)
In accordance with the standard	–	–	EN 61373
Application site	–	–	Category 1, Class A + B
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	EN 50125-1, EN 50125-3, EN 50155, EN 60068-2-1, EN 60068-2-14, EN 60068-2-2
Ambient temperature			
In accordance with the standard	EN 60068-2-14	EN 60068-2-14	EN 50155
Temperature range	0 - 60 °C	-40 - 70 °C	-40 - 70 °C
In accordance with the standard	–	–	EN 50125-1
Temperature range	–	–	-40 ... +70 °C
In accordance with the standard	–	–	EN 50125-3
Temperature range	–	–	-40 ... +70 °C
Storage temperature			
In accordance with the standard	EN 60068-2-1/-2	EN 60068-2-1/-2	EN 60068-2-1/-2
Temperature range	-25 - 70 °C	-40 - 70 °C	–

Digital input/output (Failsafe)
PSSu E F DI OZ 2

Environmental data	312220	314220	315220
Climatic suitability			
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**	–
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	–
Condensation during operation	**Not permitted**	**Short-term**	–
Max. operating height above sea level	**2000 m**	**5000 m**	**2000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 50125-3**
Frequency	**10 - 150 Hz**	**10 - 150 Hz**	**5 - 2000 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	–
Acceleration	**1g**	**1g**	**0,23g**
Broadband noise			
In accordance with the standard	–	**EN 60068-2-64**	**EN 61373**
Frequency	–	**5 - 500 Hz**	**5 - 150 Hz**
Acceleration	–	**1,9grms**	**0,79 g RMS**
Shock stress			
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 50125-3**
Number of shocks	**6**	**6**	**20**
Acceleration	**15g**	**15g**	**2g**
Duration	**11 ms**	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 61373**
Number of shocks	**1000**	**1000**	**20**
Acceleration	**10g**	**10g**	**5g**
Duration	**16 ms**	**16 ms**	**30 ms**
Supply interruptions			
In accordance with the standard	–	–	**EN 50155**
Class	–	–	**S2, C1, C2**
Airgap creepage			
In accordance with the standard	**EN 60664-1**	**EN 60664-1**	**EN 50124-1**
Overvoltage category	**II**	**II**	**OV2**
Pollution degree	**2**	**2**	**PD2**

Digital input/output (Failsafe)
PSSu E F DI OZ 2

Environmental data	312220	314220	315220
Protection type			
In accordance with the standard	**EN 60529**	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**	**IP20**
Terminals	**IP20**	**IP20**	–
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP51**
Mechanical data	**312220**	**314220**	**315220**
Material			
Bottom	**PC**	**PC**	**PC**
Front	**PC**	**PC**	**PC**
Coding	**PA**	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Dimensions			
Height	**76 mm**	**76 mm**	**76 mm**
Width	**12,6 mm**	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**	**60,2 mm**
Weight	**35 g**	**37 g**	**46 g**
Mechanical coding			
Type	**G**	**G**	**G**
Colour	**Yellow**	**Yellow**	**Yellow**

Where standards are undated, the 2009-10 latest editions shall apply.

Safety characteristic data

Unit	Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	EN ISO 13849-1: 2015 T_M [year]
Input						
Digital inputs	**1-channel**	**PL d**	**Cat. 2**	**SIL CL 2**	**9,10E-09**	**20**
Digital inputs	**2-channel**	**PL e**	**Cat. 3**	**SIL CL 3**	**3,10E-09**	**20**
Digital inputs	**2-ch. pulsed**	**PL e**	**Cat. 4**	**SIL CL 3**	**3,10E-09**	**20**
Digital inputs	**1-ch., pulsed light barrier**	**PL e**	**Cat. 4**	**SIL CL 3**	**2,91E-09**	**20**
Output						
SC outputs (2-pole)	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**1,37E-09**	**20**

Digital input/output (Failsafe)
PSSu E F DI OZ 2

If the module is operated at an ambient temperature above 60° C, the values stated in the table for PFH_D and PFD will need to be doubled when a safety function is calculated.

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

Order reference

Product

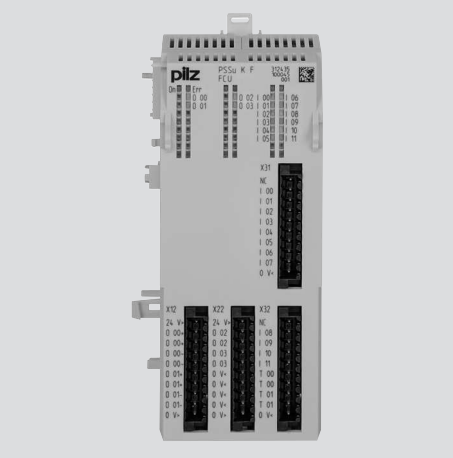
Product type	Features	Order No.
PSSu E F DI OZ 2	Electronic module, base type	312 220
PSSu E F DI OZ 2-T	Electronic module, T-type	314 220
PSSu E F DI OZ 2-R	Electronic module, R-type	315 220

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623
PSSu BP-C1 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 623

Digital input/output (Failsafe)
PSSu K F FCU



Overview

Module features

- For failsafe applications in system environment B (automation system PSS 4000)
- Operating modes:
  - Pulse stretching supported from FS firmware version 1.13.0 of the head modules and from firmware version 06 of the module.
  - Fast shutdown supported from FS firmware version 1.7.0 of the head modules
- Maximum number of modules: 12
- Configurable input filter
- 12 digital inputs
- Filter time can be configured
- 2 independent test pulse outputs that use different test pulses
- 2 Digital outputs
  - Semiconductor technology
  - Single-pole
  - Positive-switching
  - Current load capacity per output: 2 A
  - Short circuit-proof
  - Overload-proof
  - Free from feedback
- 2 Dual-pole digital outputs
  - Semiconductor technology
  - Switches to 24 V (Ox+) and 0 V (Ox-)

Digital input/output (Failsafe)
PSSu K F FCU

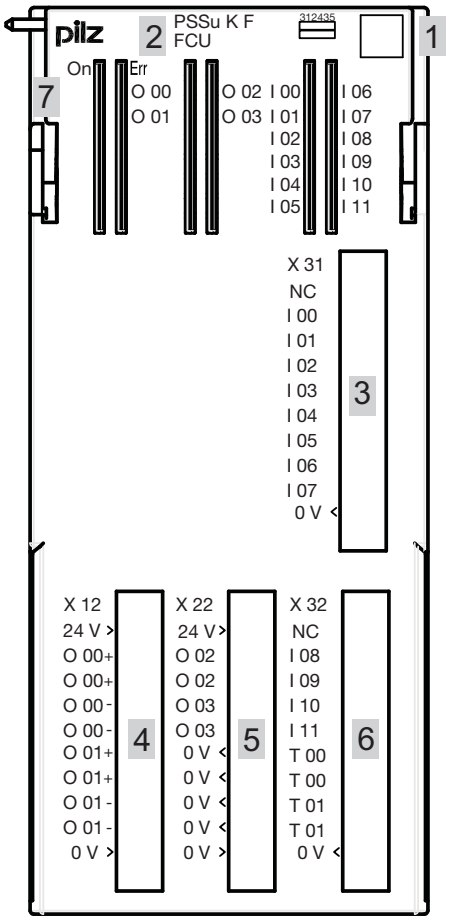
  - Current load capacity: 3 A
  - Short circuit-proof
  - Overload-proof
  - High discharge voltage
  - Free from feedback
- LEDs for:
  - Switch status of each input/output
  - Module error
  - Module status
- 4 x 10-pin connector strip

Accessories:

- Connector with spring-loaded terminals (necessary for operation)
- Labelling bracket
- Labelling strips (sheets)

Digital input/output (Failsafe)
PSSu K F FCU

Front view



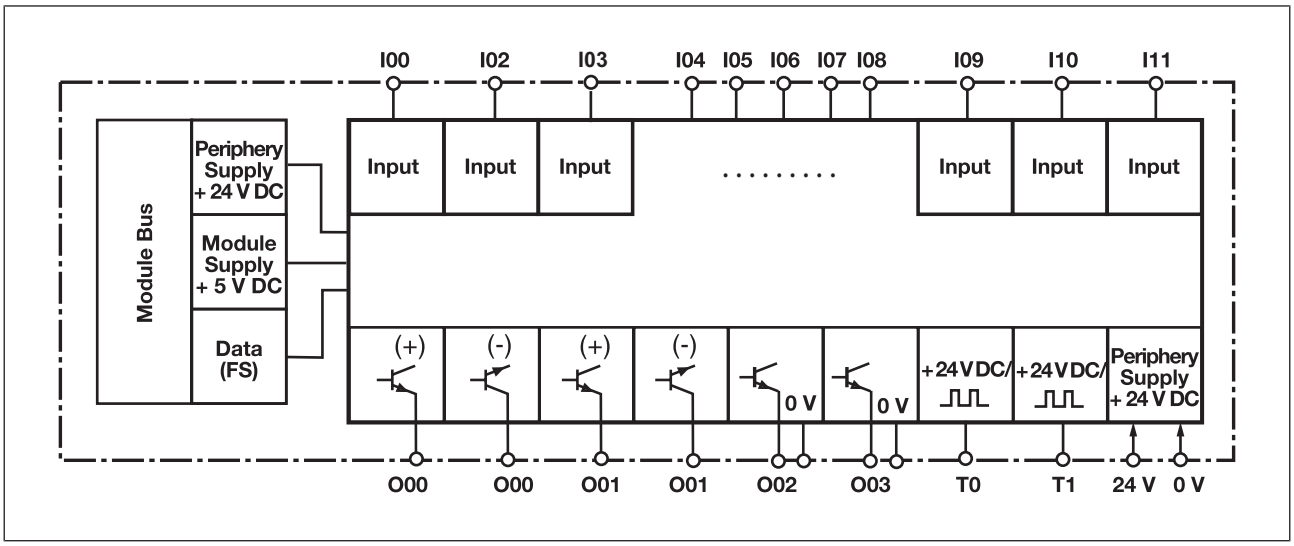
Legend:

- 1: Labelling strip with:
  - 2D code
  - Order number
  - Serial number
  - Hardware version number
- 2: Name of compact module
- 3: Connector strip X31 for connectors with spring-loaded terminals and labelling strip
- 4: Connector strip X12 for connectors with spring-loaded terminals and labelling strip
- 5: Connector strip X22 for connectors with spring-loaded terminals and labelling strip
- 6: Connector strip X32 for connectors with spring-loaded terminals and labelling strip
- 7: LEDs for status display and module diagnostics

Digital input/output (Failsafe)
PSSu K F FCU

Function description

Block diagram



Module and periphery supply

Module supply

- The module supply provides the module with voltage.

Periphery Supply

- The periphery supply for the test pulse outputs is switched from the module bus to the module's connector strips.
- The periphery supply for the outputs must be fed in externally. The single and dual-pole outputs must have a common supply voltage.

Digital input/output (Failsafe)
PSSu K F FCU

Inputs

Digital inputs:

- 12 digital inputs
- Test pulses can be used to check the inputs for shorts across contacts and correct functionality.
- The input filter time is configurable.

Digital inputs I00 ... I07:

- Digital inputs for pulse stretching or fast shutdown

Digital inputs I08 ... I11:

- The function of these inputs is independent of the operating mode.
- The inputs can be used to connect safety switches, for example.

Test pulse outputs

- 2 test pulse outputs that use different test pulses (test pulse T00, test pulse T01)
- Short circuit-proof
- Overload-proof
- Free from feedback
- Current-limiting

Detection of shorts across contacts

- The test pulses are used to detect shorts between inputs. Shorts between inputs are detected when the test pulses are different (test pulse T00, test pulse T01).
- Only the module's test pulses may be used to detect shorts.
- The module's test pulses may not be used to detect shorts between inputs on other modules.
- Shorts between inputs of the same module with the same test pulses will not be detected.
- Test pulses can be switched on or off.
- Test pulses are switched on in the default setting.
- When test pulses are switched off, the periphery supply is constantly available at the test pulse outputs.

Please note that the configured input filter time has an effect on the reaction time. The overall reaction times in fast shutdown operating mode are described in chapter Overall reaction time with fast shutdown.

Information on the reaction times of the inputs can be found in the System Description "Automation system PSS 4000".

Digital input/output (Failsafe)
PSSu K F FCU

Outputs

- 2 single-pole digital outputs

Output test

- Outputs that are switched on are checked via regular off tests.
  - Test pulses for outputs that are switched on: see Technical details [📖 665]
  - Outputs that are switched on are switched off for the duration of the test pulse.
  - The load must not switch off because of the test.
- Outputs that are switched off are checked via regular on tests.
  - Test pulses for outputs that are switched off: see Technical details [📖 665]
  - Outputs that are switched off are switched on for the duration of the test pulse.
  - The load must not switch on because of the test.

Testing for shorts

- A test is regularly carried out to check for shorts between the outputs.

Excluding individual outputs from the output test:

- If a plant is particularly sensitive to the test pulses, the output test may be switched off for individual outputs.
- The test must be replaced by other measures, depending on the safety requirement.
- When test pulses are switched off:
  - The correct switch status is always checked.
  - The output's ability to switch will not be detected until the next time the output is switched on/off.

Testing for shorts

- A test is regularly carried out to check for shorts between the outputs.

Digital input/output (Failsafe)
PSSu K F FCU

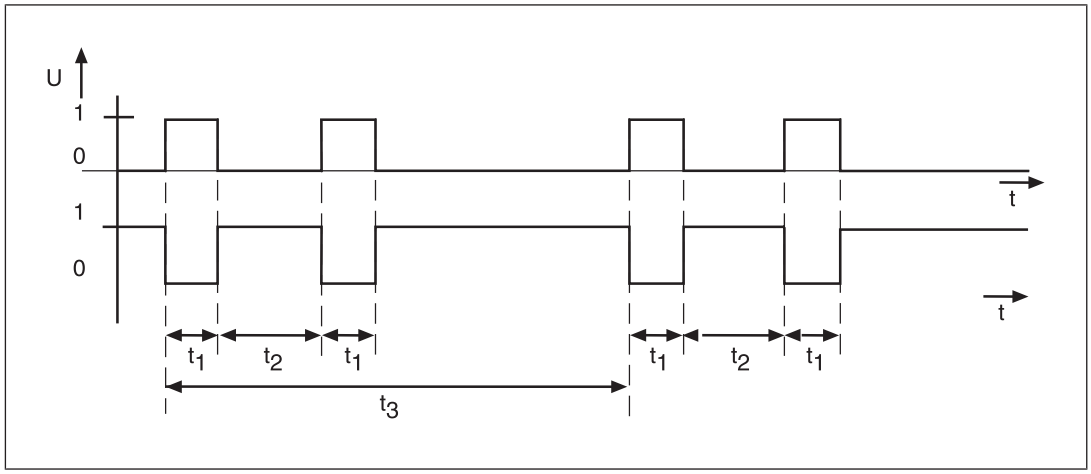


Fig.: On and off test for single-pole outputs

Legend

t_1 Pulse duration of on/off test (200 µs)

t_2 Max. waiting time between the on/off test (approx. 4 ms)

t_3 Repetition time of on and off test in normal circumstances (approx. 2 s)

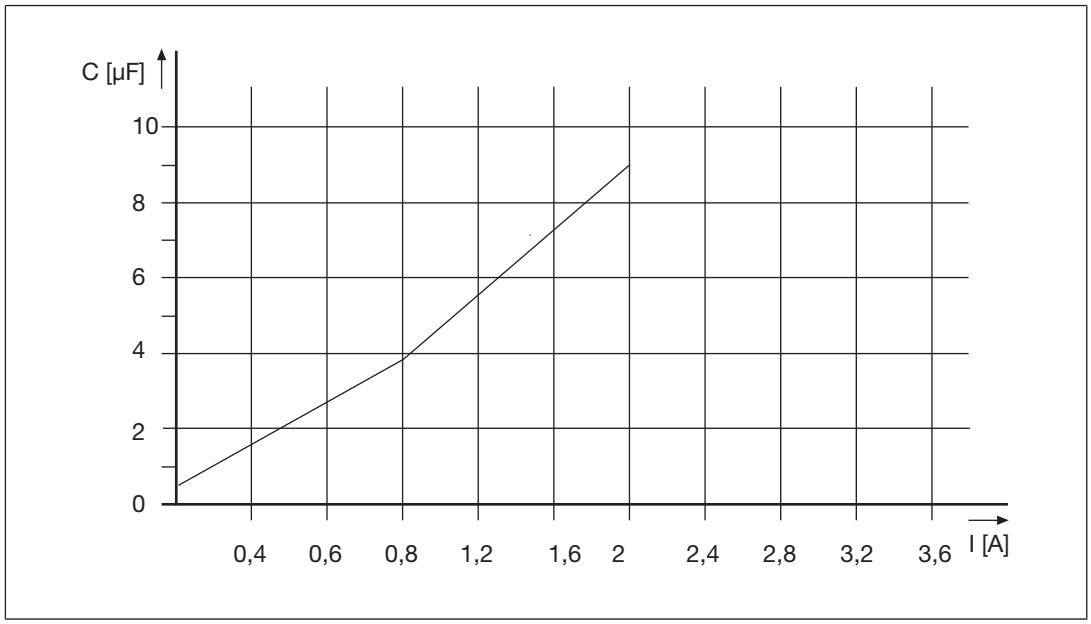


Fig.: Characteristic for single-pole outputs: Output capacitance C dependent on load current I

Digital input/output (Failsafe)
PSSu K F FCU

- 2 dual-pole digital outputs (cannot be used as a single-pole output)

Output test

- Outputs that are switched on are checked via regular off tests.
  - Test pulses for outputs that are switched on: see Technical details [📖 665]
  - Outputs that are switched on are switched off for the duration of the test pulse.
  - The load must not switch off because of the test.
- Outputs that are switched off are checked via regular on tests.
  - Test pulses for outputs that are switched off: see Technical details [📖 665]
  - Outputs that are switched off are switched on for the duration of the test pulse.
  - The load must not switch on because of the test.

Testing for shorts

- A test is regularly carried out to check for shorts between the outputs.

Open circuit detection (only on dual-pole outputs):

- The module will detect an open circuit between outputs O0x+ and O0x-.
- The result of open circuit detection is entered as an error in the diagnostic list and all outputs are deactivated.
- The outputs will not be switched on until the head module is restarted.
- Loads over 0,17 kOhm may mistakenly be detected as an open circuit.
- Even between unused outputs O0x+ and O0x-, an open circuit will be detected and signalled as an output error.
  - Place a jumper between unused outputs.
  - Make sure that bridged outputs are not switched on in the user program, otherwise an output error will be signalled.

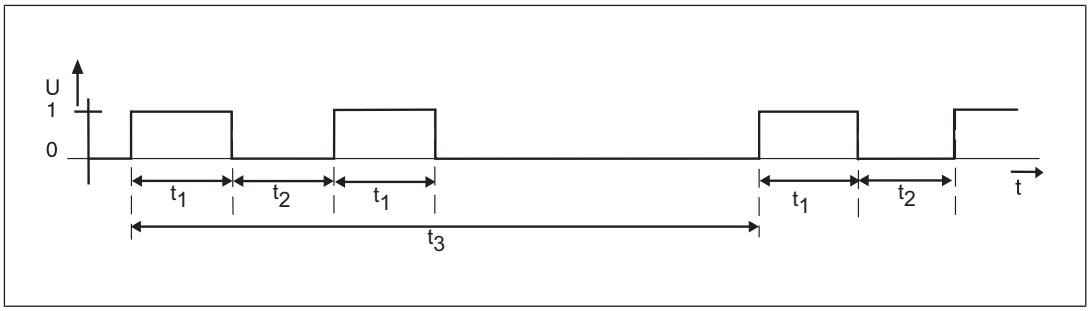


Fig.: On test for dual-pole outputs

Legend

t_1 Max. pulse duration of on test (4 ms)

t_2 Max. waiting time between the on tests (approx. 4 ms)

t_3 Repetition time of on test in normal circumstances (approx. 2 s)

Digital input/output (Failsafe)
PSSu K F FCU

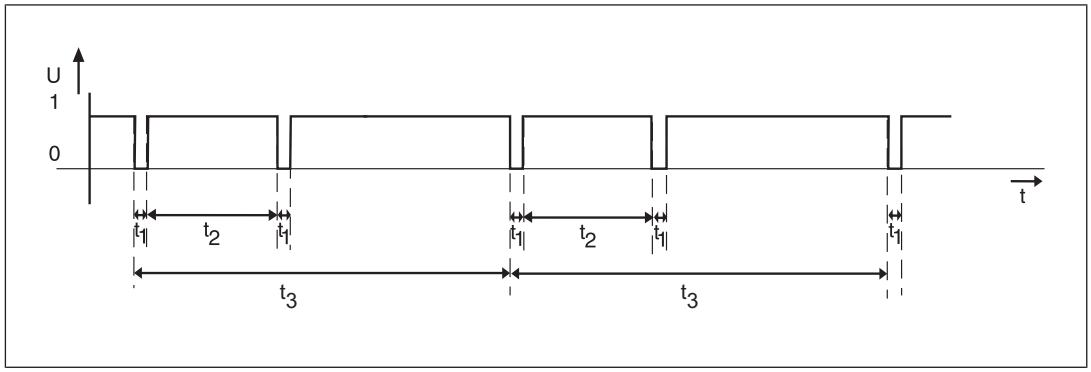


Fig.: Off test for dual-pole outputs

Legend

t_1 Pulse length of off test (0.2 ms)

t_2 Max. waiting time between the off tests (approx. 4 ms)

t_3 Repetition time of off test in normal circumstances (approx. 2 s)

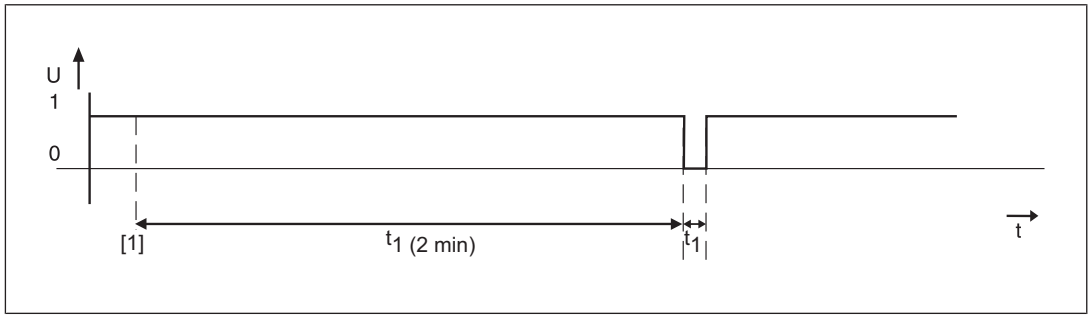


Fig.: Discharge voltage test

Legend

[1] Start of off test for dual-pole outputs

t1 Waiting time between discharge voltage tests (2 min)

t2 Pulse duration of discharge voltage test (approx. 0.3 ms)

Digital input/output (Failsafe)
PSSu K F FCU

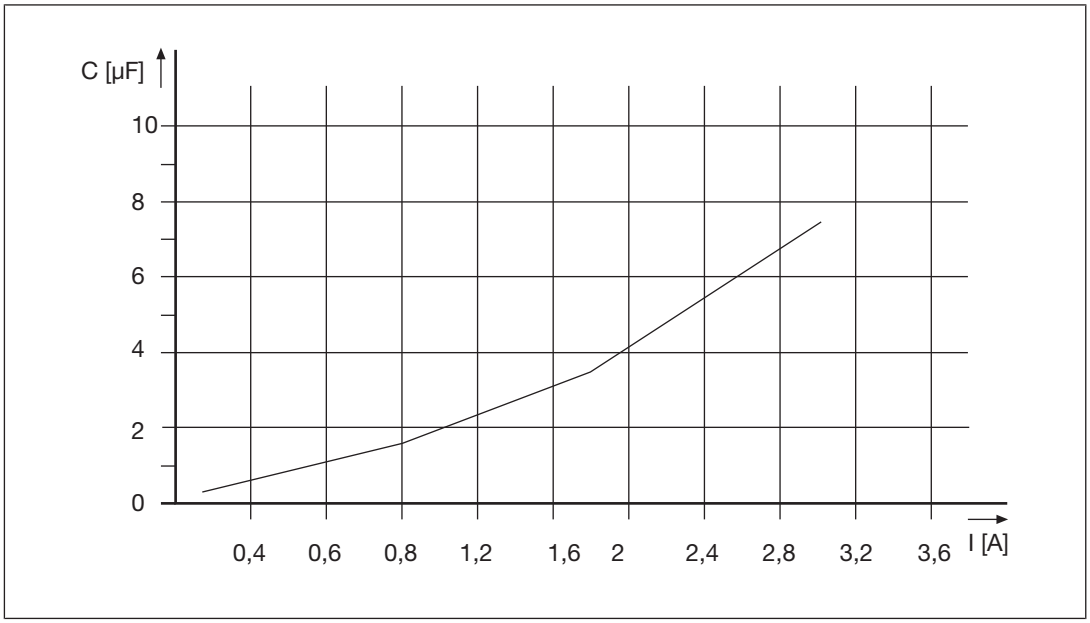


Fig.: Characteristic for dual-pole outputs: Output capacitance C dependent on load current

- For applications in accordance with Category 4, PL e and SIL 3, detection of shorts between contacts must be guaranteed either via the on/off test or through other measures (e.g. asynchronous switching). A short between contacts must be simulated during commissioning.

You can find the processing time of the outputs in the technical data.

Integrated protection mechanisms

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- FS communication error
- Bus termination error
- Temperature error: too warm
- Test pulse error
- Input error
- Output error

Digital input/output (Failsafe)
PSSu K F FCU

The module has the following protection mechanisms:

- Test pulse signals are always buffered for 20 ms
- Common second shutdown route, tested regularly
- Cyclical output tests
- Tests for shorts between the outputs

Digital input/output (Failsafe)
PSSu K F FCU

Pulse stretch mode

Pulse stretch mode is supported from FS firmware version 1.13.0 of the head modules.

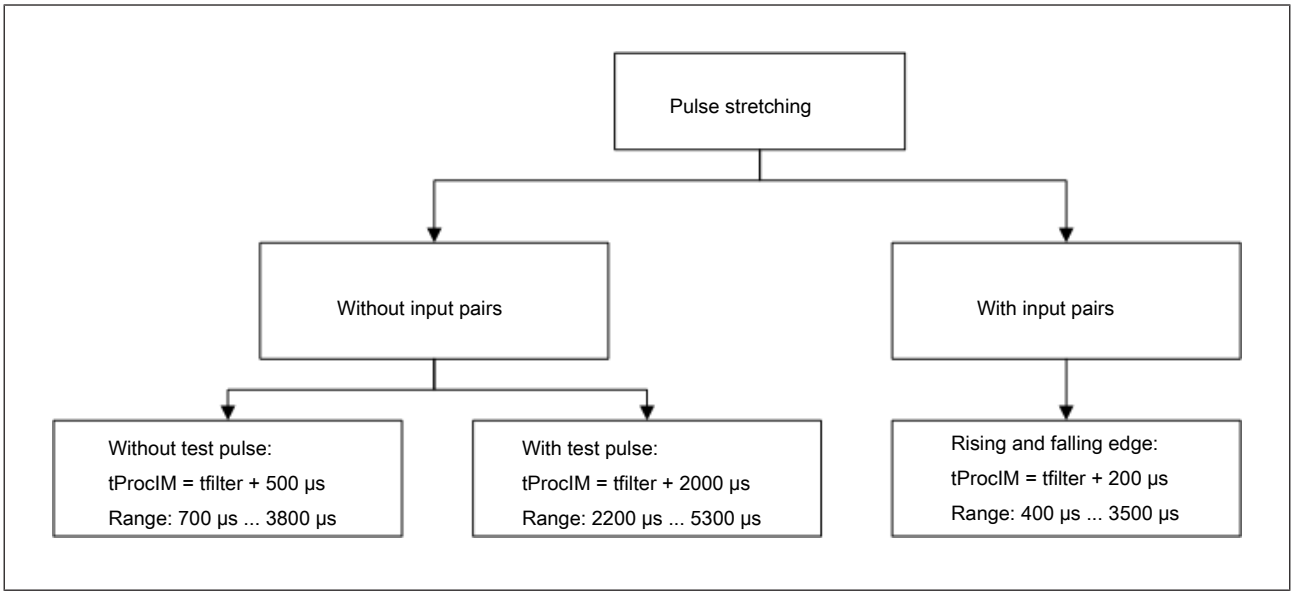


Fig.: Processing times

Legend

tProcIM Time for which a signal must be present at the input in order to be detected safely.

tfilter Configurable input filter time

The module stretches detected signals that are present only briefly at input terminals I00 … I07 so that they are present in the module's process image for the configured pulse stretch time $t_{stretch}$.

Requirement for the configured pulse stretch time $t_{stretch}$:

The configured pulse stretch must be at least as long as the sum of the reaction times of the data subpaths from the module to the task to be processed (see System Description PSS 4000).

Requirement of the signals on the terminals when stretching positive pulses:

- The 1-signal ($t_{1\text{-}Signal}$) must be present at the input for longer than the maximum processing time $t_{ProcIM.}$
- The 0-signal must be present at the input for longer than the sum of the configured pulse stretch time $t_{stretch}$ and the maximum processing time $t_{ProcIM.}$
- The 1-signal and the subsequent 0-signal together must be present at the input for longer than twice the sum of the configured pulse stretch time $t_{stretch}$ and the maximum processing time t_{ProcIM}
  - $t_{1\text{-}Signal} + t_{0\text{-}Signal} >= 2 \times (t_{stretch} + t_{ProcIM})$

Digital input/output (Failsafe)
PSSu K F FCU

Requirement of the signals on the terminals when stretching negative pulses:

- The 0-signal ($t_{0\text{-Signal}}$) must be present at the input for longer than the maximum processing time $t_{ProcIM.}$
- The 1-signal must be present at the input for longer than the sum of the configured pulse stretch time $t_{stretch}$ and the maximum processing time $t_{ProcIM.}$
- The 0-signal and the subsequent 1-signal together must be present at the input for longer than twice the sum of the configured pulse stretch time $t_{stretch}$ and the maximum processing time $t_{ProcIM.}$
  - $t_{0\text{-Signal}} + t_{1\text{-Signal}} >= 2 \times (t_{stretch} + t_{ProcIM})$

The maximum processing time (t_{ProcIM}) depends on the configured filter time and the wiring, see Safely detected signals with input pairs [📖 640] and Safely detected signals without input pairs [📖 640].

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

Configured input filter time (FZ) in µs	Signal suppression time (t_{pulse_sup}) in µs
200	13
300	40
400	140
500	240
…	FZ - 260
…	…
…	…
3100	2840
3200	2940
3300	3040

Digital input/output (Failsafe)
PSSu K F FCU

A signal must be present at the input for longer than the maximum processing time t_{ProcIM} in order to be detected safely. Due to the use of input pairs, short signals at an input are also detected. Any two inputs I00 … I07 can be used as an input pair.

Separate test pulses (T0/T1) must be used for the two inputs forming an input pair, e.g. input I00 must be configured with test pulse T0 and input I01 with test pulse T1. The ***24 V*** option can also be configured for both inputs.

Configured input filter time (FZ) in µs	Maximum processing time t_{ProcIM} in µs
200	400
300	500
400	600
500	700
…	FZ + 200
…	…
…	…
3100	3300
3200	3400
3300	3500

A signal must be present at the input for longer than the maximum processing time t_{ProcIM} in order to be detected safely. If input pairs are not used, then the maximum processing time is calculated as follows:

- Signal times without test pulses:

$t_{ProcIM} = (t_{Configured\ input\ filter\ time} + 500\ µs)$

- Signal times with test pulses

$t_{ProcIM} = (t_{Configured\ input\ filter\ time} + 2000\ µs)$

Digital input/output (Failsafe)
PSSu K F FCU

Signal states for pulse stretching:

- Initialisation:
  - After start-up the module is in the "Initialisation" state. A 0-signal is present in the module.
  - If a 0-signal is present at the terminal after initialisation has elapsed, then the module switches to the state "Waiting for 1-signal".
  - If a 1-signal is present at the terminal after initialisation has elapsed, then the module switches to the state "Waiting for 0-signal".
- Waiting for 1-signal
  - A 0-signal is present in the module. As soon as a 1-signal is present at the terminals, a timer is started with the configured pulse stretching and the module switches to the state "Stretching 1-signal".
- Stretching 1-signal
  - A 1-signal is present in the module.
  - If a 0-signal is present at the terminals after pulse stretching has elapsed, then the module switches to the state "Stretching 0-signal".
  - If a 1-signal is present at the terminals after pulse stretching has elapsed, then the module switches to the state "Waiting for 0-signal".
- Waiting for 0-signal
  - A 1-signal is present in the module. As soon as a 0-signal is present at the terminals, a timer is started with the configured pulse stretching and the module switches to the state "Stretching 0-signal".
- Stretching 0-signal
  - A 0-signal is present in the module.
  - If a 1-signal is present at the terminals after pulse stretching has elapsed, then the module switches to the state "Stretching 1-signal".
  - If a 0-signal is present at the terminals after pulse stretching has elapsed, then the module switches to the state "Waiting for 1-signal".

Digital input/output (Failsafe)
PSSu K F FCU

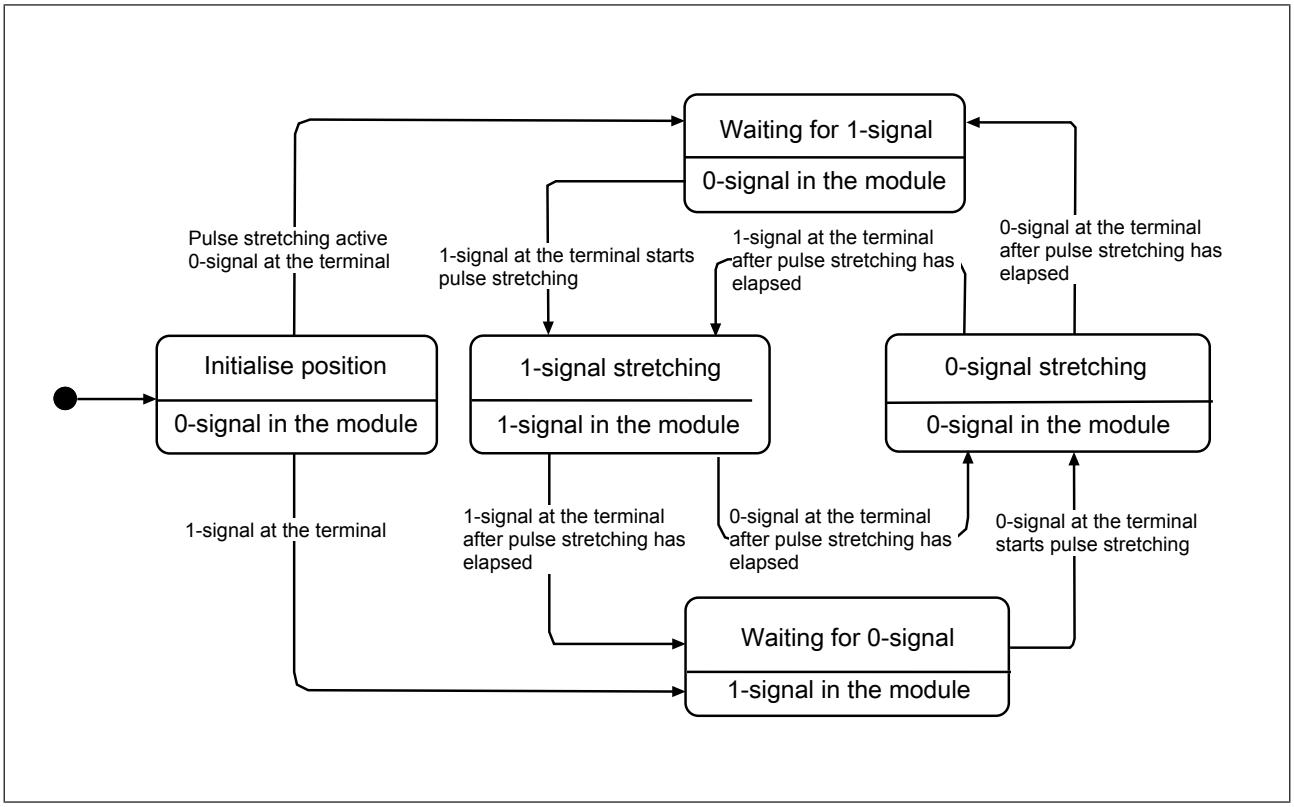


Fig.: State diagram for pulse stretching

Digital input/output (Failsafe)
PSSu K F FCU

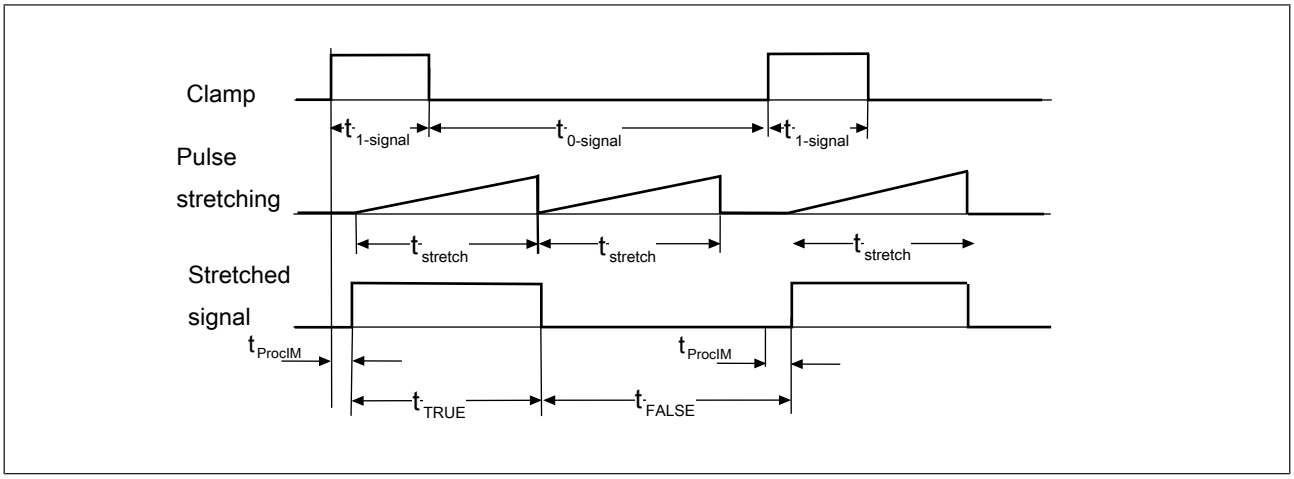


Fig.: Timing diagram: pulse stretching > signal duration of 1-signal

Legend

Clamp	Signal at the terminal
Pulse stretching	Pulse stretching
Stretched signal	Stretched signal
$t_{1\text{-signal}}$	Duration of 1-signal
$t_{stretch}$	Duration of pulse stretching
t_{ProcIM}	Maximum processing time of input, depending on the configured filter time and wiring
t_{TRUE}	Stretched 1-signal in the module
t_{FALSE}	Stretched 0-signal in the module

Digital input/output (Failsafe)
PSSu K F FCU

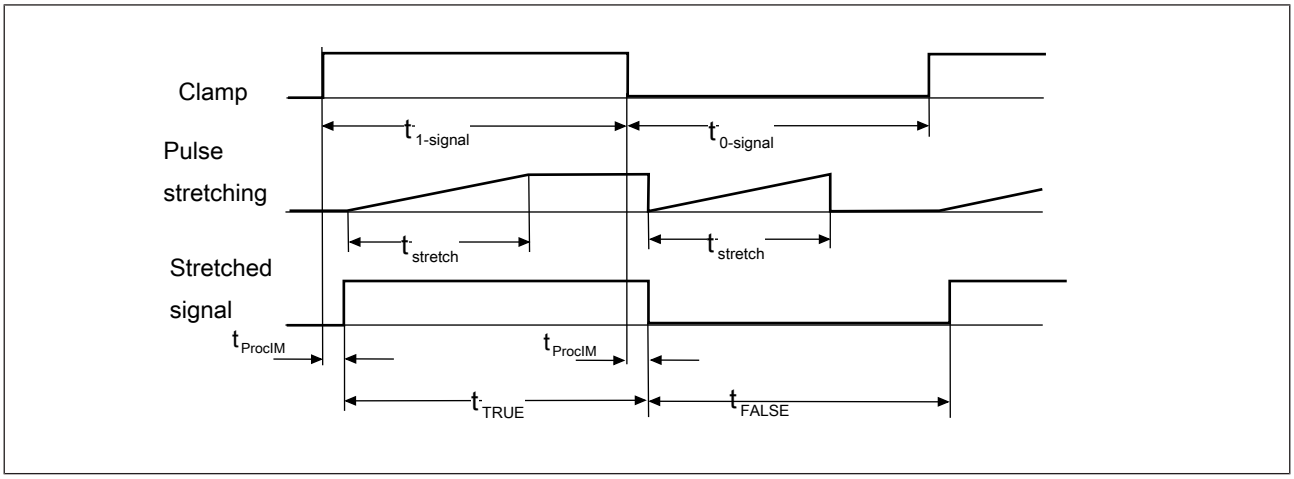


Fig.: Timing diagram: pulse stretching ≤ signal duration of 1-signal

Legend

Clamp	Signal at the terminal
Pulse stretching	Pulse stretching
Stretched signal	Stretched signal
$t_{1\text{-signal}}$	Duration of 1-signal
$t_{stretch}$	Duration of pulse stretching
t_{ProcIM}	Maximum processing time of input, depending on the configured filter time and wiring
t_{TRUE}	Stretched 1-signal in the module
t_{FALSE}	Stretched 0-signal in the module

Digital input/output (Failsafe)
PSSu K F FCU

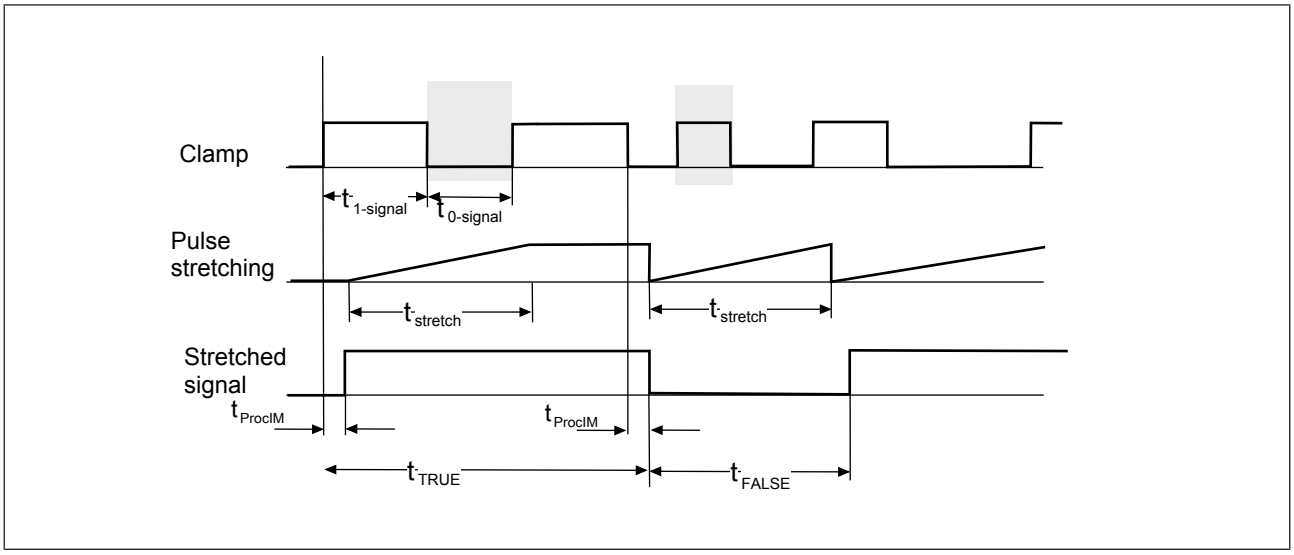


Fig.: Timing diagram: pulse stretching with variable signal duration

Legend

Clamp	Signal at the terminal
Pulse stretching	Pulse stretching
Stretched signal	Stretched signal
$t_{1\text{-signal}}$	Duration of 1-signal
$t_{stretch}$	Duration of pulse stretching
t_{ProcIM}	Maximum processing time of input, depending on the configured filter time and wiring
t_{TRUE}	Stretched 1-signal in the module
t_{FALSE}	Stretched 0-signal in the module

Configuration overview:

Configuration	Default value	Meaning
Input filter times	300 µs	Filter times can be configured for inputs I00 … I11.
Pulse stretching	50 ms	Pulse stretching can be configured for inputs I00 … I07.
On and off test for the outputs	On	Only configurable for single-pole outputs
Test pulse	24 V	24 V: Test pulse switched off T0/T1: Test pulse T0 and T1

Further information is available in PAS4000's online help.

Digital input/output (Failsafe)
PSSu K F FCU

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

I/O data name	I/O data type	I/O data element	Meaning
I00 … I11	FS_I_DI	Data: SAFEBOOL	Input data I00 … I11
O00 … O03	FS_O_DO	Data: SAFEBOOL	Output data O00 … O03

Digital input/output (Failsafe)
PSSu K F FCU

Information on the reaction times of the inputs can be found in the System Description "Automation system PSS 4000".

Please note that the configured input filter time has an effect on the reaction time.

Fast shutdown mode

Fast shutdown mode is supported from FS firmware version 1.7.0 of the head modules.

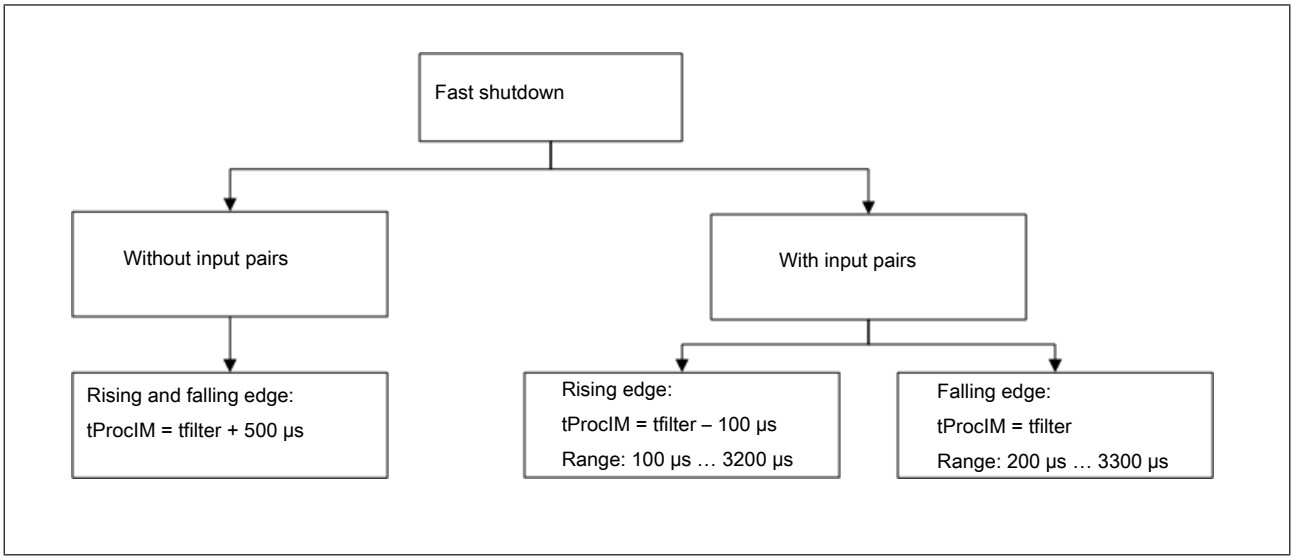


Fig.: Processing times

Legend

tProcIM	Time for which a signal must be present at the input in order to be detected safely.
tfilter	Configurable input filter time

Digital input/output (Failsafe)
PSSu K F FCU

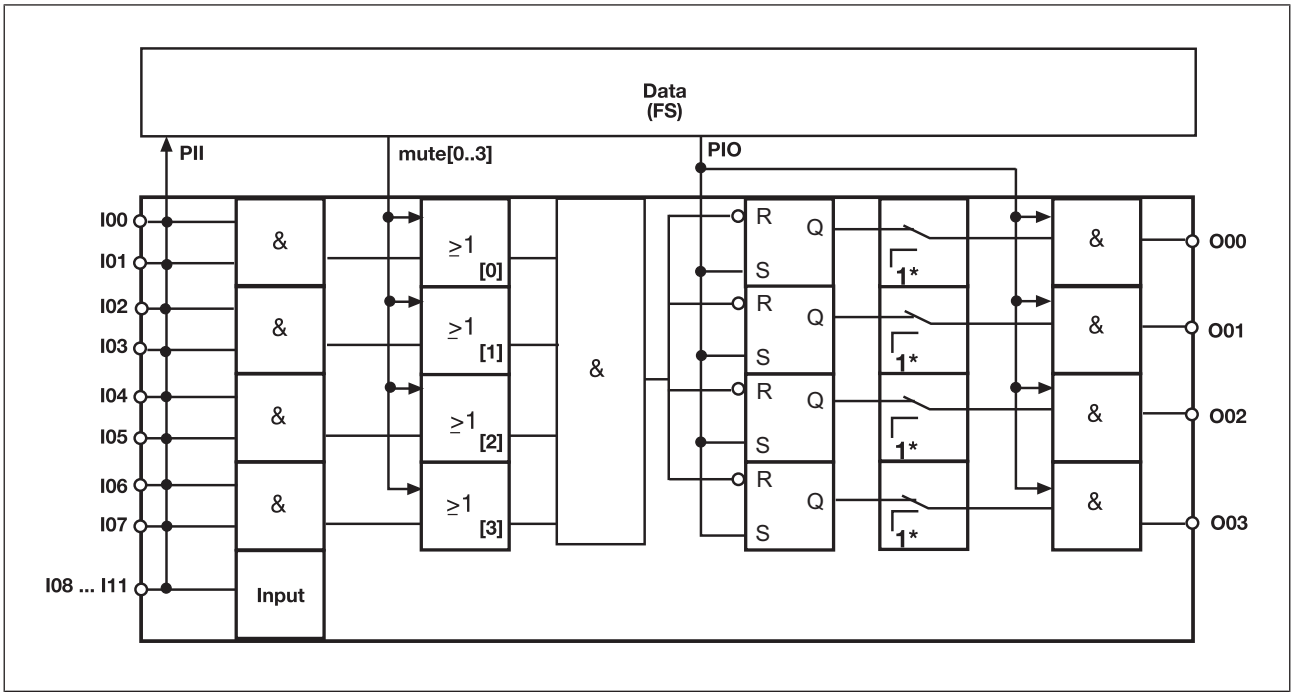


Fig.: Functional overview for fast shutdown

- Inputs I00 … I07 form 4 input pairs (I00 and I01, I02 and I03, I04 and I05, I06 and I07). If these input pairs are used it is possible to achieve PL e (Cat. 4) SIL CL 3.
- If a signal at these inputs should change, the module's outputs will be shut down immediately. You can determine which input has triggered the fast shutdown by using the data type "FS_I_FCU".
- If one of the input pairs has triggered a fast shutdown, then the fast shutdown must be reset in the user program (see PAS4000 Online Help).
- The edge used to trigger the fast shutdown can be configured (default values see Configuration [📖 651]).
- A joint input filter can be configured for these 8 inputs
- The inputs can be used to connect OSSDs, for example.
- Test pulses can be used to check the inputs for shorts across contacts and correct functionality.

Deactivate fast shutdown for inputs

- The data type "FS_O_FCU" can be used to deactivate the fast shutdown for individual input pairs.
- The state of these inputs is signalled to the head module via the module bus and no direct shutdown of the outputs occurs.

An overview of the I/O data types can be found under Access to I/O data types [📖 651].

Digital input/output (Failsafe)
PSSu K F FCU

Deactivate fast shutdown for outputs

- The configuration software can be used to deactivate the fast shutdown for individual outputs. When the fast shutdown is deactivated, the head module sets the status of the outputs via the module bus.

Further information is available in PAS4000's online help.

All signals that are shorter than the signal suppression time t_{pulse_sup} are safely filtered out. The signal suppression time depends on the configured filter time and the configured pulse edge for fast shutdown.

Configured input filter time (FZ)	Signal suppression time t_{pulse_sup} in µs with rising edge	Signal suppression time t_{pulse_sup} in µs with falling edge
200	13	13
300	30	100
400	130	200
500	230	300
…	FZ - 270	FZ - 200
…	…	…
…	…	…
3100	2830	2900
3200	2930	3000
3300	3030	3100

A signal must be present at the input for longer than the maximum processing time t_{ProcIM} in order to be detected safely. Due to the use of input pairs, short signals at an input are also detected. Inputs I00 and I01 or I02 and I03 or I04 and I05 or I06 and I07 can be used as an input pair.

Separate test pulses (T0/T1) must be used for the two inputs forming an input pair or the ***24 V*** option must be configured for both inputs.

Configured input filter time (FZ)	Fast shutdown with rising edge		Fast shutdown with falling edge	
	Safely filtered out signal time (µs)	Safely detected signal time (µs)	Safely filtered out signal time (µs)	Safely detected signal time (µs)
200	13	100	10	200
300	30	200	110	300
400	130	300	210	400
500	230	400	310	500
…	FZ - 270	FZ -100	FZ - 190	FZ

Digital input/output (Failsafe)
PSSu K F FCU

Configured input filter time (FZ)	Fast shutdown with rising edge		Fast shutdown with falling edge	
…	…	…	…	…
…	…	…	…	…
3100	2830	3000	2910	3100
3200	2930	3100	3010	3200
3300	3030	3200	3110	3300

If fast shutdown is deactivated for the 4 input pairs, then a signal change at inputs I00 … I07 is signalled to the head module. A signal change at inputs I08 … I11 is always signalled to the head module.

A signal must be present at the input for longer than the maximum processing time tProcIM in order to be detected safely. If input pairs are not used, then the maximum processing time is calculated as follows:

- $t_{ProcIM} = (t_{Configured\ input\ filter\ time} + 2500\ \mu s)$

Digital input/output (Failsafe)
PSSu K F FCU

Configuration	Default value	Meaning
Input filter times	300 µs	The filter times can be configured separately for the inputs I00 … I07 and I08 … I11.
Test pulse	T0/T1	24 V: Test pulse switched off T0/T1: Test pulse T0 or T1
Edge used to trigger the fast shutdown	Falling edge	
On and off test for the outputs	On	Only configurable for single-pole outputs
Fast shutdown for the outputs	On	Exclude individual outputs from fast shutdown

Further information is available in PAS4000's online help.

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

I/O data name	I/O data type	I/O data element	Meaning
I00 … I11	FS_I_DI	Data: SAFEBOOL	Input data I00 … I11
O00 … O03	FS_O_DO	Data: SAFEBOOL	Output data O00 … O03
InputData	FS_I_FCU	SwitchedOff : ARRAY[0..7] OF SAFEBOOL	Stores which input has triggered the fast shutdown.
OutputData	FS_O_FCU	Mute: ARRAY[0..3] OF SAFEBOOL	Deactivates the fast shutdown for input pairs (I00 and I01, I02 and I03, I04 and I05, I06 and I07).

The overall reaction time is the time that elapses between a signal being detected at the input and the outputs shutting down. The time depends on the safely detected signal time with input pairs and the maximum processing time at the output when the signal changes from "1" to "0".

The maximum reaction time for a shutdown with falling edge at the input is calculated as follows:

- Safely detected signal time when input pairs are used = Configured input filter time
- Max. processing time of the output when the signal changes from "1" to "0" = 250 µs
- $\mathbf{t}_{\text{FS overall reaction time max (0-signal)}} = \mathbf{t}_{\text{Configured input filter time}} + 250\ \mu s$

Maximum reaction time for a shutdown with rising edge at the input is calculated as follows:

- Safely detected signal time when input pairs are used = Configured input filter time – 100 µs
- Max. processing time of the output when the signal changes from "1" to "0" = 250 µs
- $\mathbf{t}_{\text{FS overall reaction time max (1-signal)}} = (\mathbf{t}_{\text{Configured input filter time}} - 100\ \mu s) + 250\ \mu s$

Digital input/output (Failsafe)
PSSu K F FCU

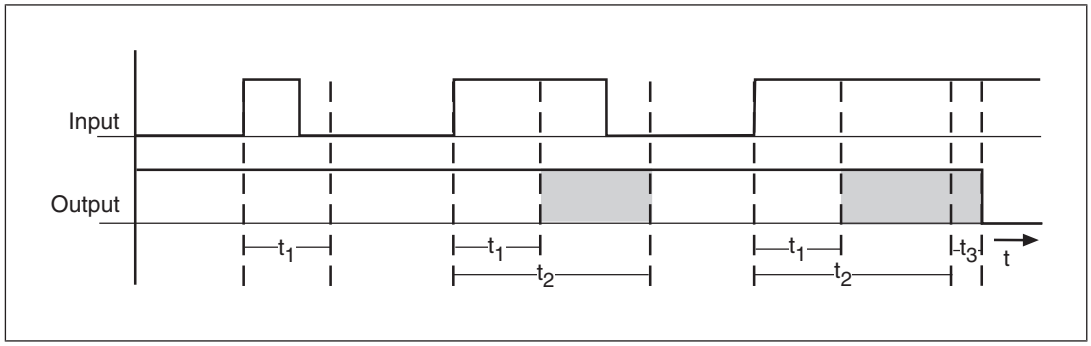


Fig.: Timing diagram for fast shutdown with rising edge with a configured input filter time

Legend

Input	Signal at the input
Output	Signal at the output
t_1	Safely filtered out signal time (see Safely filtered out signals)
t_2	Safely detected signal times with input pairs (see Safely detected signals with input pairs)
t_3	Max. processing time of semiconductor output when a signal changes from "1" to "0" (see Techncal details)
Grey shaded area	Output state not defined

Digital input/output (Failsafe)
PSSu K F FCU

Wiring

Connectors' mechanical connection

Please note:

- The conductor cross section on the spring-loaded terminals without ferrules is 0,2 - 1 mm², 22 - 18 AWG.
- If you are using multi-core or fine-core cables we recommend ferrules in accordance with DIN 46228/Part 1 or DIN 46228/Part 4, 0.2 ... 1 mm^2. To crimp the ferrules we recommend crimping pliers (crimp form A) conforming to EN 60947-1, such as the PZ 6/5 from Weidmüller, for example.
- Terminal points per connection: 1
- Stripping length: 8 mm

Digital input/output (Failsafe)
PSSu K F FCU

Connect/disconnect the cables

We recommend you use a screw driver with a 0.4 x 2.5 mm (DIN 5264) blade!

Strip the cable:

- Strip the cable [1] and apply a ferrule if necessary (DIN 46228/Part 1 or DIN 46228/Part 4).

Connect cable:

- Using the screwdriver, press the actuator button on the spring-loaded terminal down as far as it will go [2], keep it held down and insert the stripped cable into the plug connection as far as it will go [2].
- Check that the cable is firmly seated [3].

Disconnect cable:

- Using the screwdriver, press the actuator button down as far as it will go [4], keep it held down and pull the cable out of the plug connection [4].

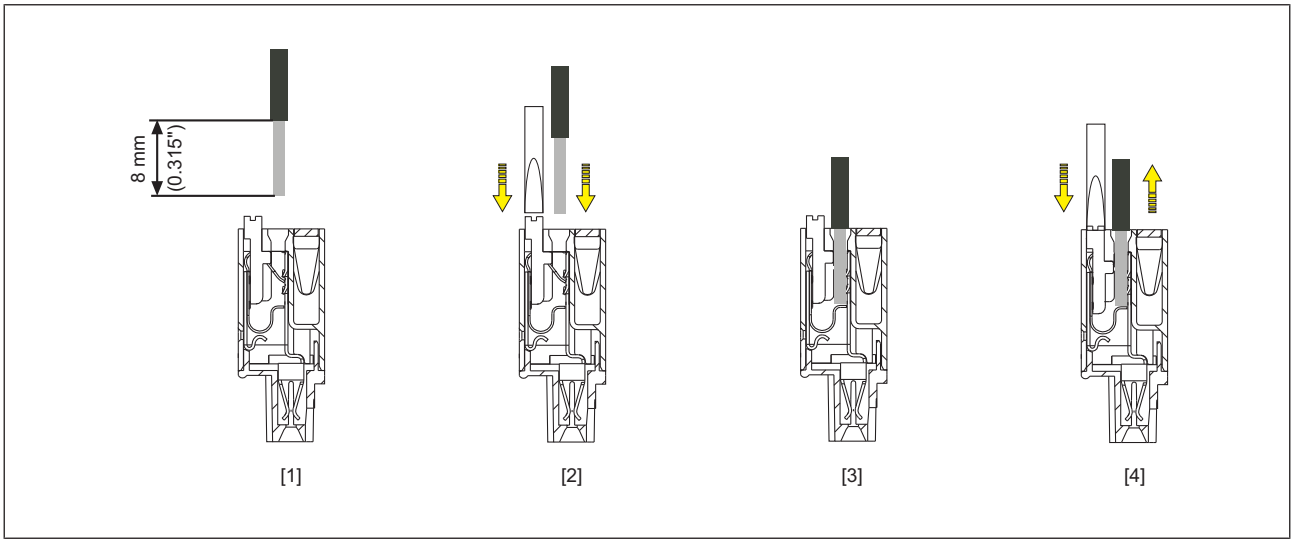
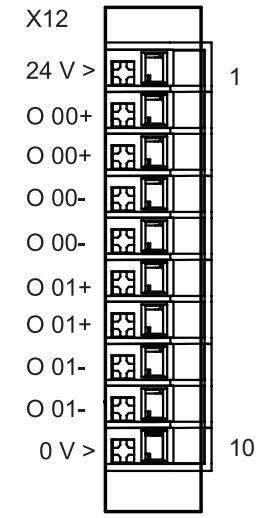
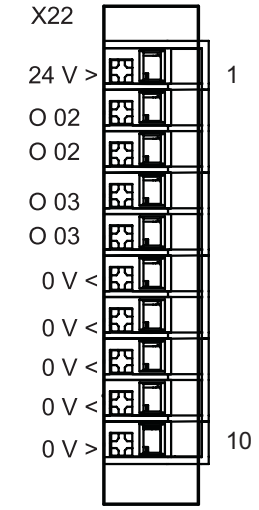


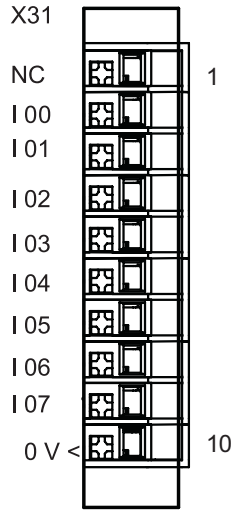
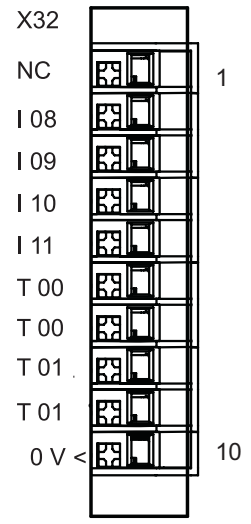
Fig.: Connect and disconnect the cables

Digital input/output (Failsafe)
PSSu K F FCU

Terminal configuration

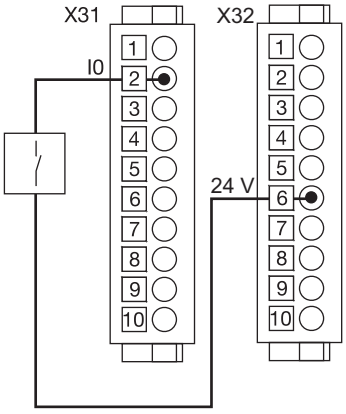
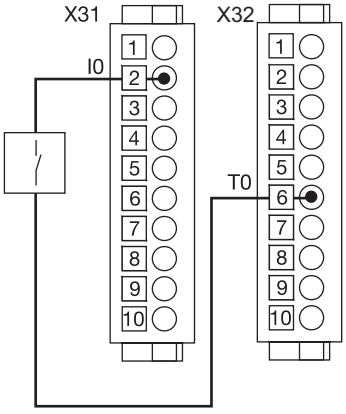
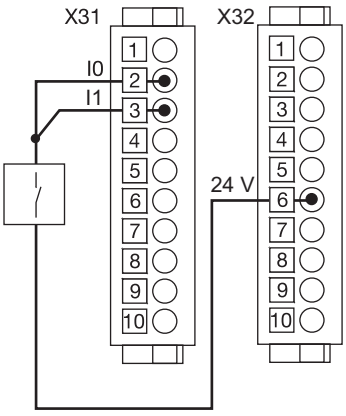
Output terminals of connectors with spring-loaded terminals (1-row/10-pin): PSSu A Con 1/10 C	
X12: 24 V >: +24 V (external periphery supply) O 00+: Output 1, dual-pole positive-switching O 00+: Output 1, dual-pole positive-switching O 00-: Output 1, dual-pole negative-switching O 00-: Output 1, dual-pole negative-switching O 01+: Output 2, dual-pole positive-switching O 01+: Output 2, dual-pole positive-switching O 01-: Output 2, dual-pole negative-switching O 01-: Output 2, dual-pole negative-switching 0 V >: 0 V (external periphery supply)	
X22: 24 V >: +24 V (external periphery supply) O 02: Output 0 O 02: Output 0 O 03: Output 1 O 03: Output 1 0 V <: 0 V (periphery supply) 0 V <: 0 V (periphery supply) 0 V <: 0 V (periphery supply) 0 V <: 0 V (periphery supply) 0 V >: 0 V (external periphery supply)	

Digital input/output (Failsafe)
PSSu K F FCU

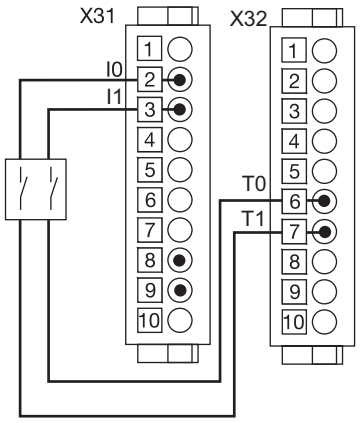
Input pin assignment of connectors with spring-loaded terminals (1-row/10-pin): PSSu A Con 1/10 C	
X31: n.c.: not connected I 00: Input 0 I 01: Input 1 I 02: Input 2 I 03: Input 3 I 04: Input 4 I 05: Input 5 I 06: Input 6 I 07: Input 7 0 V <: 0 V (periphery supply)	
X32: NC.: not connected I 08: Input 8 I 09: Input 9 I 10: Input 10 I 11: Input 11 T 00: Test pulse output T0 or +24 V output (periphery supply) T 00: Test pulse output T0 or +24 V output (periphery supply) T 01: Test pulse output T1 or +24 V output (periphery supply) T 01: Test pulse output T1 or +24 V output (periphery supply) 0 V <: 0 V (periphery supply)	

Digital input/output (Failsafe)
PSSu K F FCU

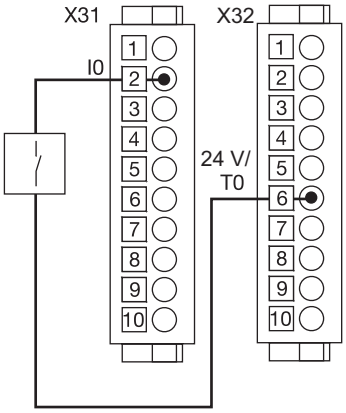
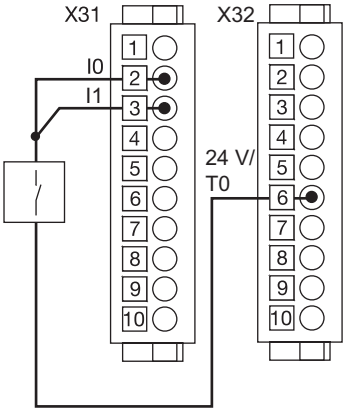
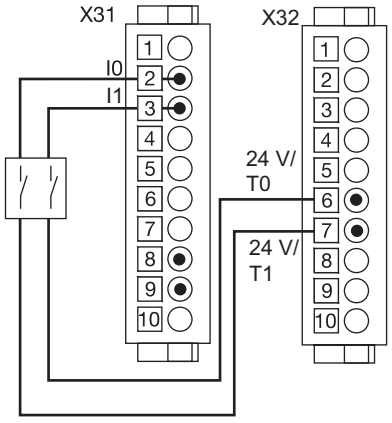
Connecting the module

Input circuit for pulse stretching	Wiring
▸ 1-channel sensor ▸ Without input pairs ▸ Without test pulse ▸ Maximum processing time t_{ProcIM}: $t_{ProcIM} = t_{filter} + 500\ \mu s$	
▸ 1-channel sensor ▸ Without input pairs ▸ With test pulse ▸ Maximum processing time t_{ProcIM}: $t_{ProcIM} = t_{filter} + 2000\ \mu s$	
▸ 1-channel sensor ▸ With input pairs ▸ Without test pulse ▸ Maximum processing time t_{ProcIM}: $t_{ProcIM} = t_{filter} + 200\ \mu s$	

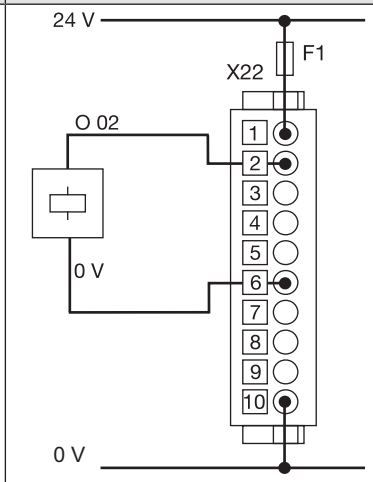
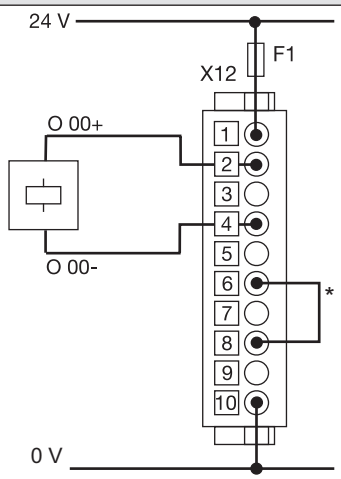
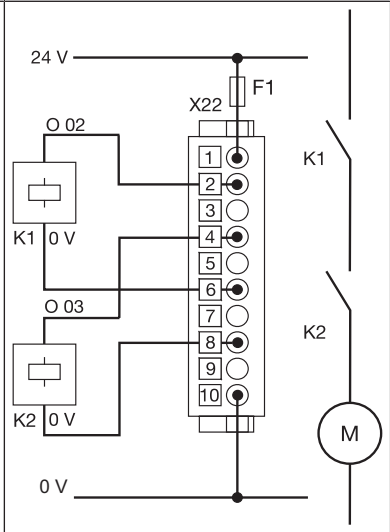
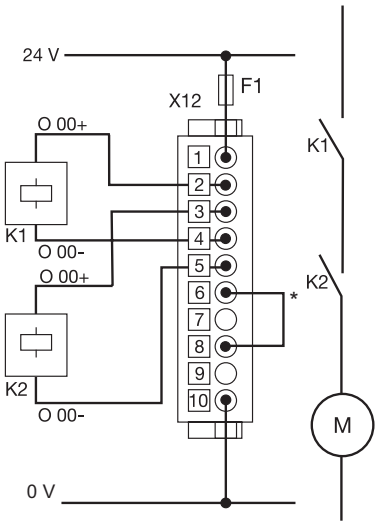
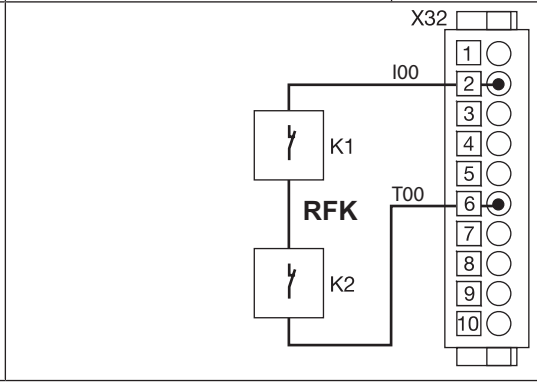
Digital input/output (Failsafe)
PSSu K F FCU

Input circuit for pulse stretching	Wiring
▸ 2-channel sensor ▸ With input pairs ▸ With test pulse ▸ Maximum processing time t_{ProcIM}: $t_{ProcIM} = t_{filter} + 200\ \mu s$ ▸ Please note that errors in one of the two channels for signals less than 200 µs cannot be detected safely. For signal times less than 2000 µs the sensor must be included in the safety assessment as a 1-channel sensor. ▸ The signals from a 2-channel sensor with two N/O contacts must be logic AND-linked in the user program. ▸ The signals from a 2-channel sensor with two N/C contacts must be logic OR-linked in the user program.	

Digital input/output (Failsafe)
PSSu K F FCU

Input circuit for fast shutdown	Wiring
▸ 1-channel sensor ▸ Without input pairs ▸ With/without test pulse ▸ Maximum processing time t_{ProcIM}: $t_{ProcIM} = t_{filter} + 2500\ \mu s$	
▸ 1-channel sensor ▸ With input pairs ▸ With/without test pulse ▸ Rising edge: Maximum processing time t_{ProcIM}: $t_{ProcIM} = t_{filter} - 100\ \mu s$ ▸ Falling edge: Maximum processing time t_{ProcIM}: $t_{ProcIM} = t_{filter}$	
▸ 2-channel sensor ▸ With input pairs ▸ With/without test pulse ▸ Rising edge: Maximum processing time t_{ProcIM}: $t_{ProcIM} = t_{filter} - 100\ \mu s$ ▸ Falling edge: Maximum processing time t_{ProcIM}: $t_{ProcIM} = t_{filter}$	

Digital input/output (Failsafe)
PSSu K F FCU

Output circuit	1-pole outputs	2-pole outputs
1-channel operation		
2-channel operation		
Feedback loop		

* Place a jumper between unused 2-pole outputs, because otherwise an open circuit will be detected between these outputs.

On dual-pole outputs, both terminals (O00 +/- or O01 +/-) must be used from an output current of 2.18 A per load.

Digital input/output (Failsafe)
PSSu K F FCU

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 a short circuit to a supply voltage.

Technical details

General	
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Application range	**Failsafe**
Module's device code	**0E01h**
Number of FS input bits	**12**
Number of FS output bits	**4**
Number of FS status bits	**8**
Number of FS control bits	**4**
Application in system environment B	
From FS firmware version, head modules	**1.7.0**
Electrical data	
Supply voltage	
for	**Module supply**
Voltage	**5 V**
Kind	**DC**
Voltage tolerance	**-4 %/+4 %**
Max. continuous current that the external power supply must provide	**0,3 A**
Output of external power supply (DC)	**1,3 W**
Supply voltage	
for	**Periphery supply**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**0,5 A**
Output of external power supply (DC)	**12 W**
Supply voltage	
for	**Outputs**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**10 A**
Internal supply voltage (module supply)	
Module's power consumption	**1,25 W**

Digital input/output (Failsafe)
PSSu K F FCU

Electrical data	
Periphery's supply voltage (periphery supply)	
Voltage range	**16,8 - 30 V**
Module's current consumption with no load	**8 mA**
Module's power consumption with no load	**0,19 W**
Max. power dissipation of module	**7,15 W**
Inputs	
Number	**12**
Input current range	**2,5 - 7,5 mA**
Min. threshold voltage when signal changes from "1" to "0"	**9 V**
Max. threshold voltage when signal changes from "0" to "1"	**10 V**
Max. processing time of input in "pulse stretching" mode when signal changes from "0" to "1" (depending on the configured input filter time)	**400 ... 5300 µs**
Max. processing time of input in "pulse stretching" mode when signal changes from "1" to "0" (depending on the configured input filter time)	**400 ... 5300 µs**
Max. processing time of input in "rapid shutdown" mode when signal changes from "0" to "1" (depending on the configured input filter time)	**100 ... 5800 µs**
Max. processing time of input in "rapid shutdown" mode when signal changes from "1" to "0" (depending on the configured input filter time)	**200 ... 5800 µs**
Potential isolation between input and internal module bus voltage	**yes**
Semiconductor outputs	
Number of positive-switching single-pole semiconductor outputs	**2**
Voltage	**24 V**
Typ. output current at "1" signal and rated voltage of semiconductor output	**2 A**
Permitted current range	**0,000 - 2,500 A**
Residual current at "0" signal	**0,02 A**
Max. transient pulsed current	**6 A**
Max. internal voltage drop	**100 mV**
Monitoring threshold of semiconductor output	**9 V**
Max. duration of on time during self test	**200 µs**
Max. duration of off time during self test	**200 µs**
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,25 ms**
Max. processing time of semiconductor output when signal changes from "0" to "1"	**0,45 ms**
Potential isolation from system voltage	**yes**

Digital input/output (Failsafe)
PSSu K F FCU

Semiconductor outputs	
Potential isolation between semiconductor output and input	**yes**
Short circuit-proof	**yes**
Permitted loads	**inductive, capacitive, resistive**
Semiconductor outputs, 2-pole	
Number of dual-pole semiconductor outputs	**2**
Permitted current range	**0,00 - 3,50 A**
Terminal voltage when switching off inductive loads	**-185 V**
Typ. output current at "1" signal and rated voltage of semiconductor output	**3 A**
Residual current at "0" signal	**0,02 A**
Max. pulsed current for t < 100 ms	**12 A**
Open circuit detection off	**0,17 kOhm**
Potential isolation	**yes**
Short circuit-proof	**yes**
Permitted loads	**inductive, capacitive, resistive**
Monitoring threshold of semiconductor output	**9 V**
Max. duration of on time during self test	**4 ms**
Max. duration of off time during self test	**400 µs**
Max. processing time of semiconductor output when signal changes from "0" to "1"	**9,3 ms**
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,25 ms**
Test pulse outputs	
Number of test pulse outputs	**2**
Voltage, test pulse outputs	**24 V DC**
Short circuit-proof	**yes**
Number of outputs that can be configured as test pulses	**2**
Max. output current at "1" signal	**0,25 A**
Max. cable length between test pulse output and input	**200 m**
Standard for voltage interruptions	**DIN V EN V 1954, EN61131-2, EN61496-1**
Times	
Max. reaction time of fast shutdown when signal changes from "1" to "0" (depending on the configured input filter time)	**0,45 - 3,55 ms**
Max. reaction time of fast shutdown when signal changes from "0" to "1" (depending on the configured input filter time)	**0,65 - 3,75 ms**

Digital input/output (Failsafe)
PSSu K F FCU

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 - 60 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**
Climatic suitability	
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**
Max. operating height above sea level	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 150 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Acceleration	**15g**
Duration	**11 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
In accordance with the standard	**EN 60529**
Housing	**IP20**
Mounting area (e.g. control cabinet)	**IP54**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Labelling bracket (accessories)	**PC**
Connection type	**Connector strip**
Mounting type	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1 mm², 22 - 18 AWG**

Digital input/output (Failsafe)
PSSu K F FCU

Mechanical data	
Spring-loaded terminals: Terminal points per connection	**1**
Stripping length with spring-loaded terminals	**8 mm**
Dimensions	
Height	**128,9 mm**
Width	**56 mm**
Depth	**56 mm**
Depth incl. connector (accessories)	**69,5 mm**
Depth incl. labelling bracket (accessories)	**83,5 mm**
Weight	**170 g**

Where standards are undated, the 2012-02 latest editions shall apply.

Safety characteristic data

Unit	Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	EN ISO 13849-1: 2015 T_M [year]
Logic						
Logic	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**1,36E-10**	**20**
Input						
Digital inputs	**1-channel**	**PL d**	**Cat. 2**	**SIL CL 2**	**3,55E-09**	**20**
Digital inputs	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**7,31E-11**	**20**
Digital inputs	**1-ch., pulsed light barrier**	**PL e**	**Cat. 4**	**SIL CL 3**	**3,55E-10**	**20**
Output						
SC outputs (1-pole)	**1-channel**	**PL d**	**Cat. 2**	**SIL CL 2**	**3,95E-09**	**20**
SC outputs (1-pole)	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**8,17E-11**	**20**
SC outputs (2-pole)	–	**PL e**	**Cat. 4**	**SIL CL 3**	**7,85E-11**	**20**

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

Digital input/output (Failsafe)
PSSu K F FCU

Order reference

Product

Product type	Features	Order No.
PSSu K F FCU	Compact module	312 435

Accessories

Terminals

Product type	Features	Order No.
PSSu A Con 1/10 C	Connector with spring-loaded terminals 1-row/10-pin, scope of supply: 2 pieces. 2 sets are needed per module (4 pieces)	313 115

Labelling

Product type	Features	Order no.
PSSu A LC 0.2	Labelling bracket, scope of supply: 5 pieces	312 965
PSSu A LA0	Labelling strips, laser printable, scope of supply: 1080 pieces (10 x DIN A4 sheet, 108 on each)	312 958

Analogue input/output (standard)

Analogue input/output (standard)

Contents	Page

Analogue input/output (standard)
PSSu E S 2AI I se

Overview

Module features

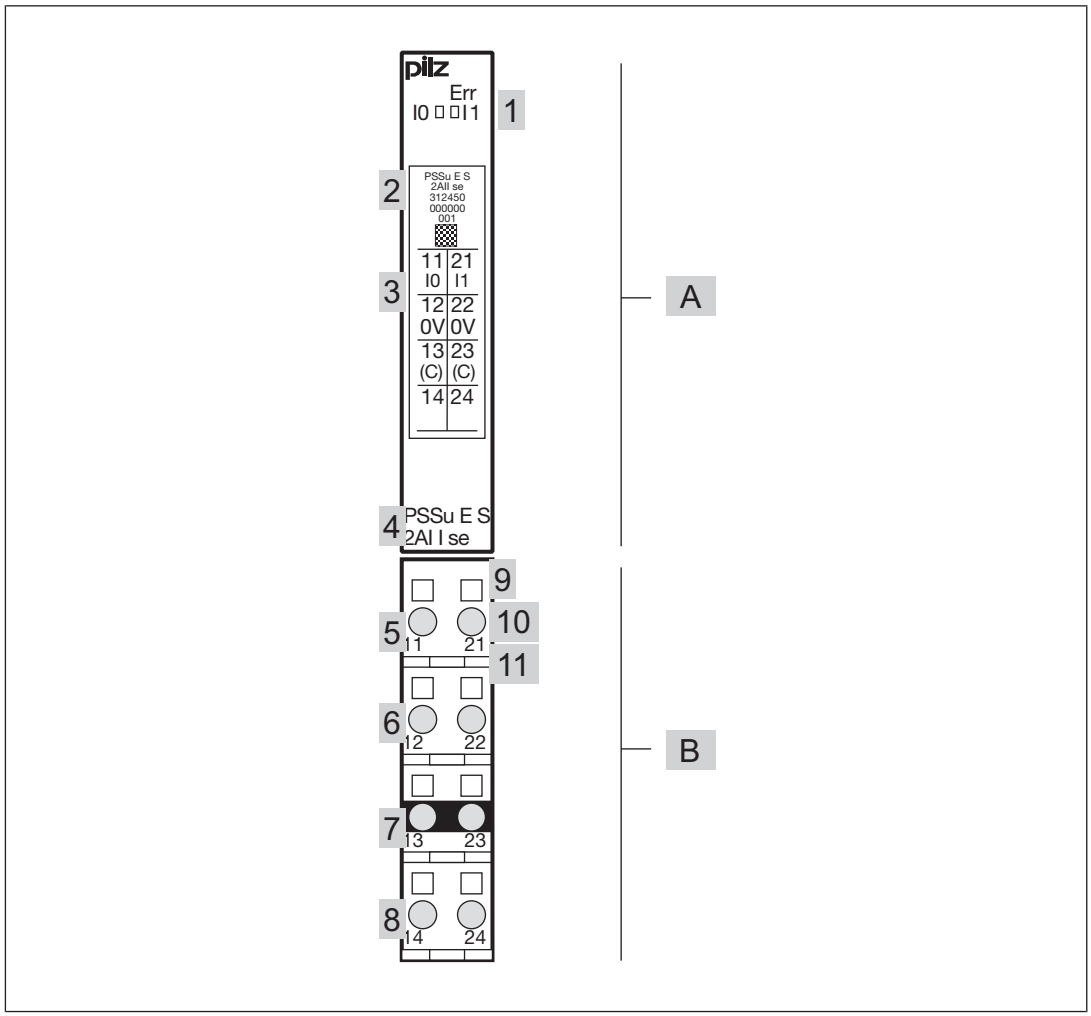
The product has the following features:

- 2 analogue current inputs
- Configurable current ranges:
  - 0 ... 20 mA single-pole, referenced to earth (single-ended)
  - 4 ... 20 mA single-pole, referenced to earth (single-ended)
- Resolution: 12 Bit
- LEDs for:
  - Operating status per input
  - Module error
- For standard applications in system environment A and B
- T-type:

  PSSu E S 2AI I se-T: for increased environmental requirements

Analogue input/output (standard)
PSSu E S 2AI I se

Front view



Legend:

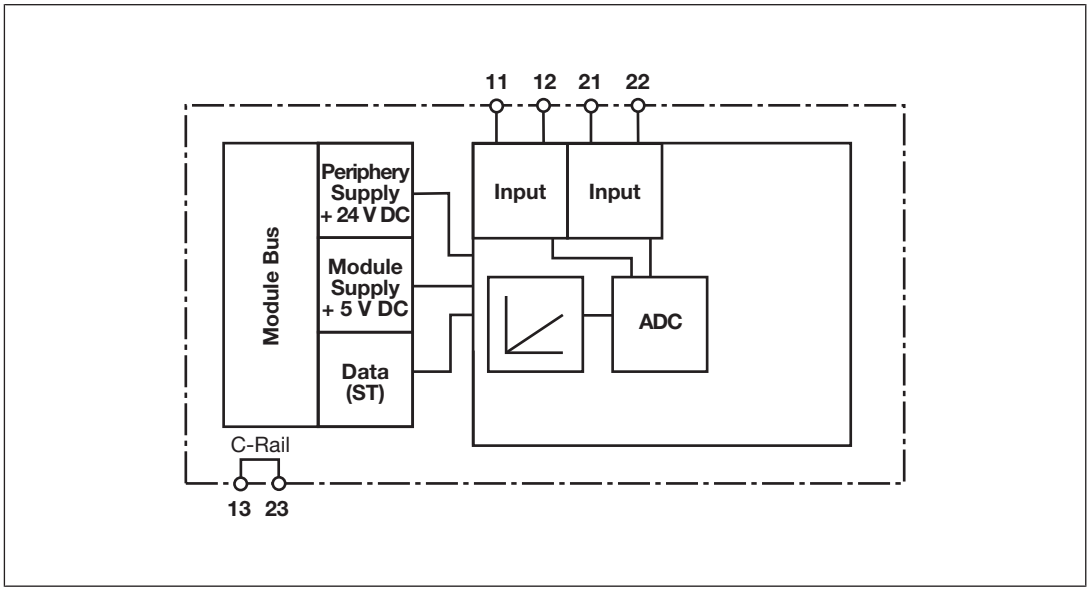
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Status indicator
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Analogue input/output (standard)
PSSu E S 2AI I se

- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1
- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Analogue input/output (standard)
PSSu E S 2AI I se

Module features

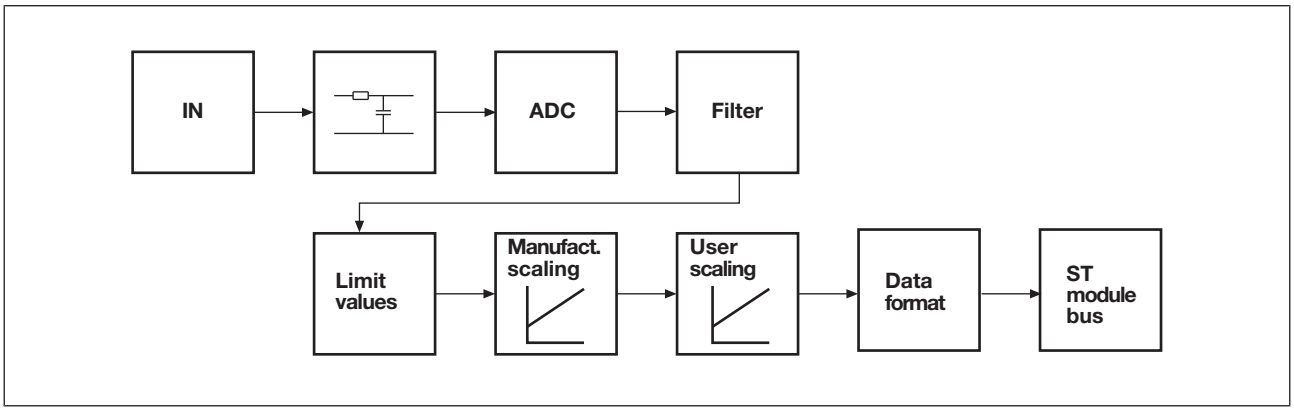
The module supply provides the module with voltage.

The input signals are read in, analogue prefiltered and converted into digital signals. The resolution is 12 bits (4095 steps) and is converted into a 16 Bit value. Additional signal processing can be defined using the system software (see schematic representation of signal processing). The individual steps are described in the "Configuration" section.

The input signals are transmitted to the head module via the ST module bus. As an option the input module can send status information for each input.

All the configuration data is stored in the head module and is assigned to the input module on restart. This way the configuration data is retained even if you change the input module.

Schematic representation of signal processing:



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

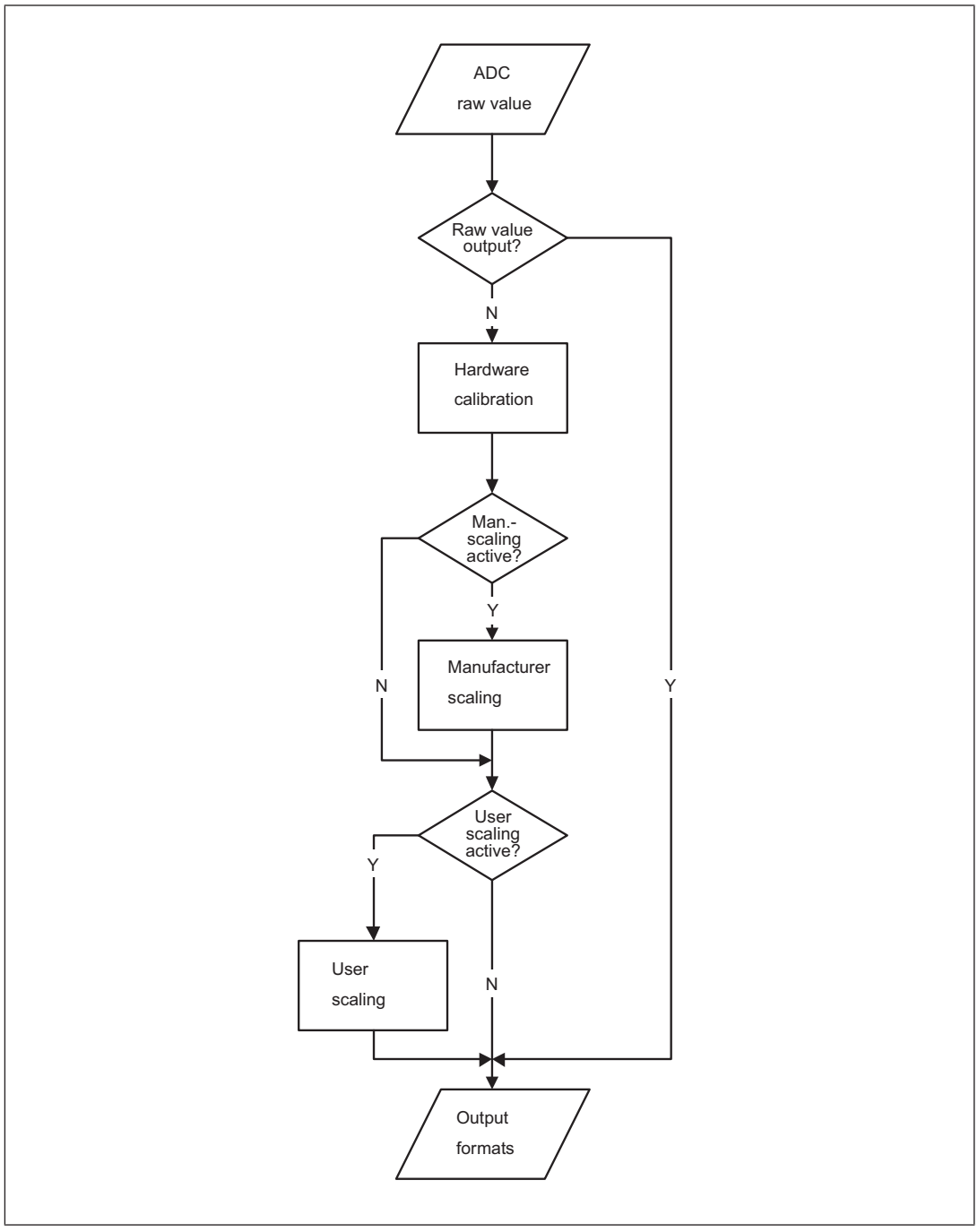
- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Analogue input/output (standard)
PSSu E S 2AI I se

Configuration

The module can be configured using the system software.

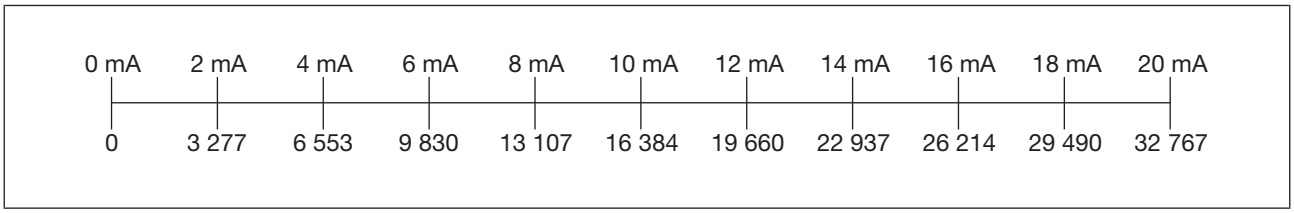
Scaling is a multi-stage process to adapt the values from the AD converter. The straight path in the diagram indicates the default configuration.



Analogue input/output (standard)
PSSu E S 2AI I se

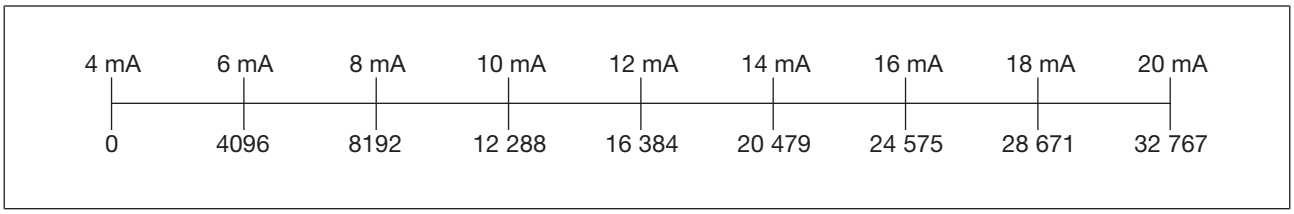
Analogue value and typical digital value with a current range of 0 ... 20 mA and default values:

Analogue value of current	Decimal digital value
0 mA	0
10 mA	16 384
20 mA	32 767



Analogue value and typical digital value with a current range of 4 ... 20 mA and default values:

Analogue value of current	Decimal digital value
4 mA	0
12 mA	16 384
20 mA	32 767



You can configure each channel so that the raw value from the AD converter is issued directly, without calibration or scaling.

If the AD converter fails to supply a valid value, the module will adopt the ADC initialisation value for this channel instead. The default value is 4096_D (1000_H).

Each channel is calibrated ex-works in order to correct component dispersion and other influences.

The range is divided so that zero is assigned the value 0 and the end point is assigned the value 4095_D ($0FFF_H$).

The manufacturer scaling is used to define the offset (zero point compensation) and gain (amplification) of the digital signal.

Manufacturer scaling active (default setting)

- Default values for manufacturer scaling:
  - Offset (b_1): 0
  - Gain (a_1): 8194_D (2002_H)

Analogue input/output (standard)
PSSu E S 2AI I se

The digital value after manufacturer scaling is calculated using the following formula:

- $y = (a_1 / 1024_D * x) + b_1$ or
- $y = (a_1 / 400_H * x) + b_1$

Legend:

- **y**: Digital value after manufacturer scaling
- **x**: Digital value before manufacturer scaling
- **a** $_1$: Gain
- **b** $_1$: Offset
- **a** $_1$ / 1024_D: Amplification factor

Arithmetic examples using decimal values:

Digital value before manufacturer scaling (x)	Gain (a_1)	Offset (b_1)	Amplification factor (a_1 / 1024_D)	Value after manufacturer scaling (y)
1 000	1 024	0	1	1 000
1 000	2 048	0	2	2 000
1 000	8 192	0	8	8 000
1 000	1 075	500	1.05	1 550
1 000	512	-50	0.5	450

The module always uses two's complement representation for internal processing, irrespective of the configured data format. The values from 0000_H to $FFFF_H$ form a number circle in the two's complement representation. 8000_H follows $7FFF_H$ (= $32\ 767_D$) and is interpreted as the lowest negative number (= $-32\ 768_D$). $32\ 767_D$ is never exceeded; the value never falls below $-32\ 768_D$.

User scaling is a second level of scaling. You can use this scaling to correct local influences. The function is the same as that of manufacturer scaling, but a different value is used for amplification factor 1:

- $y = (a_2 / 256_D * x) + b_2$ or
- $y = (a_2 / 100_H * x) + b_2$

a_2 = Amplification factor * 256_D

User scaling is deactivated in the default setting. The default value for offset is 0. The default value for gain is 256_D (100_H). That corresponds to amplification factor 1.

Key:

- **y**: Digital value after user scaling
- **x**: Digital value before user scaling
- **a_2**: Gain
- **b_2**: Offset

Analogue input/output (standard)
PSSu E S 2AI I se

- **a_2** / 1024_D: Amplification factor

Task:

When there is 20 mA at the input, the PII should show a decimal value of 20 000. User scaling (Gain a_2) should be used in this case. Manufacturer scaling should not be changed. All numbers are decimals.

Solution:

Manufacturer scaling
$y = (a_1 / 1024 * x) + b_1$
and user scaling
$y = (a_2 / 256 * x) + b_2$
act consecutively, giving:
$y = (a_2 / 256 * ((a_1 / 1024 * x) + b_1)) + b_2$ or:
$y = (a_1 * a_2 * x / 262144) + (a_2 * b_1 / 256) + b_2$

With default values for $a_1 = 8194$, $b_1 = 0$ and the default value $b_2 = 0$:
$y = a_2 / 32 * x$
$a_2 = y * 32 / x$

Due to the hardware calibration the converter's input range is divided so that the 10 V end point is assigned the value x = 4095. With the default values x = 4095 and y= 20 000 the result is:
Gain $a_2 = 156$

A digital filter can suppress spurious frequencies in the input signals.

- FIR filters specifically suppress certain spurious frequencies (notch mode). In this way, for example, the residual ripple from the power supply can be filtered out of the input signal.
- IIR filters suppress all frequencies above a cutoff frequency (low pass mode). This means that short-term fluctuations can be filtered out of the input signal.

You can select one of the following filters per module:

- 2nd order FIR filter
- IIR filter, cutoff frequency 1 kHz
- IIR filter, cutoff frequency 100 Hz
- IIR filter, cutoff frequency 50 Hz
- IIR filter, cutoff frequency 20 Hz
- IIR filter, cutoff frequency 10 Hz
- IIR filter, cutoff frequency 5 Hz
- IIR filter, cutoff frequency 1 Hz
- FIR filter, notch frequency 50 Hz
- FIR filter, notch frequency 60 Hz

The filter is deactivated as the default value.

Analogue input/output (standard)
PSSu E S 2AI I se

The module has range monitoring and limit value monitoring on each channel:

- Range monitoring
  - Upper limit value: 4095_D
  - Lower limit value: -4095_D
  - The module compares the upper and lower limit value with the digital value after the hardware calibration (values with 12 bits plus sign) and writes the result of the comparison as follows:
    - System environment A:
    - In the status byte (see "PSSu assignment in system environment A")
    - System environment B:
    - In the I/O data element "Overrange" or "Underrange" (see "PSSu assignment in system environment B").
  - The limit of the measuring range corresponds to 4095_D.
- Limit value monitoring
  - Limit value 1
  - Limit value 2
  - The module compares limit value 1 and limit value 2 with the digital value after scaling (values with 15 bits plus sign) and writes the result of the comparison as follows:
    - System environment A:
    - In the status byte (see "PSSu assignment in system environment A")
    - System environment B:
    - In the I/O data element "LimitValue1" or "LimitValue2" (see "PSSu assignment in system environment B").
  - The limit of the measuring range corresponds to $32\ 767_D$ with default scaling values.

You can change the default values in the system software.

The decimal value for the PSSuniversal Configurator (n) is calculated from the analogue value at the input (I_{Limit}) as follows:

- Current range 0 … 20 mA:
  $n = 32\ 768 * I_{Limit} / 20\ mA$
- Current range 4 … 20 mA:
  $n = 32\ 768 * (I_{Limit} – 4\ mA) / 16\ mA$

Example:

- Current at the input, which is to be monitored through the limit values:
  - Limit value 1 is to be 8 mA.
  - Limit value 2 is to be 15 mA.

Analogue input/output (standard)
PSSu E S 2AI I se

- Entry in the PSSuniversal Configurator at
  Current range 0 … 20 mA:
  - Limit value 1 corresponds to 13 107
  - Limit value 2 corresponds to 24 576
- Entry in the PSSuniversal Configurator at
  Current range 4 … 20 mA:
  - Limit value 1 corresponds to 8 192
  - Limit value 2 corresponds to 22 528

The way in which the analogue value is displayed depends on the voltage range, on scaling and on the data format. The following examples show the relationship between the values with default scaling.

The module uses the following data format:

- Two's complement
  The digital values are transferred with 15 bits plus a sign bit (MSB). The MSB is always "0" with positive numbers.

Analogue value and typical digital value with a current range of 0 ... 20 mA, two's complement:

Analogue value of current	Decimal digital value	Binary digital value	Hexadecimal digital value
0 mA	0	0000 0000 0000 0000	0000_H
10 mA	16 384	0100 0000 0000 0000	4000_H
20 mA	32 767	0111 1111 1111 1111	$7FFF_H$

Analogue value and typical digital value with a current range of 4 ... 20 mA, two's complement:

Analogue value of current	Decimal digital value	Binary digital value	Hexadecimal digital value
4 mA	0	0000 0000 0000 0000	0000_H
12 mA	16 384	0100 0000 0000 0000	4000_H
20 mA	32 767	0111 1111 1111 1111	$7FFF_H$

Analogue input/output (standard)
PSSu E S 2AI I se

The module has the following configuration options:

Configurable properties	Default value	Meaning
Input area	0	0 mA ... 20 mA (1 = 4 mA ... 20 mA)
Manufacturer scaling active	1/TRUE	Activated
Manufacturer scaling offset	0	Offset: Magnitude 0
Manufacturer scaling gain	8194_D	8x amplification, displaced three bit places
User scaling active	0/FALSE	Deactivated
User scaling offset	0	Offset: Magnitude 0
User scaling gain	256_D	1x amplification, signal unchanged
Filter active	0/FALSE	Deactivated
Filter characteristic	0	2nd order FIR filter
Range monitoring active	1/TRUE	Activated
Upper limit value	4095_D	Upper limit of number range
Lower limit value	-4095_D	Lower limit of number range
Limit value 1 active	0/FALSE	Deactivated
Limit value 1	$-32\ 767_D$	Lower limit of number range
Limit value 2 active	0/FALSE	Deactivated
Limit value 2	$32\ 767_D$	Upper limit of number range
Sign and magnitude representation active	0/FALSE	Deactivated; two's complement is activated
Output ADC raw value only	0/FALSE	Deactivated
ADC initialisation value	4096_D	4096_D (1000_H) is issued when no data is detected.

Each input occupies 16 consecutive bit addresses for the input data. Each input occupies an additional 8 consecutive bit addresses for the status byte, where this has been configured for the input. If the status byte is configured to be transferred without input data, each input occupies 8 consecutive bit addresses. All the status bytes are displayed first in the PII, followed by the input data.

Configuration	Standard bus system	
	ST-PII	ST-PIO
Send input data	32 Bit	- - -
Send status byte ("R")	16 Bit	- - -

Analogue input/output (standard)
PSSu E S 2AI I se

Bit sequence in the PII, input data only, no status byte:

Input	PII	Assignment
Input I0	1	LSB input data
	...	...
	16	MSB input data
Input I1	17	LSB input data
	...	...
	32	MSB input data

Bit sequence in the PII, input data and status byte:

Input	PII	Assignment
Input I0	1	LSB status byte
	...	...
	8	MSB status byte
Input I1	9	LSB status byte
	...	...
	16	MSB status byte
Input I0	17	LSB input data
	...	...
	32	MSB input data
Input I1	33	LSB input data
	...	...
	48	MSB input data

Bit sequence in the PII, status byte only, no input data:

Input	PII	Assignment
Input I0	1	LSB status byte
	...	...
	8	MSB status byte
Input I1	9	LSB status byte
	...	...
	16	MSB status byte

ST modules for analogue input can transfer a variety of status information to the ST-PII (see table below for the conveyed status). The information is transmitted using the input's status byte. Read access (R) is configured for the input for that purpose.

Analogue input/output (standard)
PSSu E S 2AI I se

Structure and contents of the status byte:

Bit number	Content	Meaning
0	0	Input value above the lower limit value
	1	Value below the lower limit value
1	0	Input value below the upper limit value
	1	Value exceeds the upper limit value
2 / 3	0 0	Limit value 1 inactive
	0 1	Input value greater than or equal to limit value 1
	1 0	Input value less than limit value 1
	1 1	Reserved
4 / 5	0 0	Limit value 2 inactive
	0 1	Input value greater than limit value 2
	1 0	Input value less than or equal to limit value 2
	1 1	Reserved
6	0	Valid data from A/D converter
	1	No valid data from A/D converter
7	0	Reserved
	1	Reserved

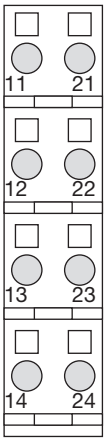
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
I0(11) I1(21)	ST_I_AI	Data: WORD	Input data I0 and I1
		Underrange: BOOL	0: Input value above the lower limit value 1: Value below the lower limit value
		Overrange: BOOL	0: Input value below the upper limit value 1: Value exceeds the upper limit value
		LimitValue1: BOOL	0: Limit value 1 inactive 1: Input value greater than or equal to limit value 1
		LimitValue2: BOOL	0: Limit value 2 inactive 1: Input value greater than or equal to limit value 2

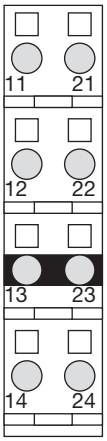
Analogue input/output (standard)
PSSu E S 2AI I se

Wiring

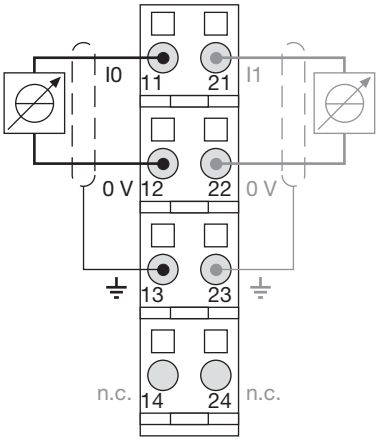
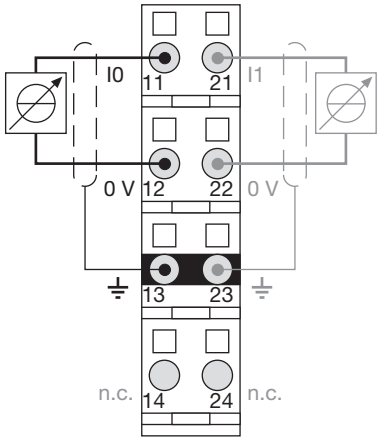
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Input I0 21: Input I1 12-22: 0 V analogue (12-22 linked within the base module) 13-23: Shield connection (13-23 linked within the base module) 14: Not connected 24: Not connected	

Analogue input/output (standard)
PSSu E S 2AI I se

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Input I0 21: Input I1 12-22: 0 V analogue (12-22 linked within the base module) 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Not connected 24: Not connected	

Connecting the module

Input circuit	Without C-rail	With C-rail
current range 0 ... 20 mA current range 4 ... 20 mA single-pole, referenced to earth		

Analogue input/output (standard)
PSSu E S 2AI I se

Technical details

General	312450	314450
Approvals	**CE, TÜV, cULus Listed**	**CE, TÜV, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0310h**	**0310h**
Number of ST input bits	**32**	**32**
Number of ST status bits	**16**	**16**
Application in system environment A		
From ST firmware version, other head modules	**7**	**7**
From ST firmware version PSSu H S PN	**1**	**1**
From ST firmware version PSSu WR S IDN	**4**	**4**
Application in system environment B		
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312450**	**314450**
Internal supply voltage (module supply)		
Module's power consumption	**0,22 W**	**0,22 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**10 mA**	**10 mA**
Module's power consumption with no load	**0,24 W**	**0,24 W**
Max. power dissipation of module	**1,50 W**	**1,50 W**
Analogue inputs	**312450**	**314450**
Number of analogue inputs	**2**	**2**
Type of analogue inputs	**Current**	**Current**
Input area	**0 ... 20 mA, 4 ... 20 mA**	**0 ... 20 mA, 4 ... 20 mA**
Measuring ranges		
Type	**Single-ended**	**Single-ended**
Measuring range	**0 - 20 mA**	**0 - 20 mA**
Type	**Single-ended**	**Single-ended**
Measuring range	**4 - 20 mA**	**4 - 20 mA**
Input filter	**RC filter**	**RC filter**
Cutoff frequency	**130 Hz**	**130 Hz**

Analogue input/output (standard)
PSSu E S 2AI I se

Analogue inputs	312450	314450
Current measurement		
Input resistance	**115,000 Ohm**	**115,000 Ohm**
Max. continuous current	**35 mA**	**35 mA**
Resolution	**12 Bit**	**12 Bit**
Deviations from the measuring range limit value		
Linearity error	**0,05 %**	**0,05 %**
Output variable error at 25 °C	**0,2 %**	**0,2 %**
Temperature coefficient	**0,0200 %/K**	**0,0200 %/K**
Max. measurement error during EMC test	**2,5 %**	**2,5 %**
Potential isolation between input and periphery supply	**yes**	**yes**
Typ. processing time of the analogue input	**1,0 ms**	**1,0 ms**
Inputs	**312450**	**314450**
Potential isolation between input and internal module bus voltage	**yes**	**yes**
Environmental data	**312450**	**314450**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**

Analogue input/output (standard)
PSSu E S 2AI I se

Environmental data	312450	314450
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312450**	**314450**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**36 g**	**36 g**
Mechanical coding		
Type	**D**	**D**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2005-04 latest editions shall apply.

Analogue input/output (standard)
PSSu E S 2AI I se

Order reference

Product

Product type	Features	Order No.
PSSu E S 2AI se	Electronic module, base type	312 450
PSSu E S 2AI se-T	Electronic module, T-type	314 450

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C 1/12 S	Base module with C-rail and screw terminals	312 620
PSSu BP-C 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 620
PSSu BP-C 1/12 C	Base module with C-rail and cage clamp terminals	312 621
PSSu BP-C 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 621

Analogue input/output (standard)
PSSu E S 4AI U

Overview

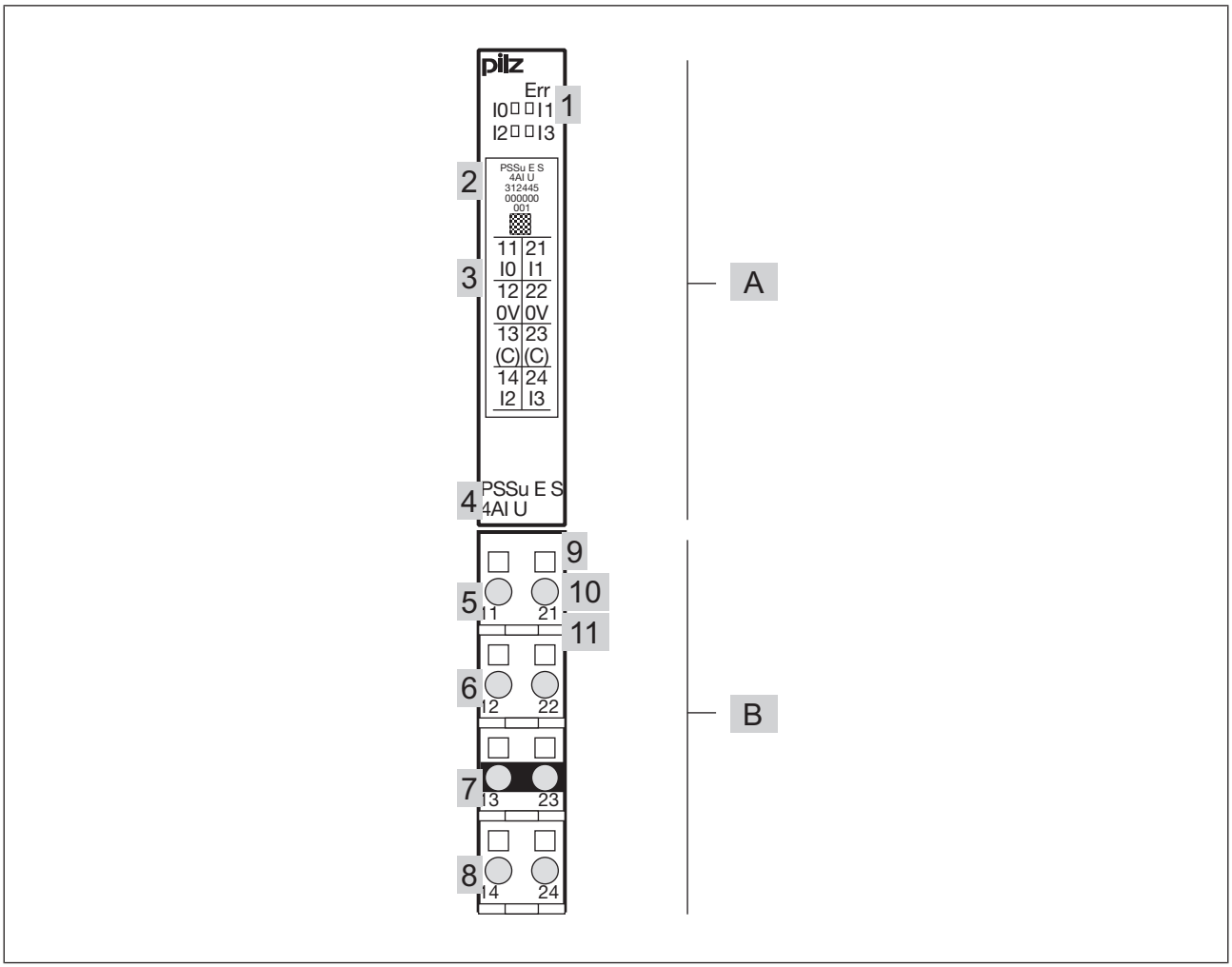
Module features

The product has the following features:

- 4 analogue voltage inputs
- Voltage range:
  - 0 ... +10 V single-pole, referenced to earth (single-ended)
- Resolution: 12 Bit
- LEDs for:
  - Operating status per input
  - Module error
- For standard applications in system environment A and B
- T-type:
  PSSu E S 4AI U-T: for increased environmental requirements

Analogue input/output (standard)
PSSu E S 4AI U

Front view



Legend:

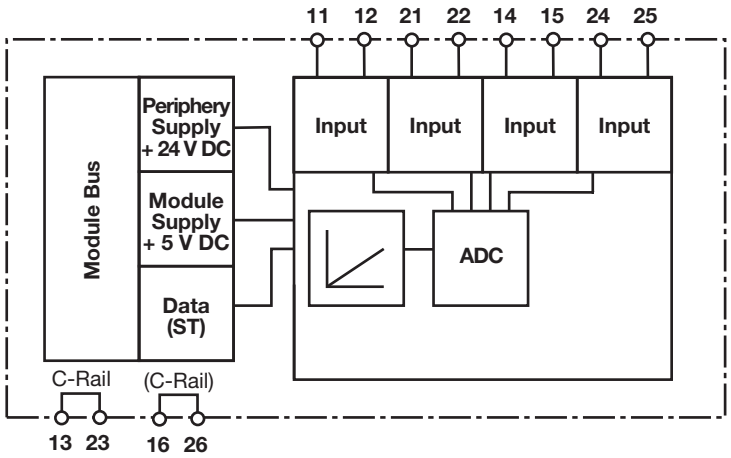
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Status indicator
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Analogue input/output (standard)
PSSu E S 4AI U

- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1
- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Analogue input/output (standard)
PSSu E S 4AI U

Module features

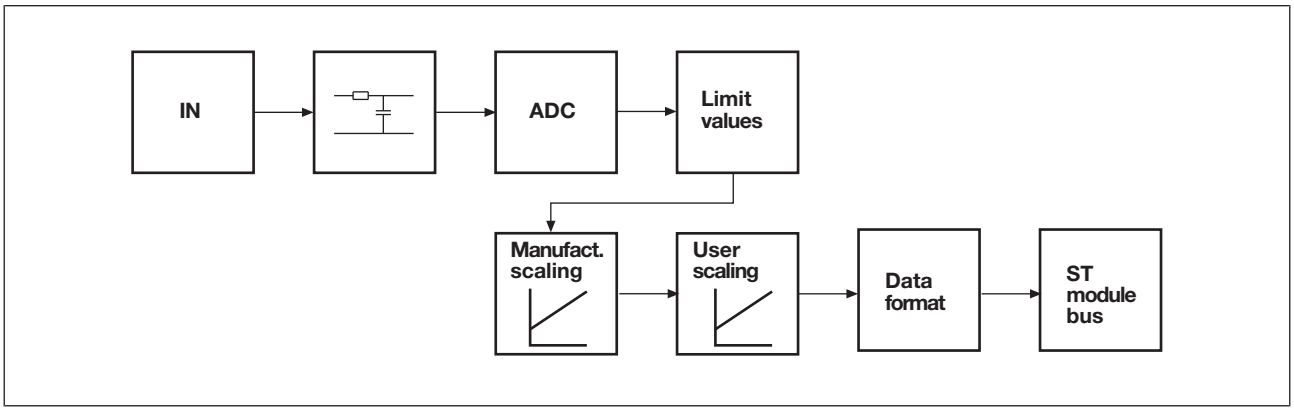
The module supply provides the module with voltage.

The input signals are read in, analogue prefiltered and converted into digital signals. The resolution is 12 bits (4095 steps) and is converted into a 16 Bit value. Additional signal processing can be defined using the system software (see schematic representation of signal processing). The individual steps are described in the "Configuration" section.

The input signals are transmitted to the head module via the ST module bus. As an option the input module can send status information for each input.

All the configuration data is stored in the head module and is assigned to the input module on restart. This way the configuration data is retained even if you change the input module.

Schematic representation of signal processing:



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

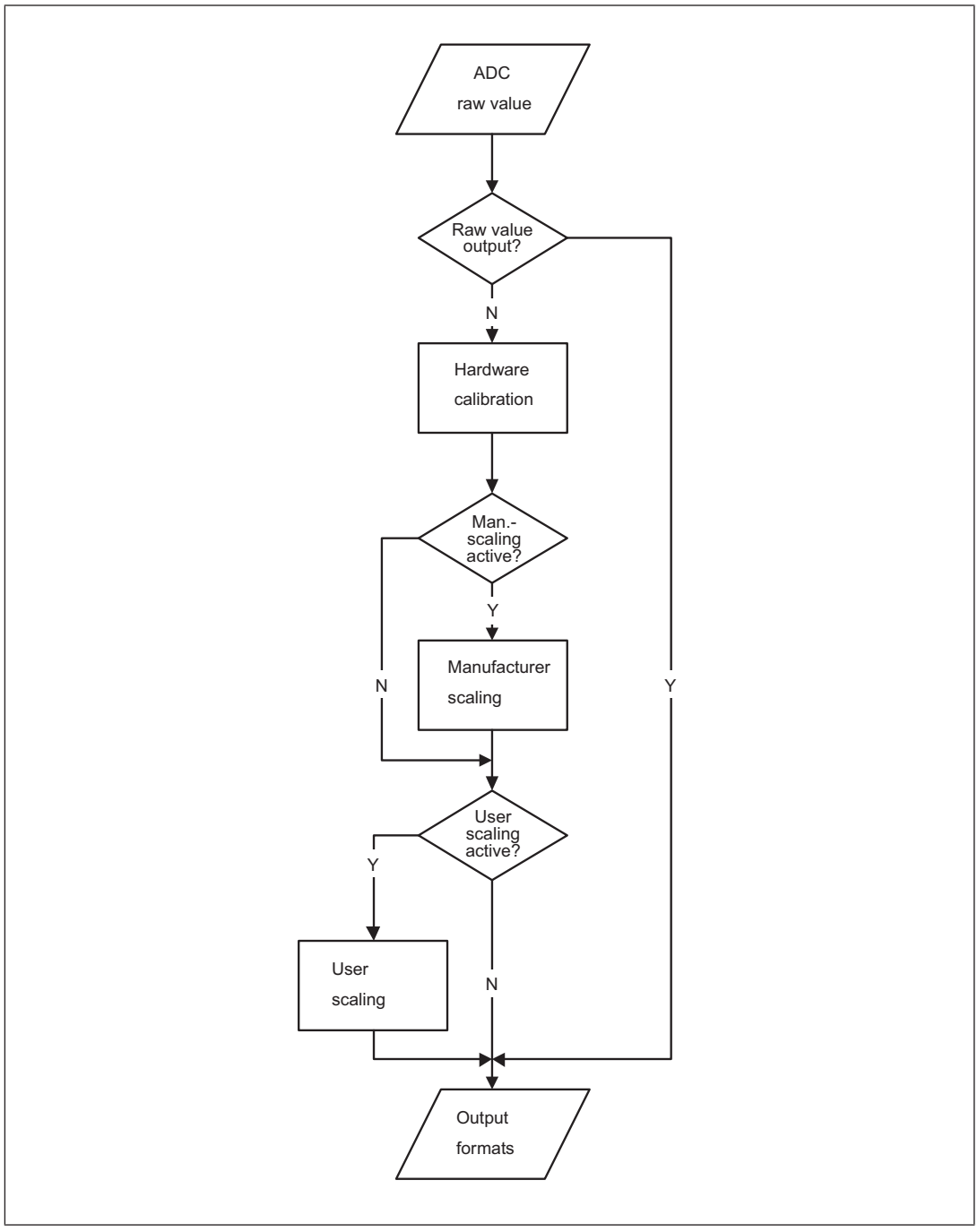
- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Analogue input/output (standard)
PSSu E S 4AI U

Configuration

The module can be configured using the system software.

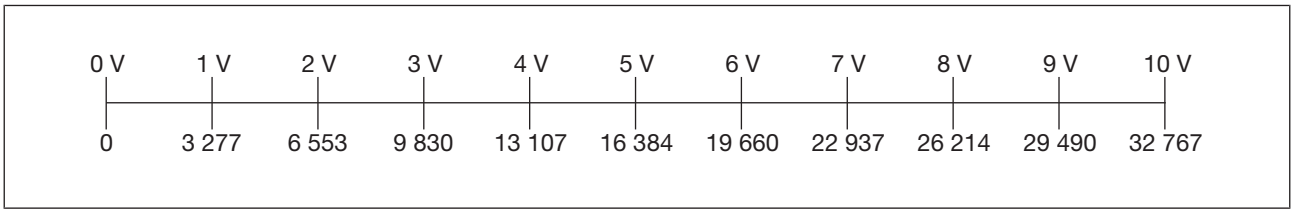
Scaling is a multi-stage process to adapt the values from the AD converter. The straight path in the diagram indicates the default configuration.



Analogue input/output (standard)
PSSu E S 4AI U

Analogue value and typical digital value with a voltage range of 0 ... +10 V and default values:

Analogue value of voltage	Hexadecimal digital value	Decimal digital value
0 V	0	0
5 V	4000	16 384
10 V	7FFF	32 767



You can configure each channel so that the raw value from the AD converter is issued directly, without calibration or scaling.

If the AD converter fails to supply a valid value, the module will adopt the ADC initialisation value for this channel instead. The default value is 4096_D (1000_H).

Each channel is calibrated ex-works in order to correct component dispersion and other influences.

The range is divided so that zero is assigned the value 0 and the end point is assigned the value 4095_D ($0FFF_H$).

The manufacturer scaling is used to define the offset (zero point compensation) and gain (amplification) of the digital signal.

Manufacturer scaling active (default setting)

- Default values for manufacturer scaling:
  - Offset (b_1): 0
  - Gain (a_1): 8194_D (2002_H)

Analogue input/output (standard)
PSSu E S 4AI U

The digital value after manufacturer scaling is calculated using the following formula:

- $y = (a_1 / 1024_D * x) + b_1$ or
- $y = (a_1 / 400_H * x) + b_1$

Legend:

- **y**: Digital value after manufacturer scaling
- **x**: Digital value before manufacturer scaling
- **a** $_1$: Gain
- **b** $_1$: Offset
- **a** $_1 / 1024_D$: Amplification factor

Arithmetic examples using decimal values:

Digital value before manufacturer scaling (x)	Gain (a_1)	Offset (b_1)	Amplification factor ($a_1 / 1024_D$)	Value after manufacturer scaling (y)
1 000	1 024	0	1	1 000
1 000	2 048	0	2	2 000
1 000	8 192	0	8	8 000
1 000	1 075	500	1.05	1 550
1 000	512	-50	0.5	450

The module always uses two's complement representation for internal processing, irrespective of the configured data format. The values from 0000_H to $FFFF_H$ form a number circle in the two's complement representation. 8000_H follows $7FFF_H$ (= $32\ 767_D$) and is interpreted as the lowest negative number (= $-32\ 768_D$). $32\ 767_D$ is never exceeded; the value never falls below $-32\ 768_D$.

User scaling is a second level of scaling. You can use this scaling to correct local influences. The function is the same as that of manufacturer scaling, but a different value is used for amplification factor 1:

- $y = (a_2 / 256_D * x) + b_2$ or
- $y = (a_2 / 100_H * x) + b_2$

a_2 = Amplification factor * 256_D

User scaling is deactivated in the default setting. The default value for offset is 0. The default value for gain is 256_D (100_H). That corresponds to amplification factor 1.

Key:

- **y**: Digital value after user scaling
- **x**: Digital value before user scaling
- **a_2**: Gain
- **b_2**: Offset

Analogue input/output (standard)
PSSu E S 4AI U

- **a_2** / 1024_D: Amplification factor

Task:

When there is 10 V at the input, the PII should show a decimal value of 10 000. User scaling (Gain a_2) should be used in this case. Manufacturer scaling should not be changed. All numbers are decimals.

Solution:

Manufacturer scaling
$y = (a_1 / 1024 * x) + b_1$
and user scaling
$y = (a_2 / 256 * x) + b_2$
act consecutively, giving:
$y = (a_2 / 256 * ((a_1 / 1024 * x) + b_1)) + b_2$ or:
$y = (a_1 * a_2 * x / 262144) + (a_2 * b_1 / 256) + b_2$

With default values for $a_1 = 8194$, $b_1 = 0$ and the default value $b_2 = 0$:

$y = a_2 / 32 * x$

$a_2 = y * 32 / x$

Due to the hardware calibration the converter's input range is divided so that the 10 V end point is assigned the value x = 4095. With the default values x = 4095 and y= 10 000 the result is:
Gain $a_2 = 78$

The module has range monitoring and limit value monitoring on each channel:

- Range monitoring
  - Upper limit value: 4095_D
  - Lower limit value: -4095_D
  - The module compares the upper and lower limit value with the digital value after the hardware calibration (values with 12 bits plus sign) and writes the result of the comparison as follows:
    – System environment A:
    – In the status byte (see "PSSu assignment in system environment A")
    – System environment B:
    – In the I/O data element "Overrange" or "Underrange" (see "PSSu assignment in system environment B").
  - The limit of the measuring range corresponds to 4095_D.
- Limit value monitoring
  - Limit value 1
  - Limit value 2
  - The module compares limit value 1 and limit value 2 with the digital value after scaling (values with 15 bits plus sign) and writes the result of the comparison as follows:

Analogue input/output (standard)
PSSu E S 4AI U

– System environment A:

– In the status byte (see "PSSu assignment in system environment A")

– System environment B:

– In the I/O data element "LimitValue1" or "LimitValue2" (see "PSSu assignment in system environment B").

– The limit of the measuring range corresponds to 32 767_D with default scaling values.

You can change the default values in the system software.

Conversion of analogue limit values into decimal values (n) for the system software:

$n = 32\,768 * U_{Limit} / 10\ V$

Key:

U_{Limit}: Analogue value at the input

Example:

- Voltages at the input, which are to be monitored through the limit values:
  - Limit value 1 is to be 8 V.
  - Limit value 2 is to be 5 V.
- Entry in the system software:
  - Limit value 1 corresponds to 26 214
  - Limit value 2 corresponds to 16 384

The way in which the analogue value is displayed depends on the voltage range, on scaling and on the data format. The following examples show the relationship between the values with default scaling.

The module uses the following data format:

- Two's complement (default)
  The digital values are transferred with 15 bits plus a sign bit (MSB). The MSB is always "0" with positive numbers.

Analogue input/output (standard)
PSSu E S 4AI U

Analogue value and typical digital value with two's complement representation:

Analogue value of voltage	Decimal digital value	Binary digital value	Hexadecimal digital value
0 V	0	0000 0000 0000 0000	0000_H
5 V	16 384	0100 0000 0000 0000	4000_H
10 V	32 767	0111 1111 1111 1111	$7FFF_H$

The module has the following configuration options:

Configurable properties	Default value	Meaning
Input area	0	0 V … 10 V (cannot be changed)
Manufacturer scaling active	1/TRUE	Activated
Manufacturer scaling offset	0	Offset: Magnitude 0
Manufacturer scaling gain	8194_D	8x amplification, displaced three bit places
User scaling active	0/FALSE	Deactivated
User scaling offset	0	Offset: Magnitude 0
User scaling gain	256_D	1x amplification, signal unchanged
Range monitoring active	1/TRUE	Activated
Upper limit value	4095_D	Upper limit of number range
Lower limit value	-4095_D	Lower limit of number range
Limit value 1 active	0/FALSE	Deactivated
Limit value 1	-32 767	Lower limit of number range
Limit value 2 active	0/FALSE	Deactivated
Limit value 2	$32\ 767_D$	Upper limit of number range
Sign and magnitude representation active	0/FALSE	Deactivated; two's complement is activated
Output ADC raw value only	0/FALSE	Deactivated
ADC initialisation value	4096_D	4096_D (1000_H) is issued when no data is detected.

Each input occupies 16 consecutive bit addresses for the input data. Each input occupies an additional 8 consecutive bit addresses for the status byte, where this has been configured for the input. If the status byte is configured to be transferred without input data, each input occupies 8 consecutive bit addresses. All the status bytes are displayed first in the PII, followed by the input data.

Analogue input/output (standard)
PSSu E S 4AI U

Configuration	Standard bus system	
	ST-PII	ST-PIO
Send input data	64 Bit	- - -
Send status byte ("R")	32 Bit	- - -

Bit sequence in the PII, without status byte:

Input	PII	Assignment
Input I0	1	LSB input data
	...	...
	16	MSB input data
Input I1	17	LSB input data
	...	...
	32	MSB input data
Input I2	33	LSB input data
	...	...
	48	MSB input data
Input I3	49	LSB input data
	...	...
	64	MSB input data

Bit sequence in the PII, with status byte:

Input	PII	Assignment
Input I0	1	LSB status byte
	...	...
	8	MSB status byte
Input I1	9	LSB status byte
	...	...
	16	MSB status byte
Input I2	17	LSB status byte
	...	...
	24	MSB status byte
Input I3	25	LSB status byte
	...	...
	32	MSB status byte

Analogue input/output (standard)
PSSu E S 4AI U

Input	PII	Assignment
Input I0	33	LSB input data
	...	...
	48	MSB input data
Input I1	49	LSB input data
	...	...
	64	MSB input data
Input I2	65	LSB input data
	...	...
	80	MSB input data
Input I3	81	LSB input data
	...	...
	96	MSB input data

Bit sequence in the PII, status byte only (no input data):

Input	PII	Assignment
Input I0	1	LSB status byte
	...	...
	8	MSB status byte
Input I1	9	LSB status byte
	...	...
	16	MSB status byte
Input I2	17	LSB status byte
	...	...
	24	MSB status byte
Input I3	25	LSB status byte
	...	...
	32	MSB status byte

ST modules for analogue input can transfer a variety of status information to the ST-PII (see table below for the conveyed status). The information is transmitted using the input's status byte. Read access (R) is configured for the input for that purpose.

Analogue input/output (standard)
PSSu E S 4AI U

Structure and contents of the status byte:

Bit number	Content	Meaning
0	0	Input value above the lower limit value
	1	Value below the lower limit value
1	0	Input value below the upper limit value
	1	Value exceeds the upper limit value
2 / 3	0 0	Limit value 1 inactive
	0 1	Input value greater than or equal to limit value 1
	1 0	Input value less than limit value 1
	1 1	Reserved
4 / 5	0 0	Limit value 2 inactive
	0 1	Input value greater than limit value 2
	1 0	Input value less than or equal to limit value 2
	1 1	Reserved
6	0	Valid data from A/D converter
	1	No valid data from A/D converter
7	0	Reserved
	1	Reserved

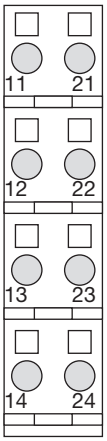
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
I0(11) I1(21) I2(14) I3(24)	ST_I_AI	Data: WORD	Input data I0 ... I3
		Underrange: BOOL	0: Input value above the lower limit value 1: Value below the lower limit value
		Overrange: BOOL	0: Input value below the upper limit value 1: Value exceeds the upper limit value
		LimitValue1: BOOL	0: Limit value 1 inactive 1: Input value greater than or equal to limit value 1
		LimitValue2: BOOL	0: Limit value 2 inactive 1: Input value greater than or equal to limit value 2

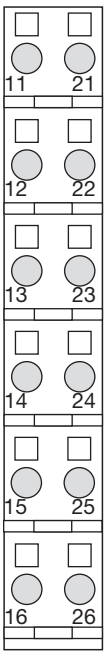
Analogue input/output (standard)
PSSu E S 4AI U

Wiring

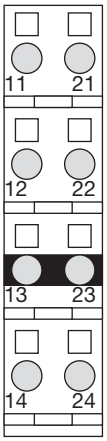
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Input I0 21: Input I1 12-22: 0 V analogue (12-22 linked within the base module) 13-23: Shield connection (13-23 linked within the base module) 14: Input I2 24: Input I3	

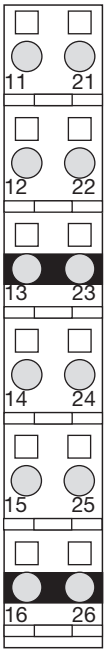
Analogue input/output (standard)
PSSu E S 4AI U

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/12 S PSSu BP 1/12 S-T Cage clamp terminals: PSSu BP 1/12 C PSSu BP 1/12 C-T	Without C-rail: 11: Input I0 21: Input I1 12-22: 0 V analogue (12-22-15-25 linked within the base module) 13-23: Shield connection (13-23-16-26 linked within the base module) 14: Input I2 24: Input I3 15-25: 0 V analogue (12-22-15-25 linked within the base module) 16-26: Shield connection (13-23-16-26 linked within the base module)	

Analogue input/output (standard)
PSSu E S 4AI U

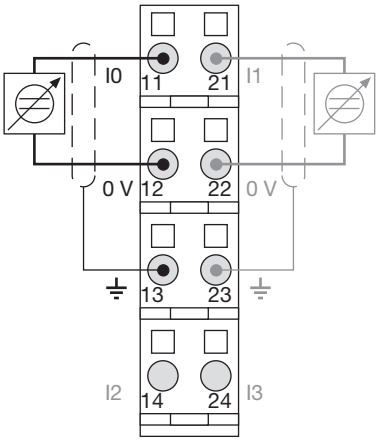
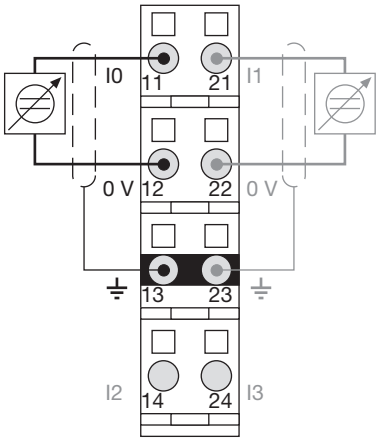
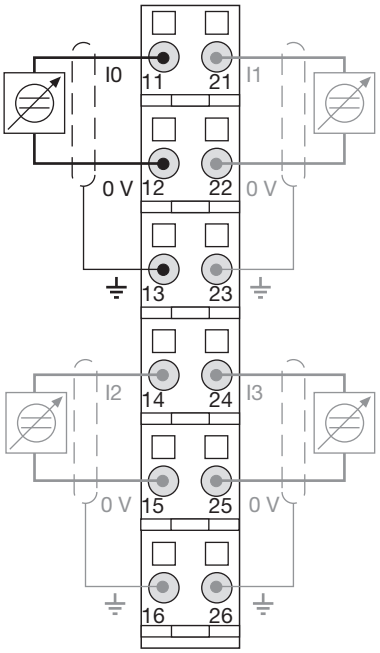
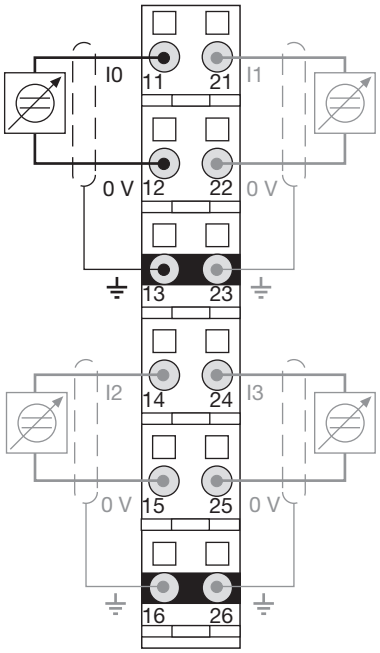
Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Input I0 21: Input I1 12-22: 0 V analogue (12-22 linked within the base module) 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Input I2 24: Input I3	

Analogue input/output (standard)
PSSu E S 4AI U

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/12 S PSSu BP-C 1/12 S-T Cage clamp terminals: PSSu BP-C 1/12 C PSSu BP-C 1/12 C-T	With C-rail: 11: Input I0 21: Input I1 12-22: 0 V analogue (12-22-15-25 linked within the base module) 13-23: C-rail supply, shield connection (13-23-16-26 linked within the base module) 14: Input I2 24: Input I3 15-25: 0 V analogue (12-22-15-25 linked within the base module) 16-26: C-rail supply, shield connection (13-23-16-26 linked within the base module)	

Analogue input/output (standard)
PSSu E S 4AI U

Connecting the module

Input circuit	Without C-rail	With C-rail
Voltage range (0 ... +10 V single-pole, referenced to earth Base modules with four connection levels		
Voltage range (0 ... +10 V single-pole, referenced to earth Base modules with six connection levels		

Analogue input/output (standard)
PSSu E S 4AI U

Technical details

General	312445	314445
Approvals	**CE**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0301h**	**0301h**
Number of ST input bits	**64**	**64**
Number of ST status bits	**32**	**32**
Application in system environment A		
From ST firmware version, other head modules	**7**	**7**
From ST firmware version PSSu H S PN	**1**	**1**
From ST firmware version PSSu WR S IDN	**4**	**4**
Application in system environment B		
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312445**	**314445**
Internal supply voltage (module supply)		
Module's power consumption	**0,26 W**	**0,26 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**10 mA**	**10 mA**
Module's power consumption with no load	**0,24 W**	**0,24 W**
Max. power dissipation of module	**0,50 W**	**0,50 W**
Analogue inputs	**312445**	**314445**
Number of analogue inputs	**4**	**4**
Type of analogue inputs	**Voltage**	**Voltage**
Input area	**0 ... 10 V (single-ended)**	**0 ... 10 V (single-ended)**
Measuring ranges		
Type	**Single-ended**	**Single-ended**
Measuring range	**0 - 10 V**	**0 - 10 V**
Input filter	**RC filter**	**RC filter**
Cutoff frequency	**130 Hz**	**130 Hz**

Analogue input/output (standard)
PSSu E S 4AI U

Analogue inputs	312445	314445
Voltage measurement		
Input resistance	**100 kOhm**	**100 kOhm**
Max. continuous voltage	**12 V**	**12 V**
Resolution	**12 Bit**	**12 Bit**
Deviations from the measuring range limit value		
Linearity error	**0,05 %**	**0,05 %**
Output variable error at 25 °C	**0,2 %**	**0,2 %**
Temperature coefficient	**0,0200 %/K**	**0,0200 %/K**
Max. measurement error during EMC test	**1,0 %**	**1,0 %**
Potential isolation between input and periphery supply	**yes**	**yes**
Typ. processing time of the analogue input	**1,0 ms**	**1,0 ms**
Inputs	**312445**	**314445**
Potential isolation between input and internal module bus voltage	**yes**	**yes**
Environmental data	**312445**	**314445**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**

Analogue input/output (standard)
PSSu E S 4AI U

Environmental data	312445	314445
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312445**	**314445**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**37 g**	**37 g**
Mechanical coding		
Type	**D**	**D**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2005-04 latest editions shall apply.

Analogue input/output (standard)
PSSu E S 4AI U

Order reference

Product

Product type	Features	Order No.
PSSu E S 4AI U	Electronic module, base type	312 445
PSSu E S 4AI U-T	Electronic module, T-type	314 445

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C 1/12 S	Base module with C-rail and screw terminals	312 620
PSSu BP-C 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 620
PSSu BP-C 1/12 C	Base module with C-rail and cage clamp terminals	312 621
PSSu BP-C 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 621

Analogue input/output (standard)
PSSu E S 2AI U

Overview

Module features

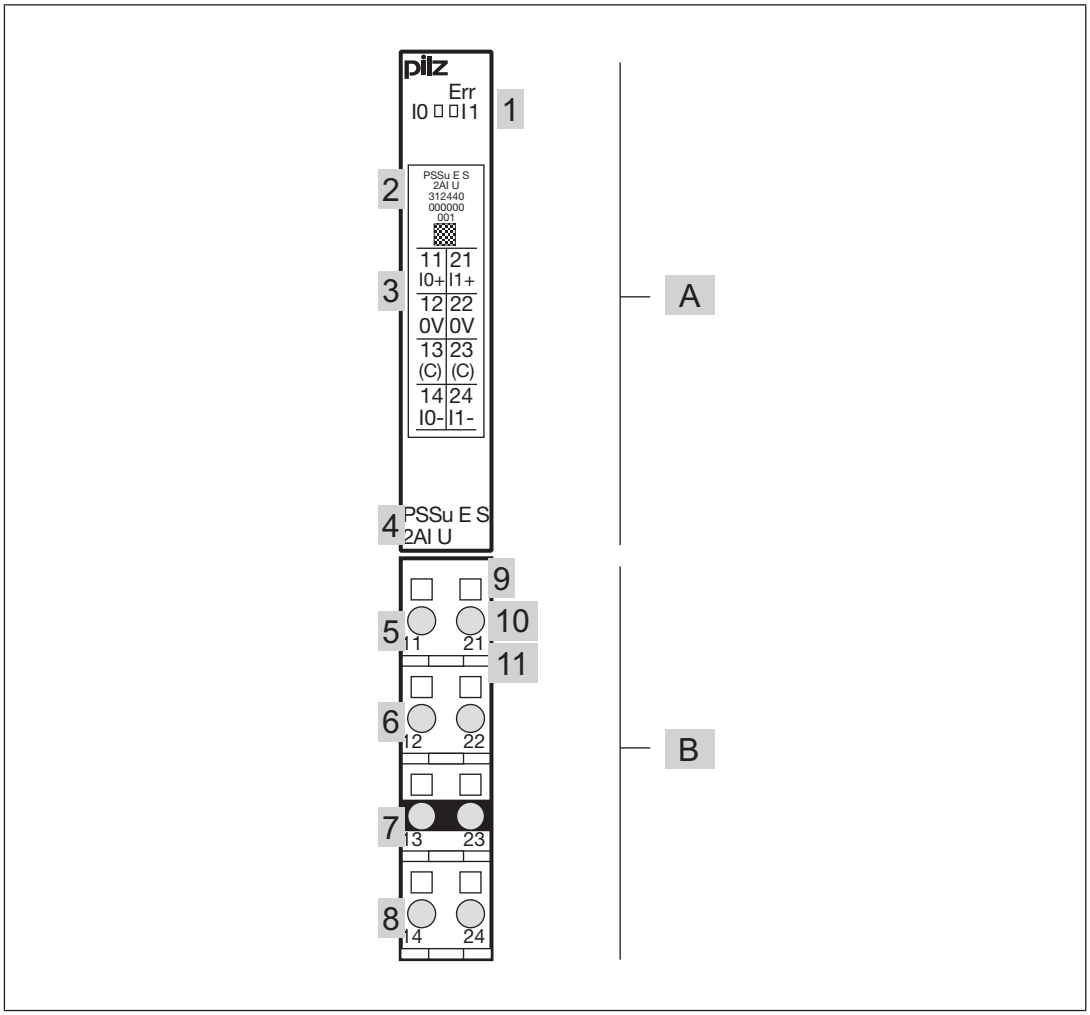
The product has the following features:

- 2 Analogue voltage inputs
- Configurable voltage ranges:
  - 0 ... +10 V single-pole, referenced to earth (single-ended)
  - 0 ... +10 V dual-pole, differential input
  - -10 V ... +10 V dual-pole, differential input
- Resolution: 12 bit plus sign bit
- LEDs for:
  - Operating status per input
  - Module error
- For standard applications in system environment A and B
- T-type:

  PSSu E S 2AI U-T: for increased environmental requirements

Analogue input/output (standard)
PSSu E S 2AI U

Front view



Legend:

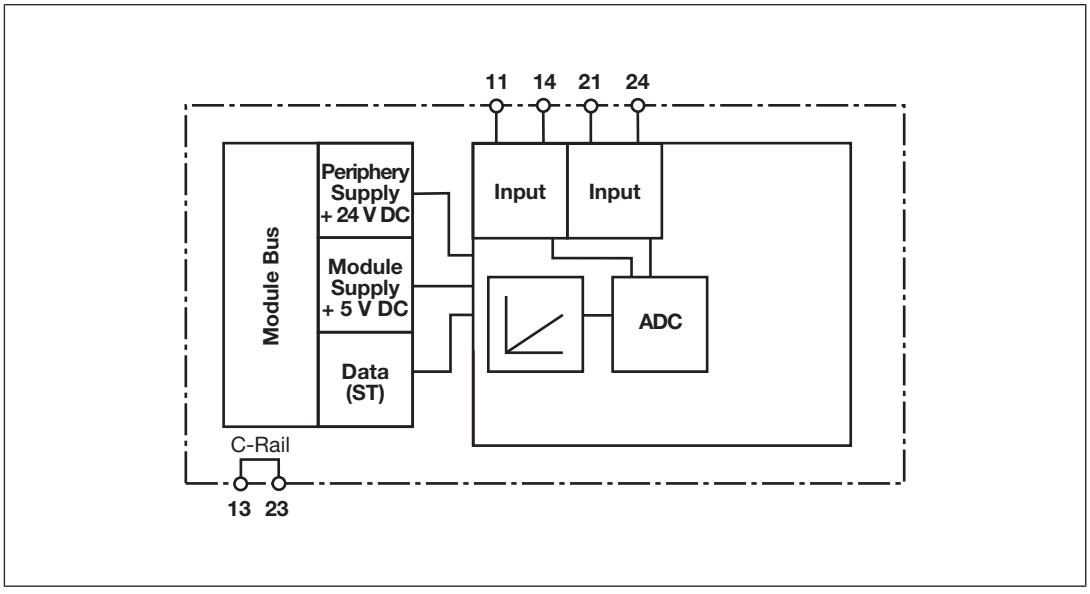
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Status indicator
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Analogue input/output (standard)
PSSu E S 2AI U

- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1
- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Analogue input/output (standard)
PSSu E S 2AI U

Module features

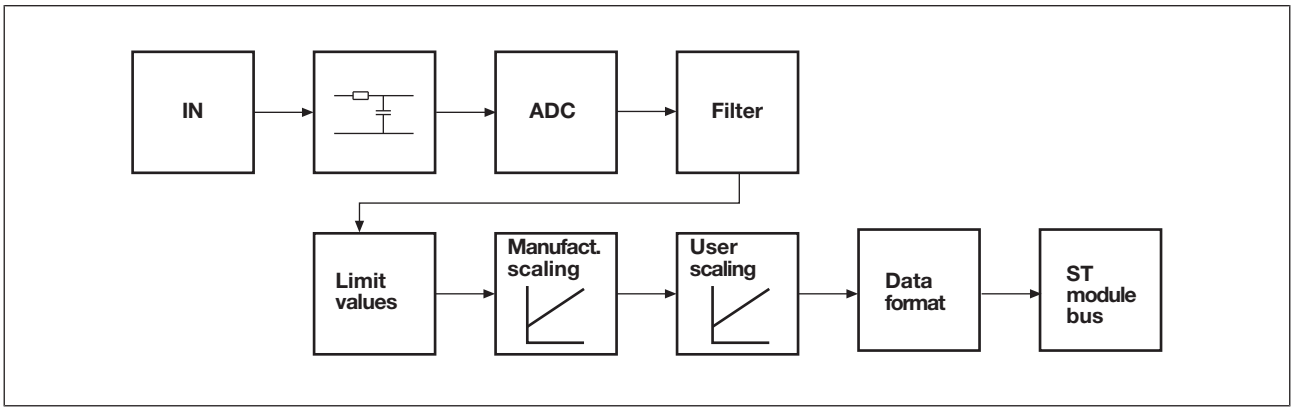
The module supply provides the module with voltage.

The input signals are read in, analogue prefiltered and converted into digital signals. The resolution is 12 bits (4095 steps) and is converted into a 16 Bit value. Additional signal processing can be defined using the system software (see schematic representation of signal processing). The individual steps are described in the "Configuration" section.

The input signals are transmitted to the head module via the ST module bus. As an option the input module can send status information for each input.

All the configuration data is stored in the head module and is assigned to the input module on restart. This way the configuration data is retained even if you change the input module.

Schematic representation of signal processing:



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Analogue input/output (standard)
PSSu E S 2AI U

Configuration

The following options exist for configuring the module in system environment A:

- Via a fieldbus without the modular device description file
  Without the modular device description file it is only possible to configure the input or output range. All other configuration details have default values.
- Via a fieldbus with the modular device description file
  With a modular device description file it is possible to configure all the values.
- Via the USB port of the head module, using the PSSuniversal Configurator
  All the values can be configured using the PSSuniversal Assistant. Any configuration via the USB port will overwrite the configuration made via the fieldbus.

If a module has been configured via the head module's USB port, it is locked and cannot be overwritten by the fieldbus. This lock can be deactivated again in the PSSuniversal Configurator.

The following options exist for configuring the module in system environment B:

- Via the head module's USB port with PAS4000.

You can configure the following voltage ranges per module:

- 0 ... +10 V single-pole, referenced to earth (single-ended)
- 0 ... +10 V dual-pole, differential input
- -10 V ... +10 V dual-pole, differential input

A digital filter can suppress spurious frequencies in the input signals.

- FIR filters specifically suppress certain spurious frequencies (notch mode). In this way, for example, the residual ripple from the power supply can be filtered out of the input signal.
- IIR filters suppress all frequencies above a cutoff frequency (low pass mode). This means that short-term fluctuations can be filtered out of the input signal.

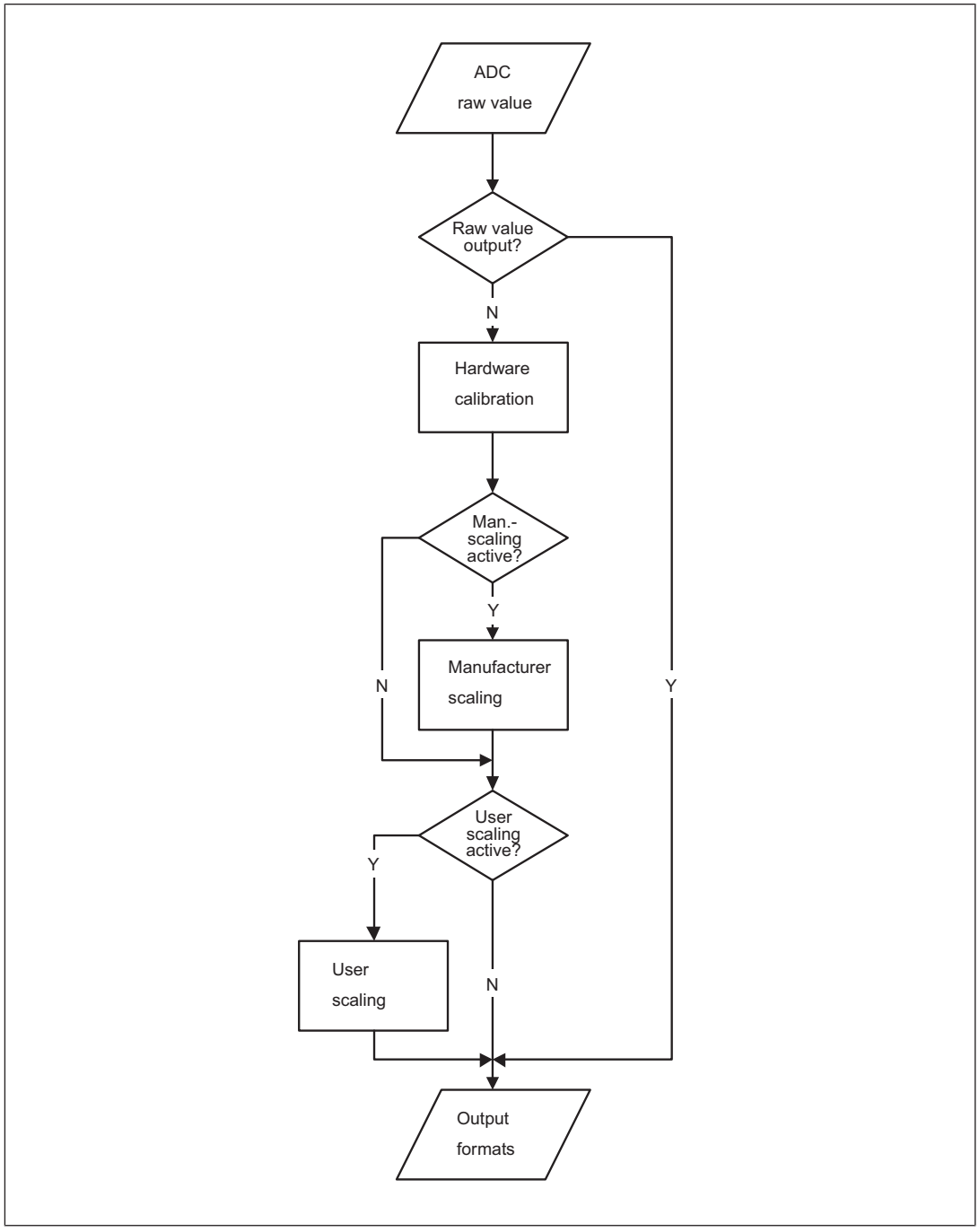
You can select one of the following filters per module:

- 2nd order FIR filter
- IIR filter, cutoff frequency 1 kHz
- IIR filter, cutoff frequency 100 Hz
- IIR filter, cutoff frequency 50 Hz
- IIR filter, cutoff frequency 20 Hz
- IIR filter, cutoff frequency 10 Hz
- IIR filter, cutoff frequency 5 Hz
- IIR filter, cutoff frequency 1 Hz
- FIR filter, notch frequency 50 Hz
- FIR filter, notch frequency 60 Hz

The filter is deactivated as the default value.

Analogue input/output (standard)
PSSu E S 2AI U

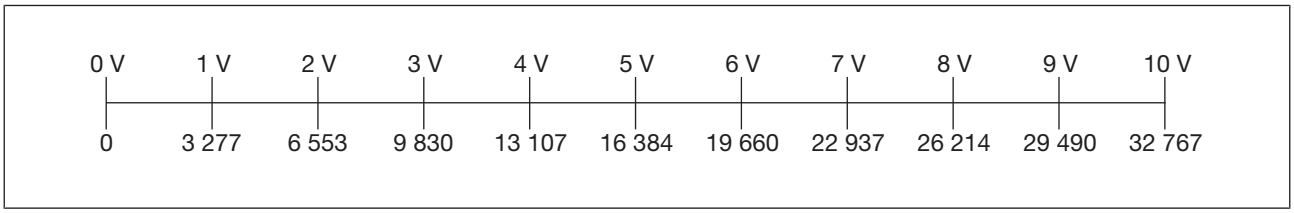
Scaling is a multi-stage process to adapt the values from the AD converter. The straight path in the diagram indicates the default configuration.



Analogue input/output (standard)
PSSu E S 2AI U

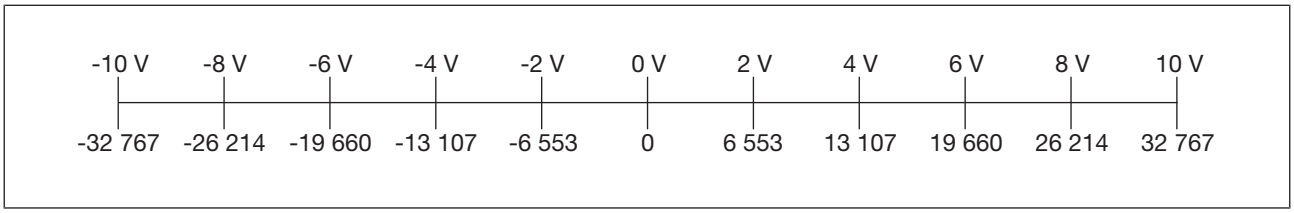
Analogue value and typical digital value with a voltage range of 0 ... +10 V and default values:

Analogue value of voltage	Decimal digital value
0 V	0
5 V	16 384
10 V	32 767



Analogue value and typical digital value with a voltage range of -10 V ... +10 V and default values:

Analogue value of voltage	Decimal digital value
-10 V	-32 767
-5 V	-16 384
0 V	0
5 V	16 384
10 V	32 767



You can configure each channel so that the raw value from the AD converter is issued directly, without calibration or scaling.

If the AD converter fails to supply a valid value, the module will adopt the ADC initialisation value for this channel instead. The default value is 4096_D (1000_H).

Each channel is calibrated ex-works in order to correct component dispersion and other influences.

The range is divided so that zero is assigned the value 0 and the end point is assigned the value 4095_D ($0FFF_H$).

The manufacturer scaling is used to define the offset (zero point compensation) and gain (amplification) of the digital signal.

Analogue input/output (standard)
PSSu E S 2AI U

Manufacturer scaling active (default setting)

- Default values for manufacturer scaling:
  - Offset (b_1): 0
  - Gain (a_1): 8194_D (2002_H)

The digital value after manufacturer scaling is calculated using the following formula:

- $y = (a_1 / 1024_D * x) + b_1$ or
- $y = (a_1 / 400_H * x) + b_1$

Legend:

- **y**: Digital value after manufacturer scaling
- **x**: Digital value before manufacturer scaling
- **a** $_1$: Gain
- **b** $_1$: Offset
- **a** $_1 / 1024_D$: Amplification factor

Arithmetic examples using decimal values:

Digital value before manufacturer scaling (x)	Gain (a_1)	Offset (b_1)	Amplification factor ($a_1 / 1024_D$)	Value after manufacturer scaling (y)
1 000	1 024	0	1	1 000
1 000	2 048	0	2	2 000
1 000	8 192	0	8	8 000
1 000	1 075	500	1.05	1 550
1 000	512	-50	0.5	450

The module always uses two's complement representation for internal processing, irrespective of the configured data format. The values from 0000_H to $FFFF_H$ form a number circle in the two's complement representation. 8000_H follows $7FFF_H$ (= $32\,767_D$) and is interpreted as the lowest negative number (= $-32\,768_D$). $32\,767_D$ is never exceeded; the value never falls below $-32\,768_D$.

User scaling is a second level of scaling. You can use this scaling to correct local influences. The function is the same as that of manufacturer scaling, but a different value is used for amplification factor 1:

- $y = (a_2 / 256_D * x) + b_2$ or
- $y = (a_2 / 100_H * x) + b_2$

a_2 = Amplification factor * 256_D

User scaling is deactivated in the default setting. The default value for offset is 0. The default value for gain is 256_D (100_H). That corresponds to amplification factor 1.

Analogue input/output (standard)
PSSu E S 2AI U

Key:

- **y**: Digital value after user scaling
- **x**: Digital value before user scaling
- **a_2**: Gain
- **b_2**: Offset
- **a_2 / 1024_D**: Amplification factor

Task:

When there is 10 V at the input, the PII should show a decimal value of 10 000. User scaling (Gain a_2) should be used in this case. Manufacturer scaling should not be changed. All numbers are decimals.

Solution:

Manufacturer scaling
$y = (a_1 / 1024 * x) + b_1$
and user scaling
$y = (a_2 / 256 * x) + b_2$
act consecutively, giving:
$y = (a_2 / 256 * ((a_1 / 1024 * x) + b_1)) + b_2$ or:
$y = (a_1 * a_2 * x / 262144) + (a_2 * b_1 / 256) + b_2$

With default values for $a_1 = 8194$, $b_1 = 0$ and the default value $b_2 = 0$:

$y = a_2 / 32 * x$

$a_2 = y * 32 / x$

Due to the hardware calibration the converter's input range is divided so that the 10 V end point is assigned the value x = 4095. With the default values x = 4095 and y= 10 000 the result is:
Gain $a_2 = 78$

The module has range monitoring and limit value monitoring on each channel:

- Range monitoring
  - Upper limit value: 4095_D
  - Lower limit value: -4095_D
  - The module compares the upper and lower limit value with the digital value after the hardware calibration (values with 12 bits plus sign) and writes the result of the comparison as follows:
    - System environment A:
    - In the status byte (see "PSSu assignment in system environment A")
    - System environment B:
    - In the I/O data element "Overrange" or "Underrange" (see "PSSu assignment in system environment B").
  - The limit of the measuring range corresponds to 4095_D.

Analogue input/output (standard)
PSSu E S 2AI U

- Limit value monitoring
  - Limit value 1
  - Limit value 2
  - The module compares limit value 1 and limit value 2 with the digital value after scaling (values with 15 bits plus sign) and writes the result of the comparison as follows:
    – System environment A:
    – In the status byte (see "PSSu assignment in system environment A")
    – System environment B:
    – In the I/O data element "LimitValue1" or "LimitValue2" (see "PSSu assignment in system environment B").
  - The limit of the measuring range corresponds to 32 767_D with default scaling values.

You can change the default values in the system software.

The decimal value for the PSSuniversal Configurator (n) is calculated from the analogue value at the input (U_{Limit}) as follows:

$n = 32\,768 * U_{Limit} / 10\ V$

Example:

- Voltages at the input, which are to be monitored through the limit values:
  - Limit value 1 is to be -8 V.
  - Limit value 2 is to be 5 V.
- Entry in the PSSuniversal Configurator:
  - Limit value 1 corresponds to -26 214
  - Limit value 2 corresponds to 16 384

The way in which the analogue value is displayed depends on the voltage range, on scaling and on the data format. The following examples show the relationship between the values with default scaling.

You can configure the following data formats:

- Two's complement (default)
  The digital values are transferred with 15 bits plus a sign bit (MSB). The MSB is "1" with negative values and "0" with positive values.
- Sign and magnitude representation
  The digital values are transferred with 15 bits plus a sign bit (MSB). The MSB is "1" with negative values and "0" with positive values. With negative values there is a distinction between sign and magnitude representation and two's complement representation.

Analogue input/output (standard)
PSSu E S 2AI U

Analogue value and typical digital value with a voltage range of 0 ... two's complement or sign and magnitude representation:

Analogue value of voltage	Decimal digital value	Binary digital value	Hexadecimal digital value
0 V	0	0000 0000 0000 0000	0000_H
5 V	16 384	0100 0000 0000 0000	4000_H
10 V	32 767	0111 1111 1111 1111	$7FFF_H$

Analogue value and typical digital value with a voltage range of -10 V ... +10 V, two's complement:

Analogue value of voltage	Decimal digital value	Binary digital value	Hexadecimal digital value
-10 V	-32 767	1000 0000 0000 0001	8001_H
-5 V	-16 384	1100 0000 0000 0000	$C000_H$
-2.4 mV (= 1 LSB)	-8	1111 1111 1111 1000	$FFF8_H$
0 V	0	0000 0000 0000 0000	0000_H
10 V	32 767	0111 1111 1111 1111	$7FFF_H$

Analogue value and typical digital value with a voltage range of -10 V ... +10 V, sign and magnitude representation:

Analogue value of voltage	Decimal digital value	Binary digital value	Hexadecimal digital value
-10 V	-32 768	1111 1111 1111 1111	$FFFF_H$
-5 V	-16 384	1011 1111 1111 1111	$BFFF_H$
-2.4 mV (= 1 LSB)	-8	1000 0000 0000 0100	8008_H
0 V	0	0000 0000 0000 0000	0000_H
10 V	32 767	0111 1111 1111 1111	$7FFF_H$

Each input occupies 16 consecutive bit addresses for the input data. Each input occupies an additional 8 consecutive bit addresses for the status byte, where this has been configured for the input. If the status byte is configured to be transferred without input data, each input occupies 8 consecutive bit addresses. All the status bytes are displayed first in the PII, followed by the input data.

Configuration	Standard bus system	
	ST-PII	ST-PIO
Send input data	32 Bit	- - -
Send status byte ("R")	16 Bit	- - -

Analogue input/output (standard)
PSSu E S 2AI U

Bit sequence in the PII, input data only, no status byte:

Input	PII	Assignment
Input I0	1	LSB input data
	...	...
	16	MSB input data
Input I1	17	LSB input data
	...	...
	32	MSB input data

Bit sequence in the PII, input data and status byte:

Input	PII	Assignment
Input I0	1	LSB status byte
	...	...
	8	MSB status byte
Input I1	9	LSB status byte
	...	...
	16	MSB status byte
Input I0	17	LSB input data
	...	...
	32	MSB input data
Input I1	33	LSB input data
	...	...
	48	MSB input data

Bit sequence in the PII, status byte only, no input data:

Input	PII	Assignment
Input I0	1	LSB status byte
	...	...
	8	MSB status byte
Input I1	9	LSB status byte
	...	...
	16	MSB status byte

Analogue input/output (standard)
PSSu E S 2AI U

The module has the following configuration options:

Configurable properties	Default value	Meaning
Input area	0	0 V … 10 V, single-pole, referenced to earth (single-ended) (1 = 0 ... +10 V dual-pole, differential input) (2 = -10 V ... +10 V dual-pole, differential input)
Manufacturer scaling active	1/TRUE	Activated
Manufacturer scaling offset	0	Offset: Magnitude 0
Manufacturer scaling gain	8194_D	8x amplification, displaced three bit places
User scaling active	0/FALSE	Deactivated
User scaling offset	0	Offset: Magnitude 0
User scaling gain	256_D	1x amplification, signal unchanged
Filter active	0/FALSE	Deactivated
Filter characteristic	0	2nd order FIR filter
Range monitoring active	1/TRUE	Activated
Upper limit value	4095_D	Upper limit of number range
Lower limit value	-4095_D	Lower limit of number range
Limit value 1 active	0/FALSE	Deactivated
Limit value 1	$-32\ 767_D$	Lower limit of number range
Limit value 2 active	0/FALSE	Deactivated
Limit value 2	$32\ 767_D$	Upper limit of number range
Sign and magnitude representation active	0/FALSE	Deactivated; two's complement is activated
Output ADC raw value only	0/FALSE	Deactivated
ADC initialisation value	4096_D	4096_D (1000_H) is issued when no data is detected.

Each input occupies 16 consecutive bit addresses for the input data. Each input occupies an additional 8 consecutive bit addresses for the status byte, where this has been configured for the input. If the status byte is configured to be transferred without input data, each input occupies 8 consecutive bit addresses. All the status bytes are displayed first in the PII, followed by the input data.

Configuration	Standard bus system	
	ST-PII	ST-PIO
Send input data	32 Bit	- - -
Send status byte ("R")	16 Bit	- - -

Analogue input/output (standard)
PSSu E S 2AI U

Bit sequence in the PII, input data only, no status byte:

Input	PII	Assignment
Input I0	1	LSB input data
	...	...
	16	MSB input data
Input I1	17	LSB input data
	...	...
	32	MSB input data

Bit sequence in the PII, input data and status byte:

Input	PII	Assignment
Input I0	1	LSB status byte
	...	...
	8	MSB status byte
Input I1	9	LSB status byte
	...	...
	16	MSB status byte
Input I0	17	LSB input data
	...	...
	32	MSB input data
Input I1	33	LSB input data
	...	...
	48	MSB input data

Bit sequence in the PII, status byte only, no input data:

Input	PII	Assignment
Input I0	1	LSB status byte
	...	...
	8	MSB status byte
Input I1	9	LSB status byte
	...	...
	16	MSB status byte

ST modules for analogue input can transfer a variety of status information to the ST-PII (see table below for the conveyed status). The information is transmitted using the input's status byte. Read access (R) is configured for the input for that purpose.

Analogue input/output (standard)
PSSu E S 2AI U

Structure and contents of the status byte:

Bit number	Content	Meaning
0	0	Input value above the lower limit value
	1	Value below the lower limit value
1	0	Input value below the upper limit value
	1	Value exceeds the upper limit value
2 / 3	0 0	Limit value 1 inactive
	0 1	Input value greater than or equal to limit value 1
	1 0	Input value less than limit value 1
	1 1	Reserved
4 / 5	0 0	Limit value 2 inactive
	0 1	Input value greater than limit value 2
	1 0	Input value less than or equal to limit value 2
	1 1	Reserved
6	0	Valid data from A/D converter
	1	No valid data from A/D converter
7	0	Reserved
	1	Reserved

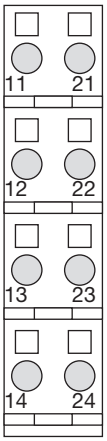
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
I0(11) I1(21)	ST_I_AI	Data: WORD	Input data I0 ... I1
		Underrange: BOOL	0: Input value above the lower limit value 1: Value below the lower limit value
		Overrange: BOOL	0: Input value below the upper limit value 1: Value exceeds the upper limit value
		LimitValue1: BOOL	0: Limit value 1 inactive 1: Input value greater than or equal to limit value 1
		LimitValue2: BOOL	0: Limit value 2 inactive 1: Input value greater than or equal to limit value 2

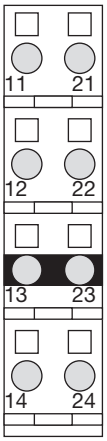
Analogue input/output (standard)
PSSu E S 2AI U

Wiring

Terminal configuration

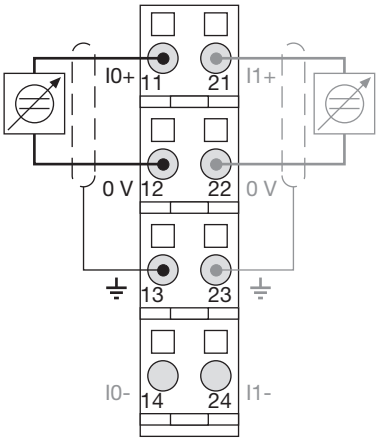
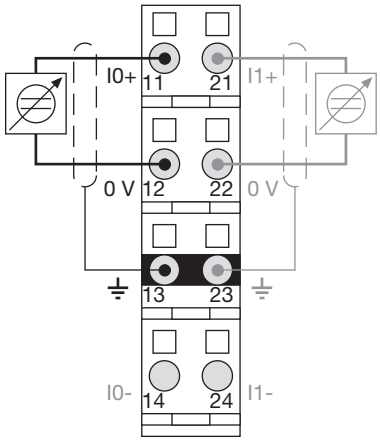
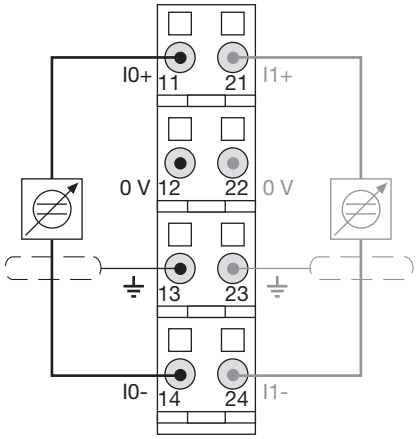
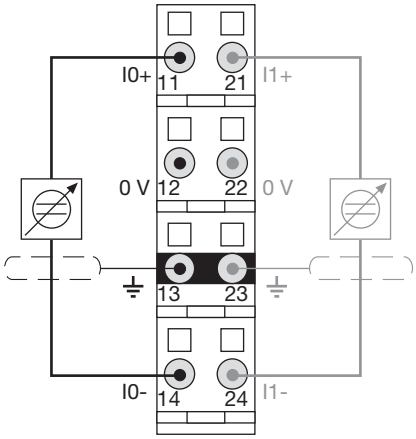
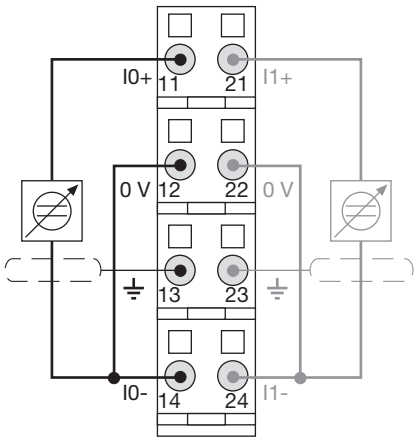
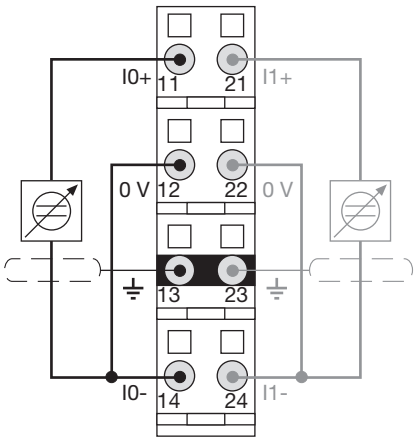
Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Input I0+ 21: Input I1+ 12-22: 0 V analogue (12-22 linked within the base module) 13-23: Shield connection (13-23 linked within the base module) 14: Input I0- 24: Input I1-	

Analogue input/output (standard)
PSSu E S 2AI U

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Input I0+ 21: Input I1+ 12-22: 0 V analogue (12-22 linked within the base module) 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Input I0- 24: Input I1-	

Analogue input/output (standard)
PSSu E S 2AI U

Connecting the module

Input circuit	Without C-rail	With C-rail
Voltage range (0 ... +10 V single-pole, referenced to earth		
Voltage range (0 ... +10 V Voltage range –10 V ... +10 V dual-pole, differential input		
Voltage range –10 V ... +10 V Differential measurement refer- enced to earth In a noise susceptible environment		

Analogue input/output (standard)
PSSu E S 2AI U

Technical details

General	312440	314440
Approvals	**CE, TÜV, cULus Listed**	**CE, TÜV, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0300h**	**0300h**
Number of ST input bits	**32**	**32**
Number of ST status bits	**16**	**16**
Application in system environment A		
From ST firmware version, other head modules	**7**	**7**
From ST firmware version PSSu H S PN	**1**	**1**
From ST firmware version PSSu WR S IDN	**4**	**4**
Application in system environment B		
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312440**	**314440**
Internal supply voltage (module supply)		
Module's power consumption	**0,22 W**	**0,22 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**10 mA**	**10 mA**
Module's power consumption with no load	**0,24 W**	**0,24 W**
Max. power dissipation of module	**0,50 W**	**0,50 W**
Analogue inputs	**312440**	**314440**
Number of analogue inputs	**2**	**2**
Type of analogue inputs	**Voltage**	**Voltage**
Input area	**-10 ... 10 V (differential input), 0 ... 10 V (differential input), 0 ... 10 V (single-ended)**	**-10 ... 10 V (differential input), 0 ... 10 V (differential input), 0 ... 10 V (single-ended)**

Analogue input/output (standard)
PSSu E S 2AI U

Analogue inputs	312440	314440
Measuring ranges		
Type	**Single-ended**	**Single-ended**
Measuring range	**0 - 10 V**	**0 - 10 V**
Type	**Differential input**	**Differential input**
Measuring range	**0 - 10 V**	**0 - 10 V**
Type	**Differential input**	**Differential input**
Measuring range	**-10 - 10 V**	**-10 - 10 V**
Input filter	**RC filter**	**RC filter**
Cutoff frequency	**130 Hz**	**130 Hz**
Voltage measurement		
Input resistance	**100 kOhm**	**100 kOhm**
Max. continuous voltage	**12 V**	**12 V**
Resolution	**12 Bit**	**12 Bit**
Max. common mode voltage	**5 V**	**5 V**
Deviations from the measuring range limit value		
Linearity error	**0,05 %**	**0,05 %**
Output variable error at 25 °C	**0,2 %**	**0,2 %**
Temperature coefficient	**0,0200 %/K**	**0,0200 %/K**
Max. measurement error during EMC test	**1,0 %**	**1,0 %**
Potential isolation between input and periphery supply	**yes**	**yes**
Typ. processing time of the analogue input	**1,0 ms**	**1,0 ms**
Inputs	**312440**	**314440**
Potential isolation between input and internal module bus voltage	**yes**	**yes**
Environmental data	**312440**	**314440**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**

Analogue input/output (standard)
PSSu E S 2AI U

Environmental data	312440	314440
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312440**	**314440**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**

Analogue input/output (standard)
PSSu E S 2AI U

Mechanical data	312440	314440
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**37 g**	**37 g**
Mechanical coding		
Type	**D**	**D**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2005-04 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E S 2AI U	Electronic module, base type	312 440
PSSu E S 2AI U-T	Electronic module, T-type	314 440

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C 1/12 S	Base module with C-rail and screw terminals	312 620
PSSu BP-C 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 620

Analogue input/output (standard)
PSSu E S 2AI U

Product type	Features	Order no.
PSSu BP-C 1/12 C	Base module with C-rail and cage clamp terminals	312 621
PSSu BP-C 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 621

Analogue input/output (standard)
PSSu E S 2AO I

Overview

Module features

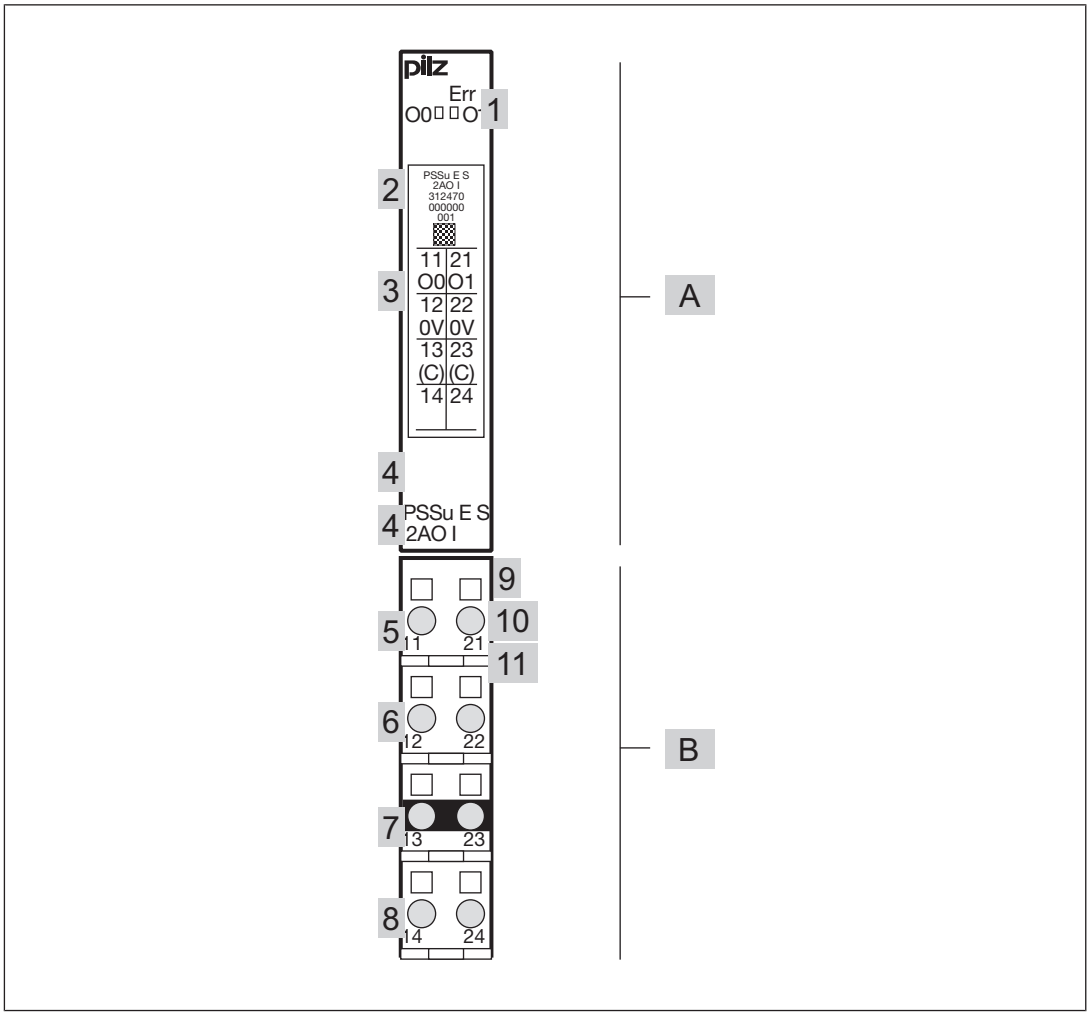
The product has the following features:

- 2 analogue current outputs
- Configurable current ranges:
  - 0 ... 20 mA single-pole, referenced to earth (single-ended)
  - 4 ... 20 mA single-pole, referenced to earth (single-ended)
- Resolution: 12 Bit
- LEDs for:
  - Operating status per output
  - Module error
- For standard applications in system environment A and B
- T-type:

  PSSu E S 2AO I-T: for increased environmental requirements

Analogue input/output (standard)
PSSu E S 2AO I

Front view



Legend:

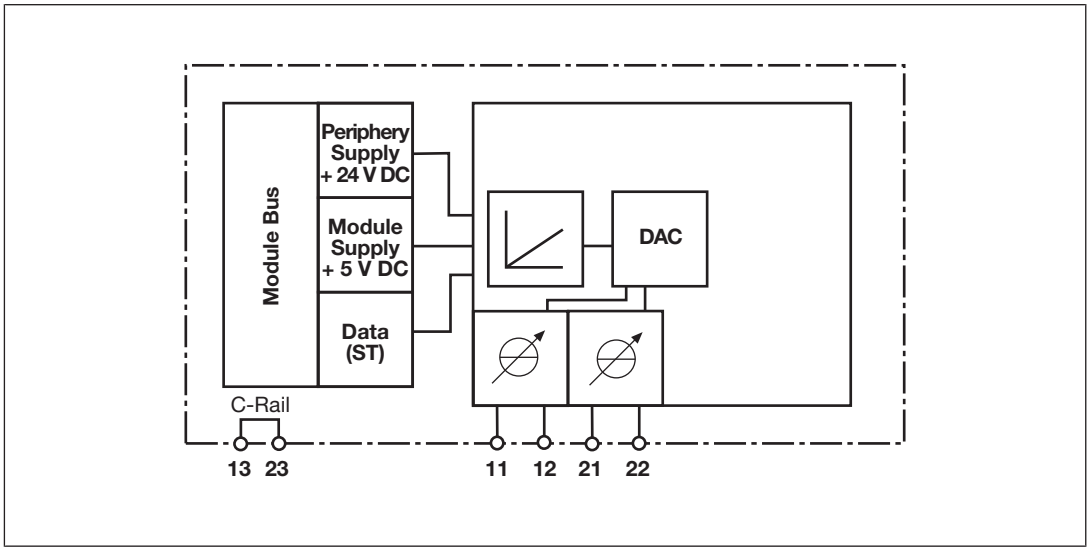
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Status indicator
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Analogue input/output (standard)
PSSu E S 2AO I

- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1
- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Analogue input/output (standard)
PSSu E S 2AO I

Module features

Module supply

- The module supply provides the module with voltage.

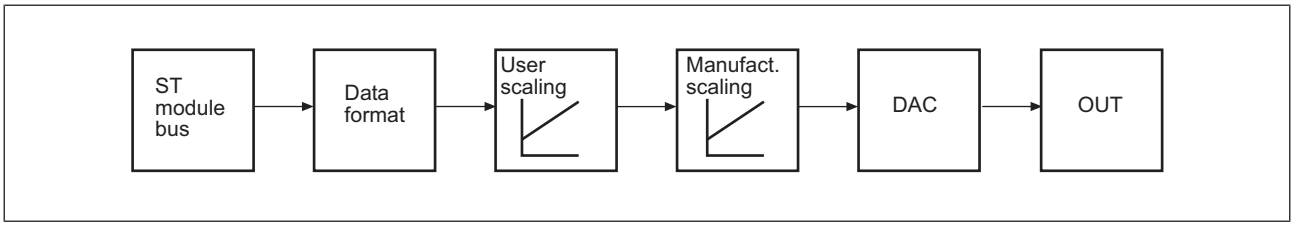
Periphery supply

- The supply for the outputs is generated from the periphery supply.
- The periphery supply and the outputs are galvanically isolated.

The output signals for each output are transmitted to the output module via the ST module bus. The resolution is 12 bits (4095 steps). Additional signal processing can be defined using the system software (see schematic representation of signal processing). The individual steps are described in the "Configuration" section.

All the configuration data is stored in the head module and is assigned to the output module on restart. This way the configuration data is retained even if you change the output module.

Schematic representation of signal processing:



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Analogue input/output (standard)
PSSu E S 2AO I

Configuration

The following options exist for configuring the module in system environment A:

- Via a fieldbus without the modular device description file
  Without the modular device description file it is only possible to configure the input or output range. All other configuration details have default values.
- Via a fieldbus with the modular device description file
  With a modular device description file it is possible to configure all the values.
- Via the USB port of the head module, using the PSSuniversal Configurator
  All the values can be configured using the PSSuniversal Assistant. Any configuration via the USB port will overwrite the configuration made via the fieldbus.

If a module has been configured via the head module's USB port, it is locked and cannot be overwritten by the fieldbus. This lock can be deactivated again in the PSSuniversal Configurator.

The following options exist for configuring the module in system environment B:

- Via the head module's USB port with PAS4000.

You can configure the following current ranges per module:

- 0 ... 20 mA single-pole, referenced to earth (single-ended)
- 4 ... 20 mA single-pole, referenced to earth (single-ended)

The way in which the analogue value is displayed depends on the voltage range, on scaling and on the data format. The following examples show the relationship between the values with default scaling.

You can configure the following data formats:

- Two's complement (default)
  The digital values are transferred with 15 bits plus a sign bit (MSB). The MSB is "1" with negative values and "0" with positive values.
- Sign and magnitude representation
  The digital values are transferred with 15 bits plus a sign bit (MSB). The MSB is "1" with negative values and "0" with positive values. With negative values there is a distinction between sign and magnitude representation and two's complement representation.
- Formation of magnitude option
  Negative digital values are converted into positive values of equal magnitude.

As the module's resolution is 12 bits plus sign bit, the three least significant bits have no significance for the analogue value.

Analogue input/output (standard)
PSSu E S 2AO I

Analogue value and typical digital value with a current range of 0 ... 20 mA, two's complement or sign and magnitude representation:

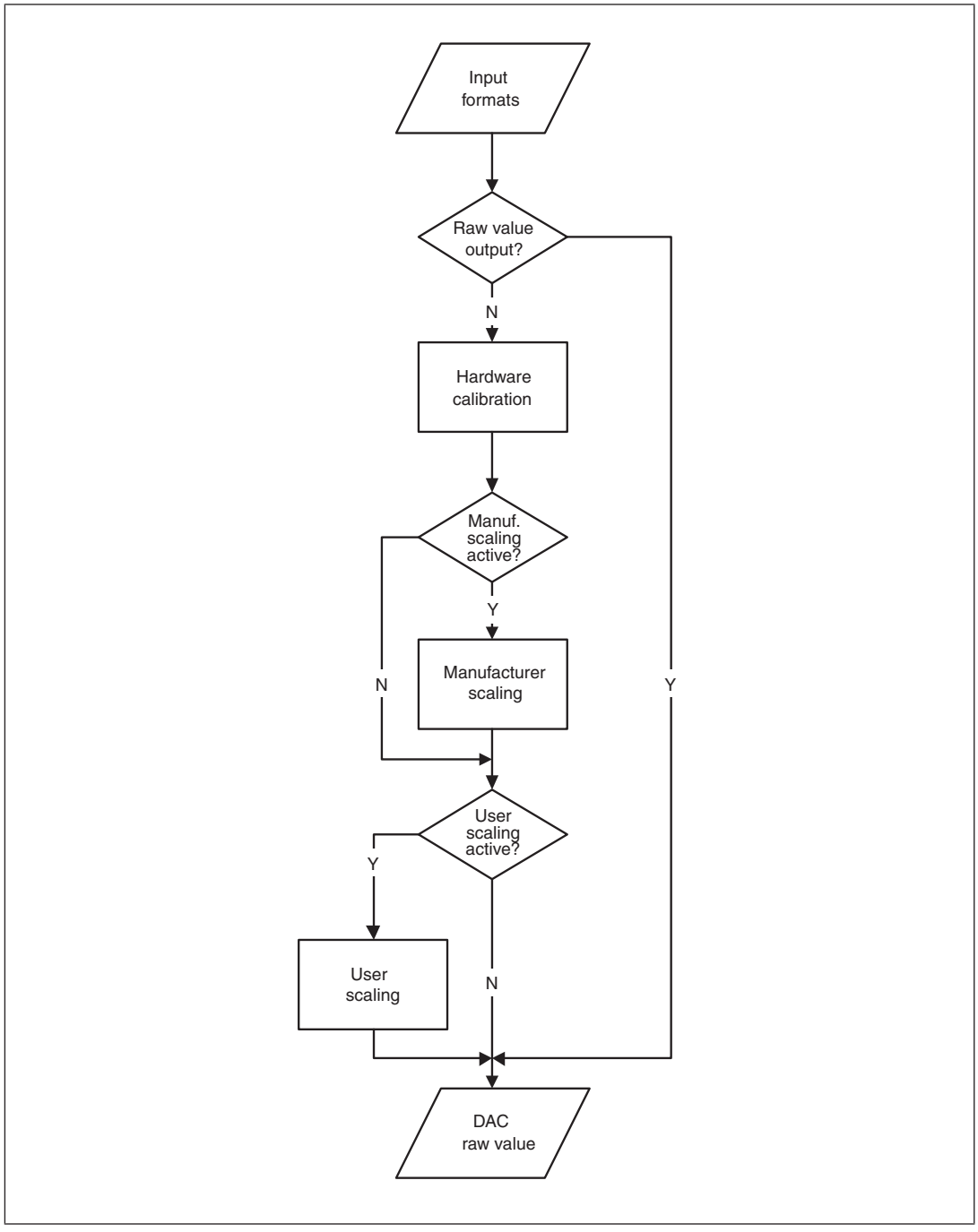
Analogue value of current	Decimal digital value	Binary digital value	Hexadecimal digital value
0 mA	0	0000 0000 0000 0000	0000_H
10 mA	16 384	0100 0000 0000 0000	4000_H
20 mA	32 767	0111 1111 1111 1111	$7FFF_H$

Analogue value and typical digital value with a current range of 4 ... 20 mA, two's complement or sign and magnitude representation:

Analogue value of current	Decimal digital value	Binary digital value	Hexadecimal digital value
4 mA	0	0000 0000 0000 0000	0000_H
12 mA	16 384	0100 0000 0000 0000	4000_H
20 mA	32 767	0111 1111 1111 1111	$7FFF_H$

Scaling is a multi-stage process to adapt the values to the DA converter. The straight path in the diagram indicates the default configuration.

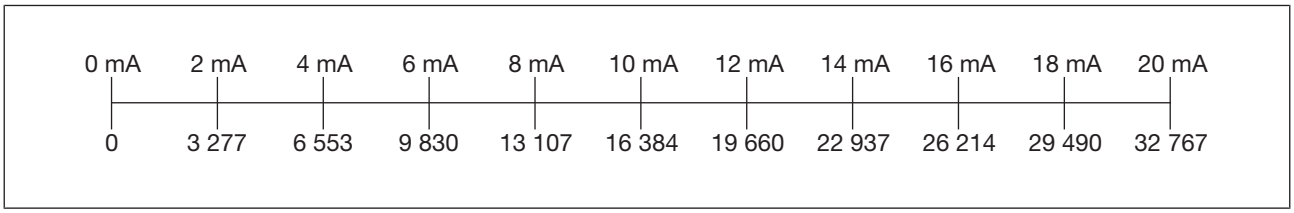
Analogue input/output (standard)
PSSu E S 2AO I



Analogue input/output (standard)
PSSu E S 2AO I

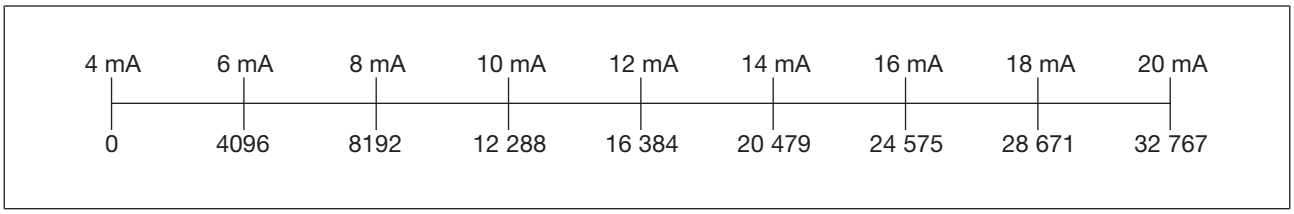
Analogue value and typical digital value with a current range of 0 ... 20 mA and default values:

Analogue value of current	Decimal digital value
0 mA	0
10 mA	16 384
20 mA	32 767



Analogue value and typical digital value with a current range of 4 ... 20 mA and default values:

Analogue value of current	Decimal digital value
4 mA	0
12 mA	16 384
20 mA	32 767



You can configure each channel so that the raw value is transferred directly to the DA converter, without calibration or scaling.

Each channel is calibrated ex-works in order to correct component dispersion and other influences.

The range is divided so that zero is assigned the value 0 and the end point is assigned the value 4095_D ($0FFF_H$).

The manufacturer scaling is used to define the offset (zero point compensation) and gain (amplification) of the digital signal.

Manufacturer scaling active (default setting)

- Default values for manufacturer scaling:
  - Offset (b_1): 0
  - Gain (a_1): 32_D (20_H)

Analogue input/output (standard)
PSSu E S 2AO I

The digital value after manufacturer scaling is calculated using the following formula:

- $y = (a_1 / 256_D * x) + b_1$ or
- $y = (a_1 / 100_H * x) + b_1$

Key:

- **y**: Digital value after manufacturer scaling
- **x**: Digital value before manufacturer scaling
- **a_1**: Gain
- **b_1**: Offset
- **$a_1 / 256_D$**: Amplification factor

Arithmetic examples using decimal values:

Digital value before manufacturer scaling (x)	Gain (a_1)	Offset (b_1)	Amplification factor ($a_1 / 256_D$)	Value after manufacturer scaling (y)
1 000	256	0	1	1 000
1 000	512	0	2	2 000
1 000	32	0	0,125	125
1 000	269	500	1,05	1 550
1 000	128	-50	0,5	450

The module always uses two's complement representation for internal processing, irrespective of the configured data format. The values from 0000_H to $FFFF_H$ form a number circle in the two's complement representation. 8000_H follows $7FFF_H$ (= $32\,767_D$) and is interpreted as the lowest negative number (= $-32\,768_D$). $32\,767_D$ is never exceeded; the value never falls below $-32{,}768_D$.

User scaling is an additional scaling level prior to manufacturer scaling. You can use this scaling to correct local influences. The function is the same as that of manufacturer scaling:

$y = (a_2 / 256_D * x) + b_2$ or

$y = (a_2 / 100_H * x) + b_2$

a_2 = Amplification factor * 256_D

User scaling is deactivated in the default setting. The default value for offset is 0. The default value for gain is 256_D (100_H). That corresponds to amplification factor 1.

Task:

If the PIO shows a decimal value of 20 000, there should be 20 mA at the output. User scaling should be used in this case (Gain a_2). Manufacturer scaling should not be changed. All numbers are decimals.

Analogue input/output (standard)
PSSu E S 2AO I

Solution:

User scaling
$y = (a_2 / 256 * x) + b_2$
and manufacturer scaling
$y = (a_1 / 256 * x) + b_1$
act consecutively, giving:
$y = (a_1 / 256 * ((a_2 / 256 * x) + b_2)) + b_1$ or:
$y = (a_1 * a_2 * x / 65536) + (a_1 * b_2 / 256) + b_1$

With default values for $a_1 = 32$, $b_1 = 0$ and the default value $b_2 = 0$:
$y = a_2 * x / 2048$
$a_2 = y * 2048 / x$

Due to the hardware calibration the converter's output range is divided so that the 20 mA end point is assigned the value x = 4095. With the default values y = 4095 and x= 20,000 the result is:
Gain $a_2 = 419$

When the PSSuniversal is switched on, the output assumes the switch-on value until the module receives data for the value of the output. You can configure the outputs per channel with the manufacturer switch-on value (default) or you can use a freely definable user switch-on value. The manufacturer switch-on value is:

- 0 mA for the current range 0 … 20 mA and
- 4 mA for the current range 4 … 20 mA.

If the module does not receive any data from the module bus for 50 ms, the outputs are reset to the switch-on value.

Switch-on values are entered in the system software as decimal vaues. With default scaling, the decimal value (n) is calculated from the analogue value at the output (I_{Start}) as follows:

- Current range 0 … 20 mA:
  $n = 32\,767 * I_{Start} / 20\ mA$
- Current range 4 … 20 mA:
  $n = 32\,767 * (I_{Start} – 4\ mA) / 16\ mA$

example:

- Switch-on values as an analogue value at the output (I_{Start}):
  - Switch-on value for channel 1 is to be 8 mA.
  - Switch-on value for channel 2 is to be 15 mA.
- Entry in the system software at
  Current range 0 … 20 mA:
  - Switch-on value 1 corresponds to 13 107
  - Switch-on value 2 corresponds to 24 576

Analogue input/output (standard)
PSSu E S 2AO I

- Entry in the system software at
  Current range 4 … 20 mA:
  - Switch-on value 1 corresponds to 8 192
  - Switch-on value 2 corresponds to 22 528

The relationship between the switch-on value and the actual current at the output is dependent on the scaling. The module sets the current, which corresponds to the switch-on voltage after scaling. Please refer to the "Scaling" section in this manual.

The module has the following configuration options:

Configurable properties	Default value	Meaning
Output range	0	0 mA ... 20 mA (1 = 4 mA ... 20 mA)
Manufacturer scaling active	1/TRUE	Activated
Manufacturer scaling offset	0	Offset: Magnitude 0
Manufacturer scaling gain	32_D	Amplification by 1/8, displaced three bit places
User scaling active	0/FALSE	Deactivated
User scaling offset	0	Offset: Magnitude 0
User scaling gain	256_D	1x amplification, signal unchanged
Switch-on value active	0/FALSE	Manufacturer switch-on value active (1/TRUE = User switch-on value active)
Manufacturer switch-on value	0	0 mA / 4 mA on switch-on
User switch-on value	0	0 mA / 4 mA on switch-on
Sign and magnitude representation active	0/FALSE	Deactivated; two's complement is activated
Formation of magnitude active	0/FALSE	Deactivated
Output DAC raw value only	0/FALSE	Deactivated

Each output channel occupies 16 consecutive bit addresses for the output data.

Configuration	Standard bus system	
	ST-PII	ST-PIO
None	- - -	32 Bit

Bit sequence in the PIO:

Input	PIO	Assignment
Output O0	1	LSB
	...	...
	16	MSB

Analogue input/output (standard)
PSSu E S 2AO I

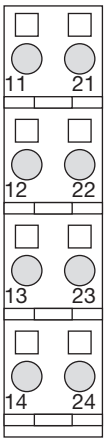
Input	PIO	Assignment
Output O1	17	LSB
	...	...
	32	MSB

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

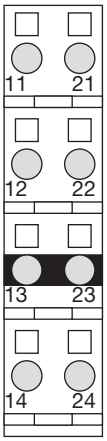
I/O data name	I/O data type	I/O data element	Meaning
O0(11), O1(21)	ST_O_AO	Data: WORD	Output data O0, O1

Wiring

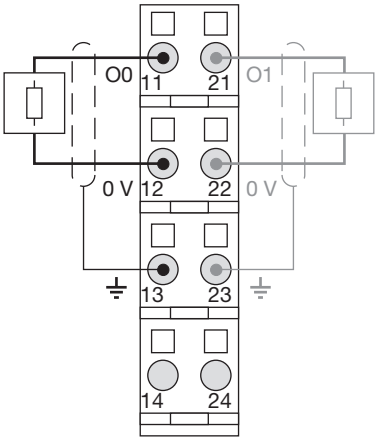
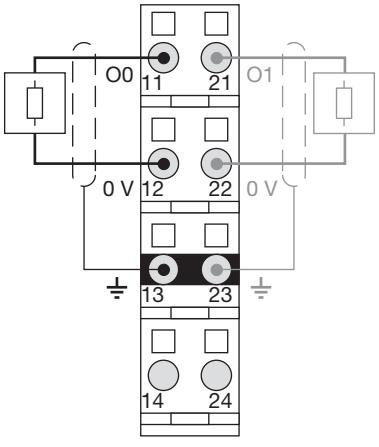
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Output O0 21: Output O1 12-22: 0 V analogue (12-22 linked within the base module) 13-23: Shield connection (13-23 linked within the base module) 14: Not connected 24: Not connected	

Analogue input/output (standard)
PSSu E S 2AO I

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V analogue (12-22 linked within the base module) 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Not connected 24: Not connected	

Connecting the module

Output circuit	Without C-rail	With C-rail
current range 0 ... 20 mA current range 4 ... 20 mA single-pole, referenced to earth		

Analogue input/output (standard)
PSSu E S 2AO I

Technical details

General	312470	314470
Approvals	**CE, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0510h**	**0510h**
Number of ST output bits	**32**	**32**
Application in system environment A		
From ST firmware version, other head modules	**7**	**7**
From ST firmware version PSSu H S PN	**1**	**1**
From ST firmware version PSSu WR S IDN	**4**	**4**
Application in system environment B		
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312470**	**314470**
Internal supply voltage (module supply)		
Module's power consumption	**0,22 W**	**0,22 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**54 mA**	**54 mA**
Module's power consumption with no load	**1,29 W**	**1,29 W**
Max. power dissipation of module	**0,50 W**	**0,50 W**
Permitted loads	**inductive, resistive**	**inductive, resistive**
Analogue outputs	**312470**	**314470**
Number of analogue outputs	**2**	**2**
Type of analogue outputs	**Current**	**Current**
Output range	**0 .. 20mA, 4 .. 20mA**	**0 .. 20mA, 4 .. 20mA**
Resolution (without sign bit)	**12 Bit**	**12 Bit**
Max. open circuit voltage	**14 V**	**14 V**
Max. permitted resistive load	**500 Ohm**	**500 Ohm**

Analogue input/output (standard)
PSSu E S 2AO I

Analogue outputs	312470	314470
Deviations from the measuring range limit value		
Linearity error	**0,15 %**	**0,15 %**
Output variable error at 25 °C	**0,3 %**	**0,3 %**
Max. output variable error at 25 °C	**2,0 %**	**2,0 %**
Temperature coefficient	**0,02 %/K**	**0,02 %/K**
Potential isolation between output and voltage for the internal module bus	**yes**	**yes**
Potential isolation between output and periphery supply	**yes**	**yes**
Typ. processing time of the analogue output	**1,0 ms**	**1,0 ms**
Environmental data	**312470**	**314470**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**

Analogue input/output (standard)
PSSu E S 2AO I

Environmental data	312470	314470
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312470**	**314470**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**36 g**	**38 g**
Mechanical coding		
Type	**E**	**E**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2005-04 latest editions shall apply.

Analogue input/output (standard)
PSSu E S 2AO I

Order reference

Product

Product type	Features	Order No.
PSSu E S 2AO I	Electronic module, base type	312 470
PSSu E S 2AO I-T	Electronic module, T-type	314 470

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C 1/12 S	Base module with C-rail and screw terminals	312 620
PSSu BP-C 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 620
PSSu BP-C 1/12 C	Base module with C-rail and cage clamp terminals	312 621
PSSu BP-C 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 621

Analogue input/output (standard)
PSSu E S 4AO U

Overview

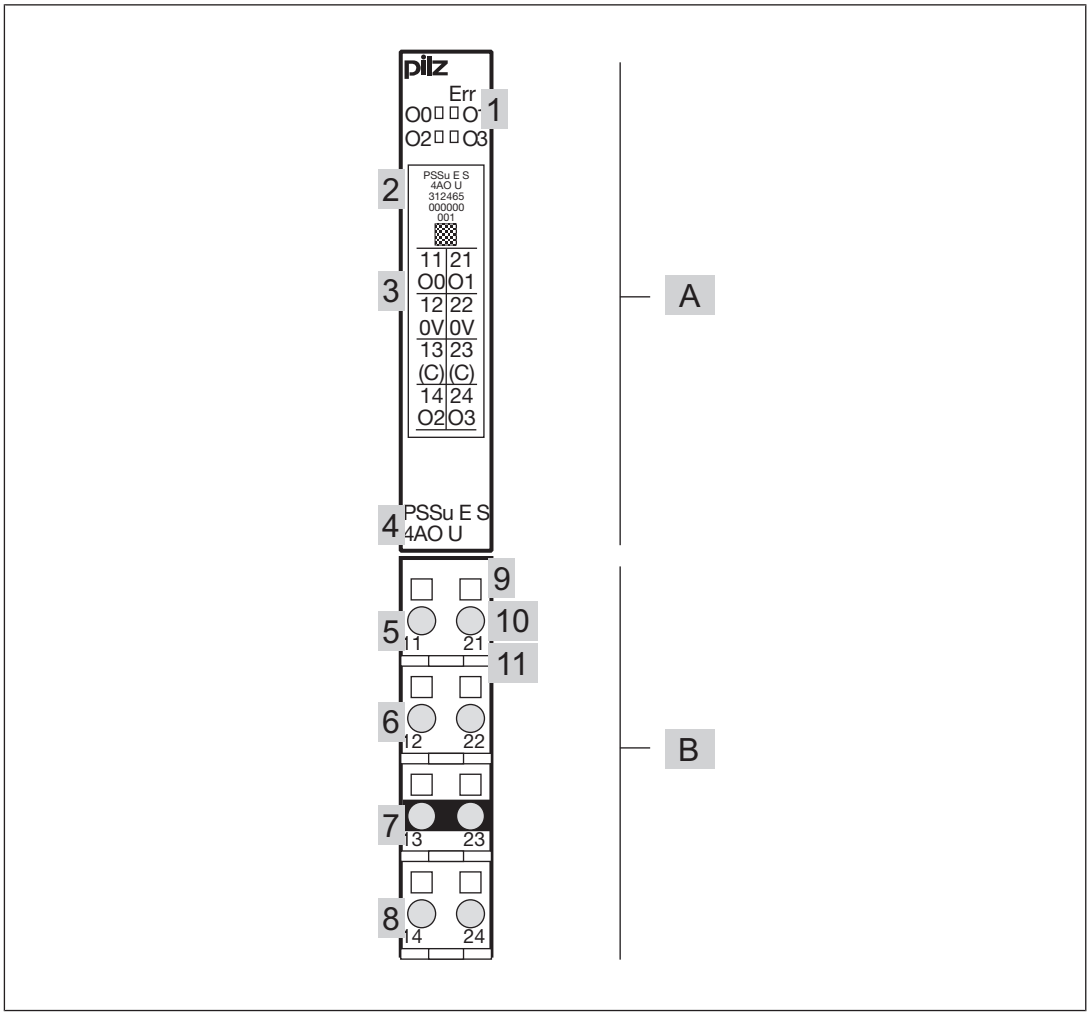
Module features

The product has the following features:

- 4 analogue voltage outputs
- Voltage range:
  - 0 ... +10 V single-pole, referenced to earth (single-ended)
- Resolution: 12 Bit
- LEDs for:
  - Operating status per output
  - Module error
- For standard applications in system environment A and B
- T-type:
  PSSu E S 4AO U-T: for increased environmental requirements

Analogue input/output (standard)
PSSu E S 4AO U

Front view



Legend:

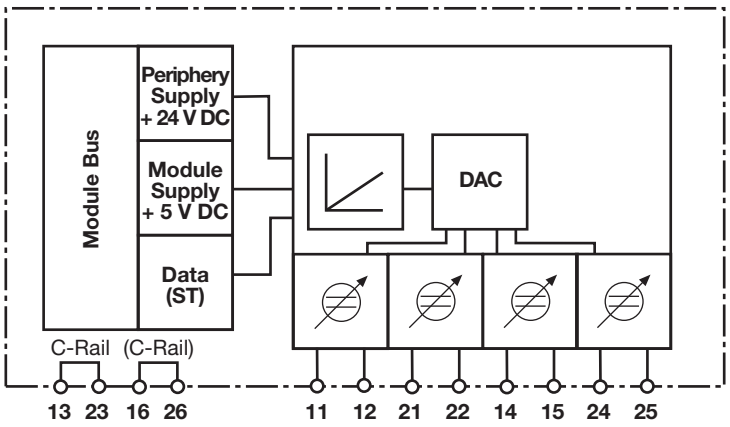
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Status indicator
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Analogue input/output (standard)
PSSu E S 4AO U

- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1
- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Analogue input/output (standard)
PSSu E S 4AO U

Module features

Module supply

- The module supply provides the module with voltage.

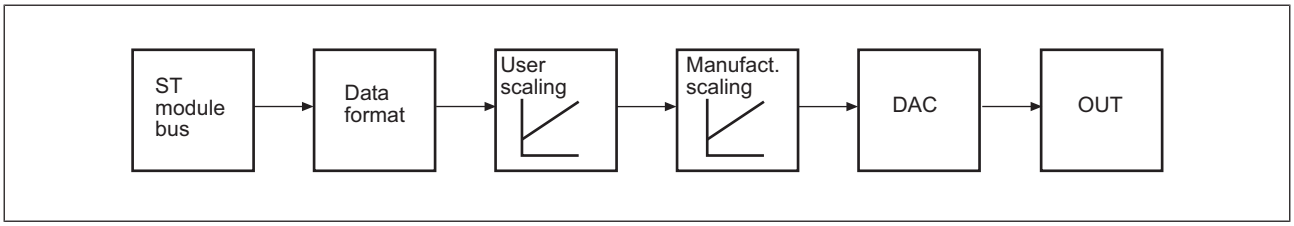
Periphery supply

- The supply for the outputs is generated from the periphery supply.
- The periphery supply and the outputs are galvanically isolated.

The output signals for each output are transmitted to the output module via the ST module bus. The resolution is 12 bits (4095 steps). Additional signal processing can be defined using the system software (see schematic representation of signal processing). The individual steps are described in the "Configuration" section.

All the configuration data is stored in the head module and is assigned to the output module on restart. This way the configuration data is retained even if you change the output module.

Schematic representation of signal processing:



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

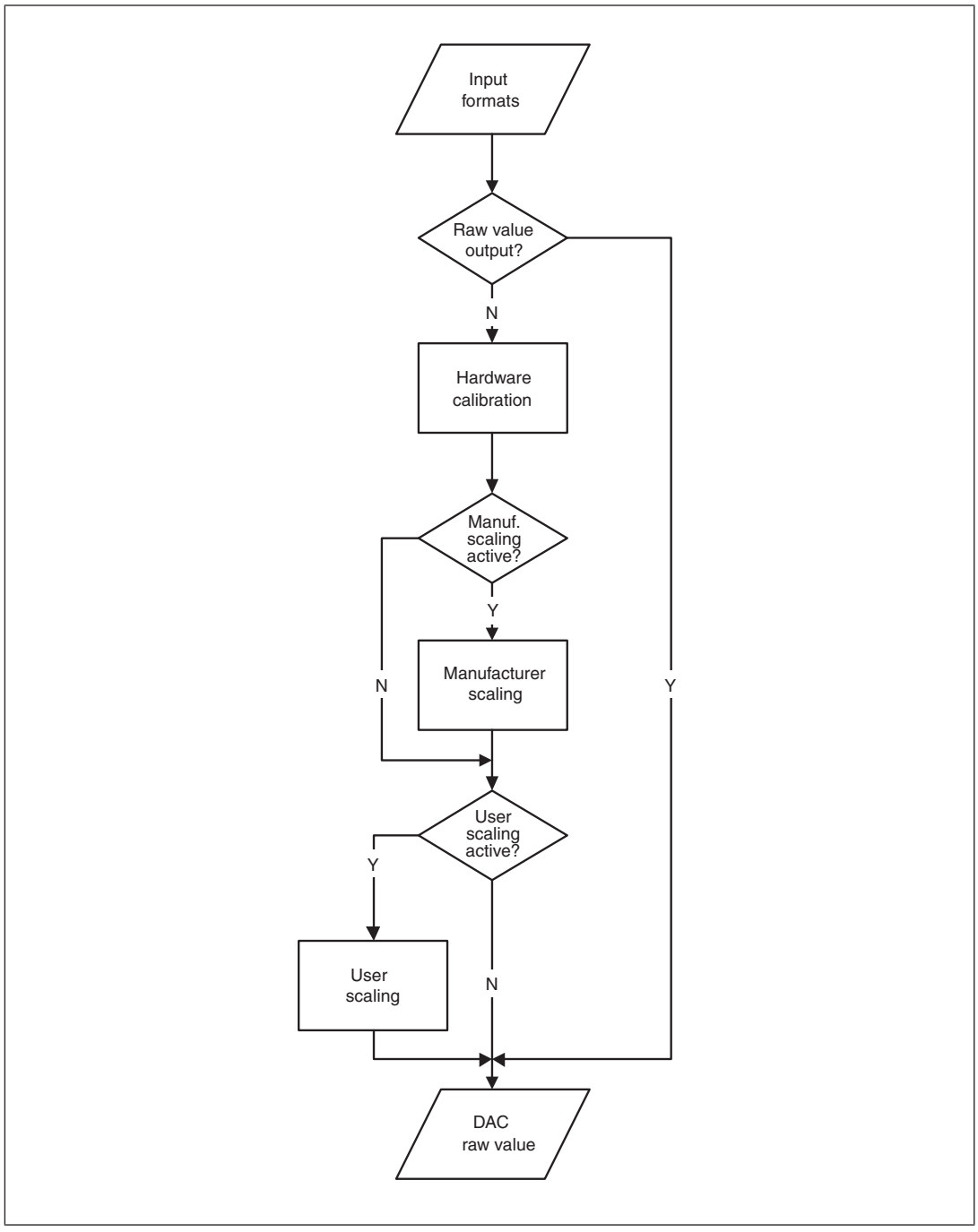
- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Analogue input/output (standard)
PSSu E S 4AO U

Configuration

The module can be configured using the system software.

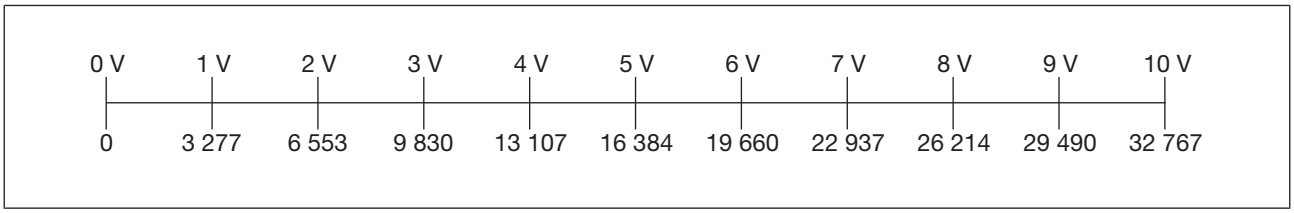
Scaling is a multi-stage process to adapt the values to the DA converter. The straight path in the diagram indicates the default configuration.



Analogue input/output (standard)
PSSu E S 4AO U

Analogue value and typical digital value with a voltage range of 0 ... +10 V and default values:

Analogue value of voltage	Hexadecimal digital value	Decimal digital value
0 V	0	0
5 V	4000	16 384
10 V	7FFF	32 767



You can configure each channel so that the raw value is transferred directly to the DA converter, without calibration or scaling.

Each channel is calibrated ex-works in order to correct component dispersion and other influences.

The range is divided so that zero is assigned the value 0 and the end point is assigned the value 4095_D ($0FFF_H$).

The manufacturer scaling is used to define the offset (zero point compensation) and gain (amplification) of the digital signal.

Manufacturer scaling active (default setting)

- Default values for manufacturer scaling:
  - Offset (b_1): 0
  - Gain (a_1): 32_D (20_H)

Analogue input/output (standard)
PSSu E S 4AO U

The digital value after manufacturer scaling is calculated using the following formula:

- $y = (a_1 / 256_D * x) + b_1$ or
- $y = (a_1 / 100_H * x) + b_1$

Key:

- **y**: Digital value after manufacturer scaling
- **x**: Digital value before manufacturer scaling
- **a_1**: Gain
- **b_1**: Offset
- **$a_1 / 256_D$**: Amplification factor

Arithmetic examples using decimal values:

Digital value before manufacturer scaling (x)	Gain (a_1)	Offset (b_1)	Amplification factor ($a_1 / 256_D$)	Value after manufacturer scaling (y)
1 000	256	0	1	1 000
1 000	512	0	2	2 000
1 000	32	0	0,125	125
1 000	269	500	1,05	1 550
1 000	128	-50	0,5	450

The module always uses two's complement representation for internal processing, irrespective of the configured data format. The values from 0000_H to $FFFF_H$ form a number circle in the two's complement representation. 8000_H follows $7FFF_H$ (= $32\,767_D$) and is interpreted as the lowest negative number (= $-32\,768_D$). $32\,767_D$ is never exceeded; the value never falls below $-32{,}768_D$.

User scaling is an additional scaling level prior to manufacturer scaling. You can use this scaling to correct local influences. The function is the same as that of manufacturer scaling:

$y = (a_2 / 256_D * x) + b_2$ or

$y = (a_2 / 100_H * x) + b_2$

a_2 = Amplification factor * 256_D

User scaling is deactivated in the default setting. The default value for offset is 0. The default value for gain is 256_D (100_H). That corresponds to amplification factor 1.

Task:

If the PIO shows a decimal value of 10 000, there should be 10 V at the output. User scaling should be used in this case (Gain a_2). Manufacturer scaling should not be changed. All numbers are decimals.

Analogue input/output (standard)
PSSu E S 4AO U

Solution:

User scaling
$y = (a_2 / 256 * x) + b_2$
and manufacturer scaling
$y = (a_1 / 256 * x) + b_1$
act consecutively, giving:
$y = (a_1 / 256 * ((a_2 / 256 * x) + b_2)) + b_1$ or:
$y = (a_1 * a_2 * x / 65536) + (a_1 * b_2 / 256) + b_1$

With default values for $a_1 = 32$, $b_1 = 0$ and the default value $b_2 = 0$:
$y = a_2 * x / 2048$
$a_2 = y * 2048 / x$

Due to the hardware calibration the converter's output range is divided so that the 10 V end point is assigned the value x = 4095. With the default values y = 4095 and x= 10 000 the result is:
Gain $a_2 = 838$

The way in which the analogue value is displayed depends on the voltage range, on scaling and on the data format. The following examples show the relationship between the values with default scaling.

You can configure the following data formats:

- Two's complement (default)
  The digital values are transferred with 15 bits plus a sign bit (MSB). The MSB is "1" with negative values and "0" with positive values.
- Sign and magnitude representation
  The digital values are transferred with 15 bits plus a sign bit (MSB). The MSB is "1" with negative values and "0" with positive values. With negative values there is a distinction between sign and magnitude representation and two's complement representation.
- Formation of magnitude option
  Negative digital values are converted into positive values of equal magnitude.

As the module's resolution is 12 bits plus sign bit, the three least significant bits have no significance for the analogue value.

Analogue input/output (standard)
PSSu E S 4AO U

Analogue value and typical digital value, two's complement or sign and magnitude representation:

Analogue value of voltage	Decimal digital value	Binary digital value	Hexadecimal digital value
0 V	0	0000 0000 0000 0000	0000_H
5 V	16 384	0100 0000 0000 0000	4000_H
10 V	32 767	0111 1111 1111 1111	$7FFF_H$

When the PSSuniversal is switched on, the output assumes the switch-on value until the module receives data for the value of the output. You can configure the outputs per channel with the manufacturer switch-on value (default) or you can use a freely definable user switch-on value. The manufacturer switch-on value is 0 V.

If the module does not receive any data from the module bus for 50 ms, the outputs are reset to the switch-on value.

Switch-on values are entered in the system software as decimal vaues. With default scaling, the decimal value (n) is calculated from the analogue value at the output (U_{Start}) as follows:

$n = 32\,767 * U_{Start} / 10\ V$

Example:

- Switch-on values as an analogue value at the output (U_{Start}):
  - Switch-on value for channel 1 is to be 8 V.
  - Switch-on value for channel 2 is to be 5 V.
- Entry in the system software:
  - Switch-on value 1 corresponds to 26 214
  - Switch-on value 2 corresponds to 16 384

The relationship between the switch-on value and the actual voltage at the output is dependent on the scaling. The module sets the voltage, which corresponds to the switch-on voltage after scaling. Please refer to the "Scaling" section in this manual.

The module has the following configuration options:

Configurable properties	Default value	Meaning
Output range	0	0 V ... 10 V (cannot be changed)
Manufacturer scaling active	1/TRUE	Activated
Manufacturer scaling offset	0	Offset: Magnitude 0
Manufacturer scaling gain	32_D	Amplification by 1/8, displaced three bit places
User scaling active	0/FALSE	Deactivated
User scaling offset	0	Offset: Magnitude 0

Analogue input/output (standard)
PSSu E S 4AO U

Configurable properties	Default value	Meaning
User scaling gain	256_D	1x amplification, signal unchanged
Switch-on value active	0	Manufacturer switch-on value active (1 = User switch-on value active)
Manufacturer switch-on value	0	0 V on switch-on
User switch-on value	0	0 V on switch-on
Sign and magnitude representation active	0/FALSE	Deactivated; two's complement is activated
Formation of magnitude active	0/FALSE	Deactivated
Output DAC raw value only	0/FALSE	Deactivated

Each output channel occupies 16 consecutive bit addresses for the output data.

Configuration	Standard bus system	
	ST-PII	ST-PIO
None	- - -	64 Bit

Bit sequence in the PIO:

Input	PIO	Assignment
Output O0	1	LSB
	...	...
	16	MSB
Output O1	17	LSB
	...	...
	32	MSB
Output O2	33	LSB
	...	...
	48	MSB
Output O3	49	LSB
	...	...
	64	MSB

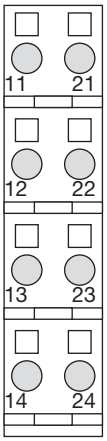
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
O0(11), O1(21), O2(14), O3(24)	ST_O_AO	Data: WORD	Output data O0 ... O3

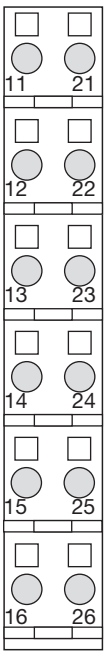
Analogue input/output (standard)
PSSu E S 4AO U

Wiring

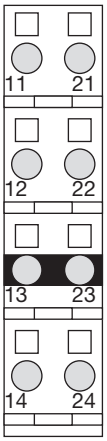
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Output O0 21: Output O1 12-22: 0 V analogue (12-22 linked within the base module) 13-23: Shield connection (13-23 linked within the base module) 14: Output O2 24: Output O3	

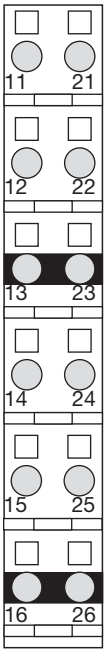
Analogue input/output (standard)
PSSu E S 4AO U

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/12 S PSSu BP 1/12 S-T Cage clamp terminals: PSSu BP 1/12 C PSSu BP 1/12 C-T	Without C-rail: 11: Output O0 21: Output O1 12-22: 0 V analogue (12-22-15-25 linked within the base module) 13-23: Shield connection (13-23-16-26 linked within the base module) 14: Output O2 24: Output O3 15-25: 0 V analogue (12-22-15-25 linked within the base module) 16-26: C-rail supply, shield connection (13-23-16-26 linked within the base module)	

Analogue input/output (standard)
PSSu E S 4AO U

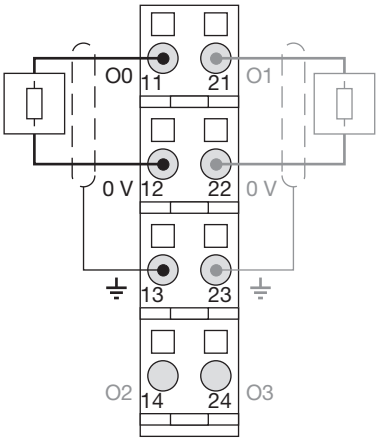
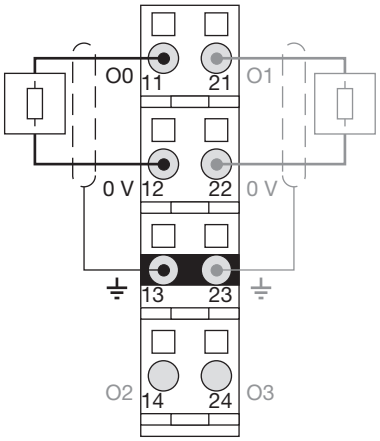
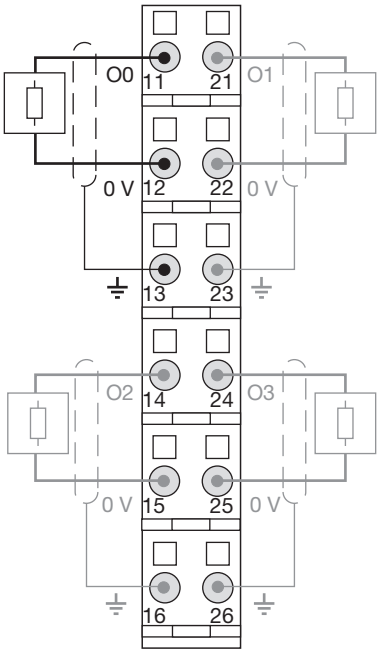
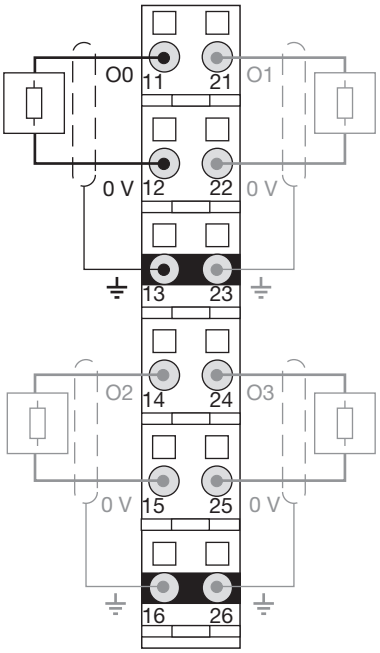
Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V analogue (12-22 linked within the base module) 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Output O2 24: Output O3	

Analogue input/output (standard)
PSSu E S 4AO U

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/12 S PSSu BP-C 1/12 S-T Cage clamp terminals: PSSu BP-C 1/12 C PSSu BP-C 1/12 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V analogue (12-22-15-25 linked within the base module) 13-23: C-rail supply, shield connection (13-23-16-26 linked within the base module) 14: Output O2 24: Output O3 15-25: 0 V analogue (12-22-15-25 linked within the base module) 16-26: C-rail supply, shield connection (13-23-16-26 linked within the base module)	

Analogue input/output (standard)
PSSu E S 4AO U

Connecting the module

Output circuit	Without C-rail	With C-rail
Voltage range (0 ... +10 V single-pole, referenced to earth Base modules with four connection levels		
Voltage range (0 ... +10 V single-pole, referenced to earth Base modules with six connection levels		

Analogue input/output (standard)
PSSu E S 4AO U

Technical details

General	312465	314465
Approvals	**CE, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0501h**	**0501h**
Number of ST output bits	**64**	**64**
Application in system environment A		
From ST firmware version, other head modules	**7**	**7**
From ST firmware version PSSu H S PN	**1**	**1**
From ST firmware version PSSu WR S IDN	**4**	**4**
Application in system environment B		
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312465**	**314465**
Internal supply voltage (module supply)		
Module's power consumption	**0,26 W**	**0,26 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**10 mA**	**10 mA**
Module's power consumption with no load	**0,24 W**	**0,24 W**
Max. power dissipation of module	**0,50 W**	**0,50 W**
Permitted loads	**Capacitive, resistive**	**Capacitive, resistive**
Analogue outputs	**312465**	**314465**
Number of analogue outputs	**4**	**4**
Type of analogue outputs	**Voltage**	**Voltage**
Output range	**0 .. 10V**	**0 .. 10V**
Resolution (without sign bit)	**12 Bit**	**12 Bit**
Max. short circuit current	**25 mA**	**25 mA**
Min. permitted resistive load	**5 kOhm**	**5 kOhm**

Analogue input/output (standard)
PSSu E S 4AO U

Analogue outputs	312465	314465
Deviations from the measuring range limit value		
Linearity error	**0,05 %**	**0,05 %**
Output variable error at 25 °C	**0,2 %**	**0,2 %**
Max. output variable error at 25 °C	**1,0 %**	**1,0 %**
Temperature coefficient	**0,02 %/K**	**0,02 %/K**
Potential isolation between output and voltage for the internal module bus	**yes**	**yes**
Potential isolation between output and periphery supply	**yes**	**yes**
Typ. processing time of the analogue output	**1,0 ms**	**1,0 ms**
Environmental data	**312465**	**314465**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**

Analogue input/output (standard)
PSSu E S 4AO U

Environmental data	312465	314465
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312465**	**314465**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**36 g**	**37 g**
Mechanical coding		
Type	**E**	**E**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2005-04 latest editions shall apply.

Analogue input/output (standard)
PSSu E S 4AO U

Order reference

Product

Product type	Features	Order No.
PSSu E S 4AO U	Electronic module, base type	312 465
PSSu E S 4AO U-T	Electronic module, T-type	314 465

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C 1/12 S	Base module with C-rail and screw terminals	312 620
PSSu BP-C 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 620
PSSu BP-C 1/12 C	Base module with C-rail and cage clamp terminals	312 621
PSSu BP-C 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 621

Analogue input/output (standard)
PSSu E S 2AO U

Overview

Module features

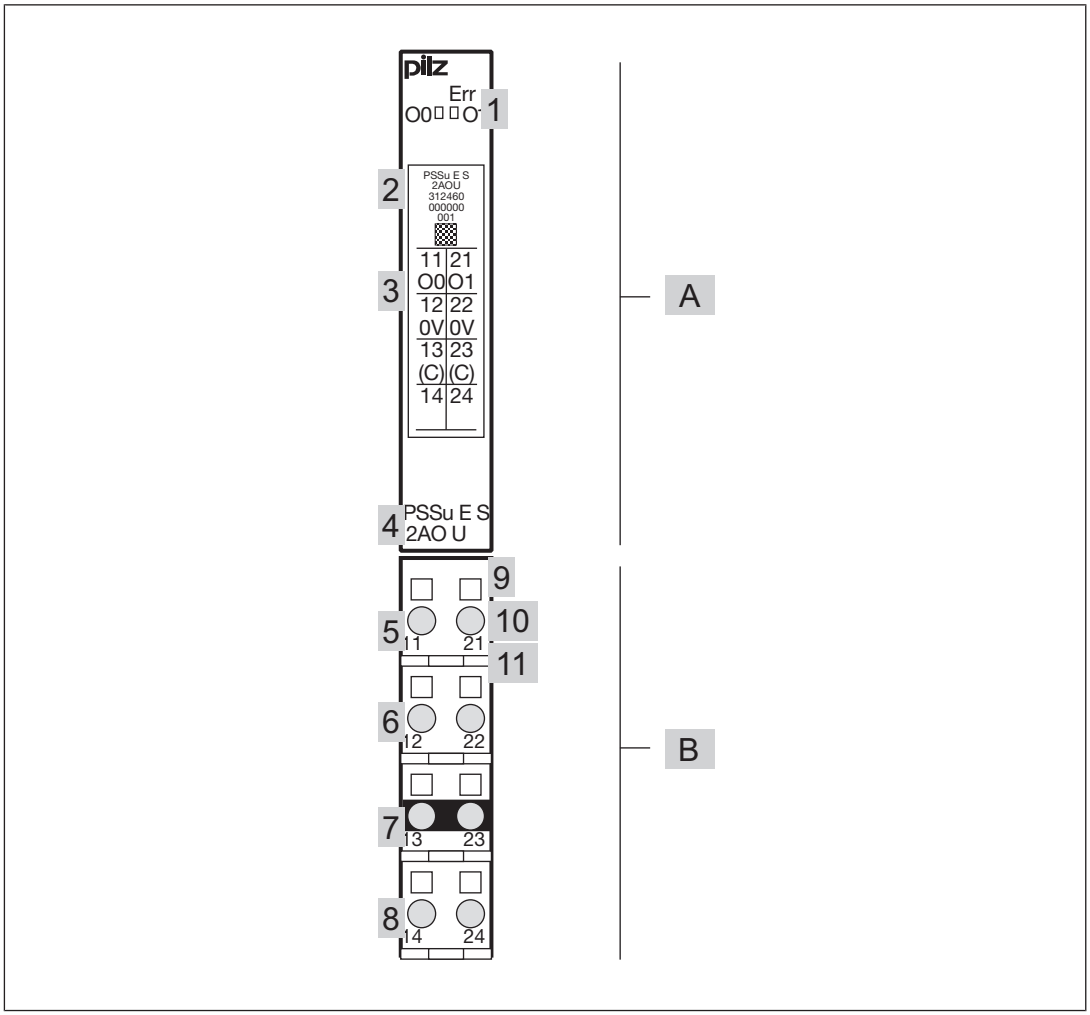
The product has the following features:

- 2 analogue voltage outputs
- Configurable voltage ranges:
  - 0 ... +10 V single-pole, referenced to earth (single-ended)
  - -10 V ... +10 V single-pole, referenced to earth (single-ended)
- Resolution: 12 bit plus sign bit
- LEDs for:
  - Operating status per output
  - Module error
- For standard applications in system environment A and B
- T-type:

  PSSu E S 2AO U-T: for increased environmental requirements

Analogue input/output (standard)
PSSu E S 2AO U

Front view



Legend:

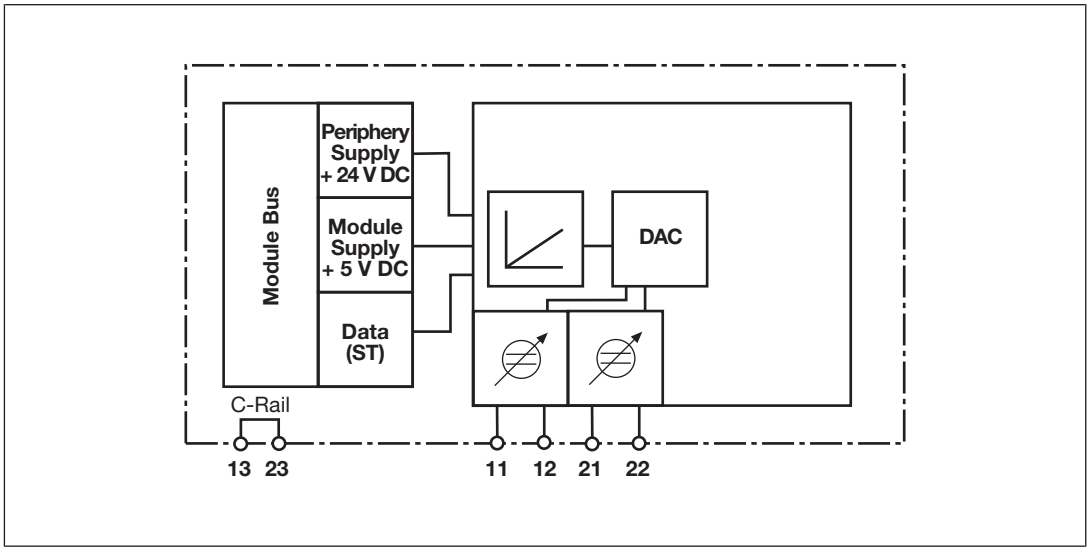
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Status indicator
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Analogue input/output (standard)
PSSu E S 2AO U

- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1
- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Analogue input/output (standard)
PSSu E S 2AO U

Module features

Module supply

- The module supply provides the module with voltage.

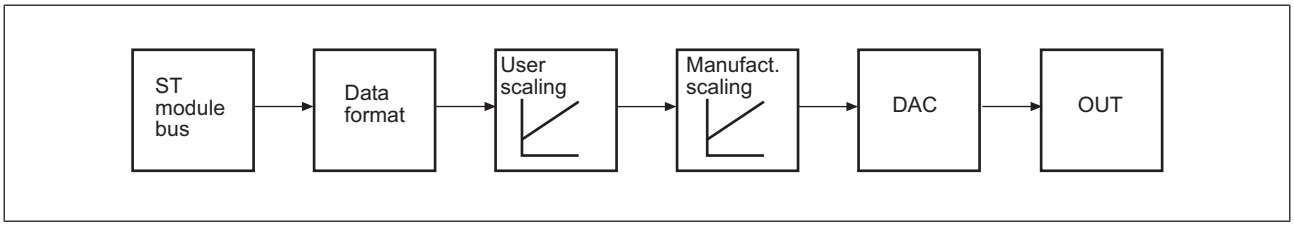
Periphery supply

- The supply for the outputs is generated from the periphery supply.
- The periphery supply and the outputs are galvanically isolated.

The output signals for each output are transmitted to the output module via the ST module bus. The resolution is 12 bits (4095 steps). Additional signal processing can be defined using the system software (see schematic representation of signal processing). The individual steps are described in the "Configuration" section.

All the configuration data is stored in the head module and is assigned to the output module on restart. This way the configuration data is retained even if you change the output module.

Schematic representation of signal processing:



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

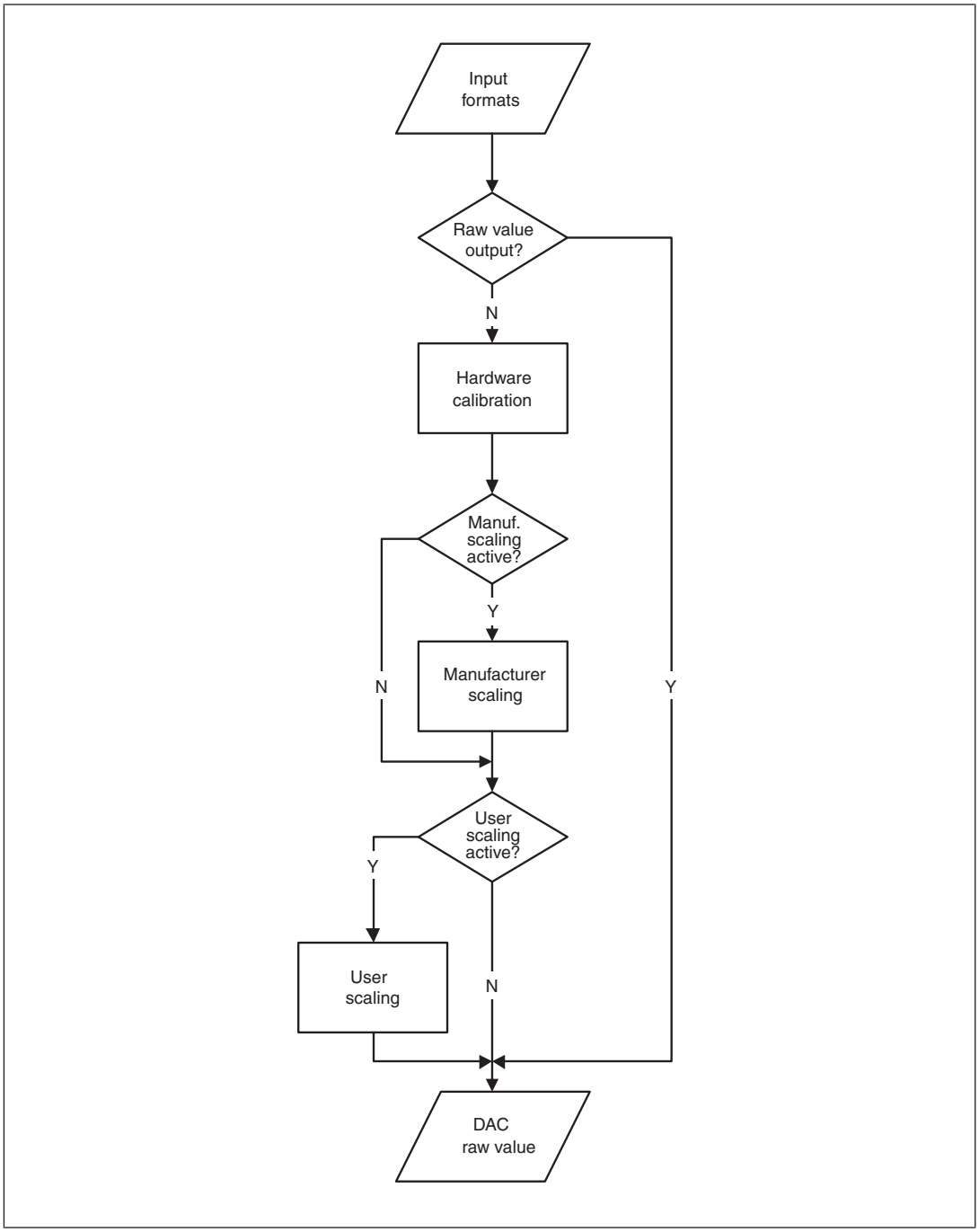
- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Analogue input/output (standard)
PSSu E S 2AO U

Configuration

The module can be configured using the system software.

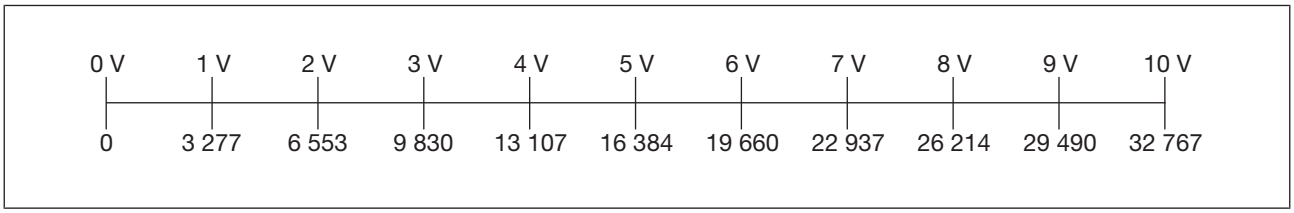
Scaling is a multi-stage process to adapt the values to the DA converter. The straight path in the diagram indicates the default configuration.



Analogue input/output (standard)
PSSu E S 2AO U

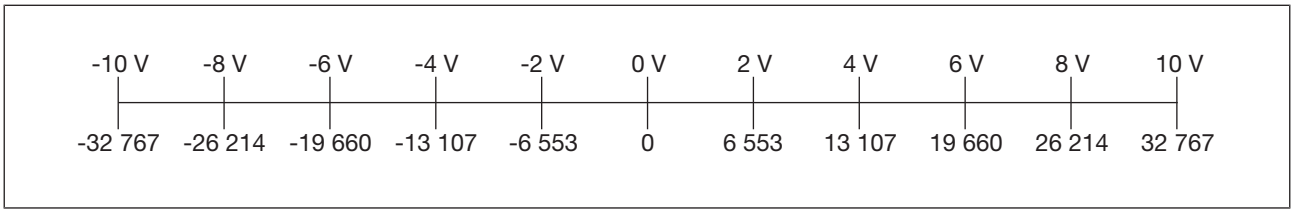
Analogue value and typical digital value with a voltage range of 0 ... +10 V and default values:

Analogue value of voltage	Decimal digital value
0 V	0
5 V	16 384
10 V	32 767



Analogue value and typical digital value with a voltage range of -10 V ... +10 V and default values:

Analogue value of voltage	Decimal digital value
-10 V	-32 767
-5 V	-16 384
0 V	0
5 V	16 384
10 V	32 767



You can configure each channel so that the raw value is transferred directly to the DA converter, without calibration or scaling.

Each channel is calibrated ex-works in order to correct component dispersion and other influences.

The range is divided so that zero is assigned the value 0 and the end point is assigned the value 4095_D ($0FFF_H$).

Scaling is used to define the offset (zero point compensation) and gain (amplification) of the digital signal. Offset and gain are entered in the PSSuniversal Configurator as decimal vaues. The relationship between the signal before manufacturer scaling (x), the signal after manufacturer scaling (y), offset (b_1) and gain (a_1) is a linear equation as follows:

$y = (a_1 / 256_D * x) + b_1$ or

$y = (a_1 / 100_H * x) + b_1$

Analogue input/output (standard)
PSSu E S 2AO U

The term a_1 / 256_D corresponds to the amplification factor. With the stated amplification factor, a_1 is calculated as follows:
a_1 = Amplification factor * 256_D

Amplification by 5 % is therefore:
1.05 * 256_D = 269_D

Arithmetic examples using decimal values:

Digital value before manufacturer scaling	Gain Manufacturer scaling	Offset Manufacturer scaling	Amplification	Value after manufacturer scaling
x	a_1	b_1	a_1 / 256_D	y
1 000	256	0	1	1 000
1 000	512	0	2	2 000
1 000	32	0	0.125	125
1 000	269	500	1.05	1 550
1 000	128	-50	0.5	450

The module always uses two's complement representation for internal processing, irrespective of the configured data format. The values from 0000_H to $FFFF_H$ form a number circle in the two's complement representation. 8000_H follows $7FFF_H$ (= $32\ 767_D$) and is interpreted as the lowest negative number (= $-32\ 768_D$). $32\ 767_D$ is never exceeded; the value never falls below $-32\ 767_D$.

Manufacturer scaling is activated in the default setting. The default value for offset is 0. The default value for gain is 32_D (20_H). That corresponds to amplification factor 0.125 (1/8). This means that the signal is converted from 15 to 12 Bit for the converter.

User scaling is an additional scaling level prior to manufacturer scaling. You can use this scaling to correct local influences. The function is the same as that of manufacturer scaling:

$y = (a_2 / 256_D * x) + b_2$ or

$y = (a_2 / 100_H * x) + b_2$

a_2 = Amplification factor * 256_D

User scaling is deactivated in the default setting. The default value for offset is 0. The default value for gain is 256_D (100_H). That corresponds to amplification factor 1.

Task:

If the PIO shows a decimal value of 10 000, there should be 10 V at the output. User scaling should be used in this case (Gain a_2). Manufacturer scaling should not be changed. All numbers are decimals.

Analogue input/output (standard)
PSSu E S 2AO U

Solution:

User scaling
$y = (a_2 / 256 * x) + b_2$
and manufacturer scaling
$y = (a_1 / 256 * x) + b_1$
act consecutively, giving:
$y = (a_1 / 256 * ((a_2 / 256 * x) + b_2)) + b_1$ or:
$y = (a_1 * a_2 * x / 65536) + (a_1 * b_2 / 256) + b_1$

With default values for $a_1 = 32$, $b_1 = 0$ and the default value $b_2 = 0$:
$y = a_2 * x / 2048$
$a_2 = y * 2048 / x$

Due to the hardware calibration the converter's output range is divided so that the 10 V end point is assigned the value x = 4095. With the default values y = 4095 and x= 10 000 the result is:
Gain $a_2 = 838$

The way in which the analogue value is displayed depends on the voltage range, on scaling and on the data format. The following examples show the relationship between the values with default scaling.

You can configure the following data formats:

- Two's complement (default)
  The digital values are transferred with 15 bits plus a sign bit (MSB). The MSB is "1" with negative values and "0" with positive values.
- Sign and magnitude representation
  The digital values are transferred with 15 bits plus a sign bit (MSB). The MSB is "1" with negative values and "0" with positive values. With negative values there is a distinction between sign and magnitude representation and two's complement representation.
- Formation of magnitude option
  Negative digital values are converted into positive values of equal magnitude.

As the module's resolution is 12 bits plus sign bit, the three least significant bits have no significance for the analogue value.

Analogue input/output (standard)
PSSu E S 2AO U

Analogue value and typical digital value with a voltage range of 0 ... +10 V, two's complement or sign and magnitude representation:

Analogue value of voltage	Decimal digital value	Binary digital value	Hexadecimal digital value
0 V	0	0000 0000 0000 0000	0000_H
5 V	16 384	0100 0000 0000 0000	4000_H
10 V	32 767	0111 1111 1111 1111	$7FFF_H$

Analogue value and typical digital value with a voltage range of -10 V ... +10 V, two's complement:

Analogue value of voltage	Decimal digital value	Binary digital value	Hexadecimal digital value
-10 V	-32 768	1000 0000 0000 0001	8001_H
-5 V	-16 383	1100 0000 0000 0001	$C001_H$
-2.4 mV	-1	1111 1111 1111 1111	$FFFF_H$
0 V	0	0000 0000 0000 0000	0000_H
10 V	32 767	0111 1111 1111 1111	$7FFF_H$

Analogue value and typical digital value with a voltage range of -10 V ... +10 V, sign and magnitude representation:

Analogue value of voltage	Decimal digital value	Binary digital value	Hexadecimal digital value
-10 V	-32 768	1111 1111 1111 1111	$FFFF_H$
-5 V	-16 383	1011 1111 1111 1111	$BFFF_H$
-2.4 mV	-1	1000 0000 0000 0001	8001_H
0 V	0	0000 0000 0000 0000	0000_H
10 V	32 767	0111 1111 1111 1111	$7FFF_H$

When the PSSuniversal is switched on, the output assumes the switch-on value until the module receives data for the value of the output. You can configure the outputs per channel with the manufacturer switch-on value (default) or you can use a freely definable user switch-on value. The manufacturer switch-on value is 0 V.

If the module does not receive any data from the module bus for 50 ms, the outputs are reset to the switch-on value.

Analogue input/output (standard)
PSSu E S 2AO U

Switch-on values are entered in the system software as decimal vaues. With default scaling, the decimal value (n) is calculated from the analogue value at the output (U_{Start}) as follows:

$n = 32\,767 * U_{Start} / 10\ V$

example:

- Switch-on values as an analogue value at the output (U_{Start}):
  - Switch-on value for channel 1 is to be -8 V.
  - Switch-on value for channel 2 is to be 5 V.
- Entry in the system software:
  - Switch-on value 1 corresponds to -26 214
  - Switch-on value 2 corresponds to 16 384

The relationship between the switch-on value and the actual voltage at the output is not dependent on the data format, but is dependent on the scaling. The module sets the voltage, which corresponds to the switch-on voltage after scaling. Please refer to the "Scaling" section in this manual.

The module has the following configuration options:

Configurable properties	Default value	Meaning
Output range	0	0 V ... 10 V (1 = -10 V ... 10 V)
Manufacturer scaling active	1/TRUE	Activated
Manufacturer scaling offset	0	Offset: Magnitude 0
Manufacturer scaling gain	32_D	Amplification by 1/8, displaced three bit places
User scaling active	0/FALSE	Deactivated
User scaling offset	0	Offset: Magnitude 0
User scaling gain	256_D	1x amplification, signal unchanged
Switch-on value active	0	Manufacturer switch-on value active (1/TRUE = User switch-on value active)
Manufacturer switch-on value	0	0 V on switch-on
User switch-on value	0	0 V on switch-on
Sign and magnitude representation active	0/FALSE	Deactivated; two's complement is activated
Formation of magnitude active	0/FALSE	Deactivated (1/TRUE = Activated, not with output range -10 V ... 10 V)
Output DAC raw value only	0/FALSE	Deactivated

Analogue input/output (standard)
PSSu E S 2AO U

Each output channel occupies 16 consecutive bit addresses for the output data.

Configuration	Standard bus system	
	ST-PII	ST-PIO
None	- - -	32 Bit

Bit sequence in the PIO:

Input	PIO	Assignment
Output O0	1	LSB
	...	...
	16	MSB
Output O1	17	LSB
	...	...
	32	MSB

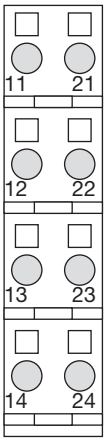
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
O0(11), O1(21)	ST_O_AO	Data: WORD	Output data O0, O1

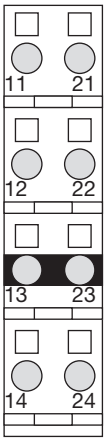
Analogue input/output (standard)
PSSu E S 2AO U

Wiring

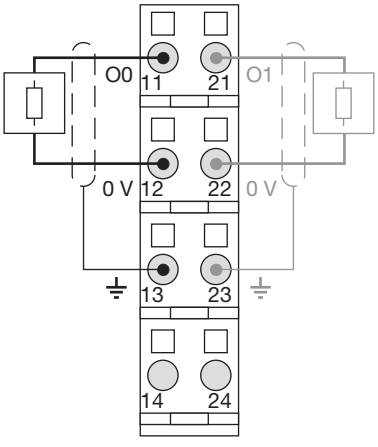
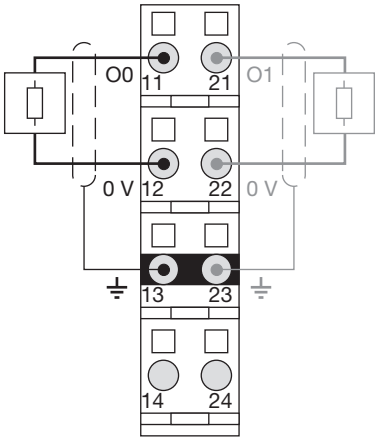
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Output O0 21: Output O1 12-22: 0 V analogue (12-22 linked within the base module) 13-23: Shield connection (13-23 linked within the base module) 14: Not connected 24: Not connected	

Analogue input/output (standard)
PSSu E S 2AO U

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Output O0 21: Output O1 12-22: 0 V analogue (12-22 linked within the base module) 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Not connected 24: Not connected	

Connecting the module

Output circuit	Without C-rail	With C-rail
Voltage range (0 ... +10 V Voltage range –10 V ... +10 V single-pole, referenced to earth		

Analogue input/output (standard)
PSSu E S 2AO U

Technical details

General	312460	314460
Approvals	**CE, TÜV, cULus Listed**	**CE, TÜV, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0500h**	**0500h**
Number of ST output bits	**32**	**32**
Application in system environment A		
From ST firmware version, other head modules	**7**	**7**
From ST firmware version PSSu H S PN	**1**	**1**
From ST firmware version PSSu WR S IDN	**4**	**4**
Application in system environment B		
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312460**	**314460**
Internal supply voltage (module supply)		
Module's power consumption	**0,22 W**	**0,22 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**10 mA**	**10 mA**
Module's power consumption with no load	**0,24 W**	**0,24 W**
Max. power dissipation of module	**0,50 W**	**0,50 W**
Permitted loads	**Capacitive, resistive**	**Capacitive, resistive**
Analogue outputs	**312460**	**314460**
Number of analogue outputs	**2**	**2**
Type of analogue outputs	**Voltage**	**Voltage**
Output range	**-10 .. 10V, 0 .. 10V**	**-10 .. 10V, 0 .. 10V**
Resolution (without sign bit)	**12 Bit**	**12 Bit**
Max. short circuit current	**25 mA**	**25 mA**
Min. permitted resistive load	**5 kOhm**	**5 kOhm**

Analogue input/output (standard)
PSSu E S 2AO U

Analogue outputs	312460	314460
Deviations from the measuring range limit value		
Linearity error	**0,05 %**	**0,05 %**
Output variable error at 25 °C	**0,2 %**	**0,2 %**
Max. output variable error at 25 °C	**1,0 %**	**1,0 %**
Temperature coefficient	**0,02 %/K**	**0,02 %/K**
Potential isolation between output and voltage for the internal module bus	**yes**	**yes**
Potential isolation between output and periphery supply	**yes**	**yes**
Typ. processing time of the analogue output	**1,0 ms**	**1,0 ms**
Environmental data	**312460**	**314460**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**1g**
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**

Analogue input/output (standard)
PSSu E S 2AO U

Environmental data	312460	314460
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312460**	**314460**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**36 g**	**37 g**
Mechanical coding		
Type	**E**	**E**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2005-04 latest editions shall apply.

Analogue input/output (standard)
PSSu E S 2AO U

Order reference

Product

Product type	Features	Order No.
PSSu E S 2AO U	Electronic module, base type	312 460
PSSu E S 2AO U-T	Electronic module, T-type	314 460

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C 1/12 S	Base module with C-rail and screw terminals	312 620
PSSu BP-C 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 620
PSSu BP-C 1/12 C	Base module with C-rail and cage clamp terminals	312 621
PSSu BP-C 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 621

Analogue input/output (standard)
PSSu E S 2AI RTD

Overview

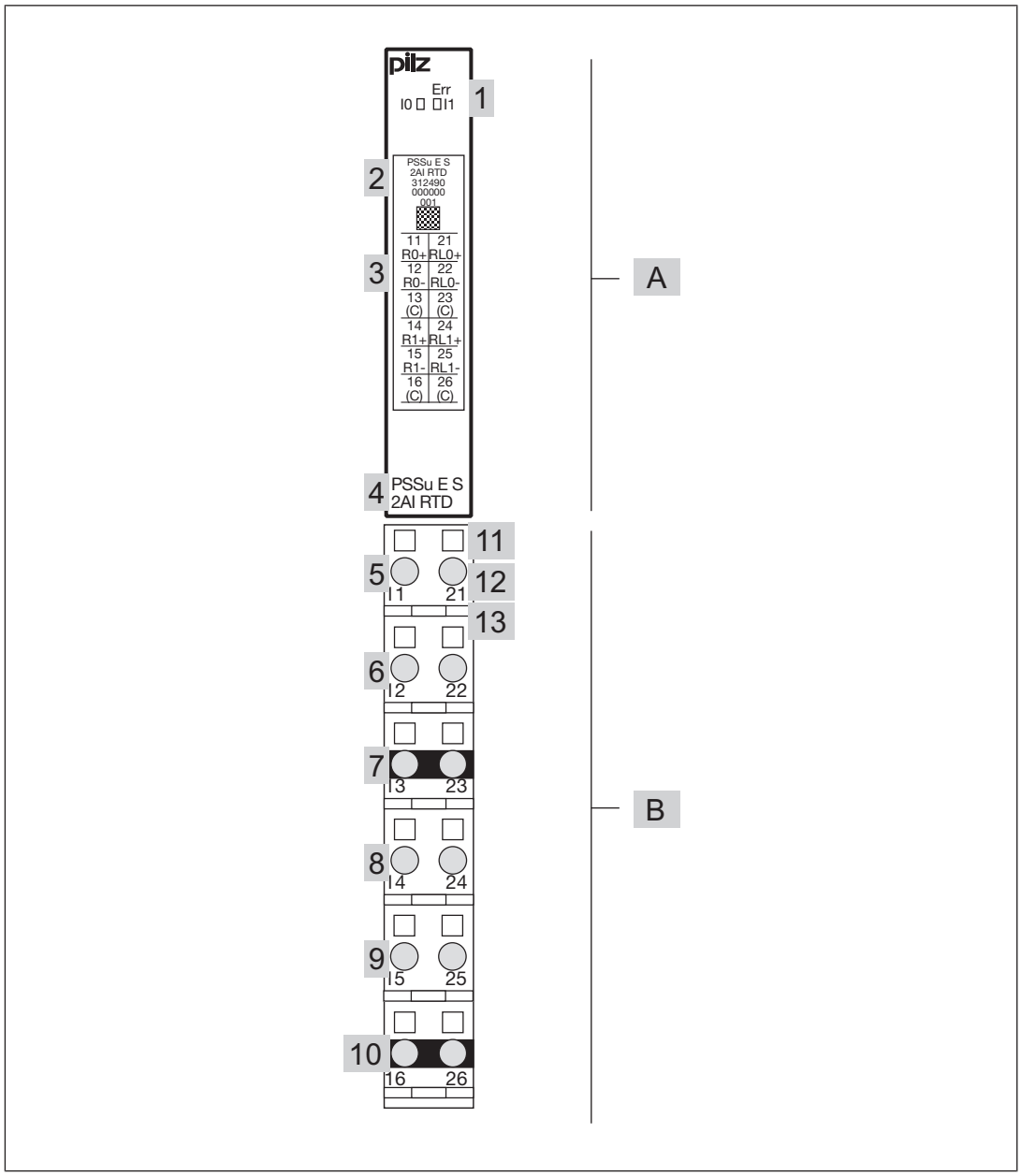
Module features

The product has the following features:

- Analogue ST inputs: 2
- Type of inputs: Resistance thermometer
- Corresponding sensors (configurable):
  - Pt100
  - Pt200
  - Pt500
  - Pt1000
  - Ni100
  - Ni120
  - Ni1000
- Resistance measurement (configurable):
  - 0 ... 4000 Ohm
- Max. resolution:
  - 0.0625 °C
  - 0.0625 Ohm
- Open circuit detection
- LEDs for:
  - Operating status per input
  - Module error
- For standard applications in system environment A and B
- T-type:
  PSSu E S 2AI RTD-T: for increased environmental requirements

Analogue input/output (standard)
PSSu E S 2AI RTD

Front view



Legend:

- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number

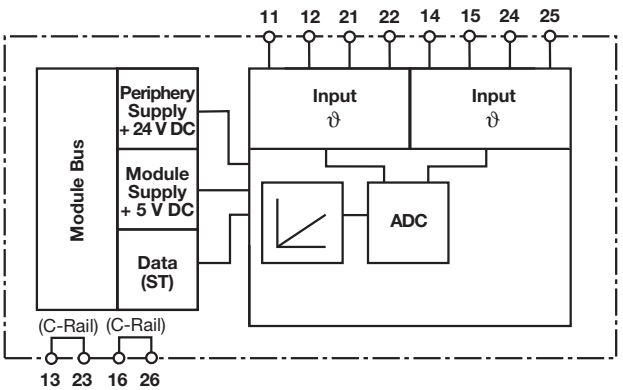
Analogue input/output (standard)
PSSu E S 2AI RTD

- Serial number
- Hardware version number
- 2D code

- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1
- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Connection level 5
- 10: Connection level 6
- 11: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 12: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 13: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Analogue input/output (standard)
PSSu E S 2AI RTD

Module features

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

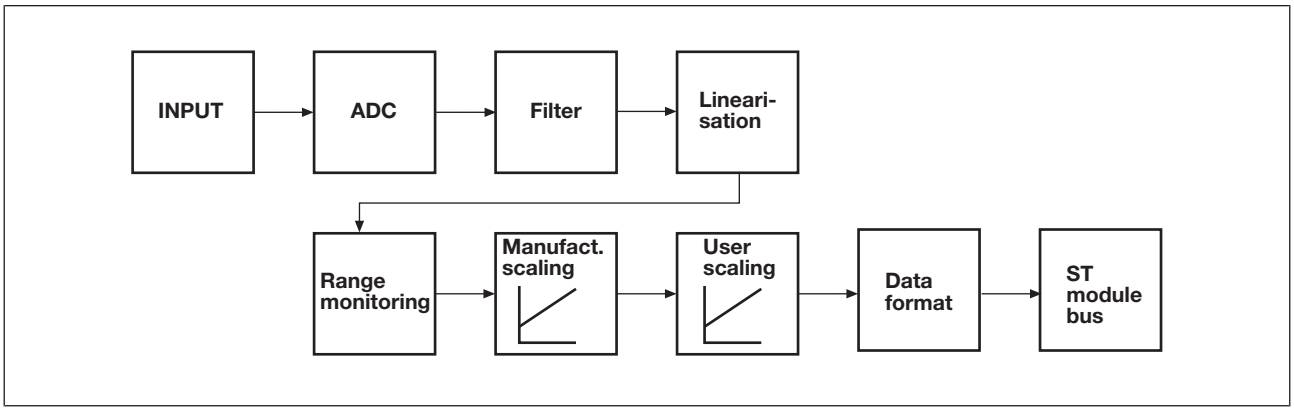
The module supply provides the module with voltage. The periphery supply provides the analogue section with voltage.

The input signals are read in and converted into digital signals. The resolution depends on the configured measuring range. Additional signal processing can be defined using the system software (see schematic representation of signal processing). The individual steps are described in the "Configuration" section.

The input signals are transmitted to the head module via the ST module bus. As an option the input module can send status information for each input.

All the configuration data is stored in the head module and is assigned to the input module on restart. This way the configuration data is retained even if you change the input module.

Schematic representation of signal processing:



Analogue input/output (standard)
PSSu E S 2AI RTD

Configuration

The following options exist for configuring the module in system environment A:

- Via a fieldbus without the modular device description file
  Without the modular device description file it is only possible to configure the input or output range. All other configuration details have default values.
- Via a fieldbus with the modular device description file
  With a modular device description file it is possible to configure all the values.
- Via the USB port of the head module, using the PSSuniversal Configurator
  All the values can be configured using the PSSuniversal Assistant. Any configuration via the USB port will overwrite the configuration made via the fieldbus.

If a module has been configured via the head module's USB port, it is locked and cannot be overwritten by the fieldbus. This lock can be deactivated again in the PSSuniversal Configurator.

The following options exist for configuring the module in system environment B:

- Via the head module's USB port with PAS4000.

The input measuring ranges may be configured per input:

- Pt100 (Default)
- Pt200
- Pt500
- Pt1000
- Ni100
- Ni120
- Ni1000
- 0 ... 4000 Ohm (resistance measurement)

The temperature ranges for these measuring ranges can be found in the technical details.

The measuring circuits for the temperature measurements may be configured per input:

- 2-wire measurement
- 3-wire measurement (default)
- Connection for 4-wire sensor

The module will detect an open circuit on the measuring lines. Should an open circuit occur, the module will output 7FFF as the measured value. If resistance measurement is configured, the module will output FFFF in the case of an open circuit. With a 4-wire sensor connection, an open circuit on an individual measuring line will not be detected; consequently, the measurement result will be corrupted.

You can deactivate range monitoring for each input. Range monitoring refers to the measuring range of the sensor which is configured for the input. This option is activated in the default configuration. The module writes the result of range monitoring as follows:

- System environment A:
  In the status byte (see PSSu assignment in system environment A [📖 797])

Analogue input/output (standard)
PSSu E S 2AI RTD

- System environment B:

  in the I/O data element "Overrange" or "Underrange" (see PSSu assignment in system environment B [📖 798])

The module behaves as follows, irrespective of the range monitoring configuration:

- If the value falls **below** the range, the temperature value stops. The temperature value corresponding to the lower limit of the measuring range is output.
- If the range is **exceeded**, the temperature value continues. The module extrapolates the temperature value linearly.

In the case of 2-wire measurement, the line resistance influences the measurement as a matter or principle, corrupting the result. The module allows you to take the value for the line resistance into account and to compensate for it when determining the temperature.

You can calculate the line resistance (feed and return line), measure it directly using a meter or define it via the module.

To use the module to define the measuring line resistance, follow the instructions below:

- Short out the temperature sensor. The short circuit should be as close as possible to the temperature sensor.
- Connect the PSSuniversal system to the system software.
- Call up the module configuration.
  - Deactivate "Manufacturer scaling" and "User scaling".
  - Select the resistance measurement ("0.0 ... 4000.0") under "Measuring range".
  - Select 2-wire measurement under "Connection type".
  - Enter zero under "2-wire measurement offset".
- Start the PSSuniversal system. Measurement of the line resistance will start.
  - The measurement will be more accurate if the line temperature is the same during measurement as it is during operation.
- In the system's PII (system environment A) or in the I/O data element "Data" (system environment B), the measurement value appears as a hexadecimal value. Convert this value into a decimal figure and note down the decimal value. This decimal value is the measuring line resistance in 1/16 Ohm.

To account for the line resistance within the configuration, follow the instructions below:

- Call up the module configuration in the system software.
- Enter the measuring line resistance (feed and return line) in 1/16 Ohm under "2-wire measurement offset".
  - When you have established the measuring line resistance using the module, re-select the required sensor under "Measuring range".

Analogue input/output (standard)
PSSu E S 2AI RTD

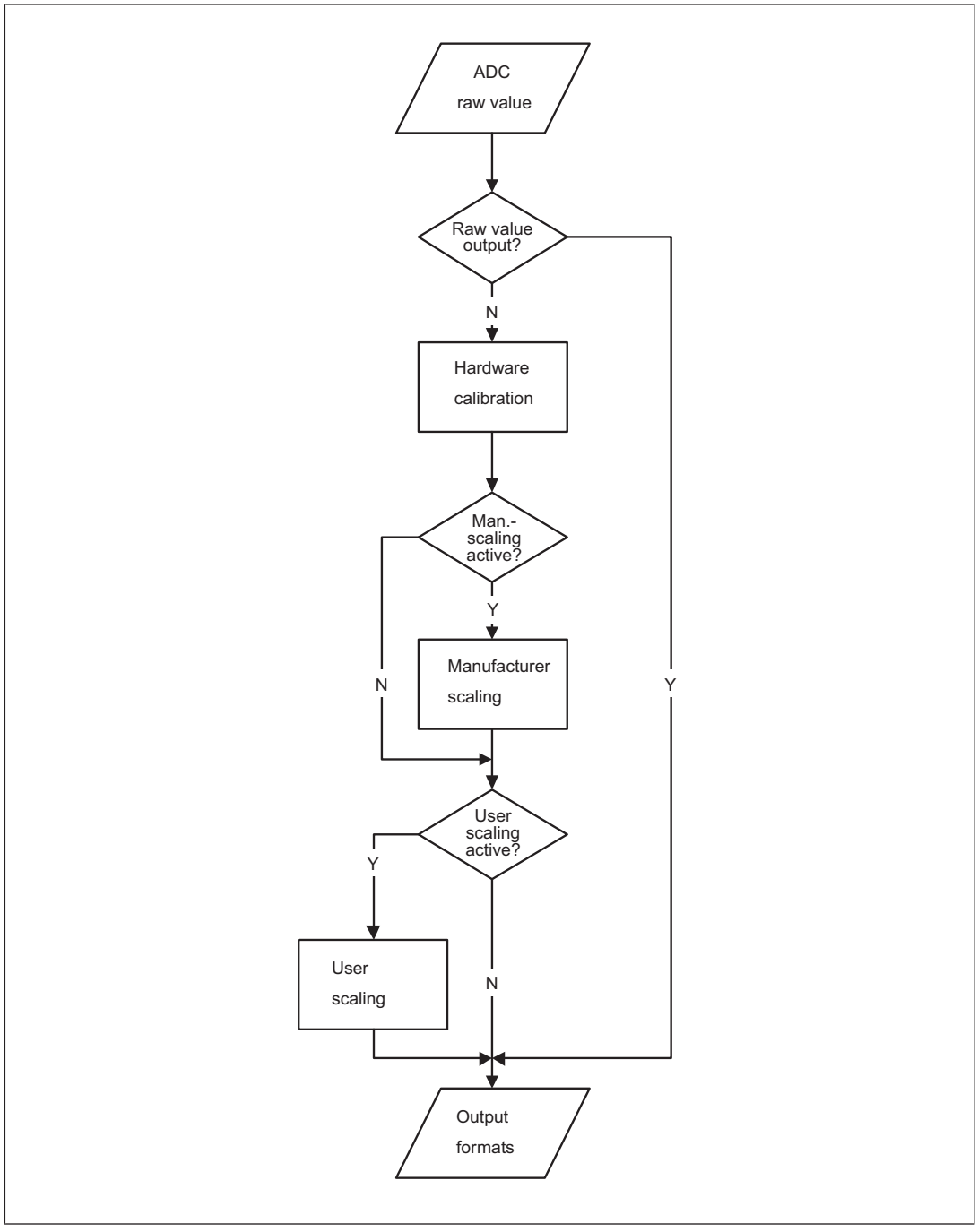
A digital filter suppresses interference frequencies in the input signals. The module's processing time will vary depending on the filter. With 3-wire measurement, or when a sensor with four wires is connected, the filter time is double that found with a 2-wire measurement. The module's processing time corresponds approximately to the sum of the filter times of both inputs.

You can select one of the following filters per input:

Filtered frequencies	Attenuation	Filter time per input 2-wire measurement	Filter time per input 3-wire measurement 4-wire sensor connection
60 Hz	90 dB	103 ms	206 ms
50 Hz	80 dB	122 ms	244 ms
50 Hz and 60 Hz	65 dB	122 ms	244 ms
50 Hz and 60 Hz	69 dB	202 ms	404 ms
50 Hz and 60 Hz	74 dB	482 ms	964 ms

Scaling is a multi-stage process to adapt the values from the AD converter. The straight path in the diagram indicates the default configuration.

Analogue input/output (standard)
PSSu E S 2AI RTD



You can configure each input so that the raw value from the AD converter is output directly, without calibration or scaling. The following configurations are possible:

- No raw value (default)

  The ADC value is calibrated, linearised (in the case of temperature output) and scaled if necessary.

- Raw value for sensor

  The raw value of the sensor is output.

Analogue input/output (standard)
PSSu E S 2AI RTD

- Raw value for wire

  The raw value from a feed wire is output in the case of 3-wire measurement or when a sensor with four wires is connected. In the case of 2-wire measurement, "0" is output.

If the AD converter fails to supply a valid value, the module will adopt the last valid value for this input instead.

Scaling is used to define the offset (zero point compensation) and gain (amplification) of the digital signal. Offset and gain are entered in the system software as decimal vaues. The relationship between the signal before manufacturer scaling (x), the signal after manufacturer scaling (y), offset (b_1) and gain (a_1) is a linear equation as follows:

$y = (a_1 / 256_D * x) + b_1$ or

$y = (a_1 / 100_H * x) + b_1$

The term $a_1 / 256_D$ corresponds to the amplification factor. With the stated amplification factor, a_1 is calculated as follows:
a_1 = Amplification factor * 256_D

Amplification by 5 % is therefore:
$1.05 * 256_D = 269_D$

Manufacturer scaling is activated in the default setting. The default value for offset is 0. The default value for gain is 160_D ($0A0_H$). That corresponds to an amplification factor of 10/16. The resolution is 1/10 K or 1/10 Ohm.

If the manufacturer scaling **and** the user scaling are deactivated, the resolution will be 1/16 K or 1/16 Ohm.

User scaling is an additional scaling level applied after manufacturer scaling. You can use this scaling to correct local influences. The function is the same as that of manufacturer scaling:

- $y = (a_2 / 256_D * x) + b_2$ or
- $y = (a_2 / 100_H * x) + b_2$
- a_2 = Amplification factor * 256_D

User scaling is deactivated in the default setting. The default value for offset is 0. The default value for gain is 256_D (100_H). That corresponds to amplification factor 1.

If the manufacturer scaling **and** the user scaling are deactivated, the resolution will be 1/16 K or 1/16 Ohm.

If a value lies outside the range that can be displayed in the PII, the respective upper or lower range limit is output (see section entitled "Data formats")

The way in which the analogue value is displayed depends on the measuring range, on scaling and on the data format. The following examples show the relationship between the values with default scaling.

You can configure the following data formats:

- Two's complement (default)
  The digital values are transferred with 16 bits.

Analogue input/output (standard)
PSSu E S 2AI RTD

- Sign and magnitude representation
  The digital values are transferred with 15 bits plus a sign bit (MSB). The MSB is "1" with negative values and "0" with positive values.

With negative values there is a distinction between sign and magnitude representation and two's complement representation. The values in the following tables apply with default scaling.

Analogue value and typical digital value with a measuring range of -100 °C ... +100 °C, two's complement:

Temperature	Decimal digital value	Binary digital value	Hexadecimal digital value
-100 °C	-1000	1111 1100 0001 1000	$FC18_H$
0 °C	0	0000 0000 0000 0000	0000_H
100 °C	1000	0000 0011 1110 1000	$03E8_H$

Analogue value and typical digital value with a measuring range of -100 °C ... +100 °C, sign and magnitude representation:

Temperature	Decimal digital value	Binary digital value	Hexadecimal digital value
-100 °C	-1000	1000 0011 1110 1000	$83E8_H$
0 °C	0	0000 0000 0000 0000	0000_H
100 °C	1000	0000 0011 1110 1000	$03E8_H$

With resistance measurement, data is always transmitted with 16 bits as positive values.

Analogue value and typical digital value with a measuring range of 0 Ohm ... 1000 Ohm:

Resistance	Decimal digital value	Binary digital value	Hexadecimal digital value
0 Ohm	0	0000 0000 0000 0000	0000_H
1000 Ohm	10000	0010 0111 0001 0000	2710_H

Range limits:

Measurement type	Lower range limit		Upper range limit
	Two's complement	Sign and magnitude representation	Two's complement/sign and magnitude representation
Temperature	8001_H	$FFFF_H$	$7FFF_H$
Resistance	0000_H	0000_H	$FFFF_H$

The module has the following configuration options:

Analogue input/output (standard)
PSSu E S 2AI RTD

Configurable parameters	Configurable values		Default	Key
Measuring range	Pt100, Pt200, Pt500, Pt1000, Ni100, Ni120, Ni1000, 0 … 4000 Ohm		Pt100	
Connection type	2-wire measurement, 3-wire measurement, Connection for 4-wire sensor		3-wire measurement	
2-wire measurement offset	0 … 32767_D		0	Resolution in 1/16 Ohm
Manufacturer scaling	-		Activated/TRUE	
Manufacturer scaling offset	-32768 … 32767_D		0	
Manufacturer scaling gain	-32768 … 32767_D		160_D	Amplification factor 10/16
User scaling	-		Deactivated/ FALSE	
User scaling offset	-32768 … 32767_D		0	
User scaling gain	-32768 … 32767_D		256_D	Amplification factor 1
Filter characteristic	2-wire measurement: 103 ms/90 dB (60 Hz), 122 ms/80 dB (50 Hz), 122 ms/65 dB (50 Hz and 60 Hz), 202 ms/69 dB (50 Hz and 60 Hz), 482 ms/74 dB (50 Hz and 60 Hz)	3-wire measurement or 4-wire sensor connection: 206 ms/90 dB (60 Hz), 244 ms/80 dB (50 Hz), 244 ms/65 dB (50 Hz and 60 Hz), 404 ms/69 dB (50 Hz and 60 Hz), 964 ms/74 dB (50 Hz and 60 Hz)	404 ms/69 dB (50 Hz and 60 Hz)	With 2-wire measurement, 202 ms/69 dB (50 Hz and 60 Hz) is the default setting
Range monitoring	-		Activated/TRUE	
Sign and magnitude representation	-		Deactivated/ FALSE	Two's complement is activated
ADC raw value	No raw value, Raw value of sensor, Raw value of wire		No raw value	

Analogue input/output (standard)
PSSu E S 2AI RTD

Each input occupies 16 consecutive bit addresses for the input data. Each input occupies an additional 8 consecutive bit addresses for the status byte, where this has been configured for the input. All the status bytes are displayed first in the PII, followed by the input data.

Configuration	Standard bus system	
	ST-PII	ST-PIO
Input data	32 Bit	- - -
Input data and status byte ("X")	48 Bit	- - -

Bit sequence in the PII, input data only, no status byte:

Input	PII	Assignment
Input I0	1	LSB input data
	...	...
	16	MSB input data
Input I1	17	LSB input data
	...	...
	32	MSB input data

Bit sequence in the PII, input data and status byte:

Input	PII	Assignment
Input I0	1	LSB status byte
	...	...
	8	MSB status byte
Input I1	9	LSB status byte
	...	...
	16	MSB status byte
Input I0	17	LSB input data
	...	...
	32	MSB input data
Input I1	33	LSB input data
	...	...
	48	MSB input data

ST modules for measuring temperature can transfer a variety of status information to the ST-PII (see table below for the conveyed status). The information is transmitted using the input's status byte. Read access (R) is configured for the input for that purpose.

Analogue input/output (standard)
PSSu E S 2AI RTD

Structure and contents of the status byte:

Bit number	Content	Meaning
0	0	Input value above or equal to the lower limit value
	1	Value below the lower limit value
1	0	Input value below or equal to the upper limit value
	1	Value above the upper limit value
2-5, 7	0	Reserved
	1	Reserved
6	0	No module error
	1	Module error

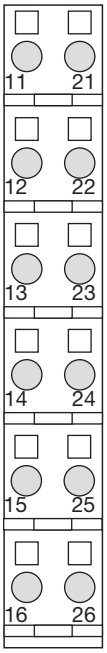
Data access is via pre-defined I/O data types:

I/O data name	I/O data type	I/O data element	Meaning
I0(11, 21) I1(14, 24)	ST_I_THERMO	Data: WORD	Input data I0 ... I1
		Underrange: BOOL	0: Input value above or equal to the lower limit value 1: Value below the lower limit value
		Overrange: BOOL	0: Input value below or equal to the upper limit value 1: Value exceeds the upper limit value

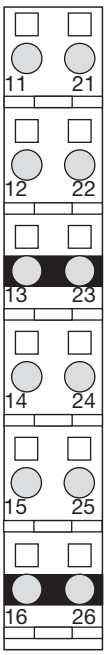
Analogue input/output (standard)
PSSu E S 2AI RTD

Wiring

Terminal configuration

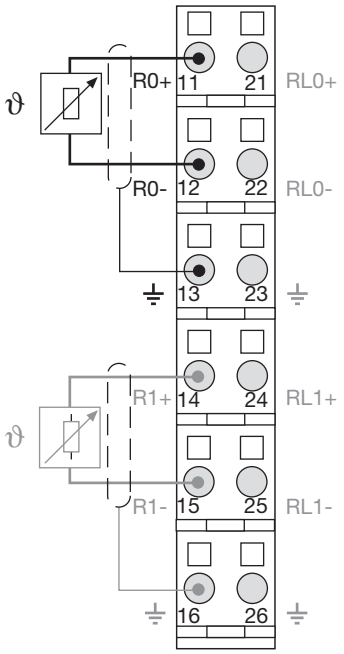
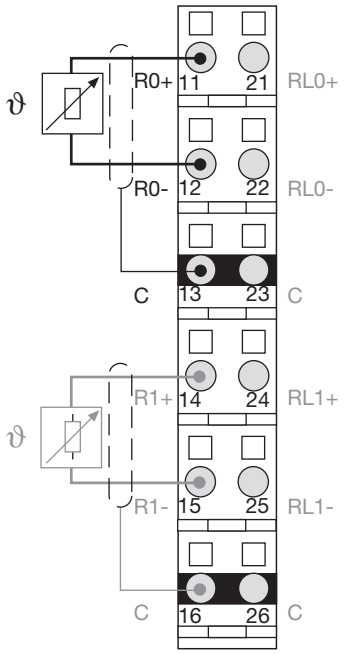
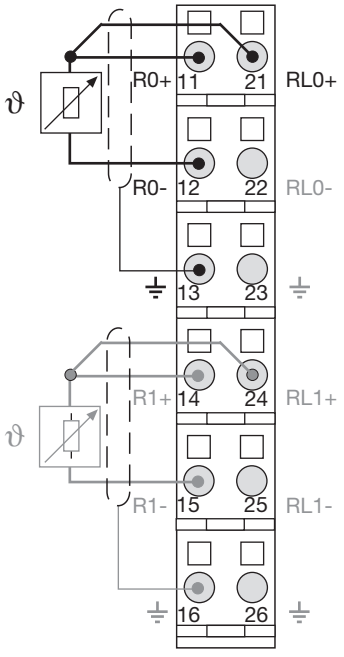
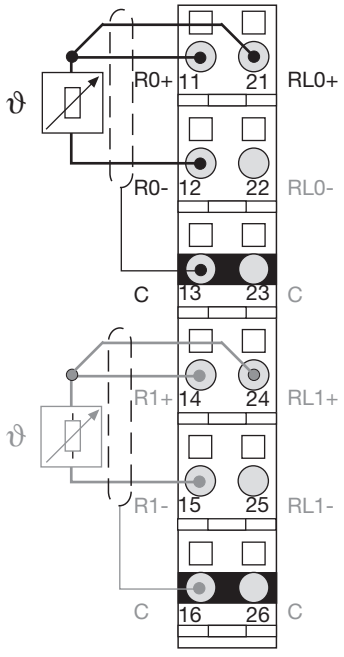
Base module	Terminal configuration	
Screw terminals: PSSu BP 1/12 S PSSu BP 1/12 S-T Cage clamp terminals: PSSu BP 1/12 C PSSu BP 1/12 C-T	Without C-rail: 11: Input R0+ 21: Input RL0+ 12: Input R0- 22: Input RL0- 13-23: Shield connection (13-23-16-26 linked within the base module) 14: Input R1+ 24: Input RL1+ 15: Input R1- 25: Input RL1- 16-26: Shield connection (13-23-16-26 linked within the base module)	

Analogue input/output (standard)
PSSu E S 2AI RTD

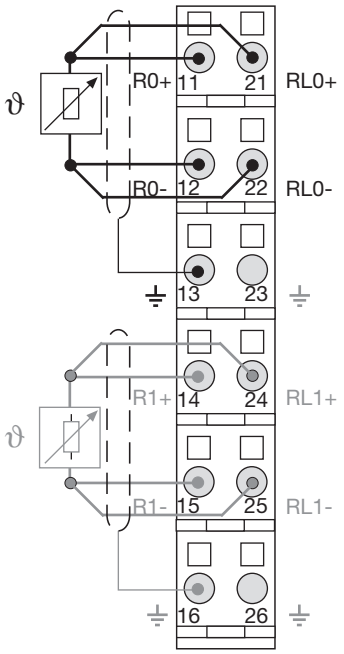
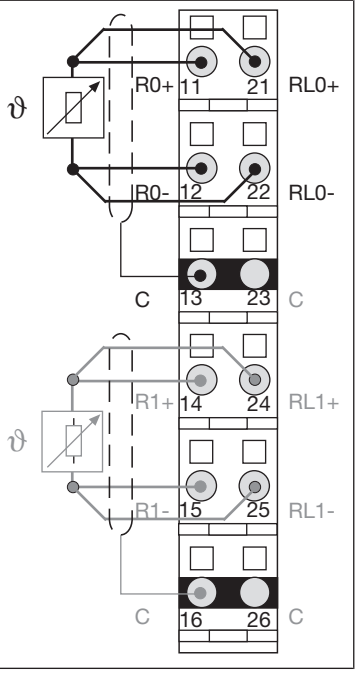
Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/12 S PSSu BP-C 1/12 S-T Cage clamp terminals: PSSu BP-C 1/12 C PSSu BP-C 1/12 C-T	With C-rail: 11: Input R0+ 21: Input RL0+ 12: Input R0- 22: Input RL0- 13-23: C-rail supply, shield connection (13-23-16-26 linked within the base module) 14: Input R1+ 24: Input RL1+ 15: Input R1- 25: Input RL1- 16-26: C-rail supply, shield connection (13-23-16-26 linked within the base module)	

Analogue input/output (standard)
PSSu E S 2AI RTD

Connecting the module

Input circuit	Without C-rail	With C-rail
2-wire measurement		
3-wire measurement		

Analogue input/output (standard)
PSSu E S 2AI RTD

Input circuit	Without C-rail	With C-rail
Connection for 4-wire sensor		

Technical Details

General	312490	314490
Approvals	**CE, TÜV, cULus Listed**	**CE, TÜV, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0303h**	**0303h**
Number of ST input bits	**32**	**32**
Number of ST status bits	**16**	**16**
Application in system environment A		
From ST firmware version, other head modules	**14**	**14**
From ST firmware version PSSu H S PN	**2**	**2**
From ST firmware version PSSu WR S IDN	**6**	**6**
Application in system environment B		
From ST firmware version, head modules	**1.8.0**	**1.8.0**

Analogue input/output (standard)
PSSu E S 2AI RTD

Electrical data	312490	314490
Internal supply voltage (module supply)		
Module's power consumption	**0,63 W**	**0,63 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**15 mA**	**15 mA**
Module's power consumption with no load	**0,36 W**	**0,36 W**
Max. power dissipation of module	**1,00 W**	**1,00 W**
Analogue inputs	**312490**	**314490**
Number of analogue inputs	**2**	**2**
Type of analogue inputs	**Resistance thermometer**	**Resistance thermometer**
Input area	**Ni100, Ni1000, Ni120, Pt100, Pt1000, Pt200, Pt500, resistance**	**Ni100, Ni1000, Ni120, Pt100, Pt1000, Pt200, Pt500, resistance**
Input area		
Platinum sensors in accordance with the standard	**DIN EN 60751**	**DIN EN 60751**
Nickel sensors in accordance with the standard	**DIN 43760**	**DIN 43760**
Measuring ranges		
Type	**Pt100**	**Pt100**
Measuring range	**-200 - 850 °C**	**-200 - 850 °C**
Type	**Pt200**	**Pt200**
Measuring range	**-200 - 850 °C**	**-200 - 850 °C**
Type	**Pt500**	**Pt500**
Measuring range	**-200 - 850 °C**	**-200 - 850 °C**
Type	**Pt1000**	**Pt1000**
Measuring range	**-200 - 850 °C**	**-200 - 850 °C**
Type	**Ni100**	**Ni100**
Measuring range	**-60 - 250 °C**	**-60 - 250 °C**
Type	**Ni120**	**Ni120**
Measuring range	**-60 - 250 °C**	**-60 - 250 °C**
Type	**Ni1000**	**Ni1000**
Measuring range	**-60 - 250 °C**	**-60 - 250 °C**
Type	**Resistance**	**Resistance**
Measuring range	**0 - 4000 Ohm**	**0 - 4000 Ohm**
Input filter	**Digital filter**	**Digital filter**

Analogue input/output (standard)
PSSu E S 2AI RTD

Analogue inputs	312490	314490
Filter time per input (2-wire measurement) with attenuation		
Attenuation	**90 dB (60 Hz)**	**90 dB (60 Hz)**
Filter time	**103 ms**	**103 ms**
Attenuation	**80 dB (50 Hz)**	**80 dB (50 Hz)**
Filter time	**122 ms**	**122 ms**
Attenuation	**65 dB (50 Hz, 60 Hz)**	**65 dB (50 Hz, 60 Hz)**
Filter time	**122 ms**	**122 ms**
Attenuation	**69 dB (50 Hz, 60 Hz)**	**69 dB (50 Hz, 60 Hz)**
Filter time	**202 ms**	**202 ms**
Attenuation	**74 dB (50 Hz, 60 Hz)**	**74 dB (50 Hz, 60 Hz)**
Filter time	**482 ms**	**482 ms**
Voltage measurement		
Input resistance	**100 MOhm**	**100 MOhm**
Max. continuous voltage	**5 V**	**5 V**
Temperature measurement		
Value of least significant bit (LSB)	**0,0625 K**	**0,0625 K**
Resistance measurement		
Value of least significant bit (LSB)	**0,0625 Ohm**	**0,0625 Ohm**
Typ. conversion time per input	**404 ms**	**404 ms**
Max. measuring current	**500 µA**	**500 µA**
Deviations from the measuring range limit value		
Output variable error at 25 °C	**0,3 %**	**0,3 %**
Temperature coefficient	**0,0040 %/K**	**0,0040 %/K**
Potential isolation between input and periphery supply	**yes**	**yes**
Typ. processing time of the analogue input	**808,0 ms**	**808,0 ms**
Inputs	**312490**	**314490**
Potential isolation between input and internal module bus voltage	**yes**	**yes**
Environmental data	**312490**	**314490**
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**

Analogue input/output (standard)
PSSu E S 2AI RTD

Environmental data	312490	314490
Storage temperature		
In accordance with the standard	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
Max. operating height above sea level in accordance with EN 81-1, EN 81-2 and EN 115-1	**2000 m**	**2000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 1000,0 Hz**
Acceleration	**1g**	**5g**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**25g**
Duration	**16 ms**	**6 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1, EN 61131-2**	**EN 60664-1, EN 61131-2**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Mechanical data	**312490**	**314490**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**

Analogue input/output (standard)
PSSu E S 2AI RTD

Mechanical data	312490	314490
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**35 g**	**34 g**
Mechanical coding		
Type	**G**	**G**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2008-06 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E S 2AI RTD	Electronic module, base type	312 490
PSSu E S 2AI RTD-T	Electronic module, T-type	314 490

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C 1/12 S	Base module with C-rail and screw terminals	312 620
PSSu BP-C 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 620
PSSu BP-C 2/12 C	Base module with C-rail and cage clamp terminals	312 621
PSSu BP-C 2/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 621

Analogue input/output (standard)
PSSu E S 2AI TC

Overview

Module features

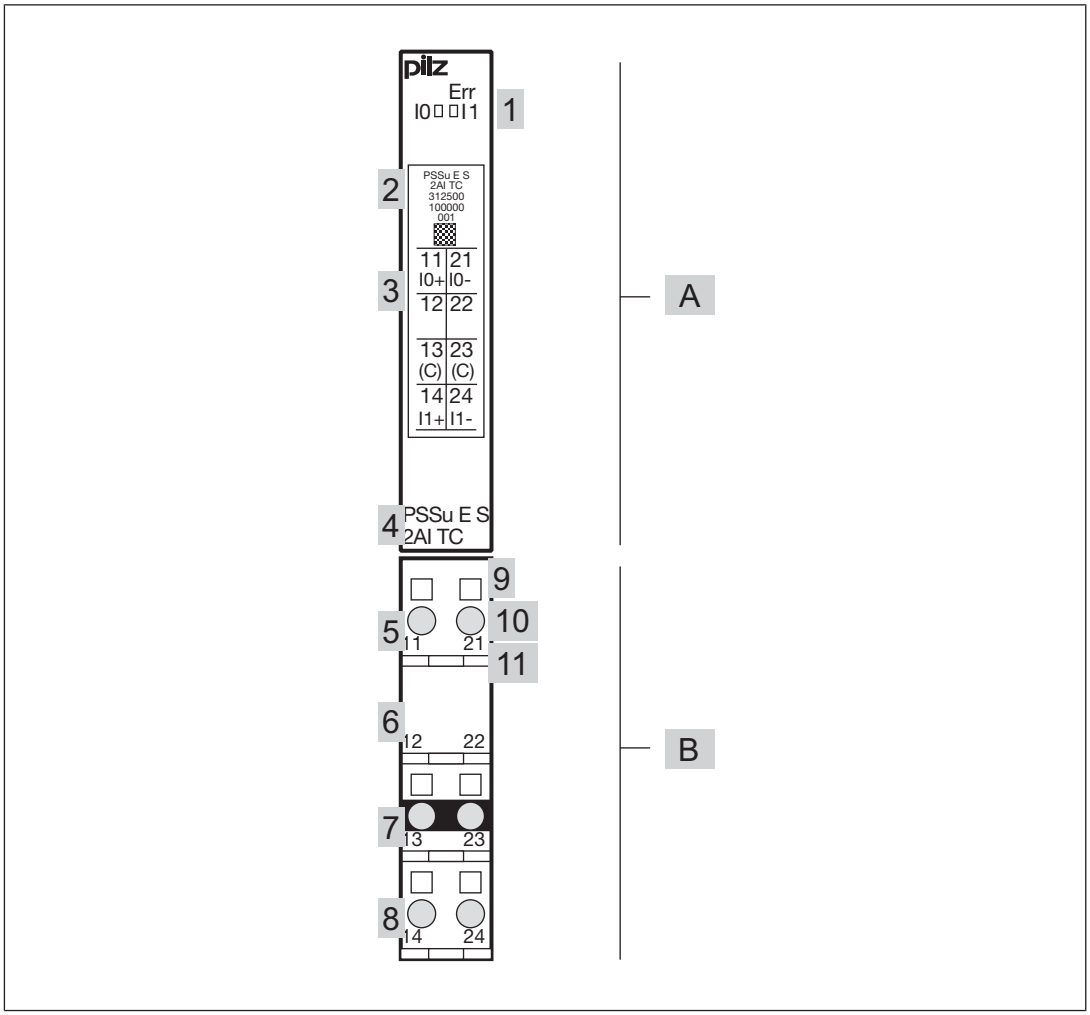
The product has the following features:

- Analogue ST inputs: 2
- Type of inputs: Thermocouples in accordance with EN 60584-1
- Corresponding sensors are thermocouples (configurable) with the letter codes:
  - R, S, B, J, T, E, K, N
- Voltage measurement (configurable):
  - -30 ... 30 mV
  - -60 ... 60 mV
  - -120 ... 120 mV
- Max. resolution:
  - 0.0625°C
  - 1 µV (-30 ... 30 mV)
  - 2 µV (-60 ... 60 mV)
  - 4 µV (-120 ... 120 mV)
- Reference temperature measurement
- Open circuit detection
- LEDs for:
  - Operating status per input
  - Module error
- For standard applications in system environment A and B
- T-type:

  PSSu E S 2AI TC-T: for increased environmental requirements

Analogue input/output (standard)
PSSu E S 2AI TC

Front view



Legend:

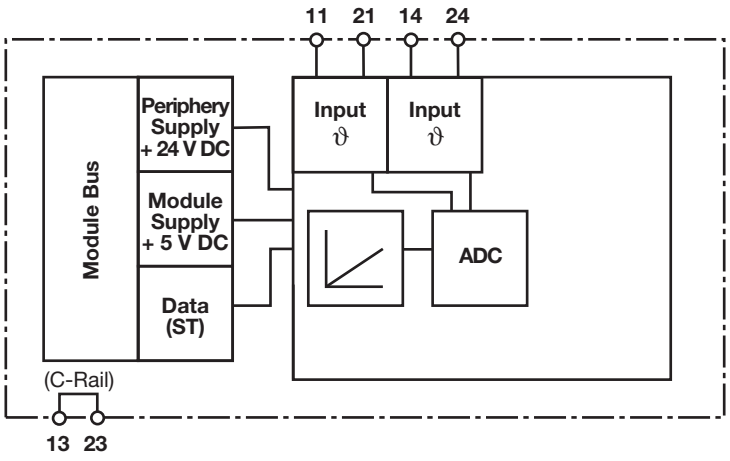
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Status indicator
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Analogue input/output (standard)
PSSu E S 2AI TC

- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1
- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Analogue input/output (standard)
PSSu E S 2AI TC

Module features

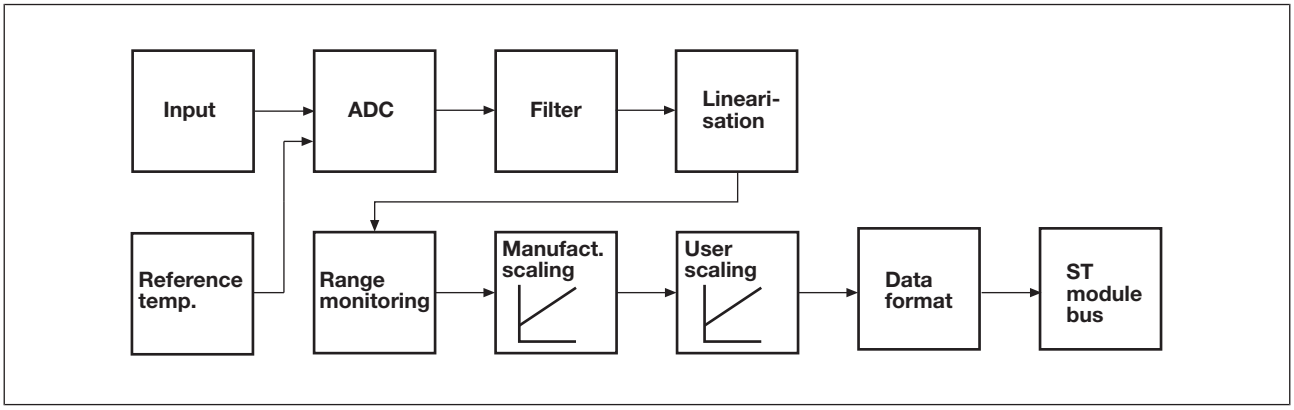
The module supply provides the module with voltage. The periphery supply provides the analogue section with voltage.

The input signals are read in and converted into digital signals. The resolution depends on the configured measuring range. Additional signal processing can be defined using the system software (see schematic representation of signal processing). The individual steps are described in the "Configuration" section.

The input signals are transmitted to the head module via the ST module bus. As an option the input module can send status information for each input.

All the configuration data is stored in the head module and is assigned to the input module on restart. This way the configuration data is retained even if you change the input module.

Schematic representation of signal processing:



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Analogue input/output (standard)
PSSu E S 2AI TC

Configuration

The following options exist for configuring the module in system environment A:

- Via a fieldbus without the modular device description file
  Without the modular device description file it is only possible to configure the input or output range. All other configuration details have default values.
- Via a fieldbus with the modular device description file
  With a modular device description file it is possible to configure all the values.
- Via the USB port of the head module, using the PSSuniversal Configurator
  All the values can be configured using the PSSuniversal Assistant. Any configuration via the USB port will overwrite the configuration made via the fieldbus.

If a module has been configured via the head module's USB port, it is locked and cannot be overwritten by the fieldbus. This lock can be deactivated again in the PSSuniversal Configurator.

The following options exist for configuring the module in system environment B:

- Via the head module's USB port with PAS4000.

The input measuring ranges may be configured per input. Corresponding sensors are thermocouples with the letter codes:

- R
- S
- B
- J
- T
- E
- K (Default)
- N

The module can be configured for voltage measurement:

- -30 ... 30 mV
- -60 ... 60 mV
- -120 ... 120 mV

The temperature ranges for these measuring ranges can be found in the technical details.

The module will detect an open circuit on the measuring lines. In the event of an open circuit the module outputs 8000_H as the measured value and sets:

- In system environment A:
  the "Value exceeds the upper limit value" bit (bit number 1) in the status byte
- In system environment B:
  the I/O data element "Overrange" to TRUE

Analogue input/output (standard)
PSSu E S 2AI TC

Open circuit detection is activated in the default configuration. For open circuit detection, a small, transient measuring current (100 nA) flows through the connected sensor or connected voltage source as part of each cycle. This measuring current is also present when open circuit detection is deactivated.

You can deactivate range monitoring for each input. Range monitoring refers to the measuring range of the sensor which is configured for the input. This option is activated in the default configuration.

The module writes the result of range monitoring as follows:

- System environment A:

  in the Status Byte [📖 817]
- System environment B:

  in the I/O data element "Overrange" or "Underrange" (see PSSu assignment in system environment B [📖 818])

The module behaves as follows, irrespective of the range monitoring configuration:

- If the value falls **below** the range, the temperature value stops. The temperature value corresponding to the lower limit of the measuring range is output.
- If the value **exceeds** the range, the temperature value stops. The temperature value corresponding to the upper limit of the measuring range is output.
- With voltage measurement, the voltage values continue if the value falls **below** or **exceeds** the range.

The reference temperature is measured in the base module. For each input, the reference temperature at the connection points is measured using a temperature-dependent resistor (PT1000). The Pt1000 sensors are located in the base module between terminals 21 and 12 / 24 and 12.

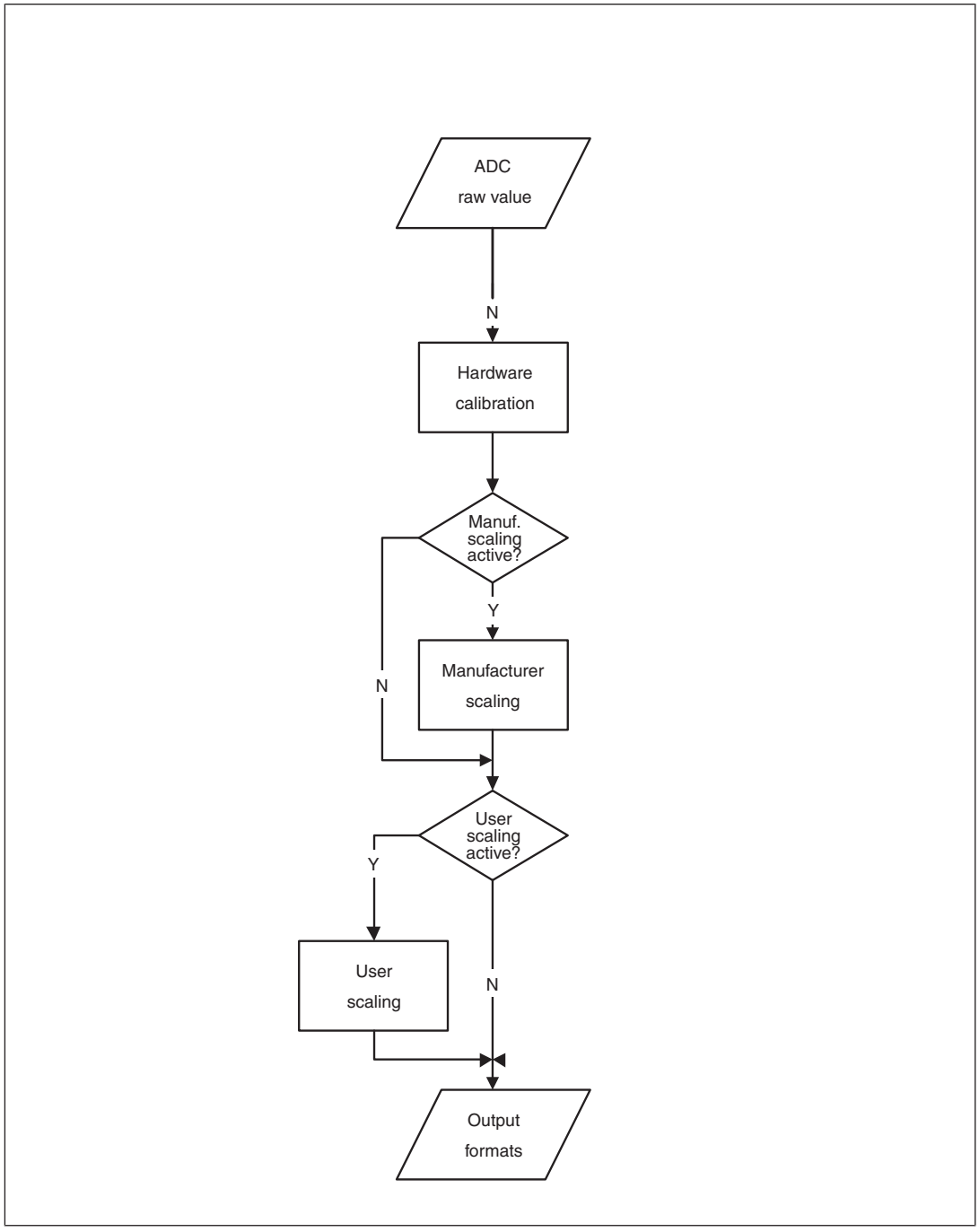
A digital filter suppresses interference frequencies in the input signals. The module's processing time will vary depending on the filter. The module's processing time corresponds approximately to the sum of the filter times of both inputs.

You can select one of the following filters per input:

Filtered frequencies	Attenuation	Filter time per input, without reference temperature measurement	Filter time per input, with reference temperature measurement
60 Hz	90 dB	103 ms	206 ms
50 Hz	80 dB	122 ms	244 ms
50 Hz and 60 Hz	65 dB	122 ms	244 ms
50 Hz and 60 Hz	69 dB	202 ms	404 ms
50 Hz and 60 Hz	74 dB	482 ms	964 ms

Analogue input/output (standard)
PSSu E S 2AI TC

Scaling is a multi-stage process to adapt the values from the AD converter. The straight path in the diagram indicates the default configuration.



Analogue input/output (standard)
PSSu E S 2AI TC

Scaling is used to define the offset (zero point compensation) and gain (amplification) of the digital signal. Offset and gain are entered in the system software as decimal vaues. The relationship between the signal before manufacturer scaling (x), the signal after manufacturer scaling (y), offset (b_1) and gain (a_1) is a linear equation as follows:

$y = (a_1 / 256_D * x) + b_1$ or

$y = (a_1 / 100_H * x) + b_1$

The term $a_1 / 256_D$ corresponds to the amplification factor. With the stated amplification factor, a_1 is calculated as follows:
a_1 = Amplification factor * 256_D

Amplification by 5 % is therefore:
$1.05 * 256_D = 269_D$

Manufacturer scaling is activated in the default setting. The default value for offset is 0. The default value for gain is 160_D ($0A0_H$). That corresponds to an amplification factor of 10/16. The resolution is 1/10° K.

If the manufacturer scaling **and** the user scaling are deactivated, the resolution will be 1/16 K, 1 µV, 2 µV or 4 µV.

User scaling is an additional scaling level applied after manufacturer scaling. You can use this scaling to correct local influences. The function is the same as that of manufacturer scaling:

- $y = (a_2 / 256_D * x) + b_2$ or
- $y = (a_2 / 100_H * x) + b_2$
- a_2 = Amplification factor * 256_D

User scaling is deactivated in the default setting. The default value for offset is 0. The default value for gain is 256_D (100_H). That corresponds to amplification factor 1.

If the manufacturer scaling **and** the user scaling are deactivated, the resolution will be 1/16 K, 1 µV, 2 µV or 4 µV.

If a value lies outside the range that can be displayed in the PII, the respective upper or lower range limit is output (see section entitled "Data formats")

The way in which the analogue value is displayed depends on the measuring range, on scaling and on the data format. The following examples show the relationship between the values with default scaling.

You can configure the following data formats:

- Two's complement (default)
  The digital values are transferred with 16 bits.
- Sign and magnitude representation
  The digital values are transferred with 15 bits plus a sign bit (MSB). The MSB is "1" with negative values and "0" with positive values.

With negative values there is a distinction between sign and magnitude representation and two's complement representation. The values in the following tables apply with default scaling.

Analogue input/output (standard)
PSSu E S 2AI TC

Analogue value and typical digital value with a measuring range of -100 °C ... +100 °C, two's complement:

Temperature	Decimal digital value	Binary digital value	Hexadecimal digital value
-100 °C	-1000	1111 1100 0001 1000	$FC18_H$
0 °C	0	0000 0000 0000 0000	0000_H
100 °C	1000	0000 0011 1110 1000	$03E8_H$

Analogue value and typical digital value with a measuring range of -100 °C ... +100 °C, sign and magnitude representation:

Temperature	Decimal digital value	Binary digital value	Hexadecimal digital value
-100 °C	-1000	1000 0011 1110 1000	$83E8_H$
0 °C	0	0000 0000 0000 0000	0000_H
100 °C	1000	0000 0011 1110 1000	$03E8_H$

Range limits:

Measurement type	Lower range limit		Upper range limit
	Two's complement	Sign and magnitude representation	Two's complement/sign and magnitude representation
Temperature	8001_H	$FFFF_H$	$7FFF_H$
Voltage	8001_H	$FFFF_H$	$7FFF_H$

The module has the following configuration options:

Configurable parameters	Configurable values	Default	Explanation
Measuring range	Type "R", Type "S", Type "B", Type "J", Type "T", Type "E", Type "K", Type "N", ±30 mV, ±60 mV, ±120 mV	Type "K"	
Open circuit detection	-	Activated/TRUE	
Range monitoring	-	Activated/TRUE	
Reference temperature measurement	-	Activated/TRUE	

Analogue input/output (standard)
PSSu E S 2AI TC

Configurable parameters	Configurable values		Default	Explanation
Filter characteristic	Without reference temperature measurement: 103 ms/90 dB (60 Hz), 122 ms/80 dB (50 Hz), 122 ms/65 dB (50 Hz and 60 Hz), 202 ms/69 dB (50 Hz and 60 Hz), 482 ms/74 dB (50 Hz and 60 Hz)	With reference temperature measurement: 206 ms/90 dB (60 Hz), 244 ms/80 dB (50 Hz), 244 ms/65 dB (50 Hz and 60 Hz), 404 ms/69 dB (50 Hz and 60 Hz), 964 ms/74 dB (50 Hz and 60 Hz)	404 ms/69 dB (50 Hz and 60 Hz)	Without reference temperature measurement, 202 ms/69 dB (50 Hz and 60 Hz) is the default setting
Manufacturer scaling	-		Activated/TRUE	
Manufacturer scaling offset	-32768 … 32767_D		0	
Manufacturer scaling gain	-32768 … 32767_D		160_D	Amplification factor 10/16
User scaling	-		Deactivated/ FALSE	
User scaling offset	-32768 … 32767_D		0	
User scaling gain	-32768 … 32767_D		256_D	Amplification factor 1
Sign and magnitude representation	-		Deactivated/ FALSE	Two's complement is activated

Each input occupies 16 consecutive bit addresses for the input data. Each input occupies an additional 8 consecutive bit addresses for the status byte, where this has been configured for the input. All the status bytes are displayed first in the PII, followed by the input data.

Configuration	Standard bus system	
	ST-PII	ST-PIO
Input data	32 Bit	- - -
Input data and status byte ("X")	48 Bit	- - -

Analogue input/output (standard)
PSSu E S 2AI TC

Bit sequence in the PII, input data only, no status byte:

Input	PII	Assignment
Input I0	1	LSB input data
	...	...
	16	MSB input data
Input I1	17	LSB input data
	...	...
	32	MSB input data

Bit sequence in the PII, input data and status byte:

Input	PII	Assignment
Input I0	1	LSB status byte
	...	...
	8	MSB status byte
Input I1	9	LSB status byte
	...	...
	16	MSB status byte
Input I0	17	LSB input data
	...	...
	32	MSB input data
Input I1	33	LSB input data
	...	...
	48	MSB input data

ST modules for measuring temperature can transfer a variety of status information to the ST-PII (see table below for the conveyed status). The information is transmitted using the input's status byte.

Structure and contents of the status byte:

Bit number	Content	Meaning
0	0	Input value above or equal to the lower limit value
	1	Value below the lower limit value
1	0	Input value below or equal to the upper limit value
	1	Value exceeds the upper limit value
2-5, 7	0	Reserved
	1	Reserved

Analogue input/output (standard)
PSSu E S 2AI TC

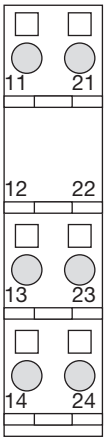
Bit number	Content	Meaning
6	0	No module error
	1	Module error

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

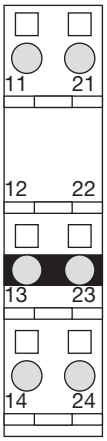
I/O data name	I/O data type	I/O data element	Meaning
I0(11, 21) I1(14, 24)	ST_I_THERMO	Data: WORD	Input data I0 ... I1
		Underrange: BOOL	0: Input value above or equal to the lower limit value 1: Value below the lower limit value
		Overrange: BOOL	0: Input value below or equal to the upper limit value 1: Value exceeds the upper limit value

Wiring

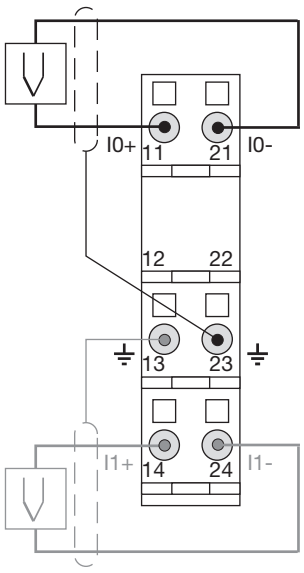
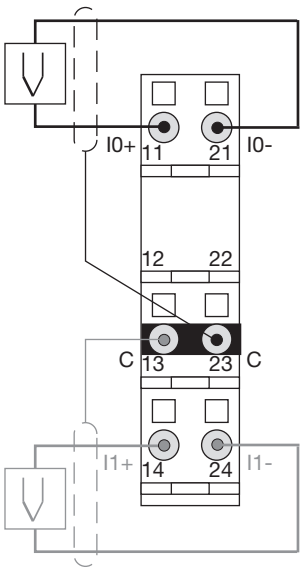
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S-J PSSu BP 1/8 S-TJ Cage clamp terminals: PSSu BP 1/8 C-J PSSu BP 1/8 C-TJ	Without C-rail: 11: Input I0+ 21: Input I0- 12-22: n. n. 13-23: Shield connection (13-23 linked within the base module) 14: Input I1+ 24: Input I1-	

Analogue input/output (standard)
PSSu E S 2AI TC

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S-J PSSu BP-C 1/8 S-TJ Cage clamp terminals: PSSu BP-C 1/8 C-J PSSu BP-C 1/8 C-TJ	With C-rail: 11: Input I0+ 21: Input I0- 12-22: n. n. 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Input I1+ 24: Input I1-	

Connecting the module

Input circuit	Without C-rail	With C-rail
Thermocouple		

Analogue input/output (standard)
PSSu E S 2AI TC

Technical Details

General	312500	314500
Approvals	**CE, TÜV, cULus Listed**	**CE, TÜV, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0304h**	**0304h**
Number of ST input bits	**32**	**32**
Number of ST status bits	**16**	**16**
Application in system environment A		
From ST firmware version, other head modules	**17**	**17**
From ST firmware version PSSu H S PN	**2**	**2**
From ST firmware version PSSu WR S IDN	**6**	**6**
Application in system environment B		
From ST firmware version, head modules	**1.8.0**	**1.8.0**
Electrical data	**312500**	**314500**
Internal supply voltage (module supply)		
Module's power consumption	**0,63 W**	**0,63 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**15 mA**	**15 mA**
Module's power consumption with no load	**0,36 W**	**0,36 W**
Max. power dissipation of module	**1,00 W**	**1,00 W**
Analogue inputs	**312500**	**314500**
Number of analogue inputs	**2**	**2**
Type of analogue inputs	**Thermocouple**	**Thermocouple**
Input area	**Voltage, Type B, Type E, Type J, Type K, Type N, Type R, Type S, Type T**	**Voltage, Type B, Type E, Type J, Type K, Type N, Type R, Type S, Type T**
Input area		
Thermocouples in accordance with the standard	**EN 60584-1**	**EN 60584-1**

Analogue input/output (standard)
PSSu E S 2AI TC

Analogue inputs	312500	314500
Measuring ranges		
Type	**R type**	**R type**
Measuring range	**-50 - 1768 °C**	**-50 - 1768 °C**
Type	**S type**	**S type**
Measuring range	**-50 - 1768 °C**	**-50 - 1768 °C**
Type	**B type**	**B type**
Measuring range	**600 - 1820 °C**	**600 - 1820 °C**
Type	**J type**	**J type**
Measuring range	**-210 - 1200 °C**	**-210 - 1200 °C**
Type	**T type**	**T type**
Measuring range	**-200 - 400 °C**	**-200 - 400 °C**
Type	**E type**	**E type**
Measuring range	**-200 - 1000 °C**	**-200 - 1000 °C**
Type	**K type**	**K type**
Measuring range	**-200 - 1372 °C**	**-200 - 1372 °C**
Type	**N type**	**N type**
Measuring range	**-200 - 1300 °C**	**-200 - 1300 °C**
Type	**Voltage**	**Voltage**
Measuring range	**+/-30 mV**	**+/-30 mV**
Type	**Voltage**	**Voltage**
Measuring range	**+/-60 mV**	**+/-60 mV**
Type	**Voltage**	**Voltage**
Measuring range	**+/-120 mV**	**+/-120 mV**
Input filter	**Digital filter**	**Digital filter**
Filter time per input (2-wire measurement) with attenuation		
Attenuation	**90 dB (60 Hz)**	**90 dB (60 Hz)**
Filter time	**103 ms**	**103 ms**
Attenuation	**80 dB (50 Hz)**	**80 dB (50 Hz)**
Filter time	**122 ms**	**122 ms**
Attenuation	**65 dB (50 - 60 Hz)**	**65 dB (50 - 60 Hz)**
Filter time	**122 ms**	**122 ms**
Attenuation	**69 dB (50 - 60 Hz)**	**69 dB (50 - 60 Hz)**
Filter time	**202 ms**	**202 ms**
Attenuation	**74 dB (50 - 60 Hz)**	**74 dB (50 - 60 Hz)**
Filter time	**482 ms**	**482 ms**
Voltage measurement		
Value of least significant bit (LSB)	**1 µV (+/-30 mV), 2 µV (+/-60 mV), 4 µV (+/-120 mV)**	**1 µV (+/-30 mV), 2 µV (+/-60 mV), 4 µV (+/-120 mV)**
Input resistance	**100 MOhm**	**100 MOhm**
Max. continuous voltage	**5 V**	**5 V**

Analogue input/output (standard)
PSSu E S 2AI TC

Analogue inputs	312500	314500
Temperature measurement		
Value of least significant bit (LSB)	**0,0625 K**	**0,0625 K**
Typ. conversion time per input	**404 ms**	**404 ms**
Output variable measurement error at 25 °C over the whole measuring range		
Types R, S, J, E, K, N	**0,5 %**	**0,5 %**
T type	**1,3 %**	**1,3 %**
B type	**0,1 %**	**0,1 %**
+/-30 mV, +/-60 mV, +/-120 mV	**0,1 %**	**0,1 %**
Measurement error with positive measured values		
Types R, S, J, E, K, N	**0,3 %**	**0,3 %**
T type	**0,7 %**	**0,7 %**
Temperature coefficient		
Types R, S, J, E, K, N	**0,0040 %/K**	**0,0040 %/K**
T type	**0,0090 %/K**	**0,0090 %/K**
B type	**0,0020 %/K**	**0,0020 %/K**
+/-30 mV, +/-60 mV, +/-120 mV	**0,0020 %/K**	**0,0020 %/K**
Potential isolation between input and periphery supply	**yes**	**yes**
Typ. processing time of the analogue input	**808,0 ms**	**808,0 ms**
Inputs	**312500**	**314500**
Potential isolation between input and internal module bus voltage	**yes**	**yes**
Environmental data	**312500**	**314500**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**

Analogue input/output (standard)
PSSu E S 2AI TC

Environmental data	312500	314500
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 1000,0 Hz**
Acceleration	**1g**	**5g**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**25g**
Duration	**16 ms**	**6 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1, EN 61131-2**	**EN 60664-1, EN 61131-2**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Mechanical data	**312500**	**314500**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**36 g**	**36 g**
Mechanical coding		
Type	**H**	**H**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2009-03 latest editions shall apply.

Analogue input/output (standard)
PSSu E S 2AI TC

Order reference

Product

Product type	Features	Order No.
PSSu E S 2AI TC	Electronic module, base type	312 500
PSSu E S 2AI TC-T	Electronic module, T-type	314 500

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S-J	Base module without C-rail with screw terminals, with integrated cold junction compensation	312 602
PSSu BP 1/8 S-TJ	Base module without C-rail with screw terminals, with integrated cold junction compensation, T-type	314 602
PSSu BP 1/8 C-J	Base module without C-rail with cage clamp terminals, with integrated cold junction compensation	312 603
PSSu BP 1/8 C-TJ	Base module without C-rail with cage clamp terminals, with integrated cold junction compensation, T-type	314 603
PSSu BP-C 1/8 S-J	Base module with C-rail and screw terminals, with integrated cold junction compensation	312 612
PSSu BP-C 1/8 S-TJ	Base module with C-rail and screw terminals, with integrated cold junction compensation, T-type	314 612
PSSu BP-C 1/8 C-J	Base module with C-rail and cage clamp terminals, with integrated cold junction compensation	312 613
PSSu BP-C 1/8 C-TJ	Base module with C-rail and cage clamp terminals, with integrated cold junction compensation, T-type	314 613

Analogue input/output (standard)
PSSu E AI SHT1

Overview

Module features

The product has the following features:

- 1 analogue current input

  Current range:

  0 ... 0.6 A, single-pole, referenced to earth
- 2 analogue current outputs

  Current range:

  0 .. 20 mA, single-pole, referenced to earth

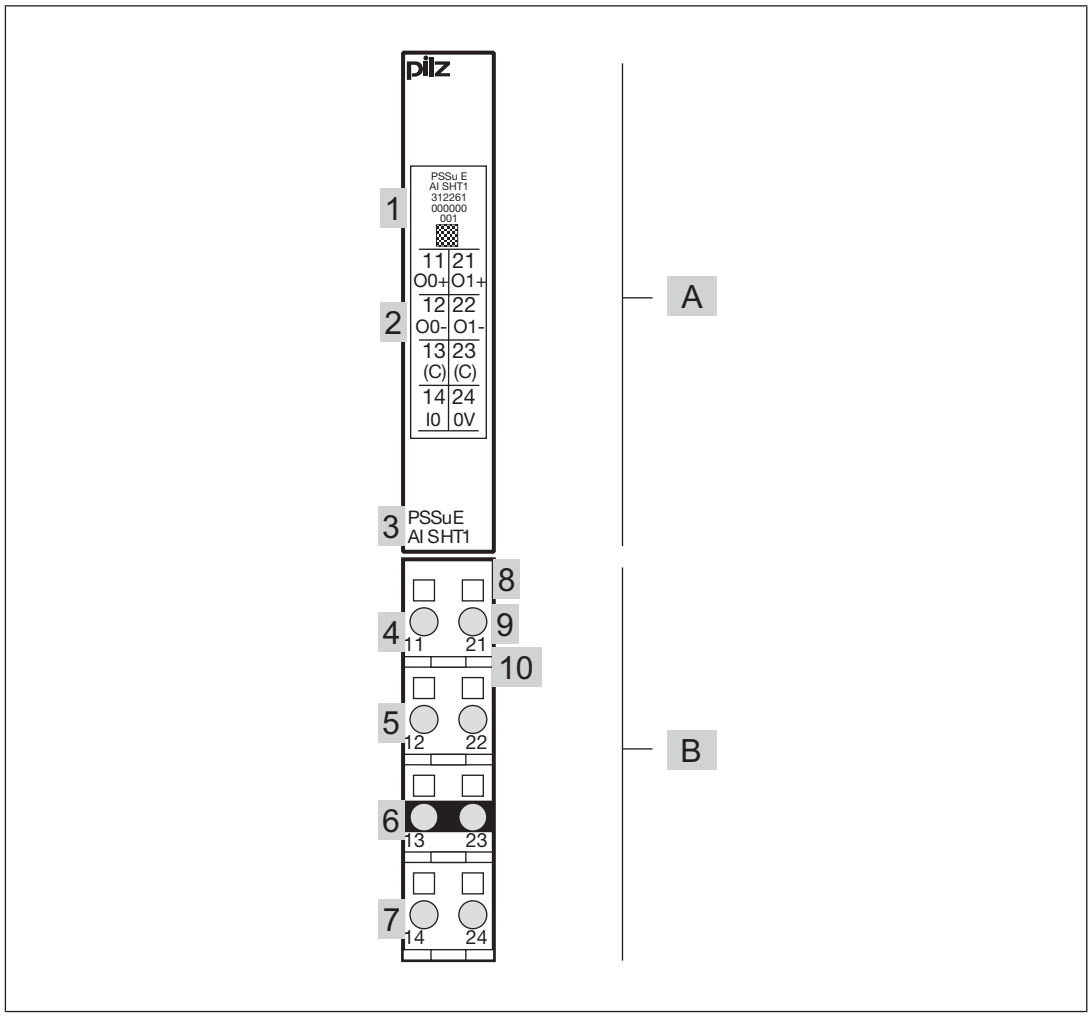
  – Scaling of input current 1:100 and 1:200

  – Evaluation via analogue input module with an input resistance = 115 Ohm, (e.g. PSSu E F AI I), order no.: 312 260)
- For standard and failsafe applications in system environment A and B
- T-type:

  PSSu E AI SHT1-T: for increased environmental requirements

Analogue input/output (standard)
PSSu E AI SHT1

Front view



Legend:

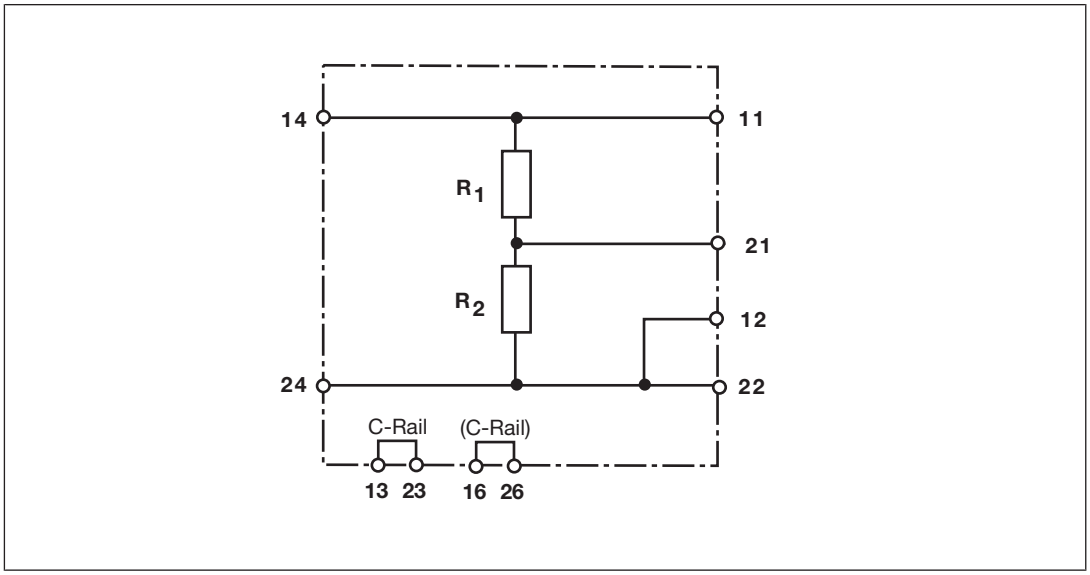
- A: Electronic module
- B: Base module
- 1: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 2: Labelling strip for the terminal configuration on the base module
- 3: Name of electronic module
- 4: Connection level 1
- 5: Connection level 2

Analogue input/output (standard)
PSSu E AI SHT1

- 6: Connection level 3
- 7: Connection level 4
- 8: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 9: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 10: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function Description

Block diagram



Analogue input/output (standard)
PSSu E AI SHT1

Module features

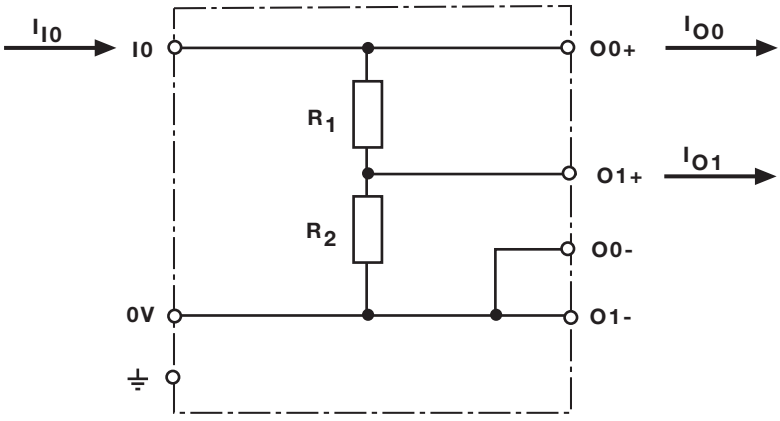
The electronic module PSSu E AI SHT1 contains two shunts for scaling an input current I_{I0} (connection I0). The two current outputs I_{O0} (connection O0+) and I_{O1} (connection O1+) are evaluated by analogue current inputs.

Scaling is applied during evaluation via an analogue input module with an input resistance of 115 Ohm, (e.g. PSSu E F AI I)

- Scaling factor with resistance $R_1 + R_2$ = 1,163 Ohm (connections O0+/O0-):
  $I_{O0} : I_{I0} = 1:100$
- Scaling factor with resistance R_2 = 0,583 Ohm (connections O1+/O1-):
  $I_{O1} : I_{I0} = 1:200$

Example:

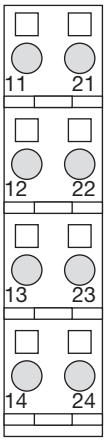
- Input current I_{I0} = 500 mA
- Output current I_{O0} at $R_1 + R_2$ = 5 mA
- Output current I_{O1} at R_2 = 2.5 mA



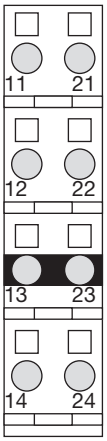
Analogue input/output (standard)
PSSu E AI SHT1

Wiring

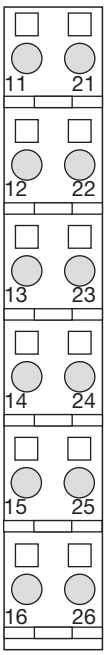
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Output O0+ 21: Output O1+ 12: Output O0- 22: Output O1- 13-23: Shield connection (13-23 linked within the base module) 14: Input I0 24: 0 V analogue	

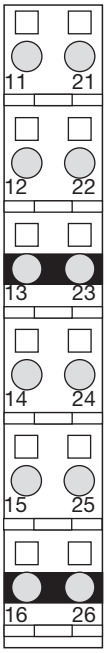
Analogue input/output (standard)
PSSu E AI SHT1

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Output O0+ 21: Output O1+ 12: Output O0- 22: Output O1- 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Input I0 24: 0 V analogue	

Analogue input/output (standard)
PSSu E AI SHT1

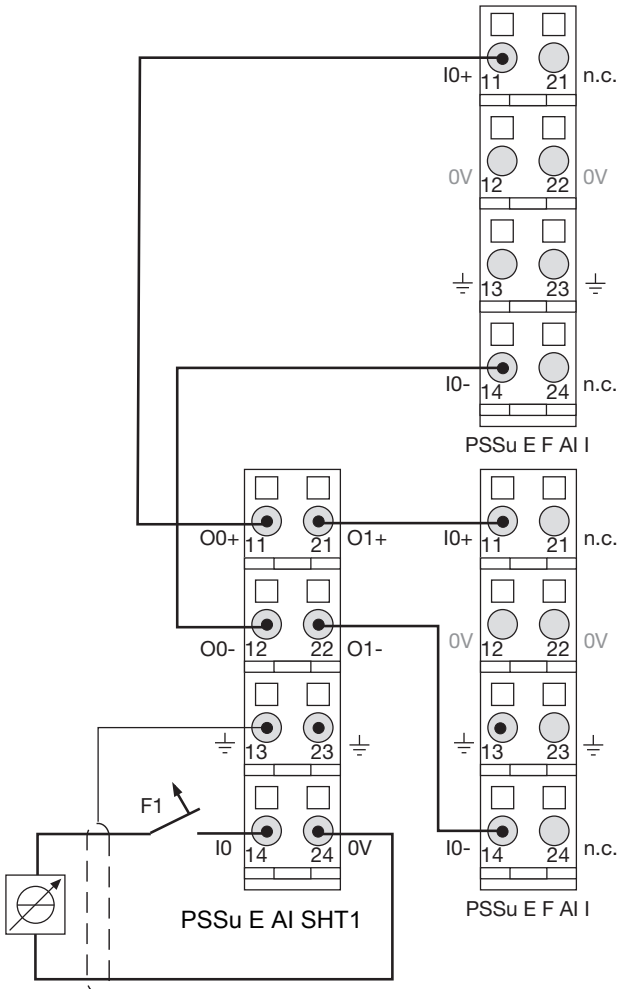
Base module	Terminal configuration	
Screw terminals: PSSu BP 1/12 S PSSu BP 1/12 S-T Cage clamp terminals: PSSu BP 1/12 C PSSu BP 1/12 C-T	Without C-rail: 11: Output O0+ 21: Output O1+ 12: Output O0- 22: Output O1- 13-23: Shield connection (13-23-16-26 linked within the base module) 14: Input I0 24: 0 V analogue 15: Output O0- 25: Output O1- 16-26: Shield connection (13-23-16-26 linked within the base module)	

Analogue input/output (standard)
PSSu E AI SHT1

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/12 S PSSu BP-C 1/12 S-T Cage clamp terminals: PSSu BP-C 1/12 C PSSu BP-C 1/12 C-T	With C-rail: 11: Output O0+ 21: Output O1+ 12: Output O0- 22: Output O1- 13-23: C-rail supply, shield connection (13-23-16-26 linked within the base module) 14: Input I0 24: 0 V analogue 15: Output O0- 25: Output O1- 16-26: C-rail supply, shield connection (13-23-16-26 linked within the base module)	

Analogue input/output (standard)
PSSu E AI SHT1

Connecting the module

Input circuit	
Current range 0 ... 0.6 A single-pole, referenced to earth	

Analogue input/output (standard)
PSSu E AI SHT1

Technical details

General	312261	314261
Approvals	**CE, EAC (Eurasian), TÜV, cULus Listed**	**CE, EAC (Eurasian), TÜV**
Application range	**Standard**	**Standard**
Application in system environment A		
From ST firmware version, other head modules	**1**	**1**
From FS firmware version PSSu H F PN	**1**	**1**
From ST firmware version PSSu H S PN	**1**	**1**
Application in system environment B		
From FS firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312261**	**314261**
Max. power dissipation of module	**0,5 W**	**0,5 W**
Max. current		
for max.	**120 s**	**120 s**
Current	**2 A**	**2 A**
Analogue inputs	**312261**	**314261**
Number of analogue inputs	**1**	**1**
Type of analogue inputs	**Current**	**Current**
Input area	**0 ... 0.6 A**	**0 ... 0.6 A**
Measuring ranges		
Type	**Single-ended**	**Single-ended**
Analogue outputs	**312261**	**314261**
Number of analogue outputs	**2**	**2**
Type of analogue outputs	**Current**	**Current**
Output range	**0 .. 20 mA**	**0 .. 20 mA**
Scaling		
Analogue output O0	**1:100**	**1:100**
Analogue output O1	**1:200**	**1:200**
Internal resistance		
Connection O0+/O0-	**1,163 Ohm**	**1,163 Ohm**
Connection O1+/O1	**0,583 Ohm**	**0,583 Ohm**
Deviations from the measuring range limit value		
Output variable error at 25 °C	**1 %**	**1 %**

Analogue input/output (standard)
PSSu E AI SHT1

Environmental data	312261	314261
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**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 150 Hz**	**10 - 150 Hz**
Acceleration	**1g**	**1g**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1, EN 61131-2**	**EN 60664-1, 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**
Terminals	**IP20**	**IP20**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**

Analogue input/output (standard)
PSSu E AI SHT1

Mechanical data	312261	314261
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76 mm**	**76 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**30 g**	**29 g**
Mechanical coding		
Type	**E**	**E**
Colour	**Light grey**	**Light grey**

Where standards are undated, the 2009-10 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E AI SHT1	Electronic module, base type	312 261
PSSu E AI SHT1-T	Electronic module, T-type	314 261

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618

Analogue input/output (standard)
PSSu E AI SHT1

Product type	Features	Order no.
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C 1/12 S	Base module with C-rail and screw terminals	312 620
PSSu BP-C 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 620
PSSu BP-C 1/12 C	Base module with C-rail and cage clamp terminals	312 621
PSSu BP-C 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 621

Analogue input/output (standard)
PSSu E AI SHT2

Overview

Module features

The product has the following features:

- 1 analogue current input

  Current range:

  0 ... 0.2 A, single-pole, referenced to earth
- 2 analogue current outputs

  Current range:

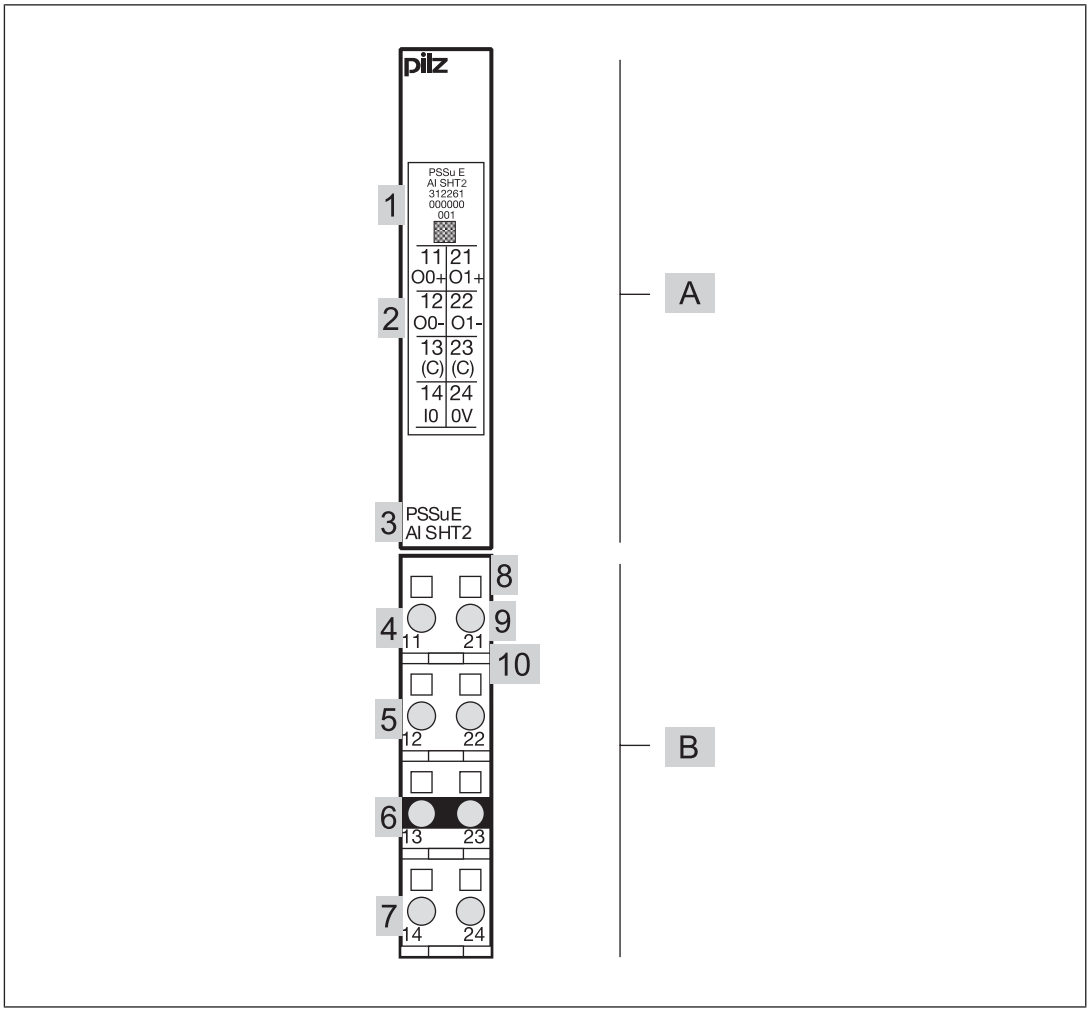
  0 .. 20mA, single-pole, referenced to earth

  – Scaling of input current 1:10 and 1:20

  – Evaluation via analogue input module with an input resistance = 115 Ohm, (e.g. PSSu E F AI I), order no.: 312 260)
- For standard and failsafe applications in system environment A and B

Analogue input/output (standard)
PSSu E AI SHT2

Front view



Legend:

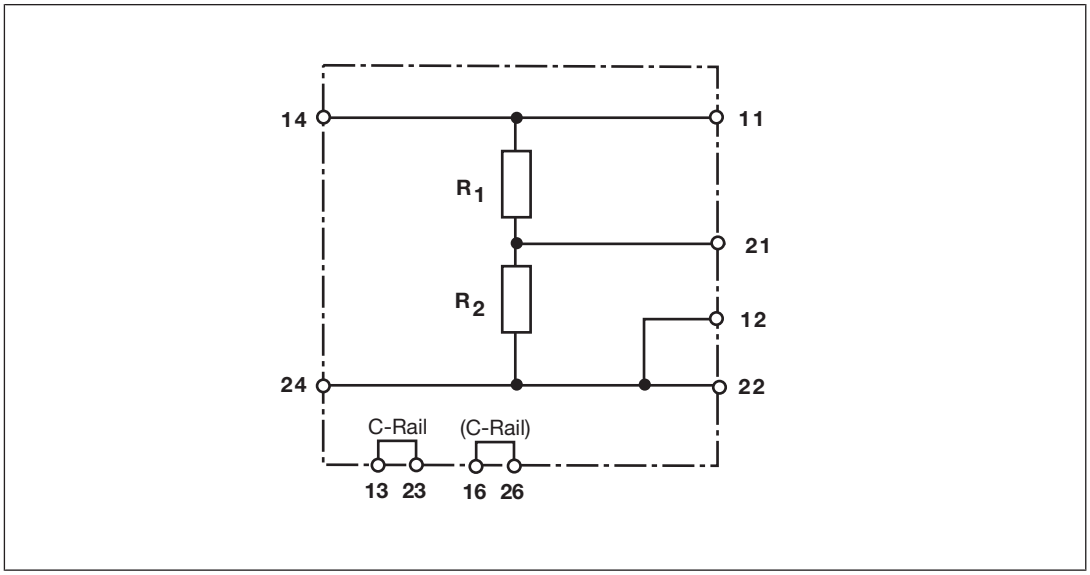
- A: Electronic module
- B: Base module
- 1: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 2: Labelling strip for the terminal configuration on the base module
- 3: Name of electronic module
- 4: Connection level 1
- 5: Connection level 2

Analogue input/output (standard)
PSSu E AI SHT2

- 6: Connection level 3
- 7: Connection level 4
- 8: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 9: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 10: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function Description

Block diagram



Analogue input/output (standard)
PSSu E AI SHT2

Module features

The electronic module PSSu E AI SHT2 contains two shunts for scaling an input current I_{I0} (connection I0). The two current outputs I_{O0} (connection O0+) and I_{O1} (connection O1+) are evaluated by analogue current inputs.

Scaling is applied during evaluation via an analogue input module with an input resistance of 115 Ohm, (e.g. PSSu E F AI I)

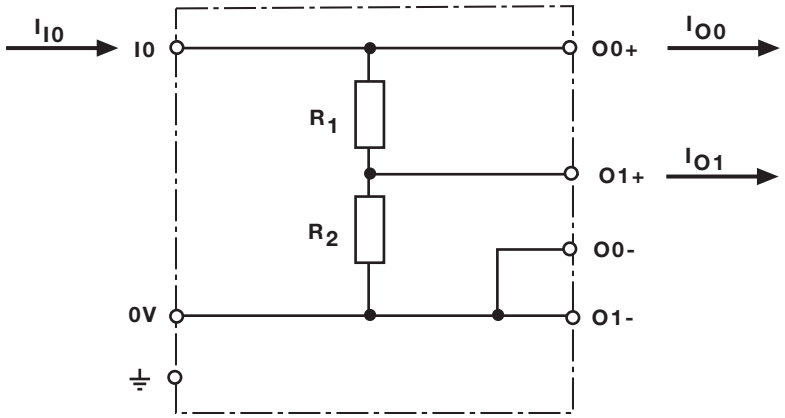
- Scaling factor with resistance $R_1 + R_2$ = 10,150 Ohm (connections O0+/O0-):
  $I_{O0} : I_{I0} = 1:10$
- Scaling factor with resistance R_2 = 6,750 Ohm (connections O1+/O1-):
  $I_{O1} : I_{I0} = 1:20$

The maximum output variable error at 25 °C is:

- When two analogue input modules are connected (e.g. PSSu E F AI I) 1,0 %
- When one analogue input module is connected (e.g. PSSu E F AI I) 3,6 %

Example:

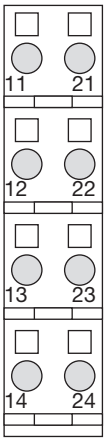
- Input current I_{I0} = 200 mA
- Output current I_{O0} at $R_1 + R_2$ = 20 mA
- Output current I_{O1} at R_2 = 10 mA



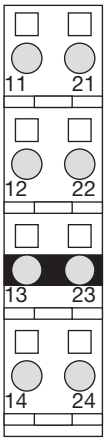
Analogue input/output (standard)
PSSu E AI SHT2

Wiring

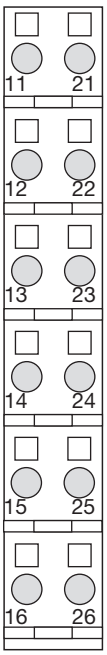
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Output O0+ 21: Output O1+ 12: Output O0- 22: Output O1- 13-23: Shield connection (13-23 linked within the base module) 14: Input I0 24: 0 V analogue	

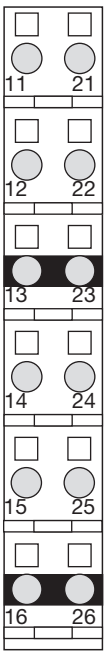
Analogue input/output (standard)
PSSu E AI SHT2

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Output O0+ 21: Output O1+ 12: Output O0- 22: Output O1- 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Input I0 24: 0 V analogue	

Analogue input/output (standard)
PSSu E AI SHT2

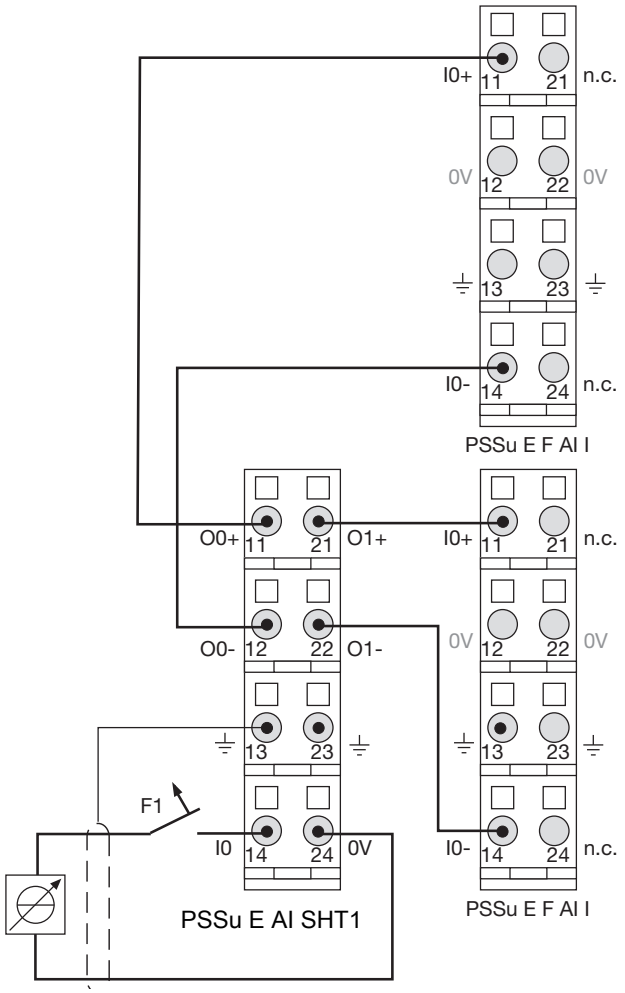
Base module	Terminal configuration	
Screw terminals: PSSu BP 1/12 S PSSu BP 1/12 S-T Cage clamp terminals: PSSu BP 1/12 C PSSu BP 1/12 C-T	Without C-rail: 11: Output O0+ 21: Output O1+ 12: Output O0- 22: Output O1- 13-23: Shield connection (13-23-16-26 linked within the base module) 14: Input I0 24: 0 V analogue 15: Output O0- 25: Output O1- 16-26: Shield connection (13-23-16-26 linked within the base module)	

Analogue input/output (standard)
PSSu E AI SHT2

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/12 S PSSu BP-C 1/12 S-T Cage clamp terminals: PSSu BP-C 1/12 C PSSu BP-C 1/12 C-T	With C-rail: 11: Output O0+ 21: Output O1+ 12: Output O0- 22: Output O1- 13-23: C-rail supply, shield connection (13-23-16-26 linked within the base module) 14: Input I0 24: 0 V analogue 15: Output O0- 25: Output O1- 16-26: C-rail supply, shield connection (13-23-16-26 linked within the base module)	

Analogue input/output (standard)
PSSu E AI SHT2

Connecting the module

Input circuit	
Current range 0 ... 0.2 A single-pole, referenced to earth	

Analogue input/output (standard)
PSSu E AI SHT2

Technical details

General	
Approvals	**CE, cULus Listed**
Application range	**Standard**
Application in system environment A	
From ST firmware version, other head modules	**1**
From FS firmware version PSSu H F PN	**1**
From ST firmware version PSSu H S PN	**1**
Application in system environment B	
From FS firmware version, head modules	**1.0.0**
Analogue inputs	
Number of analogue inputs	**1**
Type of analogue inputs	**Current**
Input area	**0 ... 0.2 A**
Analogue outputs	
Number of analogue outputs	**2**
Type of analogue outputs	**Current**
Output range	**0 .. 20mA**
Scaling	
Analogue output O0	**1:10**
Analogue output O1	**1:20**
Internal resistance	
Connection O0+/O0-	**10,150 Ohm**
Connection O1+/O1	**6,750 Ohm**
Deviations from the measuring range limit value	
Output variable error at 25 °C	**1,0 %**
Max. output variable error at 25 °C	**3,6 %**
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 - 60 °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 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**

Analogue input/output (standard)
PSSu E AI SHT2

Environmental data	
Max. operating height above sea level	**2000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1, EN 61131-2**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
In accordance with the standard	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**
Housing	**IP20**
Terminals	**IP 20**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Coding	**PA**
Mounting type	**plug-in**
Dimensions	
Height	**76,0 mm**
Width	**12,6 mm**
Depth	**60,2 mm**
Weight	**29 g**
Mechanical coding	
Type	**E**
Colour	**Light grey**

Where standards are undated, the 2009-10 latest editions shall apply.

Analogue input/output (standard)
PSSu E AI SHT2

Order reference

Product

Product type	Features	Order No.
PSSu E AI SHT2	Electronic module, base type	312 262

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP-C 1/12 S	Base module with C-rail and screw terminals	312 620
PSSu BP-C 1/12 C	Base module with C-rail and cage clamp terminals	312 621

Analogue input/output (failsafe)

Analogue input/output (failsafe)

Contents	Page

Analogue input/output (failsafe)
PSSu E F AI I

Overview

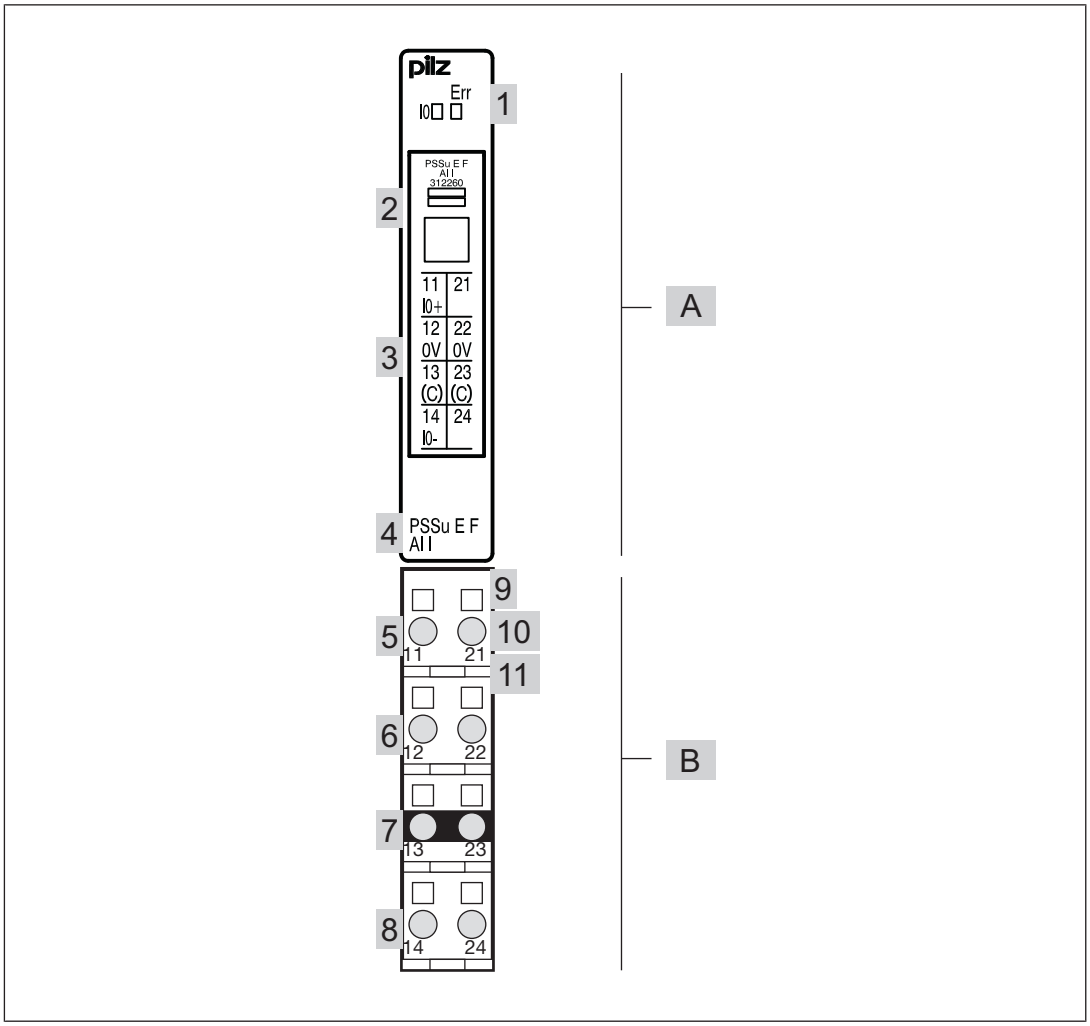
Module features

The product has the following features:

- 1 Analogue current input
- Current range:
  0 ... 25.59375 mA Dual-pole, differential input
- Resolution:
  12 Bit (representation of negative values in the two's complement)
- LEDs for:
  - Operating status per input
  - Module error
- For failsafe applications in system environment B (automation system PSS 4000)
- T-type:
  PSSu E F AI I-T: for increased environmental requirements
- R-type:
  PSSu E F AI I-R: for railway applications

Analogue input/output (failsafe)
PSSu E F AI I

Front view



Legend:

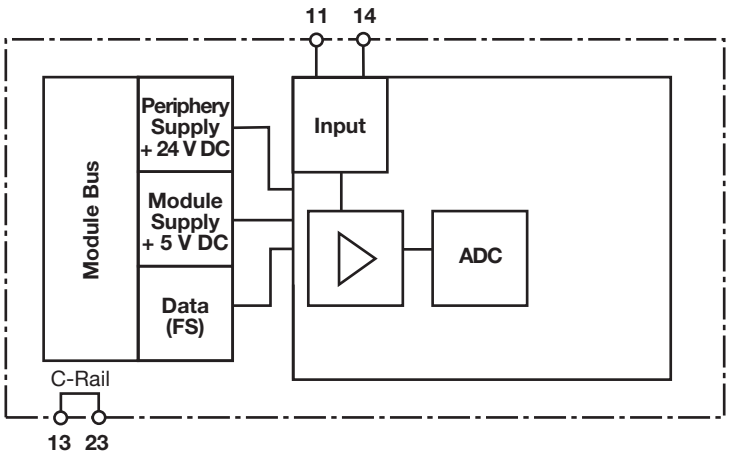
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Status indicator
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Analogue input/output (failsafe)
PSSu E F AI I

- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1
- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Analogue input/output (failsafe)
PSSu E F AI I

Module features

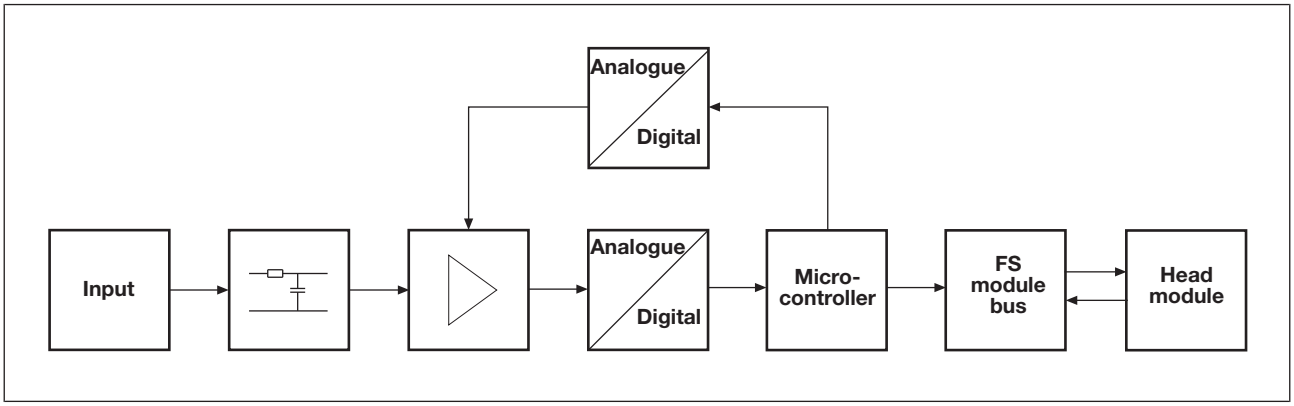
Module supply

- The module supply provides the module with voltage.

Input signal processing:

- The analogue input signal is prefiltered, amplified and stored as a digital measured value.
- To achieve functional safety, a test signal is generated in the microcontroller.
- The test signal is fed back to the amplifier via the D/A converter; there it is added to the measured value that has been read in.
- The test signal is subtracted again from this total value and the result is compared with the original measured value that was read in. The tolerance in this comparison process is 5 %. If this tolerance is exceeded, the signal is considered to be faulty. The module's safety-related accuracy is therefore 5 %. This must be considered in the application. It can also be reduced through certain measures. For further information see Measures for achieving process safety.

Schematic representation of signal processing:



Resolution of analogue-digital converter

- The resolution of the analogue-digital converter is 12 bits and therefore has 4096 quantisation levels.
- Due to the system, the LSB always changes by 2 bits instead of 1. The resolution remains unaffected.

Analogue input/output (failsafe)
PSSu E F AI I

Integrated protection mechanisms

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- FS communication error
- Bus termination error

Configuration

The table below shows the converted data formats of the analogue input currents. When the digital values are converted into I/O data elements, the three highest binary digits are filled with "0".

Analogue value	Digital value (12 Bit)			I/O data element "Data" (16 Bit)		
	Binary	Hexa-decimal	Decimal	Binary	Hexa-decimal	Decimal
25.59375 mA	0 1111 1111 1111	0FFF	4095	0000 1111 1111 1111	0FFF	4095
20.0 mA	0 1100 1000 0000	0C80	3200	0000 1100 1000 0000	0C80	3200
17.5 mA	0 1010 1111 0000	0AF0	2800	0000 1010 1111 0000	0AF0	2800
15.0 mA	0 1001 0110 0000	0960	2400	0000 1001 0110 0000	0960	2400
12.5 mA	0 0111 1101 0000	07D0	2000	0000 0111 1101 0000	07D0	2000
10.0 mA	0 0110 0100 0000	0640	1600	0000 0110 0100 0000	0640	1600
7.5 mA	0 0100 1011 0000	04B0	1200	0000 0100 1011 0000	04B0	1200
5.0 mA	0 0011 0010 0000	0320	800	0000 0011 0010 0000	0320	800
2.5 mA	0 0001 1001 0000	0190	400	0000 0001 1001 0000	0190	400
1.0 mA	0 0000 1010 0000	00A0	160	0000 0000 1010 0000	00A0	160
0.1 mA	0 0000 0001 0000	0010	16	0000 0000 0001 0000	0010	16
50 µA	0 0000 0000 1000	0008	8	0000 0000 0000 1000	0008	8
25 µA	0 0000 0000 0100	0004	4	0000 0000 0000 0100	0004	4
12.5 µA	0 0000 0000 0010	0002	2	0000 0000 0000 0010	0002	2
6.25 µA	0 0000 0000 0001	0001	1	0000 0000 0000 0001	0001	1
0.00 A	0 0000 0000 0000	0000	0	0000 0000 0000 0000	0000	0

If the measured value is invalid, the value 0x0000 (0000 hexadecimal) is output and the valid bit is set to "0".

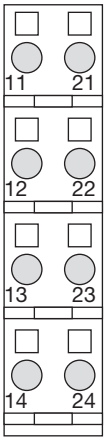
Analogue input/output (failsafe)
PSSu E F AI I

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

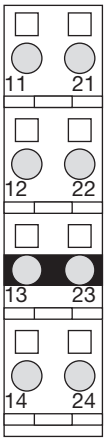
I/O data name	I/O data type	I/O data element	Meaning
I0(11)	FS_I_AI	Data: SAFEWORD	Input data

Wiring

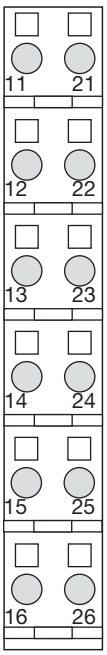
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Input I0+ 21: Not connected 12 -22: 0 V analogue (12-22 linked within the base module) 13 -23: Shield connection (13-23 linked within the base module) 14: Input I0- 24: Not connected	

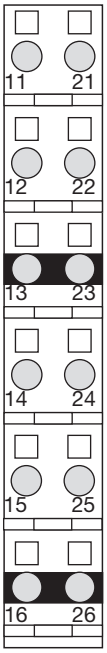
Analogue input/output (failsafe)
PSSu E F AI I

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Input I0+ 21: Not connected 12 -22: 0 V analogue (12-22 linked within the base module) 13 -23: C-rail supply, shield connection (13-23 linked within the base module) 14: Input I0- 24: Not connected	

Analogue input/output (failsafe)
PSSu E F AI I

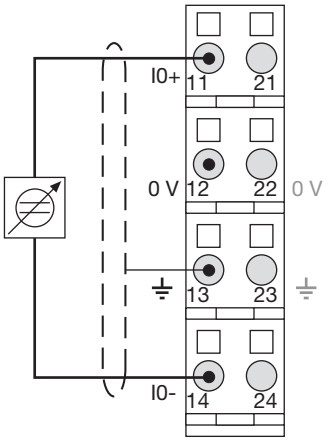
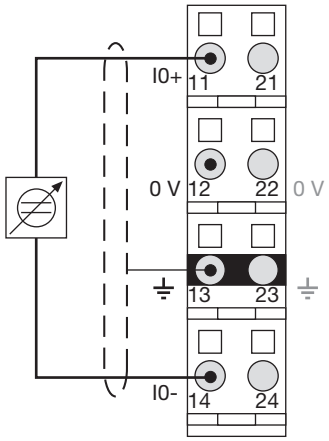
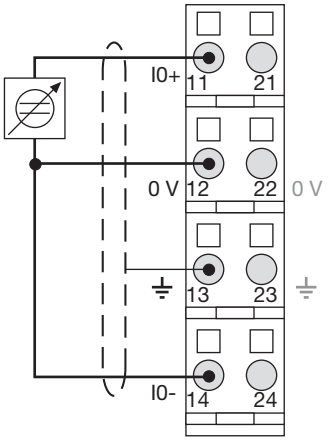
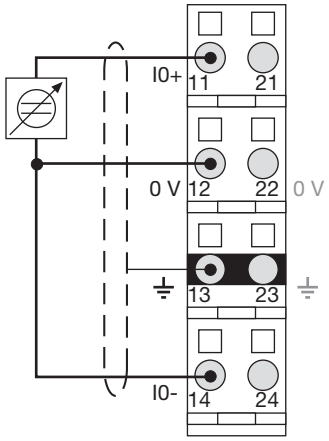
Base module	Terminal configuration	
Screw terminals: PSSu BP 1/12 S PSSu BP 1/12 S-T Cage clamp terminals: PSSu BP 1/12 C PSSu BP 1/12 C-T	Without C-rail: 11: Input I0+ 21: Not connected 12 -22: 0 V analogue (12-22-15-25 linked within the base module) 13 -23: Shield connection (13-23-16-26 linked within the base module) 14: Input I0- 24: Not connected 15 -25: 0 V analogue (12-22-15-25 linked within the base module) 16 -26: Shield connection (13-23-16-26 linked within the base module)	

Analogue input/output (failsafe)
PSSu E F AI I

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/12 S PSSu BP-C 1/12 S-T Cage clamp terminals: PSSu BP-C 1/12 C PSSu BP-C 1/12 C-T	With C-rail: 11: Input I0+ 21: Not connected 12 -22: 0 V analogue (12-22 linked within the base module) 13 -23: C-rail supply, shield connection (13-23 linked within the base module) 14: Input I0- 24: Not connected 15 -25: 0 V analogue (12-22-15-25 linked within the base module) 16 -26: C-rail supply, shield connection (13-23-16-26 linked within the base module)	

Analogue input/output (failsafe)
PSSu E F AI I

Connecting the module

Input circuit	Without C-rail	With C-rail
Current range 0 ... 25.59375 mA dual-pole, differential input		
Current range 0 ... 25.59375 mA measurement referenced to earth In a noise susceptible environment		

Analogue input/output (failsafe)
PSSu E F AI I

Technical details

General	312260	314260	315260
Approvals	CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CE, TÜV
Application range	Failsafe	Failsafe	Failsafe
Module's device code	0B10h	0B10h	0B10h
Number of FS input bits	16	16	16
Application in system environment B			
From FS firmware version, head modules	1.0.0	1.0.0	1.5.0
Electrical data	**312260**	**314260**	**315260**
Internal supply voltage (module supply)			
Module's power consumption	0,22 W	0,22 W	0,22 W
Periphery's supply voltage (periphery supply)			
Voltage range	16,8 - 30 V	16,8 - 30 V	16,8 - 30 V
Module's current consumption with no load	34 mA	34 mA	34 mA
Module's power consumption with no load	0,58 W	0,58 W	0,58 W
Max. power dissipation of module	0,8 W	0,8 W	0,8 W
Analogue inputs	**312260**	**314260**	**315260**
Number of analogue inputs	1	1	1
Type of analogue inputs	Current	Current	Current
Input area	0 ... 25.59375 mA	0 ... 25.59375 mA	0 ... 25.59375 mA
Input filter	RC filter	RC filter	RC filter
Cutoff frequency	71 Hz	71 Hz	71 Hz
Current measurement			
Value of least significant bit (LSB)	6,25 µA	6,25 µA	6,25 µA
Input resistance	115 Ohm	115 Ohm	115 Ohm
Max. continuous current	40 mA	40 mA	40 mA
Resolution	12 Bit	12 Bit	12 Bit
Safety-related accuracy (1 input)	5 %	5 %	5 %

Analogue input/output (failsafe)
PSSu E F AI I

Analogue inputs	312260	314260	315260
Deviations from the measuring range limit value			
Linearity error	**0,05 %**	**0,05 %**	**0,05 %**
Output variable error at 25 °C	**0,4 %**	**0,4 %**	**0,4 %**
Temperature coefficient	**0,003 %/K**	**0,003 %/K**	**0,003 %/K**
Max. measurement error during EMC test	**1 %**	**1 %**	**1 %**
Potential isolation between input and periphery supply	**yes**	**yes**	**yes**
Inputs	**312260**	**314260**	**315260**
Potential isolation between input and internal module bus voltage	**yes**	**yes**	**yes**
Environmental data	**312260**	**314260**	**315260**
Application site			
In accordance with the standard	–	–	**EN 50125-3**
Application site	–	–	**Track area (1 m - 3 m)**
In accordance with the standard	–	–	**EN 61373**
Application site	–	–	**Category 1, Class A + B**
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**	**EN 50125-1, EN 50125-3, EN 50155, EN 60068-2-1, EN 60068-2-14, EN 60068-2-2**
Ambient temperature			
In accordance with the standard	**EN 60068-2-14**	**EN 60068-2-14**	**EN 50155**
Temperature range	**0 - 60 °C**	**-40 - 70 °C**	**-40 - 70 °C**
In accordance with the standard	–	–	**EN 50125-1**
Temperature range	–	–	**-40 ... +70 °C**
In accordance with the standard	–	–	**EN 50125-3**
Temperature range	–	–	**-40 ... +70 °C**
Storage temperature			
In accordance with the standard	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**	**-40 - 70 °C**

Analogue input/output (failsafe)
PSSu E F AI I

Environmental data	312260	314260	315260
Climatic suitability			
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**	–
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	–
Condensation during operation	**Not permitted**	**ISO 16750-4**	–
Max. operating height above sea level	**2000 m**	**5000 m**	**2000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 50125-3**
Frequency	**10 - 150 Hz**	**10 - 1000 Hz**	**5 - 2000 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	–
Acceleration	**1g**	**5g**	**0,23g**
Broadband noise			
In accordance with the standard	–	**EN 60068-2-64**	**EN 61373**
Frequency	–	**5 - 500 Hz**	**5 - 150 Hz**
Acceleration	–	**1,9grms**	**0,79 g RMS**
Shock stress			
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 50125-3**
Number of shocks	**6**	**6**	**20**
Acceleration	**15g**	**15g**	**2g**
Duration	**11 ms**	**11 ms**	**11 ms**
In accordance with the standard	–	–	**EN 61373**
Number of shocks	–	–	**20**
Acceleration	–	–	**5g**
Duration	–	–	**30 ms**
Supply interruptions			
In accordance with the standard	–	–	**EN 50155**
Class	–	–	**S2, C1, C2**
Airgap creepage			
In accordance with the standard	**EN 60664-1**	**EN 60664-1**	**EN 50124-1**
Overvoltage category	**II**	**II**	**OV2**
Pollution degree	**2**	**2**	**PD2**

Analogue input/output (failsafe)
PSSu E F AI I

Environmental data	312260	314260	315260
Protection type			
In accordance with the standard	**EN 60529**	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**	**IP20**
Terminals	**IP20**	**IP20**	**IP20**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP51**
Mechanical data	**312260**	**314260**	**315260**
Material			
Bottom	**PC**	**PC**	**PC**
Front	**PC**	**PC**	**PC**
Coding	**PA**	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Dimensions			
Height	**76 mm**	**76 mm**	**76 mm**
Width	**12,6 mm**	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**	**60,2 mm**
Weight	**36 g**	**37 g**	**38 g**
Mechanical coding			
Type	**K**	**K**	**K**
Colour	**Yellow**	**Yellow**	**Yellow**

Where standards are undated, the 2005-04 latest editions shall apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
1-channel	–	–	**SIL CL 2**	**1,56E-08**	**SIL 2**	**1,37E-03**	**20**
2-channel	**PL e**	**Cat. 4**	**SIL CL 3**	**4,37E-09**	**SIL 3**	**2,99E-05**	**20**

If the module is operated at an ambient temperature above 60° C, the values stated in the table for PFH_D and PFD will need to be doubled when a safety function is calculated.

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

Analogue input/output (failsafe)
PSSu E F AI I

Order reference

Product

Product type	Features	Order No.
PSSu E F AI I	Electronic module, base type	312 260
PSSu E F AI I-T	Electronic module, T-type	314 260
PSSu E F AI I-R	Electronic module, R-type	315 260

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C 1/12 S	Base module with C-rail and screw terminals	312 620
PSSu BP-C 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 620
PSSu BP-C 1/12 C	Base module with C-rail and cage clamp terminals	312 621
PSSu BP-C 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 621

Analogue input/output (failsafe)
PSSu E F AI U

Overview

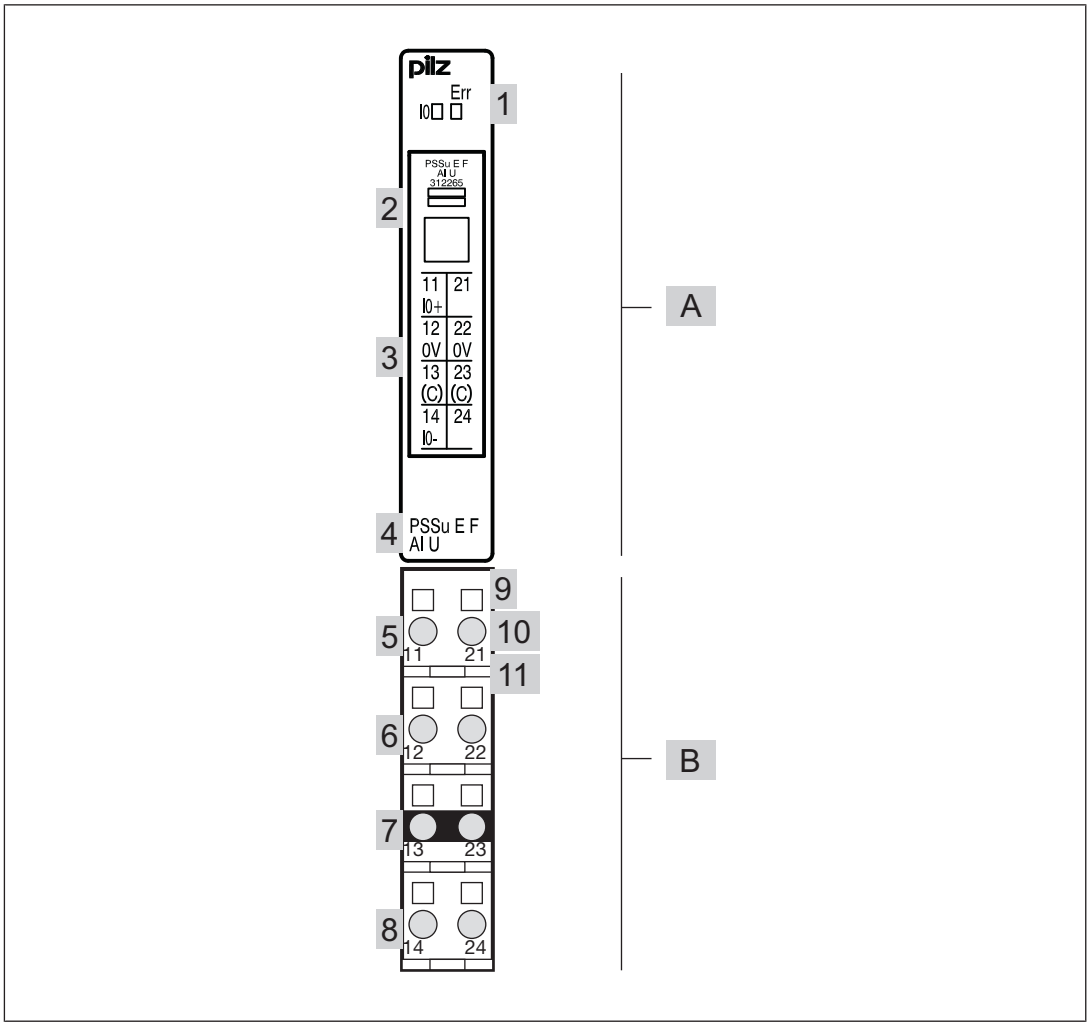
Module features

The product has the following features:

- 1 Analogue voltage input
- Voltage range:
  -10.24 V ... +10.2375 V Dual-pole, differential input
- Resolution:
  13 Bit (representation of negative values in the two's complement)
- LEDs for:
  - Operating status per input
  - Module error
- For failsafe applications in system environment B (automation system PSS 4000)
- T-type:
  PSSu E F AI U-T: for increased environmental requirements
- R-type:
  PSSu E F AI U-R: for railway applications

Analogue input/output (failsafe)
PSSu E F AI U

Front view



Legend:

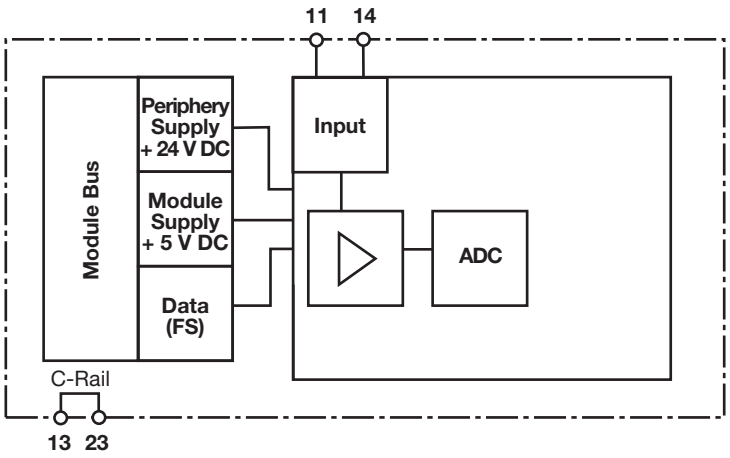
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Status indicator
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Analogue input/output (failsafe)
PSSu E F AI U

- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1
- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Analogue input/output (failsafe)
PSSu E F AI U

Module features

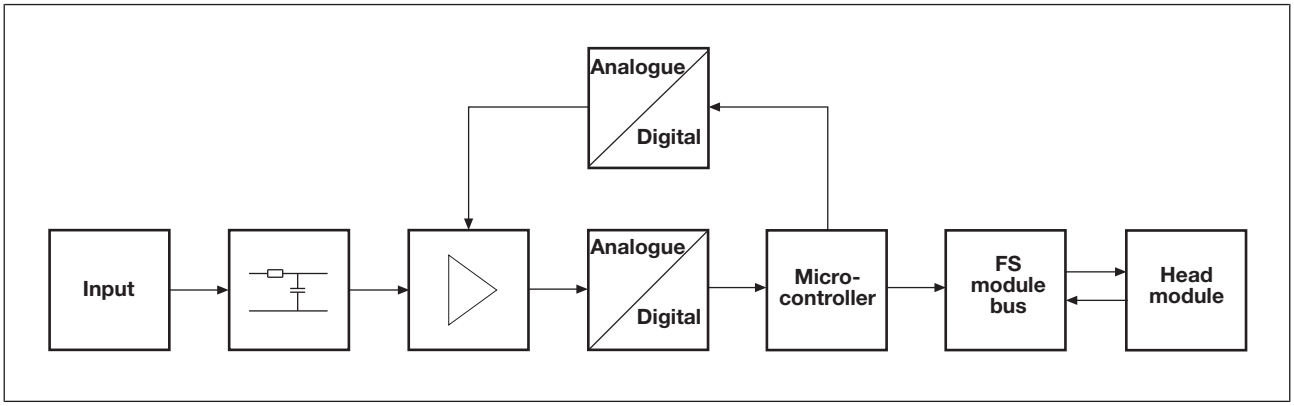
Module supply

- The module supply provides the module with voltage.

Input signal processing:

- The analogue input signal is prefiltered, amplified and stored as a digital measured value.
- To achieve functional safety, a test signal is generated in the microcontroller.
- The test signal is fed back to the amplifier via the D/A converter; there it is added to the measured value that has been read in.
- The test signal is subtracted again from this total value and the result is compared with the original measured value that was read in. The tolerance in this comparison process is 5 %. If this tolerance is exceeded, the signal is considered to be faulty. The module's safety-related accuracy is therefore 5 %. This must be considered in the application. It can also be reduced through certain measures. For further information see Measures for achieving process safety.

Schematic representation of signal processing:



Resolution of analogue-digital converter

- The resolution of the analogue-digital converter is 12 bits wide. There is also an additional 1 sign bit. It therefore has 4096 quantisation levels in both the positive and negative range.
- Due to the system, the LSB always changes by 2 bits instead of 1. The resolution remains unaffected.

Analogue input/output (failsafe)
PSSu E F AI U

Integrated protection mechanisms

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- FS communication error
- Bus termination error

Configuration

The table below shows the converted data formats of the analogue input voltages. When the digital values are converted into I/O data elements, the three highest binary digits are filled with "0" for positive values and "1" for negative values.

Analogue value	**Digital value (13 Bit)**			**I/O data element "Data" (16 Bit)**		
	Binary	Hexa-decimal	Decimal	Binary	Hexa-decimal	Decimal
10.2375 V	0 1111 1111 1111	0FFF	4095	0000 1111 1111 1111	0FFF	4095
10.00 V	0 1111 1010 0000	0FA0	4000	0000 1111 1010 0000	0FA0	4000
9.00 V	0 1110 0001 0000	0E10	3600	0000 1110 0001 0000	0E10	3600
8.00 V	0 1100 1000 0000	0C80	3200	0000 1100 1000 0000	0C80	3200
7.00 V	0 1010 1111 0000	0AF0	2800	0000 1010 1111 0000	0AF0	2800
6.00 V	0 1001 0110 0000	0960	2400	0000 1001 0110 0000	0960	2400
5.00 V	0 0111 1101 0000	07D0	2000	0000 0111 1101 0000	07D0	2000
4.00 V	0 0110 0100 0000	0640	1600	0000 0110 0100 0000	0640	1600
3.00 V	0 0100 1011 0000	04B0	1200	0000 0100 1011 0000	04B0	1200
2.50 V	0 0011 1110 1000	03E8	1000	0000 0011 1110 1000	03E8	1000
2.00 V	0 0011 0010 0000	0320	800	0000 0011 0010 0000	0320	800
1.00 V	0 0001 1001 0000	0190	400	0000 0001 1001 0000	0190	400
2.5 mV	0 0000 0000 0001	0001	1	0000 0000 0000 0001	0001	1
0.00 V	0 0000 0000 0000	0000	0	0000 0000 0000 0000	0000	0
-2.5 mV	1 1111 1111 1111	1FFF	-1	1111 1111 1111 1111	FFFF	-1
-1.00 V	1 1110 0111 0000	1E70	-400	1111 1110 0111 0000	FE70	-400
-2.00 V	1 1100 1110 0000	1CE0	-800	1111 1100 1110 0000	FCE0	-800
-3.00 V	1 1011 0101 0000	1B50	-1200	1111 1011 0101 0000	FB50	-1200
-4.00 V	1 1001 1100 0000	19C0	-1600	1111 1001 1100 0000	F9C0	-1600

Analogue input/output (failsafe)
PSSu E F AI U

-5.00 V	1 1000 0011 0000	1830	-2000	1111 1000 0011 0000	F830	-2000
-6.00 V	1 0110 1010 0000	16A0	-2400	1111 0110 1010 0000	F6A0	-2400
-7.00 V	1 0101 0001 0000	1510	-2800	1111 0101 0001 0000	F510	-2800
-8.00 V	1 0011 1000 0000	1380	-3200	1111 0011 1000 0000	F380	-3200
-9.00 V	1 0001 1111 0000	11F0	-3600	1111 0001 1111 0000	F1F0	-3600
-10.00 V	1 0000 0110 0000	1060	-4000	1111 0000 0110 0000	F060	-4000
-10.24 V	1 0000 0000 0000	1000	-4096	1111 0000 0000 0000	F000	-4096

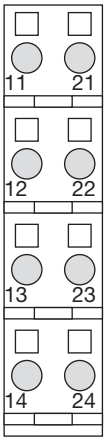
If the measured range is exceeded, the default value 0x0000 (0000 hexadecimal) is output and the valid bit is set to "0".

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

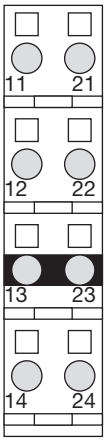
I/O data name	I/O data type	I/O data element	Meaning
I0(11)	FS_I_AI	Data: SAFEWORD	Input data

Wiring

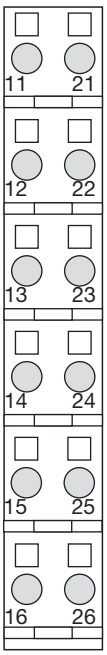
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Input I0+ 21: Not connected 12 -22: 0 V analogue (12-22 linked within the base module) 13 -23: Shield connection (13-23 linked within the base module) 14: Input I0- 24: Not connected	

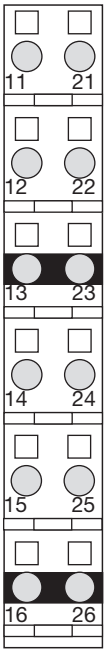
Analogue input/output (failsafe)
PSSu E F AI U

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Input I0+ 21: Not connected 12 -22: 0 V analogue (12-22 linked within the base module) 13 -23: C-rail supply, shield connection (13-23 linked within the base module) 14: Input I0- 24: Not connected	

Analogue input/output (failsafe)
PSSu E F AI U

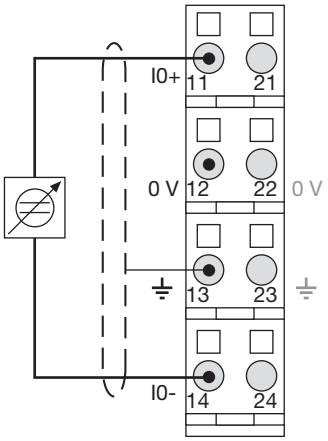
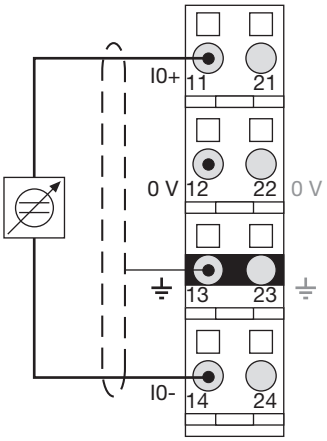
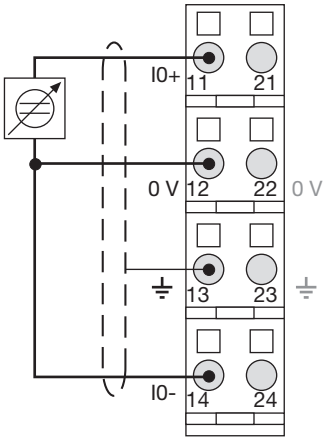
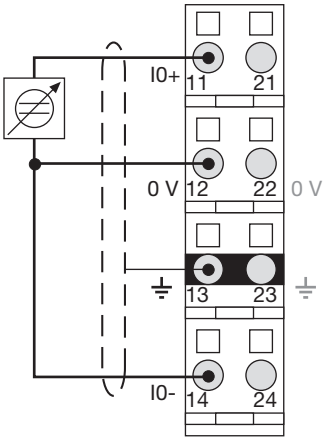
Base module	Terminal configuration	
Screw terminals: PSSu BP 1/12 S PSSu BP 1/12 S-T Cage clamp terminals: PSSu BP 1/12 C PSSu BP 1/12 C-T	Without C-rail: 11: Input I0+ 21: Not connected 12 -22: 0 V analogue (12-22-15-25 linked within the base module) 13 -23: Shield connection (13-23-16-26 linked within the base module) 14: Input I0- 24: Not connected 15 -25: 0 V analogue (12-22-15-25 linked within the base module) 16 -26: Shield connection (13-23-16-26 linked within the base module)	

Analogue input/output (failsafe)
PSSu E F AI U

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/12 S PSSu BP-C 1/12 S-T Cage clamp terminals: PSSu BP-C 1/12 C PSSu BP-C 1/12 C-T	With C-rail: 11: Input I0+ 21: Not connected 12 -22: 0 V analogue (12-22 linked within the base module) 13 -23: C-rail supply, shield connection (13-23 linked within the base module) 14: Input I0- 24: Not connected 15 -25: 0 V analogue (12-22-15-25 linked within the base module) 16 -26: C-rail supply, shield connection (13-23-16-26 linked within the base module)	

Analogue input/output (failsafe)
PSSu E F AI U

Connecting the module

Input circuit	Without C-rail	With C-rail
Voltage range -10.24 V ... +10.2375 V Dual-pole, differential input		
Voltage range -10.24 V ... +10.2375 V Differential measurement referenced to earth In a noise susceptible environment		

Analogue input/output (failsafe)
PSSu E F AI U

Technical details

General	312265	314265	315265
Approvals	CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CE, TÜV
Application range	Failsafe	Failsafe	Failsafe
Module's device code	0B00h	0B00h	0B00h
Number of FS input bits	16	16	16
Application in system environment B			
From FS firmware version, head modules	1.0.0	1.0.0	1.5.0
Electrical data	**312265**	**314265**	**315265**
Internal supply voltage (module supply)			
Module's power consumption	0,22 W	0,22 W	0,22 W
Periphery's supply voltage (periphery supply)			
Voltage range	16,8 - 30 V	16,8 - 30 V	16,8 - 30 V
Module's current consumption with no load	34 mA	34 mA	34 mA
Module's power consumption with no load	0,58 W	0,58 W	0,58 W
Max. power dissipation of module	0,8 W	0,8 W	0,8 W
Analogue inputs	**312265**	**314265**	**315265**
Number of analogue inputs	1	1	1
Type of analogue inputs	Voltage	Voltage	Voltage
Input area	-10.24 V ... +10.2375 V	-10.24 V ... +10.2375 V	-10.24 V ... +10.2375 V
Input filter	RC filter	RC filter	RC filter
Cutoff frequency	82 Hz	82 Hz	82 Hz
Voltage measurement			
Value of least significant bit (LSB)	2,5 mV	2,5 mV	2,5 mV
Input resistance	57 kOhm	57 kOhm	57 kOhm
Max. continuous voltage	60 V	60 V	60 V
Resolution	13 Bit	13 Bit	13 Bit
Max. common mode voltage	40 V	40 V	40 V

Analogue input/output (failsafe)
PSSu E F AI U

Analogue inputs	312265	314265	315265
Safety-related accuracy (1 input)	**5 %**	**5 %**	**5 %**
Deviations from the measuring range limit value			
Linearity error	**0,05 %**	**0,05 %**	**0,05 %**
Output variable error at 25 °C	**0,4 %**	**0,4 %**	**0,4 %**
Temperature coefficient	**0,003 %/K**	**0,003 %/K**	**0,003 %/K**
Max. measurement error during EMC test	**1 %**	**1 %**	**1 %**
Potential isolation between input and periphery supply	**yes**	**yes**	**yes**
Inputs	**312265**	**314265**	**315265**
Potential isolation between input and internal module bus voltage	**yes**	**yes**	**yes**
Environmental data	**312265**	**314265**	**315265**
Application site			
In accordance with the standard	–	–	**EN 50125-3**
Application site	–	–	**Track area (1 m - 3 m)**
In accordance with the standard	–	–	**EN 61373**
Application site	–	–	**Category 1, Class A + B**
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**	**EN 50125-1, EN 50125-3, EN 50155, EN 60068-2-1, EN 60068-2-14, EN 60068-2-2**
Ambient temperature			
In accordance with the standard	**EN 60068-2-14**	**EN 60068-2-14**	**EN 50155**
Temperature range	**0 - 60 °C**	**-40 - 70 °C**	**-40 - 70 °C**
In accordance with the standard	–	–	**EN 50125-1**
Temperature range	–	–	**-40 ... +70 °C**
In accordance with the standard	–	–	**EN 50125-3**
Temperature range	–	–	**-40 ... +70 °C**
Storage temperature			
In accordance with the standard	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**	**-40 - 70 °C**	**-40 - 70 °C**

Analogue input/output (failsafe)
PSSu E F AI U

Environmental data	312265	314265	315265
Climatic suitability			
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**	–
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	–
Condensation during operation	**Not permitted**	**ISO 16750-4**	–
Max. operating height above sea level	**2000 m**	**5000 m**	**2000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 50125-3**
Frequency	**10 - 150 Hz**	**10 - 1000 Hz**	**5 - 2000 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	–
Acceleration	**1g**	**5g**	**0,23g**
Broadband noise			
In accordance with the standard	–	**EN 60068-2-64**	**EN 61373**
Frequency	–	**5 - 500 Hz**	**5 - 150 Hz**
Acceleration	–	**1,9grms**	**0,79 g RMS**
Shock stress			
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 50125-3**
Number of shocks	**6**	**6**	**20**
Acceleration	**15g**	**15g**	**2g**
Duration	**11 ms**	**11 ms**	**11 ms**
In accordance with the standard	–	–	**EN 61373**
Number of shocks	–	–	**20**
Acceleration	–	–	**5g**
Duration	–	–	**30 ms**
Supply interruptions			
In accordance with the standard	–	–	**EN 50155**
Class	–	–	**S2, C1, C2**
Airgap creepage			
In accordance with the standard	**IEC 60664-1**	**IEC 60664-1**	**EN 50124-1**
Overvoltage category	**II**	**II**	**OV2**
Pollution degree	**2**	**2**	**PD2**

Analogue input/output (failsafe)
PSSu E F AI U

Environmental data	312265	314265	315265
Protection type			
In accordance with the standard	**EN 60529**	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**	**IP20**
Terminals	**IP20**	**IP20**	**IP20**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP51**
Mechanical data	**312265**	**314265**	**315265**
Material			
Bottom	**PC**	**PC**	**PC**
Front	**PC**	**PC**	**PC**
Coding	**PA**	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Dimensions			
Height	**76 mm**	**76 mm**	**76 mm**
Width	**12,6 mm**	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**	**60,2 mm**
Weight	**35 g**	**37 g**	**37 g**
Mechanical coding			
Type	**M**	**M**	**M**
Colour	**Yellow**	**Yellow**	**Yellow**

Where standards are undated, the 2005-04 latest editions shall apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
2-channel	**PL e**	**Cat. 4**	**SIL CL 3**	**4,37E-09**	**SIL 3**	**2,99E-05**	**20**

If the module is operated at an ambient temperature above 60° C, the values stated in the table for PFH_D and PFD will need to be doubled when a safety function is calculated.

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

Analogue input/output (failsafe)
PSSu E F AI U

Order reference

Product

Product type	Features	Order no.
PSSu E F AI U	Electronic module, base type	312 265
PSSu E F AI U-T	Electronic module, T-type	314 265
PSSu E F AI U-R	Electronic module, R-type	315 265

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C 1/12 S	Base module with C-rail and screw terminals	312 620
PSSu BP-C 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 620
PSSu BP-C 1/12 C	Base module with C-rail and cage clamp terminals	312 621
PSSu BP-C 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 621

Counter modules (standard)

Counter modules (standard)

Counter modules (standard)
PSSu E S ABS SSI

Overview

Module features

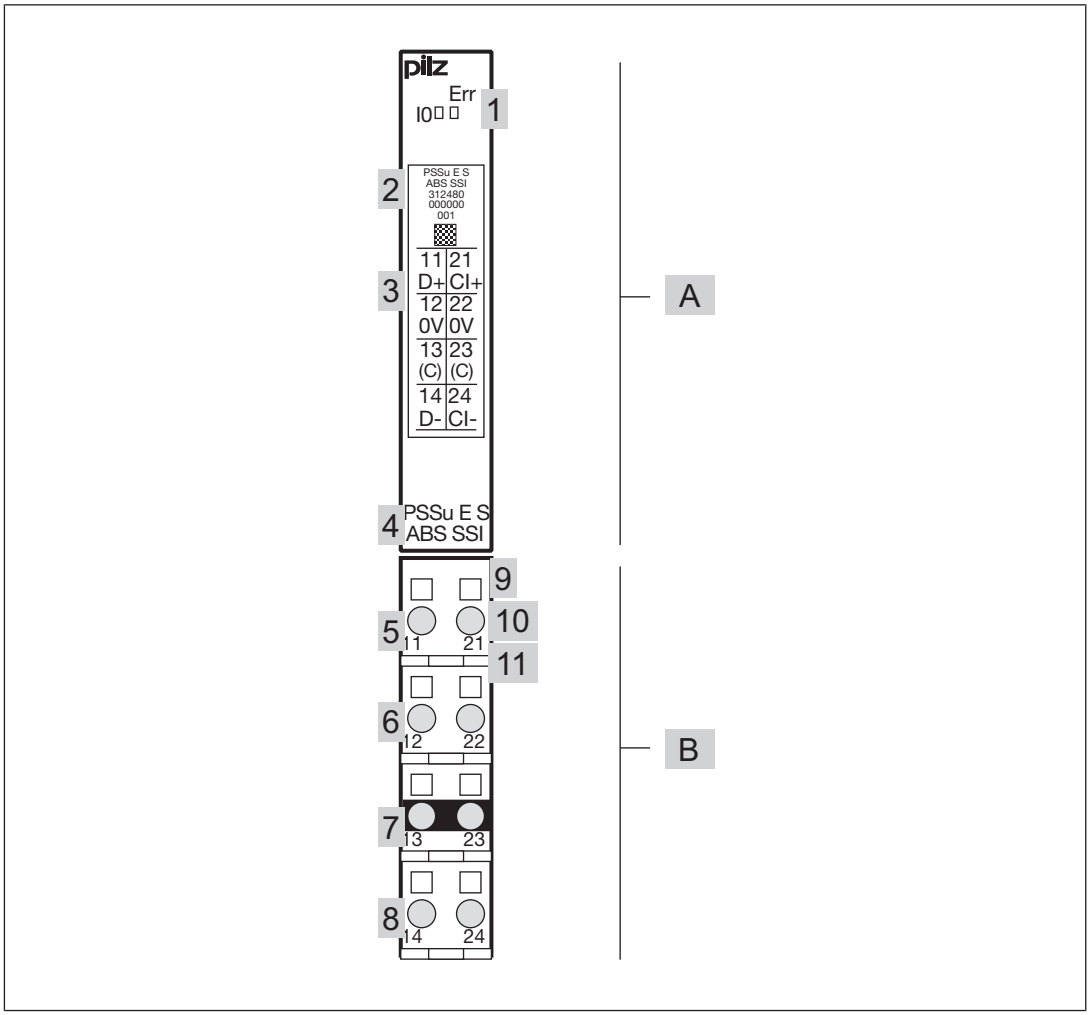
The product has the following features:

- Counter input (data)
  - Input data length up to max. 32 Bit
  - Differential input
- Test pulse output (clock) for requesting data
  - Differential output
- Transmission rate up to max. 1.5 MHz
- LED-Anzeigen für:
  - Data transfer
  - Module error
- For standard applications in system environment A and B
- T-type:

  PSSu E S ABS SSI-T: for increased environmental requirements

Counter modules (standard)
PSSu E S ABS SSI

Front view



Legend:

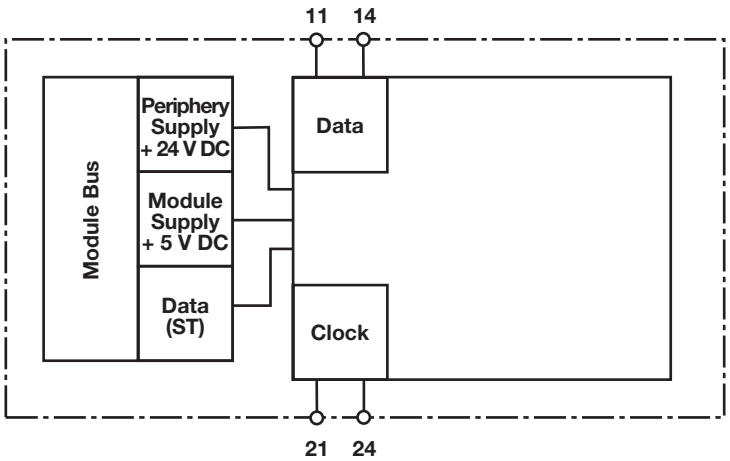
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Status of the data transfer
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Counter modules (standard)
PSSu E S ABS SSI

- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1 (terminals 11, 21)
- 6: Connection level 2 (terminals 12, 22)
- 7: Connection level 3 (terminals 13, 23)
- 8: Connection level 4 (terminals 14, 24)
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Counter modules (standard)
PSSu E S ABS SSI

Module features

Module supply

- The module supply provides the module with voltage.

Periphery supply

- The supply for the test pulse output is generated from the periphery supply. It is galvanically isolated from the periphery supply.

As part of each cycle the module sends a pulse sequence at the test pulse output (Cl) to the SSI absolute encoder. In turn the encoder transmits its position data. The position data is read in at the module's input (D) (see timing diagram: SSI data transfer).

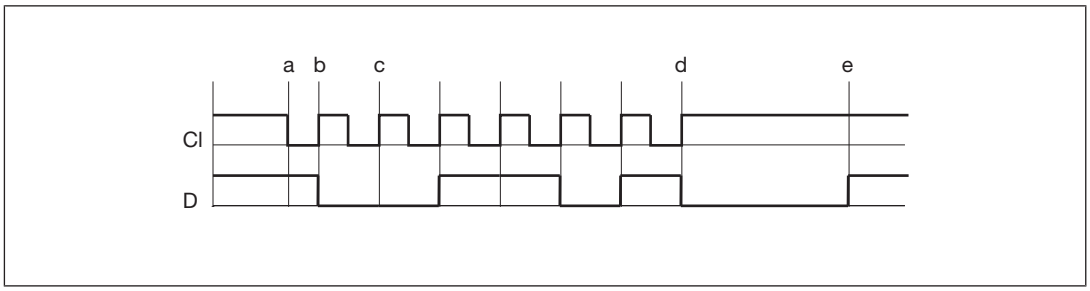
With the system software the user can set the following values to adapt the module to the encoder or higher level control system:

- Transmission rate
  The frequency of the pulses at the test pulse output (Cl) determines the transmission rate. The user can adapt the frequency to the encoder in a range from 62.5 kHz up to 1.5 MHz (see Technical Details).
- Input data length:
  The module's input data length must be adjusted to the data length of the absolute encoder.
  The module can process up to 32 Bits. The default is 24 Bits.
- Data format:
  The data format in which the module transmits the position data of the connected absolute encoder to the head module.
  - Gray code (default)
  - Binary code

The position data is transmitted to the head module via the ST module bus with 4 Bytes, irrespective of the configured input data length. The module sends additional status information.

Counter modules (standard)
PSSu E S ABS SSI

Timing diagram: Example of SSI data transfer:



Legend:

The bit width in the example is 6. The position of the encoder is 001101 in gray code, i.e. 9_D.

- a: Data transfer begins with a falling edge at the Cl signal.
- b: The first bit is transmitted with the first rising edge from the Cl signal.
- c: The time up to the second rising edge is the period length T. 1/T is the signal frequency.
- d: The last rising edge from the Cl signal ends the transfer. The encoder acknowledges the end of the transfer with a 0 signal.
- e: The encoder can transfer data again as soon as there is a 1 signal at input D.

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Counter modules (standard)
PSSu E S ABS SSI

Configuration

The module has the following configuration options:

Configuration	Default value	Meaning
Transmission rate	250 kHz	62.5 kHz 100 kHz 125 kHz 250 kHz 500 kHz 1 MHz 1.5 MHz
Gray code format	On	On: Gray code is activated. Off: Binary code is activated.
Fault detection within the data frame[1]	On	On: Errors within the data frame are identified. Off: Errors within the data frame are ignored.
Input data length	24	2 ... 32 Bit

[1] An error within the data frame means that the absolute encoder does not terminate the serial data transfer with a zero.

In the PII the module occupies

- 32 bits with position data
- 8 bits with the status byte

Description	ST-PII bit assignment LSB … MSB	Notes
Status byte	0 … 7	See "Status byte assignment" table
Position data	8 … 39	Measured value

Status byte assignment:

Meaning	Bit	Assignment
Data frame	0	0: No error within the data frame 1: Data frame faulty[1]
SSI input	1	0: Counter input active 1: Counter input passive
Reserved	2	-
Reserved	3	-
Reserved	4	-
Reserved	5	-
Module	6	0: No error within the module 1: Module is faulty

Counter modules (standard)
PSSu E S ABS SSI

Meaning	Bit	Assignment
Reserved	7	-

(1) "Data frame faulty" indicates that the module is receiving faulty values or no values from the absolute encoder.

- Possible cause for faulty receipt of data:
  - max. input data length of 32 bit exceeded
- Possible cause for not receiving data:
  - Open circuit
  - Absolute encoder is not connected.

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

I/O data name	I/O data type	I/O data element	Meaning
InputData	ST_I_ABS_SSI	Data: DWORD	Current position data
		InputError: BOOL	FALSE: Counter input active TRUE: Counter input passive
		DataFrameError: BOOL	FALSE: No error within the data frame TRUE: Data frame faulty(1)
		ModuleError: BOOL	FALSE: No error within the module TRUE: Module is faulty

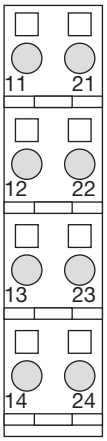
(1) "Data frame faulty" indicates that the module is receiving faulty values or no values from the absolute encoder.

- Possible cause for faulty receipt of data:
  - max. input data length of 32 bit exceeded
- Possible cause for not receiving data:
  - Open circuit
  - Absolute encoder is not connected.

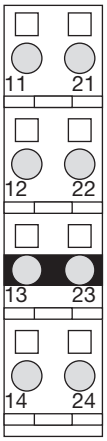
Counter modules (standard)
PSSu E S ABS SSI

Wiring

Terminal configuration

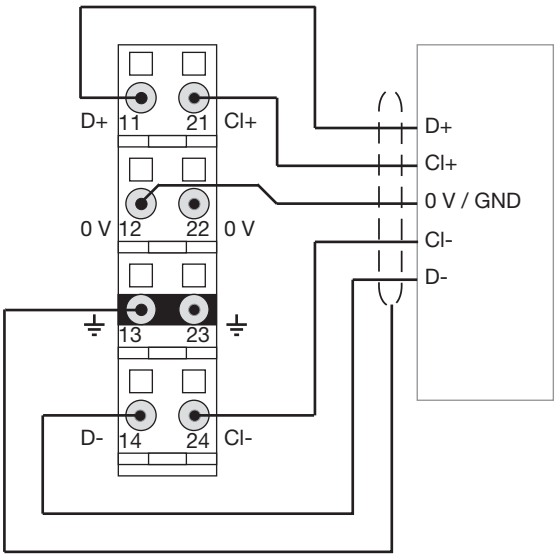
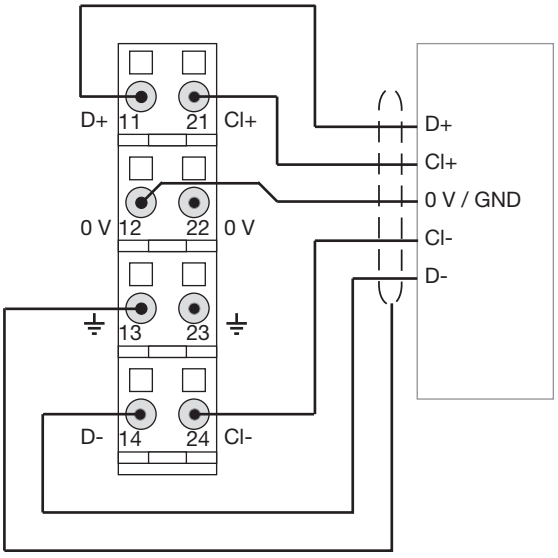
Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Input D+ (Data +) 21: Output Cl+ (Clock +) 12-22: 0 V counter (12-22 linked within the base module) 13-23: Shield connection (13-23 linked within the base module) 14: Input D- (Data -) 24: Output Cl- (Clock -)	

Counter modules (standard)
PSSu E S ABS SSI

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Input D+ (Data +) 21: Output Cl+ (Clock +) 12-22: 0 V counter (12-22 linked within the base module) 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Input D- (Data -) 24: Output Cl- (Clock -)	

Counter modules (standard)
PSSu E S ABS SSI

Connecting the module

Input and output circuit	
Connecting an SSI encoder (master mode) With C-rail Encoder supply via the PSSu E PD module 0 V connection is not absolutely essential.	
Connecting an SSI encoder (master mode) Without C-rail Encoder supply via the PSSu E PD module 0 V connection is not absolutely essential.	

Counter modules (standard)
PSSu E S ABS SSI

Technical details

General	312480	314480
Approvals	**CE, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0320h**	**0320h**
Number of ST input bits	**32**	**32**
Number of ST status bits	**8**	**8**
Application in system environment A		
From ST firmware version, other head modules	**11**	**11**
From ST firmware version PSSu H S PN	**2**	**2**
From ST firmware version PSSu WR S IDN	**4**	**4**
Application in system environment B		
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312480**	**314480**
Internal supply voltage (module supply)		
Module's power consumption	**0,51 W**	**0,51 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**10 mA**	**10 mA**
Module's power consumption with no load	**0,24 W**	**0,24 W**
Max. power dissipation of module	**0,75 W**	**0,75 W**
Absolute encoder input	**312480**	**314480**
Number of counter inputs	**1**	**1**
Type of counter inputs	**SSI encoder**	**SSI encoder**
Output signal (clock)	**Differential signal (RS 422)**	**Differential signal (RS 422)**
Max. number of bits on the counter input	**32 Bit**	**32 Bit**
Transmission rate	**62,5 kHz, 100,0 kHz, 125,0 kHz, 250,0 kHz, 500,0 kHz, 1.000,0 kHz, 1.500,0 kHz**	**62,5 kHz, 100,0 kHz, 125,0 kHz, 250,0 kHz, 500,0 kHz, 1.000,0 kHz, 1.500,0 kHz**
Coding of the input signal	**Binary, Gray**	**Binary, Gray**
Signal at the data input	**Differential signal (RS 422)**	**Differential signal (RS 422)**

Counter modules (standard)
PSSu E S ABS SSI

Absolute encoder input	312480	314480
Potential isolation between input/ output and periphery supply	**yes**	**yes**
Potential isolation between input/ output and voltage for the internal module bus	**yes**	**yes**
Typ. processing time	**0,1 ms**	**0,1 ms**
Environmental data	**312480**	**314480**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 1000,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**5g**
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**

Counter modules (standard)
PSSu E S ABS SSI

Environmental data	312480	314480
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**25g**
Duration	**16 ms**	**6 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312480**	**314480**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**36 g**	**37 g**
Mechanical coding		
Type	**F**	**F**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2005-04 latest editions shall apply.

Counter modules (standard)
PSSu E S ABS SSI

Order reference

Product

Product type	Features	Order No.
PSSu E S ABS SSI	Electronic module	312 480
PSSu E S ABS SSI-T	Electronic module, T-type	314 480

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623
PSSu BP-C1 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 623

Counter modules (standard)
PSSu E S INC

Overview

Module features

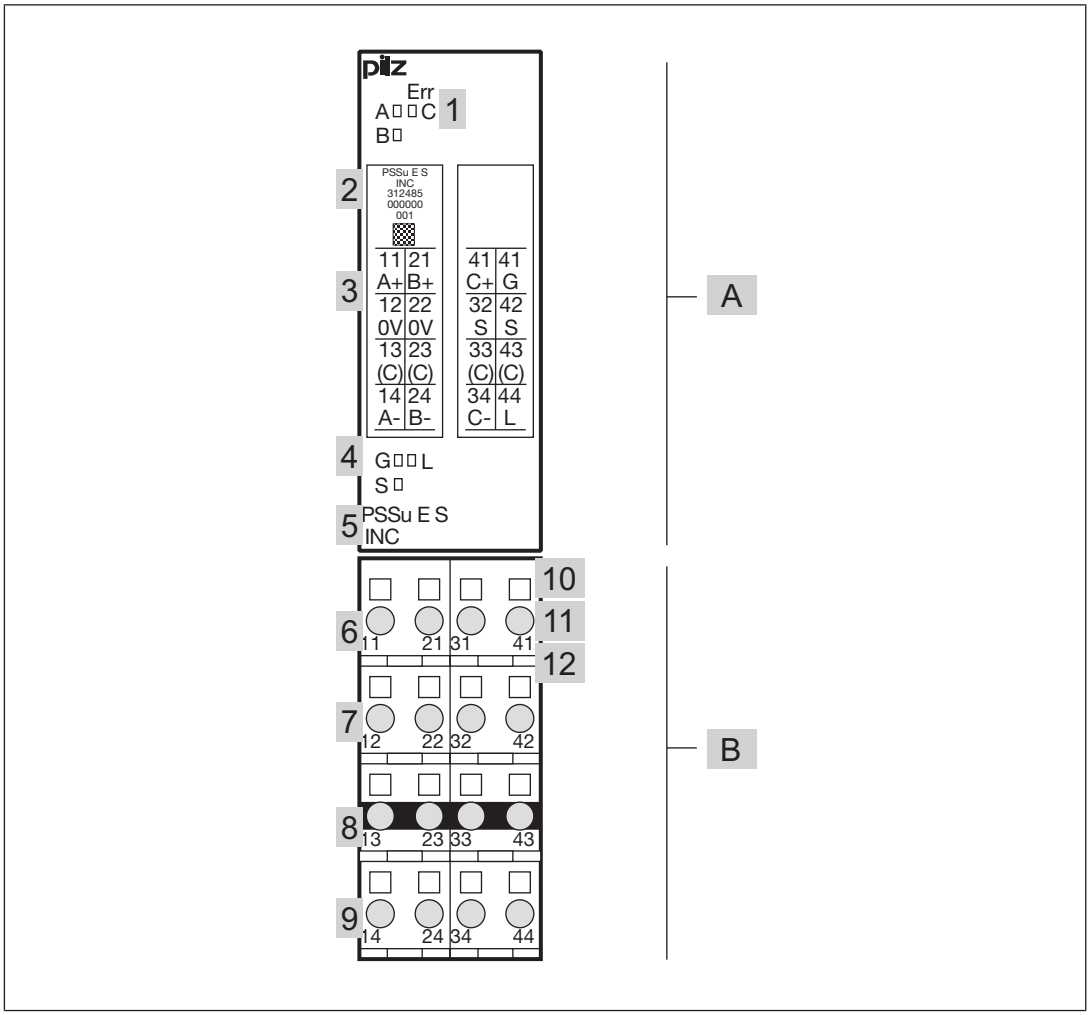
The product has the following features:

- Inputs for
  - Counter pulses (inputs A, B)
  - Zero pulse (input C)
  - Stopping the counter (input G, Gate)
  - Memory function (Input L, Latch)
  - Rotary encoder status (Input S, Status)
- Resolution of the counter and latch memory: 32 Bit
- Operating modes:
  - Incremental encoder
  - Counter
- Inputs A, B, C are operated as differential inputs with inverted signals (A-, B-, C-).
- Pulse multiplication (up to four times)
- LEDs for:
  - Data transfer per input A, B, C
  - Status per functional input (Gate, Latch, Status)
  - Module error
- For standard applications in system environment A and B
- T-type:

  PSSu E S INC-T: for increased environmental requirements

Counter modules (standard)
PSSu E S INC

Front view



Legend:

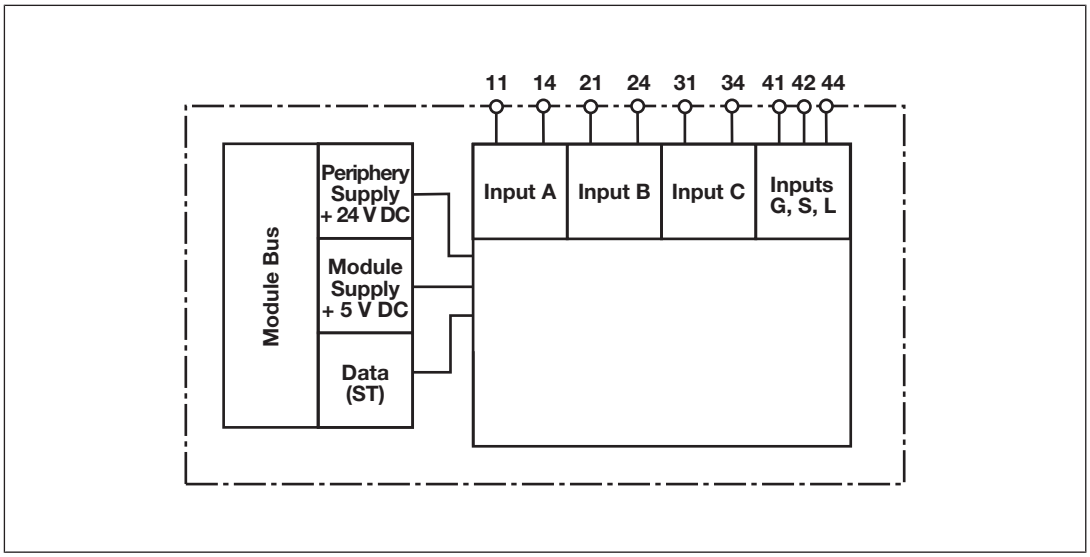
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Status of the input channels A, B, C
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Counter modules (standard)
PSSu E S INC

- 3: Labelling strip for the terminal configuration on the base module
- 4: LEDs for
  - Status of function inputs G, L, S
- 5: Name of electronic module
- 6: Connection level 1 (terminals 11, 21, 31, 41)
- 7: Connection level 2 (terminals 12, 22, 32, 42)
- 8: Connection level 3 (terminals 13, 23, 33, 43)
- 9: Connection level 4 (terminals 14, 24, 34, 44)
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Counter modules (standard)
PSSu E S INC

Module features

Module supply

- The module supply provides the module with voltage.

Inputs

- 3 dual-pole, differential inputs A, B, C for connecting an incremental encoder or an encoder that provides rising edges as counter pulses.
- 3 single-pole inputs referenced to earth: G, L, S, for special functions

Operating modes

- Incremental encoder
- Counter

Functions

- Period length measurement
  or
- Storing the counter status in latch memory after a latch pulse or zero pulse
- Setting the counter status

The module transfers the data and status information to the head module via the module bus. The choice of function and the function's configuration are defined via the system software.

The single-pole inputs (G, L, S) are used for special functions. Inputs G and L may be connected to external signal sources, e.g. to a higher order control system.

- Input G (gate input)
  The counter is stopped with a 1 signal. The module ignores the counter pulses at the inputs until a 0 signal returns.
- Input L (input for latch pulse)
  At a rising edge, the module stores the current counter value in the latch memory. The counter continues counting; it is not stopped by the latch pulse. The module transmits the stored value to the head module. The period length measurement may be configured as an alternative to the latch function.
- Input S (status input)
  The encoder's fault signal output can be connected to the status input. The module transmits the input state to the head module with the status information.

In both operating modes the counter can accept values from 0000 0000_H to FFFF $FFFF_H$.

- With an underflow the value drops below 0000 0000_H and the counter continues from FFFF $FFFF_H$.
- With an overflow the value FFFF $FFFF_H$ is exceeded and the counter continues from 0000 0000_H.

The overflow or underflow is signalled to the head module as status information.

Counter modules (standard)
PSSu E S INC

The status information overflow is reset:

- if the value again falls below 0000 0000_H (underflow).
- if 5555 0000_H is exceeded (the lower third of the value range).

The status information underflow is reset:

- if FFFF $FFFF_H$ is exceeded again (overflow).
- if AAAA $FFFF_H$ is exceeded (the upper third of the value range).

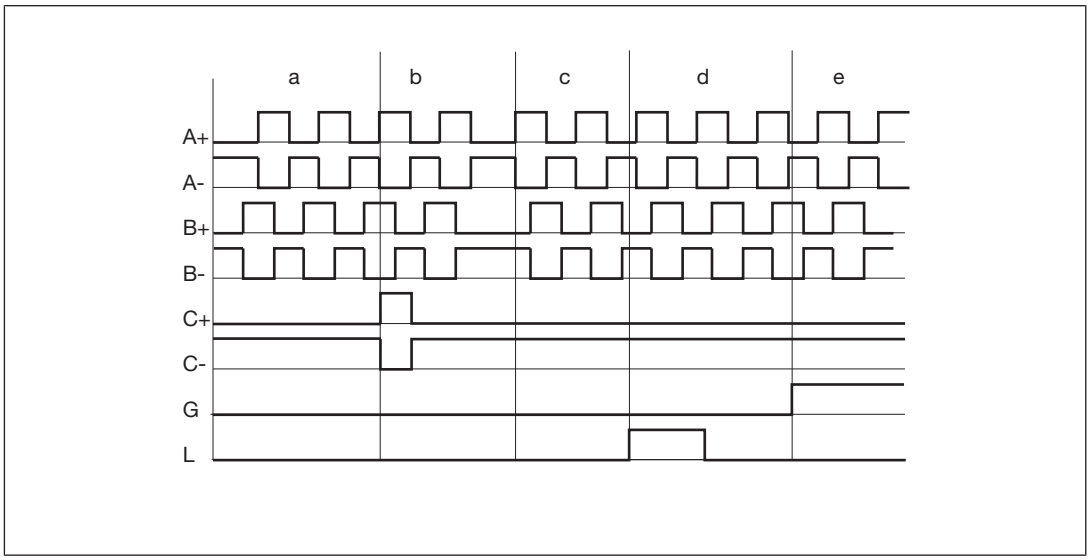
When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

The counter outputs and the output for the incremental encoder's zero pulse are connected to the dual-pole inputs (A, B, C).

- Inputs A, B
  The first channel of the encoder is connected to input A, the second to input B. The second channel is 90° out of phase. If channel A is leading, the module counts forwards. If channel A is lagging, the module counts backwards (see timing diagram).
- Input C
  The output for the incremental encoder's zero pulse is connected to input C. An incremental encoder typically supplies one zero pulse per rotation. If the zero pulse function is activated, the module copies the last value prior to the zero pulse into the latch memory and passes it to the process image of inputs (see chapter entitled "Transfer counter status via latch pulse").

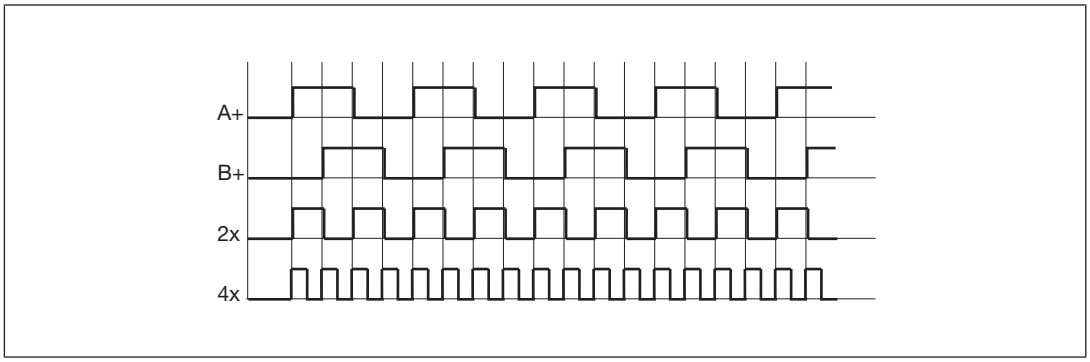


Counter modules (standard)
PSSu E S INC

Legend:

- a: The counter counts backwards because the signal at channel A is lagging.
- b: The module has received a zero pulse. Provided the function is activated, the counter value is copied into the latch memory with a rising edge at input C+.
- c: The counter counts forwards because the signal at channel A is leading.
- d: The module has received a latch pulse. Provided the function is activated, the counter value is copied into the latch memory with a rising edge at input L.
- e: The counter is disabled because there is a 1 signal at input G.

The module can evaluate the counter pulses once, twice or four times (configuration in the PSSu Configurator or PAS4000).



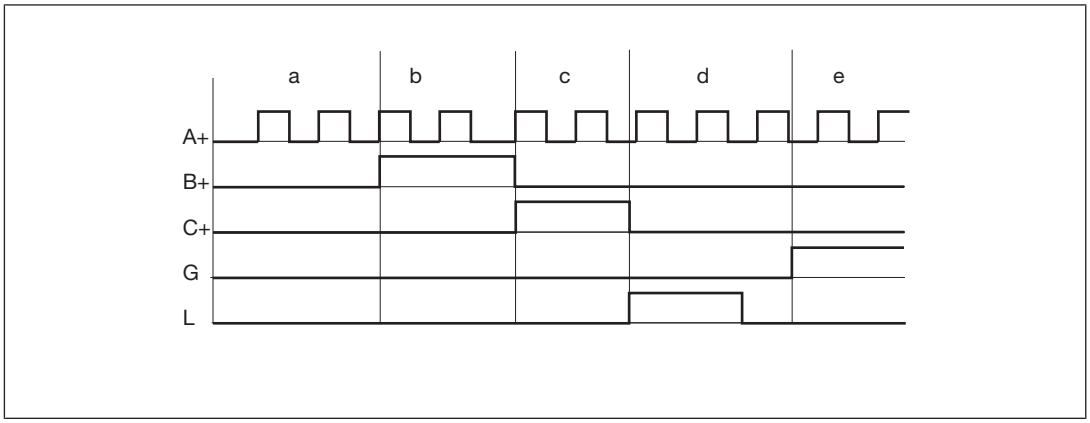
- Single evaluation:
  Each rising edge at channel A increases the counter status.
- Double evaluation:
  Each rising and each falling edge at channel A increases the counter status.
- Quadruple evaluation (default):
  Each rising and each falling edge at channel A and channel B increases the counter status.

"Counter" operating mode is not recommended for safety functions because pulses can be generated if there are any track errors. Compare errors can arise as a result, which can lead to a shutdown or to common cause errors.

In "Counter" operating mode, the module's dual-pole, differential inputs A, B, C have the following functions:

- Input A (Count)
  Input A is the input for the encoder's counter pulses. The module counts each rising edge.
- Input B (Up/down)
  At a 0 signal the module counts forwards. At a 1 signal the module counts backwards.
- Input C (Gate/Latch)
  The counter is stopped with a 1 signal. The module ignores the counter pulses at the input until a 0 signal returns.

Counter modules (standard)
PSSu E S INC

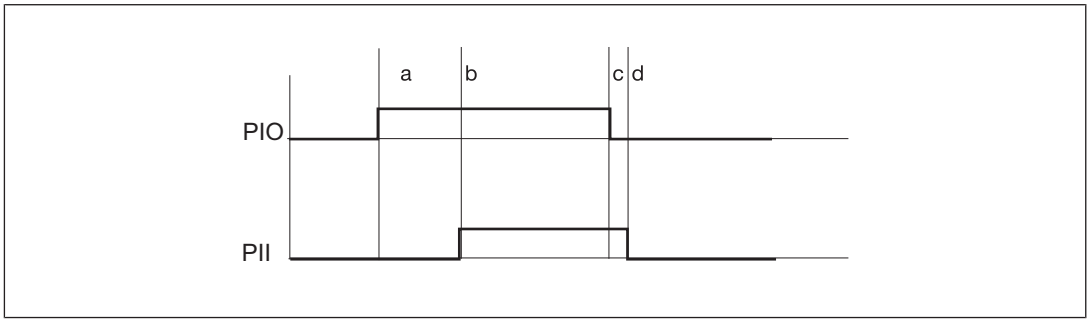


Legend:

- a: The counter counts forwards because there is 0 signal at channel B.
- b: At the next rising edge at channel A, the counter counts backwards because there is a 1 signal at channel B.
- c: The counter is disabled because there is a 1 signal at input C.
- d: The module has received a latch pulse. Provided the function is activated, the counter value is copied into the latch memory with a rising edge at input L.
- e: The counter is disabled because there is a 1 signal at input G.

The module can record the period length of the counter pulses on channel A. The period length is the time between two rising edges at channel A. It is transferred to the process image of inputs as multiple of 200 ns.

Prerequisite: This function is configured in the PSSu Configurator / PAS4000.



Legend:

- PIO: Bit 1 of the function call in the process image of outputs or I/O data OutputData.LatchOrMeasure
- PII: Bit 1 of the status byte in the process image of inputs or I/O data InputData.LatchOrMeasureDone

Counter modules (standard)
PSSu E S INC

Key to timing diagram:

Section	Function	Procedure for PSSu in system environment A	Procedure for PSSu in system environment B
a	Start measurement	In the user program, set Bit 1 of the function call	In the user program, set OutputData.LatchOrMeasure
b	Output measured value Set status bit	Measured value is transferred into the process image of inputs The module sets Bit 1 of the status byte	Measured value is written in InputData.LatchOrPeriod The module sets InputData.LatchOrMeasureDone
c	Finish measurement	In the user program, reset Bit 1 of the function call	In the user program, reset OutputData.LatchOrMeasure
d	Ready for new measurement	The module resets Bit 1 of the status byte	The module resets InputData.LatchOrMeasureDone

The result of the last period length measurement remains in the process image of inputs until the module signals a new measurement result by setting the status information. Before the initial measurement the process image of inputs contains 0000 0000_H or FFFF $FFFF_H$

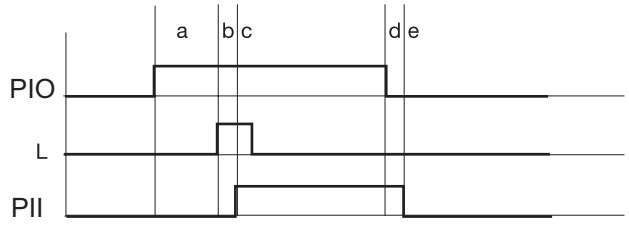
The module issues the result of period length measurement in multiples of 200 ns.

Example:

- The process image of inputs contains $32_H/50_D$
- The period length is 200 ns x 50 = 10 µs

A signal output can be connected to input L on the module for a latch pulse. The latch pulse may come from a PLC or position switch, for example. Using the latch function it is possible to record and transmit the counter status at the time of this latch pulse.

Prerequisite: This function is configured in the PSSu Configurator / PAS4000.



Legend:

- PIO: Bit 1 of the byte for function calls in the process image of outputs or I/O data OutputData.LatchOrMeasure
- L: Input L for external latch
- PII: Bit 1 of the status byte in the process image of inputs or I/O data InputData.LatchOrMeasureDone

Counter modules (standard)
PSSu E S INC

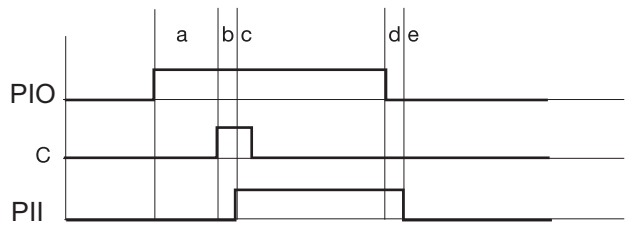
Key to timing diagram:

Section	Function	Procedure for PSSu in system environment A	Procedure for PSSu in system environment B
a	Activate latch function	In the user program, set Bit 1 of the function call	In the user program, set OutputData.LatchOrMeasure
b	Fill latch memory	Rising edge at input L: Counter status is transferred to the latch memory	Rising edge at input L: Counter status is transferred to the latch memory
c	Output counter status Set status bit	Counter status is transferred to the process image of inputs The module sets Bit 1 of the status byte	Counter status is written in InputData.LatchOrPeriod The module sets InputData.LatchOrMeasureDone
d	Finish latch function	In the user program, reset Bit 1 of the function call	In the user program, reset OutputData.LatchOrMeasure
e	Ready for new latch function	The module resets Bit 1 of the status byte	The module resets InputData.LatchOrMeasureDone

The contents of the latch memory remains in the process image of inputs until the module signals a new memory value by setting the status information. Before the initial transfer the process image of inputs contains 0000 0000_H or FFFF $FFFF_H$

The module always transmits the counter status when the first latch pulse occurs after the function has started. All subsequent latch pulses are ignored until the function is completed and reset.

The output for the incremental encoder's zero pulse is connected to input C (C+/C-). An incremental encoder typically supplies one zero pulse per rotation. Using the zero pulse function it is possible to record the last counter status before the zero pulse and transmit it via the process image of inputs.



Legend:

- PIO: Bit 0 of the function call in the process image of outputs or I/O datum OutputData.ZeroPulseActive
- C: Input C
- PII: Bit 0 of the status byte in the process image of inputs or I/O datum InputData.ZeroPulse

Counter modules (standard)
PSSu E S INC

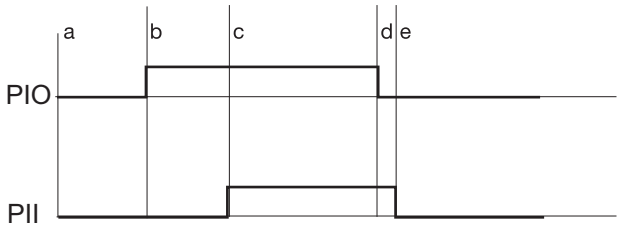
Key to timing diagram:

Section	Function	Procedure for PSSu in system environment A	Procedure for PSSu in system environment B
a	Activate zero pulse function	In the user program, set Bit 0 of the function call	In the user program, set OutputData.ZeroPulseActiv
b	Fill latch memory	Rising edge at input C: Counter status is transferred to the latch memory	Rising edge at input C: Counter status is transferred to the latch memory
c	Output counter status Set status bit	Counter status is transferred to the process image of inputs The module sets Bit 0 of the status byte	Counter status is written in InputData.LatchOrPeriod The module sets InputData.ZeroPulse
d	Finish zero pulse function	In the user program, reset Bit 0 of the function call	In the user program, reset OutputData.ZeroPulseActiv
e	Ready for new latch function	The module resets Bit 0 of the status byte	The module resets InputData.ZeroPulse

The zero pulse function has priority over the latch function and the "Period length measurement" function. If this function is activated, both the other functions are ignored, even if they have been activated.

The module always transmits the counter status when the first zero pulse occurs after the function has started. The counter statuses on all subsequent zero pulses are ignored until the function has been completed and reset.

The "Set counter status" function sets the counter to any value. The value is stated in the user program. The module transfers the value and continues counting from this counter status.



Legend:

- PIO: Bit 2 of the function call in the process image of outputs or I/O data OutputData.SetCounter
- PII: Bit 2 of the status byte in the process image of inputs or I/O data InputData.SetCounterDone

Counter modules (standard)
PSSu E S INC

Key to timing diagram:

Section	Function	Procedure for PSSu in system environment A	Procedure for PSSu in system environment B
a	Enter counter status	In the user program, write the default counter status in the process image of outputs	In the user program, assign the default counter status to OutputData.NewCounterValue
b	Transfer counter status	In the user program, set Bit 2 of the function call	In the user program, set OutputData.SetCounter
c	Acknowledge transfer	The module sets Bit 2 of the status byte; the underflow and overflow bits are reset	The module sets InputData.SetCounterDone; InputData.Underflow and InputData.Overflow are reset
d	Finish transfer	In the user program, reset Bit 2 of the function call	In the user program, reset OutputData.SetCounter
e	Ready for new function	The module resets Bit 2 of the status byte	The module resets InputData.SetCounterDone

Configuration

The module has the following configuration options:

Configuration	Default value	Meaning
Operating mode	X	Incremental encoder operating mode
		Counter operating mode
Signal for gate input	X	Input G disables at a 1 signal
		Input G disables at a 0 signal
Period length measurement or latch function	X	Latch function
		Period length measurement
Multiple evaluation	X	Quadruple evaluation
		Double evaluation
		Single evaluation
Status input	X	The status at input S is transmitted via a bit.
		The status is transmitted via two redundant bits.
		The status is transmitted via two diverse bits.(1)

(1) Transmitting the status via two bits enables simple fault detection: Two redundant bits must always be the same, two diverse bits must always be different, otherwise the transmission is faulty.

Counter modules (standard)
PSSu E S INC

In the PII the module occupies

- 32 Bits with counter data
- 32 Bits with data from the latch memory or with the result from the period length measurement
- 8 bits with the status byte

In the PIO the module occupies

- 32 Bits with the default counter status
- 8 Bits with function calls

Description	ST-PII bit assignment LSB … MSB	ST-PIO bit assignment LSB … MSB	Notes
Status byte	0 … 7		See "Status byte assignment" table
Current counter status	8 … 39		Measured value in incremental encoder or counter operating mode
Counter status from the latch memory or result from the period length measurement	40 … 71		Value recorded after a latch or zero pulse or period length
Byte for function calls		0 … 7	See table: "Overview of function calls"
Default counter status		8 … 39	Value at which the counter is set

Overview of function calls:

Function calls	Bit	Assignment
Transfer counter status via zero pulse	0	0: Input C (zero pulse) inactive 1: Input C (zero pulse) active
Transfer counter status via latch pulse or measure period length (1)	1	0: Input L (latch pulse) inactive/period length measurement inactive 1: Input L (latch pulse) active/period length measurement active
Set counter status	2	0: Do not transfer default counter status 1: Adopt default counter status
-	3 … 7	Reserved

(1) Whether the period length is measured or the latch pulse is evaluated, must be defined in the PSSu Configurator or PAS4000.

Counter modules (standard)
PSSu E S INC

Status byte assignment:

Meaning	Bit	Assignment
Zero pulse	0	0: No zero pulse at input C 1: Zero pulse at input C
Latch pulse or period length measurement	1	0: Period length or contents of latch memory not transferred 1: Period length or contents of latch memory transferred
Default counter status	2	0: Default counter status not transferred 1: Default counter status transferred
Counter underflow	3	0: No counter underflow 1: Counter underflow
Counter overflow	4	0: No counter overflow 1: Counter overflow
Status input S, Bit 1	5	0: Status input, Bit 1 (message from encoder) 1: Status input, Bit 1
Status input S, Bit 2	6	0: Status input, Bit 2 (1) 1: Status input, Bit 2
Reserved	7	-

(1) When configuring the module, users can determine the evaluation method for the status input: single, redundant or diverse. Transmitting the status via two bits enables simple fault detection: Two redundant bits must always be the same, two diverse bits must always be different, otherwise the transmission is faulty.

Counter modules (standard)
PSSu E S INC

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

I/O data name	I/O data type	I/O data element	Meaning
OutputData	ST_O_INC	ZeroPulseActiv: BOOL	FALSE: Input C (zero pulse) inactive TRUE: Input C (zero pulse) active
		LatchOrMeasure: BOOL	FALSE: Input L (latch pulse) inactive/period length measurement inactive TRUE: Input L (latch pulse) active/ period length measurement active
		SetCounter: BOOL	FALSE: Do not transfer default counter status TRUE: Adopt default counter status
		NewCounterValue: DWORD	Default counter status

Counter modules (standard)
PSSu E S INC

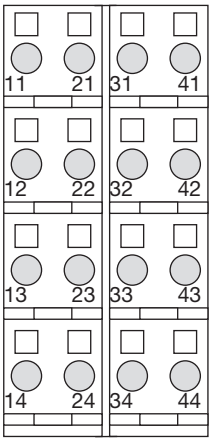
I/O data name	I/O data type	I/O data element	Meaning
InputData	ST_I_INC	CurrentData: DWORD	Current counter status in incremental encoder or counter operating mode
		LatchOrPeriod: DWORD	Counter status after a latch or zero pulse or period length
		ZeroPulse: BOOL	FALSE: No zero pulse at input C TRUE: Zero pulse at input C
		LatchOrMeasure-Done: BOOL	FALSE: Period length or contents of latch memory not transferred TRUE: Period length or contents of latch memory transferred
		SetCounterDONE: BOOL	FALSE: Default counter status not transferred TRUE: Default counter status transferred
		Underflow: BOOL	FALSE: No counter underflow TRUE: Counter underflow
		Overflow: BOOL	FALSE: No counter overflow TRUE: Counter overflow
		State1: BOOL	FALSE: Status input, Bit 1 (message from encoder) TRUE: Status input, Bit 1
		State2: BOOL	FALSE: Status input, Bit 2 (1) TRUE: Status input, Bit 2

(1) When configuring the module, users can determine the evaluation method for the status input: single, redundant or diverse. Transmitting the status via two bits enables simple fault detection: Two redundant bits must always be the same, two diverse bits must always be different, otherwise the transmission is faulty.

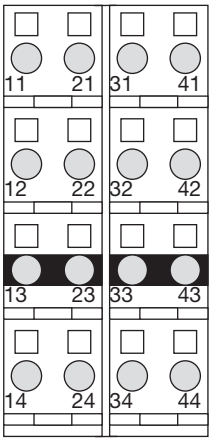
Counter modules (standard)
PSSu E S INC

Wiring

Terminal configuration

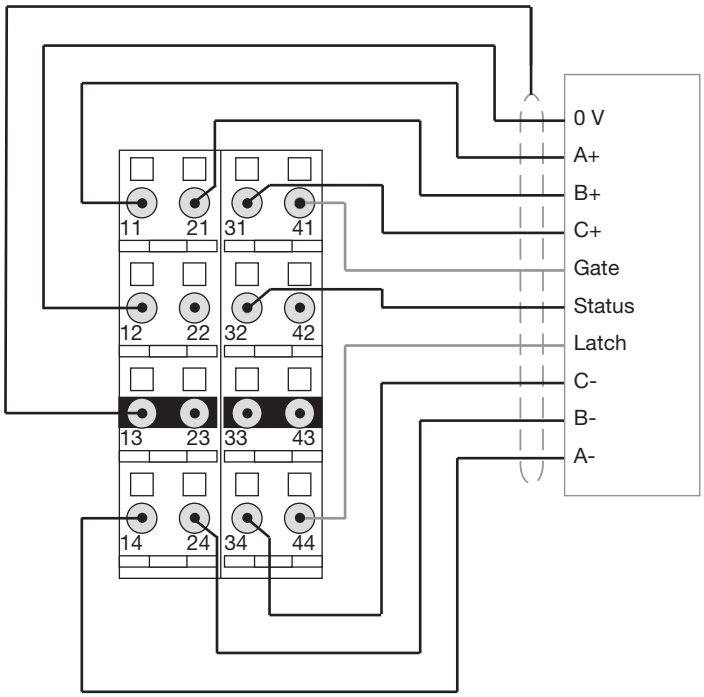
Base module	Terminal configuration	
Screw terminals: PSSu BP 2/16 S PSSu BP 2/16 S-T Cage clamp terminals: PSSu BP 2/16 C PSSu BP 2/16 C-T	Without C-rail: 11: Input A+ 21: Input B+ 31: Input C+ 41: Input G (Gate) 12-22: 0 V counter (12-22 linked within the base module) 32-42: Input S (Status) (32-42 linked within the base module) 13-23-33-43: Shield connection (13-23, 33-43 linked within the base module) 14: Input A- 24: Input B- 34: Input C- 44: Input L (Latch)	

Counter modules (standard)
PSSu E S INC

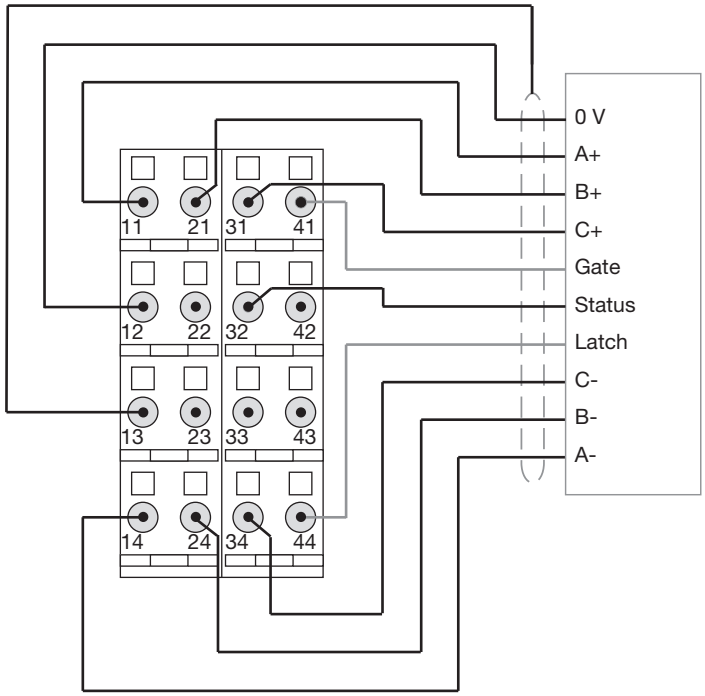
Base module	Terminal configuration	
Screw terminals: PSSu BP-C 2/16 S PSSu BP-C 2/16 S-T Cage clamp terminals: PSSu BP-C 2/16 C PSSu BP-C 2/16 C-T	With C-rail: 11: Input A+ 21: Input B+ 31: Input C+ 41: Input G (Gate) 12-22: 0 V counter (12-22 linked within the base module) 32-42: Input S (Status) (32-42 linked within the base module) 13-23-33-43: C-rail supply shield connection (13-23, 33-43 linked within the base module) 14: Input A- 24: Input B- 34: Input C- 44: Input L (Latch)	

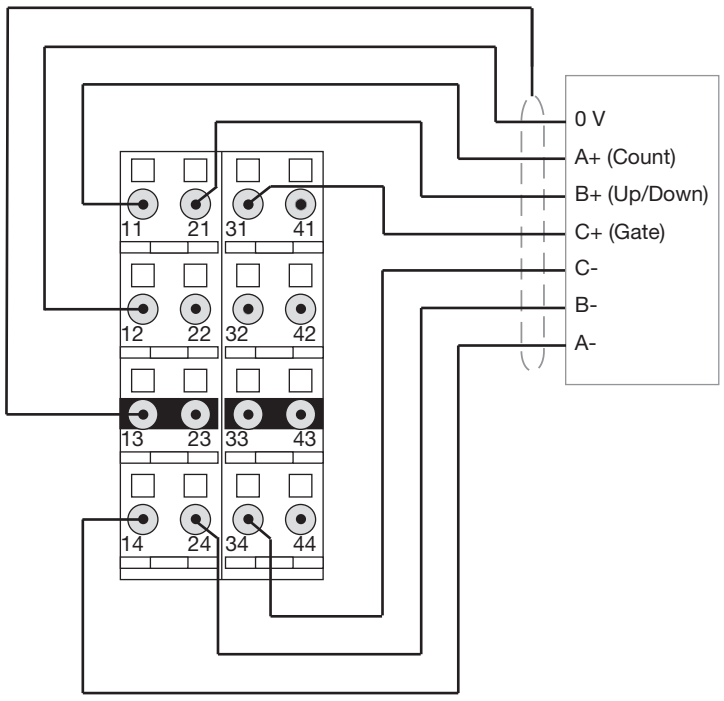
Counter modules (standard)
PSSu E S INC

Connecting the module

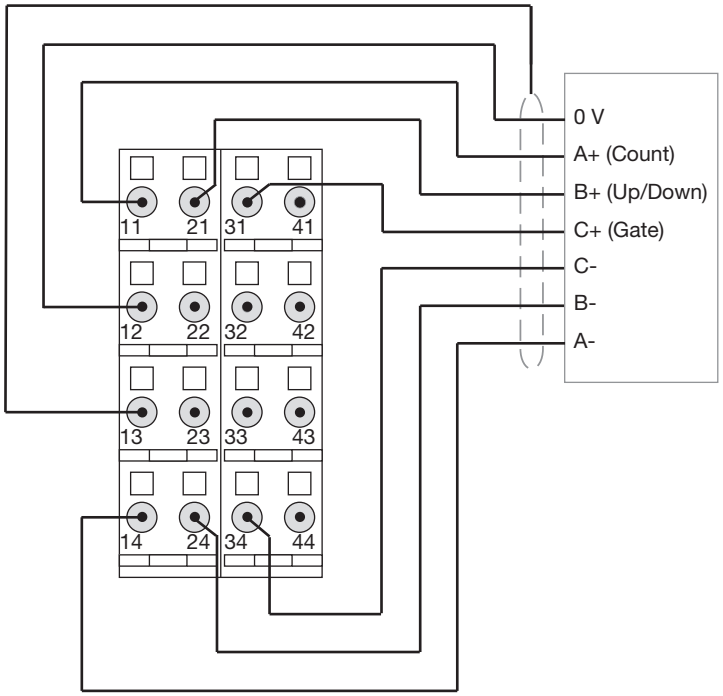
Incremental encoder operating mode	With C-rail
Encoder supply via the PSSu E PD module	

Counter modules (standard)
PSSu E S INC

Incremental encoder operating mode	Without C-rail
Encoder supply via the PSSu E PD module	

Counter operating mode	With C-rail
Encoder supply via the PSSu E PD module Function inputs (G, L, S) not connected.	

Counter modules (standard)
PSSu E S INC

Counter operating mode	Without C-rail
Encoder supply via the PSSu E PD module Function inputs (G, L, S) not connected.	

Counter modules (standard)
PSSu E S INC

Technical details

General	312485	314485
Approvals	**CE, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0321h**	**0321h**
Number of ST input bits	**64**	**64**
Number of ST output bits	**32**	**32**
Number of ST status bits	**8**	**8**
Number of ST control bits	**8**	**8**
Application in system environment A		
From ST firmware version, other head modules	**11**	**11**
From ST firmware version PSSu H S PN	**2**	**2**
From ST firmware version PSSu WR S IDN	**4**	**4**
Application in system environment B		
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312485**	**314485**
Internal supply voltage (module supply)		
Module's power consumption	**0,79 W**	**0,79 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**15 mA**	**15 mA**
Module's power consumption with no load	**0,37 W**	**0,37 W**
Max. power dissipation of module	**1,20 W**	**1,20 W**
Incremental encoder input	**312485**	**314485**
Number of counter inputs	**1**	**1**
Type of counter inputs	**Incremental encoder**	**Incremental encoder**
Signal at counter inputs A and B and/or C	**Differential signal (RS 422)**	**Differential signal (RS 422)**
Permitted low signal range on LATCH/GATE/STATUS signals	**-3 - 5 V**	**-3 - 5 V**
Permitted high signal range on LATCH/GATE/STATUS signals	**11 - 30 V**	**11 - 30 V**

Counter modules (standard)
PSSu E S INC

Incremental encoder input	312485	314485
Typ. input current of the LATCH and/or GATE and/or STATUS signals at low level	**0 mA**	**0 mA**
Typ. input current of the LATCH and/or GATE and/or STATUS signals at high level	**4,0 mA**	**4,0 mA**
Max. number of bits on the counter input	**32 Bit**	**32 Bit**
Evaluation of counter pulses	**1x, 2x, 4x**	**1x, 2x, 4x**
Phase offset between differential signals A and B	**90 deg**	**90 deg**
Phase offset tolerance	**30 deg**	**30 deg**
Maximum cutoff frequency	**5,0 MHz**	**5,0 MHz**
Time constant of input filter on LATCH signal	**50 µs**	**50 µs**
Time constant of input filter on GATE signal	**50 µs**	**50 µs**
Time constant of input filter on STATUS signal	**50 µs**	**50 µs**
Typ. processing time	**0,1 ms**	**0,1 ms**
Potential isolation between input/ output and periphery supply	**yes**	**yes**
Potential isolation between input/ output and voltage for the internal module bus	**yes**	**yes**
Environmental data	**312485**	**314485**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**

Counter modules (standard)
PSSu E S INC

Environmental data	312485	314485
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 1000,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**5g**
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**25g**
Duration	**16 ms**	**6 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312485**	**314485**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**25,2 mm**	**25,2 mm**
Depth	**60,2 mm**	**60,2 mm**

Counter modules (standard)
PSSu E S INC

Mechanical data	312485	314485
Weight	**49 g**	**52 g**
Mechanical coding		
Type	**F**	**F**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2005-04 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E S INC	Electronic module	312 485
PSSu E S INC-T	Electronic module, T-type	314 485

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 2/16 S	Base module without C-rail with screw terminals	312 628
PSSu BP 2/16 S-T	Base module without C-rail with screw terminals, T-type	314 628
PSSu BP 2/16 C	Base module without C-rail with cage clamp terminals	312 629
PSSu BP 2/16 C-T	Base module without C-rail with cage clamp terminals, T-type	314 629
PSSu BP-C 2/16 S	Base module with C-rail and screw terminals	312 630
PSSu BP-C 2/16 S-T	Base module with C-rail and screw terminals, T-type	314 630
PSSu BP-C 2/16 C	Base module with C-rail and cage clamp terminals	312 631
PSSu BP-C 2/16 C-T	Base module with C-rail and cage clamp terminals, T-type	314 631

Counter modules (standard)
PSSu E S INC 24V se

Overview

Module features

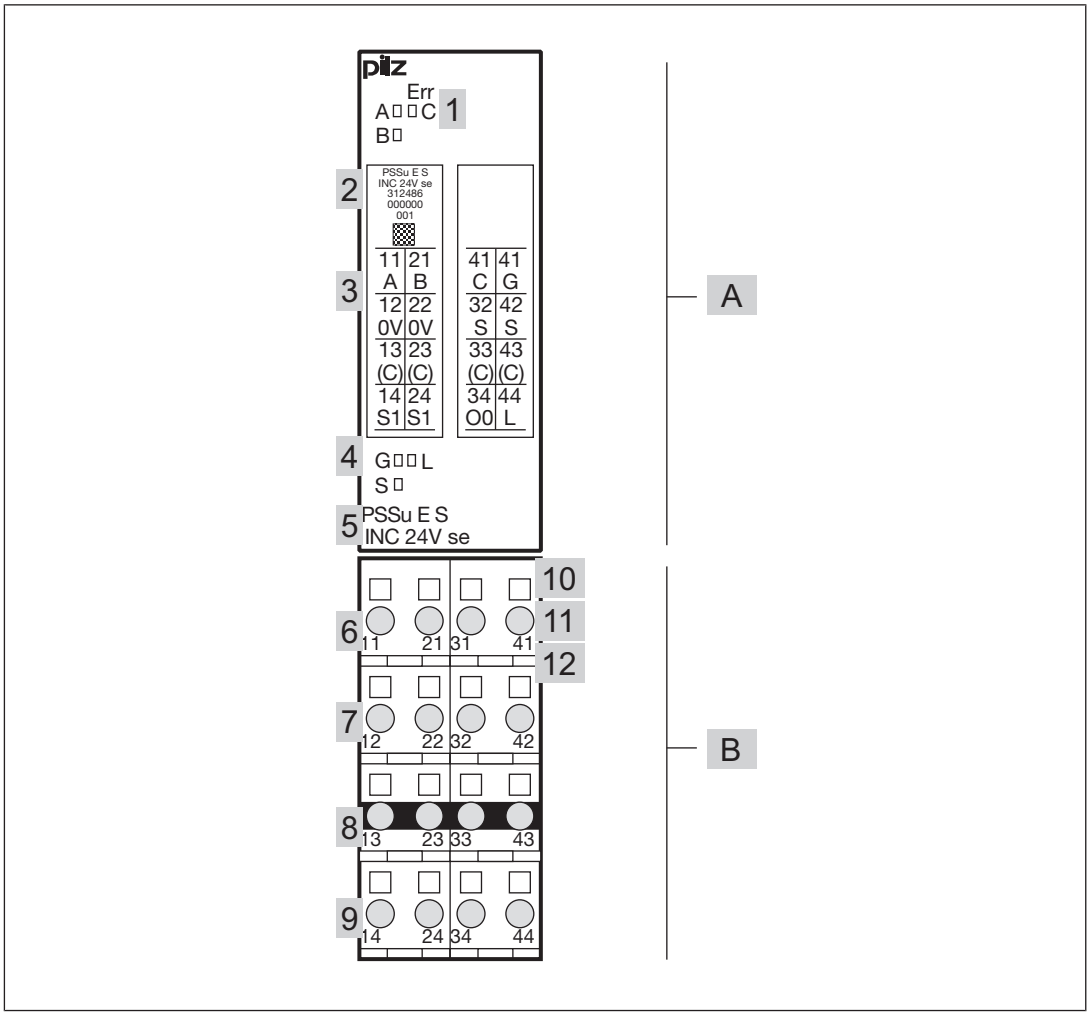
The product has the following features:

- Connection of a rotary encoder with HTL output signal
- Inputs for
  - Counter pulses (inputs A, B), single-pole, referenced to earth (single-ended)
  - Zero pulse (inputs C), single-pole, referenced to earth (single-ended)
  - Stopping the counter (input G, Gate)
  - Memory function (Input L, Latch)
  - Rotary encoder status (Input S, Status)
- Outputs:
  - 24 VDC supply voltage for encoder
  - 1 semiconductor output (switches depending on the counter status)
- Resolution of the counter and latch memory: 32 Bit
- Operating modes:
  - Incremental encoder
  - Counter
- Pulse multiplication (up to four times)
- No potential isolation between periphery supply and inputs/outputs
- LEDs for:
  - Data transfer per input A, B, C
  - Status per functional input (Gate, Latch, Status)
  - Module error
- For standard applications in system environment A and B
- T-type:

  PSSu E S INC 24V se-T: for increased environmental requirements

Counter modules (standard)
PSSu E S INC 24V se

Front view



Legend:

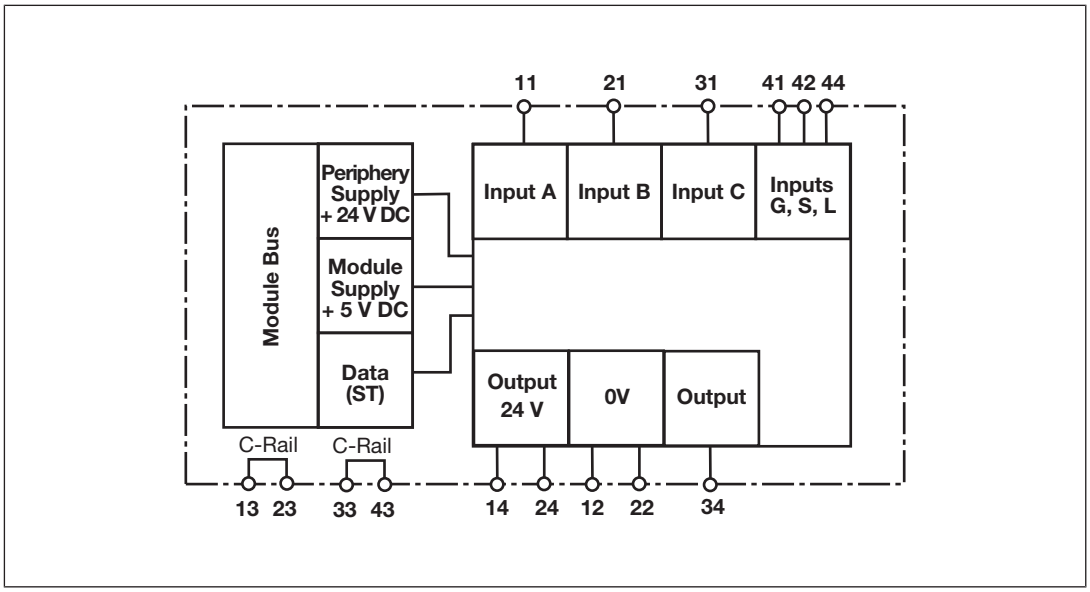
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Status of the input channels A, B, C
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Counter modules (standard)
PSSu E S INC 24V se

- 3: Labelling strip for the terminal configuration on the base module
- 4: LEDs for
  - Status of function inputs G, L, S
- 5: Name of electronic module
- 6: Connection level 1 (terminals 11, 21, 31, 41)
- 7: Connection level 2 (terminals 12, 22, 32, 42)
- 8: Connection level 3 (terminals 13, 23, 33, 43)
- 9: Connection level 4 (terminals 14, 24, 34, 44)
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Counter modules (standard)
PSSu E S INC 24V se

Module features

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error
- Supply voltage overload for the encoder

Module supply

- The module supply provides the module with voltage.

Inputs

- 3 single-pole inputs referenced to earth: A, B, C, for connecting an incremental encoder or an encoder that provides rising edges as counter pulses.
- 3 single-pole inputs referenced to earth: G, L, S, for special functions

Outputs:

- Supply voltage for encoder, 24 VDC, 100 mA
- Semiconductor output (switches depending on the counter status)

  “0” signal (0 V) at the output:

  – Output is high impedance
  – No current to the load

  “1” signal (+24 V) at the output:

  – Output is low impedance
  – Current is supplied to the load

Operating modes

- Incremental encoder
- Counter

Functions

- Period length measurement
  or
- Storing the counter status in latch memory after a latch pulse or zero pulse
- Setting the counter status

The electronic module transfers the data and status information to the head module via the module bus. The choice of function and the function's configuration are defined via the system software.

The single-pole inputs (G, L, S) are used for special functions. Inputs G and L may be connected to external signal sources, e.g. to a higher order control system.

Counter modules (standard)
PSSu E S INC 24V se

- Input G (gate input)
  The counter is stopped with a 1 signal. The module ignores the counter pulses at the inputs until a 0 signal returns.
- Input L (input for latch pulse)
  At a rising edge, the module stores the current counter value in the latch memory. The counter continues counting; it is not stopped by the latch pulse. The module transmits the stored value to the head module. The period length measurement may be configured as an alternative to the latch function.
- Input S (status input)
  The encoder's fault signal output can be connected to the status input. The module transmits the input state to the head module with the status information.

The module provides a supply voltage of 24 VDC / 100 mA to supply the rotary encoder.

The output is short circuit-proof. In the event of an overload, the supply voltage is switched off and a warning is issued on the bus. The supply voltage is re-established when the cause of the overload has been rectified.

In both operating modes the counter can accept values from 0000 0000_H to FFFF $FFFF_H$.

- With an underflow the value drops below 0000 0000_H and the counter continues from FFFF $FFFF_H$.
- With an overflow the value FFFF $FFFF_H$ is exceeded and the counter continues from 0000 0000_H.

The overflow or underflow is signalled to the head module as status information.

The status information overflow is reset:

- if the value again falls below 0000 0000_H (underflow).
- if 5555 0000_H is exceeded (the lower third of the value range).

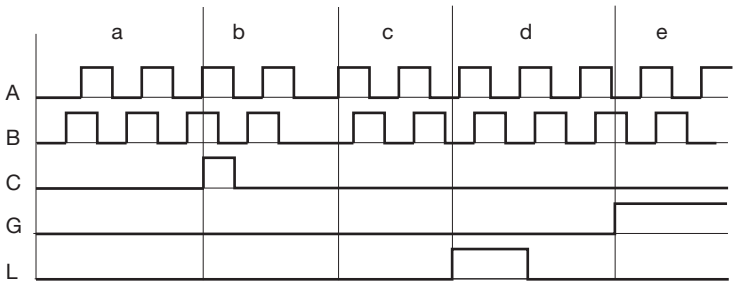
The status information underflow is reset:

- if FFFF $FFFF_H$ is exceeded again (overflow).
- if AAAA $FFFF_H$ is exceeded (the upper third of the value range).

The counter outputs and the output for the incremental encoder's zero pulse are connected to the single-pole inputs (A, B, C).

- Inputs A, B
  The first channel of the encoder is connected to input A, the second to input B. The second channel is 90° out of phase. If channel A is leading, the module counts forwards. If channel A is lagging, the module counts backwards (see timing diagram).
- Input C
  The output for the incremental encoder's zero pulse is connected to input C. An incremental encoder typically supplies one zero pulse per rotation. If the zero pulse function is activated, the module copies the last value prior to the zero pulse into the latch memory and passes it to the process image of inputs (see chapter entitled "Transfer counter status via latch pulse").

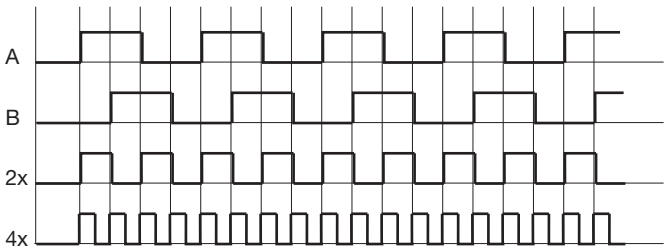
Counter modules (standard)
PSSu E S INC 24V se



Legend:

- a: The counter counts backwards because the signal at channel A is lagging.
- b: The module has received a zero pulse. Provided the function is activated, the counter value is copied into the latch memory with a rising edge at input C.
- c: The counter counts forwards because the signal at channel A is leading.
- d: The module has received a latch pulse. Provided the function is activated, the counter value is copied into the latch memory with a rising edge at input L.
- e: The counter is disabled because there is a 1 signal at input G.

The module can evaluate the counter pulses once, twice or four times (configuration in the PSSu Configurator or PAS4000).

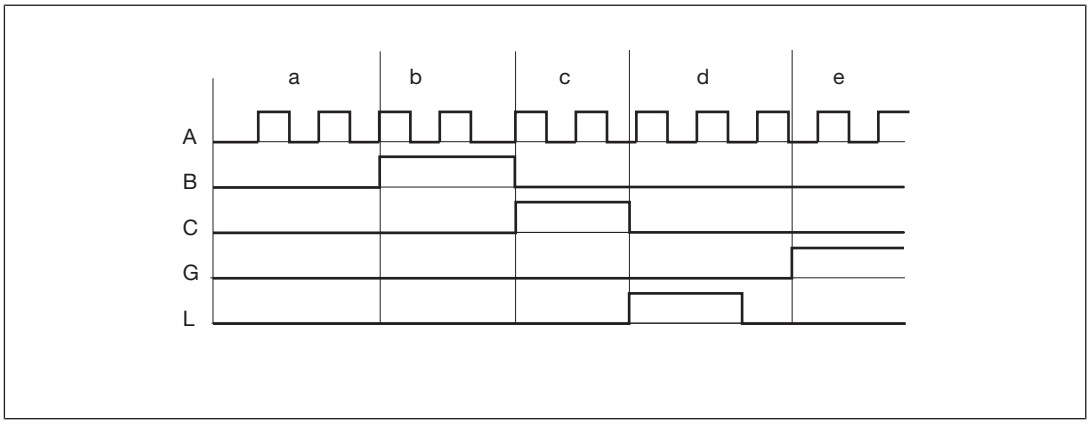


- Single evaluation:
  Each rising edge at channel A increases the counter status.
- Double evaluation:
  Each rising and each falling edge at channel A increases the counter status.
- Quadruple evaluation (default):
  Each rising and each falling edge at channel A and channel B increases the counter status.

Counter modules (standard)
PSSu E S INC 24V se

In counter operating mode, the module's single-pole inputs A, B, C have the following functions:

- Input A (Count)
  Input A is the input for the encoder's counter pulses. The module counts each rising edge.
- Input B (Up/down)
  At a 0 signal the module counts forwards. At a 1 signal the module counts backwards.
- Input C (Gate/Latch)
  The counter is stopped with a 1 signal. The module ignores the counter pulses at the input until a 0 signal returns.



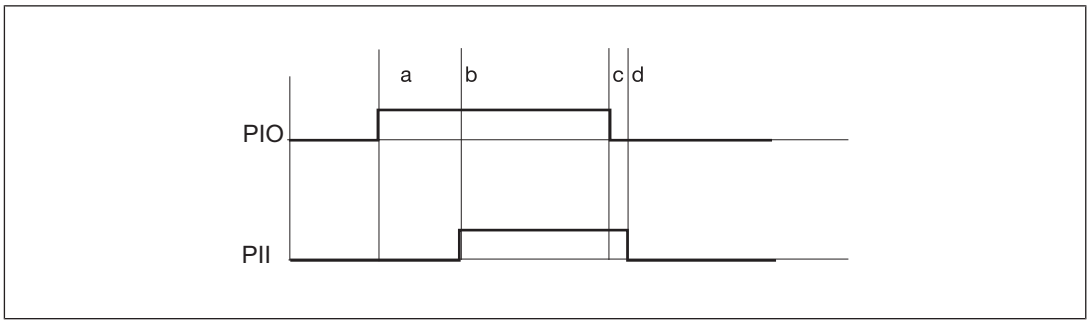
Legend:

- a: The counter counts forwards because there is 0 signal at channel B.
- b: At the next rising edge at channel A, the counter counts backwards because there is a 1 signal at channel B.
- c: The counter is disabled because there is a 1 signal at input C.
- d: The module has received a latch pulse. Provided the function is activated, the counter value is copied into the latch memory with a rising edge at input L.
- e: The counter is disabled because there is a 1 signal at input G.

The module can record the period length of the counter pulses on channel A. The period length is the time between two rising edges at channel A. It is transferred to the process image of inputs as multiple of 200 ns.

Counter modules (standard)
PSSu E S INC 24V se

Prerequisite: This function is configured in the PSSu Configurator / PAS4000.



Legend:

- PIO: Bit 1 of the function call in the process image of outputs or I/O data OutputData.LatchOrMeasure
- PII: Bit 1 of the status byte in the process image of inputs or I/O data InputData.LatchOrMeasureDone

Key to timing diagram:

Section	Function	Procedure for PSSu in system environment A	Procedure for PSSu in system environment B
a	Start measurement	In the user program, set Bit 1 of the function call	In the user program, set OutputData.LatchOrMeasure
b	Output measured value Set status bit	Measured value is transferred into the process image of inputs The module sets Bit 1 of the status byte	Measured value is written in InputData.LatchOrPeriod The module sets InputData.LatchOrMeasureDone
c	Finish measurement	In the user program, reset Bit 1 of the function call	In the user program, reset OutputData.LatchOrMeasure
d	Ready for new measurement	The module resets Bit 1 of the status byte	The module resets InputData.LatchOrMeasureDone

The result of the last period length measurement remains in the process image of inputs until the module signals a new measurement result by setting the status information. Before the initial measurement the process image of inputs contains 0000 0000_H or FFFF $FFFF_H$

The module issues the result of period length measurement in multiples of 200 ns.

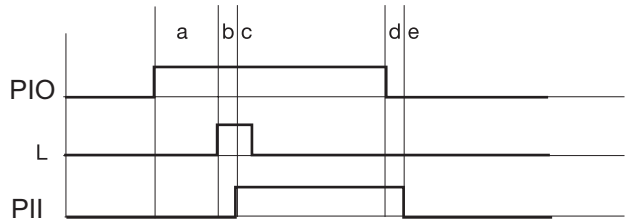
Example:

- The process image of inputs contains $32_H/50_D$
- The period length is 200 ns x 50 = 10 µs

A signal output can be connected to input L on the module for a latch pulse. The latch pulse may come from a PLC or position switch, for example. Using the latch function it is possible to record and transmit the counter status at the time of this latch pulse.

Counter modules (standard)
PSSu E S INC 24V se

Prerequisite: This function is configured in the PSSu Configurator / PAS4000.



Legend:

- PIO: Bit 1 of the byte for function calls in the process image of outputs or I/O data OutputData.LatchOrMeasure
- L: Input L for external latch
- PII: Bit 1 of the status byte in the process image of inputs or I/O data InputData.LatchOrMeasureDone

Key to timing diagram:

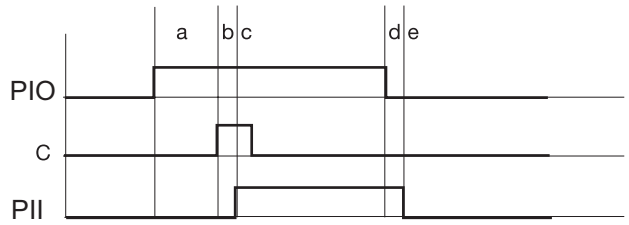
Section	Function	Procedure for PSSu in system environment A	Procedure for PSSu in system environment B
a	Activate latch function	In the user program, set Bit 1 of the function call	In the user program, set OutputData.LatchOrMeasure
b	Fill latch memory	Rising edge at input L: Counter status is transferred to the latch memory	Rising edge at input L: Counter status is transferred to the latch memory
c	Output counter status Set status bit	Counter status is transferred to the process image of inputs The module sets Bit 1 of the status byte	Counter status is written in InputData.LatchOrPeriod The module sets InputData.LatchOrMeasureDone
d	Finish latch function	In the user program, reset Bit 1 of the function call	In the user program, reset OutputData.LatchOrMeasure
e	Ready for new latch function	The module resets Bit 1 of the status byte	The module resets InputData.LatchOrMeasureDone

The contents of the latch memory remains in the process image of inputs until the module signals a new memory value by setting the status information. Before the initial transfer the process image of inputs contains 0000 0000_H or FFFF $FFFF_H$

The module always transmits the counter status when the first latch pulse occurs after the function has started. All subsequent latch pulses are ignored until the function is completed and reset.

Counter modules (standard)
PSSu E S INC 24V se

The output for the incremental encoder's zero pulse is connected to input C. An incremental encoder typically supplies one zero pulse per rotation. Using the zero pulse function it is possible to record the last counter status before the zero pulse and transmit it via the process image of inputs.



Legend:

- PIO: Bit 0 of the function call in the process image of outputs or I/O datum OutputData.ZeroPulseActive
- C: Input C
- PII: Bit 0 of the status byte in the process image of inputs or I/O datum InputData.ZeroPulse

Key to timing diagram:

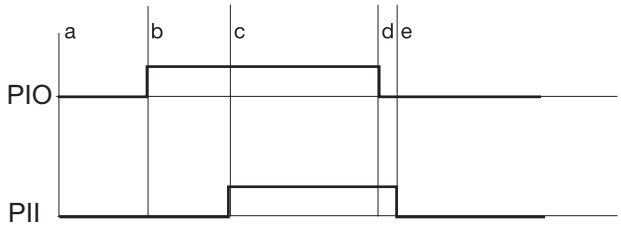
Section	Function	Procedure for PSSu in system environment A	Procedure for PSSu in system environment B
a	Activate zero pulse function	In the user program, set Bit 0 of the function call	In the user program, set OutputData.ZeroPulseActiv
b	Fill latch memory	Rising edge at input C: Counter status is transferred to the latch memory	Rising edge at input C: Counter status is transferred to the latch memory
c	Output counter status Set status bit	Counter status is transferred to the process image of inputs The module sets Bit 0 of the status byte	Counter status is written in InputData.LatchOrPeriod The module sets InputData.ZeroPulse
d	Finish zero pulse function	In the user program, reset Bit 0 of the function call	In the user program, reset OutputData.ZeroPulseActiv
e	Ready for new latch function	The module resets Bit 0 of the status byte	The module resets InputData.ZeroPulse

The zero pulse function has priority over the latch function and the "Period length measurement" function. If this function is activated, both the other functions are ignored, even if they have been activated.

The module always transmits the counter status when the first zero pulse occurs after the function has started. The counter statuses on all subsequent zero pulses are ignored until the function has been completed and reset.

Counter modules (standard)
PSSu E S INC 24V se

The "Set counter status" function sets the counter to any value. The value is stated in the user program. The module transfers the value and continues counting from this counter status.



Legend:

- PIO: Bit 2 of the function call in the process image of outputs or I/O data OutputData.SetCounter
- PII: Bit 2 of the status byte in the process image of inputs or I/O data InputData.SetCounterDone

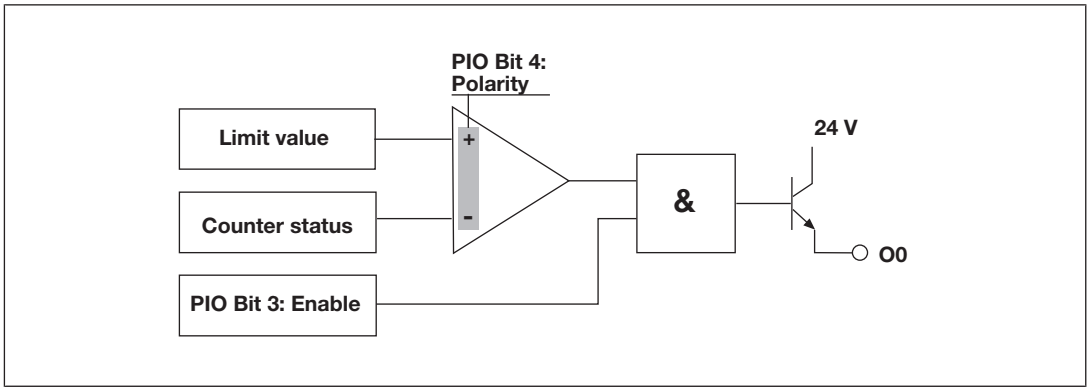
Key to timing diagram:

Section	Function	Procedure for PSSu in system environment A	Procedure for PSSu in system environment B
a	Enter counter status	In the user program, write the default counter status in the process image of outputs	In the user program, assign the default counter status to OutputData.NewCounterValue
b	Transfer counter status	In the user program, set Bit 2 of the function call	In the user program, set OutputData.SetCounter
c	Acknowledge transfer	The module sets Bit 2 of the status byte; the underflow and overflow bits are reset	The module sets InputData.SetCounterDone; InputData.Underflow and InputData.Overflow are reset
d	Finish transfer	In the user program, reset Bit 2 of the function call	In the user program, reset OutputData.SetCounter
e	Ready for new function	The module resets Bit 2 of the status byte	The module resets InputData.SetCounterDone

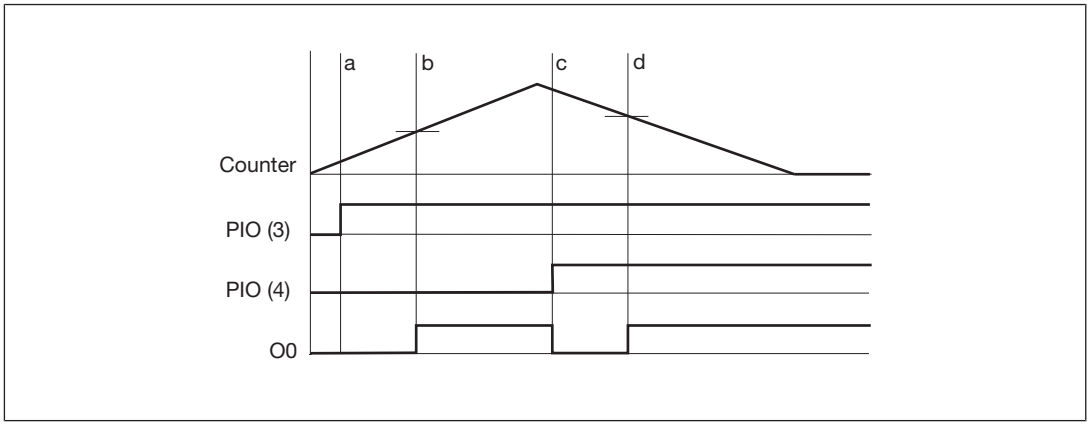
The module's output O0 is switched when a limit value is reached. The status of the output ("0" or "1") is defined with a polarity bit.

Counter modules (standard)
PSSu E S INC 24V se

The function must first be activated via an enable bit.



Timing diagram



Legend:

- Counter: Count
- PIO (3): Bit 3 of the function call in the process image of outputs or I/O datum Output-Data.LimitValueActive
- PIO (4): Bit 4 of the function call in the process image of outputs or I/O datum Output-Data.InvertOutput
- O0: Output O0

Counter modules (standard)
PSSu E S INC 24V se

Key to timing diagram:

Section	Function	Procedure for PSSu in system environment A	Procedure for PSSu in system environment B
a	Activate monitoring function	In the user program, set Bit 3 of the function call. Output O0 ("0" or "1") is set based on Bit 4 of the function call	In the user program, set OutputData.LimitValueActive
b	Limit value reached	Output O0 ("0" or "1") is set based on Bit 4 of the function call	Output O0 ("0" or "1") is set based on OutputData.InvertOutput
c	Output polarity changed	In the user program, set Bit 4 of the function call. Output O0 switches polarity	In the user program, set OutputData.InvertOutput. Output O0 switches polarity
d	Limit value reached	Output O0 ("0" or "1") is set based on Bit 4 of the function call	Output O0 ("0" or "1") is set based on OutputData.InvertOutput

Configuration

The module has the following configuration options:

Configuration	Default value	Meaning
Operating mode	X	Incremental encoder operating mode
		Counter operating mode
Signal for gate input	X	Input G disables at a 1 signal
		Input G disables at a 0 signal
Period length measurement or latch function	X	Latch function
		Period length measurement
Multiple evaluation	X	Quadruple evaluation
		Double evaluation
		Single evaluation
Status input	X	The status at input S is transmitted via a bit.
		The status is transmitted via two redundant bits.
		The status is transmitted via two diverse bits.(1)

(1) Transmitting the status via two bits enables simple fault detection: Two redundant bits must always be the same, two diverse bits must always be different, otherwise the transmission is faulty.

Counter modules (standard)
PSSu E S INC 24V se

In the PII the module occupies

- 32 Bits with counter data
- 32 Bits with data from the latch memory or with the result from the period length measurement
- 8 Bits with the status byte

In the PIO the module occupies

- 32 Bits with the default counter status
- 32 Bits with the limit value
- 8 Bits with function calls

Description	ST-PII bit assignment LSB … MSB	ST-PIO bit assignment LSB … MSB	Notes
Status byte	0 … 7		See "Status byte assignment" table
Current counter status	8 … 39		Measured value in incremental encoder or counter operating mode
Counter status from the latch memory or result from the period length measurement	40 … 71		Value recorded after a latch or zero pulse or period length
Byte for function calls		0 … 7	See table: "Overview of function calls"
Default counter status		8 … 39	Value at which the counter is set
Specify limit value		40 … 71	Value at which the limit value is set

Overview of function calls:

Function calls	Bit	Assignment
Transfer counter status via zero pulse	0	0: Input C (zero pulse) inactive 1: Input C (zero pulse) active
Transfer counter status via latch pulse or measure period length (1)	1	0: Input L (latch pulse) inactive/period length measurement inactive 1: Input L (latch pulse) active/period length measurement active
Set counter status	2	0: Do not transfer default counter status 1: Adopt default counter status
Monitor limit value	3	0: Limit value monitoring inactive 1: Limit value monitoring active

Counter modules (standard)
PSSu E S INC 24V se

Function calls	Bit	Assignment
Invert output O0	4	0: Output O0 not inverted 1: Output O0 inverted
	5 … 7	Reserved

(1) Whether the period length is measured or the latch pulse is evaluated, must be defined in the PSSu Configurator.

Status byte assignment:

Meaning	Bit	Assignment
Zero pulse	0	0: No zero pulse at input C 1: Zero pulse at input C
Latch pulse or period length measurement	1	0: Period length or contents of latch memory not transferred 1: Period length or contents of latch memory transferred
Default counter status	2	0: Default counter status not transferred 1: Default counter status transferred
Counter underflow	3	0: No counter underflow 1: Counter underflow
Counter overflow	4	0: No counter overflow 1: Counter overflow
Status input S, Bit 1	5	0: Status input, Bit 1 (message from encoder) 1: Status input, Bit 1
Status input S, Bit 2	6	0: Status input, Bit 2 (1) 1: Status input, Bit 2
Reserved	7	-

(1) When configuring the module, users can determine the evaluation method for the status input: single, redundant or diverse. Transmitting the status via two bits enables simple fault detection: Two redundant bits must always be the same, two diverse bits must always be different, otherwise the transmission is faulty.

Counter modules (standard)
PSSu E S INC 24V se

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

I/O data name	I/O data type	I/O data element	Meaning
OutputData	ST_O_INC_24V	ZeroPulseActiv: BOOL	FALSE: Input C (zero pulse) inactive TRUE: Input C (zero pulse) active
		LatchOrMeasure: BOOL	FALSE: Input L (latch pulse) inactive/period length measurement inactive TRUE: Input L (latch pulse) active/ period length measurement active
		SetCounter: BOOL	FALSE: Do not transfer default counter status TRUE: Adopt default counter status
		NewCounterValue: DWORD	Default counter status
		LimitValueActive: BOOL	FALSE: Limit value monitoring inactive TRUE: Limit value monitoring active
		InvertOutput: BOOL	FALSE: Output O0 not inverted TRUE: Output O0 inverted
		LimitValue: DWORD	Value at which the limit value is set

Counter modules (standard)
PSSu E S INC 24V se

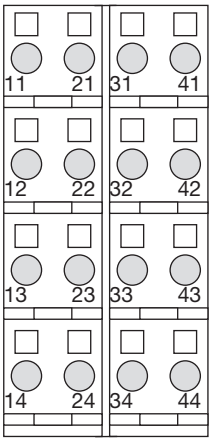
I/O data name	I/O data type	I/O data element	Meaning
InputData	ST_I_INC	CurrentData: DWORD	Current counter status in incremental encoder or counter operating mode
		LatchOrPeriod: DWORD	Counter status after a latch or zero pulse or period length
		ZeroPulse: BOOL	FALSE: No zero pulse at input C TRUE: Zero pulse at input C
		LatchOrMeasure-Done: BOOL	FALSE: Period length or contents of latch memory not transferred TRUE: Period length or contents of latch memory transferred
		SetCounterDONE: BOOL	FALSE: Default counter status not transferred TRUE: Default counter status transferred
		Underflow: BOOL	FALSE: No counter underflow TRUE: Counter underflow
		Overflow: BOOL	FALSE: No counter overflow TRUE: Counter overflow
		State1: BOOL	FALSE: Status input, Bit 1 (message from encoder) TRUE: Status input, Bit 1
		State2: BOOL	FALSE: Status input, Bit 2 (1) TRUE: Status input, Bit 2

(1) When configuring the module, users can determine the evaluation method for the status input: single, redundant or diverse. Transmitting the status via two bits enables simple fault detection: Two redundant bits must always be the same, two diverse bits must always be different, otherwise the transmission is faulty.

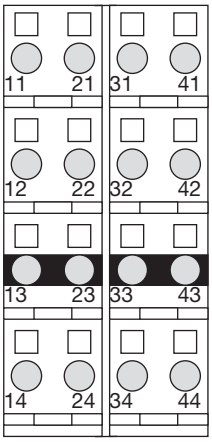
Counter modules (standard)
PSSu E S INC 24V se

Wiring

Terminal configuration

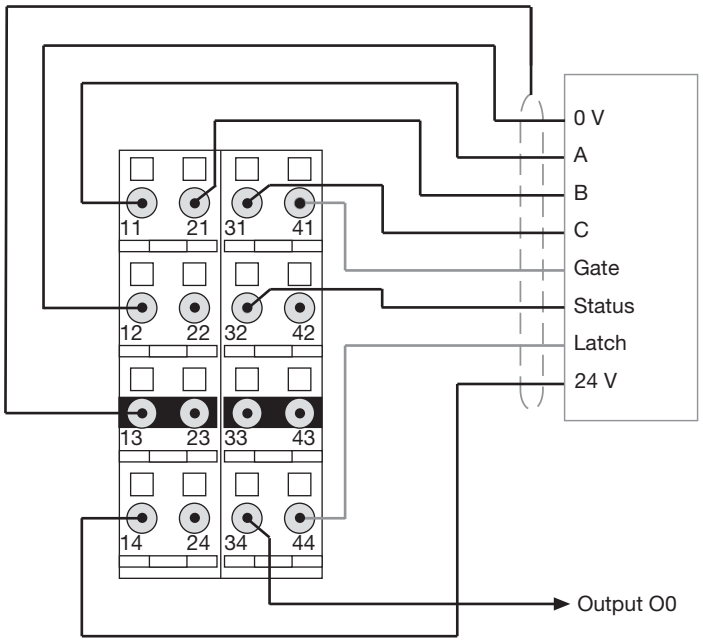
Base module	Terminal configuration	
Screw terminals: PSSu BP 2/16 S PSSu BP 2/16 S-T Cage clamp terminals: PSSu BP 2/16 C PSSu BP 2/16 C-T	Without C-rail: 11: Input A 21: Input B 31: Input C 41: Input G (Gate) 12-22: 0 V encoder (12-22 linked within the base module) 32-42: Input S (Status) (32-42 linked within the base module) 13-23-33-43: Shield connection (13-23-33-43 linked within the base module) 14-24: Supply voltage output for encoder 34: Output for limit value monitoring 44: Input L (Latch)	

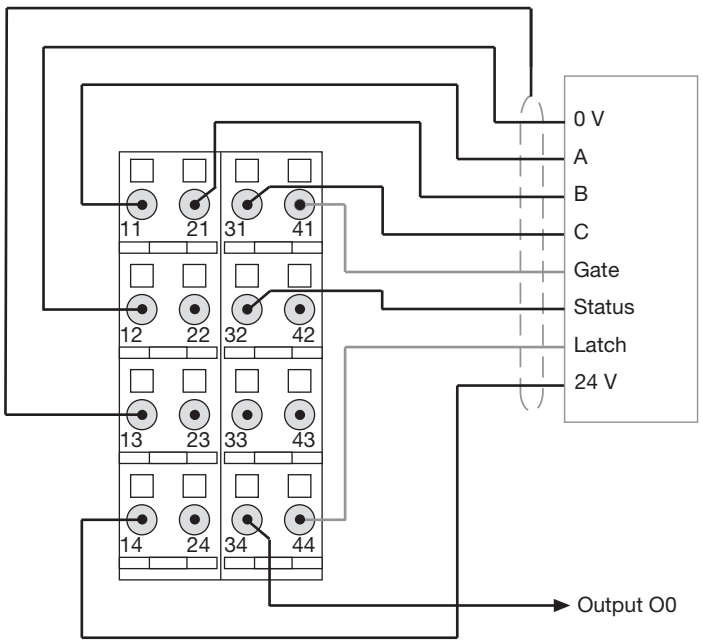
Counter modules (standard)
PSSu E S INC 24V se

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 2/16 S PSSu BP-C 2/16 S-T Cage clamp terminals: PSSu BP-C 2/16 C PSSu BP-C 2/16 C-T	With C-rail: 11: Input A 21: Input B 31: Input C 41: Input G (Gate) 12-22: 0 V encoder (12-22 linked within the base module) 32-42: Input S (Status) (32-42 linked within the base module) 13-23-33-43: C-rail supply shield connection (13-23-33-43 linked within the base module) 14-24: Supply voltage output for encoder 34: Output for limit value monitoring 44: Input L (Latch)	

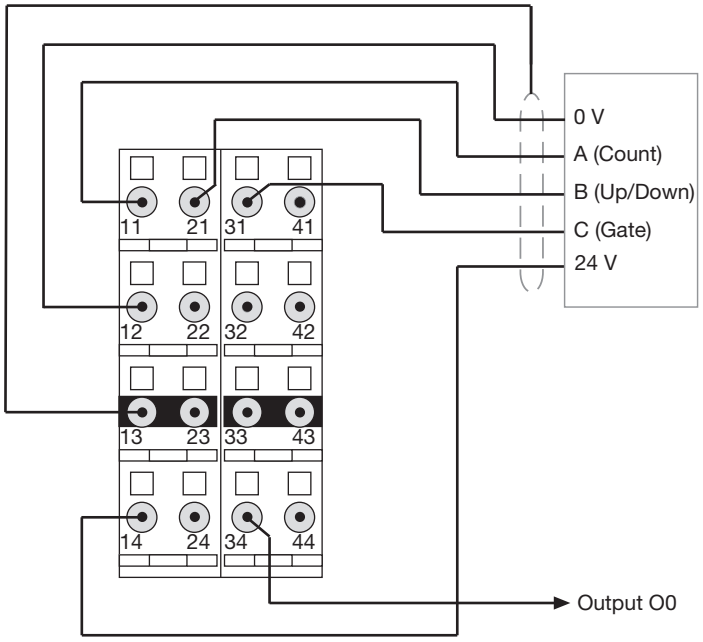
Counter modules (standard)
PSSu E S INC 24V se

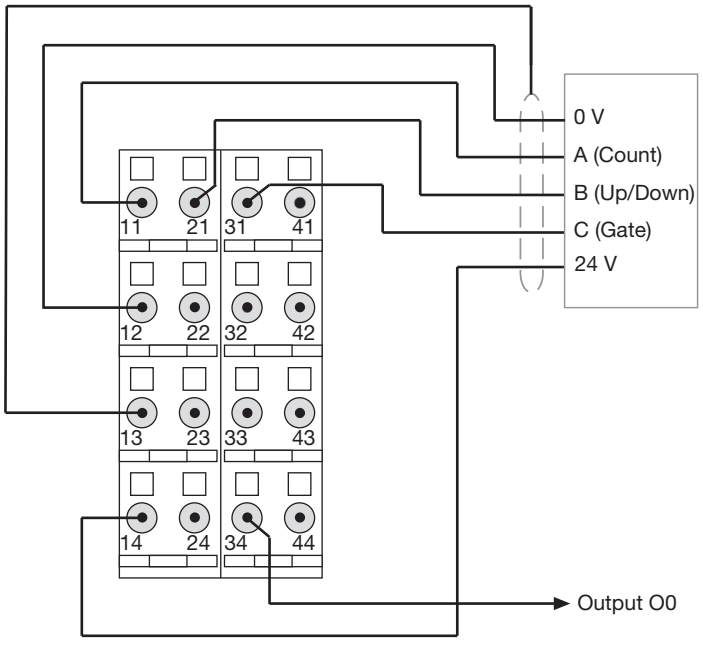
Connecting the module

Incremental encoder operating mode	With C-rail
Encoder is supplied via output 14 (S1) Output O0: Output for limit value monitoring	

Incremental encoder operating mode	Without C-rail
Encoder is supplied via output 14 (S1) Output O0: Output for limit value monitoring	

Counter modules (standard)
PSSu E S INC 24V se

Counter operating mode	With C-rail
Encoder is supplied via output 14 (S1) Function inputs (G, L, S) not connected. Output O0: Output for limit value monitoring	

Counter operating mode	Without C-rail
Encoder is supplied via output 14 (S1) Function inputs (G, L, S) not connected.	

Counter modules (standard)
PSSu E S INC 24V se

Technical details

General	312486	314486
Approvals	**CE, TÜV, cULus Listed**	**CE, TÜV**
Application range	**Standard**	**Standard**
Module's device code	**0322h**	**0322h**
Number of ST input bits	**64**	**64**
Number of ST output bits	**64**	**64**
Number of ST status bits	**8**	**8**
Number of ST control bits	**8**	**8**
Application in system environment A		
From ST firmware version, other head modules	**18**	**18**
From ST firmware version PSSu H S PN	**3**	**3**
Application in system environment B		
From ST firmware version, head modules	**1.7.0**	**1.7.0**
Electrical data	**312486**	**314486**
Internal supply voltage (module supply)		
Module's power consumption	**0,85 W**	**0,85 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**10 mA**	**10 mA**
Module's power consumption with no load	**0,24 W**	**0,24 W**
Max. power dissipation of module	**1,40 W**	**1,40 W**
Incremental encoder input	**312486**	**314486**
Number of counter inputs	**1**	**1**
Type of counter inputs	**Incremental encoder**	**Incremental encoder**
Signal at counter inputs A and B and/or C	**single-ended (HTL)**	**single-ended (HTL)**
Permitted low signal range on LATCH/GATE/STATUS signals	**-3 - 5 V**	**-3 - 5 V**
Permitted high signal range on LATCH/GATE/STATUS signals	**11 - 30 V**	**11 - 30 V**
Typ. input current of the LATCH and/or GATE and/or STATUS signals at low level	**0 mA**	**0 mA**

Counter modules (standard)
PSSu E S INC 24V se

Incremental encoder input	312486	314486
Typ. input current of the LATCH and/or GATE and/or STATUS signals at high level	**4,0 mA**	**4,0 mA**
Max. number of bits on the counter input	**32 Bit**	**32 Bit**
Evaluation of counter pulses	**1x, 2x, 4x**	**1x, 2x, 4x**
Phase offset between differential signals A and B	**90 deg**	**90 deg**
Phase offset tolerance	**30 deg**	**30 deg**
Maximum cutoff frequency	**0,2 MHz**	**0,2 MHz**
Time constant of input filter on LATCH signal	**50 µs**	**50 µs**
Time constant of input filter on GATE signal	**50 µs**	**50 µs**
Time constant of input filter on STATUS signal	**50 µs**	**50 µs**
Typ. processing time	**0,1 ms**	**0,1 ms**
Potential isolation between input/ output and periphery supply	**No**	**No**
Potential isolation between input/ output and voltage for the internal module bus	**yes**	**yes**
Semiconductor outputs	**312486**	**314486**
Rated voltage	**24 V DC**	**24 V DC**
Max. output current at rated voltage	**0,50 A**	**0,50 A**
Voltage outputs	**312486**	**314486**
Max. output current at rated voltage	**0,10 A**	**0,10 A**
Environmental data	**312486**	**314486**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**

Counter modules (standard)
PSSu E S INC 24V se

Environmental data	312486	314486
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 1000,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**5g**
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**25g**
Duration	**16 ms**	**6 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mechanical data	**312486**	**314486**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**

Counter modules (standard)
PSSu E S INC 24V se

Mechanical data	312486	314486
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**25,2 mm**	**25,2 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**47 g**	**48 g**
Mechanical coding		
Type	**M**	**M**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2005-04 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E S INC 24V se	Electronic module	312 486
PSSu E S INC 24V se-T	Electronic module, T-type	314 486

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 2/16 S	Base module without C-rail with screw terminals	312 628
PSSu BP 2/16 S-T	Base module without C-rail with screw terminals, T-type	314 628
PSSu BP 2/16 C	Base module without C-rail with cage clamp terminals	312 629
PSSu BP 2/16 C-T	Base module without C-rail with cage clamp terminals, T-type	314 629
PSSu BP-C 2/16 S	Base module with C-rail and screw terminals	312 630
PSSu BP-C 2/16 S-T	Base module with C-rail and screw terminals, T-type	314 630
PSSu BP-C 2/16 C	Base module with C-rail and cage clamp terminals	312 631
PSSu BP-C 2/16 C-T	Base module with C-rail and cage clamp terminals, T-type	314 631

Counter modules (failsafe)

Counter modules (failsafe)

Counter modules (failsafe)
PSSu E F ABS SSI

Overview

Module features

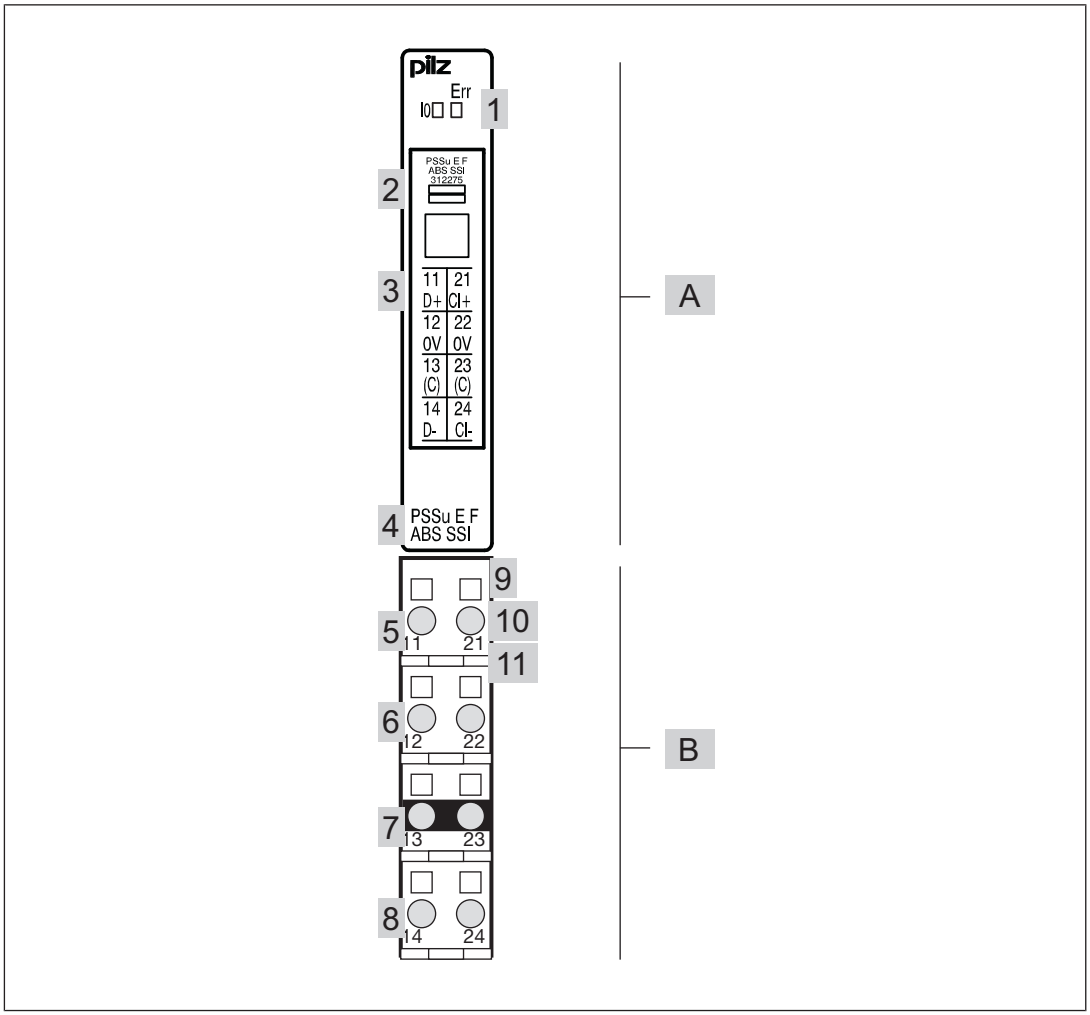
The product has the following features:

- Counter input (data)
  - Input data length up to max. 32 Bit
  - Differential input
- Test pulse output (clock) for requesting data
  - Differential output
- Transmission rate up to max. 1.5 MHz
- LED-Anzeigen für:
  - Data transfer
  - Module error
- For failsafe applications in system environment B (automation system PSS 4000)
- T-type:

  PSSu E F ABS SSI-T: for increased environmental requirements

Counter modules (failsafe)
PSSu E F ABS SSI

Front view



Legend:

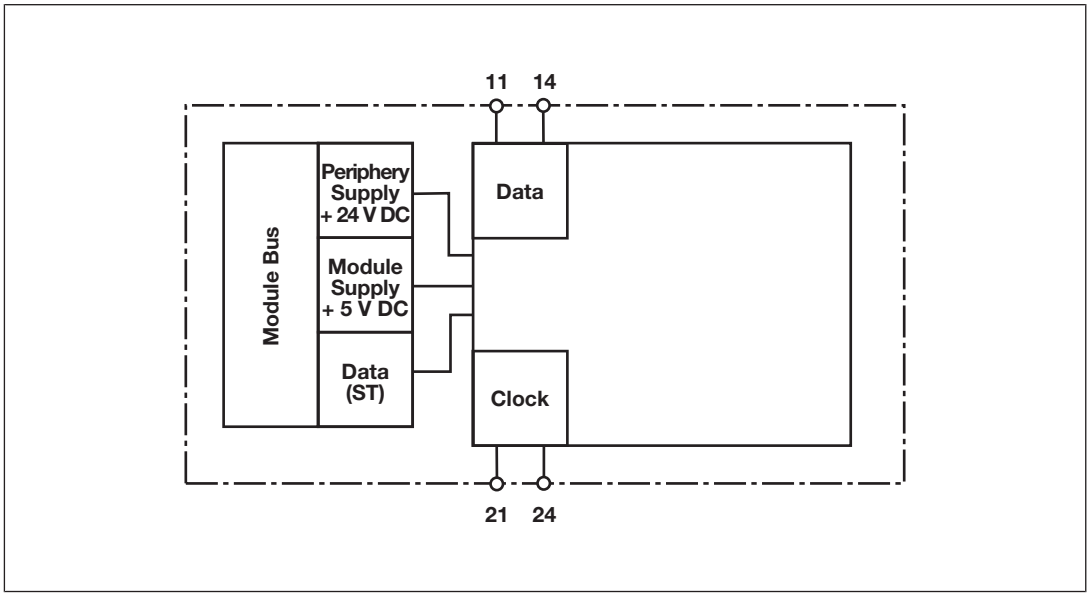
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Status of the data transfer
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code

Counter modules (failsafe)
PSSu E F ABS SSI

- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module
- 5: Connection level 1 (terminals 11, 21)
- 6: Connection level 2 (terminals 12, 22)
- 7: Connection level 3 (terminals 13, 23)
- 8: Connection level 4 (terminals 14, 24)
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Counter modules (failsafe)
PSSu E F ABS SSI

Module features

Module supply

- The module supply provides the module with voltage.

Periphery supply

- The supply for the test pulse output is generated from the periphery supply. It is galvanically isolated from the periphery supply.

As part of each cycle the module sends a pulse sequence at the test pulse output (CI) to the SSI absolute encoder. In turn the encoder transmits its position data. The position data is read in at the module's input (D) (see timing diagram: SSI data transfer).

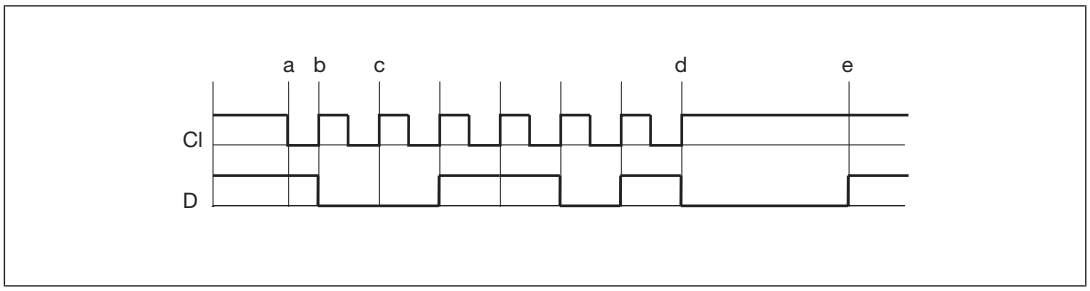
With the system software the user can set the following values to adapt the module to the encoder or higher level control system:

- Transmission rate
  The frequency of the pulses at the test pulse output (CI) determines the transmission rate. The user can adapt the frequency to the encoder in a range from 62.5 kHz up to 1.5 MHz (see Technical Details).
- Input data length:
  The module's input data length must be adjusted to the data length of the absolute encoder.
  The module can process up to 32 Bits. The default is 24 Bits.
- Data format:
  The data format in which the module transmits the position data of the connected absolute encoder to the head module.
  - Gray code (default)
  - Binary code

The position data is transmitted to the head module via the ST module bus with 4 Bytes, irrespective of the configured input data length. The module sends additional status information.

Counter modules (failsafe)
PSSu E F ABS SSI

Timing diagram: Example of SSI data transfer**:**



Legend:

The bit width in the example is 6. The position of the encoder is 001101 in gray code, i.e. 9_D.

- a: Data transfer begins with a falling edge at the Cl signal.
- b: The first bit is transmitted with the first rising edge from the Cl signal.
- c: The time up to the second rising edge is the period length T. 1/T is the signal frequency.
- d: The last rising edge from the Cl signal ends the transfer. The encoder acknowledges the end of the transfer with a 0 signal.
- e: The encoder can transfer data again as soon as there is a 1 signal at input D.

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Counter modules (failsafe)
PSSu E F ABS SSI

Configuration

The module has the following configuration options:

Configuration	Default value	Meaning
Transmission rate	250 kHz	62.5 kHz 100 kHz 125 kHz 250 kHz 500 kHz 1 MHz 1.5 MHz
Gray code format	On	On: Gray code is activated. Off: Binary code is activated.
Fault detection within the data frame[1]	On	On: Errors within the data frame are identified. Off: Errors within the data frame are ignored.
Input data length	24	2 ... 32 Bit

[1] An error within the data frame means that the absolute encoder does not terminate the serial data transfer with a zero.

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

I/O data name	I/O data type	I/O data element	Meaning
InputData	FS_I_ABS_SSI	Data: DWORD	Current position data
		InputError: BOOL	FALSE: Counter input active TRUE: Counter input passive
		DataFrameError: BOOL	FALSE: No error within the data frame TRUE: Data frame faulty[1]
		ModuleError: BOOL	FALSE: No error within the module TRUE: Module is faulty

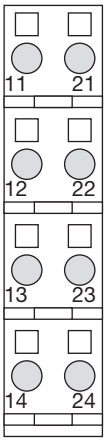
[1] "Data frame faulty" indicates that the module is receiving faulty values or no values from the absolute encoder.

- Possible cause for faulty receipt of data:
  - max. input data length of 32 bit exceeded
- Possible cause for not receiving data:
  - Open circuit
  - Absolute encoder is not connected.

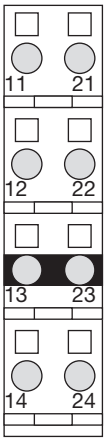
Counter modules (failsafe)
PSSu E F ABS SSI

Wiring

Terminal configuration

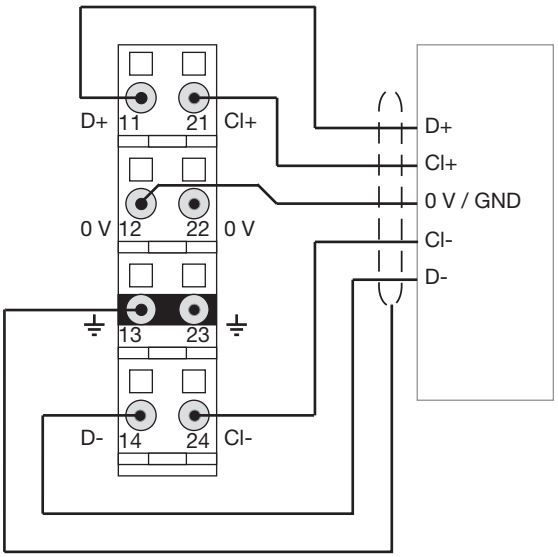
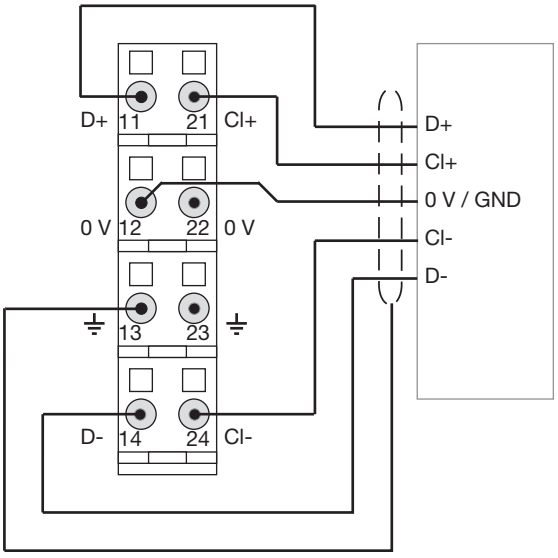
Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Input D+ (Data +) 21: Output Cl+ (Clock +) 12-22: 0 V counter (12-22 linked within the base module) 13-23: Shield connection (13-23 linked within the base module) 14: Input D- (Data -) 24: Output Cl- (Clock -)	

Counter modules (failsafe)
PSSu E F ABS SSI

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Input D+ (Data +) 21: Output Cl+ (Clock +) 12-22: 0 V counter (12-22 linked within the base module) 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Input D- (Data -) 24: Output Cl- (Clock -)	

Counter modules (failsafe)
PSSu E F ABS SSI

Connecting the module

Input and output circuit	
Connecting an SSI encoder (master mode) With C-rail Encoder supply via the PSSu E PD module 0 V connection is not absolutely essential.	
Connecting an SSI encoder (master mode) Without C-rail Encoder supply via the PSSu E PD module 0 V connection is not absolutely essential.	

Counter modules (failsafe)
PSSu E F ABS SSI

Technical Details

General	312275	314275
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, EAC (Eurasian), TÜV, cULus Listed**
Application range	**Failsafe**	**Failsafe**
Module's device code	**0323h**	**0323h**
Number of ST input bits	**32**	**32**
Number of ST status bits	**8**	**8**
Application in system environment B		
From FS firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312275**	**314275**
Internal supply voltage (module supply)		
Module's power consumption	**0,51 W**	**0,51 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30 V**	**16,8 - 30 V**
Module's current consumption with no load	**10 mA**	**10 mA**
Module's power consumption with no load	**0,24 W**	**0,24 W**
Max. power dissipation of module	**0,75 W**	**0,75 W**
Absolute encoder input	**312275**	**314275**
Number of counter inputs	**1**	**1**
Type of counter inputs	**SSI encoder**	**SSI encoder**
Output signal (clock)	**Differential signal (RS 422)**	**Differential signal (RS 422)**
Max. number of bits on the counter input	**32 Bit**	**32 Bit**
Transmission rate	**62,5 kHz, 100 kHz, 125 kHz, 250 kHz, 500 kHz, 1.000 kHz, 1.500 kHz**	**62,5 kHz, 100 kHz, 125 kHz, 250 kHz, 500 kHz, 1.000 kHz, 1.500 kHz**
Coding of the input signal	**Binary, Gray**	**Binary, Gray**
Signal at the data input	**Differential signal (RS 422)**	**Differential signal (RS 422)**
Potential isolation between input/ output and periphery supply	**yes**	**yes**
Potential isolation between input/ output and voltage for the internal module bus	**yes**	**yes**
Typ. processing time	**0,1 ms**	**0,1 ms**

Counter modules (failsafe)
PSSu E F ABS SSI

Environmental data	312275	314275
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 150 Hz**	**10 - 1000 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**5g**
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**

Counter modules (failsafe)
PSSu E F ABS SSI

Environmental data	312275	314275
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Mechanical data	**312275**	**314275**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76 mm**	**76 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**35 g**	**35 g**
Mechanical coding		
Type	**J**	**J**
Colour	**Yellow**	**Yellow**

Where standards are undated, the 2005-04 latest editions shall apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**2,61E-09**	**SIL 3**	**4,43E-06**	**20**

If the module is operated at an ambient temperature above 60° C, the values stated in the table for PFH_D and PFD will need to be doubled when a safety function is calculated.

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

Counter modules (failsafe)
PSSu E F ABS SSI

Order reference

Product

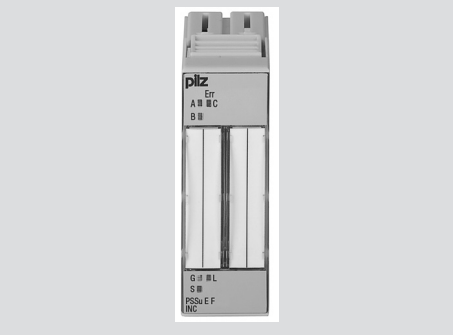
Product type	Features	Order No.
PSSu E F ABS SSI	Electronic module	312 275
PSSu E F ABS SSI-T	Electronic module, T-type	314 275

Accessories

Base modules

Product type	Features	Order No.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C1 1/12 S	Base module with C-rail and screw terminals	312 622
PSSu BP-C1 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 622
PSSu BP-C1 1/12 C	Base module with C-rail and cage clamp terminals	312 623
PSSu BP-C1 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 623

Counter modules (failsafe)
PSSu E F INC



Overview

Module features

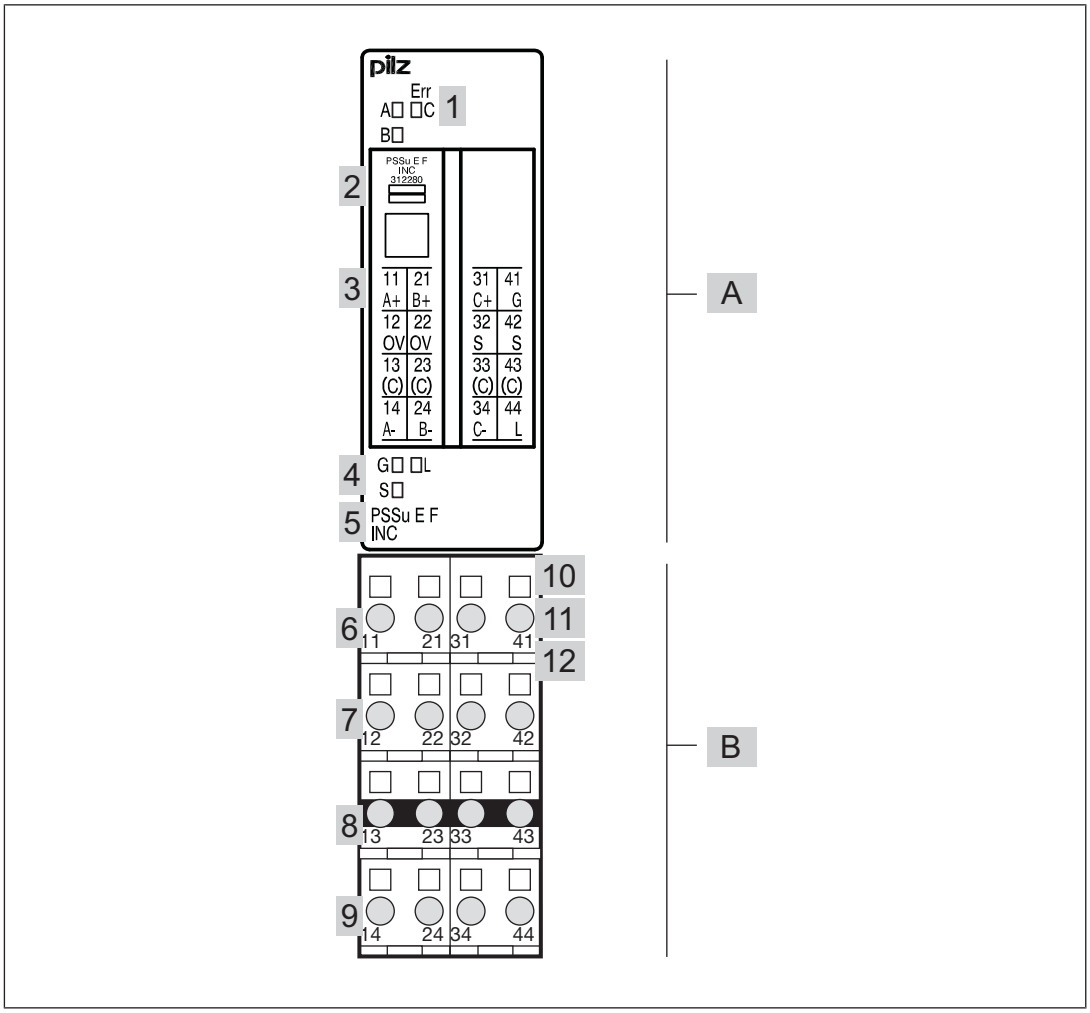
The product has the following features:

- Inputs for
  - Counter pulses (inputs A, B)
  - Zero pulse (input C)
  - Stopping the counter (input G, Gate)
  - Memory function (Input L, Latch)
  - Rotary encoder status (Input S, Status)
- Resolution of the counter and latch memory: 32 Bit
- Operating modes:
  - Incremental encoder
  - Counter
- Inputs A, B, C are operated as differential inputs with inverted signals (A-, B-, C-).
- LEDs for:
  - Data transfer per input A, B, C
  - Status per functional input (Gate, Latch, Status)
  - Module error
- For failsafe applications in system environment B (automation system PSS 4000)
- T-type:

  PSSu E F INC-T: for increased environmental requirements

Counter modules (failsafe)
PSSu E F INC

Front view



Legend:

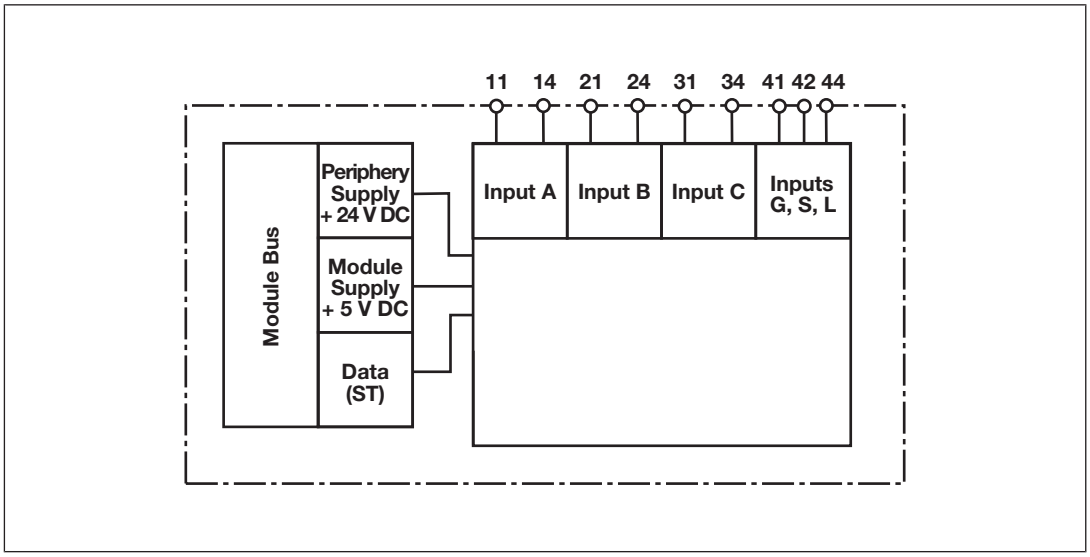
- A: Electronic module
- B: Base module
- 1: LEDs for
  - Module diagnostics
  - Status of the input channels A, B, C
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module

Counter modules (failsafe)
PSSu E F INC

- 4: LEDs for
  - Status of function inputs G, L, S
- 5: Name of electronic module
- 6: Connection level 1 (terminals 11, 21, 31, 41)
- 7: Connection level 2 (terminals 12, 22, 32, 42)
- 8: Connection level 3 (terminals 13, 23, 33, 43)
- 9: Connection level 4 (terminals 14, 24, 34, 44)
- 10: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 11: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 12: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Counter modules (failsafe)
PSSu E F INC

Integrated protection mechanisms

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Function description

Module supply

- The module supply provides the module with voltage.

Inputs

- 3 dual-pole, differential inputs A, B, C for connecting an incremental encoder or an encoder that provides rising edges as counter pulses.
- 3 single-pole inputs referenced to earth: G, L, S, for special functions

Operating modes

- Incremental encoder
- Counter

Functions

- Period length measurement
  or
- Storing the counter status in latch memory after a latch pulse or zero pulse
- Setting the counter status

The module transfers the data and status information to the head module via the module bus. The choice of function and the function's configuration are defined via the system software.

The single-pole inputs (G, L, S) are used for special functions. Inputs G and L may be connected to external signal sources, e.g. to a higher order control system. If the gate signals are generated by a non-safety-related device or if the gate inputs are connected, common cause failures may arise. A failure mode and effects analysis must be carried out when wiring the gate inputs.

- Input G (gate input)
  The counter is stopped with a 1 signal. The module ignores the counter pulses at the inputs until a 0 signal returns.

Counter modules (failsafe)
PSSu E F INC

- Input L (input for latch pulse)
  At a rising edge, the module stores the current counter value in the latch memory. The counter continues counting; it is not stopped by the latch pulse. The module transmits the stored value to the head module. The period length measurement may be configured as an alternative to the latch function.
- Input S (status input)
  The encoder's fault signal output can be connected to the status input. The module transmits the input state to the head module with the status information.

In both operating modes the counter can accept values from 0000 0000_H to FFFF $FFFF_H$.

- With an underflow the value drops below 0000 0000_H and the counter continues from FFFF $FFFF_H$.
- With an overflow the value FFFF $FFFF_H$ is exceeded and the counter continues from 0000 0000_H.

The overflow or underflow is signalled to the head module as status information.

The status information overflow is reset:

- if the value again falls below 0000 0000_H (underflow).
- if 5555 0000_H is exceeded (the lower third of the value range).

The status information underflow is reset:

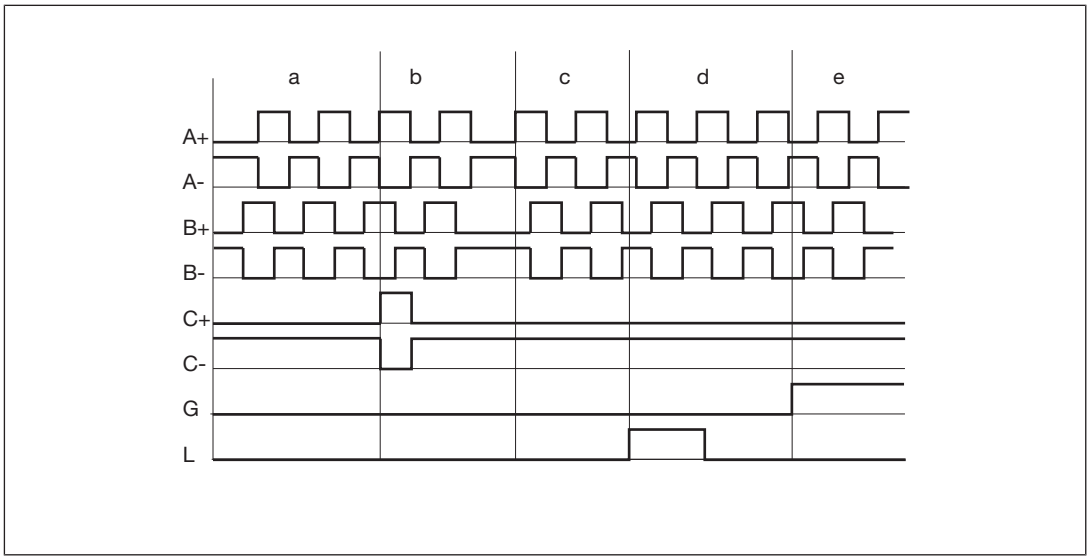
- if FFFF $FFFF_H$ is exceeded again (overflow).
- if AAAA $FFFF_H$ is exceeded (the upper third of the value range).

Counter modules (failsafe)
PSSu E F INC

Incremental encoder operating mode

The counter outputs and the output for the incremental encoder's zero pulse are connected to the dual-pole inputs (A, B, C).

- Inputs A, B
  The first channel of the encoder is connected to input A, the second to input B. The second channel is 90° out of phase. If channel A is leading, the module counts forwards. If channel A is lagging, the module counts backwards (see timing diagram).
- Input C
  The output for the incremental encoder's zero pulse is connected to input C. An incremental encoder typically supplies one zero pulse per rotation. If the zero pulse function is activated, the module copies the last value prior to the zero pulse into the latch memory and passes it to the process image of inputs (see chapter entitled "Transfer counter status via latch pulse").



Legend:

- a: The counter counts backwards because the signal at channel A is lagging.
- b: The module has received a zero pulse. Provided the function is activated, the counter value is copied into the latch memory with a rising edge at input C+.
- c: The counter counts forwards because the signal at channel A is leading.
- d: The module has received a latch pulse. Provided the function is activated, the counter value is copied into the latch memory with a rising edge at input L.
- e: The counter is disabled because there is a 1 signal at input G.

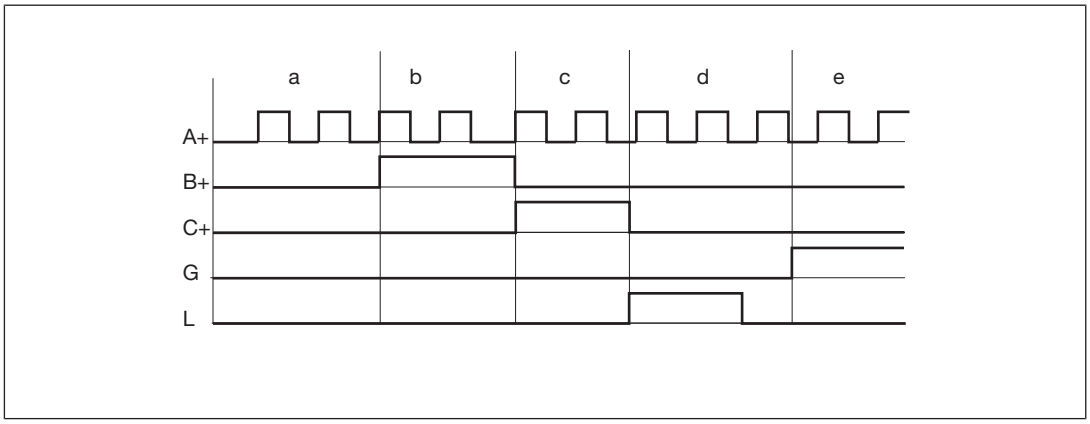
Counter modules (failsafe)
PSSu E F INC

Counter operating mode

"Counter" operating mode is not recommended for safety functions because pulses can be generated if there are any track errors. Compare errors can arise as a result, which can lead to a shutdown or to common cause errors.

In "Counter" operating mode, the module's dual-pole, differential inputs A, B, C have the following functions:

- Input A (Count)
  Input A is the input for the encoder's counter pulses. The module counts each rising edge.
- Input B (Up/down)
  At a 0 signal the module counts forwards. At a 1 signal the module counts backwards.
- Input C (Gate/Latch)
  The counter is stopped with a 1 signal. The module ignores the counter pulses at the input until a 0 signal returns.



Legend:

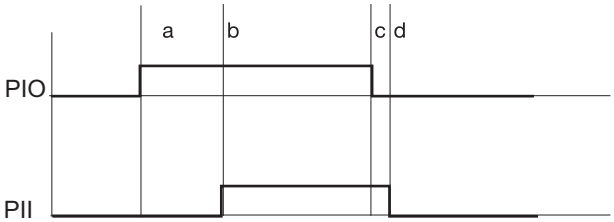
- a: The counter counts forwards because there is 0 signal at channel B.
- b: At the next rising edge at channel A, the counter counts backwards because there is a 1 signal at channel B.
- c: The counter is disabled because there is a 1 signal at input C.
- d: The module has received a latch pulse. Provided the function is activated, the counter value is copied into the latch memory with a rising edge at input L.
- e: The counter is disabled because there is a 1 signal at input G.

Counter modules (failsafe)
PSSu E F INC

Functions

The module can record the period length of the counter pulses on channel A. The period length is the time between two rising edges at channel A. It is transferred to the process image of inputs as multiple of 200 ns.

Prerequisite: This function is configured in PAS4000.



Legend:

- PIO: Process image of outputs, I/O datum: OutputData.LatchOrMeasure
- PII: Process image of inputs, I/O datum: InputData.LatchOrMeasureDone

Key to timing diagram:

Section	Function	Procedure for PSSu in system environment B
a	Start measurement	In the user program, set OutputData.LatchOrMeasure
b	Output measured value Set status bit	Measured value is written in InputData.LatchOrPeriod The module sets InputData.LatchOrMeasureDone
c	Finish measurement	In the user program, reset OutputData.LatchOrMeasure
d	Ready for new measurement	The module resets InputData.LatchOrMeasureDone

The result of the last period length measurement remains in the process image of inputs until the module signals a new measurement result by setting the status information. Before the initial measurement the process image of inputs contains 0000 0000_H or FFFF $FFFF_H$.

The module issues the result of period length measurement in multiples of 200 ns.

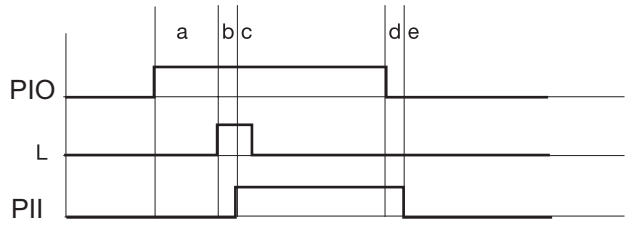
Example:

- The process image of inputs contains $32_H/50_D$
- The period length is 200 ns x 50 = 10 µs

A signal output can be connected to input L on the module for a latch pulse. The latch pulse may come from a PLC or position switch, for example. Using the latch function it is possible to record and transmit the counter status at the time of this latch pulse.

Counter modules (failsafe)
PSSu E F INC

Prerequisite: This function is configured in PAS4000.



Legend:

- PIO: Process image of outputs, I/O datum: OutputData.LatchOrMeasure
- L: Input L for external latch
- PII: Process image of inputs, I/O datum: InputData.LatchOrMeasureDone

Key to timing diagram:

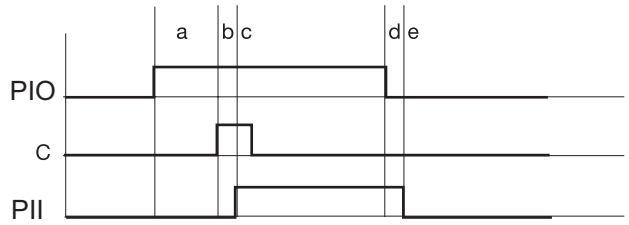
Section	Function	Procedure for PSSu in system environment B
a	Activate latch function	In the user program, set OutputData.LatchOrMeasure
b	Fill latch memory	Rising edge at input L: Counter status is transferred to the latch memory
c	Output counter status Set status bit	Counter status is written in InputData.LatchOrPeriod The module sets InputData.LatchOrMeasureDone
d	Finish latch function	In the user program, reset OutputData.LatchOrMeasure
e	Ready for new latch function	The module resets InputData.LatchOrMeasureDone

The contents of the latch memory remains in the process image of inputs until the module signals a new memory value by setting the status information. Before the initial transfer the process image of inputs contains 0000 0000_H or FFFF $FFFF_{H.}$

The module always transmits the counter status when the first latch pulse occurs after the function has started. All subsequent latch pulses are ignored until the function is completed and reset.

The output for the incremental encoder's zero pulse is connected to input C (C+/C-). An incremental encoder typically supplies one zero pulse per rotation. Using the zero pulse function it is possible to record the last counter status before the zero pulse and transmit it via the process image of inputs.

Counter modules (failsafe)
PSSu E F INC



Legend:

- PIO: Process image of outputs, I/O datum: OutputData.ZeroPulseActive
- C: Input C
- PII: Process image of inputs, I/O datum: InputData.ZeroPulse

Key to timing diagram:

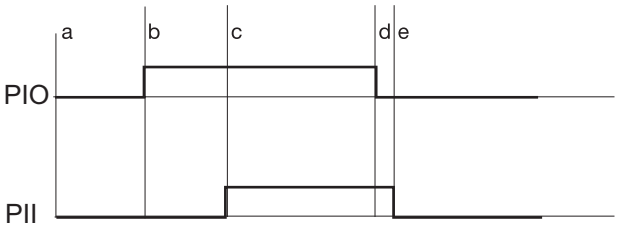
Section	Function	Procedure for PSSu in system environment B
a	Activate zero pulse function	In the user program, set OutputData.ZeroPulseActiv
b	Fill latch memory	Rising edge at input C: Counter status is transferred to the latch memory
c	Output counter status Set status bit	Counter status is written in InputData.LatchOrPeriod The module sets InputData.ZeroPulse
d	Finish zero pulse function	In the user program, reset OutputData.ZeroPulseActiv
e	Ready for new latch function	The module resets InputData.ZeroPulse

The zero pulse function has priority over the latch function and the "Period length measurement" function. If this function is activated, both the other functions are ignored, even if they have been activated.

The module always transmits the counter status when the first zero pulse occurs after the function has started. The counter statuses on all subsequent zero pulses are ignored until the function has been completed and reset.

The "Set counter status" function sets the counter to any value. The value is stated in the user program. The module transfers the value and continues counting from this counter status.

Counter modules (failsafe)
PSSu E F INC



Legend:

- PIO: Process image of outputs, I/O datum: OutputData.SetCounter
- PII: Process image of inputs, I/O datum: InputData.SetCounterDone

Key to timing diagram:

Section	Function	Procedure for PSSu in system environment B
a	Enter counter status	In the user program, assign the default counter status to OutputData.NewCounterValue
b	Transfer counter status	In the user program, set OutputData.SetCounter
c	Acknowledge transfer	The module sets InputData.SetCounterDone; InputData.Underflow and InputData.Overflow are reset
d	Finish transfer	In the user program, reset OutputData.SetCounter
e	Ready for new function	The module resets InputData.SetCounterDone

Configuration

The module has the following configuration options:

Configuration	Default value	Meaning
Operating mode	X	Incremental encoder mode
		Counter mode
Period length measurement or latch function	X	Latch function
		Period length measurement
Status input	X	The status at input S is transmitted via a bit.
		The status is transmitted via two redundant bits.
		The status is transmitted via two diverse bits.(1)

Counter modules (failsafe)
PSSu E F INC

(1) Transmitting the status via two bits enables simple fault detection: Two redundant bits must always be the same, two diverse bits must always be different, otherwise the transmission is faulty.

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

I/O data name	I/O data type	I/O data element	Meaning
OutputData	FS_O_INC	ZeroPulseActiv: BOOL	FALSE: Input C (zero pulse) inactive TRUE: Input C (zero pulse) active
		LatchOrMeasure: BOOL	FALSE: Input L (latch pulse) inactive/period length measurement inactive TRUE: Input L (latch pulse) active/ period length measurement active
		SetCounter: BOOL	FALSE: Do not transfer default counter status TRUE: Transfer default counter status
		NewCounterValue: DWORD	Default counter status

Counter modules (failsafe)
PSSu E F INC

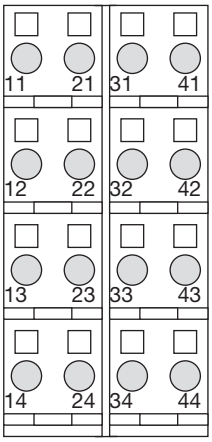
I/O data name	I/O data type	I/O data element	Meaning
InputData	FS_I_INC	CurrentData: DWORD	Current counter status in incremental encoder or counter mode
		LatchOrPeriod: DWORD	Counter status after a latch or zero pulse or period length
		ZeroPulse: BOOL	FALSE: No zero pulse at input C TRUE: Zero pulse at input C
		LatchOrMeasure-Done: BOOL	FALSE: Period length or contents of latch memory not transferred TRUE: Period length or contents of latch memory transferred
		SetCounterDONE: BOOL	FALSE: Default counter status not transferred TRUE: Default counter status transferred
		Underflow: BOOL	FALSE: No counter underflow TRUE: Counter underflow
		Overflow: BOOL	FALSE: No counter overflow TRUE: Counter overflow
		State1: BOOL	FALSE: Status input, Bit 1 (message from encoder) TRUE: Status input, Bit 1
		State2: BOOL	FALSE: Status input, Bit 2 (1) TRUE: Status input, Bit 2

(1) When configuring the module, users can determine the evaluation method for the status input: single, redundant or diverse. Transmitting the status via two bits enables simple fault detection: Two redundant bits must always be the same, two diverse bits must always be different, otherwise the transmission is faulty.

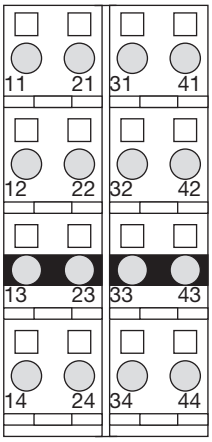
Counter modules (failsafe)
PSSu E F INC

Wiring

Terminal configuration

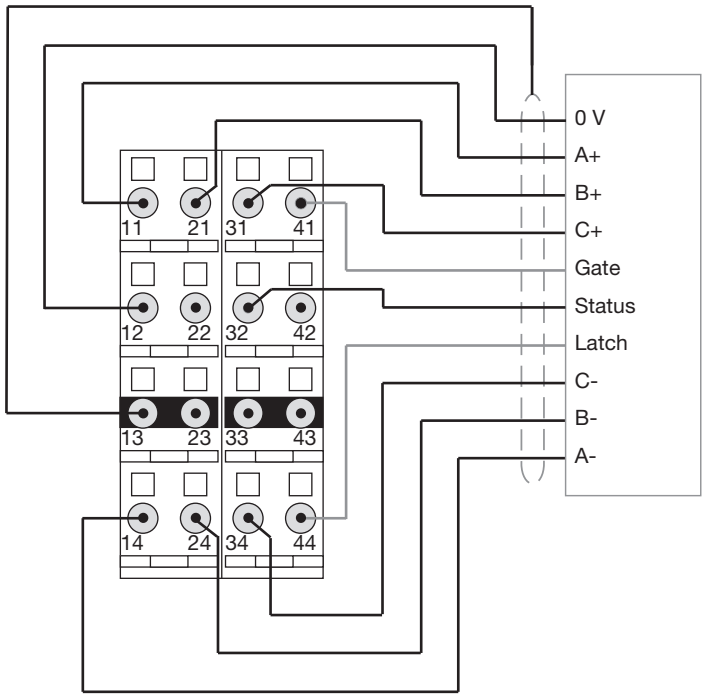
Base module	Terminal configuration	
Screw terminals: PSSu BP 2/16 S PSSu BP 2/16 S-T Cage clamp terminals: PSSu BP 2/16 C PSSu BP 2/16 C-T	Without C-rail: 11: Input A+ 21: Input B+ 31: Input C+ 41: Input G (Gate) 12-22: 0 V counter (12-22 linked within the base module) 32-42: Input S (Status) (32-42 linked within the base module) 13-23-33-43: Shield connection (13-23, 33-43 linked within the base module) 14: Input A- 24: Input B- 34: Input C- 44: Input L (Latch)	

Counter modules (failsafe)
PSSu E F INC

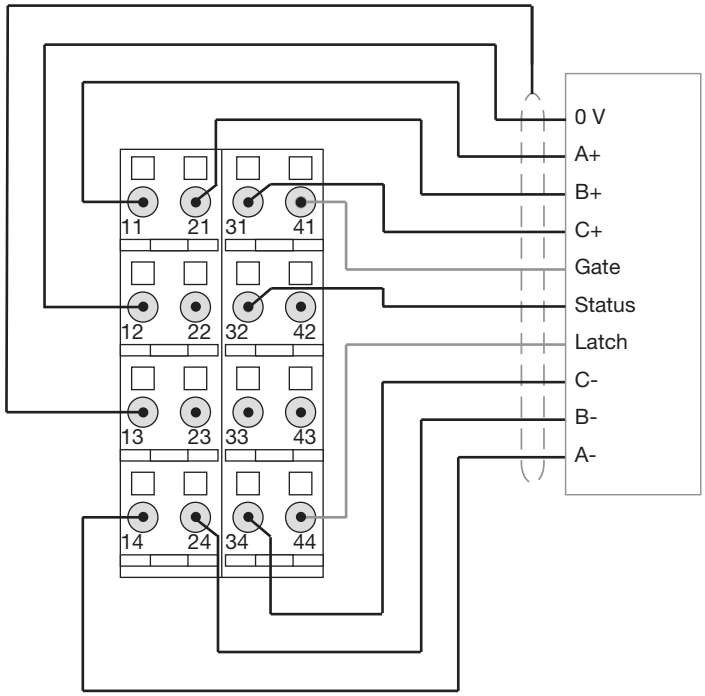
Base module	Terminal configuration	
Screw terminals: PSSu BP-C 2/16 S PSSu BP-C 2/16 S-T Cage clamp terminals: PSSu BP-C 2/16 C PSSu BP-C 2/16 C-T	With C-rail: 11: Input A+ 21: Input B+ 31: Input C+ 41: Input G (Gate) 12-22: 0 V counter (12-22 linked within the base module) 32-42: Input S (Status) (32-42 linked within the base module) 13-23-33-43: C-rail supply shield connection (13-23, 33-43 linked within the base module) 14: Input A- 24: Input B- 34: Input C- 44: Input L (Latch)	

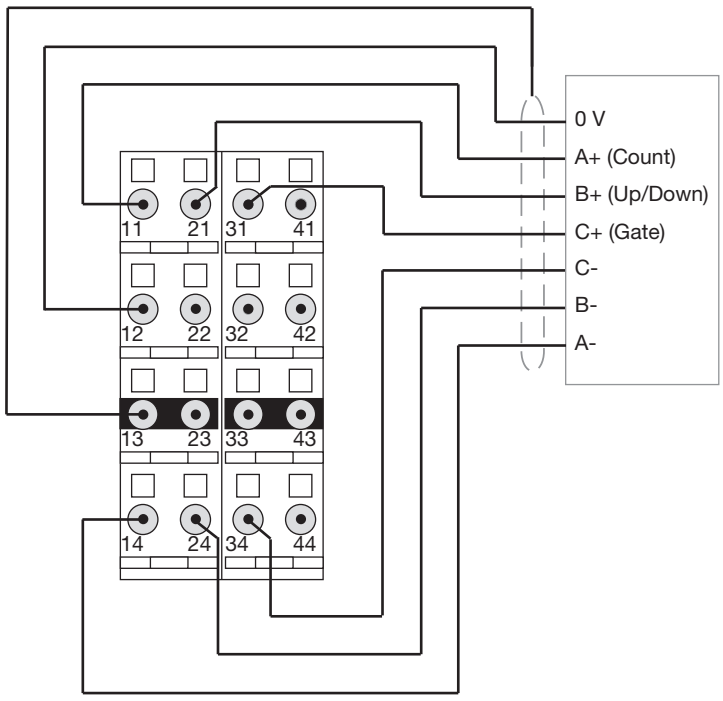
Counter modules (failsafe)
PSSu E F INC

Connecting the module

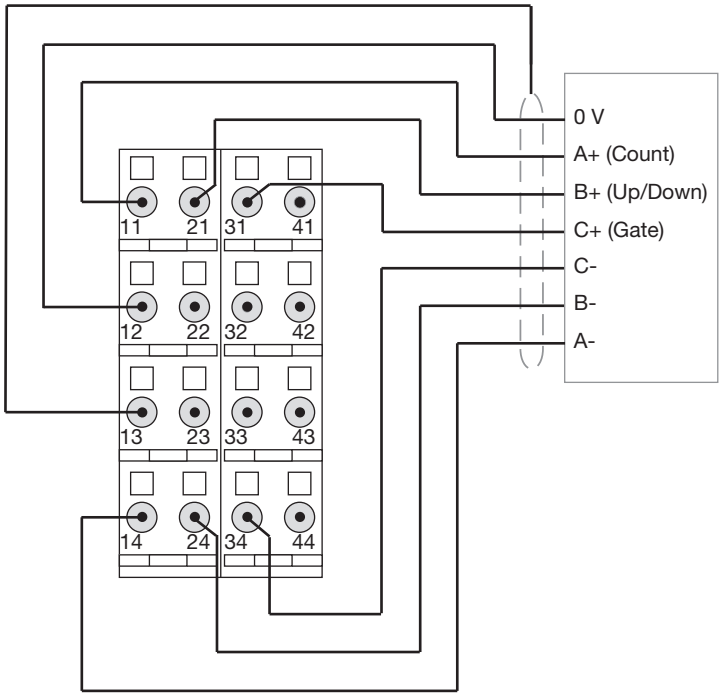
Incremental encoder operating mode	With C-rail
Encoder supply via the PSSu E PD module	

Counter modules (failsafe)
PSSu E F INC

Incremental encoder operating mode	Without C-rail
Encoder supply via the PSSu E PD module	

Counter operating mode	With C-rail
Encoder supply via the PSSu E PD module Function inputs (G, L, S) not connected.	

Counter modules (failsafe)
PSSu E F INC

Counter operating mode	Without C-rail
Encoder supply via the PSSu E PD module Function inputs (G, L, S) not connected.	

Counter modules (failsafe)
PSSu E F INC

Technical Details

General	312280	314280
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CE, EAC (Eurasian), TÜV, cULus Listed**
Application range	**Failsafe**	**Failsafe**
Module's device code	**0324h**	**0324h**
Number of ST input bits	**64**	**64**
Number of ST output bits	**32**	**32**
Number of ST status bits	**8**	**8**
Number of ST control bits	**8**	**8**
Application in system environment B		
From FS firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312280**	**314280**
Internal supply voltage (module supply)		
Module's power consumption	**0,79 W**	**0,79 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30 V**	**16,8 - 30 V**
Module's current consumption with no load	**15 mA**	**15 mA**
Module's power consumption with no load	**0,37 W**	**0,37 W**
Max. power dissipation of module	**1,2 W**	**1,2 W**
Incremental encoder input	**312280**	**314280**
Number of counter inputs	**1**	**1**
Type of counter inputs	**Incremental encoder**	**Incremental encoder**
Signal at counter inputs A and B and/or C	**Differential signal (RS 422)**	**Differential signal (RS 422)**
Permitted low signal range on LATCH/GATE/STATUS signals	**-3 - 5 V**	**-3 - 5 V**
Permitted high signal range on LATCH/GATE/STATUS signals	**11 - 30 V**	**11 - 30 V**
Typ. input current of the LATCH and/or GATE and/or STATUS signals at low level	**0 mA**	**0 mA**
Typ. input current of the LATCH and/or GATE and/or STATUS signals at high level	**4 mA**	**4 mA**
Max. number of bits on the counter input	**32 Bit**	**32 Bit**

Counter modules (failsafe)
PSSu E F INC

Incremental encoder input	312280	314280
Evaluation of counter pulses	**1x**	**1x**
Phase offset between differential signals A and B	**90 deg**	**90 deg**
Phase offset tolerance	**30 deg**	**30 deg**
Maximum cutoff frequency	**5 MHz**	**5 MHz**
Time constant of input filter on LATCH signal	**50 µs**	**50 µs**
Time constant of input filter on GATE signal	**50 µs**	**50 µs**
Time constant of input filter on STATUS signal	**50 µs**	**50 µs**
Typ. processing time	**0,1 ms**	**0,1 ms**
Potential isolation between input/ output and periphery supply	**yes**	**yes**
Potential isolation between input/ output and voltage for the internal module bus	**yes**	**yes**
Environmental data	**312280**	**314280**
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 150 Hz**	**10 - 1000 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Acceleration	**1g**	**5g**

Counter modules (failsafe)
PSSu E F INC

Environmental data	312280	314280
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**25g**
Duration	**16 ms**	**6 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Mechanical data	**312280**	**314280**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76 mm**	**76 mm**
Width	**25,2 mm**	**25,4 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**49 g**	**51 g**
Mechanical coding		
Type	**J**	**J**
Colour	**Yellow**	**Yellow**

Where standards are undated, the 2005-04 latest editions shall apply.

Counter modules (failsafe)
PSSu E F INC

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 4	SIL CL 3	3,34E-09	SIL 3	5,62E-06	20

If the module is operated at an ambient temperature above 60° C, the values stated in the table for PFH_D and PFD will need to be doubled when a safety function is calculated.

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

Order reference

Product

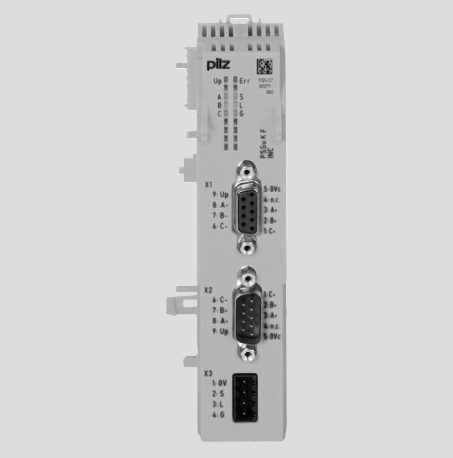
Product type	Features	Order No.
PSSu E F INC	Electronic module	312 280
PSSu E F INC-T	Electronic module, T-type	314 280

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 2/16 S	Base module without C-rail with screw terminals	312 628
PSSu BP 2/16 S-T	Base module without C-rail with screw terminals, T-type	314 628
PSSu BP 2/16 C	Base module without C-rail with cage clamp terminals	312 629
PSSu BP 2/16 C-T	Base module without C-rail with cage clamp terminals, T-type	314 629
PSSu BP-C 2/16 S	Base module with C-rail and screw terminals	312 630
PSSu BP-C 2/16 S-T	Base module with C-rail and screw terminals, T-type	314 630
PSSu BP-C 2/16 C	Base module with C-rail and cage clamp terminals	312 631
PSSu BP-C 2/16 C-T	Base module with C-rail and cage clamp terminals, T-type	314 631

Counter modules (failsafe)
PSSu K F INC



Overview

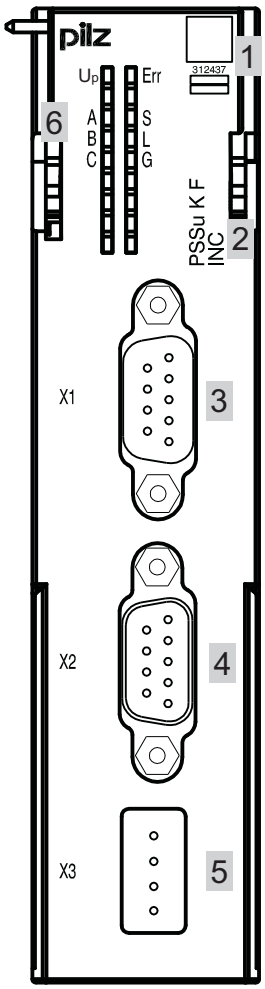
Module features

The product has the following features:

- Inputs for
  - Counter pulses (inputs A, B)
  - Zero pulse (input C)
  - Stopping the counter (input G, Gate)
  - Memory function (Input L, Latch)
  - Rotary encoder status (Input S, Status)
- Resolution of the counter and latch memory: 32 Bit
- Operating modes:
  - Incremental encoder
  - Counter
- Inputs A, B, C are operated as differential inputs with inverted signals (A-, B-, C-).
- LEDs for:
  - Data transfer per input A, B, C
  - Status per functional input (Gate, Latch, Status)
  - Module error
  - Sensor supply
- For failsafe and standard applications in system environment B (automation system PSS 4000)

Counter modules (failsafe)
PSSu K F INC

Front view



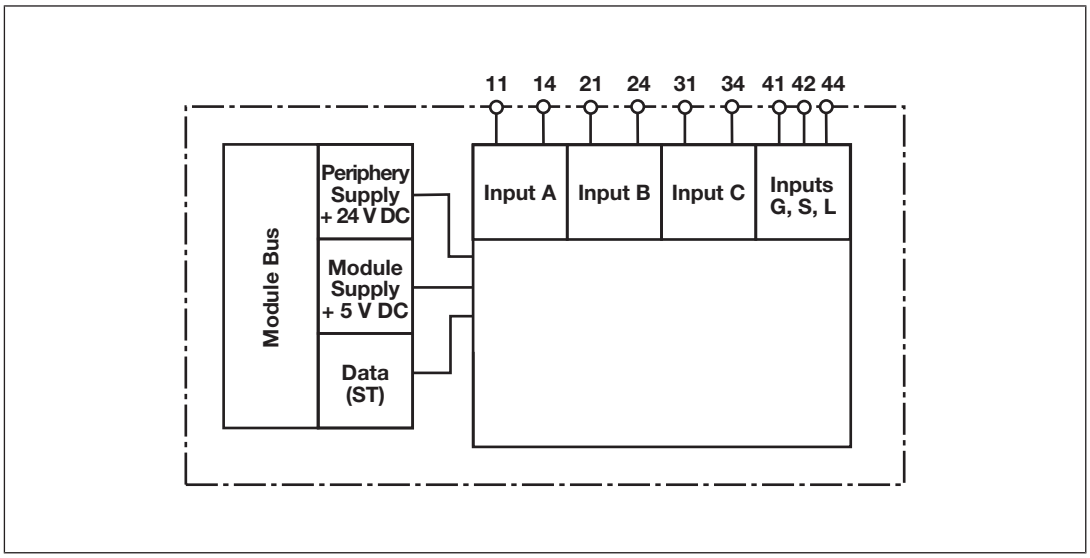
Legend:

- 1: Labelling strip with:
  - 2D code
  - Order number
  - Serial number
  - Hardware version number
- 2: Name of compact module
- 3: Female 9-pin D-Sub connector X1
- 4: Male 9-pin D-Sub connector X2
- 5: Male 4-pin connector X3
- 6: LEDs for status display and module diagnostics

Counter modules (failsafe)
PSSu K F INC

Function description

Block diagram



Module features

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Module supply

- The module supply provides the module with voltage.

Inputs

- 3 dual-pole, differential inputs A, B, C for connecting an incremental encoder or an encoder that provides rising edges as counter pulses.
- 3 single-pole inputs referenced to earth: G, L, S, for special functions

Counter modules (failsafe)
PSSu K F INC

Operating modes

- Incremental encoder
- Counter

Functions

- Period length measurement
  or
- Storing the counter status in latch memory after a latch pulse or zero pulse
- Setting the counter status

The module transfers the data and status information to the head module via the module bus. The choice of function and the function's configuration are defined via the system software.

The single-pole inputs (G, L, S) are used for special functions. Inputs G and L may be connected to external signal sources, e.g. to a higher order control system. If the gate signals are generated by a non-safety-related device or if the gate inputs are connected, common cause failures may arise. A failure mode and effects analysis must be carried out when wiring the gate inputs.

- Input G (gate input)
  The counter is stopped with a 1 signal. The module ignores the counter pulses at the inputs until a 0 signal returns.
- Input L (input for latch pulse)
  At a rising edge, the module stores the current counter value in the latch memory. The counter continues counting; it is not stopped by the latch pulse. The module transmits the stored value to the head module. The period length measurement may be configured as an alternative to the latch function.
- Input S (status input)
  The encoder's fault signal output can be connected to the status input. The module transmits the input state to the head module with the status information.

In both operating modes the counter can accept values from 0000 0000_H to FFFF $FFFF_H$.

- With an underflow the value drops below 0000 0000_H and the counter continues from FFFF $FFFF_H$.
- With an overflow the value FFFF $FFFF_H$ is exceeded and the counter continues from 0000 0000_H.

The overflow or underflow is signalled to the head module as status information.

The status information overflow is reset:

- if the value again falls below 0000 0000_H (underflow).
- if 5555 0000_H is exceeded (the lower third of the value range).

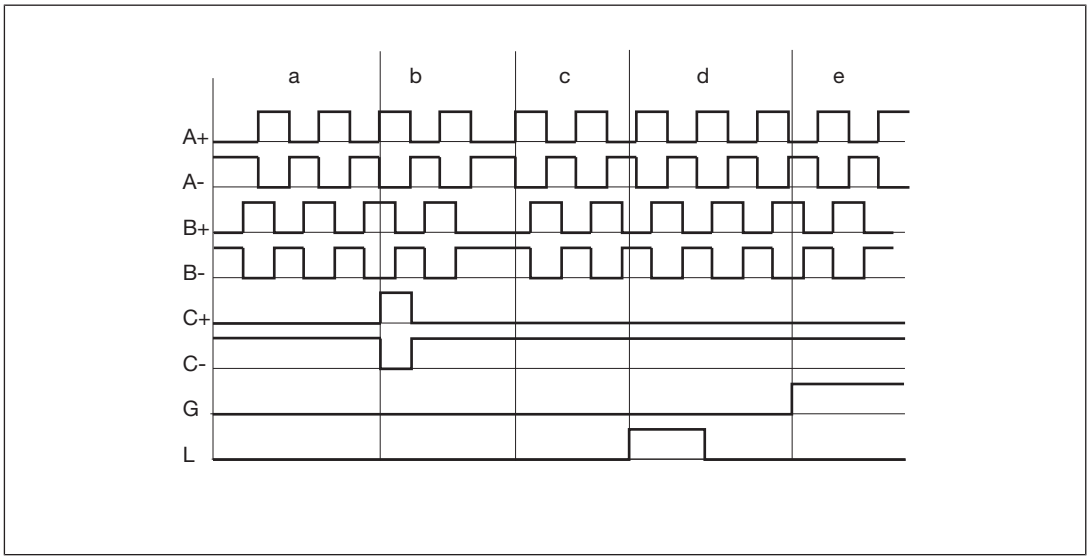
The status information underflow is reset:

- if FFFF $FFFF_H$ is exceeded again (overflow).
- if AAAA $FFFF_H$ is exceeded (the upper third of the value range).

Counter modules (failsafe)
PSSu K F INC

The counter outputs and the output for the incremental encoder's zero pulse are connected to the dual-pole inputs (A, B, C).

- Inputs A, B
  The first channel of the encoder is connected to input A, the second to input B. The second channel is 90° out of phase. If channel A is leading, the module counts forwards. If channel A is lagging, the module counts backwards (see timing diagram).
- Input C
  The output for the incremental encoder's zero pulse is connected to input C. An incremental encoder typically supplies one zero pulse per rotation. If the zero pulse function is activated, the module copies the last value prior to the zero pulse into the latch memory and passes it to the process image of inputs (see chapter entitled "Transfer counter status via latch pulse").



Legend:

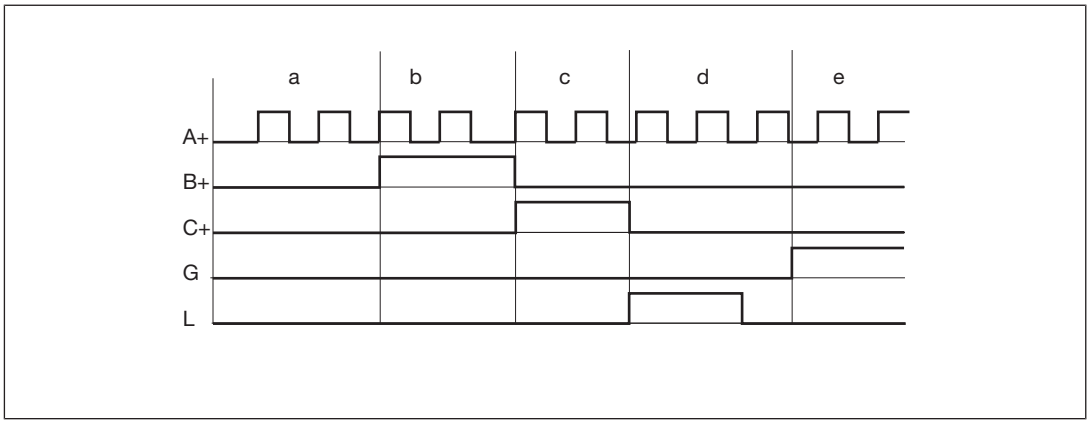
- a: The counter counts backwards because the signal at channel A is lagging.
- b: The module has received a zero pulse. Provided the function is activated, the counter value is copied into the latch memory with a rising edge at input C+.
- c: The counter counts forwards because the signal at channel A is leading.
- d: The module has received a latch pulse. Provided the function is activated, the counter value is copied into the latch memory with a rising edge at input L.
- e: The counter is disabled because there is a 1 signal at input G.

"Counter" operating mode is not recommended for safety functions because pulses can be generated if there are any track errors. Compare errors can arise as a result, which can lead to a shutdown or to common cause errors.

Counter modules (failsafe)
PSSu K F INC

In "Counter" operating mode, the module's dual-pole, differential inputs A, B, C have the following functions:

- Input A (Count)
  Input A is the input for the encoder's counter pulses. The module counts each rising edge.
- Input B (Up/down)
  At a 0 signal the module counts forwards. At a 1 signal the module counts backwards.
- Input C (Gate/Latch)
  The counter is stopped with a 1 signal. The module ignores the counter pulses at the input until a 0 signal returns.



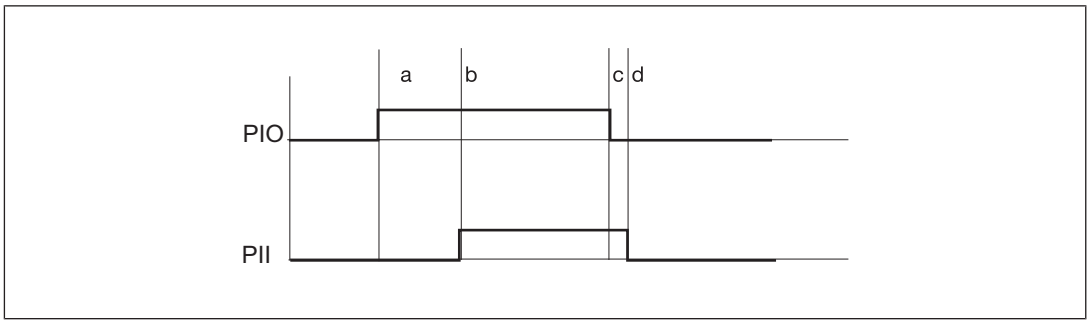
Legend:

- a: The counter counts forwards because there is 0 signal at channel B.
- b: At the next rising edge at channel A, the counter counts backwards because there is a 1 signal at channel B.
- c: The counter is disabled because there is a 1 signal at input C.
- d: The module has received a latch pulse. Provided the function is activated, the counter value is copied into the latch memory with a rising edge at input L.
- e: The counter is disabled because there is a 1 signal at input G.

The module can record the period length of the counter pulses on channel A. The period length is the time between two rising edges at channel A. It is transferred to the process image of inputs as multiple of 200 ns.

Counter modules (failsafe)
PSSu K F INC

Prerequisite: This function is configured in PAS4000.



Legend:

- PIO: Process image of outputs, I/O datum: OutputData.LatchOrMeasure
- PII: Process image of inputs, I/O datum: InputData.LatchOrMeasureDone

Key to timing diagram:

Section	Function	Procedure for PSSu in system environment B
a	Start measurement	In the user program, set OutputData.LatchOrMeasure
b	Output measured value Set status bit	Measured value is written in InputData.LatchOrPeriod The module sets InputData.LatchOrMeasureDone
c	Finish measurement	In the user program, reset OutputData.LatchOrMeasure
d	Ready for new measurement	The module resets InputData.LatchOrMeasureDone

The result of the last period length measurement remains in the process image of inputs until the module signals a new measurement result by setting the status information. Before the initial measurement the process image of inputs contains 0000 0000_H or FFFF $FFFF_H$.

The module issues the result of period length measurement in multiples of 200 ns.

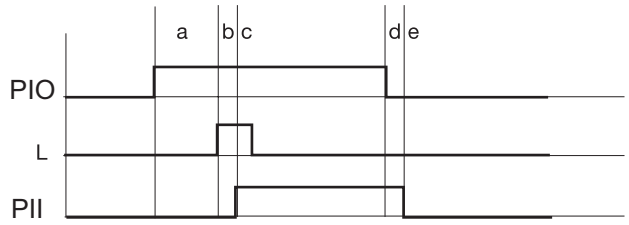
Example:

- The process image of inputs contains $32_H/50_D$
- The period length is 200 ns x 50 = 10 µs

A signal output can be connected to input L on the module for a latch pulse. The latch pulse may come from a PLC or position switch, for example. Using the latch function it is possible to record and transmit the counter status at the time of this latch pulse.

Counter modules (failsafe)
PSSu K F INC

Prerequisite: This function is configured in PAS4000.



Legend:

- PIO: Process image of outputs, I/O datum: OutputData.LatchOrMeasure
- L: Input L for external latch
- PII: Process image of inputs, I/O datum: InputData.LatchOrMeasureDone

Key to timing diagram:

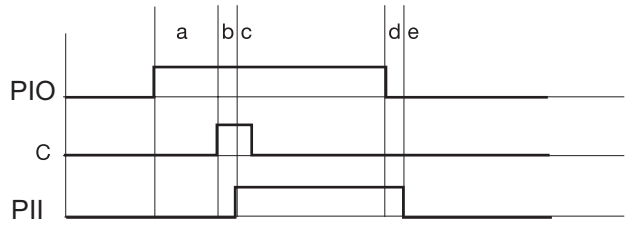
Section	Function	Procedure for PSSu in system environment B
a	Activate latch function	In the user program, set OutputData.LatchOrMeasure
b	Fill latch memory	Rising edge at input L: Counter status is transferred to the latch memory
c	Output counter status Set status bit	Counter status is written in InputData.LatchOrPeriod The module sets InputData.LatchOrMeasureDone
d	Finish latch function	In the user program, reset OutputData.LatchOrMeasure
e	Ready for new latch function	The module resets InputData.LatchOrMeasureDone

The contents of the latch memory remains in the process image of inputs until the module signals a new memory value by setting the status information. Before the initial transfer the process image of inputs contains 0000 0000_H or FFFF $FFFF_{H.}$

The module always transmits the counter status when the first latch pulse occurs after the function has started. All subsequent latch pulses are ignored until the function is completed and reset.

The output for the incremental encoder's zero pulse is connected to input C (C+/C-). An incremental encoder typically supplies one zero pulse per rotation. Using the zero pulse function it is possible to record the last counter status before the zero pulse and transmit it via the process image of inputs.

Counter modules (failsafe)
PSSu K F INC



Legend:

- PIO: Process image of outputs, I/O datum: OutputData.ZeroPulseActive
- C: Input C
- PII: Process image of inputs, I/O datum: InputData.ZeroPulse

Key to timing diagram:

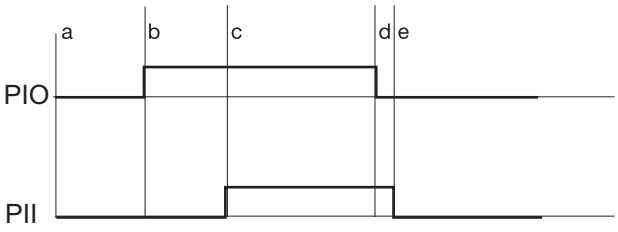
Section	Function	Procedure for PSSu in system environment B
a	Activate zero pulse function	In the user program, set OutputData.ZeroPulseActiv
b	Fill latch memory	Rising edge at input C: Counter status is transferred to the latch memory
c	Output counter status Set status bit	Counter status is written in InputData.LatchOrPeriod The module sets InputData.ZeroPulse
d	Finish zero pulse function	In the user program, reset OutputData.ZeroPulseActiv
e	Ready for new latch function	The module resets InputData.ZeroPulse

The zero pulse function has priority over the latch function and the "Period length measurement" function. If this function is activated, both the other functions are ignored, even if they have been activated.

The module always transmits the counter status when the first zero pulse occurs after the function has started. The counter statuses on all subsequent zero pulses are ignored until the function has been completed and reset.

The "Set counter status" function sets the counter to any value. The value is stated in the user program. The module transfers the value and continues counting from this counter status.

Counter modules (failsafe)
PSSu K F INC



Legend:

- PIO: Process image of outputs, I/O datum: OutputData.SetCounter
- PII: Process image of inputs, I/O datum: InputData.SetCounterDone

Key to timing diagram:

Section	Function	Procedure for PSSu in system environment B
a	Enter counter status	In the user program, assign the default counter status to OutputData.NewCounterValue
b	Transfer counter status	In the user program, set OutputData.SetCounter
c	Acknowledge transfer	The module sets InputData.SetCounterDone; InputData.Underflow and InputData.Overflow are reset
d	Finish transfer	In the user program, reset OutputData.SetCounter
e	Ready for new function	The module resets InputData.SetCounterDone

The module can evaluate the counter pulses once, twice or four times. Multiple evaluation increases the number of measuring steps and reduces the output frequency of the incremental encoder.

Multiple evaluation is only possible in incremental encoder operating mode.

- ***Single evaluation*** option:

  Each rising edge at channel A increases the counter status.
- ***Double evaluation*** option:

  Each rising and each falling edge at channel A increases the counter status.
- ***Quadruple evaluation*** option:

  Each rising and each falling edge at channel A and channel B increases the counter status.

The ***Double evaluation*** and ***Quadruple evaluation*** option may not be used for failsafe applications.

Counter modules (failsafe)
PSSu K F INC

Configuration

The module has the following configuration options:

Configuration	Default value	Meaning
Operating mode	X	Incremental encoder mode
		Counter mode
Period length measurement or latch function	X	Latch function
		Period length measurement
Multiple evaluation	X	Single evaluation
		Double evaluation[2]
		Quadruple evaluation[2]
Status input	X	The status at input S is transmitted via a bit.
		The status is transmitted via two redundant bits.
		The status is transmitted via two diverse bits.[1]

[1] Transmitting the status via two bits enables simple fault detection: Two redundant bits must always be the same, two diverse bits must always be different, otherwise the transmission is faulty.

[2] The ***Double evaluation*** and ***Quadruple evaluation*** options may not be used for failsafe applications.

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

I/O data name	I/O data type	I/O data element	Meaning
OutputData	FS_O_INC	ZeroPulseActiv: BOOL	FALSE: Input C (zero pulse) inactive TRUE: Input C (zero pulse) active
		LatchOrMeasure: BOOL	FALSE: Input L (latch pulse) inactive/period length measurement inactive TRUE: Input L (latch pulse) active/ period length measurement active
		SetCounter: BOOL	FALSE: Do not transfer default counter status TRUE: Transfer default counter status
		NewCounterValue: DWORD	Default counter status

Counter modules (failsafe)
PSSu K F INC

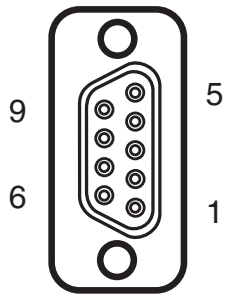
I/O data name	I/O data type	I/O data element	Meaning
InputData	FS_I_INC	CurrentData: DWORD	Current counter status in incremental encoder or counter mode
		LatchOrPeriod: DWORD	Counter status after a latch or zero pulse or period length
		ZeroPulse: BOOL	FALSE: No zero pulse at input C TRUE: Zero pulse at input C
		LatchOrMeasure-Done: BOOL	FALSE: Period length or contents of latch memory not transferred TRUE: Period length or contents of latch memory transferred
		SetCounterDONE: BOOL	FALSE: Default counter status not transferred TRUE: Default counter status transferred
		Underflow: BOOL	FALSE: No counter underflow TRUE: Counter underflow
		Overflow: BOOL	FALSE: No counter overflow TRUE: Counter overflow
		State1: BOOL	FALSE: Status input, Bit 1 (message from encoder) TRUE: Status input, Bit 1
		State2: BOOL	FALSE: Status input, Bit 2 (1) TRUE: Status input, Bit 2

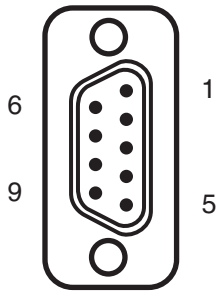
(1) When configuring the module, users can determine the evaluation method for the status input: single, redundant or diverse. Transmitting the status via two bits enables simple fault detection: Two redundant bits must always be the same, two diverse bits must always be different, otherwise the transmission is faulty.

Counter modules (failsafe)
PSSu K F INC

Wiring

Interface configuration

Connection encoder signals	Layout	
Female 9-pin D-Sub connector	**X1** 1: C+ 2: B+ 3: A+ 4: n. c. 5: 0 V counter 6: C- 7: B- 8: A- 9: U_p (+5 V for sensor)	

Connection control	Layout	
Male 9-pin D-Sub connector	**X2** 1: C+ 2: B+ 3: A+ 4: n. c. 5: 0 V counter 6: C- 7: B- 8: A- 9: U_p (+5 V for sensor)	

Connection functional outputs input devices	Layout	
4-pin connector	**X3** 1: 0 V 2: Status S 3: Latch L 4: Gate G	

n.c. = not connected

Counter modules (failsafe)
PSSu K F INC

Technical Details

General	
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Application range	**Failsafe**
Module's device code	**0324h**
Number of ST input bits	**64**
Number of ST output bits	**32**
Number of ST status bits	**8**
Number of ST control bits	**8**
Application in system environment B	
From FS firmware version, head modules	**1.0.0**
Electrical data	
Internal supply voltage (module supply)	
Module's power consumption	**0,79 W**
Periphery's supply voltage (periphery supply)	
Voltage range	**16,8 - 30 V**
Module's current consumption with no load	**15 mA**
Module's power consumption with no load	**0,37 W**
Max. power dissipation of module	**1,2 W**
Incremental encoder input	
Number of counter inputs	**1**
Type of counter inputs	**Incremental encoder**
Signal at counter inputs A and B and/or C	**Differential signal (RS 422)**
Permitted low signal range on LATCH/GATE/ STATUS signals	**-3 - 5 V**
Permitted high signal range on LATCH/GATE/ STATUS signals	**11 - 30 V**
Typ. input current of the LATCH and/or GATE and/or STATUS signals at low level	**0 mA**
Typ. input current of the LATCH and/or GATE and/or STATUS signals at high level	**4 mA**
Max. number of bits on the counter input	**32 Bit**
Evaluation of counter pulses	**1x, 2x, 4x**
Phase offset between differential signals A and B	**90 deg**
Phase offset tolerance	**30 deg**
Maximum cutoff frequency	**5 MHz**
Time constant of input filter on LATCH signal	**50 µs**
Time constant of input filter on GATE signal	**50 µs**
Time constant of input filter on STATUS signal	**50 µs**
Typ. processing time	**0,1 ms**

Counter modules (failsafe)
PSSu K F INC

Incremental encoder input	
Potential isolation between input/output and periphery supply	**yes**
Potential isolation between input/output and voltage for the internal module bus	**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 - 60 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**
Climatic suitability	
In accordance with the standard	**EN 60068-2-30, 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 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 150 Hz, 10 - 55 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
In accordance with the standard	**IEC 60664-1**
Overvoltage category	**II**
Pollution degree	**2**

Counter modules (failsafe)
PSSu K F INC

Environmental data	
Protection type	
In accordance with the standard	**EN 60529**
Housing	**IP20**
Mounting area (e.g. control cabinet)	**IP54**
Mechanical data	
Material	
Bottom	**PC**
Top	**PC**
Connection type	**D-Sub female connector, D-Sub male connector**
Dimensions	
Height	**128,9 mm**
Width	**30 mm**
Depth	**56 mm**
Weight	**90 g**

Where standards are undated, the 2005-04 latest editions shall apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**3,34E-09**	**SIL 3**	**5,62E-06**	**20**

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

Order reference

Product

Product type	Features	Order No.
PSSu K F INC	Compact module without connector, labelling bracket and labelling strips	312 437

Counter modules (failsafe)
PSSu K F INC

Accessories

Terminals

Product type	Features	Order No.
PSSu A Con 4 S	Connector with screw terminals 4pin	313 117
PSSu A Con 4 C	Connector with spring-loaded terminals 4pin	313 118

Labelling

Product type	Features	Order No.
PSSu A LC 0.1	Labelling bracket, scope of supply: 5 pieces	312 966
PSSu A LA0	Labelling strips, laser printable, scope of supply: 1080 pieces (10 x DIN A4 sheet, 108 on each)	312 958

Counter modules (failsafe)
PSSu K F EI

Overview

Module features

- Max. 8 modules in one PSSu system
- Monitoring of 1 axis
- Configurable within the PAS4000
- Measured value recorded by proximity switch or encoder
- Monitoring functions:
  - Safe speed monitoring (SSM)
  - Safe speed range monitoring (SSR-M)
  - Safe operating stop monitoring (SOS-M)
  - Safe direction of movement monitoring (SDI-M)
- Analogue voltage (track S)
- 2 digital FS outputs
  - Semiconductor technology
  - Single-pole
  - Positive-switching
  - Current load capacity per output: 0,50 A
  - Short circuit-proof
  - Overload-proof
  - Free from feedback
- 1 digital ST output
  - Semiconductor technology
  - Single-pole

Counter modules (failsafe)
PSSu K F EI

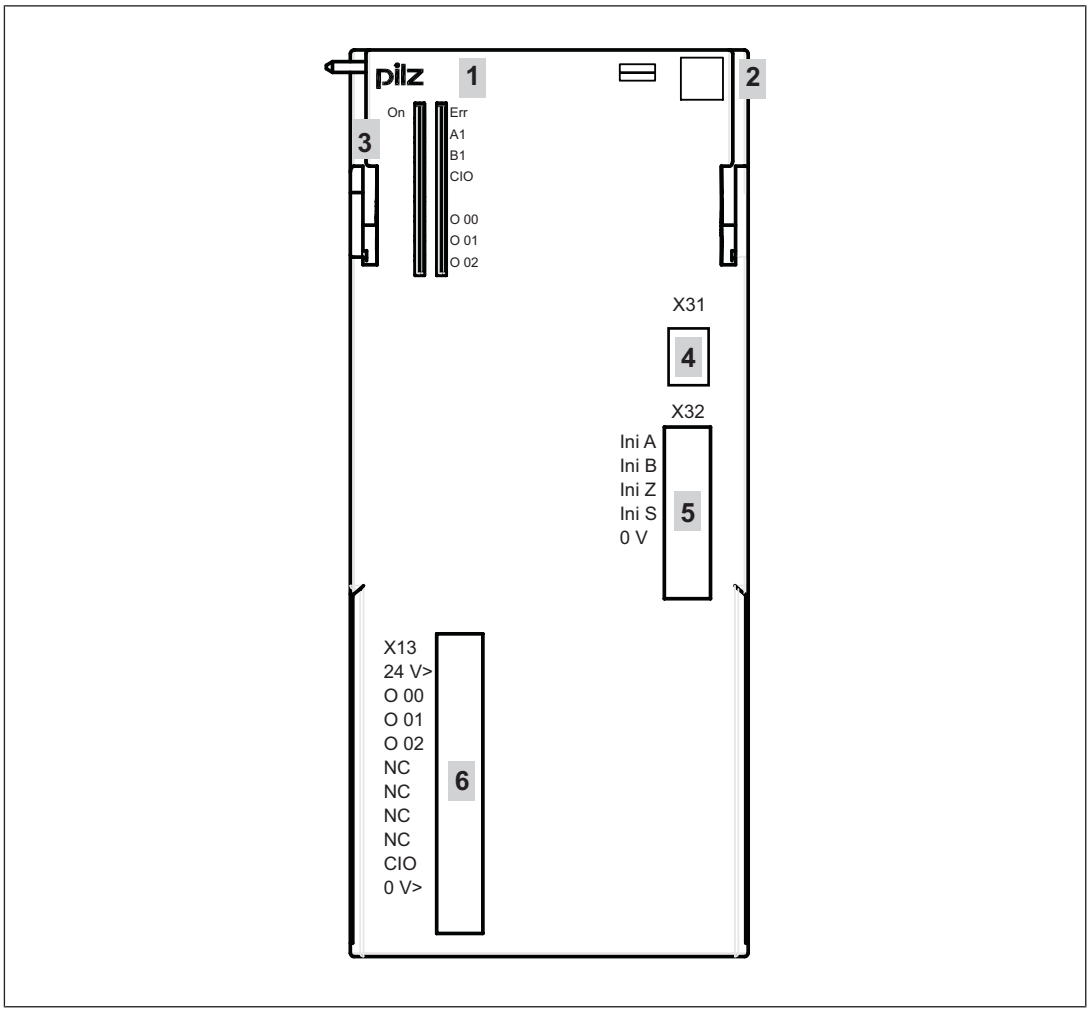
  - Positive-switching
  - Short circuit-proof
  - Current load capacity per output: 0.5 A
- 1 combined ST input and output "CIO" for networking several devices
- LEDs for:
  - Switch status of each input/output
  - Module error
  - Module status
- For failsafe applications in system environment B (automation system PSS 4000)

Accessories:

- Connector with spring-loaded terminals (necessary for operation)
- Labelling bracket
- Labelling strips (sheets)

Counter modules (failsafe)
PSSu K F EI

Front view



Legend:

- 1: Name of compact module
- 2: Labelling strip with:
  - 2D code
  - Order number
  - Serial number
  - Hardware version number
- 3: LEDs for status display and module diagnostics
- 4: Mini-IO socket X31 for connecting encoders
- 5: Connector strip X32 for connecting proximity switches
- 6: Connector strip X13 for connectors with spring-loaded terminals and labelling strip

Counter modules (failsafe)
PSSu K F EI

Function description

Module and periphery supply

Module supply

- The module supply provides the module with voltage.

Periphery supply

- The periphery supply that supplies the outputs must be fed externally. The single-pole outputs must have a common supply voltage.

FS outputs

- 2 single-pole digital outputs

Output test

- Outputs that are switched on are checked via regular off tests.
  - Test pulses for outputs that are switched on: see Technical details [1041]
  - Outputs that are switched on are switched off for the duration of the test pulse.
  - The load must not switch off because of the test.
- Outputs that are switched off are checked via regular on tests.
  - Test pulses for outputs that are switched off: see Technical details [1041]
  - Outputs that are switched off are switched on for the duration of the test pulse.
  - The load must not switch on because of the test.

Excluding individual outputs from the output test:

- If a plant is particularly sensitive to the test pulses, the output test may be switched off for individual outputs.
- The test must be replaced by other measures, depending on the safety requirement.
- When test pulses are switched off:
  - The correct switch status is always checked.
  - The output's ability to switch will not be detected until the next time the output is switched on/off.

Counter modules (failsafe)
PSSu K F EI

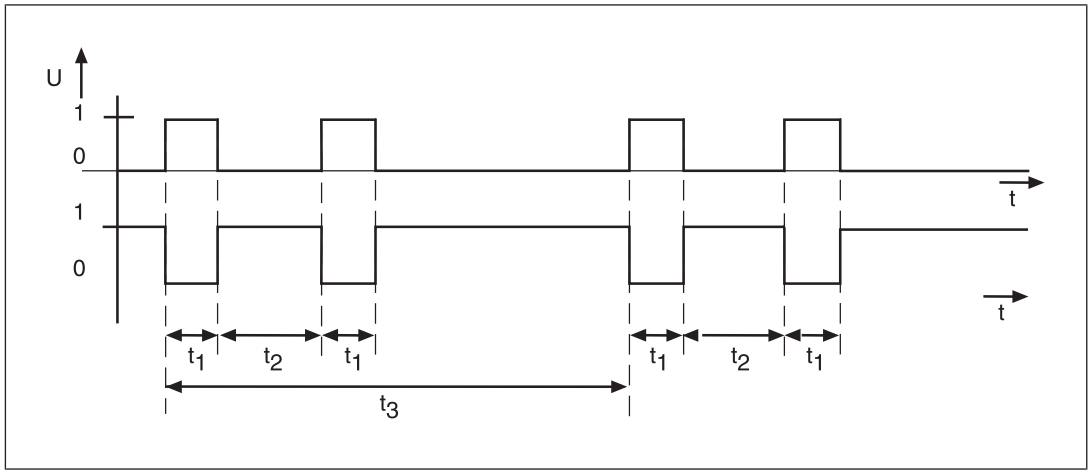


Fig.: On and off test for single-pole outputs

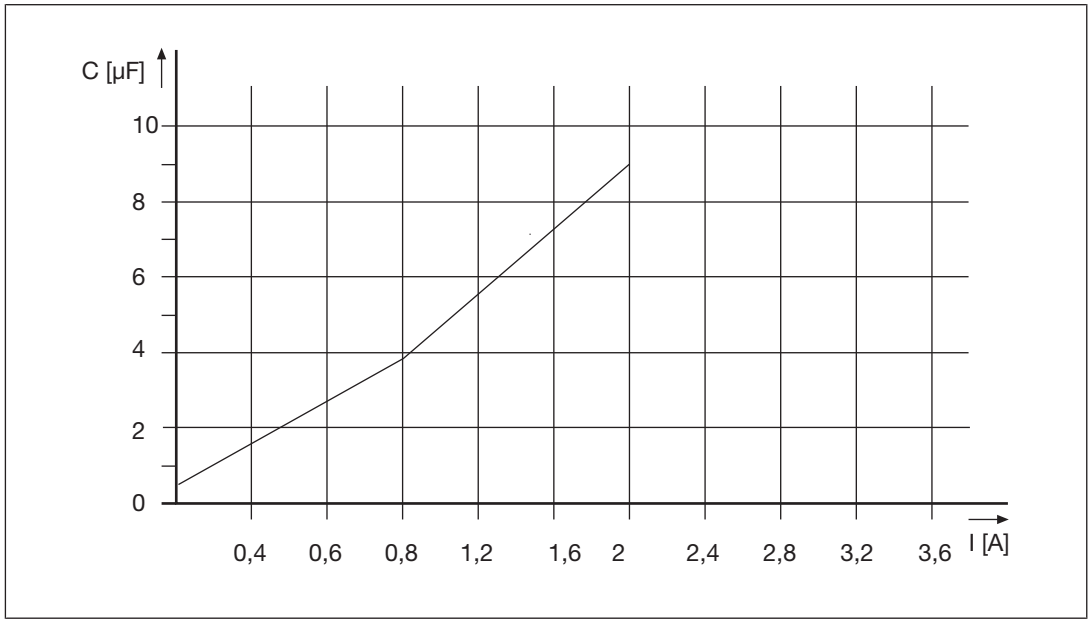
Legend

t_1 Pulse duration of on/off test (200 µs)

t_2 Max. waiting time between the on/off test (approx. 4 ms)

t_3 Repetition time of on and off test in normal circumstances (approx. 2 s)

Characteristic for single-pole outputs: Output capacitance C dependent on load current I



Counter modules (failsafe)
PSSu K F EI

- For applications in accordance with Category 4, PL e and SIL 3, detection of shorts between contacts must be guaranteed either via the on/off test or through other measures (e.g. asynchronous switching). A short between contacts must be simulated during commissioning.

ST output

- 1 ST output

Signals at the output

- "0" signal (0 V) at the output:
  - Output is high impedance
  - No current to the load
- "1" signal (+24 V) at the output:
  - Output is low impedance
  - Current is supplied to the load

Cascading

Cascading can be used to network several modules. A combined standard input/output CIO is used for cascading. If one of the networked modules triggers a monitoring function, then all networked modules are switched off. To ensure that more than one axis can be stopped via cascading when a monitoring function reacts, the following measures are necessary:

- Connect the CIO terminals of all modules, whose axes are to be stopped at the same time. Make sure that the modules are connected to a common 0 V periphery supply.
- Activate the cascading input (terminal CIO) in the module's hardware configuration (PAS4000) if the module is to be switched off by another module via the cascading output CIO (repeat for other axes if applicable).
- Activate the cascading output (terminal CIO) with *ActivateCascading* = TRUE for all the modules connected via the terminals CIO.

Example:

- Three axes are to be monitored.
- One module is used per axis:
  - Axis 1 = Module 1
  - Axis 2 = Module 2
  - Axis 3 = Module 3
- If a monitoring function has reacted at axis 1 or axis 2, then axis 3 is to be stopped.
- Wiring:
  - Connect together the CIO terminals of all modules, whose axes are to be stopped at the same time. Make sure that the modules are connected to a common 0 V periphery supply.

Counter modules (failsafe)
PSSu K F EI

- Configuration:
  - Set the I-variable *ActivateCascading* to TRUE for module 1, module 2 and module 3 on the block FS_EI_Basic. This means that the result of the monitoring functions will affect the cascading output CIO of module 1 and module 2.
  - In the hardware configuration, the "Activate cascading input" option must be set to "Yes" for module 3. This means that the result of the monitoring functions from module 1 and module 2 will affect the cascading input CIO of module 3. If a monitoring function should react on module 1 or module 2, axis 3 monitored using module 3 will be stopped.

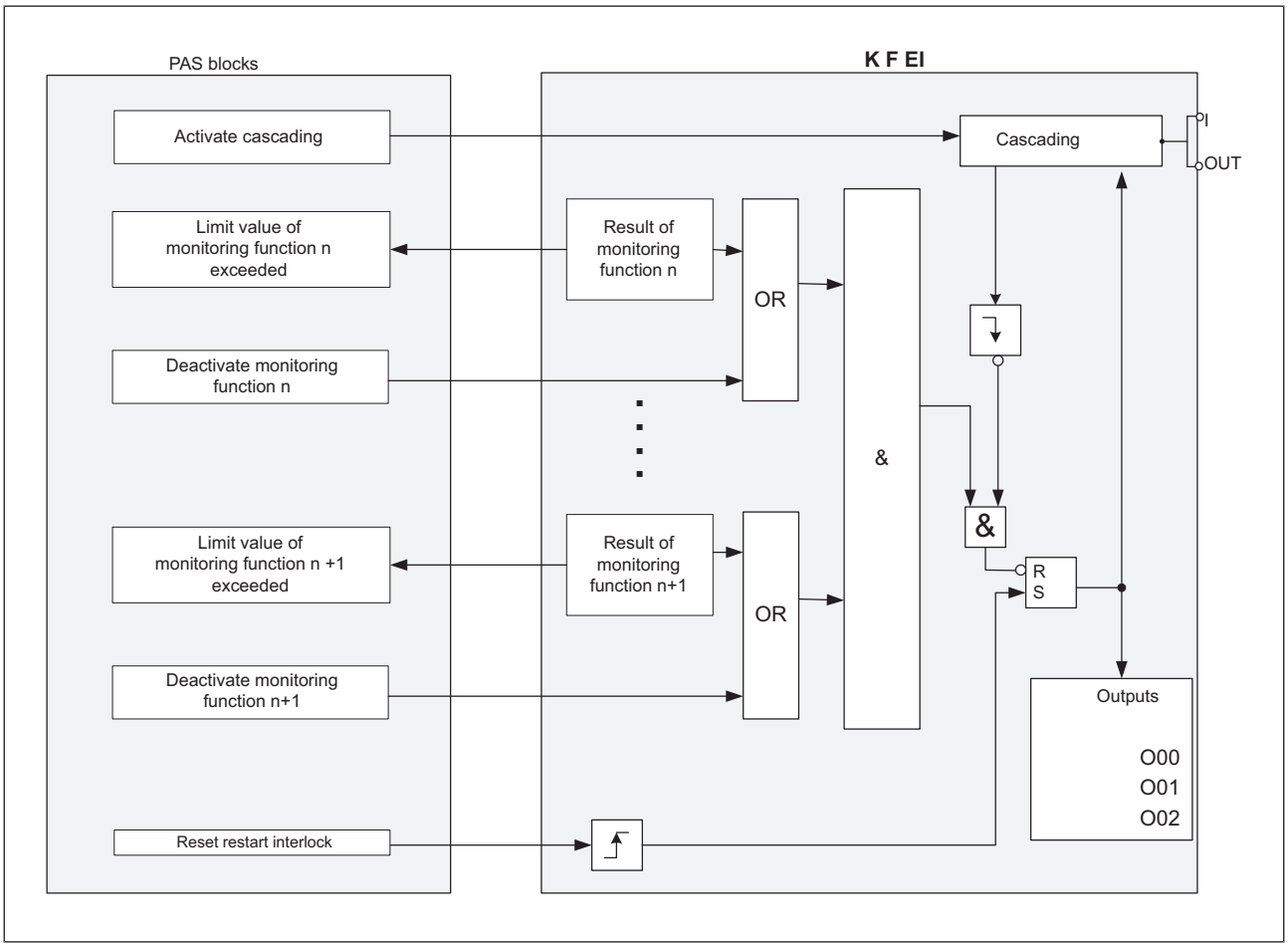
Counter modules (failsafe)
PSSu K F EI

Monitoring functions

- The module's FS outputs can trigger the safety function STO or SS1 on a drive as a reaction to the result of the monitoring functions.
- The module's ST output can trigger the braking ramp of the safety function SS1 as a reaction to the result of the monitoring functions.
- The outputs have a restart interlock.
- The blocks can be used to deactivate unneeded monitoring functions.
- All monitoring functions that are not deactivated affect the outputs, along with cascading.

Further information is available in PAS4000's online help.

Function diagram:



Counter modules (failsafe)
PSSu K F EI

The "Safe speed monitoring" function (SSM) monitors whether the current speed exceeds a limit value.

A tolerance range may also be set for the limit values used to monitor the speed. This tolerance range modifies the set limit values. As a result, one-off or periodic overshoots that exceed the limit values can be tolerated.

Activate the monitoring function by:

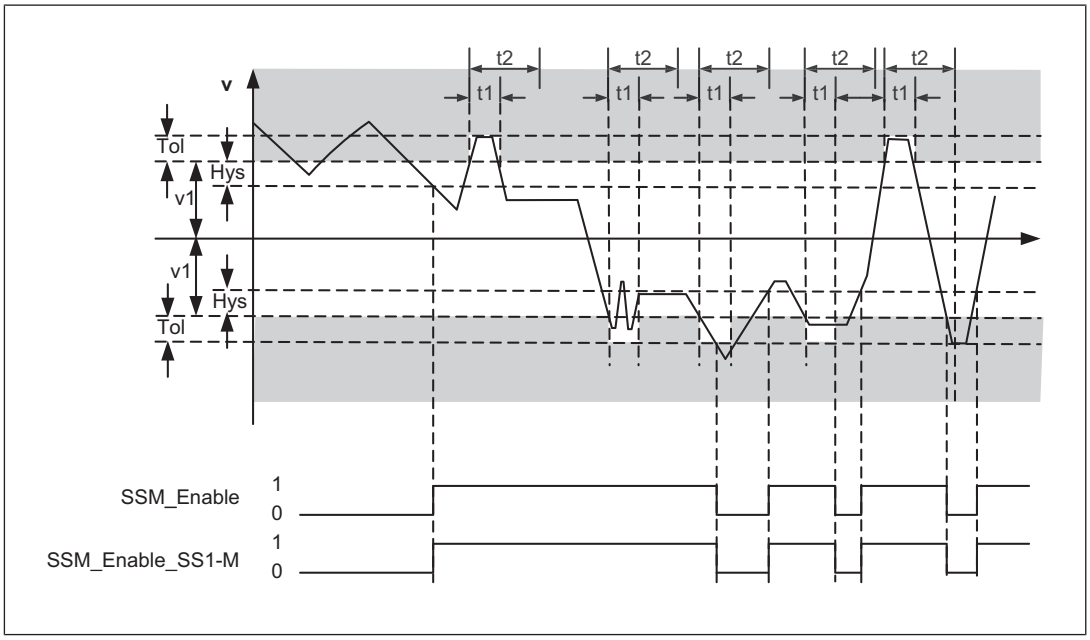
- The monitoring function does not need to be activated. Monitoring starts as soon as the module is ready for operation.

Reaction:

- If the configured limit value, plus the configured tolerance, is violated:
  - a 1/0 pulse edge at SSM_Enable
  - the local outputs switch off, depending on the configuration. Further information is available in PAS4000's online help.

The following values can be configured for the tolerance range:

- Tolerance time (t1), which takes into account the length of the overshoots (maximum time for which the limit value may be exceeded)
- Tolerance period (t2), which takes into account the oscillation period (minimum time that must elapse between one limit value overshoot and the next)
- Tolerance amount as % (Tol), which takes into account the amplitude of the overshoots (maximum permitted percentage by which the configured limit values may be exceeded)
- Hysteresis as % (Hys), prevents the outputs from bouncing if there are fluctuations around the response value. The hysteresis takes effect when the output is switched on:
  - Switch-on value = Switching threshold – Hysteresis



Counter modules (failsafe)
PSSu K F EI

Legend:

- SSM_Enable:
  - "1": Monitored limit value is not violated
  - "0": Monitored limit value is violated
- Output on the module (SSM_Enable_SS1):
  - "1": Monitored limit value is not violated
  - "0": Monitored limit value is violated
- t_1: Tolerance time
- t_2: Tolerance period
- Tol (%): Tolerance amount of limit value in both directions
- Hys (%): Hysteresis when switching the monitoring function back on

Counter modules (failsafe)
PSSu K F EI

The "Safe Speed Range Monitoring" function (SSR-M) monitors the current speed to ensure it stays within a maximum and minimum permitted limit value.

A tolerance range may also be set for the limit values used to monitor the speed range. This tolerance range modifies the set limit values. As a result, one-off or periodic overshoots that exceed the range limits can be tolerated.

Activate the monitoring function by:

- The monitoring function does not need to be activated. Monitoring starts as soon as the module is ready for operation.

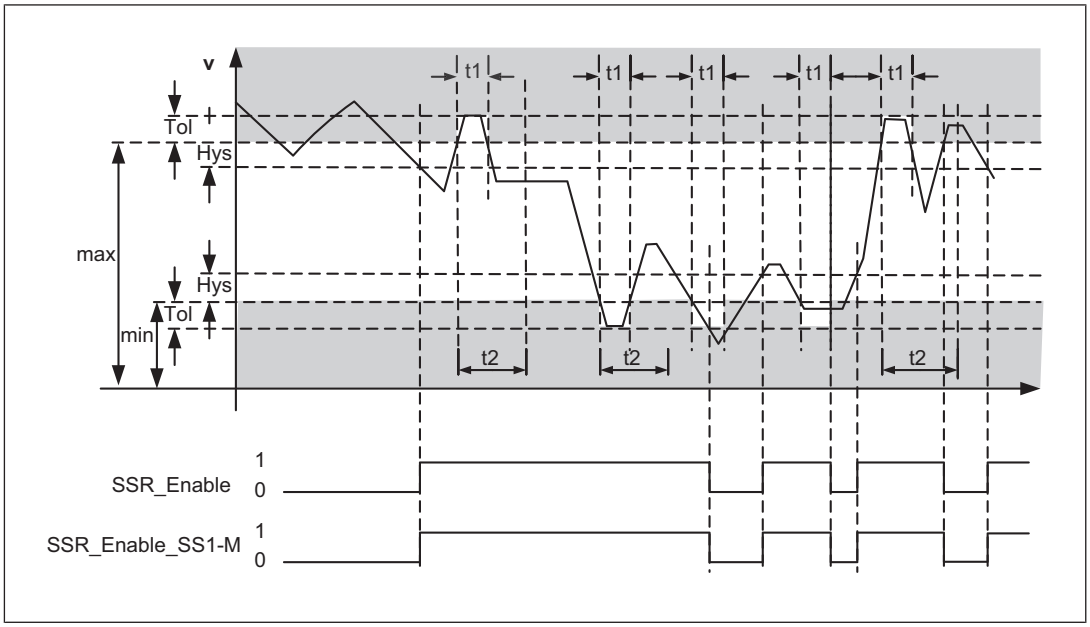
Reaction:

- If the configured limit value, plus the configured tolerance, is violated:
  - a 1/0 pulse edge at SSR_Enable
  - the local outputs switch off, depending on the configuration. Further information is available in PAS4000's online help.

The following values can be configured for the tolerance range:

- Tolerance time (t1), which takes into account the length of the overshoots (maximum time for which the limit value may be exceeded)
- Tolerance period (t2), which takes into account the oscillation period (minimum time that must elapse between one limit value overshoot and the next)
- Tolerance amount as a % (Tol), which takes into account the amplitude of the overshoots (maximum permitted percentage by which the limit value may be exceeded)
- Hysteresis as % (Hys), prevents the outputs from bouncing if there are fluctuations around the response value. The hysteresis takes effect when the output is switched on:
  - Switch-on value = Switching threshold – Hysteresis
- For the lower range limit:
  - Switch-on value = Switching threshold + Hysteresis

Counter modules (failsafe)
PSSu K F EI



Legend:

- SSR_Enable:
  - "1": Monitored limit value is not violated
  - "0": Monitored limit value is violated
- Output on the module (SSR_Enable_SS1-M):
  - "1": Monitored limit value is not violated
  - "0": Monitored limit value is violated
- t_1: Tolerance time
- t_2: Tolerance period
- Tol (%): Tolerance amount of the two limit values, maximum and minimum speed
- Hys (%): Hysteresis when switching the monitoring function back on

Counter modules (failsafe)
PSSu K F EI

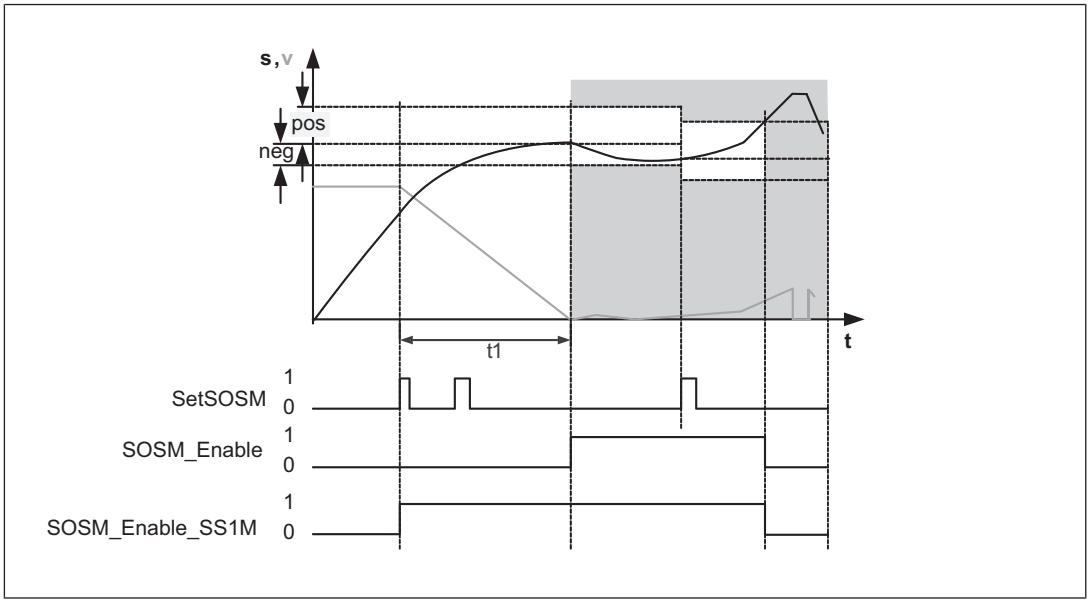
The "Safe Operating Stop Monitoring" function (SOS-M) monitors whether the standstill position remains within a configured tolerance window. The monitoring function SOS-M is not available on sensors on which a position cannot be determined (Ini pnp-pnp, pnp-npn, npn-pnp,npn-npn). The signals SOSM_Enable and SOSM_Enable_SS1M are constantly "0".

Activate the monitoring function by:

- 0/1 pulse edge at SetSOSM. The signal determines the current position to be monitored.

Reaction:

- 0/1 pulse edge at SOS-M_Enable_SS1-M
- SOS delay time (t1) is running
- A 0/1 pulse edge at SetSOSM before the delay time has elapsed is ignored.
- Once the SOS delay time has elapsed, the current position is adopted and safe standstill is monitored → 0/1 pulse edge at SOSM_Enable.
- Another 0/1 pulse edge at SetSOSM during active monitoring (SOSM_Enable = 'TRUE') means that the current position is immediately adopted as the new reference position, without delay.
- When the configured tolerance window is violated:
  - a 1/0 pulse edge at SOSM_Enable
  - the local outputs switch off, depending on the configuration. Further information is available in PAS4000's online help



Counter modules (failsafe)
PSSu K F EI

Legend

- SetSOSM: Adopt reference position once the delay time has expired
- SOSM_Enable:
  - "1": Monitored limit value not violated/monitoring of standstill position
  - "0": Monitored limit value violated/monitoring inactive
- Output on the module (SOSM_Enable_SS1-M):
  - "1": Monitored limit value not violated/monitoring of standstill position
  - "0": Monitored limit value violated/monitoring inactive
- t1: Delay time

Counter modules (failsafe)
PSSu K F EI

The "Safe Direction Monitoring" function (SDI-M) monitors the defined direction of movement of the drive axis (positive or negative). The monitoring function SDI-M is not available on sensors on which a position cannot be determined (Ini pnp-pnp, pnp-npn, npn-pnp,npn-npn). The signals SDIM_PosEnable (SDIM_NegEnable) and SDIM_PosEnable_SS1M (SDIM_NegEnable_SS1M) are constantly "0".

Activate the monitoring function by:

- The monitoring function does not need to be activated. Monitoring starts as soon as the module is ready for operation.

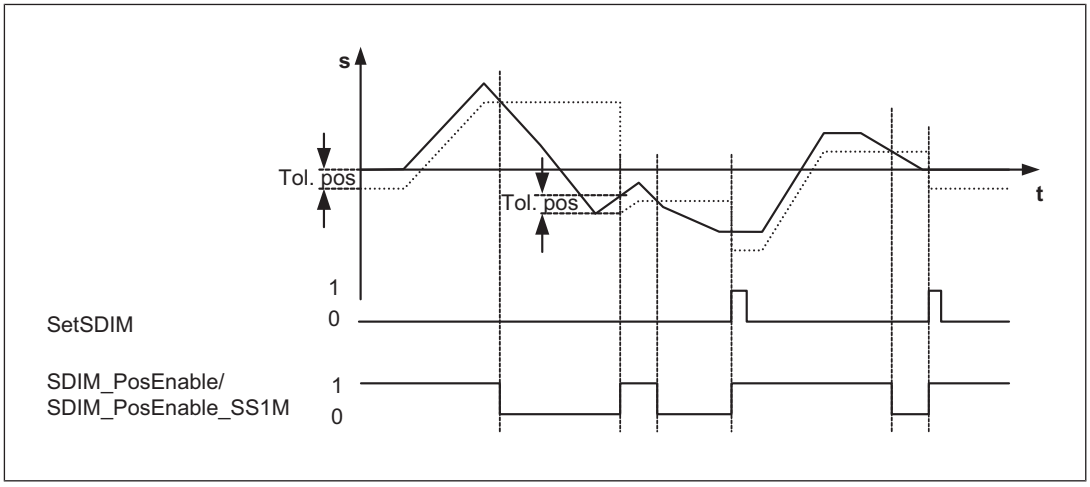
Reaction:

- If the respective direction, plus the configured tolerance, is violated:
  - a 1/0 pulse edge at SDIM_PosEnable or SDIM_NegEnable
  - the local outputs switch off, depending on the configuration. Further information is available in PAS4000's online help.
- If the monitored direction of movement has been violated and the current position moves in the right direction by more than the corresponding tolerance, SDIM_PosEnable (SDIM_NegEnable) is automatically reset to "1".
- If the monitored direction of movement has been violated and the current position cannot be moved in the right direction by at least the corresponding tolerance, then the monitoring function can be reset to "1" by a 0/1 pulse edge at SetSDIM.

Renewed adoption of the reference position or reactivation of the monitoring function:

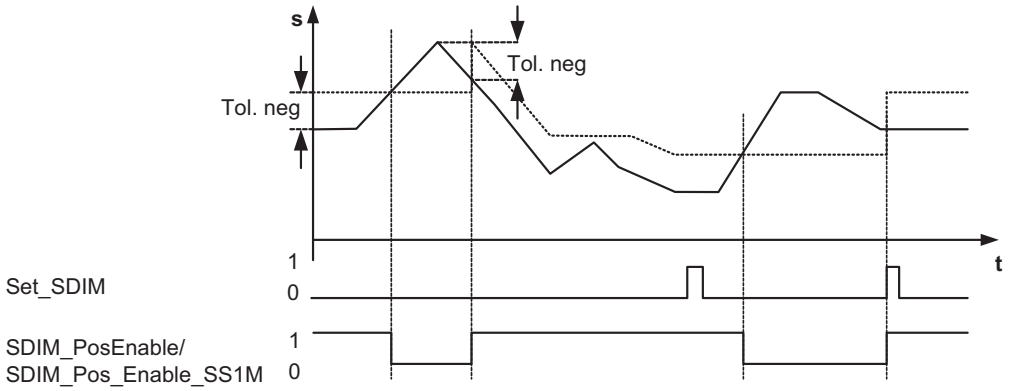
- 0/1 pulse edge at SetSDIM

Monitoring of positive direction of movement:



Counter modules (failsafe)
PSSu K F EI

Monitoring of negative direction of movement:



Legend:

- SDIM_PosEnable/SDIM_NegEnable:
  - "1": Monitored direction is not violated
  - "0": Monitored direction is violated
- Tol. pos/Tol. neg: Tolerance value, for which a movement contrary to the monitored direction will be accepted.

Counter modules (failsafe)
PSSu K F EI

The safe outputs can be configured in such a way that they can activate the safety function SS1 (a and c) on a servo amplifier.

Activation of monitoring function:

- The "Activate outputs" option must be activated in PAS4000. In this case, the monitoring function affects the outputs on the module directly if a limit value is violated.
- At least one monitoring function must be activated for the FS outputs. The monitoring functions are activated by setting the O-data type "...DeactivateSS1M" to FALSE.

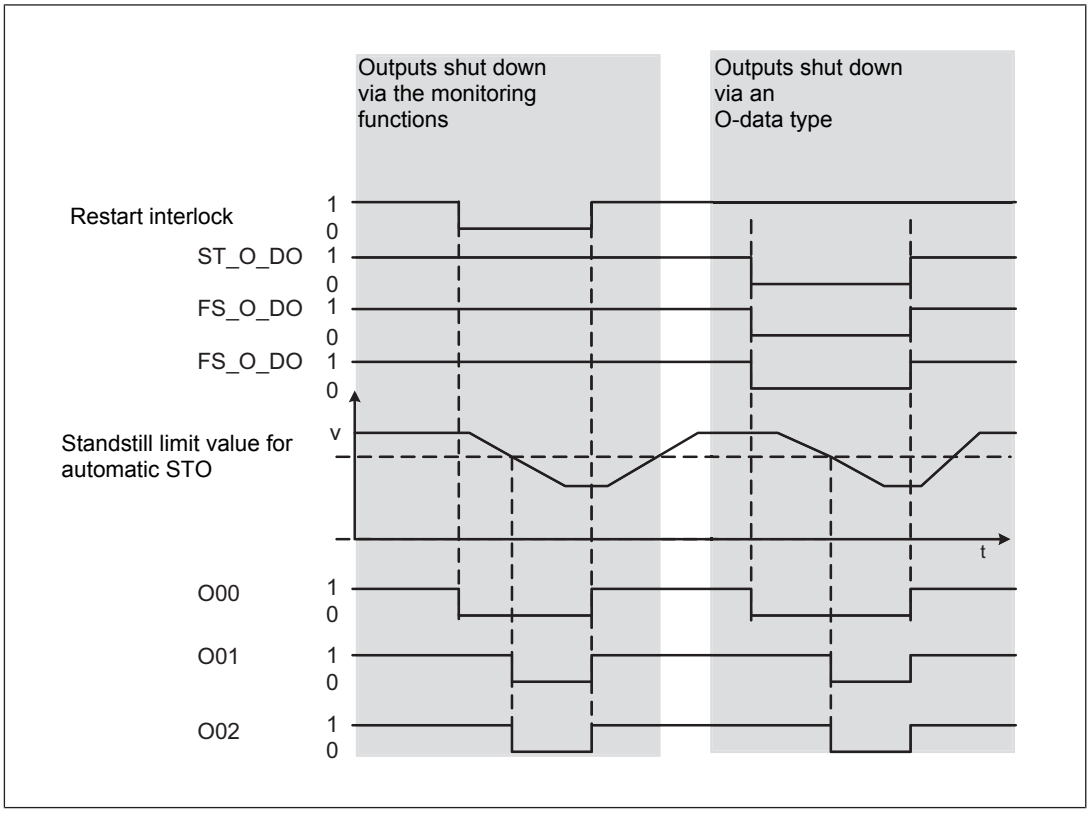
Activation:

- A monitoring function violates a monitored limit value and sets the restart interlock to "0".

  or
- The user program sets the O-data types (ST_O_DO and FS_O_DO) to "0".
- The ST output O00 is shut down immediately.
- The FS outputs are shut down,
  - if the speed drops below a configured standstill limit value for the automatic STO

    or
  - after a configured delay time has elapsed (STO delay time). The delay time starts running with a 1/0 pulse edge at the signal for the restart interlock or at the signal for the FS-O data types.
- If the delay time has elapsed and the signal for the restart interlock or FS-O data types is "0", then the assigned output is set to "0".
- If the delay time has elapsed and the signal for the restart interlock or FS-O data types is "1", then the assigned output remains at "1".
- If the delay time is running and another 1/0 pulse edge arrives at the signal for the restart interlock or FS-O data types, then the delay time is restarted.

Counter modules (failsafe)
PSSu K F EI

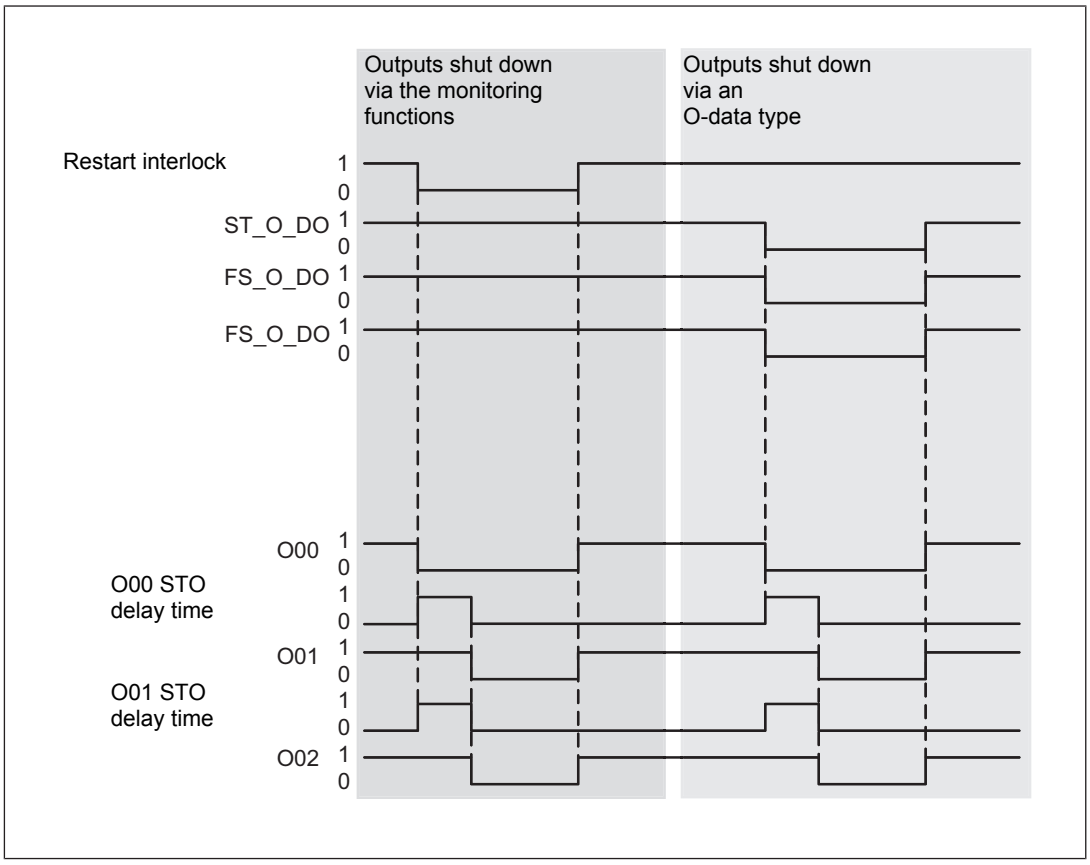


Legend:

- Restart interlock
- ST_O_DO: O-data type for the ST output
- FS_O_DO: O-data type for the FS output
- Standstill limit value for the automatic STO: Limit value for shutting down the outputs
- O00: ST output
- O01: FS output that can be used to trigger the STO function on a connected drive.
- O02: FS output that can be used to trigger the STO function on a connected drive.

Counter modules (failsafe)
PSSu K F EI

- The ST output O00 is shut down immediately.
- The FS outputs are shut down after a configured delay time (STO delay time) has elapsed. The delay time starts running with a 1/0 pulse edge at the signal for the restart interlock or at the signal for the FS-O data types.
  - If the delay time has elapsed and the signal for the restart interlock or FS-O data types is "0", then the assigned output is set to "0".
  - If the delay time has elapsed and the signal for the restart interlock or FS-O data types is "1", then the assigned output remains at "1".
  - If the delay time is running and another 1/0 pulse edge arrives at the signal for the restart interlock or FS-O data types, then the delay time is restarted.



Legend:

- Restart interlock
- ST_O_DO: O-data type for the ST output
- FS_O_DO: O-data type for the FS output
- O00: ST output
- STO delay time: Delay time for shutting down the FS outputs
- O01: FS output that can be used to trigger the STO function on a connected drive.
- O02: FS output that can be used to trigger the STO function on a connected drive.

Counter modules (failsafe)
PSSu K F EI

The module provides all the necessary functions to implement the safety function STO on a servo amplifier.

Features:

- The FS outputs O01 and O02 are used to activate the safety function STO on a servo amplifier.
- The configurable STO delay time must be deactivated in PAS4000 by entering a value of 0 ms.
- The "Display monitoring result at the outputs" option must be activated in PAS4000. In this case, the result of the monitoring functions affects the outputs on the module directly if a limit value is violated.
- At least one monitoring function must be activated for the FS outputs. The monitoring functions are activated by setting the O-data type "...DeactivateSS1M" to FALSE.

Integrated protection mechanisms

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- FS communication error
- Bus termination error
- Temperature error: too warm
- Sensor error
- Output error

The module has the following protection mechanisms:

- Common second shutdown route, tested regularly
- Cyclical output tests

Counter modules (failsafe)
PSSu K F EI

Reaction times

Maximum reaction time from the moment a monitored limit value is violated to the shutdown of outputs O0, O1, O2 is: 10 ms.

Cascading:

With 8 networked modules, the maximum reaction time from the moment a monitored limit value is violated to the shutdown of all networked modules is: 6 ms.

With 2 networked modules, the typical reaction time from the moment a monitored limit value is violated to the shutdown of all networked modules is: 4.5 ms.

Configuration

The module has the following configuration options

- In the properties view in PAS4000
- In the blocks' properties view
- Via the blocks' I-variables

Access to data during operation is via pre-defined I/O data types and the blocks FS_EI_Basic, FS_EI_SSM0, FS_EI_SOSM, FS_EI_SDIM, FS_EI_SSM1_SSRM:

I-data type: FS_I_DI

I/O data name	I/O data element	Meaning
SSM0_Enable	Data: SAFEBOOL	TRUE: configured limit value for the monitoring function SSM0 has not been violated. FALSE: configured limit value for the monitoring function has been exceeded and the monitoring function SSM0 has been activated
SSM1_Enable	Data: SAFEBOOL	TRUE: configured limit value for the monitoring function SSM1 has not been violated. FALSE: configured limit value for the monitoring function has been exceeded and the monitoring function SSM1 has been activated
SOSM_Enable	Data: SAFEBOOL	TRUE: configured limit value for the monitoring function SOSM has not been violated. FALSE: the limit value for the position tolerance has been exceeded and the monitoring function SOSM has been activated
SDIM_PosEnable	Data: SAFEBOOL	TRUE: configured limit value for the monitoring function SDIM_Pos has not been violated. FALSE: the limit value for the speed has been exceeded and the monitoring function SDIM_Pos has been activated

Counter modules (failsafe)
PSSu K F EI

I/O data name	I/O data element	Meaning
SDIM_NegEnable	Data: SAFEBOOL	TRUE: configured limit value for the monitoring function SDIM_Neg has not been violated. FALSE: the limit value for the speed has been exceeded and the monitoring function SDIM_Neg has been activated
SSRM_Enable	Data: SAFEBOOL	TRUE: configured limit values for the monitoring function SSRM has not been violated. FALSE: limit values for the speed has been exceeded and the monitoring function SSRM has been activated

I-data type: FS_I_EI_SPEED

I/O-data name	I/O data element	Meaning
Speed	Speed: SAFEWORD	Current speed value in compressed form

I-data type: FS_I_EI_STATE:

I/O-data name	I/O data element	Meaning
State	AcknowledgementRequired: BOOL	TRUE: An error has been reported, which must be acknowledged. FALSE: No error detected
State	AutomaticSTO: SAFEBOOL	TRUE: The value for the option "Automatic STO at standstill" has fallen below the set limit value and standstill has been detected. FALSE: Standstill not detected or SS1 not activated.
State	SensorMissing: BOOL	TRUE: No sensor connected FALSE: Sensor connected
State	StateCascading:BOOL	TRUE: No networked module has switched off FALSE: At least one networked module has switched off
State	StateRestartInhibit: SAFEBOOL	TRUE: corresponds to the "sum" of the local safety functions and the restart interlock inactive FALSE: Reset lock active
State	StateSTO_Timer1: SAFEBOOL	TRUE: the set STO delay time for output O1 is running. FALSE: the set STO delay time for output O1 has not been started or has already elapsed.

Counter modules (failsafe)
PSSu K F EI

I/O-data name	I/O data element	Meaning
State	StateSTO_Timer2: SAFEBOOL	TRUE: the set STO delay time for output O2 is running. FALSE: the set STO delay time for output O2 has not been started or has already elapsed.

I-data type: FS_I_EI_PARA

I/O-data name	I/O data element	Meaning
Parameters	Handshake: SAFEBOOL	Module has adopted new parameter value
Parameters	ParameterError: SAFE-BOOL	TRUE: An incorrect parameter has been trans-ferred FALSE: No fault

O-data type: ST_O_DO

I/O-data name	I/O data element	Meaning
O0	Data: BOOL	TRUE: Switch on output 0 FALSE: Switch off output 0

O-data type: FS_O_DO:

I/O-data name	I/O data element	Meaning
O1	Data: SAFEBOOL	TRUE: Switch on output 1 FALSE: Switch off output 1
O2	Data: SAFEBOOL	TRUE: Switch on output 2 FALSE: Switch off output 2
SSM0_DeactivateSS1M	Data: SAFEBOOL	TRUE: Deactivate monitoring function SSM0 for the outputs. FALSE: Activate monitoring function SSM0 for the outputs.
SSM1_DeactivateSS1M	Data: SAFEBOOL	TRUE: Deactivate monitoring function SSM1 for the outputs. FALSE: Activate monitoring function SSM1 for the outputs.
SSRM_DeactivateSS1M	Data: SAFEBOOL	TRUE: Deactivate monitoring function SSRM for the outputs. FALSE: Activate monitoring function SSRM for the outputs.

Counter modules (failsafe)
PSSu K F EI

I/O-data name	I/O data element	Meaning
SOSM_DeactivateSS1M	Data: SAFEBOOL	TRUE: Deactivate monitoring function SOSM for the outputs. FALSE: Activate monitoring function SOSM for the outputs.
SDIM_PosDeactivateSS1M	Data: SAFEBOOL	TRUE: Deactivate monitoring function SDIM-Pos for the positive direction for the outputs. FALSE: Activate monitoring function SDIM-Pos for the positive direction for the outputs.
SDIM_NegDeactivateSS1M	Data: SAFEBOOL	TRUE: Deactivate monitoring function SDIM-Neg for the negative direction for the outputs. FALSE: Activate monitoring function SDIM-Neg for the negative direction for the outputs.

O-data type: FS_O_EI_CONTROL

I/O-data name	I/O data element	Meaning
BasicInterface	ActivateCascading: BOOL	TRUE: Enable cascading output. FALSE: Switch off cascading output.
BasicInterface	Alive: SAFEBOOL	Only used internally
BasicInterface	ErrorAcknowledgement: BOOL	TRUE: Reset error
BasicInterface	Restart: SAFEBOOL	TRUE: Reset restart interlock

O-data type: FS_O_EI_REFPOS

I/O-data name	I/O data element	Meaning
SetSDIM	Set: SAFEBOOL	TRUE: Restart of monitoring functions SDIM
SetSDIM	Alive: SAFEBOOL	Only used internally
SetSOSM	Set: SAFEBOOL	TRUE: Restart of monitoring functions SOSM
SetSOSM	Alive: SAFEBOOL	Only used internally

Counter modules (failsafe)
PSSu K F EI

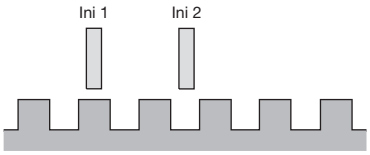
O-data type: FS_O_EI_SSR_PARA

I/O-data name	I/O data element	Meaning
SSR_Parameter	Alive: SAFEBOOL	Only used internally
SSR_Parameter	MaxSpeed: SAFEWORD	Maximum speed for safe speed range monitoring (SSRM) and limit value for safe speed monitoring 1 (SSM1) in compressed form.
SSR_Parameter	MinSpeed: SAFEWORD	Minimum speed for safe speed range monitoring (SSRM) in compressed form

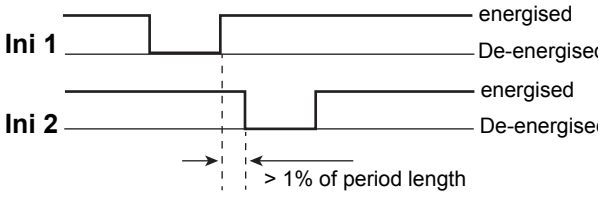
Proximity switches

- The following proximity switches can be used with a pnp or npn output:
  - Inductive
  - Capacitive
- The proximity switches must be fitted so that at least one is always activated. In other words, the proximity switches must be fitted so that the recorded signals always overlap.
- The cable used to connect the proximity switches must be shielded (see connection diagrams in the chapter entitled "EMC-compliant wiring").
- A DC voltage in the range of 0 - 30 V can be monitored via track S. It should be used to monitor the supply voltage of the proximity switches.

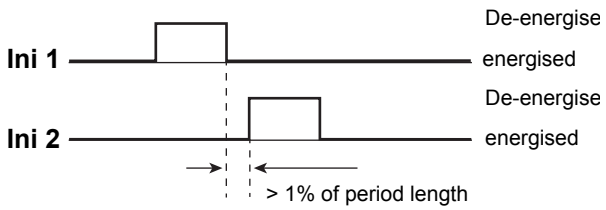
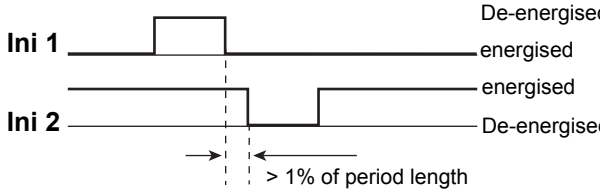
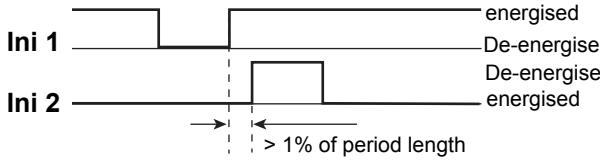
Proximity switch assembly:



Signal characteristics:

Proximity switch combinations	Signal image during movement
PNP / PNP	

Counter modules (failsafe)
PSSu K F EI

Proximity switch combinations	Signal image during movement
NPN / NPN	
NPN / PNP	
PNP / NPN	

- Please note the values stated in the sensor's technical details.
- For a full configuration, the maximum frequency of the sensors you are using must be entered in PAS4000 (see sensor's data sheet).

Counter modules (failsafe)
PSSu K F EI

Encoder

- The following encoders can be used:
  - TTL, HTL (single-ended or differential signals)
  - Sin/Cos 1 Vss
  - Hiperface®
- The encoders can be connected with or without Z index (0 index).
- The cables used to connect the encoders must be shielded (see connection diagrams in the chapter entitled "EMC-compliant wiring").
- A pnp proximity switch can also be connected to track Z for monitoring broken shear-pins.
  Please note:
  Monitoring for broken shearpins does not become active until
  - The minimum speed has been exceeded and
  - The tolerance for detecting feasibility errors has elapsed.

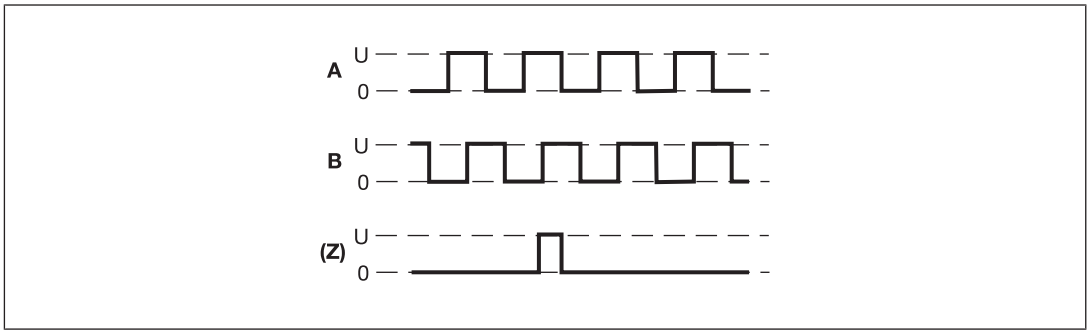
  The minimum speed and tolerance depend on the ratio of the frequency at tracks AB "f_{AB}" to the frequency at track Z "f_Z" in your configuration.
  Minimum speed:
  - Calculated ratio AB/Z ≥ 1.0
    f_Z = 10 mHz or f_{AB} = (f_{AB}/f_Z) *x* 10 mHz
  - when $\boldsymbol{f_{AB}/f_Z}$ ***Verh.*** < 1.0
    f_{AB} = 10 mHz or f_Z = 10 mHz/(f_{AB}/f_z)

  Tolerance for detecting feasibility errors:
  - when ***fAB/fZ Verh.*** ≥ 1.0
    7.5 Z-pulses or 7.5 x (f_{AB}/f_Z) AB-pulses
  - when ***fAB/fZ Verh.*** < 1.0
    4.5 AB-pulses or *4.5/*(f_{AB}/f_Z) Z-pulses
- With Hiperface encoders, only the RefSin and RefCos tracks are recorded and monitored (see Adapters for encoders [📖 1029]).
- Track S can be used:
  - To connect an encoder's error output.
  - To monitor voltages between 0 V and 30 V for a permitted upper and lower limit. For example, the encoder's supply voltage can be monitored.
- The maximum frequency of the used encoders must be entered for a complete configuration.
- Pay attention to the values in the technical details.

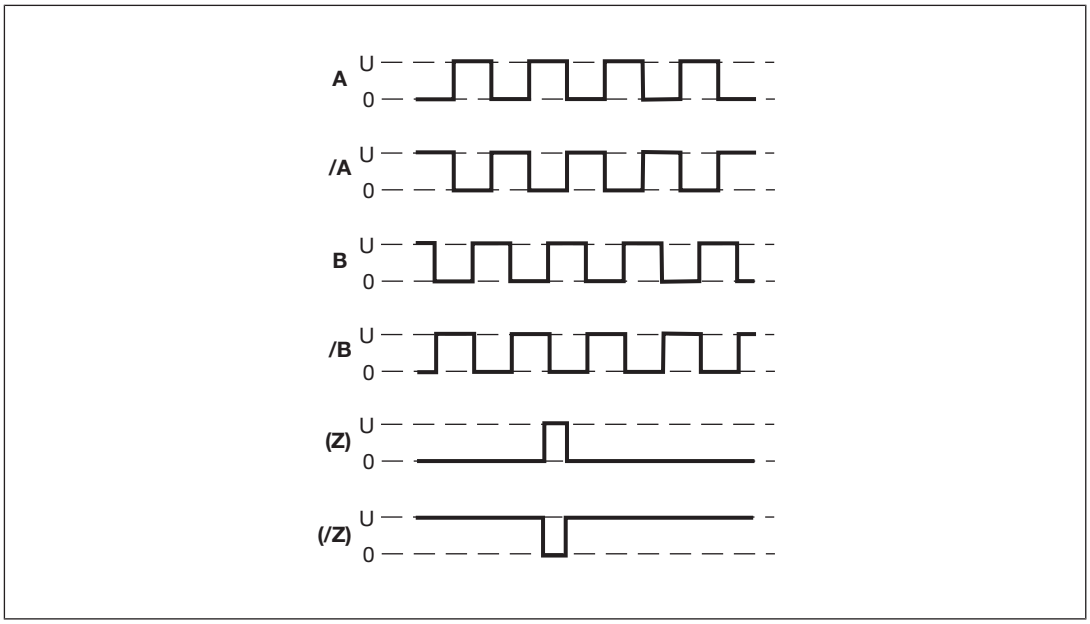
Counter modules (failsafe)
PSSu K F EI

Output signals TTL, HTL

Single ended

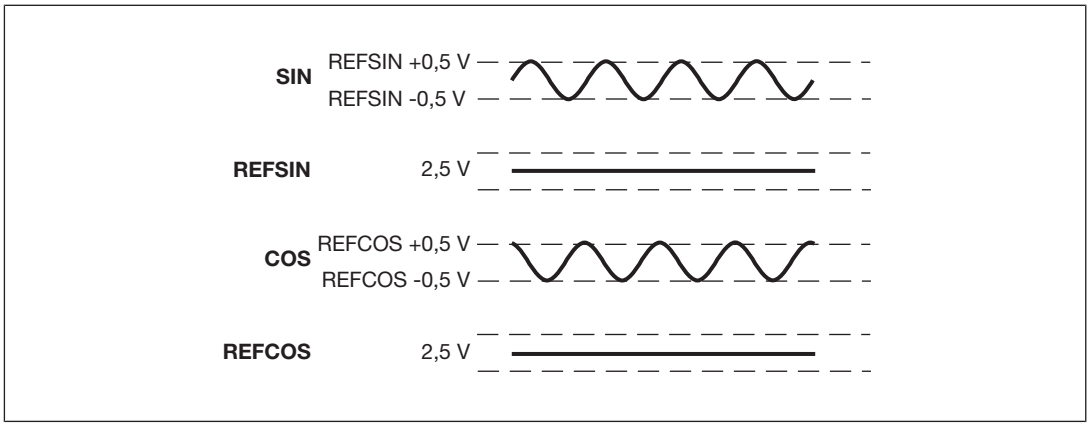


Differential



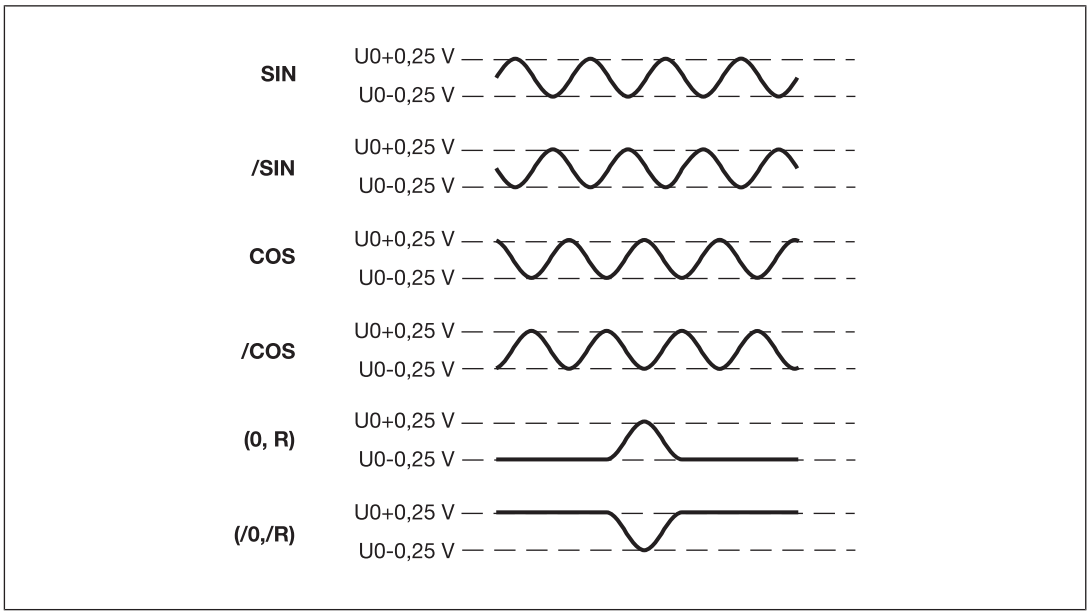
Output signals Sin/Cos (1 Vss)

Single ended with reference track (e.g. Hiperface ®)



Counter modules (failsafe)
PSSu K F EI

Differential with/without Z index (e.g. Heidenhain 1 Vss)



- Tracks Z and /Z can also be inverted
- With a SinCos encoder, the voltage U0 is 2.5 V

The adapter records the data between the encoder and the drive and makes it available to the PSSu K F EI via the Mini-IO socket.

Pilz supplies complete adapters as well as ready-made cable with Mini-IO connector, which can be used when making your own adapter. The range of products in this area is constantly being expanded. Please contact us about the range of adapters that is currently available.

Wiring

Connectors' mechanical connection

Please note:

- The conductor cross section on the spring-loaded terminals without ferrules is 0,20 - 1,00 mm², 22 - 18 AWG.
- If you are using multi-core or fine-core cables we recommend ferrules in accordance with DIN 46228/Part 1 or DIN 46228/Part 4, 0.2 ... 1 mm². To crimp the ferrules we recommend crimping pliers (crimp form A) conforming to EN 60947-1, such as the PZ 6/5 from Weidmüller, for example.
- Terminal points per connection: 1
- Stripping length: 8 mm

Counter modules (failsafe)
PSSu K F EI

Connect/disconnect the cables

We recommend you use a screw driver with a 0.4 x 2.5 mm (DIN 5264) blade!

Strip the cable:

- Strip the cable [1] and apply a ferrule if necessary (DIN 46228/Part 1 or DIN 46228/Part 4).

Connect cable:

- Using the screwdriver, press the actuator button on the spring-loaded terminal down as far as it will go [2], keep it held down and insert the stripped cable into the plug connection as far as it will go [2].
- Check that the cable is firmly seated [3].

Disconnect cable:

- Using the screwdriver, press the actuator button down as far as it will go [4], keep it held down and pull the cable out of the plug connection [4].

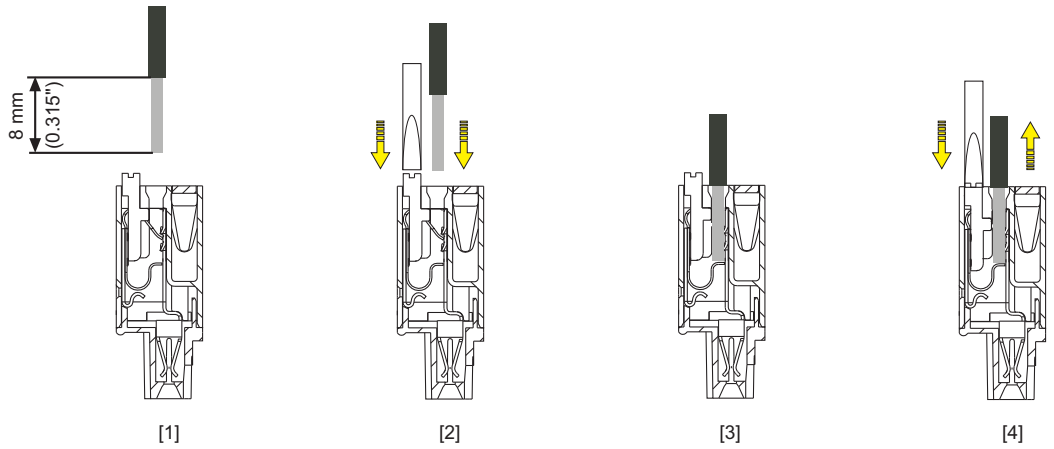
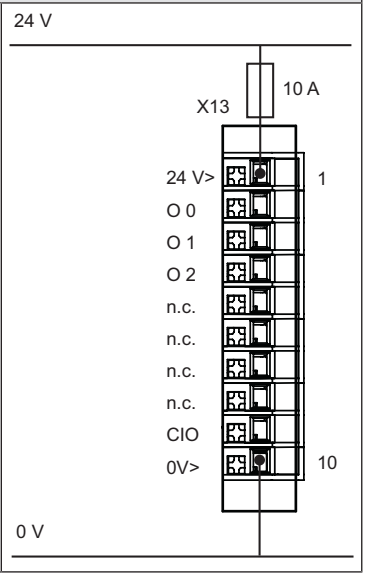


Fig.: Connect and disconnect the cables

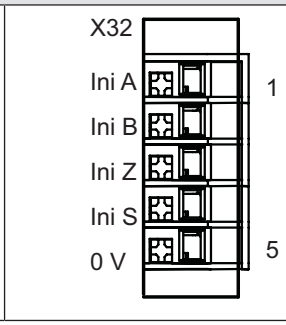
Counter modules (failsafe)
PSSu K F EI

Supply voltage

Terminal configuration (1-row): **PSSu A Con 1/10 C**	
X13: 24 V>: +24 V (external periphery supply) O 0: Single-pole ST output O 1: Single-pole FS output O 2: Single-pole FS output NC NC NC NC CIO-: Input/output for networking additional modules 0 V>: 0 V (external periphery supply)	

Counter modules (failsafe)
PSSu K F EI

Connection of proximity switches

Terminal configuration (1-row): **PSSu A Con 1/5 C**	
X32: Ini A Ini B Ini Z Ini S 0 V	

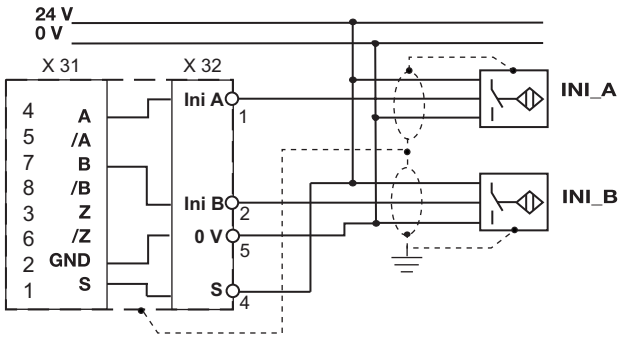
The following proximity switch combinations can be connected:

- A: pnp, B: pnp
- A: npn, B: npn
- A: pnp, B: npn
- A: npn, B: pnp

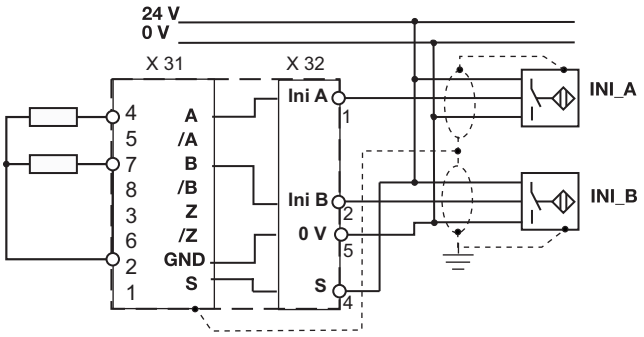
When connecting proximity switches please note:

- Proximity switches can be connected to
  - terminals Ini A, Ini B, 0 V
    or
  - tracks A, B and 0 V of the Mini-IO socket.
- Track S should be used to monitor the supply voltage (see drawing). A permitted voltage range can be entered in the PAS4000.
- Connect the proximity switch to 24 VDC of the power supply.
- When connecting the proximity switches, please refer to the chapter entitled "EMC-compliant wiring".
- Invalid signals may occur with cable lengths >50 m. In this case we recommend that you connect a resistor between the signal lines, as shown in the diagrams.

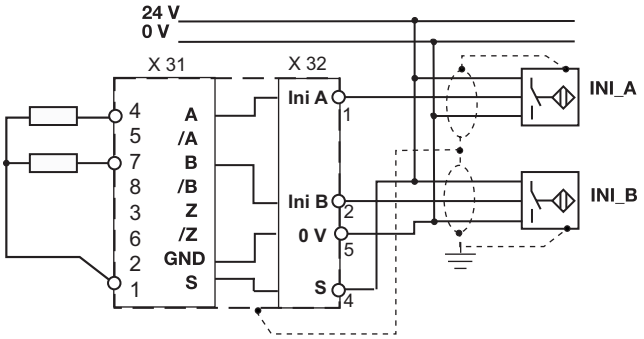
Counter modules (failsafe)
PSSu K F EI



pnp proximity switch with resistor R = 10 kOhm



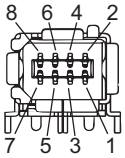
npn proximity switch with resistor R = 47 kOhm



Counter modules (failsafe)
PSSu K F EI

Connection of encoders

Connector pin assignment X31, depending on the technology

Mini-IO socket 8-pin	PIN	HTL/TTL	Sin/Cos	Hiperface
	1	S (optional)	S (optional)	S (optional)
	2	GND	GND	GND
	3	Z	Z or index	
	4	A	Sin	Sin
	5	/A	-Sin	RefSin
	6	/Z	Z or index	
	7	B	Cos	Cos
	8	/B	-Cos	RefCos

Proceed as follows when connecting the encoder:

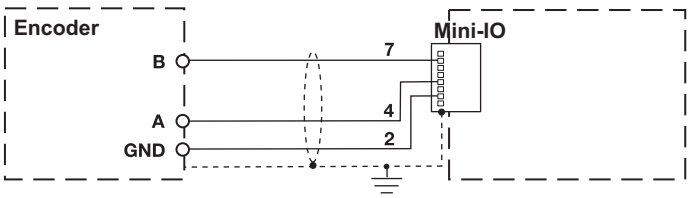
- Use only shielded cables for all connections. Please refer to the chapter EMC-compliant wiring [📖 1038].
- Always connect GND on the encoder to GND on the Mini-IO socket.

Encoder types:

- TTL single ended
- HTL single ended

Please note:

- Tracks/A, /B, Z, and /Z must remain free



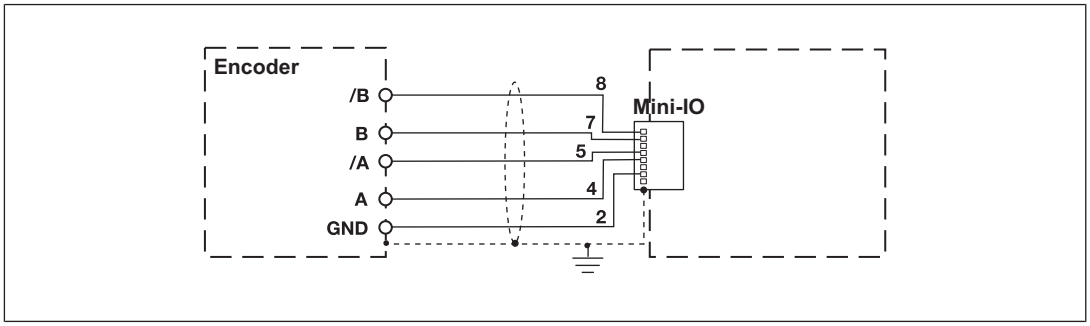
Counter modules (failsafe)
PSSu K F EI

Encoder types:

- TTL differential
- HTL differential
- sin/cos 1 Vss
- Hiperface

Please note:

- Tracks Z and /Z must remain free

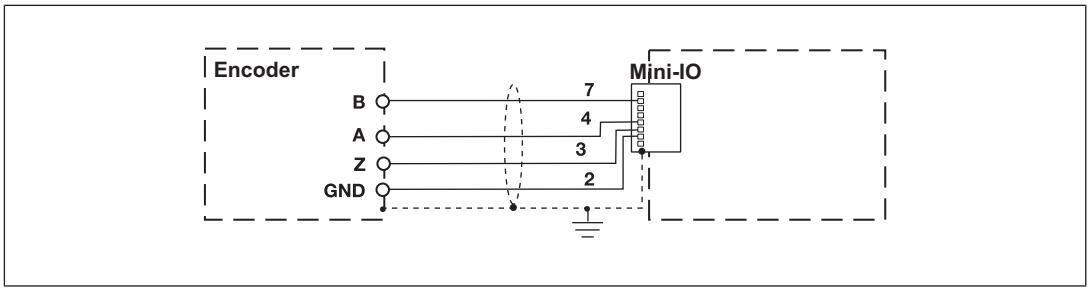


Encoder types:

- TTL single Z Index
- HTL single Z Index

Please note:

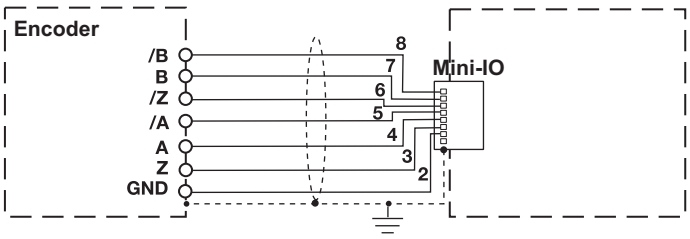
- Tracks /A, /B and /Z must remain free



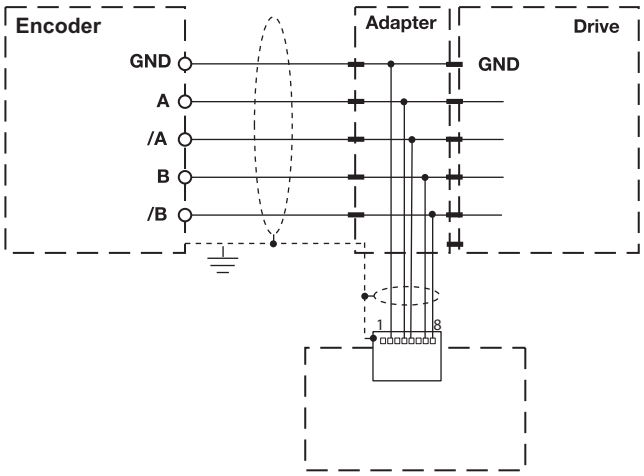
Counter modules (failsafe)
PSSu K F EI

Encoder types:

- TTL diff. Z Index
- HTL diff. Z Index
- sin/cos 1 Vss Z Index



The adapter (e.g. PNOZ msi6p) is connected between the encoder and the drive. The output on the adapter is connected to the Mini-IO socket on the PSSu K F EI.



Counter modules (failsafe)
PSSu K F EI

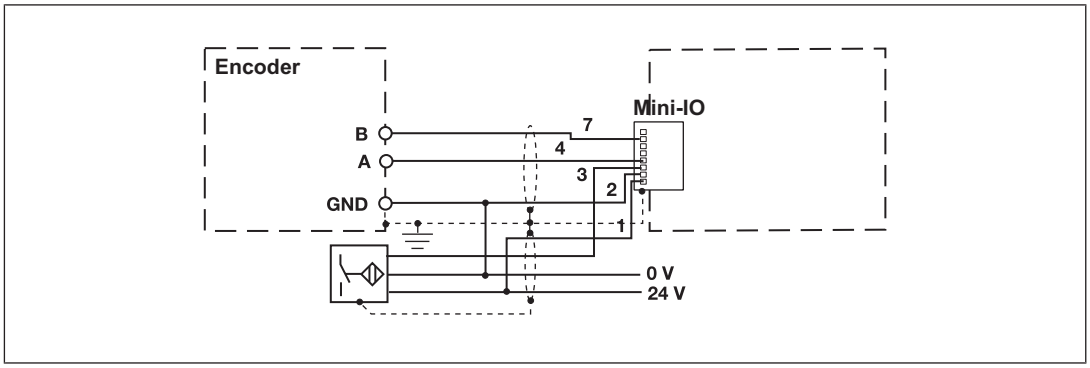
Connection of proximity switch and encoder

When connecting the encoders and proximity switches, please refer to the chapter entitled "EMC-compliant wiring".

Sensor types:

- Configuration: HTL single Z Freq. Ini pnp
  - HTL single ended (A,B) + Ini pnp (Z)
  - HTL single ended (A,B) + HTL differential (A as Z)
  - HTL single ended (A,B) + HTL single ended (A as Z)
- Configuration: TTL single Z Freq. Ini pnp
  - TTL single ended (A,B) + Ini pnp (Z)
  - TTL single ended (A,B) + HTL differential (A as Z)
  - TTL single ended (A,B) + HTL single ended (A as Z)

Please note:
Tracks /A, /B and /Z must remain free.



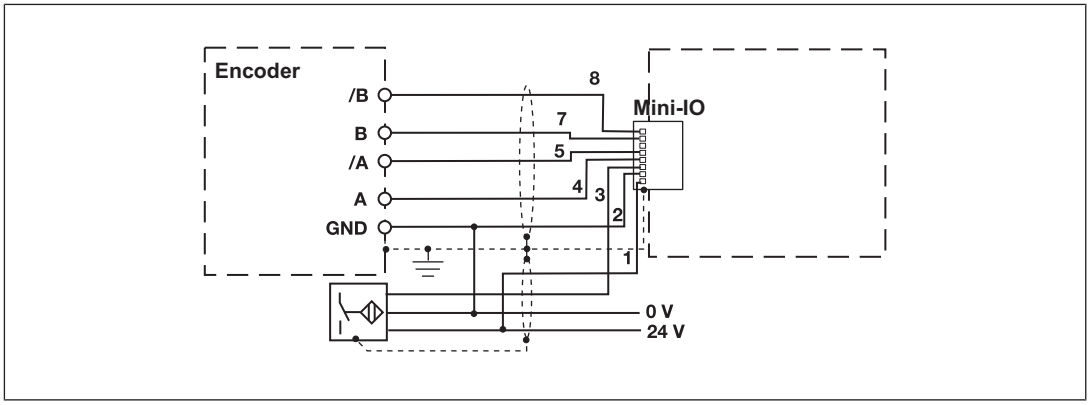
Sensor types:

- Configuration: TTL differential Z Freq. Ini pnp
  - TTL differential (A,/A,B,/B) + Ini pnp (Z)
  - TTL differential (A,/A,B,/B) + HTL differential (A as Z)
  - TTL differential (A,/A,B,/B) + HTL single ended (A as Z)
- Configuration: HTL differential Z Freq. Ini pnp
  - HTL differential (A,/A,B,/B) + Ini pnp (Z)
  - HTL differential (A,/A,B,/B) + HTL differential (A as Z)
  - HTL differential (A,/A,B,/B) + HTL single ended (A as Z)
- Configuration: sin/cos 1 Vss Z Freq. Ini pnp
  - sin/cos 1 Vss (A,/A,B,/B) + Ini pnp (Z)
  - sin/cos 1 Vss (A,/A,B,/B) + HTL differential (A as Z)
  - sin/cos 1 Vss (A,/A,B,/B) + HTL single ended (A as Z)

Counter modules (failsafe)
PSSu K F EI

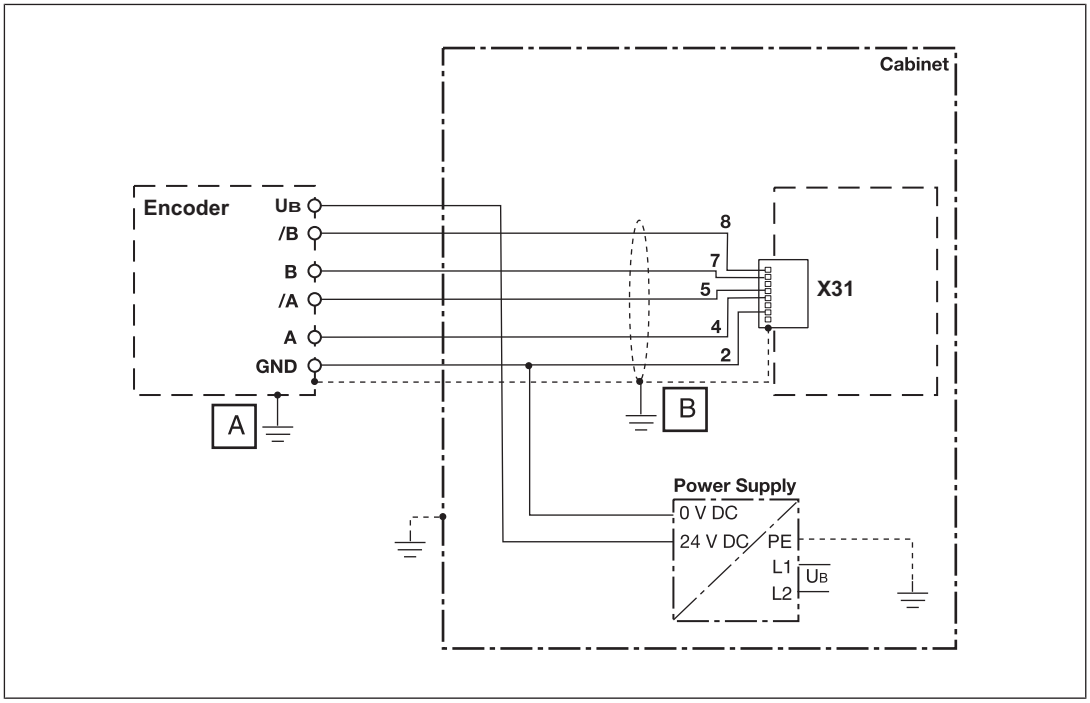
- Configuration: Hiperface Z Freq. Ini pnp
  - Hiperface (A,/A,B,/B) + Ini pnp (Z)
  - Hiperface (A,/A,B,/B) + HTL differential (A as Z)
  - Hiperface (A,/A,B,/B) + HTL single ended (A as Z)

Please note:
Track /Z must remain free



EMC-compliant wiring

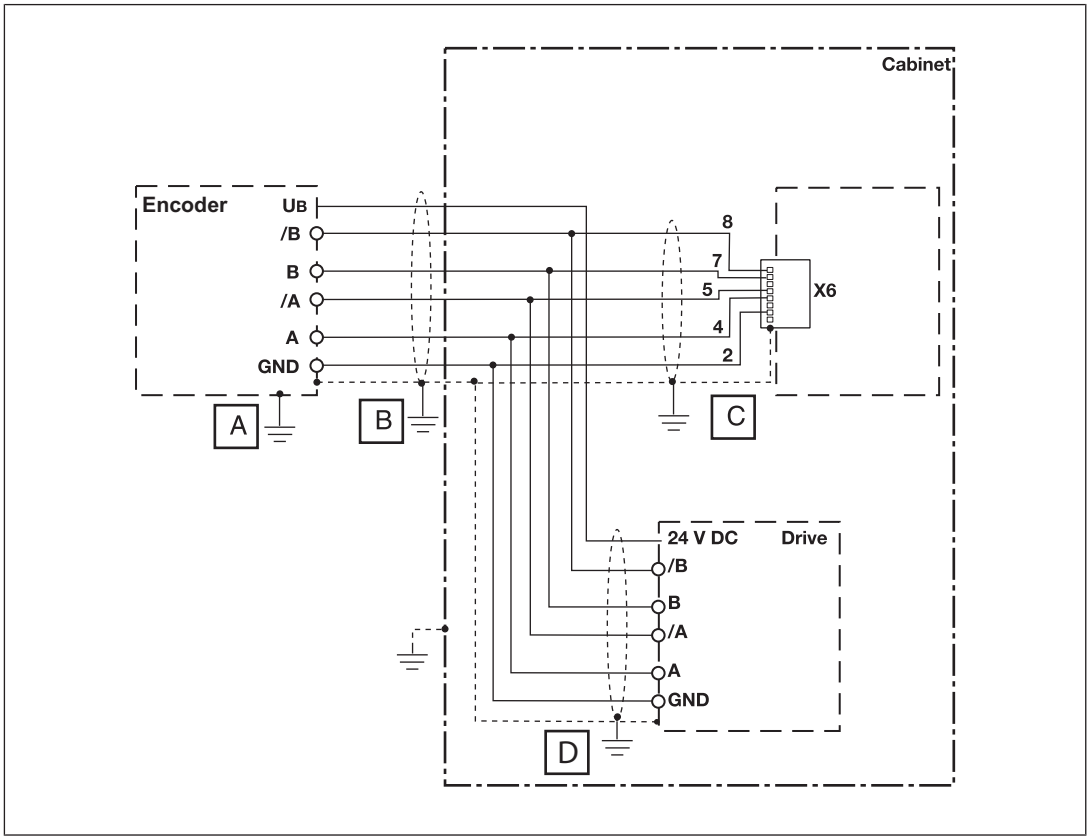
EMC-compliant wiring for connecting an encoder



Counter modules (failsafe)
PSSu K F EI

To avoid EMC interference we recommend that the shield on the sensor lines is only connected to earth at a single point:
A **or** B
Conductor loops outside the shield must be avoided.
The shield must run continuously from the sensor to the evaluation device.

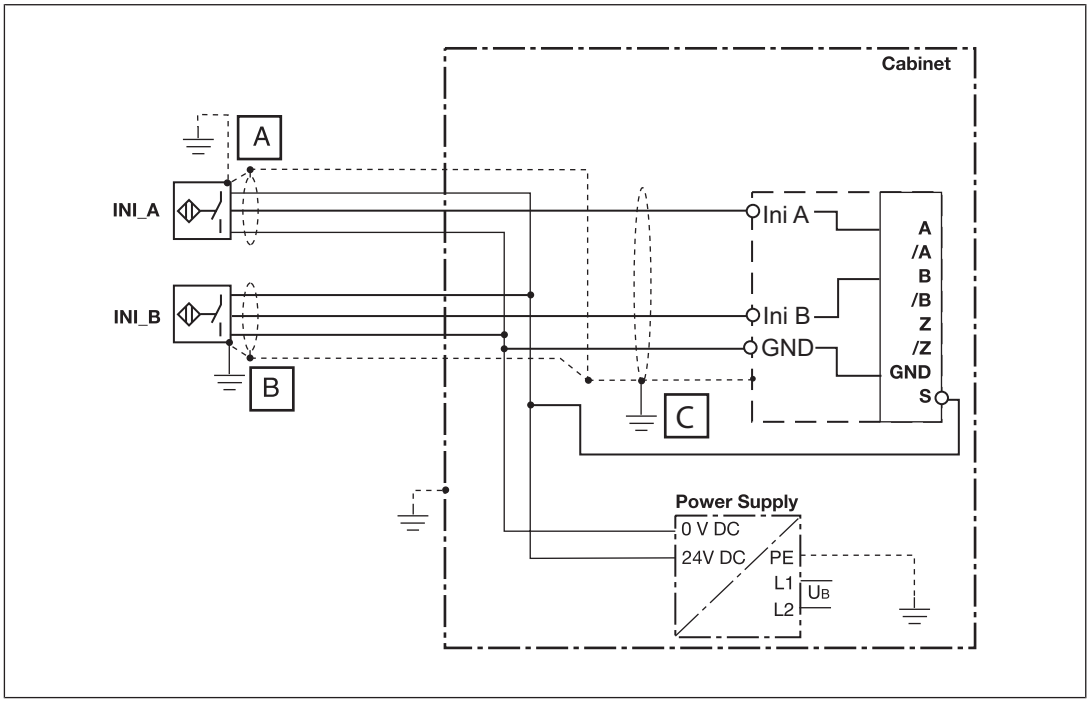
EMC-compliant wiring for connecting an encoder with drive



To avoid EMC interference we recommend that the shield on the sensor lines is only connected to earth at a single point:
A **or** B**or** C **or** D
Conductor loops outside the shield must be avoided.
The shield must run continuously from the sensor to the evaluation device.

Counter modules (failsafe)
PSSu K F EI

EMC-compliant wiring for connecting 2 proximity switches



To avoid EMC interference we recommend that the shield on the sensor lines is only connected to earth at a single point:
A **or** B**or** C
Conductor loops outside the shield must be avoided.
The shield must run continuously from the sensor to the evaluation device.

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 a short circuit to a supply voltage.

Counter modules (failsafe)
PSSu K F EI

Technical details

General	
Approvals	**CE, TÜV, cULus Listed**
Application range	**Failsafe**
Module's device code	**0F20h**
Number of FS output bits	**2**
Number of FS status bits	**2**
Number of FS control bits	**2**
Application in system environment B	
From FS firmware version, head modules	**1.12.0**
Electrical data	
Supply voltage	
for	**Module supply**
Voltage	**5,0 V**
Kind	**DC**
Voltage tolerance	**-4 %/+4 %**
Output of external power supply (DC)	**1,1 W**
Supply voltage	
for	**Periphery supply**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Output of external power supply (DC)	**1,1 W**
Supply voltage	
for	**Outputs**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-30 %/+25 %**
Internal supply voltage (module supply)	
Module's power consumption	**1,30 W**
Periphery's supply voltage (periphery supply)	
Voltage range	**16,8 - 30,0 V**
Module's current consumption with no load	**45 mA**
Module's power consumption with no load	**1,35 W**
Max. power dissipation of module	**3,50 W**
Proximity switch input	
Number of inputs	**2**
Input signal level	
Signal level at "1"	**11 - 30 V**
Signal level at "0"	**0 - 3 V**

Counter modules (failsafe)
PSSu K F EI

Proximity switch input	
Input resistance	**22 kOhm**
Input's frequency range	**0 - 5 kHz**
Configurable monitoring frequency Without hysteresis	**0.1 Hz - 5 kHz**
Incremental encoder input	
Number of inputs	**1**
Connection type	**Mini-IO female connector, 8-pin**
Input signal level	**0,5 - 30,0 Vss**
Phase position for the differential signals A, /A and B,/B	**90° ±30°**
Overload protection	**-50 - 65 V**
Input resistance	**20,0 kOhm**
Input's frequency range	**0 - 500 kHz**
Configurable monitoring frequency Without hysteresis	**0.1 Hz - 500 kHz**
Semiconductor outputs	
Number of positive-switching single-pole semiconductor outputs	**3**
Voltage	**24,0 V**
Typ. output current at "1" signal and rated voltage of semiconductor output	**0,50 A**
Permitted current range	**0,00 - 0,62 A**
Residual current at "0" signal	**0,02 A**
Max. transient pulsed current	**6 A**
Max. internal voltage drop	**100 mV**
Monitoring threshold of semiconductor output	**9,0 V**
Max. duration of on time during self test	**200 µs**
Max. duration of off time during self test	**200 µs**
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,250 ms**
Max. processing time of semiconductor output when signal changes from "0" to "1"	**0,450 ms**
Potential isolation from system voltage	**yes**
Potential isolation between semiconductor output and input	**yes**
Short circuit-proof	**yes**
Permitted loads	**inductive, capacitive, resistive**
Times	
Reaction time after limit value is exceeded	**1/f_ist + 10ms**

Counter modules (failsafe)
PSSu K F EI

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 - 60 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-25 - 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 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**
Amplitude	**0,35 mm**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Acceleration	**15g**
Duration	**11 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
In accordance with the standard	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**
Housing	**IP20**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Connection type	**Connector strip**
Mounting type	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,20 - 1,00 mm², 22 - 18 AWG**

Counter modules (failsafe)
PSSu K F EI

Mechanical data	
Spring-loaded terminals: Terminal points per connection	**1**
Stripping length with spring-loaded terminals	**8 mm**
Dimensions	
Height	**128,9 mm**
Width	**56,0 mm**
Depth	**56,0 mm**
Weight	**145 g**

Where standards are undated, the 2013-08 latest editions shall apply.

Safety characteristic data

Unit	Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	EN ISO 13849-1: 2015 T_M [year]
Logic						
Input interface	**Monitoring 1 encoder**	**PL d**	**Cat. 2**	**SIL CL 2**	**1,80E-08**	**20**
Input interface	**Monitoring 2 encoder**	**PL e**	**Cat. 3**	**SIL CL 3**	**1,01E-09**	**20**
Input interface	**Monitoring safe encoder**	**PL e**	**Cat. 4**	**SIL CL 3**	**2,35E-09**	**20**
Logic	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**1,36E-10**	**20**
Output						
SC outputs (1-pole)	**1-channel**	**PL d**	**Cat. 2**	**SIL CL 2**	**3,95E-09**	**20**
SC outputs (1-pole)	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**8,17E-11**	**20**

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

Counter modules (failsafe)
PSSu K F EI

Order reference

Product

Product type	Features	Order no.
PSSu K F EI	Compact module	312 433

Accessories

Terminals

Product type	Features	Order no.
PSSu A Con Set1 C	Set consisting of connectors with spring-loaded terminals 1-row/5-pin and 1-row/10-pin, scope of supply: 2 pieces	313 114

Labelling

Product type	Features	Order no.
PSSu A LC 0.2	Labelling bracket, scope of supply: 5 pieces	312 965
PSSu A LA0	Labelling strips, laser printable, scope of supply: 1080 pieces (10 x DIN A4 sheet, 108 on each)	312 958

Adapter cable

Product type	Features	Order no.
MM A MINI-IO CAB99	1.50 m	772 200
MM A MINI-IO CAB99	2.50 m	772 201
MM A MINI-IO CAB99	5.0 m	772 202

Counter modules (failsafe)
PSSu K F EI CV

Overview

Module features

- Max. 3 modules in one PSSu system
- Monitoring of 1 axis
- Can be configured in PAS4000
- Measured value recorded by proximity switch or encoder
- Monitoring functions:
  - Safe Speed Monitoring (SSM)
  - Safe Speed Range Monitoring (SSR-M)
  - Safe Operating Stop Monitoring (SOS-M)
  - Safe Direction Monitoring (SDI-M)
- Recording of position counter value
- Analogue voltage (track S)
- 2 digital FS outputs
  - Semiconductor technology
  - Single-pole
  - Positive-switching
  - Current load capacity per output: 0,5 A
  - Short circuit-proof
  - Overload-proof
  - Free from feedback

Counter modules (failsafe)
PSSu K F EI CV

- 1 digital ST output
  - Semiconductor technology
  - Single-pole
  - Positive-switching
  - Short circuit-proof
  - Current load capacity per output: 0.5 A
- 1 combined ST input and output "CIO" for networking several devices
- LEDs for:
  - Switch status of each input/output
  - Module error
  - Module status
- For failsafe applications in system environment B (automation system PSS 4000)

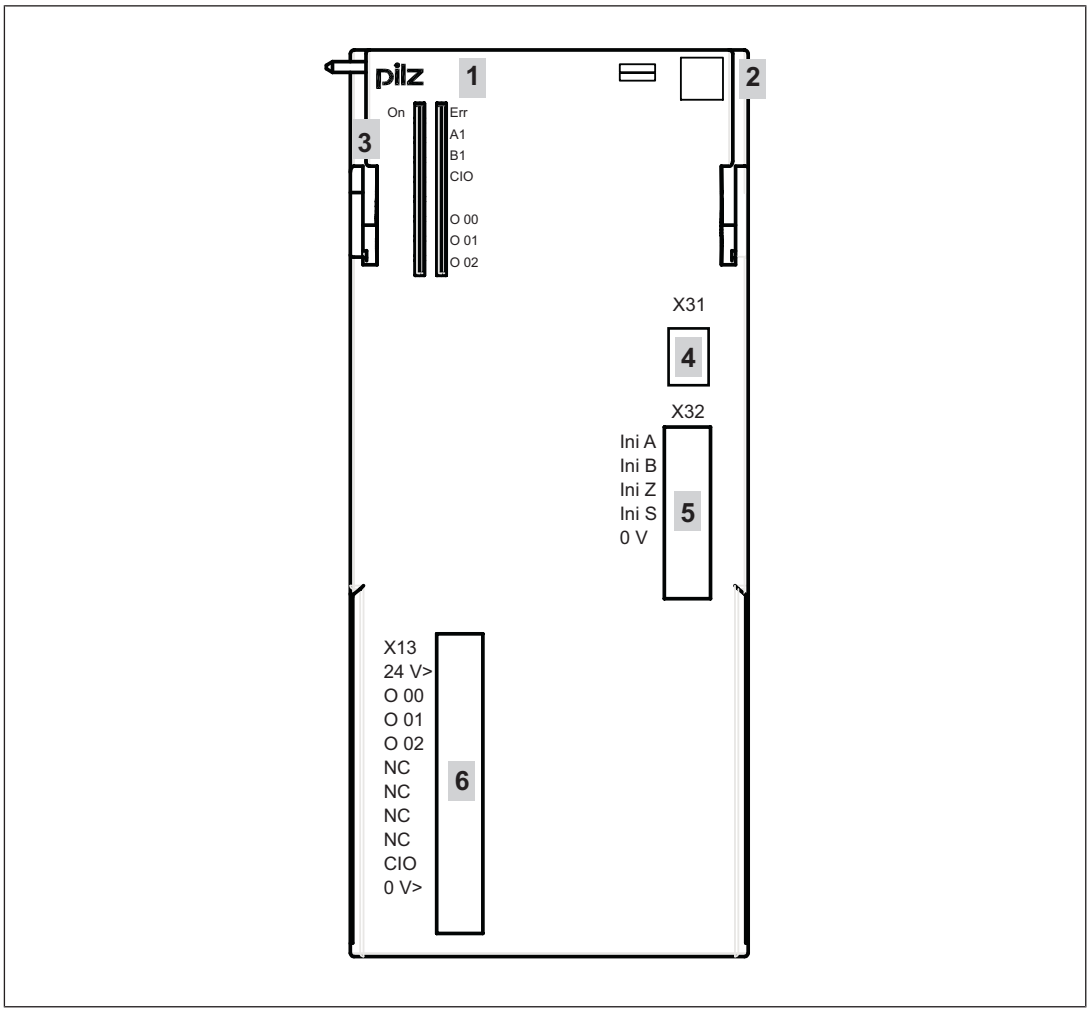
Accessories:

- Connector with spring-loaded terminals (necessary for operation)
- Labelling bracket
- Labelling strips (sheets)
- T-type:

  PSSu K F EI CV-T: for increased environmental requirements

Counter modules (failsafe)
PSSu K F EI CV

Front view



Legend:

- 1: Name of compact module
- 2: Labelling strip with:
  - 2D code
  - Order number
  - Serial number
  - Hardware version number
- 3: LEDs for status display and module diagnostics
- 4: Mini-IO socket X31 for connecting encoders
- 5: Connector strip X32 for connecting proximity switches
- 6: Connector strip X13 for connectors with spring-loaded terminals and labelling strip

Counter modules (failsafe)
PSSu K F EI CV

Function description

Module and periphery supply

Module supply

- The module supply provides the module with voltage.

Periphery supply

- The periphery supply that supplies the outputs must be fed externally. The single-pole outputs must have a common supply voltage.

FS outputs

- 2 single-pole digital outputs

Output test

- Outputs that are switched on are checked via regular off tests.
  - Test pulses for outputs that are switched on: see Technical details [1086]
  - Outputs that are switched on are switched off for the duration of the test pulse.
  - The load must not switch off because of the test.
- Outputs that are switched off are checked via regular on tests.
  - Test pulses for outputs that are switched off: see Technical details [1086]
  - Outputs that are switched off are switched on for the duration of the test pulse.
  - The load must not switch on because of the test.

Excluding individual outputs from the output test:

- If a plant is particularly sensitive to the test pulses, the output test may be switched off for individual outputs.
- The test must be replaced by other measures, depending on the safety requirement.
- When test pulses are switched off:
  - The correct switch status is always checked.
  - The output's ability to switch will not be detected until the next time the output is switched on/off.

Counter modules (failsafe)
PSSu K F EI CV

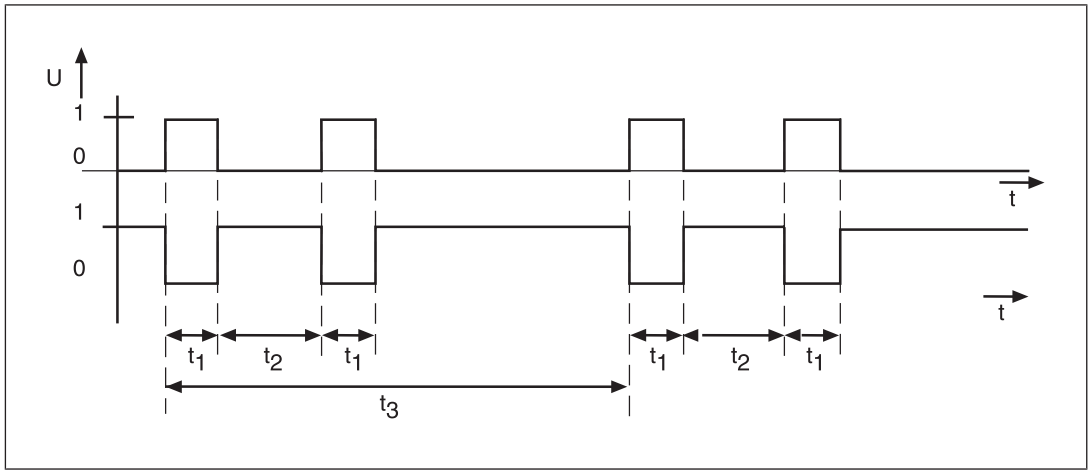


Fig.: On and off test for single-pole outputs

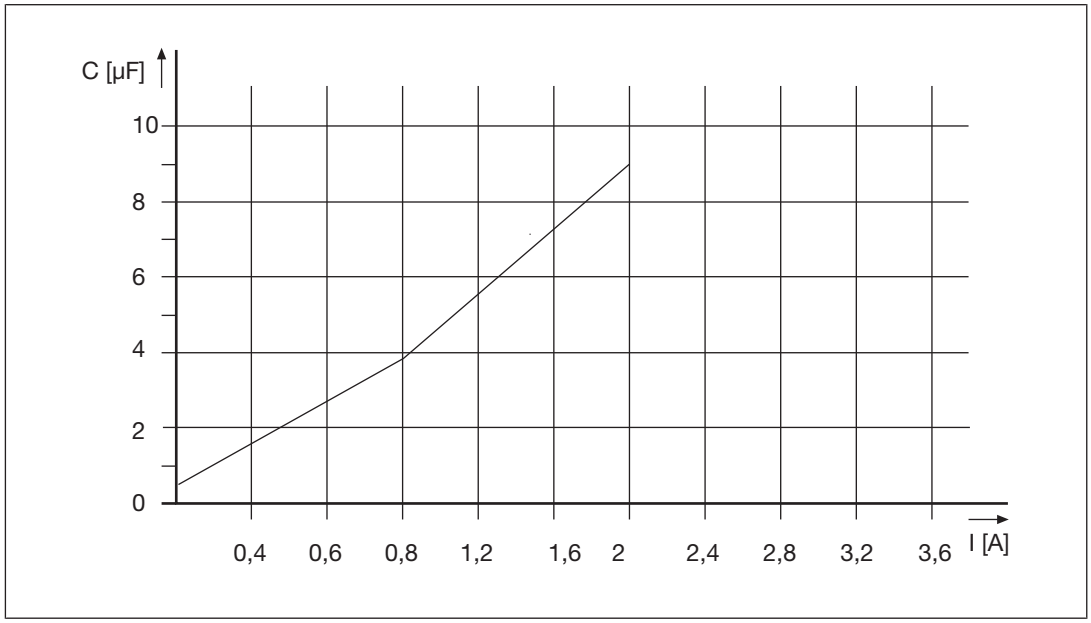
Legend

t_1 Pulse duration of on/off test (200 µs)

t_2 Max. waiting time between the on/off test (approx. 4 ms)

t_3 Repetition time of on and off test in normal circumstances (approx. 2 s)

Characteristic for single-pole outputs: Output capacitance C dependent on load current I



Counter modules (failsafe)
PSSu K F EI CV

- For applications in accordance with Category 4, PL e and SIL 3, detection of shorts between contacts must be guaranteed either via the on/off test or through other measures (e.g. asynchronous switching). A short between contacts must be simulated during commissioning.

ST output

- 1 ST output

Signals at the output

- "0" signal (0 V) at the output:
  - Output is high impedance
  - No current to the load
- "1" signal (+24 V) at the output:
  - Output is low impedance
  - Current is supplied to the load

Cascading

Cascading can be used to network several modules. A combined standard input/output CIO is used for cascading. If one of the networked modules triggers a monitoring function, then all networked modules are switched off. To ensure that more than one axis can be stopped via cascading when a monitoring function reacts, the following measures are necessary:

- Connect the CIO terminals of all modules, whose axes are to be stopped at the same time. Make sure that the modules are connected to a common 0 V periphery supply.
- Activate the cascading input (terminal CIO) in the module's hardware configuration (PAS4000) if the module is to be switched off by another module via the cascading output CIO (repeat for other axes if applicable).
- Activate the cascading output (terminal CIO) with *ActivateCascading* = TRUE for all the modules connected via the terminals CIO.

Example:

- Three axes are to be monitored.
- One module is used per axis:
  - Axis 1 = Module 1
  - Axis 2 = Module 2
  - Axis 3 = Module 3
- If a monitoring function has reacted at axis 1 or axis 2, then axis 3 is to be stopped.
- Wiring:
  - Connect together the CIO terminals of all modules, whose axes are to be stopped at the same time. Make sure that the modules are connected to a common 0 V periphery supply.

Counter modules (failsafe)
PSSu K F EI CV

- Configuration:
  - Set the I-variable *ActivateCascading* to TRUE for module 1, module 2 and module 3 on the block FS_EI_Basic. This means that the result of the monitoring functions will affect the cascading output CIO of module 1 and module 2.
  - In the hardware configuration, the "Activate cascading input" option must be set to "Yes" for module 3. This means that the result of the monitoring functions from module 1 and module 2 will affect the cascading input CIO of module 3. If a monitoring function should react on module 1 or module 2, axis 3 monitored using module 3 will be stopped.

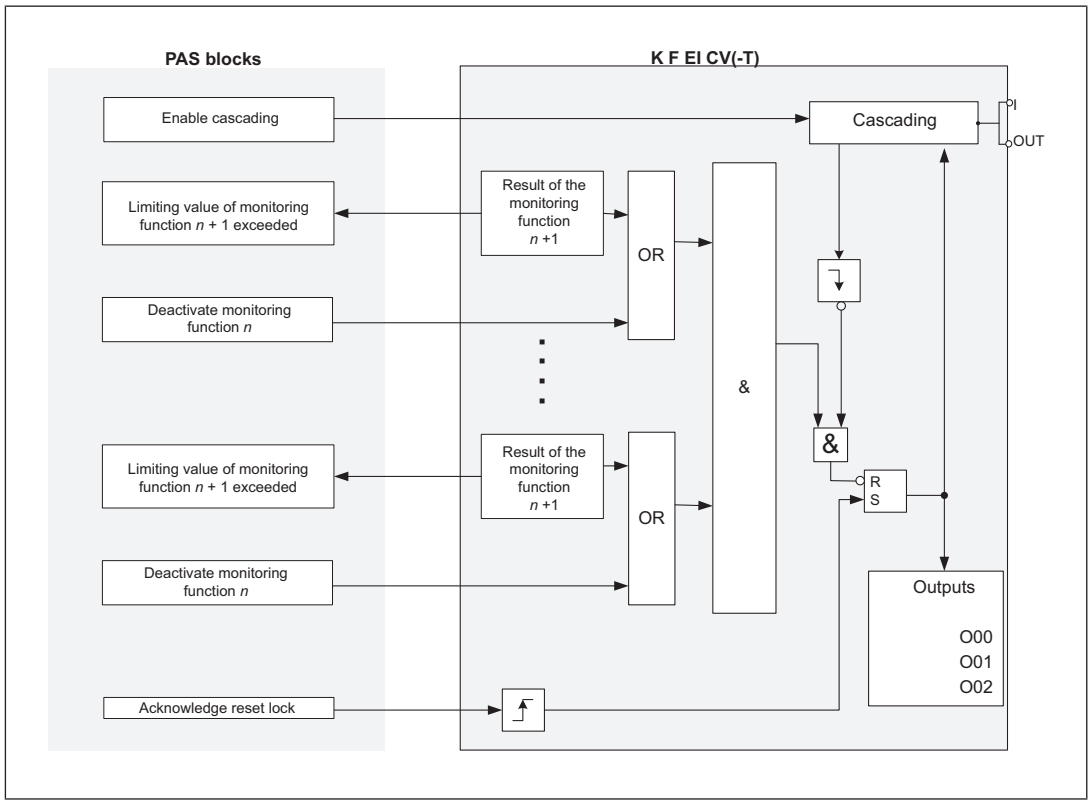
Counter modules (failsafe)
PSSu K F EI CV

Monitoring functions

- The module's FS outputs can trigger the safety function STO or SS1 on a drive as a reaction to the result of the monitoring functions.
- The module's ST output can trigger the braking ramp of the safety function SS1 as a reaction to the result of the monitoring functions.
- The outputs have a restart interlock.
- The blocks can be used to deactivate unneeded monitoring functions.
- All monitoring functions that are not deactivated affect the outputs, along with cascading.

Further information is available in PAS4000's online help.

Function diagram:



Counter modules (failsafe)
PSSu K F EI CV

The "Safe speed monitoring" function (SSM) monitors whether the current speed exceeds a limit value.

A tolerance range may also be set for the limit values used to monitor the speed. This tolerance range modifies the set limit values. As a result, one-off or periodic overshoots that exceed the limit values can be tolerated.

Activate the monitoring function by:

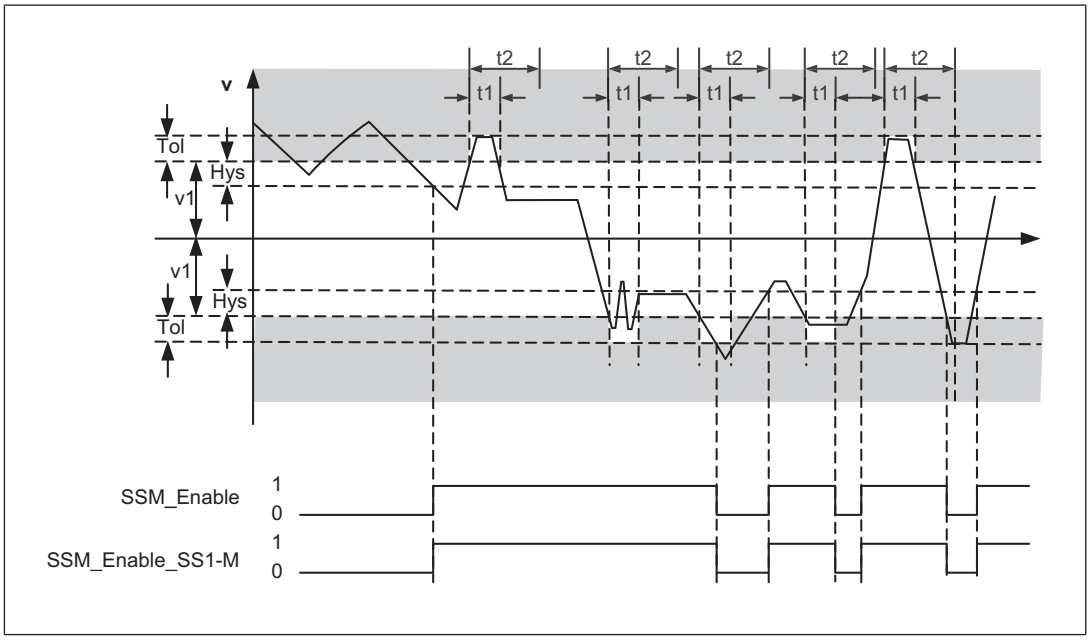
- The monitoring function does not need to be activated. Monitoring starts as soon as the module is ready for operation.

Reaction:

- If the configured limit value, plus the configured tolerance, is violated:
  - a 1/0 pulse edge at SSM_Enable
  - the local outputs switch off, depending on the configuration. Further information is available in PAS4000's online help.

The following values can be configured for the tolerance range:

- Tolerance time (t1), which takes into account the length of the overshoots (maximum time for which the limit value may be exceeded)
- Tolerance period (t2), which takes into account the oscillation period (minimum time that must elapse between one limit value overshoot and the next)
- Tolerance amount as % (Tol), which takes into account the amplitude of the overshoots (maximum permitted percentage by which the configured limit values may be exceeded)
- Hysteresis as % (Hys), prevents the outputs from bouncing if there are fluctuations around the response value. The hysteresis takes effect when the output is switched on:
  - Switch-on value = Switching threshold – Hysteresis



Counter modules (failsafe)
PSSu K F EI CV

Legend:

- SSM_Enable:
  - "1": Monitored limit value is not violated
  - "0": Monitored limit value is violated
- Output on the module (SSM_Enable_SS1):
  - "1": Monitored limit value is not violated
  - "0": Monitored limit value is violated
- t_1: Tolerance time
- t_2: Tolerance period
- Tol (%): Tolerance amount of limit value in both directions
- Hys (%): Hysteresis when switching the monitoring function back on

Counter modules (failsafe)
PSSu K F EI CV

The "Safe Speed Range Monitoring" function (SSR-M) monitors the current speed to ensure it stays within a maximum and minimum permitted limit value.

A tolerance range may also be set for the limit values used to monitor the speed range. This tolerance range modifies the set limit values. As a result, one-off or periodic overshoots that exceed the range limits can be tolerated.

Activate the monitoring function by:

- The monitoring function does not need to be activated. Monitoring starts as soon as the module is ready for operation.

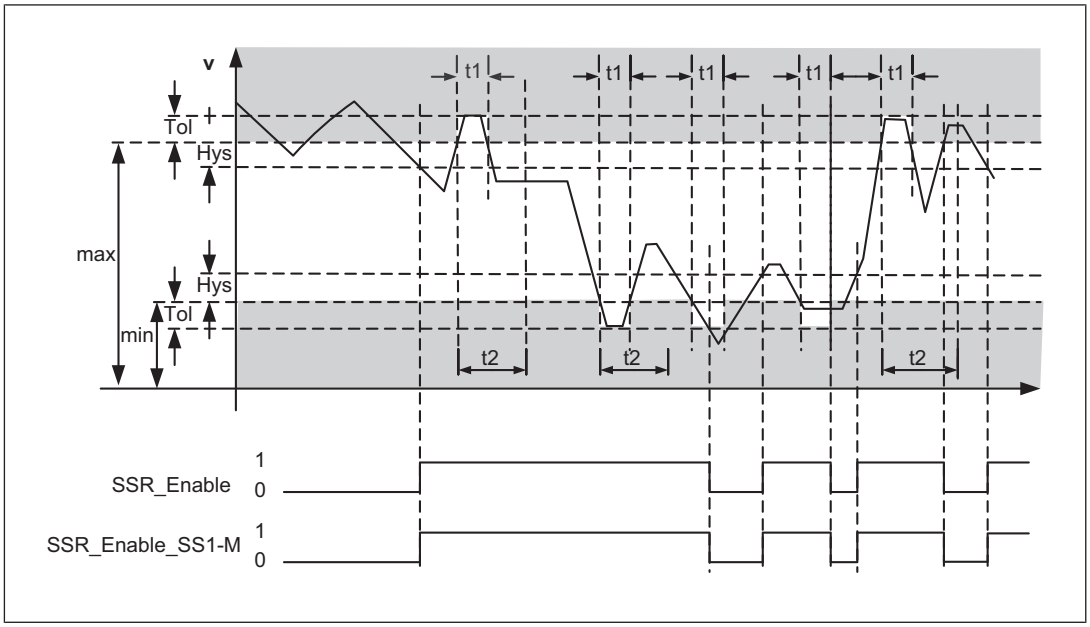
Reaction:

- If the configured limit value, plus the configured tolerance, is violated:
  - a 1/0 pulse edge at SSR_Enable
  - the local outputs switch off, depending on the configuration. Further information is available in PAS4000's online help.

The following values can be configured for the tolerance range:

- Tolerance time (t1), which takes into account the length of the overshoots (maximum time for which the limit value may be exceeded)
- Tolerance period (t2), which takes into account the oscillation period (minimum time that must elapse between one limit value overshoot and the next)
- Tolerance amount as a % (Tol), which takes into account the amplitude of the overshoots (maximum permitted percentage by which the limit value may be exceeded)
- Hysteresis as % (Hys), prevents the outputs from bouncing if there are fluctuations around the response value. The hysteresis takes effect when the output is switched on:
  - Switch-on value = Switching threshold – Hysteresis
- For the lower range limit:
  - Switch-on value = Switching threshold + Hysteresis

Counter modules (failsafe)
PSSu K F EI CV



Legend:

- SSR_Enable:
  - "1": Monitored limit value is not violated
  - "0": Monitored limit value is violated
- Output on the module (SSR_Enable_SS1-M):
  - "1": Monitored limit value is not violated
  - "0": Monitored limit value is violated
- t_1: Tolerance time
- t_2: Tolerance period
- Tol (%): Tolerance amount of the two limit values, maximum and minimum speed
- Hys (%): Hysteresis when switching the monitoring function back on

Counter modules (failsafe)
PSSu K F EI CV

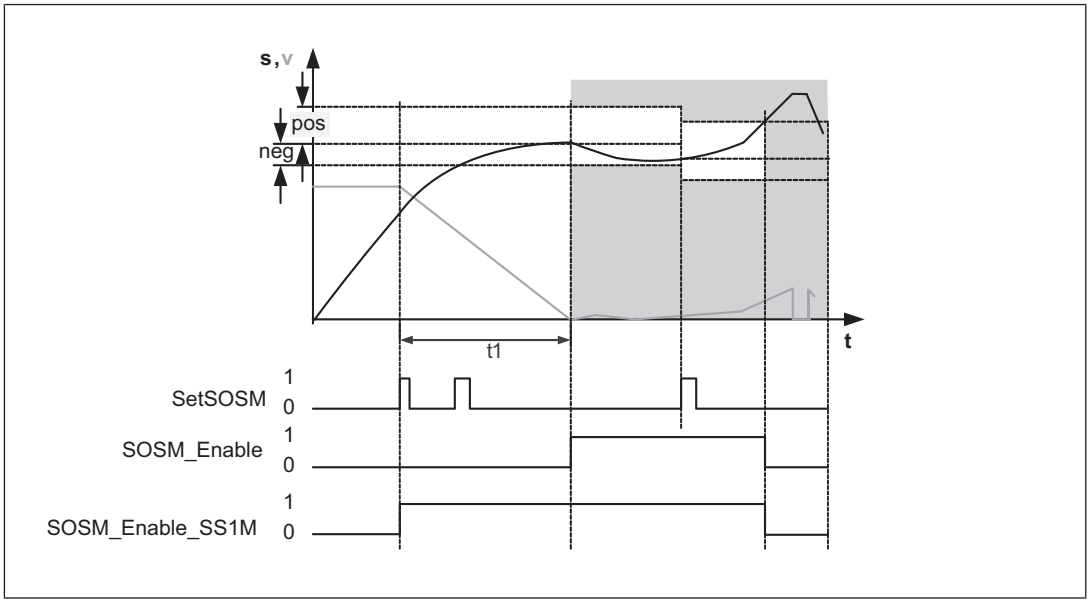
The "Safe Operating Stop Monitoring" function (SOS-M) monitors whether the standstill position remains within a configured tolerance window. The monitoring function SOS-M is not available on sensors on which a position cannot be determined (Ini pnp-pnp, pnp-npn, npn-pnp,npn-npn). The signals SOSM_Enable and SOSM_Enable_SS1M are constantly "0".

Activate the monitoring function by:

- 0/1 pulse edge at SetSOSM. The signal determines the current position to be monitored.

Reaction:

- 0/1 pulse edge at SOS-M_Enable_SS1-M
- SOS delay time (t1) is running
- A 0/1 pulse edge at SetSOSM before the delay time has elapsed is ignored.
- Once the SOS delay time has elapsed, the current position is adopted and safe standstill is monitored → 0/1 pulse edge at SOSM_Enable.
- Another 0/1 pulse edge at SetSOSM during active monitoring (SOSM_Enable = 'TRUE') means that the current position is immediately adopted as the new reference position, without delay.
- When the configured tolerance window is violated:
  - a 1/0 pulse edge at SOSM_Enable
  - the local outputs switch off, depending on the configuration. Further information is available in PAS4000's online help



Counter modules (failsafe)
PSSu K F EI CV

Legend

- SetSOSM: Adopt reference position once the delay time has expired
- SOSM_Enable:
  - "1": Monitored limit value not violated/monitoring of standstill position
  - "0": Monitored limit value violated/monitoring inactive
- Output on the module (SOSM_Enable_SS1-M):
  - "1": Monitored limit value not violated/monitoring of standstill position
  - "0": Monitored limit value violated/monitoring inactive
- t1: Delay time

Counter modules (failsafe)
PSSu K F EI CV

The "Safe Direction Monitoring" function (SDI-M) monitors the defined direction of movement of the drive axis (positive or negative). The monitoring function SDI-M is not available on sensors on which a position cannot be determined (Ini pnp-pnp, pnp-npn, npn-pnp,npn-npn). The signals SDIM_PosEnable (SDIM_NegEnable) and SDIM_PosEnable_SS1M (SDIM_NegEnable_SS1M) are constantly "0".

Activate the monitoring function by:

- The monitoring function does not need to be activated. Monitoring starts as soon as the module is ready for operation.

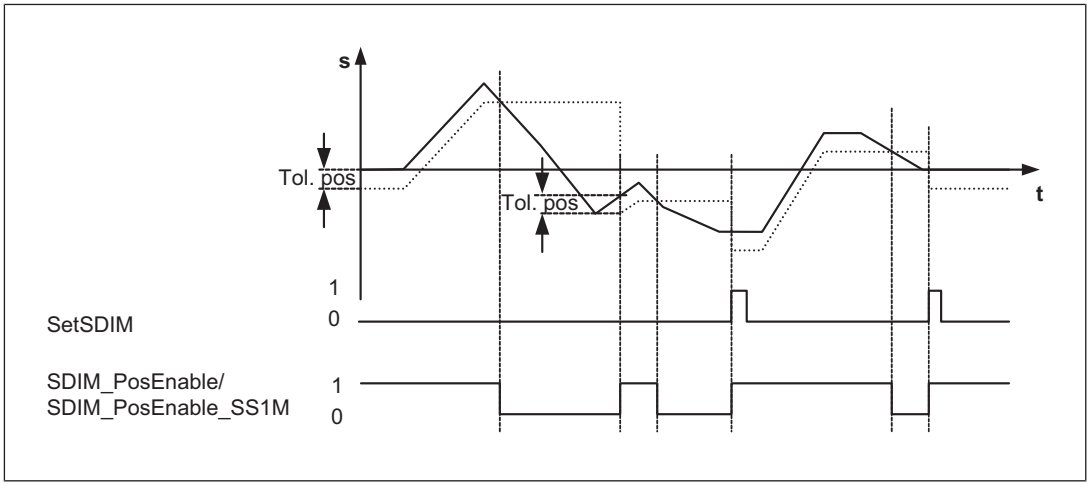
Reaction:

- If the respective direction, plus the configured tolerance, is violated:
  - a 1/0 pulse edge at SDIM_PosEnable or SDIM_NegEnable
  - the local outputs switch off, depending on the configuration. Further information is available in PAS4000's online help.
- If the monitored direction of movement has been violated and the current position moves in the right direction by more than the corresponding tolerance, SDIM_PosEnable (SDIM_NegEnable) is automatically reset to "1".
- If the monitored direction of movement has been violated and the current position cannot be moved in the right direction by at least the corresponding tolerance, then the monitoring function can be reset to "1" by a 0/1 pulse edge at SetSDIM.

Renewed adoption of the reference position or reactivation of the monitoring function:

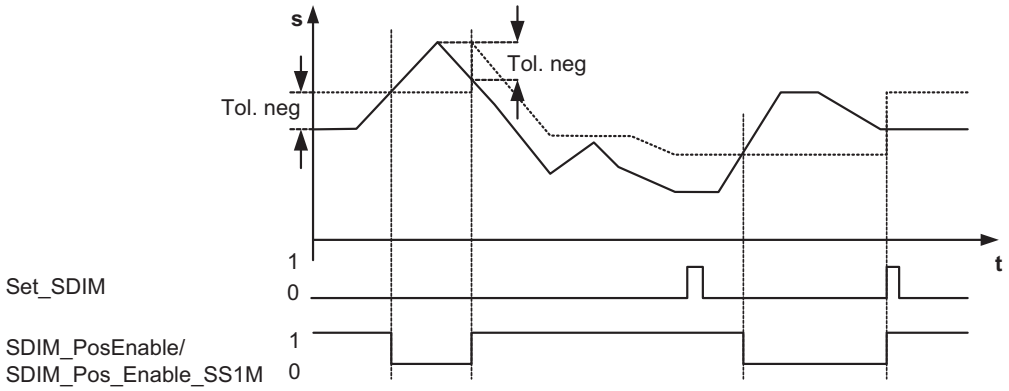
- 0/1 pulse edge at SetSDIM

Monitoring of positive direction of movement:



Counter modules (failsafe)
PSSu K F EI CV

Monitoring of negative direction of movement:



Legend:

- SDIM_PosEnable/SDIM_NegEnable:
  - "1": Monitored direction is not violated
  - "0": Monitored direction is violated
- Tol. pos/Tol. neg: Tolerance value, for which a movement contrary to the monitored direction will be accepted.

Counter modules (failsafe)
PSSu K F EI CV

The safe outputs can be configured in such a way that they can activate the safety function SS1 (a and c) on a servo amplifier.

Activation of monitoring function:

- The "Activate outputs" option must be activated in PAS4000. In this case, the monitoring function affects the outputs on the module directly if a limit value is violated.
- At least one monitoring function must be activated for the FS outputs. The monitoring functions are activated by setting the O-data type "...DeactivateSS1M" to FALSE.

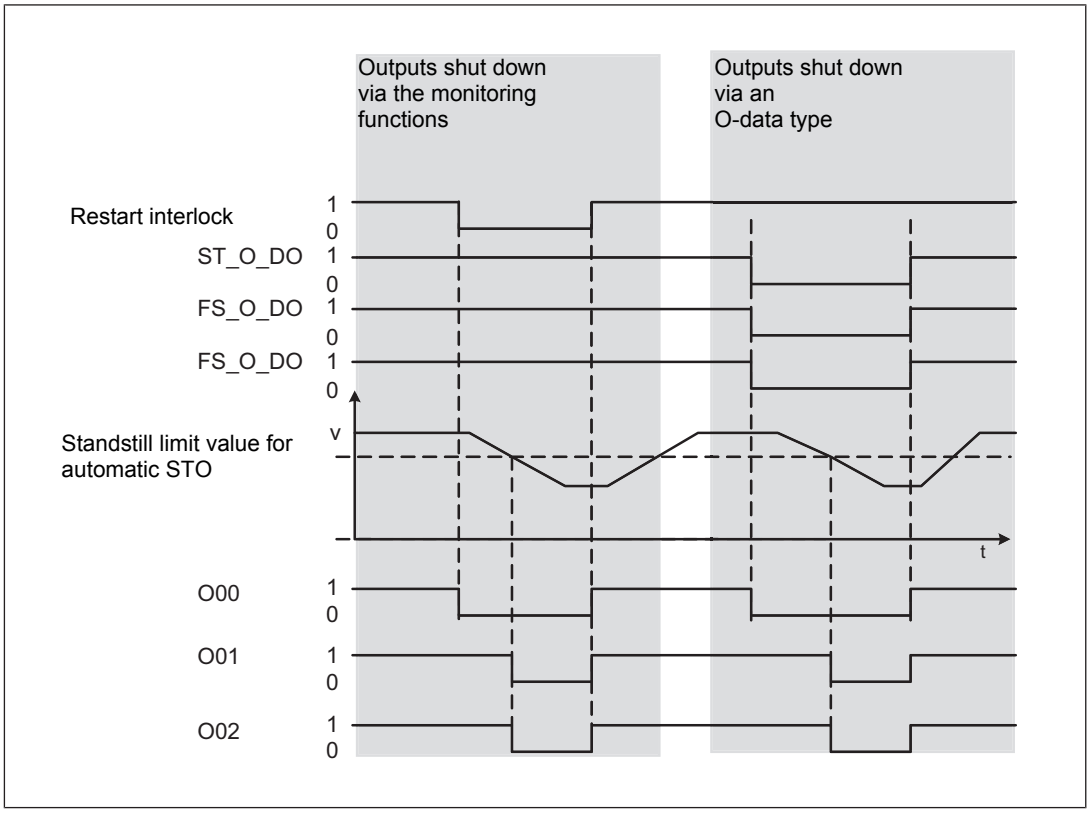
Activation:

- A monitoring function violates a monitored limit value and sets the restart interlock to "0".

  or
- The user program sets the O-data types (ST_O_DO and FS_O_DO) to "0".
- The ST output O00 is shut down immediately.
- The FS outputs are shut down,
  - if the speed drops below a configured standstill limit value for the automatic STO

    or
  - after a configured delay time has elapsed (STO delay time). The delay time starts running with a 1/0 pulse edge at the signal for the restart interlock or at the signal for the FS-O data types.
- If the delay time has elapsed and the signal for the restart interlock or FS-O data types is "0", then the assigned output is set to "0".
- If the delay time has elapsed and the signal for the restart interlock or FS-O data types is "1", then the assigned output remains at "1".
- If the delay time is running and another 1/0 pulse edge arrives at the signal for the restart interlock or FS-O data types, then the delay time is restarted.

Counter modules (failsafe)
PSSu K F EI CV

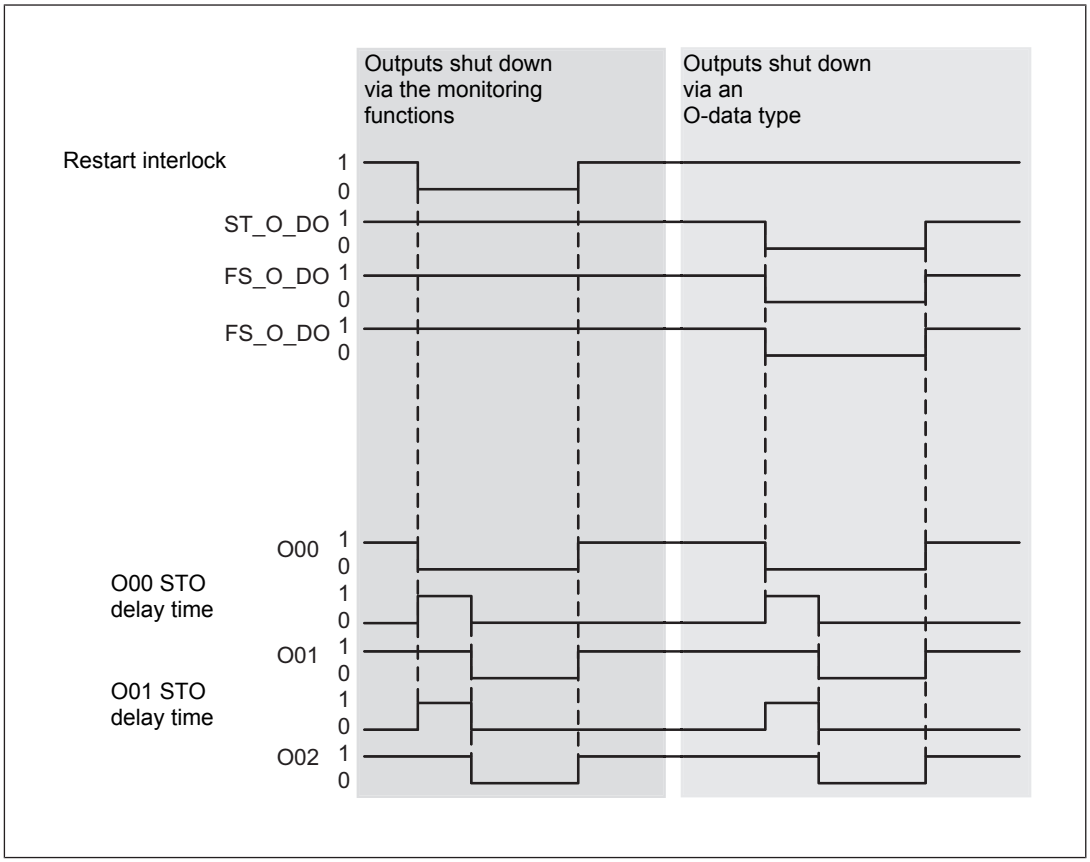


Legend:

- Restart interlock
- ST_O_DO: O-data type for the ST output
- FS_O_DO: O-data type for the FS output
- Standstill limit value for the automatic STO: Limit value for shutting down the outputs
- O00: ST output
- O01: FS output that can be used to trigger the STO function on a connected drive.
- O02: FS output that can be used to trigger the STO function on a connected drive.

Counter modules (failsafe)
PSSu K F EI CV

- The ST output O00 is shut down immediately.
- The FS outputs are shut down after a configured delay time (STO delay time) has elapsed. The delay time starts running with a 1/0 pulse edge at the signal for the restart interlock or at the signal for the FS-O data types.
  - If the delay time has elapsed and the signal for the restart interlock or FS-O data types is "0", then the assigned output is set to "0".
  - If the delay time has elapsed and the signal for the restart interlock or FS-O data types is "1", then the assigned output remains at "1".
  - If the delay time is running and another 1/0 pulse edge arrives at the signal for the restart interlock or FS-O data types, then the delay time is restarted.



Legend:

- Restart interlock
- ST_O_DO: O-data type for the ST output
- FS_O_DO: O-data type for the FS output
- O00: ST output
- STO delay time: Delay time for shutting down the FS outputs
- O01: FS output that can be used to trigger the STO function on a connected drive.
- O02: FS output that can be used to trigger the STO function on a connected drive.

Counter modules (failsafe)
PSSu K F EI CV

The module provides all the necessary functions to implement the safety function STO on a servo amplifier.

Features:

- The FS outputs O01 and O02 are used to activate the safety function STO on a servo amplifier.
- The configurable STO delay time must be deactivated in PAS4000 by entering a value of 0 ms.
- The "Display monitoring result at the outputs" option must be activated in PAS4000. In this case, the result of the monitoring functions affects the outputs on the module directly if a limit value is violated.
- At least one monitoring function must be activated for the FS outputs. The monitoring functions are activated by setting the O-data type "...DeactivateSS1M" to FALSE.

Position counter value

The position counter value is transferred to the head module via the FS module bus and is available in the user program. This function is not available on sensors on which a position cannot be determined (Ini pnp-pnp, pnp-npn, npn-pnp,npn-npn). The valid bit of the position counter value must always be evaluated together with the position counter value.

Reason: In the event of an error or open circuit on the sensor, the valid bit for the position counter value becomes 0, so identifying an invalid position counter value. While the error is present, the position counter value is set to 0.

Please note that movements cannot be recorded during an external error/open circuit. As soon as the valid bit for the position counter value becomes 0, all the reference positions in the user program that have been formed from the position counter value become invalid and must be recalculated when the valid bit returns to 1.

Integrated protection mechanisms

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module provides the following diagnostic data:

- Start-up error
- Configuration error
- FS communication error
- Bus termination error
- Temperature error: too warm
- Sensor error
- Output error

Counter modules (failsafe)
PSSu K F EI CV

The module has the following protection mechanisms:

- Common second shutdown route, tested regularly
- Cyclical output tests

Counter modules (failsafe)
PSSu K F EI CV

Reaction times

Maximum reaction time from the moment a monitored limit value is violated to the shutdown of outputs O0, O1, O2 is: 10 ms.

Cascading:

With 8 networked modules, the maximum reaction time from the moment a monitored limit value is violated to the shutdown of all networked modules is: 6 ms.

With 2 networked modules, the typical reaction time from the moment a monitored limit value is violated to the shutdown of all networked modules is: 4.5 ms.

Configuration

The module has the following configuration options

- In the properties view in PAS4000
- In the blocks' properties view
- Via the blocks' I-variables

Access to data during operation is via pre-defined I/O data types and the blocks FS_EI_Basic, FS_EI_SSM0, FS_EI_SOSM, FS_EI_SDIM, FS_EI_SSM1_SSRM:

I-data type: FS_I_DI

I/O data name	I/O data element	Meaning
SSM0_Enable	Data: SAFEBOOL	TRUE: configured limit value for the monitoring function SSM0 has not been violated. FALSE: configured limit value for the monitoring function has been exceeded and the monitoring function SSM0 has been activated
SSM1_Enable	Data: SAFEBOOL	TRUE: configured limit value for the monitoring function SSM1 has not been violated. FALSE: configured limit value for the monitoring function has been exceeded and the monitoring function SSM1 has been activated
SOSM_Enable	Data: SAFEBOOL	TRUE: configured limit value for the monitoring function SOSM has not been violated. FALSE: the limit value for the position tolerance has been exceeded and the monitoring function SOSM has been activated
SDIM_PosEnable	Data: SAFEBOOL	TRUE: configured limit value for the monitoring function SDIM_Pos has not been violated. FALSE: the limit value for the speed has been exceeded and the monitoring function SDIM_Pos has been activated

Counter modules (failsafe)
PSSu K F EI CV

I/O data name	I/O data element	Meaning
SDIM_NegEnable	Data: SAFEBOOL	TRUE: configured limit value for the monitoring function SDIM_Neg has not been violated. FALSE: the limit value for the speed has been exceeded and the monitoring function SDIM_Neg has been activated
SSRM_Enable	Data: SAFEBOOL	TRUE: configured limit values for the monitoring function SSRM has not been violated. FALSE: limit values for the speed has been exceeded and the monitoring function SSRM has been activated

I-data type: FS_I_EI_SPEED

I/O data name	I/O data element	Meaning
Speed	Speed: SAFEWORD	Current speed value in compressed form

I-data type: FS_I_EI_STATE:

I/O data name	I/O data element	Meaning
State	AcknowledgementRequired: BOOL	TRUE: An error has been reported, which must be acknowledged. FALSE: No error detected
State	AutomaticSTO: SAFEBOOL	TRUE: The value for the option "Automatic STO at standstill" has fallen below the set limit value and standstill has been detected. FALSE: Standstill not detected or SS1 not activated.
State	SensorMissing: BOOL	TRUE: No sensor connected FALSE: Sensor connected
State	StateCascading:BOOL	TRUE: No networked module has switched off FALSE: At least one networked module has switched off
State	StateRestartInhibit: SAFEBOOL	TRUE: corresponds to the "sum" of the local safety functions and the restart interlock inactive FALSE: Restart interlock active
State	StateSTO_Timer1: SAFEBOOL	TRUE: the set STO delay time for output O1 is running. FALSE: the set STO delay time for output O1 has not been started or has already elapsed.

Counter modules (failsafe)
PSSu K F EI CV

I/O data name	I/O data element	Meaning
State	StateSTO_Timer2: SAFEBOOL	TRUE: the set STO delay time for output O2 is running. FALSE: the set STO delay time for output O2 has not been started or has already elapsed.

I-data type: FS_I_EI_PARA

I/O data name	I/O data element	Meaning
Parameters	Handshake: SAFEBOOL	Module has adopted new parameter value
Parameters	ParameterError: SAFE-BOOL	TRUE: An incorrect parameter has been trans-ferred FALSE: No error

I-data type: FS_I_EI_CV

I/O data name	I/O data element	Meaning
CounterValue	CurrentData: SAFE-WORD	Position counter value as 32 bit value

O-data type: ST_O_DO

I/O data name	I/O data element	Meaning
O0	Data: BOOL	TRUE: Switch on output 0 FALSE: Switch off output 0

O-data type: FS_O_DO:

I/O data name	I/O data element	Meaning
O1	Data: SAFEBOOL	TRUE: Switch on output 1 FALSE: Switch off output 1
O2	Data: SAFEBOOL	TRUE: Switch on output 2 FALSE: Switch off output 2
SSM0_DeactivateSS1M	Data: SAFEBOOL	TRUE: Deactivate monitoring function SSM0 for the outputs. FALSE: Activate monitoring function SSM0 for the outputs.

Counter modules (failsafe)
PSSu K F EI CV

I/O data name	I/O data element	Meaning
SSM1_DeactivateSS1M	Data: SAFEBOOL	TRUE: Deactivate monitoring function SSM1 for the outputs. FALSE: Activate monitoring function SSM1 for the outputs.
SSRM_DeactivateSS1M	Data: SAFEBOOL	TRUE: Deactivate monitoring function SSRM for the outputs. FALSE: Activate monitoring function SSRM for the outputs.
SOSM_DeactivateSS1M	Data: SAFEBOOL	TRUE: Deactivate monitoring function SOSM for the outputs. FALSE: Activate monitoring function SOSM for the outputs.
SDIM_PosDeactivateSS1M	Data: SAFEBOOL	TRUE: Deactivate monitoring function SDIM-Pos for the positive direction for the outputs. FALSE: Activate monitoring function SDIM-Pos for the positive direction for the outputs.
SDIM_NegDeactivateSS1M	Data: SAFEBOOL	TRUE: Deactivate monitoring function SDIM-Neg for the negative direction for the outputs. FALSE: Activate monitoring function SDIM-Neg for the negative direction for the outputs.

O-data type: FS_O_EI_CONTROL

I/O data name	I/O data element	Meaning
BasicInterface	ActivateCascading: BOOL	TRUE: Enable cascading output. FALSE: Switch off cascading output.
BasicInterface	Alive: SAFEBOOL	Only used internally
BasicInterface	ErrorAcknowledgement: BOOL	TRUE: Reset error
BasicInterface	Restart: SAFEBOOL	TRUE: Reset restart interlock

O-data type: FS_O_EI_REFPOS

I/O data name	I/O data element	Meaning
SetSDIM	Set: SAFEBOOL	TRUE: Restart of monitoring functions SDIM
SetSDIM	Alive: SAFEBOOL	Only used internally
SetSOSM	Set: SAFEBOOL	TRUE: Restart of monitoring functions SOSM
SetSOSM	Alive: SAFEBOOL	Only used internally

Counter modules (failsafe)
PSSu K F EI CV

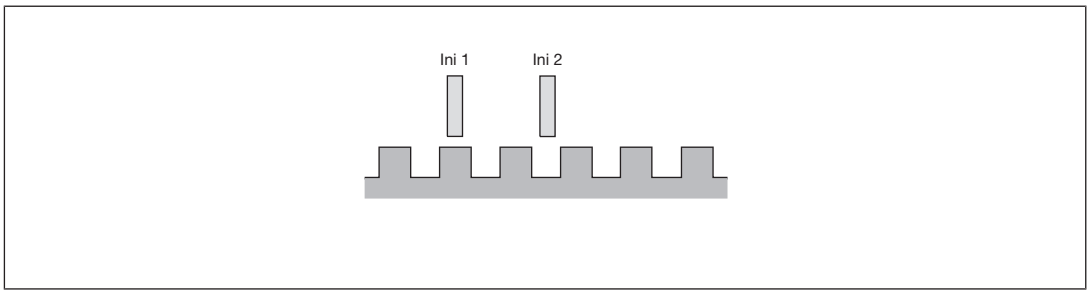
O-data type: FS_O_EI_SSR_PARA

I/O data name	I/O data element	Meaning
SSR_Parameter	Alive: SAFEBOOL	Only used internally
SSR_Parameter	MaxSpeed: SAFEWORD	Maximum speed for Safe Speed Range Monitoring (SSRM) and limit value for Safe Speed Monitoring 1 (SSM1) in compressed form.
SSR_Parameter	MinSpeed: SAFEWORD	Minimum speed for Safe Speed Range Monitoring (SSRM) in compressed form

Proximity switches

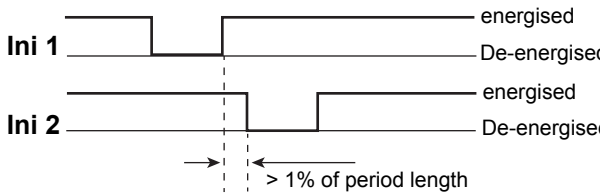
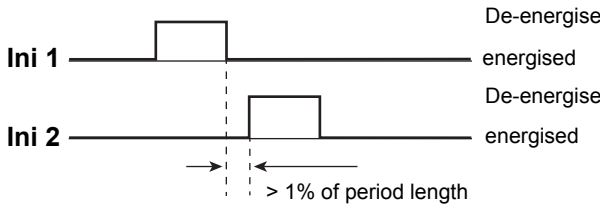
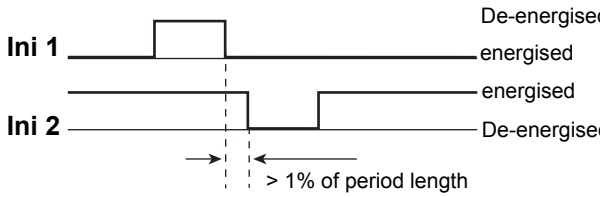
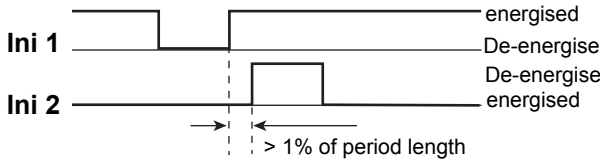
- The following proximity switches can be used with a pnp or npn output:
  - Inductive
  - Capacitive
- The proximity switches must be fitted so that at least one is always activated. In other words, the proximity switches must be fitted so that the recorded signals always overlap.
- The cable used to connect the proximity switches must be shielded (see connection diagrams in the chapter entitled "EMC-compliant wiring").
- A DC voltage in the range of 0 - 30 V can be monitored via track S. It should be used to monitor the supply voltage of the proximity switches.

Proximity switch assembly:



Counter modules (failsafe)
PSSu K F EI CV

Signal characteristics:

Proximity switch combinations	Signal image during movement
PNP / PNP	
NPN / NPN	
NPN / PNP	
PNP / NPN	

- Please note the values stated in the sensor's technical details.
- For a full configuration, the maximum frequency of the sensors you are using must be entered in PAS4000 (see sensor's data sheet).

Encoder

- The following encoders can be used:
  - TTL, HTL (single-ended or differential signals)
  - Sin/Cos 1 Vss
  - Hiperface®
- The encoders can be connected with or without Z index (0 index).
- The cables used to connect the encoders must be shielded (see connection diagrams in the chapter entitled "EMC-compliant wiring").

Counter modules (failsafe)
PSSu K F EI CV

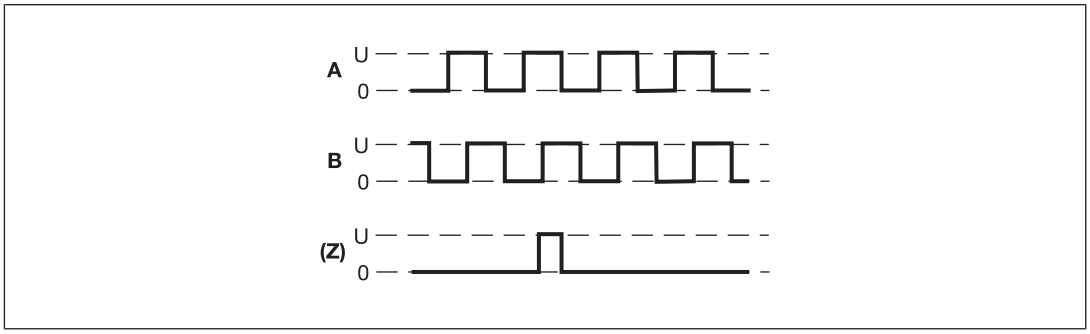
- A pnp proximity switch can also be connected to track Z for monitoring broken shear-pins.
  Please note:
  Monitoring for broken shearpins does not become active until
  - The minimum speed has been exceeded and
  - The tolerance for detecting feasibility errors has elapsed.

  The minimum speed and tolerance depend on the ratio of the frequency at tracks AB "f_{AB}" to the frequency at track Z "f_Z" in your configuration.
  Minimum speed:
  - Calculated ratio AB/Z ≥ 1.0
    f_Z = 10 mHz or f_{AB} = (f_{AB}/f_Z) *x* 10 mHz
  - when f_{AB}/f_Z ***Verh.*** < 1.0
    f_{AB} = 10 mHz or f_Z = 10 mHz/(f_{AB}/f_z)

  Tolerance for detecting feasibility errors:
  - when ***fAB/fZ Verh.*** ≥ 1.0
    7.5 Z-pulses or 7.5 x (f_{AB}/f_Z) AB-pulses
  - when ***fAB/fZ Verh.*** < 1.0
    4.5 AB-pulses or *4.5/*(f_{AB}/f_Z) Z-pulses
- With Hiperface encoders, only the RefSin and RefCos tracks are recorded and monitored (see Adapters for encoders [📖 1075]).
- Track S can be used:
  - To connect an encoder's error output.
  - To monitor voltages between 0 V and 30 V for a permitted upper and lower limit. For example, the encoder's supply voltage can be monitored.
- The maximum frequency of the used encoders must be entered for a complete configuration.
- Pay attention to the values in the technical details.

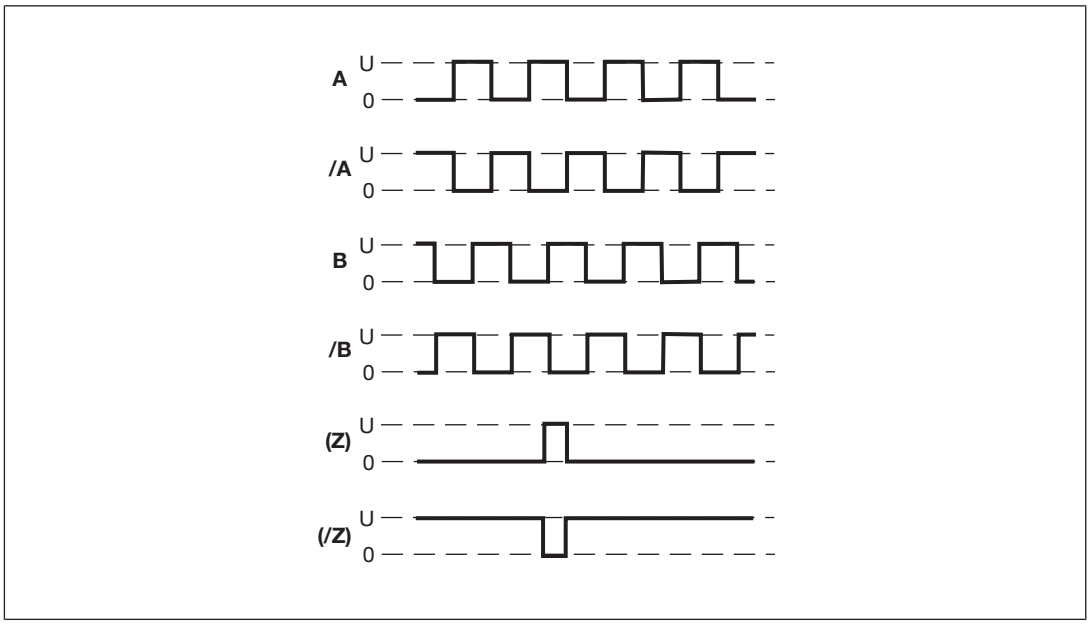
Output signals TTL, HTL

Single ended



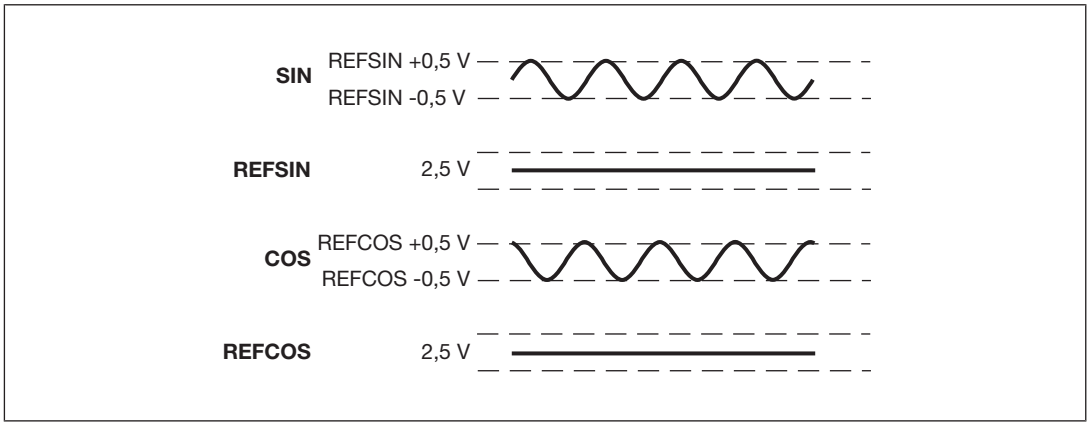
Counter modules (failsafe)
PSSu K F EI CV

Differential



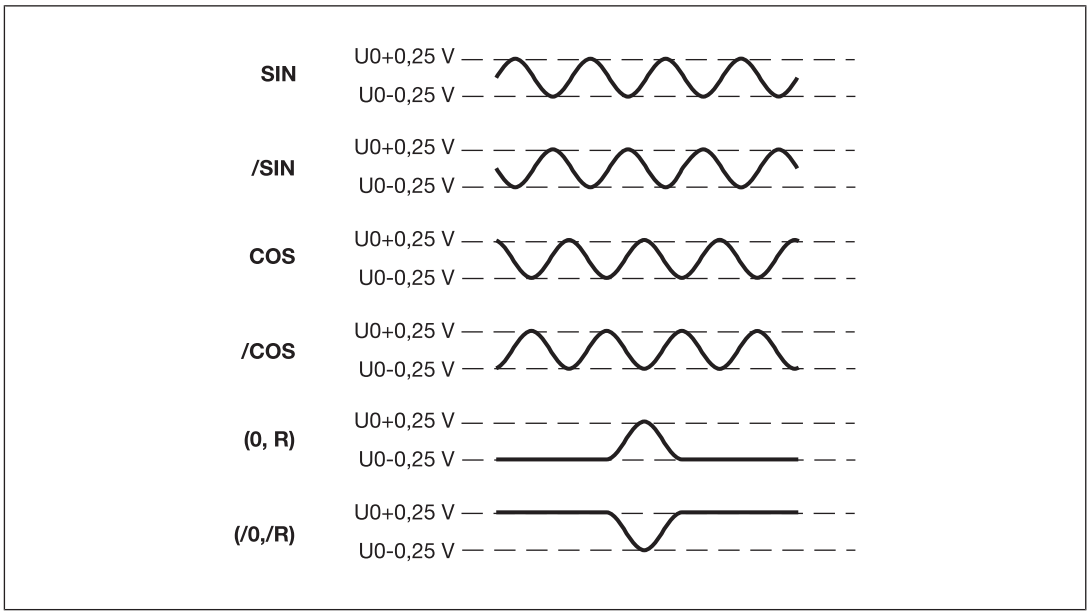
Output signals Sin/Cos (1 Vss)

Single ended with reference track (e.g. Hiperface ®)



Counter modules (failsafe)
PSSu K F EI CV

Differential with/without Z index (e.g. Heidenhain 1 Vss)



- Tracks Z and /Z can also be inverted
- With a SinCos encoder, the voltage U0 is 2.5 V

The adapter records the data between the encoder and the drive and makes it available to the module via the Mini-IO socket.

Pilz supplies complete adapters as well as ready-made cable with Mini-IO connector, which can be used when making your own adapter. The range of products in this area is constantly being expanded. Please contact us about the range of adapters that is currently available.

Wiring

Connectors' mechanical connection

Please note:

- The conductor cross section on the spring-loaded terminals without ferrules is 0,2 - 1 mm², 22 - 18 AWG.
- If you are using multi-core or fine-core cables we recommend ferrules in accordance with DIN 46228/Part 1 or DIN 46228/Part 4, 0.2 ... 1 mm². To crimp the ferrules we recommend crimping pliers (crimp form A) conforming to EN 60947-1, such as the PZ 6/5 from Weidmüller, for example.
- Terminal points per connection: 1
- Stripping length: 8 mm

Counter modules (failsafe)
PSSu K F EI CV

Connect/disconnect the cables

We recommend you use a screw driver with a 0.4 x 2.5 mm (DIN 5264) blade!

Strip the cable:

- Strip the cable [1] and apply a ferrule if necessary (DIN 46228/Part 1 or DIN 46228/Part 4).

Connect cable:

- Using the screwdriver, press the actuator button on the spring-loaded terminal down as far as it will go [2], keep it held down and insert the stripped cable into the plug connection as far as it will go [2].
- Check that the cable is firmly seated [3].

Disconnect cable:

- Using the screwdriver, press the actuator button down as far as it will go [4], keep it held down and pull the cable out of the plug connection [4].

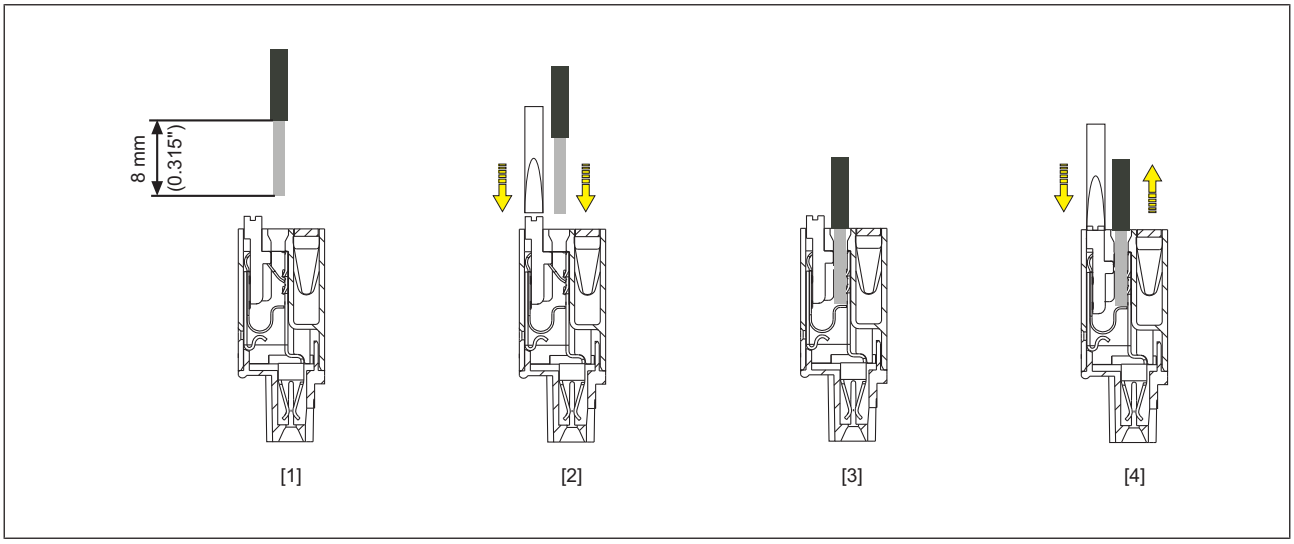
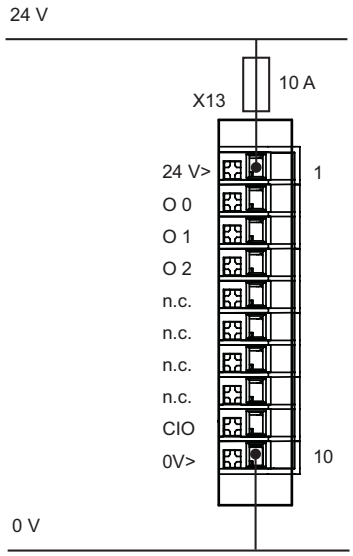


Fig.: Connect and disconnect the cables

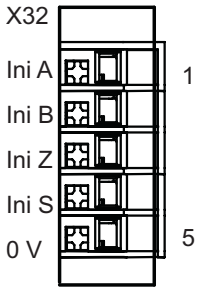
Counter modules (failsafe)
PSSu K F EI CV

Supply voltage

Terminal configuration (1-row): PSSu A Con 1/10 C	
X13: 24 V>: +24 V (external periphery supply) O 0: Single-pole ST output O 1: Single-pole FS output O 2: Single-pole FS output NC NC NC NC CIO-: Input/output for networking additional modules 0 V>: 0 V (external periphery supply)	

Counter modules (failsafe)
PSSu K F EI CV

Connection of proximity switches

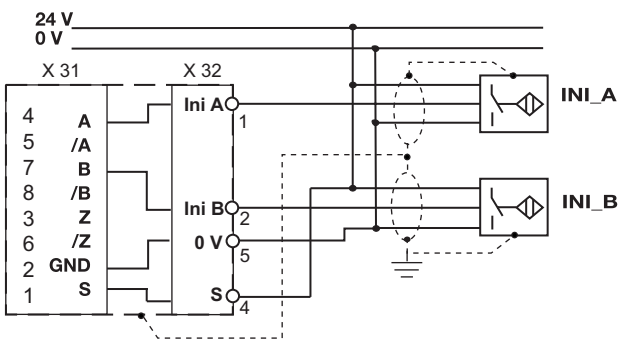
Terminal configuration (1-row): **PSSu A Con 1/5 C**	
X32: Ini A Ini B Ini Z Ini S 0 V	

The following proximity switch combinations can be connected:

- A: pnp, B: pnp
- A: npn, B: npn
- A: pnp, B: npn
- A: npn, B: pnp

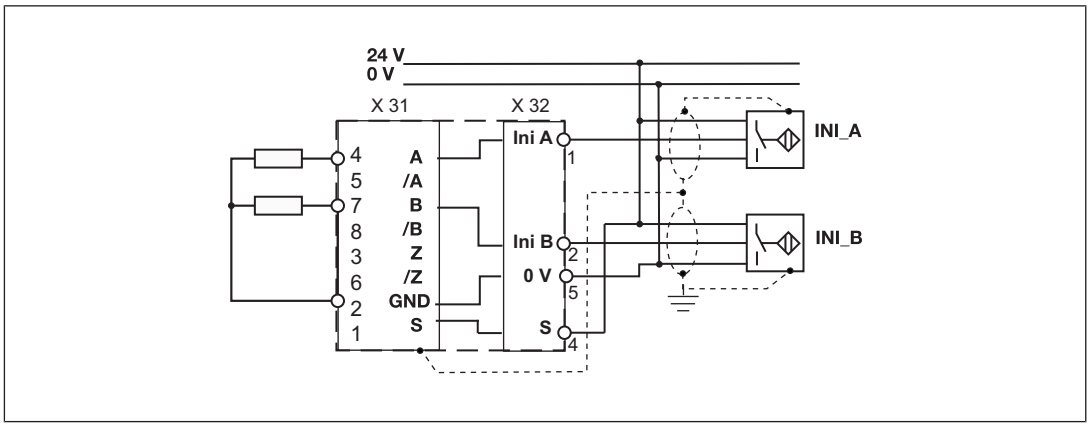
When connecting proximity switches please note:

- Proximity switches can be connected to
  - terminals Ini A, Ini B, 0 V
    or
  - tracks A, B and 0 V of the Mini-IO socket.
- Track S should be used to monitor the supply voltage (see drawing). A permitted voltage range can be entered in the PAS4000.
- Connect the proximity switch to 24 VDC of the power supply.
- When connecting the proximity switches, please refer to the chapter entitled "EMC-compliant wiring".
- Invalid signals may occur with cable lengths >50 m. In this case we recommend that you connect a resistor between the signal lines, as shown in the diagrams.

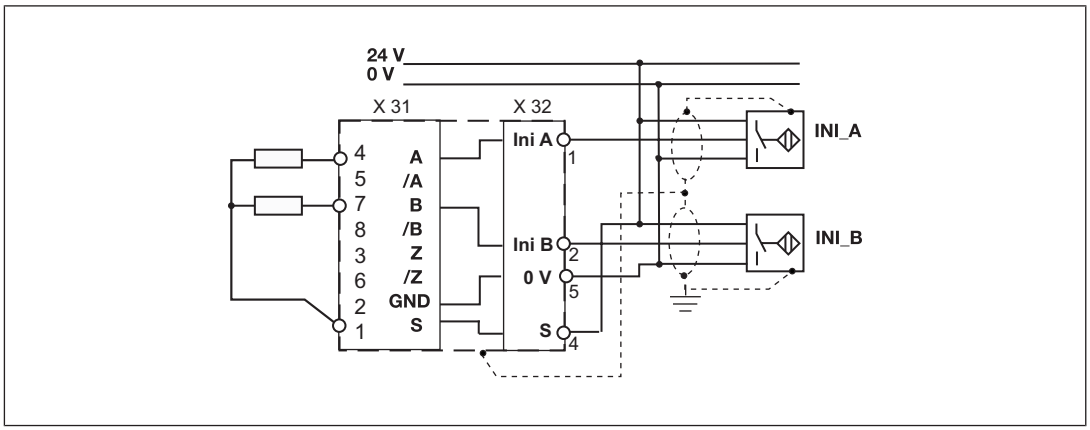


Counter modules (failsafe)
PSSu K F EI CV

pnp proximity switch with resistor R = 10 kOhm

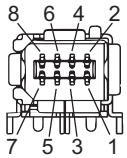


npn proximity switch with resistor R = 47 kOhm



Connection of encoders

Connector pin assignment X31, depending on the technology

Mini-IO socket 8-pin	PIN	HTL/TTL	Sin/Cos	Hiperface
	1	S (optional)	S (optional)	S (optional)
	2	GND	GND	GND
	3	Z	Z or index	
	4	A	Sin	Sin
	5	/A	-Sin	RefSin
	6	/Z	Z or index	
	7	B	Cos	Cos
	8	/B	-Cos	RefCos

Counter modules (failsafe)
PSSu K F EI CV

Proceed as follows when connecting the encoder:

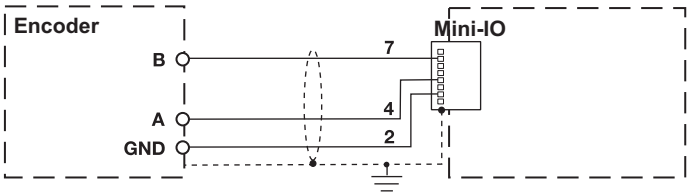
- Use only shielded cables for all connections. Please refer to the chapter EMC-compliant wiring [1083].
- Always connect GND on the encoder to GND on the Mini-IO socket.

Encoder types:

- TTL single ended
- HTL single ended

Please note:

- Tracks/A, /B, Z, and /Z must remain free

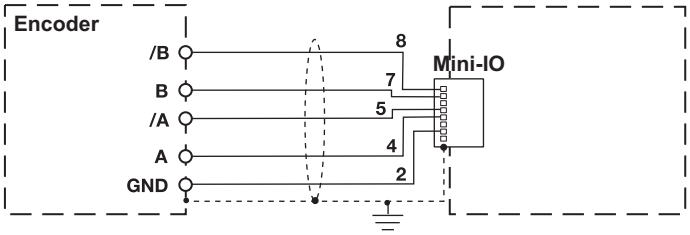


Encoder types:

- TTL differential
- HTL differential
- sin/cos 1 Vss
- Hiperface

Please note:

- Tracks Z and /Z must remain free



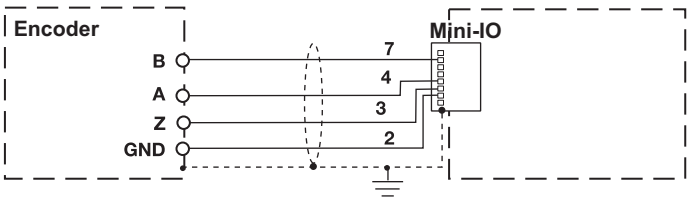
Encoder types:

- TTL single Z Index
- HTL single Z Index

Counter modules (failsafe)
PSSu K F EI CV

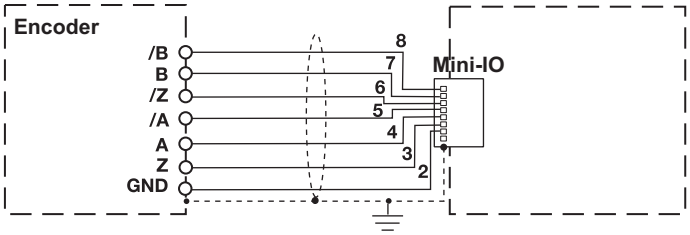
Please note:

- Tracks /A, /B and /Z must remain free

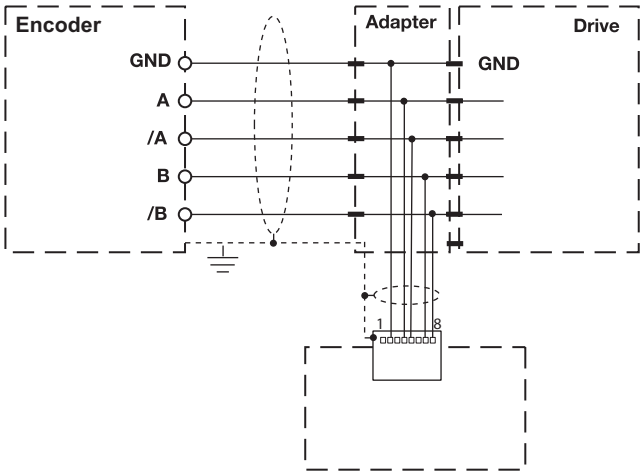


Encoder types:

- TTL diff. Z Index
- HTL diff. Z Index
- sin/cos 1 Vss Z Index



The adapter (e.g. PNOZ msi6p) is connected between the encoder and the drive. The output on the adapter is connected to the Mini-IO socket on the module.



Counter modules (failsafe)
PSSu K F EI CV

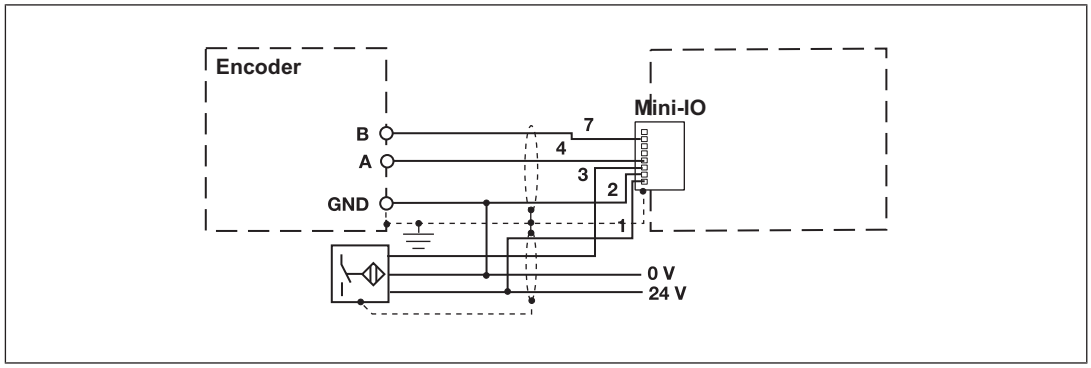
Connection of proximity switch and encoder

When connecting the encoders and proximity switches, please refer to the chapter entitled "EMC-compliant wiring".

Sensor types:

- Configuration: HTL single Z Freq. Ini pnp
  - HTL single ended (A,B) + Ini pnp (Z)
  - HTL single ended (A,B) + HTL differential (A as Z)
  - HTL single ended (A,B) + HTL single ended (A as Z)
- Configuration: TTL single Z Freq. Ini pnp
  - TTL single ended (A,B) + Ini pnp (Z)
  - TTL single ended (A,B) + HTL differential (A as Z)
  - TTL single ended (A,B) + HTL single ended (A as Z)

Please note:
Tracks /A, /B and /Z must remain free.



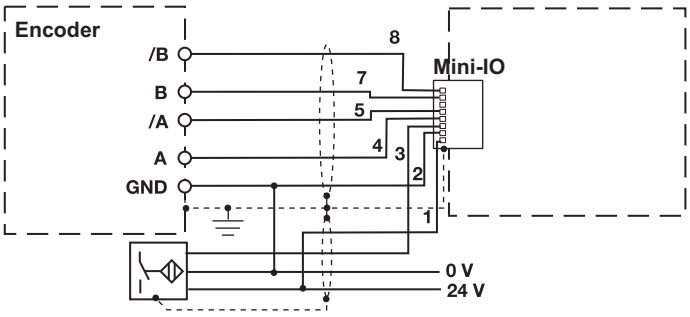
Sensor types:

- Configuration: TTL differential Z Freq. Ini pnp
  - TTL differential (A,/A,B,/B) + Ini pnp (Z)
  - TTL differential (A,/A,B,/B) + HTL differential (A as Z)
  - TTL differential (A,/A,B,/B) + HTL single ended (A as Z)
- Configuration: HTL differential Z Freq. Ini pnp
  - HTL differential (A,/A,B,/B) + Ini pnp (Z)
  - HTL differential (A,/A,B,/B) + HTL differential (A as Z)
  - HTL differential (A,/A,B,/B) + HTL single ended (A as Z)
- Configuration: sin/cos 1 Vss Z Freq. Ini pnp
  - sin/cos 1 Vss (A,/A,B,/B) + Ini pnp (Z)
  - sin/cos 1 Vss (A,/A,B,/B) + HTL differential (A as Z)
  - sin/cos 1 Vss (A,/A,B,/B) + HTL single ended (A as Z)

Counter modules (failsafe)
PSSu K F EI CV

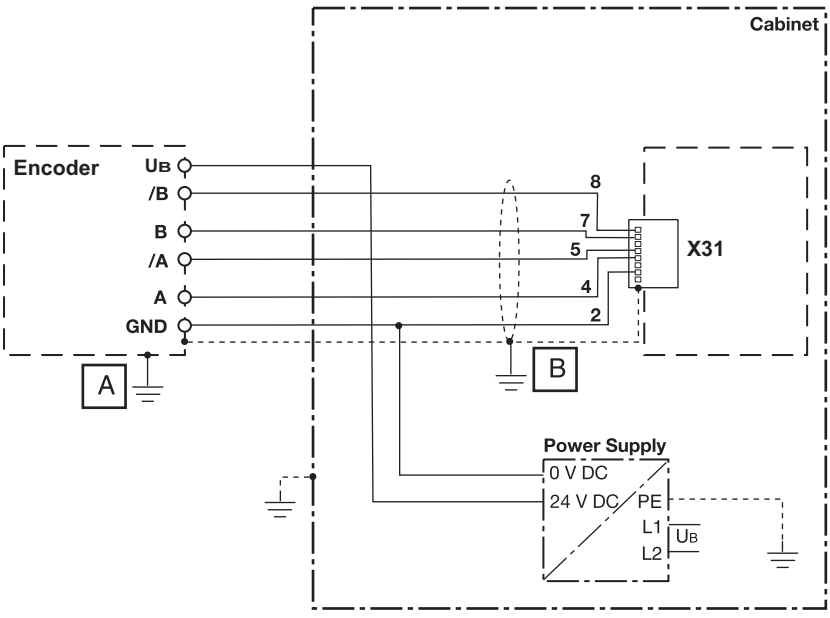
- Configuration: Hiperface Z Freq. Ini pnp
  - Hiperface (A,/A,B,/B) + Ini pnp (Z)
  - Hiperface (A,/A,B,/B) + HTL differential (A as Z)
  - Hiperface (A,/A,B,/B) + HTL single ended (A as Z)

Please note:
Track /Z must remain free



EMC-compliant wiring

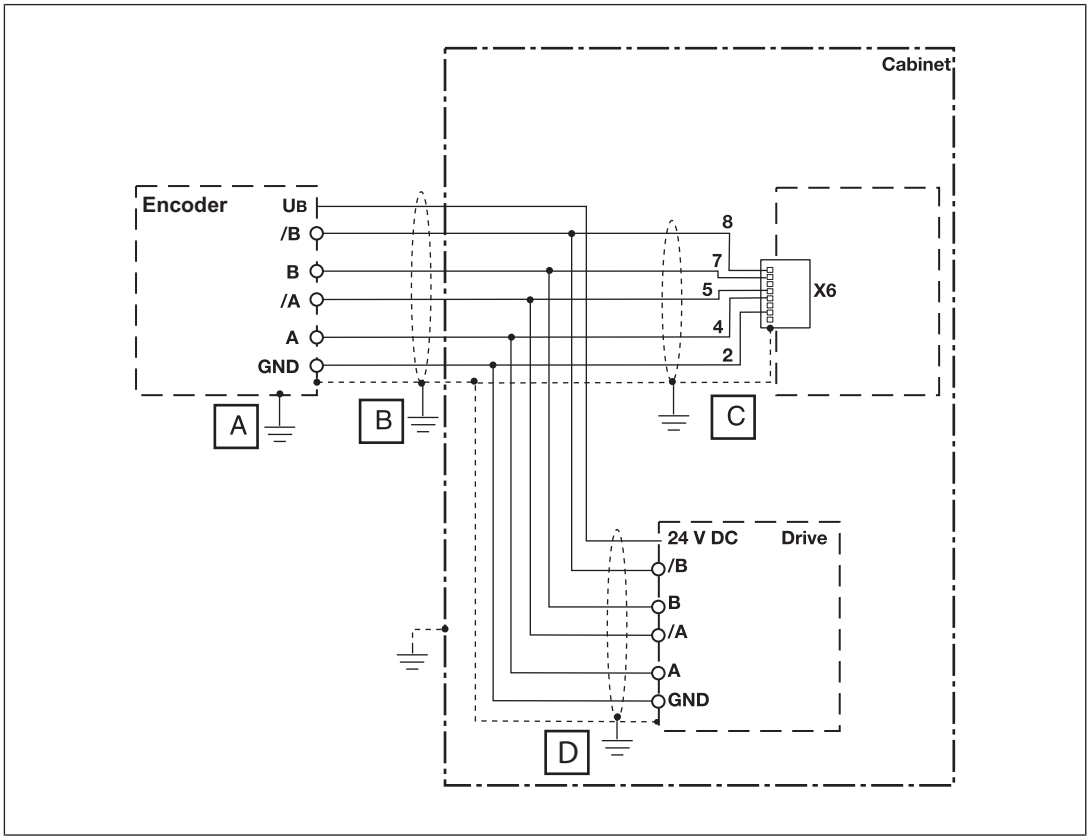
EMC-compliant wiring for connecting an encoder



Counter modules (failsafe)
PSSu K F EI CV

To avoid EMC interference we recommend that the shield on the sensor lines is only connected to earth at a single point:
A **or** B
Conductor loops outside the shield must be avoided.
The shield must run continuously from the sensor to the evaluation device.

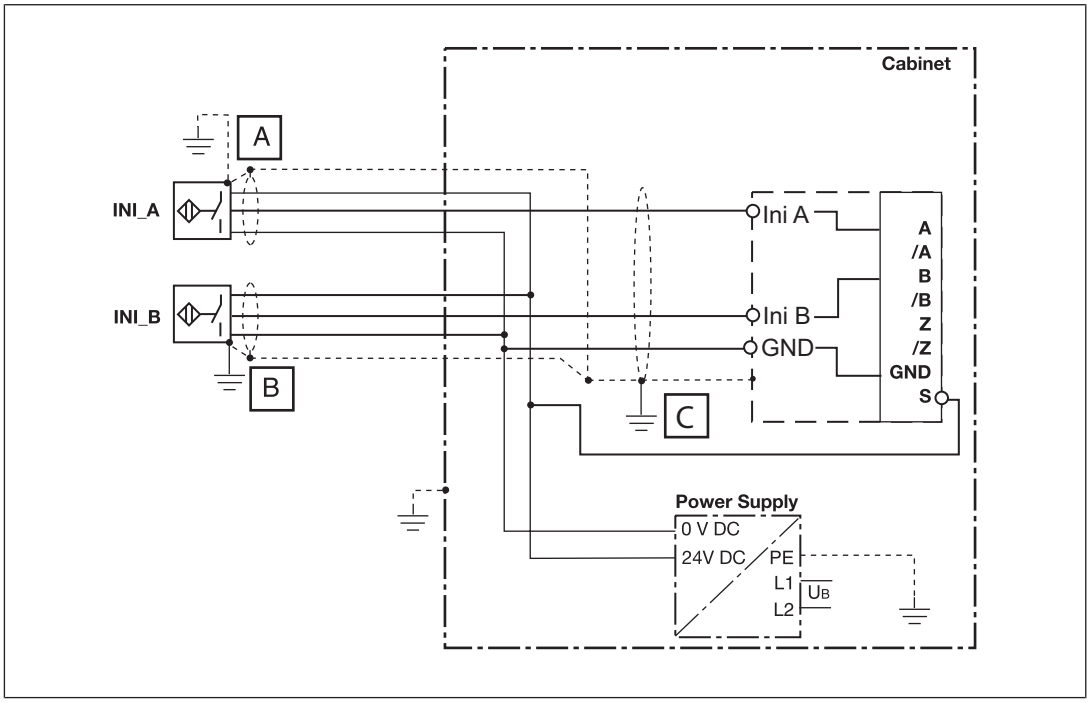
EMC-compliant wiring for connecting an encoder with drive



To avoid EMC interference we recommend that the shield on the sensor lines is only connected to earth at a single point:
A **or** B**or** C **or** D
Conductor loops outside the shield must be avoided.
The shield must run continuously from the sensor to the evaluation device.

Counter modules (failsafe)
PSSu K F EI CV

EMC-compliant wiring for connecting 2 proximity switches



To avoid EMC interference we recommend that the shield on the sensor lines is only connected to earth at a single point:
A **or** B**or** C
Conductor loops outside the shield must be avoided.
The shield must run continuously from the sensor to the evaluation device.

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 a short circuit to a supply voltage.

Counter modules (failsafe)
PSSu K F EI CV

Technical details

General	312434	314434
Approvals	**CE, TÜV, cULus Listed**	**CE, TÜV**
Application range	**Failsafe**	**Failsafe**
Module's device code	**0F24h**	**0F24h**
Number of FS output bits	**2**	**2**
Number of FS status bits	**2**	**2**
Number of FS control bits	**2**	**2**
Application in system environment B		
From FS firmware version, head modules	**1.15.0**	**1.16.0**
Electrical data	**312434**	**314434**
Supply voltage		
for	**Module supply**	**Module supply**
Voltage	**5 V**	**5 V**
Kind	**DC**	**DC**
Voltage tolerance	**-4 %/+4 %**	**-4 %/+4 %**
Output of external power supply (DC)	**1,1 W**	**1,1 W**
Supply voltage		
for	**Periphery supply**	**Periphery supply**
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**
Output of external power supply (DC)	**1,1 W**	**1,1 W**
Supply voltage		
for	**Outputs**	**Outputs**
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**
Internal supply voltage (module supply)		
Module's power consumption	**1,3 W**	**1,3 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30 V**	**16,8 - 30 V**
Module's current consumption with no load	**45 mA**	**45 mA**
Module's power consumption with no load	**1,35 W**	**1,35 W**

Counter modules (failsafe)
PSSu K F EI CV

Electrical data	312434	314434
Max. power dissipation of module	**3,5 W**	**3,5 W**
Proximity switch input	**312434**	**314434**
Number of inputs	**2**	**2**
Input signal level		
Signal level at "1"	**11 - 30 V**	**11 - 30 V**
Signal level at "0"	**0 - 3 V**	**0 - 3 V**
Input resistance	**22 kOhm**	**22 kOhm**
Input's frequency range	**0 - 5 kHz**	**0 - 5 kHz**
Configurable monitoring frequency		
Without hysteresis	**0,1 Hz - 5 kHz**	**0,1 Hz - 5 kHz**
Incremental encoder input	**312434**	**314434**
Number of inputs	**1**	**1**
Connection type	**Mini-IO female connector, 8-pin**	**Mini-IO female connector, 8-pin**
Input signal level	**0,5 - 30 Vss**	**0,5 - 30 Vss**
Max. number of bits on the counter input	**32 Bit**	**32 Bit**
Evaluation of counter pulses	**1x, 4x**	**1x, 4x**
Phase position for the differential signals A, /A and B,/B	**90° ±30°**	**90° ±30°**
Overload protection	**-50 - 65 V**	**-50 - 65 V**
Input resistance	**20 kOhm**	**20 kOhm**
Input's frequency range	**0 - 500 kHz**	**0 - 500 kHz**
Configurable monitoring frequency		
Without hysteresis	**0,1 Hz - 500 kHz**	**0,1 Hz - 500 kHz**
Semiconductor outputs	**312434**	**314434**
Number of positive-switching single-pole semiconductor outputs	**3**	**3**
Voltage	**24 V**	**24 V**
Typ. output current at "1" signal and rated voltage of semiconductor output	**0,5 A**	**0,5 A**
Permitted current range	**0,000 - 0,620 A**	**0,000 - 0,620 A**
Residual current at "0" signal	**0,02 A**	**0,02 A**
Max. transient pulsed current	**6 A**	**6 A**
Max. internal voltage drop	**100 mV**	**100 mV**
Monitoring threshold of semiconductor output	**9 V**	**9 V**
Max. duration of on time during self test	**200 µs**	**200 µs**
Max. duration of off time during self test	**200 µs**	**200 µs**

Counter modules (failsafe)
PSSu K F EI CV

Semiconductor outputs	312434	314434
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,25 ms**	**0,25 ms**
Max. processing time of semiconductor output when signal changes from "0" to "1"	**0,45 ms**	**0,45 ms**
Potential isolation from system voltage	**yes**	**yes**
Potential isolation between semiconductor output and input	**yes**	**yes**
Short circuit-proof	**yes**	**yes**
Permitted loads	**inductive, capacitive, resistive**	**inductive, capacitive, resistive**
Times	**312434**	**314434**
Reaction time after limit value is exceeded	**1/f_ist + 10ms**	**1/f_ist + 10ms**
Environmental data	**312434**	**314434**
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**
Climatic suitability		
In accordance with the standard	**EN 60068-2-78**	**EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**ISO 16750-4**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61131-2**	**EN 61131-2**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**8,4 - 150 Hz**	**8,4 - 150 Hz**
Acceleration	**10 m/s²**	**10 m/s²**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**

Counter modules (failsafe)
PSSu K F EI CV

Environmental data	312434	314434
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
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**	**IP54**
Mechanical data	**312434**	**314434**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Connection type	**Connector strip**	**Connector strip**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1 mm², 22 - 18 AWG**	**0,2 - 1 mm², 22 - 18 AWG**
Spring-loaded terminals: Terminal points per connection	**1**	**1**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**
Dimensions		
Height	**128,9 mm**	**128,9 mm**
Width	**56 mm**	**56 mm**
Depth	**56 mm**	**56 mm**
Weight	**145 g**	**145 g**

Where standards are undated, the 2016-07 latest editions shall apply.

Counter modules (failsafe)
PSSu K F EI CV

Safety characteristic data

Unit	Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	EN ISO 13849-1: 2015 T_M [year]
Logic						
Input interface	**Monitoring 1 encoder**	**PL d**	**Cat. 2**	**SIL CL 2**	**1,80E-08**	**20**
Input interface	**Monitoring 2 encoder**	**PL e**	**Cat. 3**	**SIL CL 3**	**1,01E-09**	**20**
Input interface	**Monitoring safe encoder**	**PL e**	**Cat. 4**	**SIL CL 3**	**2,35E-09**	**20**
Logic	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**1,36E-10**	**20**
Output						
SC outputs (1-pole)	**1-channel**	**PL d**	**Cat. 2**	**SIL CL 2**	**3,95E-09**	**20**
SC outputs (1-pole)	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**8,17E-11**	**20**

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

Order reference

Product

Product type	Features	Order no.
PSSu K F EI CV	Compact module, base type	312 434
PSSu K F EI CV-T	Compact module, T-type	314 434

Accessories

Terminals

Product type	Features	Order no.
PSSu A Con Set1 C	Set consisting of connectors with spring-loaded terminals 1-row/5-pin and 1-row/10-pin, scope of supply: 2 pieces	313 114

Counter modules (failsafe)
PSSu K F EI CV

Labelling

Product type	Features	Order no.
PSSu A LC 0.2	Labelling bracket, scope of supply: 5 pieces	312 965
PSSu A LA0	Labelling strips, laser printable, scope of supply: 1080 pieces (10 x DIN A4 sheet, 108 on each)	312 958

Adapter cable

Product type	Features	Order no.
MM A MINI-IO CAB99	1.50 m	772 200
MM A MINI-IO CAB99	2.50 m	772 201
MM A MINI-IO CAB99	5.0 m	772 202

Serial interfaces (standard)

Serial interfaces (standard)

Contents	Page

Serial interfaces (standard)
PSSu E S RS232

Overview

Module features

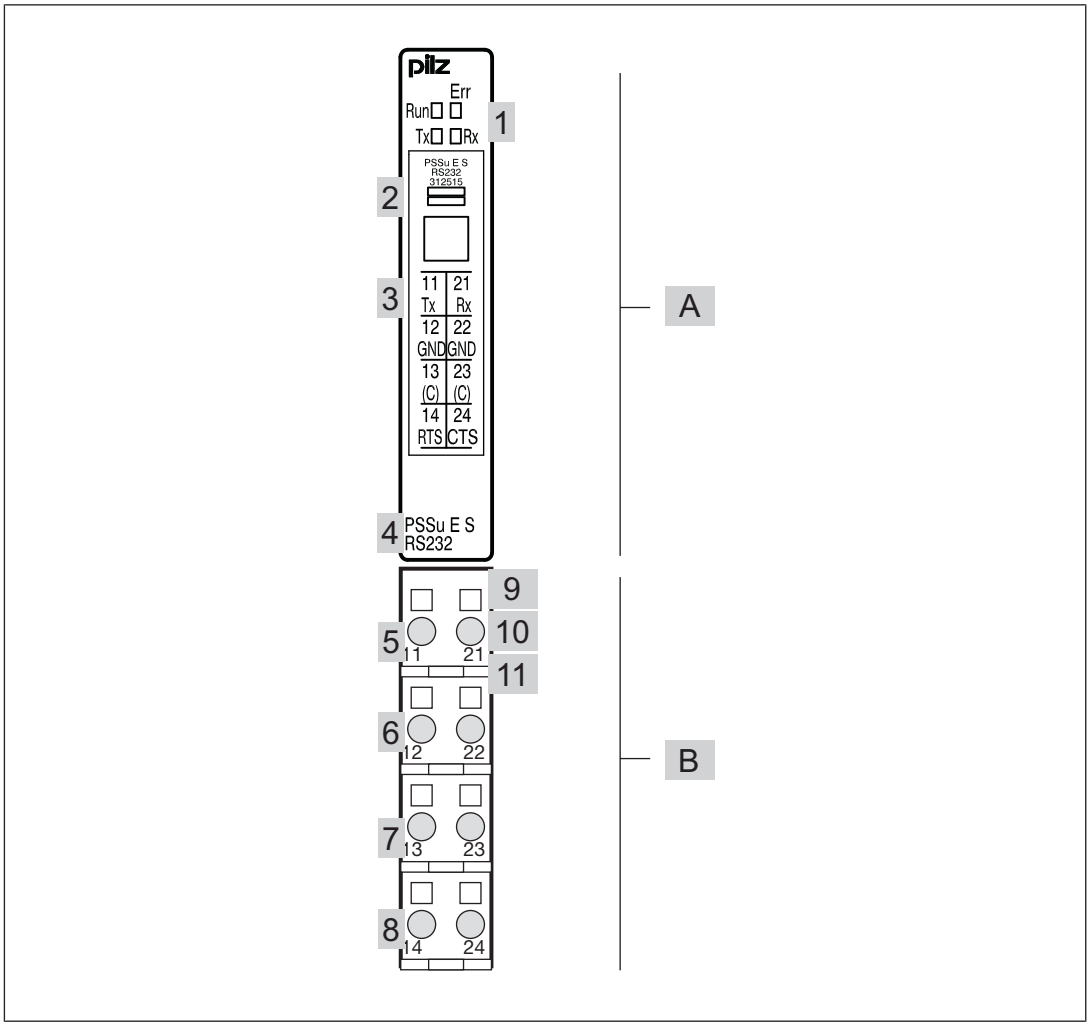
The product has the following features:

- Serial interface: RS 232
- Communication channels: 2 (Tx/Rx, full duplex)
- Configurable transmission rates
- Receive buffer: 1023 Byte
- Send buffer: 127 Byte
- Max. number per system: 6
- LEDs for:
  - Operational readiness
  - Module error
  - Data transmission
- For standard applications in system environment A and B
- T-type:

  PSSu E S RS232-T: for increased environmental requirements

Serial interfaces (standard)
PSSu E S RS232

Front view



Legend:

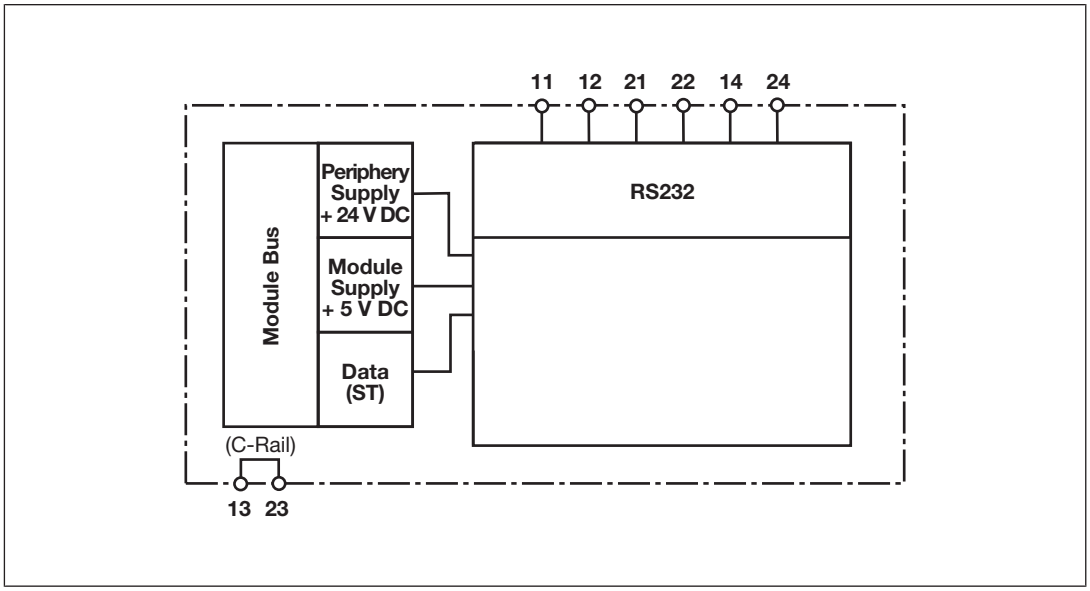
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module

Serial interfaces (standard)
PSSu E S RS232

- 5: Connection level 1
- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Serial interfaces (standard)
PSSu E S RS232

Module features

The module enables communication via a serial interface.

Module supply

- The module supply provides the module with voltage.

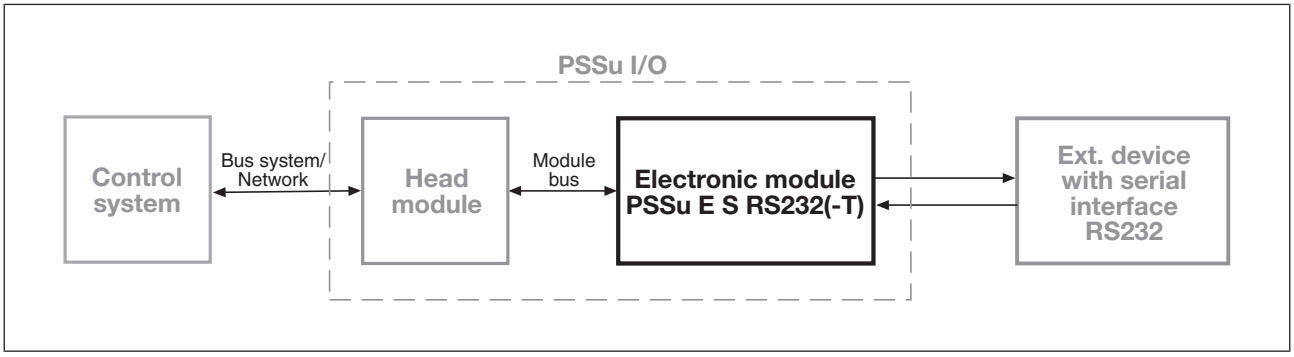
Periphery supply

- The periphery supply provides the serial interface with voltage.

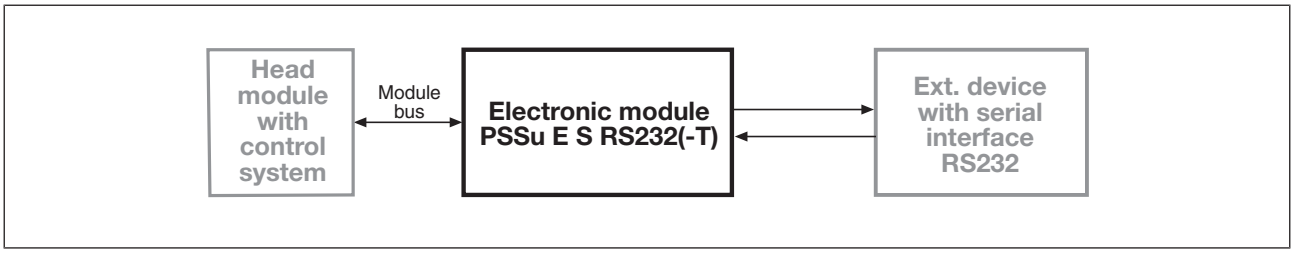
Signal processing

- In each cycle, a max. of 8 Bytes of data can be transferred in both directions between control system and module. The data to be transferred is stored temporarily in a send and receive buffer.
- Two additional status bytes and control bytes are available in the process image for data exchange between control system and module.
- All the configuration data is stored in the head module and is assigned to the module on restart. This way the configuration data is retained even if you change the module.

Schematic representation of signal processing with decentralised system PSSu I/O:



Schematic representation of signal processing with the PSSu PLC/PSSu multi control system:



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Serial interfaces (standard)
PSSu E S RS232

Data exchange

Data is exchanged between subscribers via a special protocol based on the Modbus ASCII protocol.

Configuration

The module has the following configuration options:

- Interface parameter
- Threshold receive buffer

The following interface parameters can be configured:

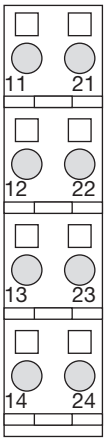
- Transmission rate
- Block size (data bits and parity)
- Number of stop bits
- Continuous sending
- Xon/Xoff when sending
- Xon/Xoff when receiving
- RTS and CTS activated

The number of Bytes in a receive buffer of the module is defined with this value, from which the status bit "Receive buffer full" is set (default value: 512).

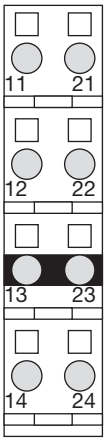
Serial interfaces (standard)
PSSu E S RS232

Wiring

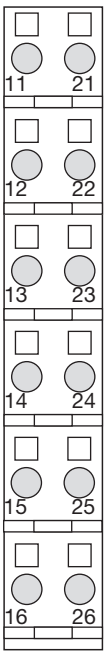
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Output Tx (send data) 21: Input Rx (receive data) 12-22: GND (12-22 linked within the base module) 13-23: Shield connection (13-23 linked within the base module) 14: Output RTS 24: Input CTS	

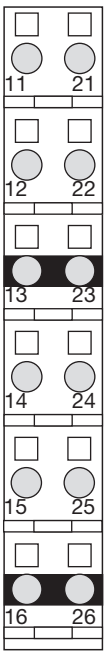
Serial interfaces (standard)
PSSu E S RS232

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Output Tx (send data) 21: Input Rx (receive data) 12-22: GND (12-22 linked within the base module) 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Output RTS 24: Input CTS	

Serial interfaces (standard)
PSSu E S RS232

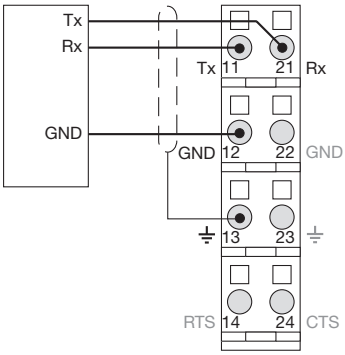
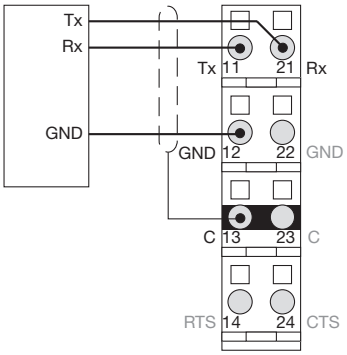
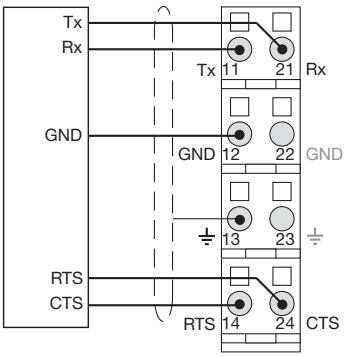
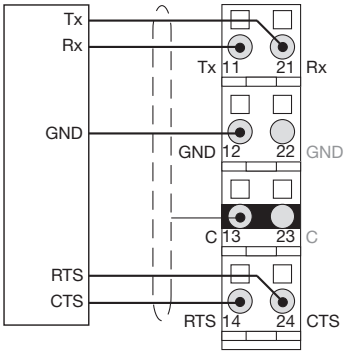
Base module	Terminal configuration	
Screw terminals: PSSu BP 1/12 S PSSu BP 1/12 S-T Cage clamp terminals: PSSu BP 1/12 C PSSu BP 1/12 C-T	Without C-rail: 11: Output Tx (send data) 21: Input Rx (receive data) 12-22: GND (12-22-15-25 linked within the base module) 13-23: Shield connection (13-23-16-26 linked within the base module) 14: Output RTS 24: Input CTS 15-25: GND (12-22-15-25 linked within the base module) 16-26: Shield connection (13-23-16-26 linked within the base module)	

Serial interfaces (standard)
PSSu E S RS232

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/12 S PSSu BP-C 1/12 S-T Cage clamp terminals: PSSu BP-C 1/12 C PSSu BP-C 1/12 C-T	With C-rail: 11: Output Tx (send data) 21: Input Rx (receive data) 12-22: GND (12-22 linked within the base module) 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Output RTS 24: Input CTS 15-25: GND (12-22-15-25 linked within the base module) 16-26: C-rail supply, shield connection (13-23-16-26 linked within the base module)	

Serial interfaces (standard)
PSSu E S RS232

Connecting the module

Input and output circuit	Without C-rail	With C-rail
With hardware handshake		
With hardware handshake		

Serial interfaces (standard)
PSSu E S RS232

Technical details

General	312515	314515
Approvals	**CE, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0720h**	**0720h**
Number of ST input bits	**64**	**64**
Number of ST output bits	**64**	**64**
Number of ST status bits	**16**	**16**
Number of ST control bits	**16**	**16**
Application in system environment A		
From ST firmware version, other head modules	**17**	**17**
From ST firmware version PSSu H S PN	**1**	**1**
Application in system environment B		
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312515**	**314515**
Internal supply voltage (module supply)		
Module's power consumption	**0,63 W**	**0,63 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**20 mA**	**20 mA**
Module's power consumption with no load	**0,48 W**	**0,48 W**
Max. power dissipation of module	**1,20 W**	**1,20 W**
Serial interface	**312515**	**314515**
Number of RS232 interfaces	**1**	**1**
Transmission rate (configurable)	**1,2 kBit/s, 19,2 kBit/s, 2,4 kBit/s, 300 Bit/s, 4,8 kBit/s, 600 Bit/s, 9,6 kBit/s**	**1,2 kBit/s, 19,2 kBit/s, 2,4 kBit/s, 300 Bit/s, 4,8 kBit/s, 600 Bit/s, 9,6 kBit/s**
Max. cable length	**15 m**	**15 m**
Size of receive buffer	**1.023 Byte**	**1.023 Byte**
Size of send buffer	**127 Byte**	**127 Byte**
Potential isolation between interface and module supply	**yes**	**yes**
Potential isolation between interface and periphery supply	**yes**	**yes**

Serial interfaces (standard)
PSSu E S RS232

Environmental data	312515	314515
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 1000,0 Hz**
Acceleration	**1g**	**5g**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**25g**
Duration	**16 ms**	**6 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1, EN 61131-2**	**EN 60664-1, EN 61131-2**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**

Serial interfaces (standard)
PSSu E S RS232

Mechanical data	312515	314515
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**36 g**	**37 g**
Mechanical coding		
Type	**K**	**K**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2009-03 latest editions shall apply.

Order reference

Product

Product type	Features	Order No.
PSSu E S RS232	Electronic module, base type	312 515
PSSu E S RS232-T	Electronic module, T-type	314 515

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618

Serial interfaces (standard)
PSSu E S RS232

Product type	Features	Order no.
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C 1/12 S	Base module with C-rail and screw terminals	312 620
PSSu BP-C 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 620
PSSu BP-C 1/12 C	Base module with C-rail and cage clamp terminals	312 621
PSSu BP-C 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 621

Serial interfaces (standard)
PSSu E S RS485

Overview

Module features

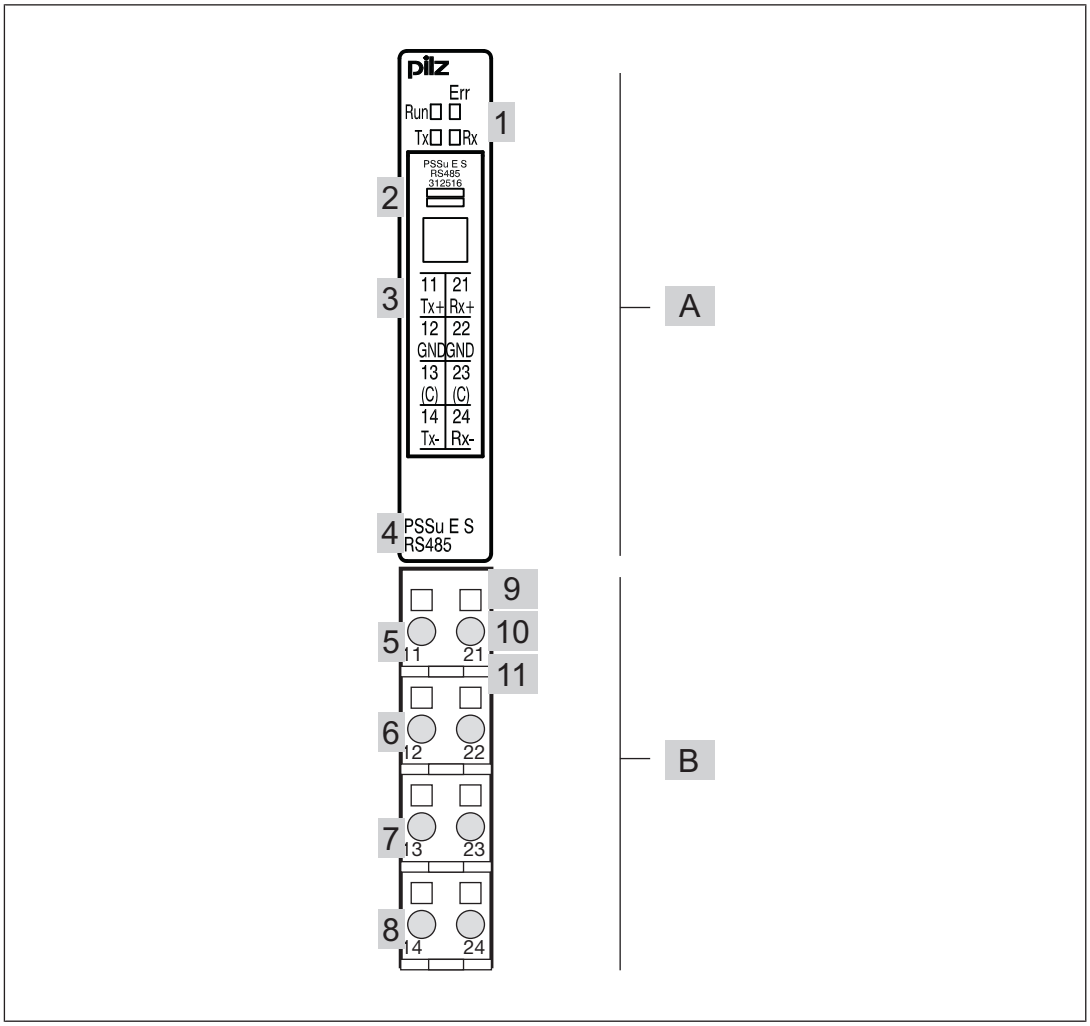
The product has the following features:

- Serial interface: RS 485
- Communication channels: 2 (Tx/Rx, full duplex)
- Configurable transmission rates
- Receive buffer 1023 Byte
- Send buffer: 127 Byte
- Max. number per system: 6
- LEDs for:
  - Operational readiness
  - Module error
  - Data transmission
- For standard applications in system environment A and B
- T-type:

  PSSu E S RS485-T: for increased environmental requirements

Serial interfaces (standard)
PSSu E S RS485

Front view



Legend:

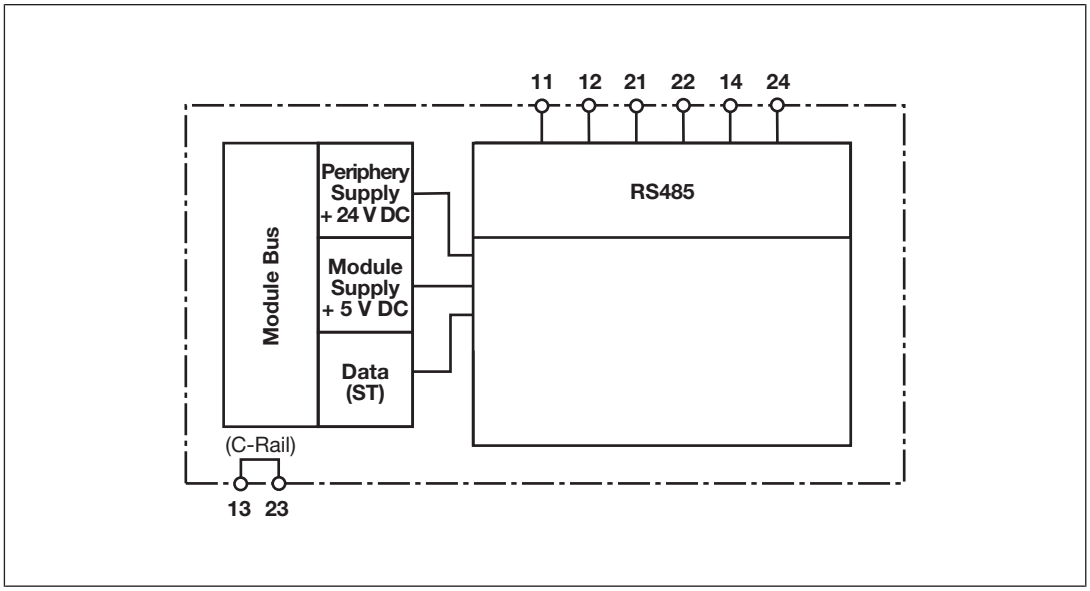
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 3: Labelling strip for the terminal configuration on the base module
- 4: Name of electronic module

Serial interfaces (standard)
PSSu E S RS485

- 5: Connection level 1
- 6: Connection level 2
- 7: Connection level 3
- 8: Connection level 4
- 9: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 10: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the signal lines
- 11: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Serial interfaces (standard)
PSSu E S RS485

Module features

The module enables communication via a serial interface.

Module supply

- The module supply provides the module with voltage.

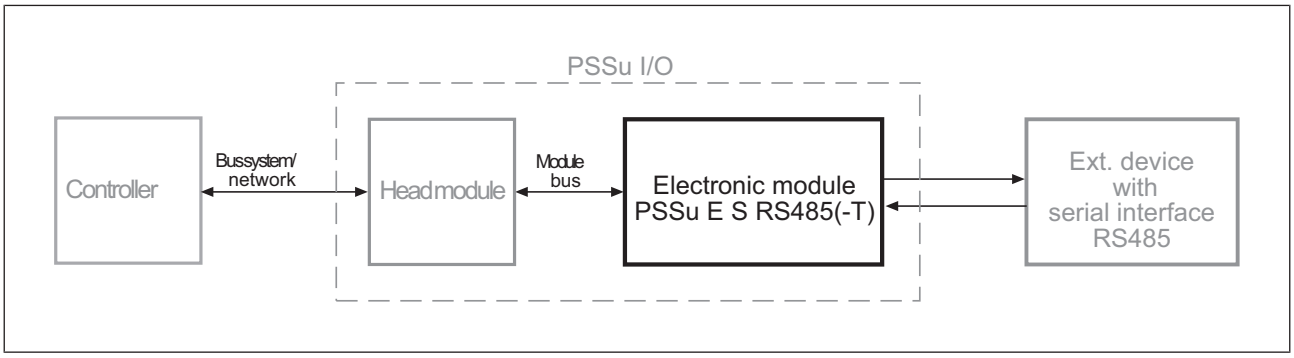
Periphery supply

- The periphery supply provides the serial interface with voltage.

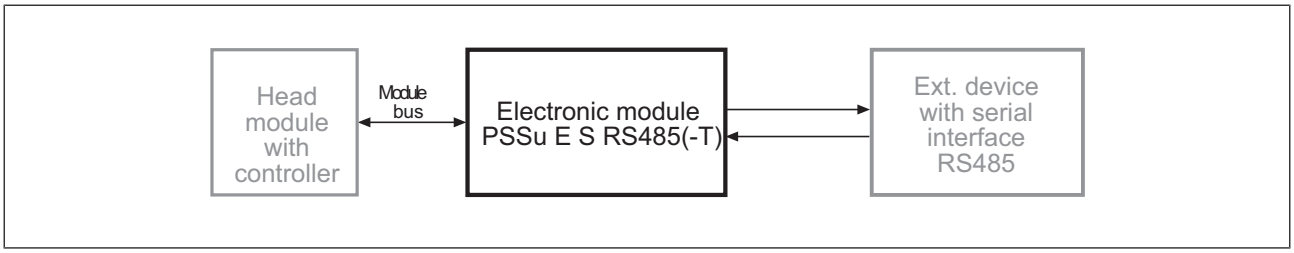
Signal processing

- In each cycle, a max. of 8 Bytes of data can be transferred in both directions between control system and module. The data to be transferred is stored temporarily in a send and receive buffer.
- Two additional status bytes and control bytes are available in the process image for data exchange between control system and module.
- All the configuration data is stored in the head module and is assigned to the module on restart. This way the configuration data is retained even if you change the module.

Schematic representation of signal processing with decentralised system PSSu I/O:



Schematic representation of signal processing with the PSSu PLC/PSSu multi control system:



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Serial interfaces (standard)
PSSu E S RS485

Data exchange

Data is exchanged between subscribers via a special protocol based on the Modbus ASCII protocol.

Configuration

The module has the following configuration options:

- Interface parameter
- Threshold receive buffer

The following interface parameters can be configured:

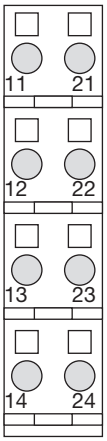
- Transmission rate
- Block size (data bits and parity)
- Number of stop bits
- Continuous sending
- Xon/Xoff when sending
- Xon/Xoff when receiving
- Duplex-Operation

The number of Bytes in a receive buffer of the module is defined with this value, from which the status bit "Receive buffer full" is set (default value: 512).

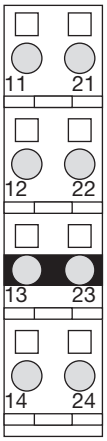
Serial interfaces (standard)
PSSu E S RS485

Wiring

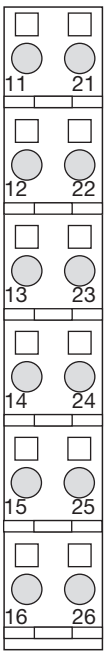
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 1/8 S PSSu BP 1/8 S-T Cage clamp terminals: PSSu BP 1/8 C PSSu BP 1/8 C-T	Without C-rail: 11: Output Tx+ (send data) 21: Input Rx+ (receive data) 12-22: GND (12-22 linked within the base module) 13-23: Shield connection (13-23 linked within the base module) 14: Output Tx- (send data) 24: Input Rx- (receive data)	

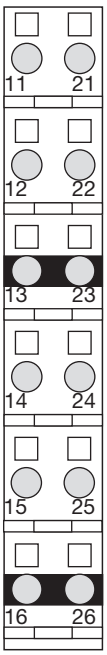
Serial interfaces (standard)
PSSu E S RS485

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/8 S PSSu BP-C 1/8 S-T Cage clamp terminals: PSSu BP-C 1/8 C PSSu BP-C 1/8 C-T	With C-rail: 11: Output Tx+ (send data) 21: Input Rx+ (receive data) 12-22: GND (12-22 linked within the base module) 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Output Tx- (send data) 24: Input Rx- (receive data)	

Serial interfaces (standard)
PSSu E S RS485

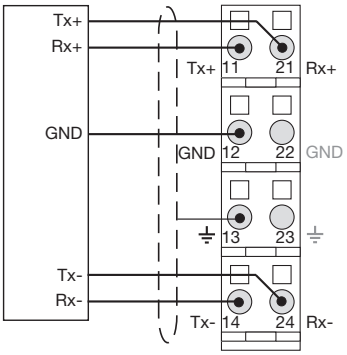
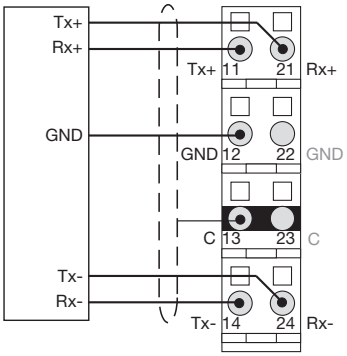
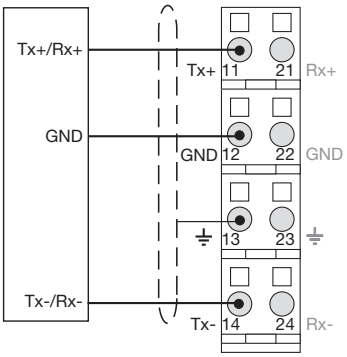
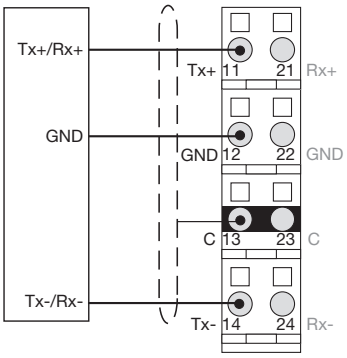
Base module	Terminal configuration	
Screw terminals: PSSu BP 1/12 S PSSu BP 1/12 S-T Cage clamp terminals: PSSu BP 1/12 C PSSu BP 1/12 C-T	Without C-rail: 11: Output Tx+ (send data) 21: Input Rx+ (receive data) 12-22: GND (12-22-15-25 linked within the base module) 13-23: Shield connection (13-23-16-26 linked within the base module) 14: Output Tx- (send data) 24: Input Rx- (receive data) 15-25: GND (12-22-15-25 linked within the base module) 16-26: Shield connection (13-23-16-26 linked within the base module)	

Serial interfaces (standard)
PSSu E S RS485

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 1/12 S PSSu BP-C 1/12 S-T Cage clamp terminals: PSSu BP-C 1/12 C PSSu BP-C 1/12 C-T	With C-rail: 11: Output Tx+ (send data) 21: Input Rx+ (receive data) 12-22: GND (12-22 linked within the base module) 13-23: C-rail supply, shield connection (13-23 linked within the base module) 14: Output Tx- (send data) 24: Input Rx- (receive data) 15-25: GND (12-22-15-25 linked within the base module) 16-26: C-rail supply, shield connection (13-23-16-26 linked within the base module)	

Serial interfaces (standard)
PSSu E S RS485

Connecting the module

Input and output circuit	Without C-rail	With C-rail
Full duplex mode		
Half duplex mode		

Serial interfaces (standard)
PSSu E S RS485

Technical details

General	312516	314516
Approvals	**CE, cULus Listed**	**CE, cULus Listed**
Application range	**Standard**	**Standard**
Module's device code	**0721h**	**0721h**
Number of ST input bits	**64**	**64**
Number of ST output bits	**64**	**64**
Number of ST status bits	**16**	**16**
Number of ST control bits	**16**	**16**
Application in system environment A		
From ST firmware version, other head modules	**17**	**17**
From ST firmware version PSSu H S PN	**1**	**1**
Application in system environment B		
From ST firmware version, head modules	**1.0.0**	**1.0.0**
Electrical data	**312516**	**314516**
Internal supply voltage (module supply)		
Module's power consumption	**0,48 W**	**0,48 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30,0 V**	**16,8 - 30,0 V**
Module's current consumption with no load	**11 mA**	**11 mA**
Module's power consumption with no load	**0,26 W**	**0,26 W**
Max. power dissipation of module	**0,80 W**	**0,80 W**
Serial interface	**312516**	**314516**
Number of RS485 interfaces	**1**	**1**
Transmission rate (configurable)	**1,2 kBit/s, 19,2 kBit/s, 2,4 kBit/s, 300 Bit/s, 4,8 kBit/s, 600 Bit/s, 9,6 kBit/s**	**1,2 kBit/s, 19,2 kBit/s, 2,4 kBit/s, 300 Bit/s, 4,8 kBit/s, 600 Bit/s, 9,6 kBit/s**
Max. cable length	**1.000 m**	**1.000 m**
Size of receive buffer	**1.023 Byte**	**1.023 Byte**
Size of send buffer	**127 Byte**	**127 Byte**
Potential isolation between interface and module supply	**yes**	**yes**
Potential isolation between interface and periphery supply	**yes**	**yes**

Serial interfaces (standard)
PSSu E S RS485

Environmental data	312516	314516
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	**-25 - 70 °C**	**-40 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
Max. operating height above sea level	**2000 m**	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**10,0 - 1000,0 Hz**
Acceleration	**1g**	**5g**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**6**	**6**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1, EN 61131-2**	**EN 60664-1, EN 61131-2**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**

Serial interfaces (standard)
PSSu E S RS485

Mechanical data	312516	314516
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Coding	**PA**	**PA**
Mounting type	**plug-in**	**plug-in**
Dimensions		
Height	**76,0 mm**	**76,0 mm**
Width	**12,6 mm**	**12,6 mm**
Depth	**60,2 mm**	**60,2 mm**
Weight	**35 g**	**36 g**
Mechanical coding		
Type	**L**	**L**
Colour	**Dark grey**	**Dark grey**

Where standards are undated, the 2009-03 latest editions shall apply.

Order reference

Products

Product type	Features	Order No.
PSSu E S RS485	Electronic module, base type	312 516
PSSu E S RS485-T	Electronic module, T-type	314 516

Accessories

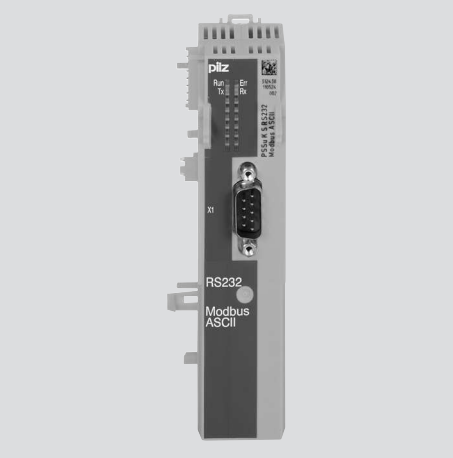
Base modules

Product type	Features	Order no.
PSSu BP 1/8 S	Base module without C-rail with screw terminals	312 600
PSSu BP 1/8 S-T	Base module without C-rail with screw terminals, T-type	314 600
PSSu BP 1/8 C	Base module without C-rail with cage clamp terminals	312 601
PSSu BP 1/8 C-T	Base module without C-rail with cage clamp terminals, T-type	314 601
PSSu BP-C 1/8 S	Base module with C-rail and screw terminals	312 610
PSSu BP-C 1/8 S-T	Base module with C-rail and screw terminals, T-type	314 610
PSSu BP-C 1/8 C	Base module with C-rail and cage clamp terminals	312 611
PSSu BP-C 1/8 C-T	Base module with C-rail and cage clamp terminals, T-type	314 611
PSSu BP 1/12 S	Base module without C-rail with screw terminals	312 618
PSSu BP 1/12 S-T	Base module without C-rail with screw terminals, T-type	314 618

Serial interfaces (standard)
PSSu E S RS485

Product type	Features	Order no.
PSSu BP 1/12 C	Base module without C-rail with cage clamp terminals	312 619
PSSu BP 1/12 C-T	Base module without C-rail with cage clamp terminals, T-type	314 619
PSSu BP-C 1/12 S	Base module with C-rail and screw terminals	312 620
PSSu BP-C 1/12 S-T	Base module with C-rail and screw terminals, T-type	314 620
PSSu BP-C 1/12 C	Base module with C-rail and cage clamp terminals	312 621
PSSu BP-C 1/12 C-T	Base module with C-rail and cage clamp terminals, T-type	314 621

Serial interfaces (standard)
PSSu K S RS232 Modbus ASCII



Overview

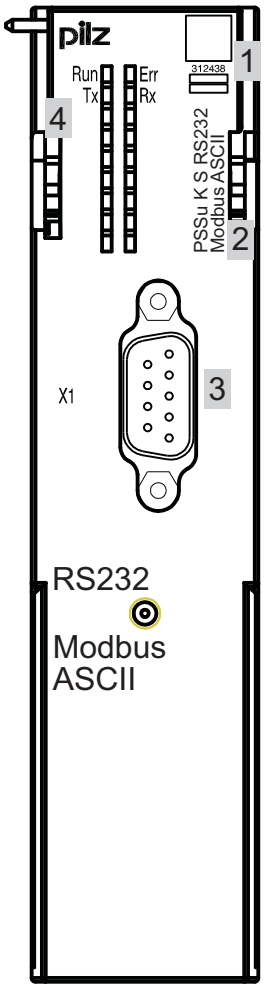
Module features

The product has the following features:

- Serial interface: RS 232
- Communication channels: 2 (Tx/Rx, full duplex)
- Configurable transmission rates
- Receive buffer: 1023 Byte
- Send buffer: 127 Byte
- Max. number per system: 6
- Data exchange based on the Modbus ASCII protocol
- LEDs for:
  - Operational readiness
  - Module error
  - Data transmission
- For standard applications in system environment B (automation system PSS 4000)

Serial interfaces (standard)
PSSu K S RS232 Modbus ASCII

Front view



Key:

- 1: Labelling strip with:
  - 2D code
  - Order Number
  - Serial Number
  - Hardware version number
- 2: Name of compact module
- 3: D-Sub connector (male) X1
- 4: LEDs for status display and module diagnostics

Serial interfaces (standard)
PSSu K S RS232 Modbus ASCII

Function description

Module features

The module enables communication via a serial interface.

Module supply

- The module supply provides the module with voltage.

Periphery supply

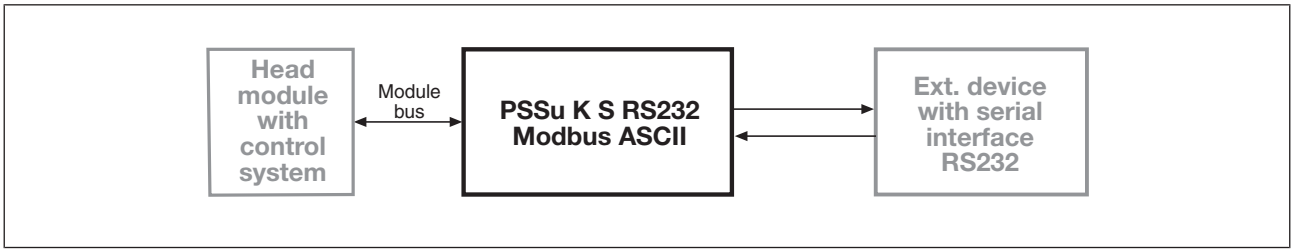
- The periphery supply provides the serial interface with voltage.

Signal processing

- In each cycle, a max. of 8 Bytes of data can be transferred in both directions between control system and module. The data to be transferred is stored temporarily in a send and receive buffer.
- Two additional status bytes and control bytes are available in the process image for data exchange between control system and module.
- All the configuration data is stored in the head module and is assigned to the module on restart. This way the configuration data is retained even if you change the module.

Serial interfaces (standard)
PSSu K S RS232 Modbus ASCII

Schematic representation of signal processing with the control system PSSu PLC/PSSu multi:



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Data exchange

Data is exchanged between subscribers via a special protocol based on the Modbus ASCII protocol.

Configuration

The module has the following configuration options:

- Interface parameter
- Threshold receive buffer

The following interface parameters can be configured:

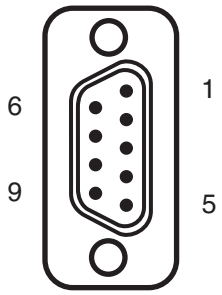
- Transmission rate
- Xon/Xoff when sending
- Xon/Xoff when receiving
- RTS and CTS enabled

The number of Bytes in a receive buffer of the module is defined with this value, from which the status bit "Receive buffer full" is set (default value: 512).

Serial interfaces (standard)
PSSu K S RS232 Modbus ASCII

Wiring

Interface configuration

RS232	Assignment	X1
D-Sub male connector	1: n.c. 2: Input Rx (receive data) 3: Output Tx (send data) 4: n.c. 5: GND 6: n.c. 7: Output RTS 8: Input CTS 9: n.c.	

n.c. = not connected

Serial interfaces (standard)
PSSu K S RS232 Modbus ASCII

Technical details

General	
Approvals	**CE, cULus Listed**
Application range	**Standard**
Module's device code	**0720h**
Number of ST input bits	**64**
Number of ST output bits	**64**
Number of ST status bits	**16**
Number of ST control bits	**16**
Application in system environment B	
From ST firmware version, head modules	**1.0.0**
Electrical data	
Internal supply voltage (module supply)	
Module's power consumption	**0,63 W**
Periphery's supply voltage (periphery supply)	
Voltage range	**16,8 - 30,0 V**
Module's current consumption with no load	**20 mA**
Module's power consumption with no load	**0,48 W**
Max. power dissipation of module	**1,20 W**
Serial interface	
Number of RS232 interfaces	**1**
Transmission rate (configurable)	**1,2 kBit/s, 19,2 kBit/s, 2,4 kBit/s, 300 Bit/s, 4,8 kBit/s, 600 Bit/s, 9,6 kBit/s**
Max. cable length	**15 m**
Size of receive buffer	**1.023 Byte**
Size of send buffer	**127 Byte**
Potential isolation between interface and module supply	**yes**
Potential isolation between interface and periphery supply	**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 - 60 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**

Serial interfaces (standard)
PSSu K S RS232 Modbus ASCII

Environmental data	
Climatic suitability	
In accordance with the standard	**EN 60068-2-30, 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 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
In accordance with the standard	**EN 61131-2, IEC 60664-1**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
In accordance with the standard	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**
Housing	**IP20**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Connection type	**D-Sub male connector**
Dimensions	
Height	**128,9 mm**
Width	**30,0 mm**
Depth	**56,0 mm**
Weight	**81 g**

Where standards are undated, the 2009-03 latest editions shall apply.

Serial interfaces (standard)
PSSu K S RS232 Modbus ASCII

Order reference

Product

Product type	Features	Order No.
PSSu K S RS232 Modbus ASCII	Compact module without connector, labelling bracket and labelling strips, base type	312 438

Accessories

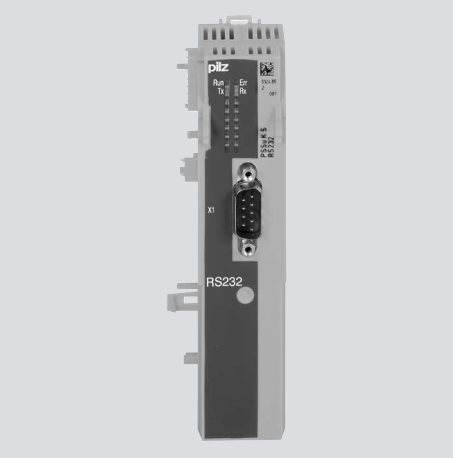
Terminals

Product type	Features	Order No.
PSSu A Con 1/10 C	Connector with spring-loaded terminals 1-row/10-pin, scope of supply: 2 pieces	313 115
PSSu A Con 3/30 C	Connector with spring-loaded terminals 3-row/30-pin, scope of supply: 2 pieces	313 116

Labelling

Product type	Features	Order No.
PSSu A LC 0.1	Labelling bracket, scope of supply: 5 pieces	312 966
PSSu A LA0	Labelling strips, laser printable, scope of supply: 1080 pieces (10 x DIN A4 sheet, 108 on each)	312 958

Serial interfaces (standard)
PSSu K S RS232



Overview

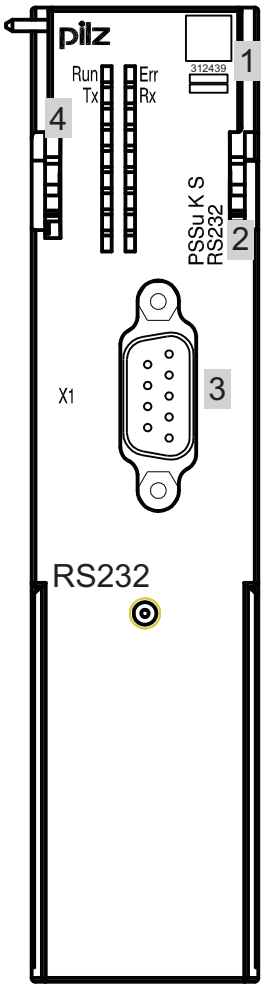
Module features

The product has the following features:

- Serial interface: RS 232
- Communication channels: 2 (Tx/Rx, full duplex)
- Configurable transmission rates
- Receive buffer: 1023 Byte
- Send buffer: 127 Byte
- Max. number per system: 6
- LEDs for:
  - Operational readiness
  - Module error
  - Data transmission
- For standard applications in system environment B (automation system PSS 4000)

Serial interfaces (standard)
PSSu K S RS232

Front view



Key:

- 1: Labelling strip with:
  - 2D code
  - Order Number
  - Serial Number
  - Hardware version number
- 2: Name of compact module
- 3: D-Sub connector (male) X1
- 4: LEDs for status display and module diagnostics

Serial interfaces (standard)
PSSu K S RS232

Function description

Module features

The module enables communication via a serial interface.

Module supply

- The module supply provides the module with voltage.

Periphery supply

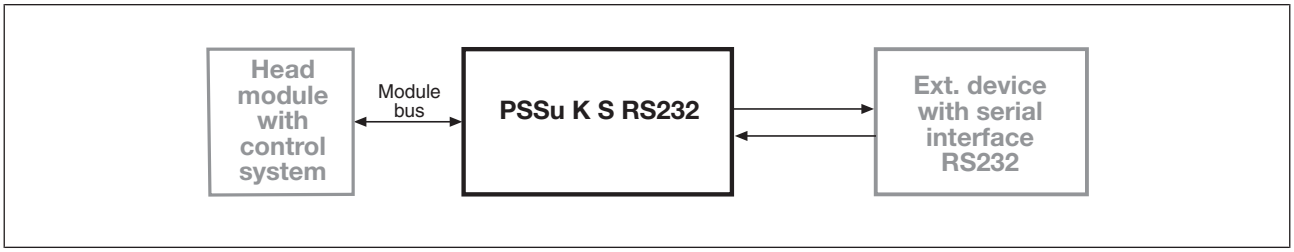
- The periphery supply provides the serial interface with voltage.

Signal processing

- In each cycle, a max. of 8 Bytes of data can be transferred in both directions between control system and module. The data to be transferred is stored temporarily in a send and receive buffer.
- Two additional status bytes and control bytes are available in the process image for data exchange between control system and module.
- All the configuration data is stored in the head module and is assigned to the module on restart. This way the configuration data is retained even if you change the module.

Serial interfaces (standard)
PSSu K S RS232

Schematic representation of signal processing with the PSSu PLC/PSSu multi control system:



When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module detects the following errors:

- Start-up error
- Configuration error
- ST communication error
- Bus termination error

Configuration

The module has the following configuration options:

- Interface parameter
- Threshold receive buffer

The following interface parameters can be configured:

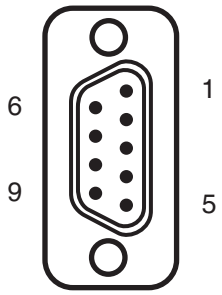
- Transmission rate
- Block size (data bits and parity)
- Number of stop bits
- Continuous sending
- Xon/Xoff when sending
- Xon/Xoff when receiving
- RTS and CTS activated

The number of Bytes in a receive buffer of the module is defined with this value, from which the status bit "Receive buffer full" is set (default value: 512).

Serial interfaces (standard)
PSSu K S RS232

Wiring

Interface configuration

RS232	Assignment	X1
D-Sub male connector	1: n.c. 2: Input Rx (receive data) 3: Output Tx (send data) 4: n.c. 5: GND 6: n.c. 7: Output RTS 8: Input CTS 9: n.c.	

n.c. = not connected

Serial interfaces (standard)
PSSu K S RS232

Technical details

General	
Approvals	**CE, cULus Listed**
Application range	**Standard**
Module's device code	**0720h**
Number of ST input bits	**64**
Number of ST output bits	**64**
Number of ST status bits	**16**
Number of ST control bits	**16**
Application in system environment B	
From ST firmware version, head modules	**1.0.0**
Electrical data	
Internal supply voltage (module supply)	
Module's power consumption	**0,63 W**
Periphery's supply voltage (periphery supply)	
Voltage range	**16,8 - 30,0 V**
Module's current consumption with no load	**20 mA**
Module's power consumption with no load	**0,48 W**
Max. power dissipation of module	**1,20 W**
Serial interface	
Number of RS232 interfaces	**1**
Transmission rate (configurable)	**1,2 kBit/s, 19,2 kBit/s, 2,4 kBit/s, 300 Bit/s, 4,8 kBit/s, 600 Bit/s, 9,6 kBit/s**
Max. cable length	**15 m**
Size of receive buffer	**1.023 Byte**
Size of send buffer	**127 Byte**
Potential isolation between interface and module supply	**yes**
Potential isolation between interface and periphery supply	**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 - 60 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**

Serial interfaces (standard)
PSSu K S RS232

Environmental data	
Climatic suitability	
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61131-2**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Max. operating height above sea level	**2000 m**
Airgap creepage	
In accordance with the standard	**EN 61131-2, IEC 60664-1**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
In accordance with the standard	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**
Housing	**IP20**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Connection type	**D-Sub male connector**
Dimensions	
Height	**128,9 mm**
Width	**30,0 mm**
Depth	**56,0 mm**
Weight	**81 g**

Where standards are undated, the 2009-03 latest editions shall apply.

Serial interfaces (standard)
PSSu K S RS232

Order reference

Product

Product type	Features	Order No.
PSSu K S RS232	Compact module without connector, labelling bracket and labelling strips, base type	312 439

Accessories

Terminals

Product type	Features	Order No.
PSSu A Con 1/10 C	Connector with spring-loaded terminals 1-row/10-pin, scope of supply: 2 pieces	313 115
PSSu A Con 3/30 C	Connector with spring-loaded terminals 3-row/30-pin, scope of supply: 2 pieces	313 116

Labelling

Product type	Features	Order No.
PSSu A LC 0.1	Labelling bracket, scope of supply: 5 pieces	312 966
PSSu A LA0	Labelling strips, laser printable, scope of supply: 1080 pieces (10 x DIN A4 sheet, 108 on each)	312 958

Link modules

Link modules

Contents	Page

Link modules
PSSu XB F-T

Overview

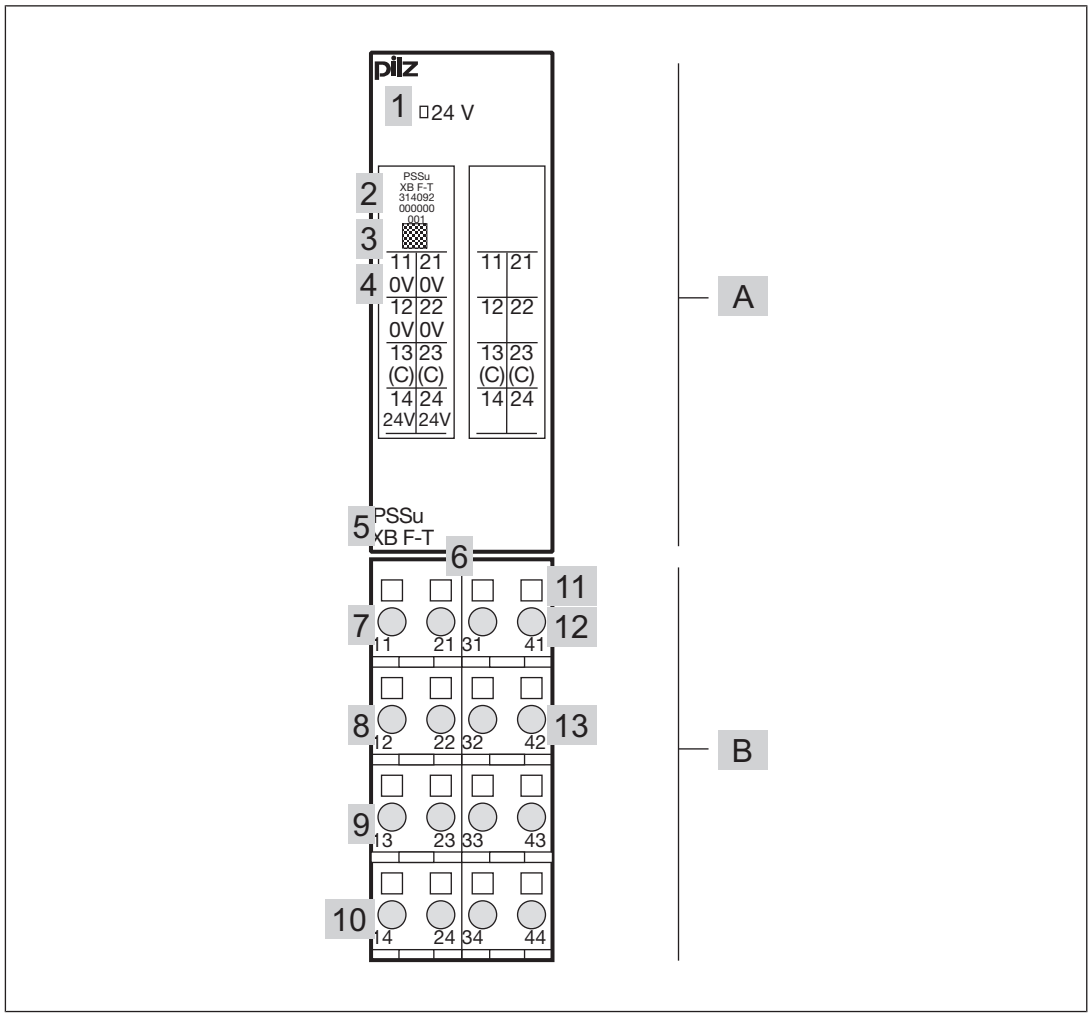
Module features

The product has the following features:

- The module terminates a PSSu system and extends the module bus via a cable connection.
- The module supports a remote station PSSu XR F-T.
- Plug for the module bus connection cable
- The cable connection transfers:
  - FS data
  - ST data
  - Module supply
- The module routes the periphery supply from the module bus to the base module terminals.
- LED for:
  - Periphery supply
- For standard and failsafe applications in system environment A and B

Link modules
PSSu XB F-T

Front view



Legend:

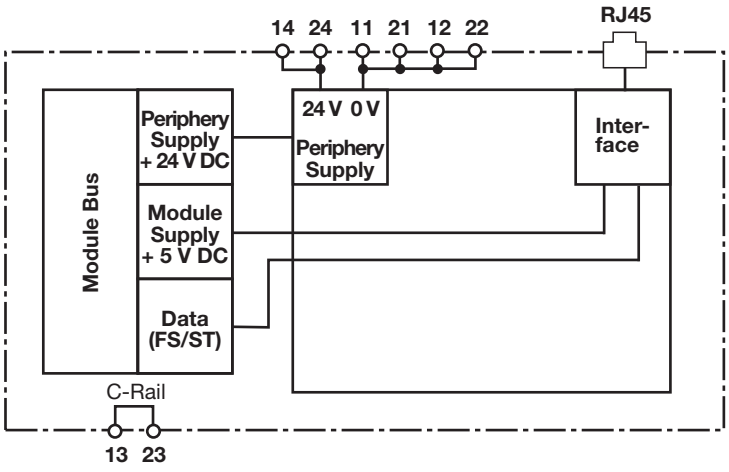
- A: Electronic module
- B: Base module
- 1: LED for module diagnostics
- 2: Labelling strip with:
  - Name of electronic module
  - Order number
  - Serial number
  - Hardware version number
- 3: 2D code
- 4: Labelling strip for the terminal configuration on the base module
- 5: Name of electronic module

Link modules
PSSu XB F-T

- 6: RJ45 interface (on the rear of the electronic module, not visible in the drawing)
- 7: Connection level 1
- 8: Connection level 2
- 9: Connection level 3
- 10: Connection level 4
- 11: Square mounting holes (connection levels 1, 2, 3 and 4)
  - With screw to loosen/tighten the screw terminal on base modules with screw terminals
  - With mechanism to operate the cage clamp on base modules with cage clamp terminals
- 12: Round connection holes (connection levels 1, 2, 3 and 4) for connecting the cables
- 13: Mounting slot for colour marker to label the connection level (connection levels 1, 2, 3 and 4)

Function description

Block diagram



Link modules
PSSu XB F-T

Module features

The module is a base station used to extend the PSSu module bus via a cable connection. The base station is always the termination module in a base system.

The cable connection disconnects the PSSu module bus on the base station and continues it on the remote station.

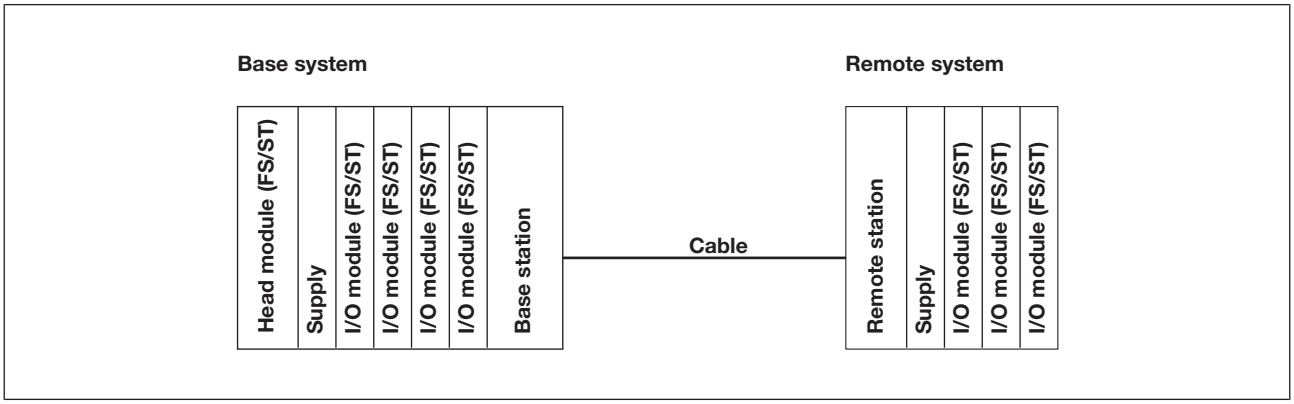
All FS data, all ST data plus the module supply are transferred via the cable connection. The periphery supply and C-rail supply are not transferred. Up to three PSSu systems can be connected, i.e. you can have up to two successive cable connections.

The cable connection does not appear in the process image. The cable connection does not need to be considered in the user program. The reaction times of the modules on the remote system are not affected by the cable connection.

The base system is terminated using a special terminating plate (PSSu A EC XB, supplied with the remote module). The remote system is terminated using the terminating plate supplied with the head module.

- The module routes the periphery supply from the module bus to the base module terminals.
- The module does not switch the periphery supply.
- The periphery supply has no current limitation.

Cable connection PSSu XB F-T – PSSu XR F-T



Configuration

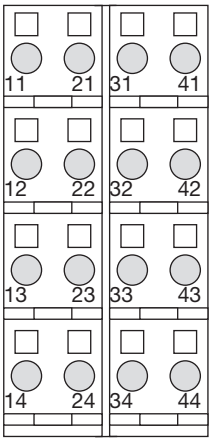
The module does not have to be configuriert.

The module does not occupy any addresses in the process image.

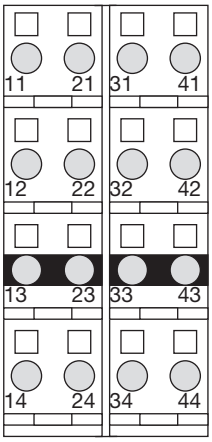
Link modules
PSSu XB F-T

Wiring

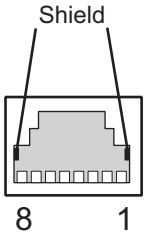
Terminal configuration

Base module	Terminal configuration	
Screw terminals: PSSu BP 2/16 S PSSu BP 2/16 S-T Cage clamp terminals: PSSu BP 2/16 C PSSu BP 2/16 C-T	Without C-rail: 11-21: 0 V periphery supply (11-21 linked internally) 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23: +24 V periphery supply (13-23 linked within the base module) 14-24: +24 V periphery supply (14-24 linked internally) 31-41-32-42-33-43-34-44 not connected	

Link modules
PSSu XB F-T

Base module	Terminal configuration	
Screw terminals: PSSu BP-C 2/16 S PSSu BP-C 2/16 S-T Cage clamp terminals: PSSu BP-C 2/16 C PSSu BP-C 2/16 C-T	With C-rail: 11-21: 0 V periphery supply (11-21 linked internally) 12-22: 0 V periphery supply (12-22 linked within the base module) 13-23-33-43: C-rail supply (13-23-33-43 linked within the base module) 14-24: +24 V periphery supply (14-24 linked internally) 31-41-32-42-34-44 not connected	

Connecting the module

RJ45 interface	Layout	
RJ45 connector	The connection cable PSSu A RJ45-CAB 1.5M is available as an accessory.	

Link modules
PSSu XB F-T

Technical details

General	
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Application range	**Standard/failsafe**
Application in system environment A	
From FS firmware version, other head modules	**1**
From ST firmware version, other head modules	**1**
From FS firmware version PSSu H F PN	**1**
From ST firmware version PSSu H S PN	**1**
From ST firmware version PSSu WR S IDN	**1**
Application in system environment B	
From FS firmware version, head modules	**1.2.0**
From ST firmware version, head modules	**1.2.0**
Electrical data	
Periphery's supply voltage (periphery supply)	
Voltage range	**16,8 - 30 V**
Module's current consumption with no load	**10 mA**
Module's power consumption with no load	**0,24 W**
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	**-40 - 70 °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 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**
Condensation during operation	**Short-term**
Max. operating height above sea level	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 150 Hz**
Acceleration	**1g**

Link modules
PSSu XB F-T

Environmental data	
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1, 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**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Coding	**PA**
Mounting type	**plug-in**
Dimensions	
Height	**76 mm**
Width	**25,2 mm**
Depth	**60,2 mm**
Weight	**35 g**
Mechanical coding	
Type	**L**
Colour	**Yellow**

Where standards are undated, the 2015-05 latest editions shall apply.

Link modules
PSSu XB F-T

Order reference

Product

Product type	Features	Order No.
PSSu XB F-T	Base station, T-type	314 092

Accessories

Base modules

Product type	Features	Order no.
PSSu BP 2/16 S	Base module without C-rail with screw terminals	312 628
PSSu BP 2/16 S-T	Base module without C-rail with screw terminals, T-type	314 628
PSSu BP 2/16 C	Base module without C-rail with cage clamp terminals	312 629
PSSu BP 2/16 C-T	Base module without C-rail with cage clamp terminals, T-type	314 629
PSSu BP-C 2/16 S	Base module with C-rail and screw terminals	312 630
PSSu BP-C 2/16 S-T	Base module with C-rail and screw terminals, T-type	314 630
PSSu BP-C 2/16 C	Base module with C-rail and cage clamp terminals	312 631
PSSu BP-C 2/16 C-T	Base module with C-rail and cage clamp terminals, T-type	314 631

Connection cable

Product type	Features	Order No.
PSSu A RJ45-CAB 1.5M	Connection cable	314 094

Link modules
PSSu XR F-T

Overview

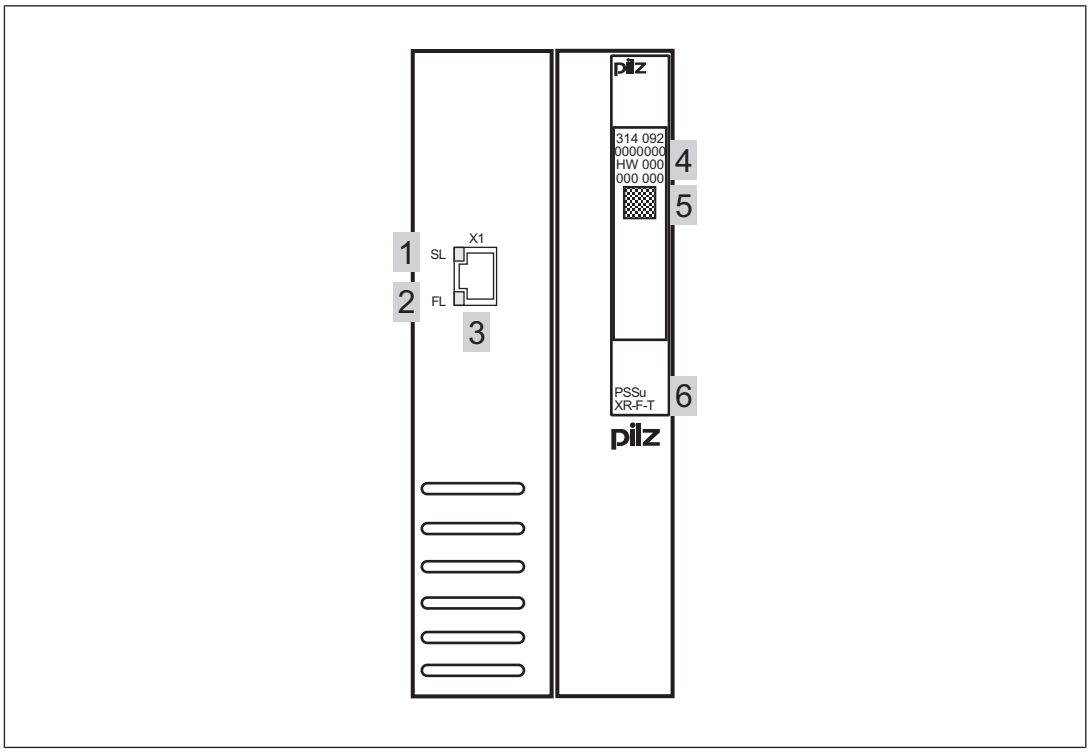
Module features

The product has the following features:

- This module represents the first module in a PSSu remote system.
- The module communicates with a base station PSSu XB F-T.
- Plug for the module bus connection cable
- The cable connection transfers:
  - FS data
  - ST data
  - Module supply
- LED indicators on the RJ45 socket for:
  - Status of ST bus
  - Status of FS bus
- Electronic modules that can be used for input/output:
  - All failsafe modules (PSSu E F...)
  - All standard modules (PSSu E S...)
- For standard and failsafe applications in system environment A and B

Link modules
PSSu XR F-T

Front view



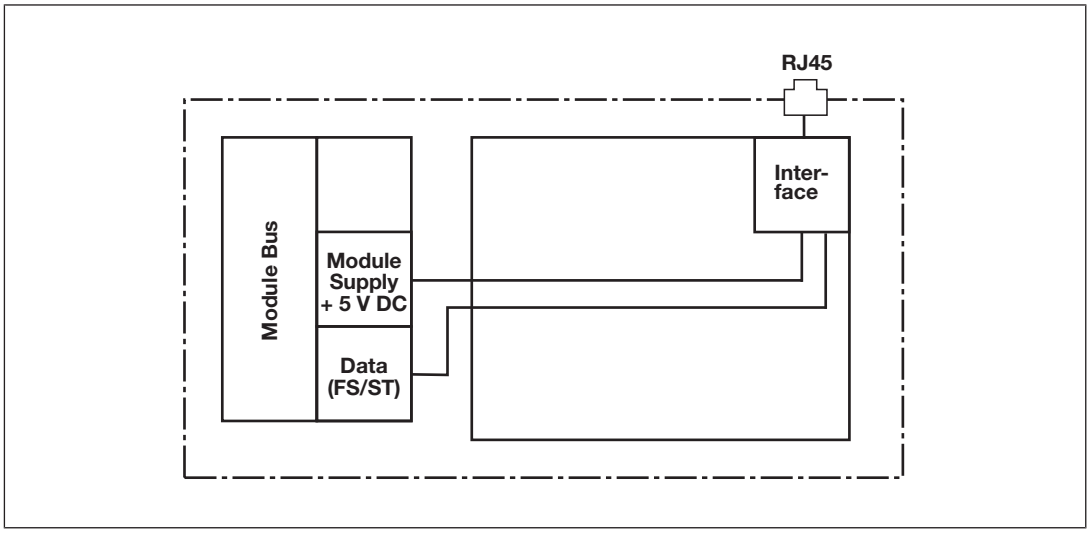
Legend:

- 1: LED to display the status of data transfer to the ST module bus
- 2: LED to display the status of data transfer to the FS module bus
- 3: RJ45 interface
- 4: Labelling strip with:
  - Order number
  - Serial number
  - Hardware version number
  - Firmware version number on delivery
- 5: Field for 2D code
- 6: Module name

Link modules
PSSu XR F-T

Function description

Block diagram



Module features

The module is a remote station used to extend the PSSu module bus via a cable connection. The remote station is always the first module in a remote system.

In the remote system, a supply voltage module with the relevant base module must be used after the remote station:

- For supply voltage modules with infeed for the periphery supply, module supply and C-rail supply, a base module must be used to refresh the supply voltage (PSSu BS-R...).
- For supply voltage modules with infeed for the periphery supply and C-rail supply, a base module must be used to provide the supply voltage (PSSu BS-R...).

The cable connection disconnects the PSSu module bus on the base station and continues it on the remote station.

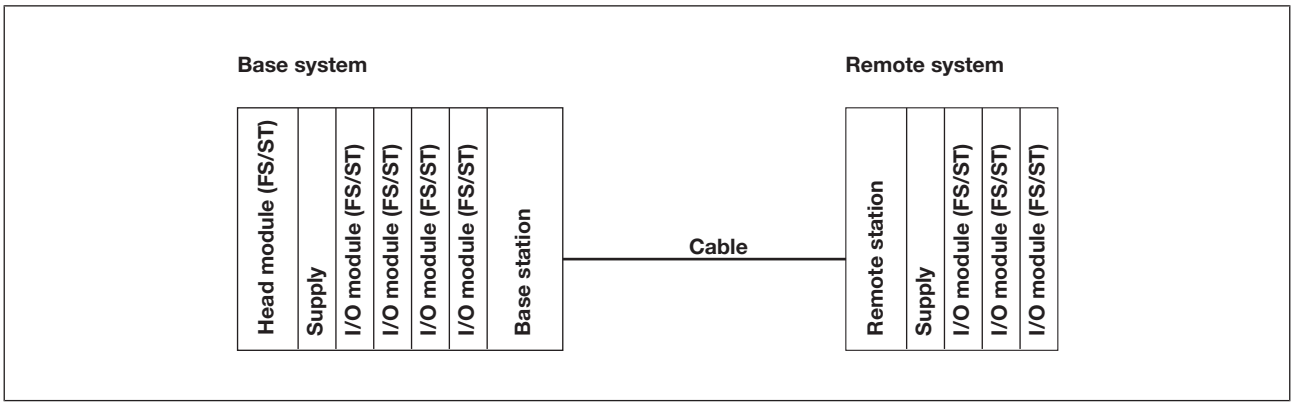
All FS data, all ST data plus the module supply are transferred via the cable connection. The periphery supply and C-rail supply are not transferred. Up to three PSSu systems can be connected, i.e. you can have up to two successive cable connections.

The cable connection does not appear in the process image. The cable connection does not need to be considered in the user program. The reaction times of the modules on the remote system are not affected by the cable connection.

The base system is terminated using a special terminating plate (PSSu A EC XB, supplied with the remote module). The remote system is terminated using the terminating plate supplied with the head module.

Link modules
PSSu XR F-T

Cable connection PSSu XB F-T – PSSu XR F-T



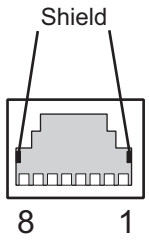
Configuration

The module does not have to be configuriert.

The module does not occupy any addresses in the process image.

Interfaces and wiring

Interface assignment

RJ45 interface	Layout	
RJ45 connector	The connection cable PSSu A RJ45-CAB 1.5M is available as an accessory.	

Wiring

Please note:

- The connection cable PSSu A RJ45-CAB 1.5M is available as an accessory.
- The base station and remote station must be in the same control cabinet.

The C-rail supply and the periphery supply are not transferred via the cable connection, so the remote system forms a new supply group.

Link modules
PSSu XR F-T

Technical details

General	
Approvals	**CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Application range	**Standard/failsafe**
Application in system environment A	
From FS firmware version, other head modules	**1**
From ST firmware version, other head modules	**1**
From FS firmware version PSSu H F PN	**1**
From ST firmware version PSSu H S PN	**1**
From ST firmware version PSSu WR S IDN	**1**
Application in system environment B	
From FS firmware version, head modules	**1.2.0**
From ST firmware version, head modules	**1.2.0**
Electrical data	
Internal supply voltage (module supply)	
Module's power consumption	**0,1 W**
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	**-40 - 70 °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 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**
Condensation during operation	**Short-term**
Max. operating height above sea level	**5000 m**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 150 Hz**
Acceleration	**1g**

Link modules
PSSu XR F-T

Environmental data	
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**6**
Acceleration	**15g**
Duration	**11 ms**
In accordance with the standard	**EN 60068-2-27**
Number of shocks	**1000**
Acceleration	**10g**
Duration	**16 ms**
Airgap creepage	
In accordance with the standard	**EN 60664-1, 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**
Mechanical data	
Material	
Bottom	**PC**
Front	**PC**
Mounting type	**plug-in**
Dimensions	
Height	**125,6 mm**
Width	**50,2 mm**
Depth	**72,6 mm**
Weight	**115 g**

Where standards are undated, the 2015-05 latest editions shall apply.

Link modules
PSSu XR F-T

Order reference

Product

Product type	Features	Order No.
PSSu XR F-T	Remote station, including terminating plate PSSu A EC XB, T-type	314 093

Accessories

Connection cable

Product type	Features	Order No.
PSSu A RJ45-CAB 1.5M	Connection cable	314 094

Special modules

Special modules

Contents	Page

Special modules
PSSu K F FAU

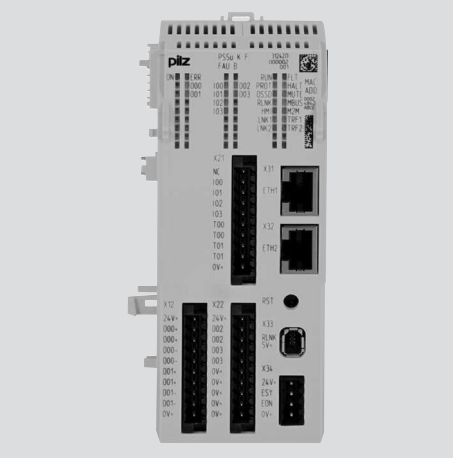


Fig.: PSSu K F FAU B

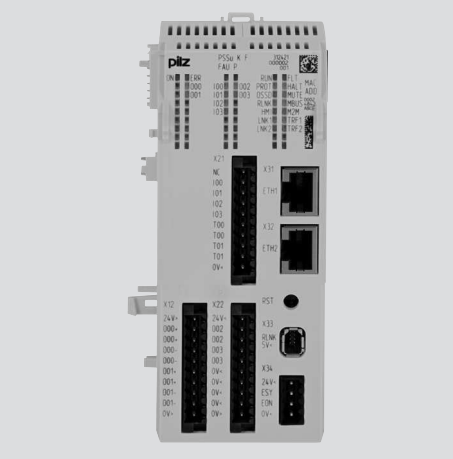


Fig.: PSSu K F FAU P

Overview

PSENvip is a camera-based protection and measuring system (electrosensitive protective equipment) for press brakes. It consists of a transmitter, receiver and a PSSu module to evaluate recordings. It monitors the detection zone between the transmitter and receiver below the moving upper tool. Operation, visualisation and configuration is via a web interface on the CNC or control system driving the press.

Special modules
PSSu K F FAU

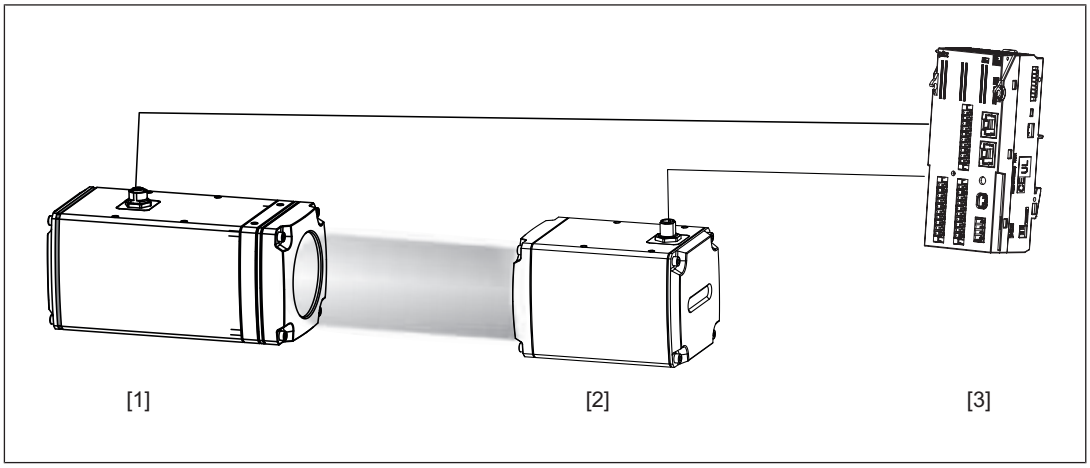


Fig.: Components of the PSENvip

Receiver PSENvip R [1]

- Receives the light generated by the transmitter
- Sends image date to the special module PSSu K F FAU
- LED display for the status of the OSSD signal

Transmitter PSENvip E [2]

- Generates parallel beam
- 2 inputs for controlling the light source

Special module PSSu K F FAU [3]

- Image evaluation of the data provided by the receiver
- Evaluation of protected field and fast shutdown of the press if the protected field is violated
- 2 outputs to control the transmitter
- Communication via Ethernet interface with the CNC
- Troubleshooting and diagnostics

This operating manual describes

- The module's inputs and outputs
- The module interfaces
- Access to the module's I/O data types

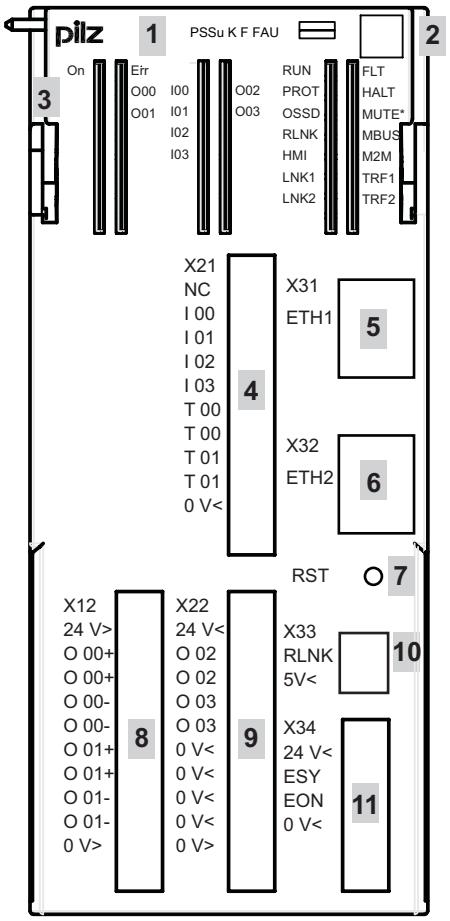
Module types described in the manual:

- PSSu K F FAU-B: monitors a configured protected field for violation.
- PSSu K F FAU-P: reduces the protected field dynamically during the press stroke (dynamic muting) and monitors this dynamic protected field for violation.
- Unless stated otherwise, the descriptions in this manual apply to both module types. The common name for both module types is: PSSu K F FAU.

Special modules
PSSu K F FAU

Further information on the PSENvip system can be found in the operating manual PSENvip R, PSENvip E

Front view



* PSSU K F FAU P only

Legend:

- 1: Name of compact module
- 2: Labelling strip with:
  - 2D code
  - Order number
  - Serial number
  - Hardware version number
- 3: LEDs for status display and module diagnostics
- 4: Connector strip X21 for connectors with spring-loaded terminals and labelling strip

- 5: Ethernet interface
- 6: Ethernet interface
- 7: Reset button
- 8: Connector strip X12 for connectors with spring-loaded terminals and labelling strip
- 9: Connector strip X22 for connectors with spring-loaded terminals and labelling strip
- 10: Interface to receiver
- 11: Interface to transmitter

Function description

Overview

The module monitors and evaluates the detection zone between the PSENvip transmitter and PSENvip receiver. If a detection zone is violated, the module switches off its outputs.

Module and periphery supply

Module supply

- The module supply provides the module and the receiver with voltage.

Periphery supply

- The periphery supply is used to supply the transmitter.
- The periphery supply is used to supply the test pulse outputs.
- The periphery supply that supplies the outputs must be fed externally. The single and dual-pole outputs must have a common supply voltage.

Inputs

- The inputs I00 ... I03 form two input pairs (I00 and I01, I02 and I03). Only by using these input pairs is it possible to achieve PL e (Cat. 4) and SIL CL 3.
- Test pulses can be used to check the inputs for shorts across contacts and correct functionality.
- The inputs can be used to connect foot switches, for example.
- Configurable settings see Configuration [📖 1168].

Test pulse outputs

- 2 test pulse outputs that use different test pulses (test pulse T00, test pulse T01)
- Short circuit-proof
- Overload-proof
- Free from feedback
- Current-limiting

Special modules
PSSu K F FAU

Detection of shorts across contacts

- The test pulses are used to detect shorts between inputs. Shorts between inputs are detected when the test pulses are different (test pulse T00, test pulse T01).
- Only the module's test pulses may be used to detect shorts.
- The module's test pulses may not be used to detect shorts between inputs on other modules.
- Shorts between inputs of the same module with the same test pulses will not be detected.
- Test pulses can be switched on or off.
- Test pulses are switched on in the default setting.
- When test pulses are switched off, the periphery supply is constantly available at the test pulse outputs.

Outputs

- 2 single-pole digital outputs

Output test

- Outputs that are switched on are checked via regular off tests.
  - Test pulses for outputs that are switched on: see Technical details [📖 1188]
  - Outputs that are switched on are switched off for the duration of the test pulse.
  - The load must not switch off because of the test.
- Outputs that are switched off are checked via regular on tests.
  - Test pulses for outputs that are switched off: see Technical details [📖 1188]
  - Outputs that are switched off are switched on for the duration of the test pulse.
  - The load must not switch on because of the test.

Testing for shorts

- A test is regularly carried out to check for shorts between the outputs.

Excluding individual outputs from the output test:

- If a plant is particularly sensitive to the test pulses, the output test may be switched off for individual outputs.
- The test must be replaced by other measures, depending on the safety requirement.
- When test pulses are switched off:
  - The correct switch status is always checked.
  - The output's ability to switch will not be detected until the next time the output is switched on/off.

Testing for shorts

- A test is regularly carried out to check for shorts between the outputs.

Special modules
PSSu K F FAU

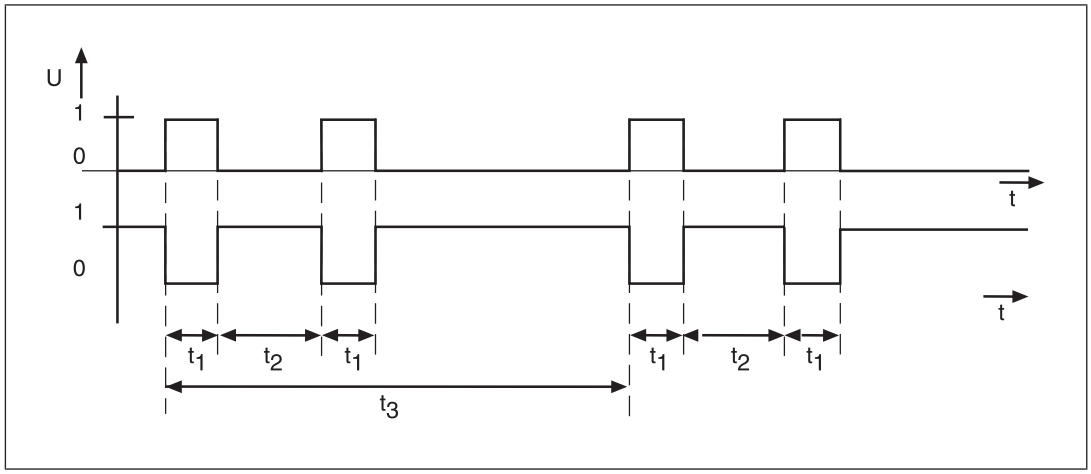


Fig.: On and off test for single-pole outputs

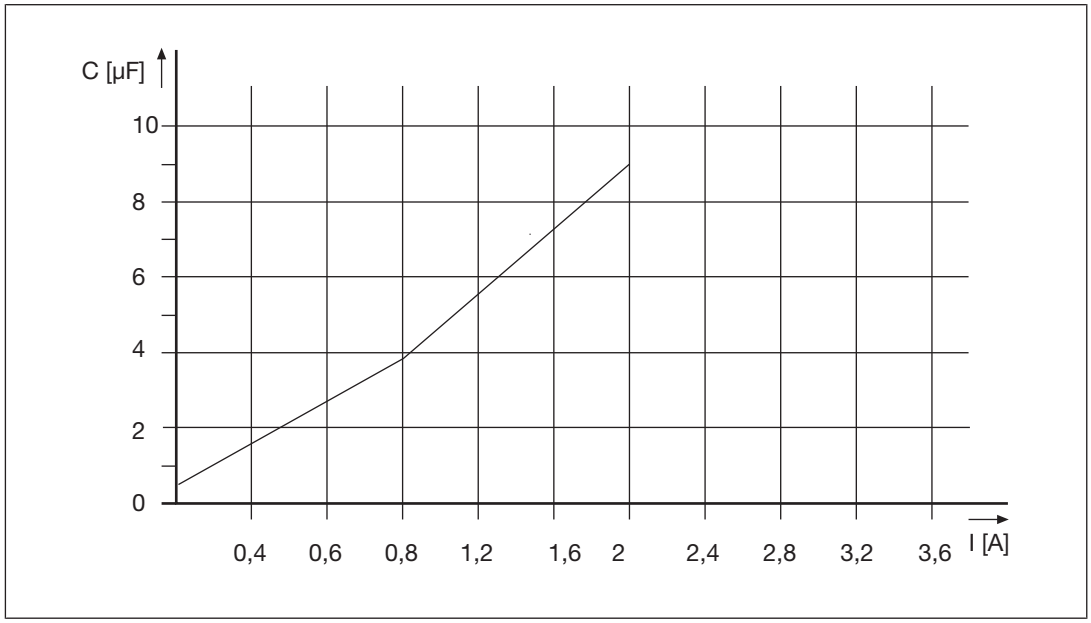
Legend

t_1 Pulse duration of on/off test (200 µs)

t_2 Max. waiting time between the on/off test (approx. 4 ms)

t_3 Repetition time of on and off test in normal circumstances (approx. 2 s)

Characteristic for single-pole outputs: Output capacitance C dependent on load current I



Special modules
PSSu K F FAU

- 2 dual-pole digital outputs (cannot be used as a single-pole output)

Output test

- Outputs that are switched on are checked via regular off tests.
  - Test pulses for outputs that are switched on: see Technical details [1188]
  - Outputs that are switched on are switched off for the duration of the test pulse.
  - The load must not switch off because of the test.
- Outputs that are switched off are checked via regular on tests.
  - Test pulses for outputs that are switched off: see Technical details [1188]
  - Outputs that are switched off are switched on for the duration of the test pulse.
  - The load must not switch on because of the test.

Testing for shorts

- A test is regularly carried out to check for shorts between the outputs.

Open circuit detection (only on dual-pole outputs):

- The module will detect an open circuit between outputs O0x+ and O0x-.
- The result from open circuit detection is issued as a warning and the affected output is deactivated.
- Loads over 0,17 kOhm may mistakenly be detected as an open circuit.
- Unused outputs can be deactivated.
  - Make sure that unused outputs are not switched on in the user program, otherwise a warning will be triggered. The affected output will be shut down and deactivated.

Special modules
PSSu K F FAU

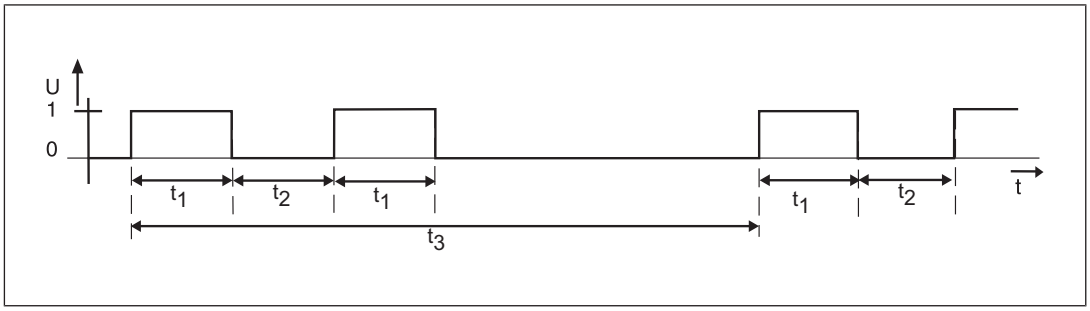


Fig.: On test for dual-pole outputs

Legend

t_1 Max. pulse duration of on test (4 ms)

t_2 Max. waiting time between the on tests (approx. 4 ms)

t_3 Repetition time of on test in normal circumstances (approx. 2 s)

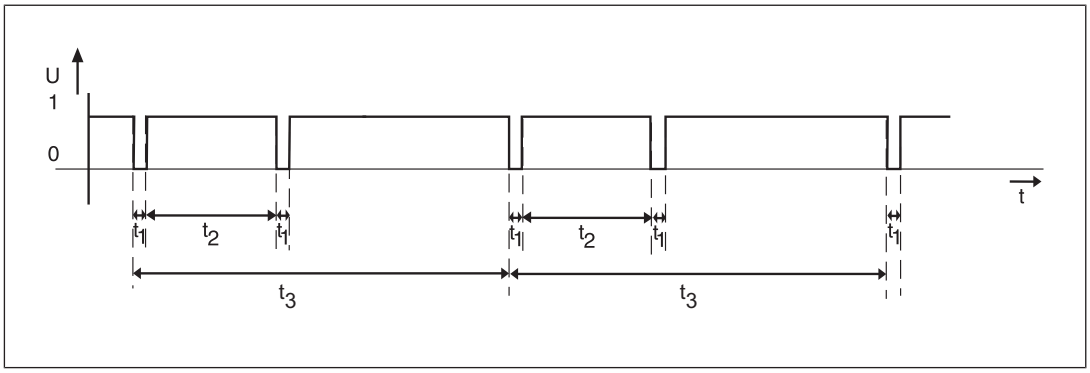


Fig.: Off test for dual-pole outputs

Legend

t_1 Pulse length of off test (0.2 ms)

t_2 Max. waiting time between the off tests (approx. 4 ms)

t_3 Repetition time of off test in normal circumstances (approx. 2 s)

Special modules
PSSu K F FAU

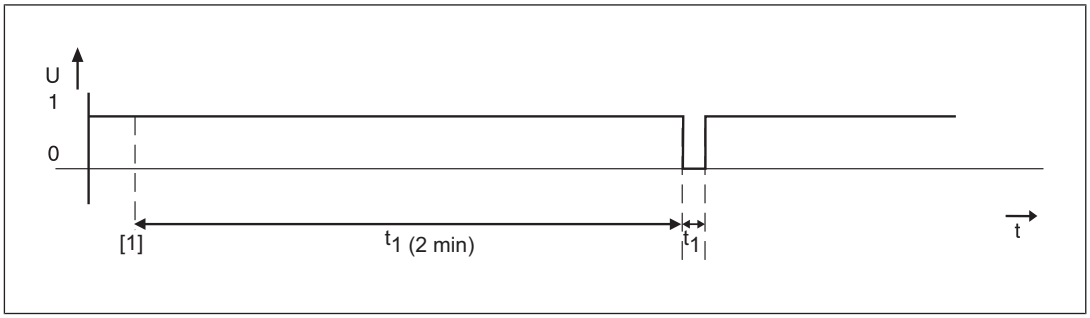


Fig.: Discharge voltage test

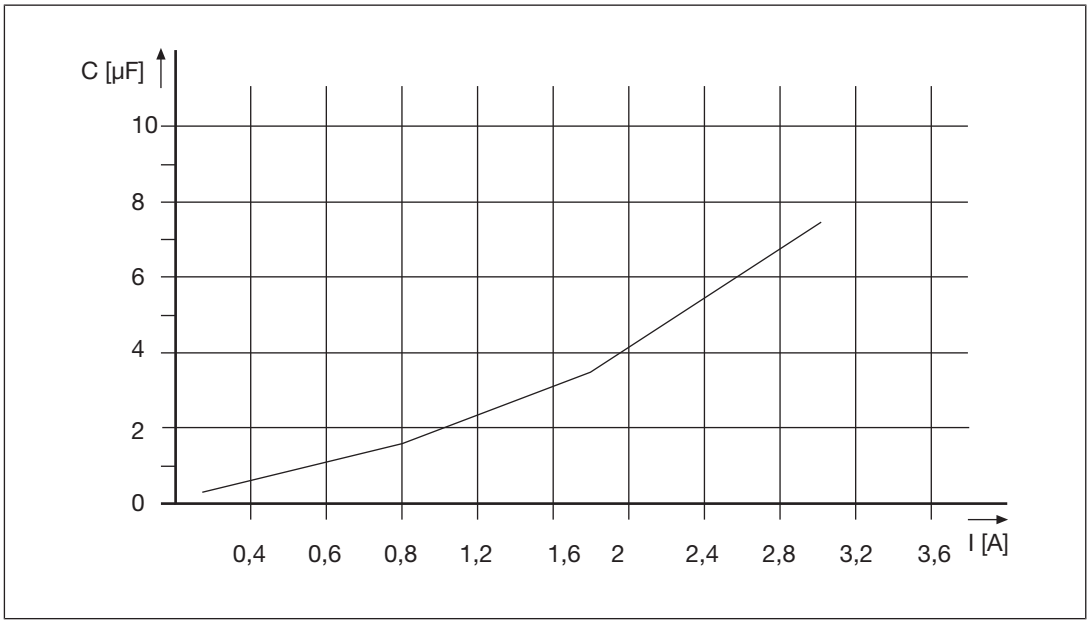
Legend

[1] Start of off test for dual-pole outputs

t1 Waiting time between discharge voltage tests (2 min)

t2 Pulse duration of discharge voltage test (approx. 0.3 ms)

Characteristic for dual-pole outputs: Output capacitance C dependent on load current



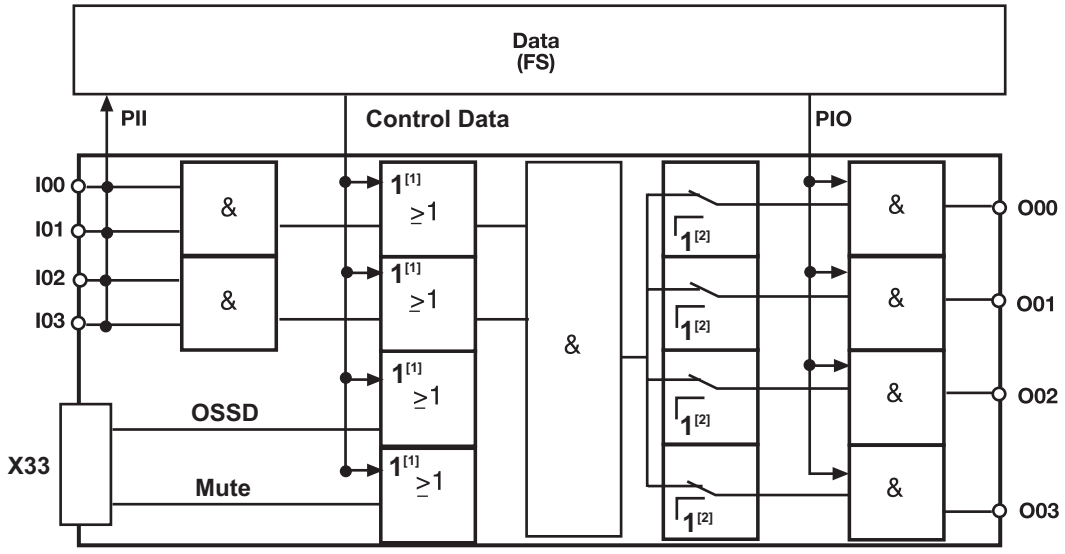
- For applications in accordance with Category 4, PL e and SIL 3, detection of shorts between contacts must be guaranteed either via the on/off test or through other measures (e.g. asynchronous switching). A short between contacts must be simulated during commissioning.

Special modules
PSSu K F FAU

Fast shutdown

The module switches the outputs off immediately when:

- The signal from the protected field evaluation (OSSD) switches from 1 to 0 (protected field violated).
- The signal for dynamic muting (MUTE) switches from 1 to 0. (Object interrupts advance measuring field.)
- The signal switches from 1 to 0 at one of the input pairs I00 and I01, I02 and I03. The edge used to trigger the fast shutdown can be configured (see Configuration [1168]).



[1] Deactivate fast shutdown for inputs
[2] Deactivate fast shutdown for outputs

Reaction times with fast shutdown

The overall reaction time with fast shutdown is independent of the PSSu cycle time.

Times that influence the overall reaction time:

- Processing time of the camera system
- Processing time of the outputs

Maximum reaction time for shutdown with falling edge:

$t_{FS\text{-overall reaction time max}}$ = 4 ms + 0,25 ms)

Times that influence the overall reaction time:

- Configured input filter time
- Processing time of the outputs

Maximum reaction time for shutdown with falling edge:

$t_{FS\text{-}overall\ reaction\ time\ max} = (t_{configured\ input\ filter\ time} + 0{,}25\ ms)$

Reaction time without fast shutdown

Information on the reaction times of the inputs can be found in the System Description "Automation system PSS 4000".

Please note that the configured input filter time has an effect on the reaction time.

Integrated protection mechanisms

When the PSSu E F PS1(-T) or PSSu E F PS2(-T)(-R) is used to supply the system, the module supply is buffered for 20 ms if the supply voltage is interrupted.

The module provides the following diagnostic data:

- PSENvip error (see operating manual PSENvip R, PSENvip E , under "Error messages")
- Start-up error
- Configuration error
- FS communication error
- Bus termination error
- Temperature error: too warm
- Test pulse error
- Input error
- Output error

The module has the following protection mechanisms:

- Test pulse signals are always buffered for 20 ms
- Common second shutdown route, tested regularly
- Cyclical output tests
- Tests for shorts between the outputs

Configuration

The module has the following configuration options:

Inputs:

- Deactivate fast shutdown for inputs

  Default value: Fast shutdown is activated for all inputs

  The data type "FS_O_FAU" can be used to deactivate fast shutdown for individual input pairs.

  For an overview of I/O data types see Access to I/O data types [1170].

Special modules
PSSu K F FAU

- Edge used to trigger the fast shutdown

  Default values: Fast shutdown with falling edge
- Filter times (default: 300 µs)
- Test pulses

  Default value: The test pulses are activated for all inputs

Outputs

- Deactivate fast shutdown for individual outputs

  Default value: The fast shutdown is activated for all outputs
- Output test for single-pole outputs

  Default value:

  The output test is activated for all single-pole outputs

Process data

- Overrun
- Receiver position
- IP address (default IP address: 169.254.1.2)

Further information is available in PAS4000's online help.

The input filter time can be configured in increments of 100 µs. The input filter time depends on the edge configured for fast shutdown. For each input filter time that is configured, there are two values each for the rising and the falling edge:

- Safely filtered out; indicates which signals are safely filtered out.
- Safely detected; indicates which signals are safely detected.

Configured input filter time (FZ)	**Fast shutdown with rising edge**		**Fast shutdown with falling edge**	
	Safely filtered out signal time (µs)	**Safely detected signal time (µs)**	**Safely filtered out signal time (µs)**	**Safely detected signal time (µs)**
200	13	100	10	200
300	30	200	110	300
400	130	300	210	400
500	230	400	310	500
…	FZ - 270	FZ -100	FZ - 190	FZ
…	…	…	…	…
…	…	…	…	…
3100	2830	3000	2910	3100
3200	2930	3100	3010	3200
3300	3030	3200	3110	3300

Special modules
PSSu K F FAU

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

Input data types

I-data name	I-data type	I-data element	Meaning
I00 … I03	FS_I_DI	Data: SAFEBOOL	Input data I00 … I03
	FS_I_FAU_SIGNALS	OSSD: SAFEBOOL	TRUE: Protected field clear FALSE: Protected field broken
		Mute: SAFEBOOL	TRUE: PSENvip is not in dynamic muting FALSE: PSENvip is in dynamic muting
		OverrunMeasure-ment: SAFEBOOL	TRUE: Overrun measurement active, overrun measuring field not interrupted, overrun not too long FALSE: Overrun measurement inactive or overrun measuring field interrupted and overrun too long.
	FS_I_FAU_FAST_SHUT-DOWN_TRIGGERED	I0: SAFEBOOL I1: SAFEBOOL I2: SAFEBOOL I3: SAFEBOOL	TRUE: Input has triggered the fast shut-down FALSE: Input has not triggered the fast shutdown
		OSSD: SAFEBOOL	TRUE: OSSD has triggered the fast shut-down FALSE OSSD has triggered the fast shut-down
		MUTE: SAFEBOOL	TRUE: The MUTE signal of the advance measuring field has triggered the fast shutdown FALSE: The MUTE signal of the advance measuring field has not triggered the fast shutdown

Special modules
PSSu K F FAU

I-data name	I-data type	I-data element	Meaning
	FS_I_FAU_SENSOR_STATE	SensorState: SAFEBYTE	Status of the PSENvip: Byte value (Hex) 0x00 - No significance 0x01 - System has been started and a user program loaded 0x02 - Protected field monitoring has been activated 0x03 - STOP state; minor, recoverable error 0x04 - System check 0x05 - Adjustment being made 0x06 - Device is in tool change mode 0x07 - Device is in standby mode 0x0F - STOP state; major error 0x10 – Fatal error
	FS_I_FAU_PROTECTION_FIELD_SIZE	ProtectionFieldSize: SAFEBYTE	The height of the protected field or the tool height above the plate
	FS_I_FAU_SENSOR_INFO	SensorInfo: SAFEBYTE	Byte for transferring the tool classes or the muting end point to the user program. For further information see chapter entitled Communication with the safety system

Special modules
PSSu K F FAU

Output data types

O-data name	O-data type	O-data element	Meaning
O00 … O03	FS_O_DO	Data: SAFEBOOL	Output data O00 … O03
	FS_O_FAU	DeactivateFastShutdownI0I1: SAFEBOOL	TRUE: Deactivate fast shutdown for input pair I00 and I01 FALSE: Activate fast shutdown for input pair I00 and I01
		DeactivateFastShutdownI2I3: SAFEBOOL	TRUE: Deactivate fast shutdown for input pair I02 and I03 FALSE: Activate fast shutdown for input pair I02 and I03
		DeactivateFastShutdownOSSD: SAFEBOOL	TRUE: Deactivate fast shutdown for OSSD FALSE: Activate fast shutdown for OSSD
		DeactivateFastShutdownMute: SAFEBOOL	TRUE: Deactivate fast shutdown for mute FALSE: Activate fast shutdown for mute
		ProtectedFieldModeBoxBending: SAFEBOOL	TRUE: Activate box mode FALSE: Deactivate box mode
		ProtectedFieldModeBackGauge: SAFEBOOL	TRUE: Activate back gauge mode FALSE: Deactivate back gauge mode
		SystemInit: SAFEBOOL	TRUE: Activate system check FALSE: Deactivate system check
		Acknowledge: SAFEBOOL	TRUE: Acknowledge protected field mode FALSE: Do not acknowledge protected field mode
		PowerOffTransmitter: SAFEBOOL	TRUE: Switch off transmitter FALSE: Transmitter switched on
		SensorControl: SAFEBYTE	Byte for transferring the tool classes or the muting end point from the user program to the module. For further information see chapter entitled Communication with the safety system
		PressCycleState: SAFEBYTE	The user program sends the current press status TRUE: In preparation FALSE: In preparation

Special modules
PSSu K F FAU

Communication with the safety system

During communication, data is transmitted between the safety system and the module. Please note the following:

- Communication must be sequential.
- Communication of the tool classes must be completed before communication regarding configuration of the muting end point can take place.

Communication between the PSENvip and safety system is required if you use tools that cannot be safeguarded in compliance with the standards. This is the case with tool classes 2 and 3 (further information is available in the operating manual PSENvip R, PSENvip E under "Safety" -> "Intended Use" -> "Tool Shapes".

Communication between the module and the safety system is conducted via the module bus.

Communication is conducted:

- After switching on
- After a tool change
- After a request by the safety system

The module transfers the information about the detected tool classes to the user program in the I-data type "SensorInfo".

Meaning of I-data type "SensorInfo":

Value (Hex)	Meaning
0x00	Init value, or invalid tool class
0x01	The module sends tool class 1 to the user program
0x02	The module sends tool class 2 to the user program
0x03	The module sends tool class 3 to the user program
0x04	Communication of the tool class was successful
0x05	Not used
0x06	The module starts communication

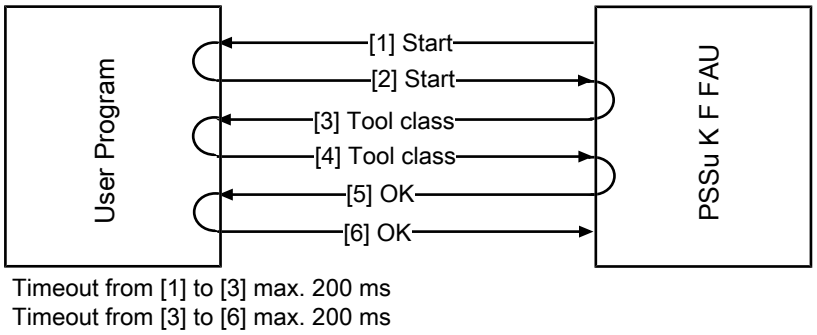
The user program sends the information about the detected tool classes to the module in the O-data type "SensorControl".

Special modules
PSSu K F FAU

Meaning of O-data type "SensorControl":

Value (Hex)	Meaning
0x00	Init value
0x01	The user program in the safety system confirms tool class 1
0x02	The user program in the safety system confirms tool class 2
0x03	The user program in the safety system confirms tool class 3
0x04	Communication of the tool class was successful
0x05	Not used
0x06	The user program in the safety system starts the communication
0x10	The user program requests the tool class

Communication sequence during adjustment after tool change or after a module reset



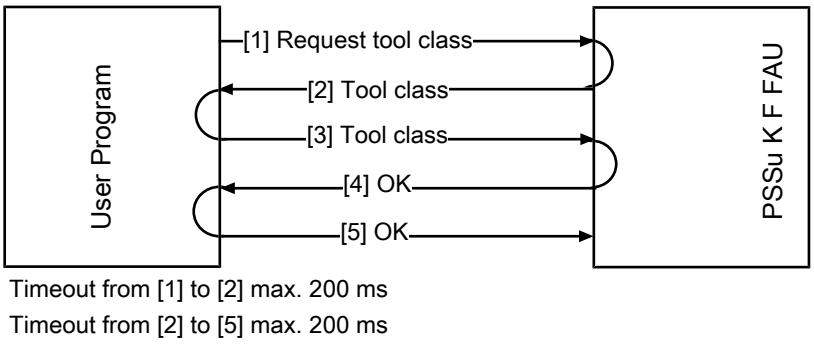
Communication sequence:

- [1] The module starts communication.
  - The value of the I-data type "SensorInfo" equals 0x06 and the value of the O-data type "SensorControl" equals 0x00.
- [2] The user program in the safety system is ready for communication.
  - The value of the O-data type "SensorControl" equals 0x00.
- [3] The module sends the detected tool class to the user program in the safety system.
  - The value of the I-data type "Sensor" equals 0x00: Tool class invalid.
  - The value of the I-data type "SensorInfo" equals 0x01: Tool class 1 detected.
  - The value of the I-data type "SensorInfo" equals 0x02: Tool class 2 detected.
  - The value of the I-data type "SensorInfo" equals 0x03: Tool class 3 detected.
- [4] The user program in the safety system confirms the validity of the tool class registered on the safety system in step 3.
  - The value of the O-data type "SensorControl" equals 0x00: Tool class invalid.
  - The value of the O-data type "SensorControl" equals 0x01: Tool class 1 confirmed.

- The value of the O-data type "SensorControl" equals 0x02: Tool class 2 confirmed.
- The value of the O-data type "SensorControl" equals 0x03: Tool class 3 confirmed.

- [5] The module ends communication.
  - The value of the I-data type "SensorInfo" equals 0x04: Communication of the tool class was successful.
- [6] The user program in the safety system ends the communication.
  - The value of the O-data type "SensorControl" equals 0x04: Communication of the tool class was successful.

User program requests the tool class after a restart of the safety system



Communication sequence:

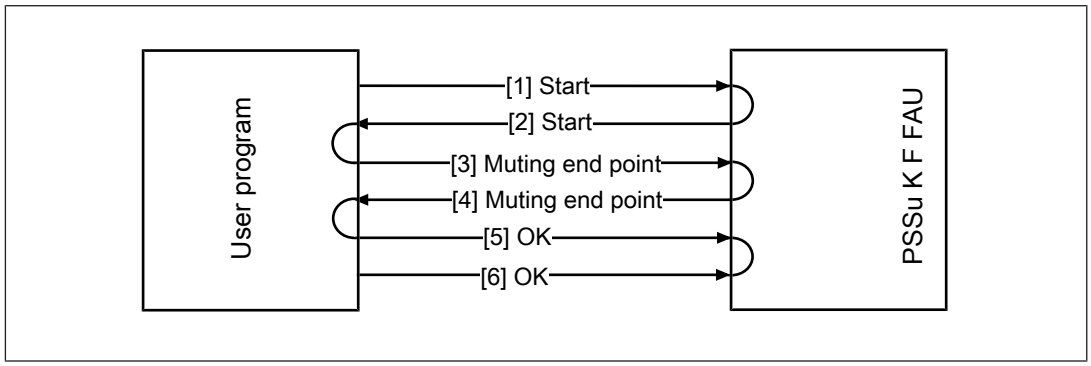
- [1] The user program in the safety system requests the tool class.
  - The value of the O-data type "SensorControl" equals 0x10 and the value of the I-data type "SensorInfo" equals 0x00.
- [2] The module sends the detected tool class to the user program in the safety system.
  - The value of the I-data type "SensorInfo" equals 0x00: Tool class invalid.
  - The value of the I-data type "SensorInfo" equals 0x01: Tool class 1 detected.
  - The value of the I-data type "SensorInfo" equals 0x02: Tool class 2 detected.
  - The value of the I-data type "SensorInfo" equals 0x03: Tool class 3 detected.
- [3] The user program in the safety system confirms the validity of the tool class registered on the safety system in step 2.
  - The value of the O-data type "SensorControl" equals 0x00: Tool class invalid.
  - The value of the O-data type "SensorControl" equals 0x01: Tool class 1 confirmed.
  - The value of the O-data type "SensorControl" equals 0x02: Tool class 2 confirmed.
  - The value of the O-data type "SensorControl" equals 0x03: Tool class 3 confirmed.
- [4] The module ends communication.
  - The value of the I-data type "SensorInfo" equals 0x04: Communication of the tool class was successful.

Special modules
PSSu K F FAU

- [5] The user program in the safety system ends the communication.
  - The value of the O-data type "SensorControl" equals 0x04: Communication of the tool class was successful.

From hardware version 2.0 and software version 1.1, the productive version PSSu K F FAU P supports a configurable muting end point. A value in the range 4 … 1.6 mm may be configured as the muting end point. The configuration must be made in the user program. Communication must take place during the system start-up.

If no muting end point has been configured, then a fixed muting end point of 4 mm is used.



Communication sequence:

- [1] The user program in the safety system starts communication.
  - The value of the O-data type "SensorControl" is 0x22 and the value of the I-data type "SensorInfo" is 0x00.
- [2] The module is ready for communication.
  - The value of the I-data type "SensorInfo" is 0x22.
- [3] The user program in the safety system sends the muting end point to the module.
  - The value of the O-data type "SensorControl" is 0x10: Muting end point = 1.6 mm.
  - The value of the O-data type "SensorControl" is 0x14: Muting end point = 2.0 mm.
  - The value of the O-data type "SensorControl" is 0x18: Muting end point = 2.4 mm.
  - The value of the O-data type "SensorControl" is 0x1C: Muting end point = 2.8 mm.
  - The value of the O-data type "SensorControl" is 0x20: Muting end point = 3.2 mm.
  - The value of the O-data type "SensorControl" is 0x24: Muting end point = 3.6 mm.
  - The value of the O-data type "SensorControl" is 0x28: Muting end point = 4.0 mm.
- [4] The module confirms the muting end point registered in step 3.
  - The value of the I-data type "SensorInfo" is 0x10: Muting end point = 1.6 mm.
  - The value of the I-data type "SensorInfo" is 0x14: Muting end point = 2.0 mm.
  - The value of the I-data type "SensorInfo" is 0x184: Muting end point = 2.4 mm.
  - The value of the I-data type "SensorInfo" is 0x1C: Muting end point = 2.8 mm.
  - The value of the I-data type "SensorInfo" is 0x20: Muting end point = 3.2 mm.

Special modules
PSSu K F FAU

- The value of the I-data type "SensorInfo" is 0x24: Muting end point = 3.6 mm.
- The value of the I-data type "SensorInfo" is 0x28: Muting end point = 4.0 mm.

▸ [5] The user program in the safety system ends the communication.

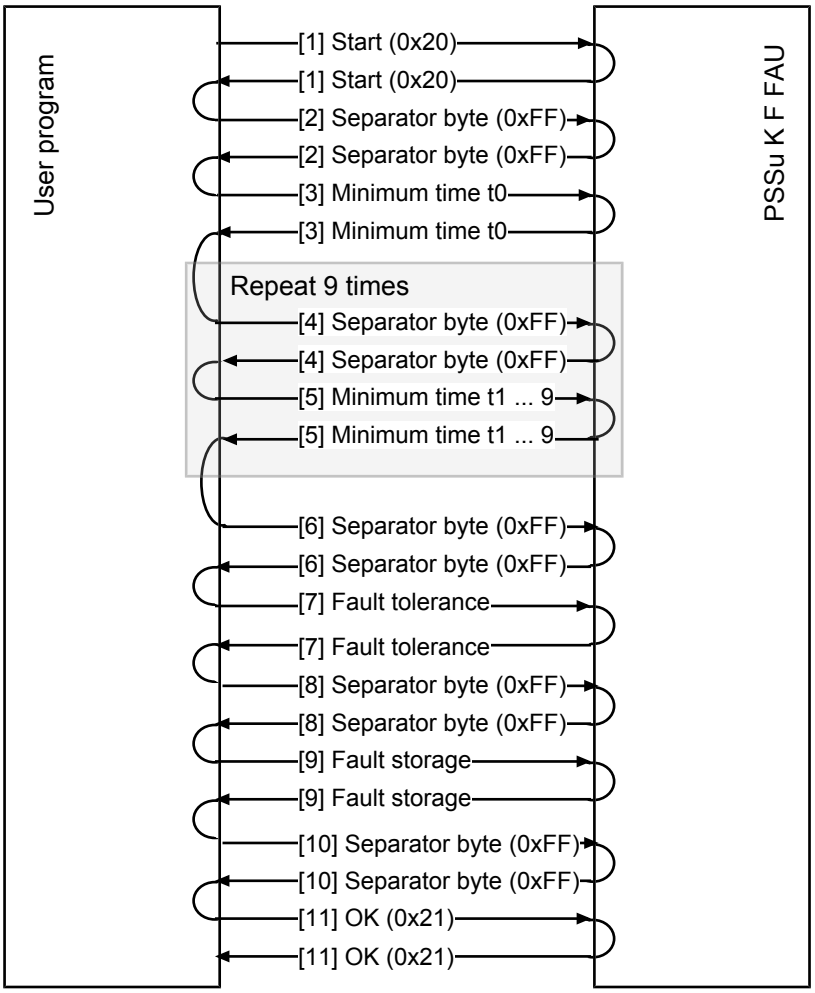
- The value of the O-data type "SensorControl" is 0x23: Communication of the muting end point was successful.

▸ [6] The module ends communication.

- The value of the I-data type "SensorInfo" is 0x23: Communication of the muting end point was successful.

Special modules
PSSu K F FAU

From hardware version 3.0 and software version 2.0, the productive version PSSu K F FAU P supports the configuration of braking ramp monitoring. The configuration must be made in the user program. Communication must take place during the system start-up. Communication may only take place if no other communication is active. The value of the I-data type "SensorInfo" must equal 0x00.



Timeout for sending and receiving information for the individual communication step[s] between user program and module: Max. 200 ms.

Fig.: Communication of braking ramp monitoring

Special modules
PSSu K F FAU

Communication sequence:

- [1] Start of communication
  - The user program in the programmable safety system starts the communication. The value of the O-data type "SensorControl" equals 0x20 and the value of the I-data type "SensorInfo" equals 0x00.
  - The module is ready for communication. The value of the I-data type "SensorInfo" equals 0x20.
- [2] Separator byte

  A separator byte must be transmitted between the configuration values to enable consecutive, identical values to be configured.
  - User program in the programmable safety system transmits a separator byte. The value of the O-data type "SensorControl" equals 0xFF.
  - The module confirms the receipt of the separator byte. The value of the I-data type "SensorInfo" equals 0xFF.
- [3] Minimum time t0

  A minimum time of 0 ms must be configured for muting steps that do not have to be monitored (e.g. the first muting step with an overrun distance < 14 mm), otherwise values of 1 to 250 ms are permitted. These values can be calculated using the Excel tool "PSENvip_OverrunCalculationTool_for_RampMonitoring", for example (see section entitled "Configure braking ramp monitoring" in the operating manual "PSENvip R, PSENvip E"). The value range of 1 to 250 corresponds to speeds of between 8 and 2000 mm/s
  - User program in the programmable safety system transmits the minimum time. The value of the O-data type "SensorControl" equals the configured value.
  - The module confirms the receipt of the minimum time. The value of the I-data type "SensorInfo" equals the minimum time configured in the O-data type "SensorControl".

Repetition for time values t1 to t9

The grey-shaded block with the separator byte 0xFF and the minimum time t for the time values 1 to 9 must be repeated for muting steps 1 to 9. The step size (i.e. the space between 2 muting steps in muting step 8 and 9) depends on the muting end point. Irrespective of this, however, the time is always calculated via a 2 mm muting step. With a fixed muting end point of 4 mm, muting step 9 is omitted. In this case, a value of 0 ms must be configured for the minimum time t9.

- [4] Separator byte

  Separator byte 0xFF for time values t1 to t9.
- [5] Minimum time t1 …9

  Minimum time for muting steps 1 to 9. Each muting step is 2 mm. A minimum time of 0 ms must be configured for muting steps that do not have to be monitored, otherwise values of 1 to 250 ms are permitted. These values can be calculated using the Excel

tool "PSENvip_OverrunCalculationTool_for_RampMonitoring", for example (see section entitled "Configure braking ramp monitoring" in the operating manual "PSENvip R, PSENvip E"). The value range of 1 to 250 corresponds to speeds of between 8 and 2000 mm/s.

End of repetition

- [6] Separator byte

  Separator byte 0xFF for time values 1 to 9.

- [7] Fault tolerance

  The fault tolerance indicates how many violations of the braking ramps are tolerated. A value between 0 and 5 can be configured for fault tolerance. 0 means that the OSSDs are shut down at the first violation.

  – The user program in the programmable safety system sends the configured value for fault tolerance. The value of the O-data type "SensorControl" equals the configured value.

  – The module confirms the receipt of the value for fault tolerance. The value of the I-data type "SensorInfo" equals the fault tolerance configured in the O-data type "SensorControl".

- [8] Separator byte 0xFF

- [9] Fault storage

  Fault storage defines the length of time for which violations are stored. After this number of successful tests, violations are forgotten. A value between 1 and 5 can be configured for fault storage.

  – The user program in the programmable safety system sends the configured value for fault storage. The value of the O-data type "SensorControl" equals the configured value.

  – The module confirms the receipt of the value for fault storage. The value of the I-data type "SensorInfo" equals the fault storage configured in the O-data type "SensorControl".

- [10] Separator byte 0xFF

- [11] End of communication

  – The user program in the programmable safety system ends the communication. The value of the O-data type "SensorControl" equals 0x21: Communication of braking ramp monitoring was successful.

  – The module ends communication. The value of the I-data type "SensorInfo" equals 0x21: Communication of braking ramp monitoring was successful.

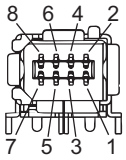
Special modules
PSSu K F FAU

Interfaces

Receiver interface

The receiver interface transfers data between the module and the receiver. Use Pilz pre-assembled cable to connect the receiver (see order references).

The connection is made with a Mini-I/O socket

Socket	PIN	Signal
	1	SerDes+
	2	SerDes-
	3	n.c.
	4	n.c.
	5	n.c.
	6	n.c.
	7	+ 5 V
	8	- GND

n.c.: Not connected

Transmitter interface

The transmitter is connected to a 4-pin connector strip.

Connector strip 4-pin	PIN	Assignment
	1	24 V
	2	ESY
	3	EON
	4	0 V

- EON

  The module uses this signal to switch the transmitter's light source on and off.
- ESY

  The module uses this signal to control the intensity of the transmitter's light source.

Special modules
PSSu K F FAU

Ethernet interface

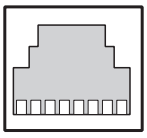
Two free switch ports are provided as Ethernet interfaces via an internal autosensing switch. The autosensing switch automatically detects whether data transfer is occurring at 10 Mbit/s or 100 Mbit/s.

The switch's automatic crossover function means there is no need to distinguish on the connection cable between patch cable (uncrossed data line connection) and crossover cable (crossover data line connection). The switch automatically creates the correct data line connection internally. Patch cable can therefore be used as the connection cable for end devices as well as cascading.

Both Ethernet interfaces use RJ45 technology.

The Ethernet interface is configured in the PAS4000 (for a description see the chapter entitled "Hardware Configuration" -> "Configuration of the PSSu Modules" -> "Configure PSSu Modules" -> "Configure Special Modules" -> "PSSu K F FAU" in PAS4000's online help).

Ethernet Interface

RJ45 socket 8-pin	PIN	Standard	Crossover
 8 1	1	TD+ (Transmit+)	RD+ (Receive+)
	2	TD- (Transmit-)	RD- (Receive-)
	3	RD+ (Receive+)	TD+ (Transmit+)
	4	n.c.	n.c.
	5	n.c.	n.c.
	6	RD- (Receive-)	TD- (Transmit-)
	7	n.c.	n.c.
	8	n.c.	n.c.

Wiring

Connectors' mechanical connection

Please note:

- The conductor cross section on the spring-loaded terminals without ferrules is 0,2 - 1 mm², 22 - 18 AWG.
- If you are using multi-core or fine-core cables we recommend ferrules in accordance with DIN 46228/Part 1 or DIN 46228/Part 4, 0.2 ... 1 mm². To crimp the ferrules we recommend crimping pliers (crimp form A) conforming to EN 60947-1, such as the PZ 6/5 from Weidmüller, for example.
- Terminal points per connection: 1
- Stripping length: 8 mm

Special modules
PSSu K F FAU

Connect/disconnect the cables

We recommend you use a screw driver with a 0.4 x 2.5 mm (DIN 5264) blade!

Strip the cable:

- Strip the cable [1] and apply a ferrule if necessary (DIN 46228/Part 1 or DIN 46228/Part 4).

Connect cable:

- Using the screwdriver, press the actuator button on the spring-loaded terminal down as far as it will go [2], keep it held down and insert the stripped cable into the plug connection as far as it will go [2].
- Check that the cable is firmly seated [3].

Disconnect cable:

- Using the screwdriver, press the actuator button down as far as it will go [4], keep it held down and pull the cable out of the plug connection [4].

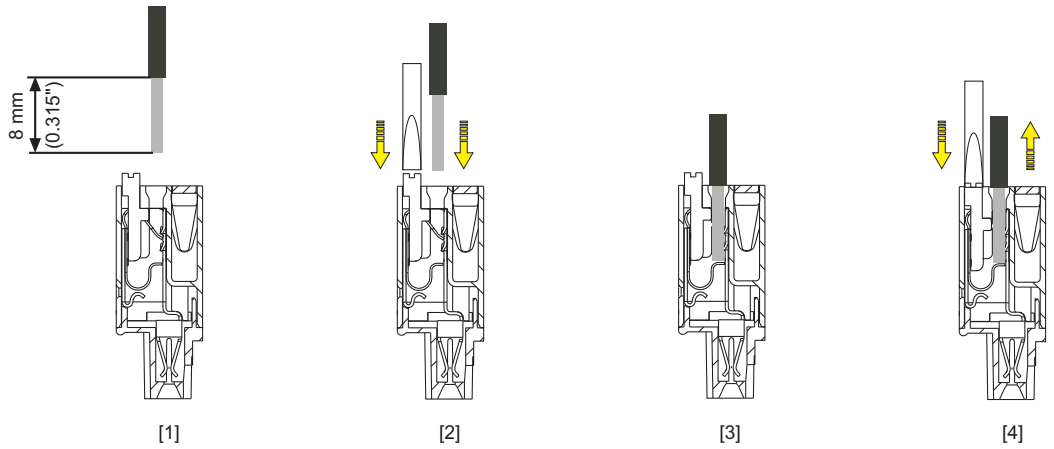
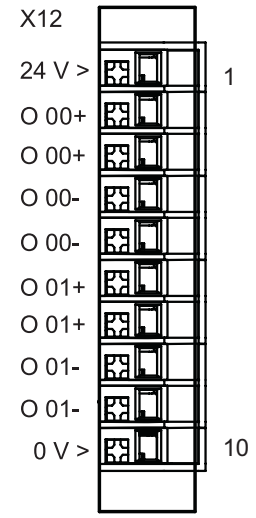
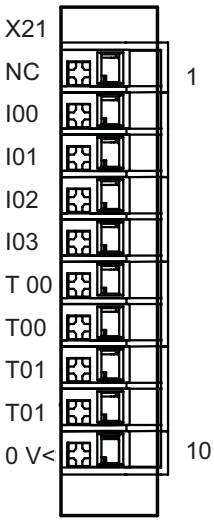


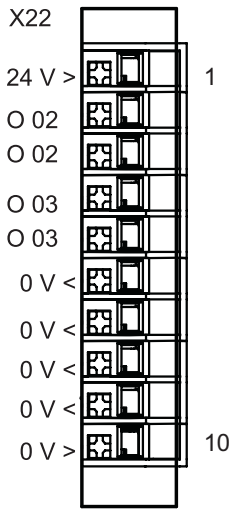
Fig.: Connect and disconnect the cables

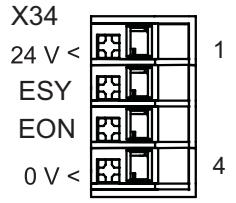
Special modules
PSSu K F FAU

Terminal configuration

Pin assignment of connector with spring-loaded terminals (1-row/10-pin): PSSu A Con 1/10 C	
X12: 24 V: +24 V (external periphery supply) O 00+: Output 1, dual-pole positive-switching O 00+: Output 1, dual-pole positive-switching O 00-: Output 1, dual-pole negative-switching O 00-: Output 1, dual-pole negative-switching O 01+: Output 2, dual-pole positive-switching O 01+: Output 2, dual-pole positive-switching O 01-: Output 2, dual-pole negative-switching O 01-: Output 2, dual-pole negative-switching 0 V: 0 V (external periphery supply)	
X21: n.c.: not connected I 00: Input 0 I 01: Input 1 I 02: Input 2 I 03: Input 3 T 00: Test pulse output T0 or +24 V output (periphery supply) T 00: Test pulse output T0 or +24 V output (periphery supply) T 01: Test pulse output T1 or +24 V output (periphery supply) T 01: Test pulse output T1 or +24 V output (periphery supply) 0 V: 0 V (periphery supply)	

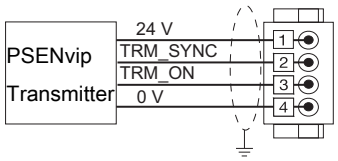
Special modules
PSSu K F FAU

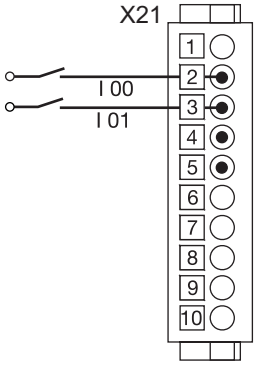
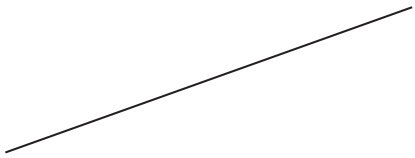
Pin assignment of connector with spring-loaded terminals (1-row/10-pin): PSSu A Con 1/10 C	
X22: 24 V: +24 V (external periphery supply) O 02: Output 1, single-pole O 02: Output 1, single-pole O 03: Output 2, single-pole O 03: Output 2, single-pole 0 V: 0 V (periphery supply) 0 V: 0 V (periphery supply) 0 V: 0 V (periphery supply) 0 V: 0 V (periphery supply) 0 V: 0 V (external periphery supply)	

Pin assignment of connector with spring-loaded terminals (1-row/4-pin): PSSu A Con 1/4 C	
X34: 24 V: +24 V (transmitter's supply voltage) ESY: Signal to control the transmitter's light source EON: Signal to switch the transmitter's light source on and off 0 V: 0 V (periphery supply)	

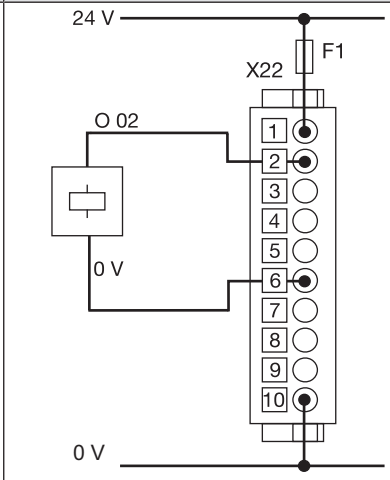
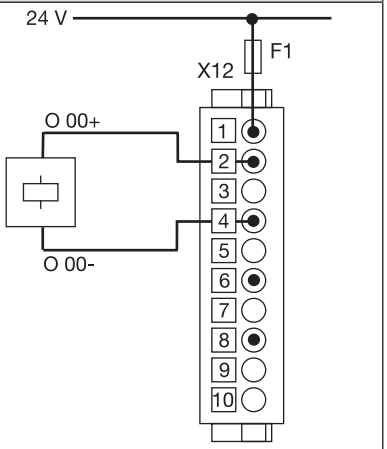
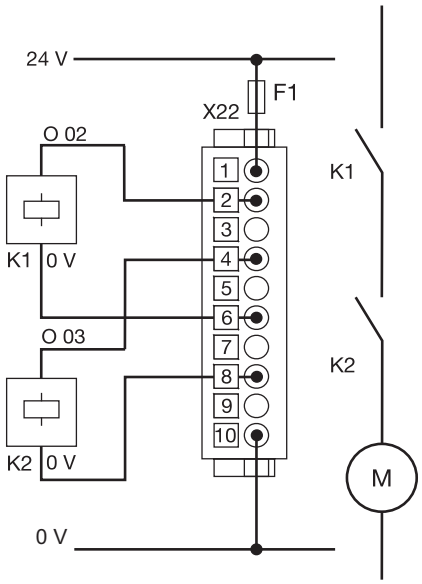
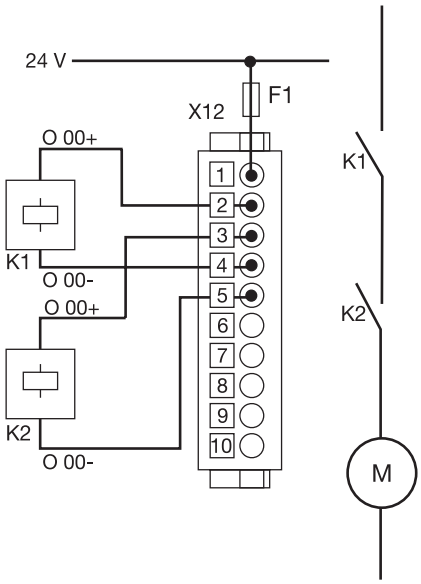
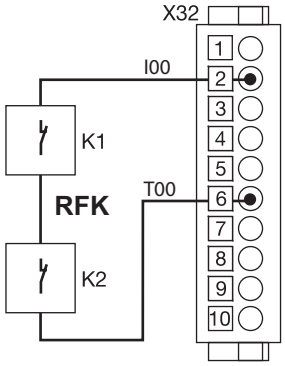
Special modules
PSSu K F FAU

Connecting the module

Interface to transmitter	
	

Input circuit for fast shutdown		
Foot switch, light beam devices		

Special modules
PSSu K F FAU

Output circuit	Single-pole outputs	Dual-pole outputs
Single-channel operation		
Dual-channel operation		
Feedback loop		

On dual-pole outputs, both terminals (O00 +/- or O01 +/-) must be used from an output current of 2.18 A per load.

Special modules
PSSu K F FAU

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 a short circuit to a supply voltage.

Technical details

General	312420	312421
Approvals	**CE, EAC (Eurasian), TÜV, cULus Listed, cULus Listed**	**CE, EAC (Eurasian), TÜV, cULus Listed, cULus Listed**
Application range	**Failsafe**	**Failsafe**
Module's device code	**0F22h**	**0F23h**
Number of FS input bits	**7**	**7**
Number of FS output bits	**4**	**4**
Number of FS status bits	**30**	**30**
Number of FS control bits	**25**	**25**
Application in system environment B		
From FS firmware version, head modules	**1.10.0**	**1.10.0**
Electrical data	**312420**	**312421**
Supply voltage		
for	**Module supply**	**Module supply**
Voltage	**5 V**	**5 V**
Kind	**DC**	**DC**
Voltage tolerance	**-4 %/+4 %**	**-4 %/+4 %**
Max. continuous current that the external power supply must provide	**1 A**	**1 A**
Output of external power supply (DC)	**5 W**	**5 W**
Supply voltage		
for	**Periphery supply**	**Periphery supply**
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**0,2 A**	**0,2 A**
Output of external power supply (DC)	**4,8 W**	**4,8 W**

Special modules
PSSu K F FAU

Electrical data	312420	312421
Supply voltage		
for	**Outputs**	**Outputs**
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-30 %/+25 %**	**-30 %/+25 %**
Max. continuous current that the external power supply must provide	**10 A**	**10 A**
Internal supply voltage (module supply)		
Module's power consumption	**5 W**	**5 W**
Periphery's supply voltage (periphery supply)		
Voltage range	**16,8 - 30 V**	**16,8 - 30 V**
Module's current consumption with no load	**25 mA**	**25 mA**
Module's power consumption with no load	**0,6 W**	**0,6 W**
Max. power dissipation of module	**11,6 W**	**11,6 W**
Inputs	**312420**	**312421**
Number	**4**	**4**
Number	**4**	**4**
Voltage at inputs	**24 V DC**	**24 V DC**
Input current range	**2,4 - 7,8 mA**	**2,4 - 7,8 mA**
Min. threshold voltage when signal changes from "1" to "0"	**8,5 V**	**8,5 V**
Max. threshold voltage when signal changes from "0" to "1"	**10,5 V**	**10,5 V**
Max. processing time of input when signal changes from "1" to "0" (depending on the configured input filter time)	**2,7 - 5,8 ms**	**2,7 - 5,8 ms**
Max. processing time of input when signal changes from "0" to "1" (depending on the configured input filter time)	**2,7 - 5,8 ms**	**2,7 - 5,8 ms**
Potential isolation between input and internal module bus voltage	**yes**	**yes**
Semiconductor outputs	**312420**	**312421**
Number of positive-switching single-pole semiconductor outputs	**2**	**2**
Voltage	**24 V**	**24 V**

Special modules
PSSu K F FAU

Semiconductor outputs	312420	312421
Typ. output current at "1" signal and rated voltage of semiconductor output	**1,75 A**	**1,75 A**
Permitted current range	**0,000 - 2,200 A**	**0,000 - 2,200 A**
Residual current at "0" signal	**0,02 mA**	**0,02 mA**
Max. transient pulsed current	**12 A**	**12 A**
Max. internal voltage drop	**300 mV**	**300 mV**
Monitoring threshold of semiconductor output	**9 V**	**9 V**
Max. duration of on time during self test	**400 µs**	**400 µs**
Max. duration of off time during self test	**400 µs**	**400 µs**
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,25 ms**	**0,25 ms**
Max. processing time of semiconductor output when signal changes from "0" to "1"	**0,45 ms**	**0,45 ms**
Potential isolation from system voltage	**yes**	**yes**
Short circuit-proof	**yes**	**yes**
Permitted loads	**inductive, capacitive, resistive**	**inductive, capacitive, resistive**
Semiconductor outputs, 2-pole	**312420**	**312421**
Number of dual-pole semiconductor outputs	**2**	**2**
Permitted current range	**0,00 - 3,75 A**	**0,00 - 3,75 A**
Terminal voltage when switching off inductive loads	**-185 V**	**-185 V**
Typ. output current at "1" signal and rated voltage of semiconductor output	**3 A**	**3 A**
Residual current at "0" signal	**0,02 mA**	**0,02 mA**
Max. pulsed current for t < 100 ms	**12 A**	**12 A**
Open circuit detection off	**0,17 kOhm**	**0,17 kOhm**
Potential isolation	**yes**	**yes**
Short circuit-proof	**yes**	**yes**
Permitted loads	**inductive, capacitive, resistive**	**inductive, capacitive, resistive**
Max. duration of on time during self test	**4 ms**	**4 ms**
Max. duration of off time during self test	**400 µs**	**400 µs**

Special modules
PSSu K F FAU

Semiconductor outputs, 2-pole	312420	312421
Max. processing time of semiconductor output when signal changes from "0" to "1"	**9,3 ms**	**9,3 ms**
Max. processing time of semiconductor output when signal changes from "1" to "0"	**0,25 ms**	**0,25 ms**
Test pulse outputs	**312420**	**312421**
Number of test pulse outputs	**2**	**2**
Voltage, test pulse outputs	**24 V DC**	**24 V DC**
Short circuit-proof	**yes**	**yes**
Number of outputs that can be configured as test pulses	**2**	**2**
Max. output current at "1" signal	**0,25 A**	**0,25 A**
Max. cable length between test pulse output and input	**200 m**	**200 m**
Standard for voltage interruptions	**EN61131-2, EN61496-1**	**EN61131-2, EN61496-1**
Times	**312420**	**312421**
Max. reaction time of fast shutdown when signal changes from "1" to "0" (depending on the configured input filter time)	**0,45 - 3,55 ms**	**0,45 - 3,55 ms**
Max. reaction time of fast shutdown when signal changes from "0" to "1" (depending on the configured input filter time)	**0,65 - 3,75 ms**	**0,65 - 3,75 ms**
Environmental data	**312420**	**312421**
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**	**0 - 60 °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**
Climatic suitability		
In accordance with the standard	**EN 60068-2-78**	**EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
Max. operating height above sea level	**5000 m**	**5000 m**

Special modules
PSSu K F FAU

Environmental data	312420	312421
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-4**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 150 Hz**	**10 - 150 Hz**
Acceleration	**1g**	**1g**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
Airgap creepage		
In accordance with the standard	**EN 60664-1**	**EN 60664-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Mechanical data	**312420**	**312421**
Mounting position	**vertical**	**vertical**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Connection type	**Connector strip**	**Connector strip**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1 mm², 22 - 18 AWG**	**0,2 - 1 mm², 22 - 18 AWG**
Spring-loaded terminals: Terminal points per connection	**1**	**1**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**
Dimensions		
Height	**128,9 mm**	**128,9 mm**
Width	**56 mm**	**56 mm**
Depth	**56 mm**	**56 mm**
Depth incl. connector (accessories)	**72 mm**	**72 mm**
Weight	**200 g**	**200 g**

Special modules
PSSu K F FAU

Where standards are undated, the 2014-04 latest editions shall apply.

Safety characteristic data

Unit	Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	EN ISO 13849-1: 2015 T_M [year]
Logic						
Logic	–	**PL e**	**Cat. 4**	**SIL CL 3**	**4,32E-10**	**20**
Input						
Digital inputs	**1-channel**	**PL d**	**Cat. 2**	**SIL CL 2**	**1,59E-08**	**20**
Digital inputs	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**3,61E-10**	**20**
Digital inputs	**1-ch., pulsed light barrier**	**PL e**	**Cat. 4**	**SIL CL 3**	**1,59E-09**	**20**
Output						
SC outputs (1-pole)	**1-channel**	**PL d**	**Cat. 2**	**SIL CL 2**	**1,14E-08**	**20**
SC outputs (1-pole)	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**2,50E-10**	**20**
SC outputs (2-pole)	–	**PL e**	**Cat. 4**	**SIL CL 3**	**2,39E-10**	**20**
Sensor						
–	–	**PL e**	**Cat. 4**	**SIL CL 3**	**3,30E-09**	**20**

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

Order reference

Product

Product type	Features	Order No.
PSSu K F FAU B	Compact module for evaluation of PSENvip, base type	312 420
PSSu K F FAU P	Compact module with dynamic muting for evaluation of PSEN-vip, base type	312 421

Special modules
PSSu K F FAU

Accessories

Terminals

Product type	Features	Order No.
PSSu A Con 4 C	Connector with spring-loaded terminals 4pin, scope of supply: 1 piece	313 118
PSSu A Con 1/10 C	Connector with spring-loaded terminals 1-row/10-pin, scope of supply: 2 pieces	313 115

Contents	Page

Installation accessories

Product type	Features	Order No.
PSSu Assistant & Startup tool CD-ROM	Installation CD-ROM for PSSu Assistant and PSSu Startup Tool. A licence key is needed to enable the PSSu Startup Tool. This must be ordered separately.	312 890
PSSu A ET PE	Earthing terminal for top hat rail, PE connection, Gr/Y. Scope of supply: 10 pieces	312 949
PSSu A ET	End bracket for top-hat rail, standard, plastic version, black. Scope of supply: 10 pieces	312 900
PSSu A ETM	End bracket for top-hat rail, metal version, for high mech. stress. Scope of supply: 2 pieces	312 901
PSSu A EC	Terminating plate with integral terminating resistor	312 902
PSSu A EC-T	Terminating plate with integral terminating resistor, T-type	314 902
PSSu A EC XB	Terminating plate with integral terminating resistor for PSSu XB F-T	312 969
PSSu A SH S	Shielded terminal for base modules with screw connection. Scope of supply: 10 pieces	312 963
PSSu A SH T	Shielded terminal for base modules with cage clamp connection. Scope of supply: 10 pieces	312 964
PSSu A Con 1/4 S	Connector with spring-loaded terminals 1-row/4-pin	313 110
PSSu A Con 2/8 C	Connector with spring-loaded terminals 2-row/8-pin	313 111
PSSu A Con 1/10 C	Connector with spring-loaded terminals 1-row/10-pin	313 115
PSSu A Con 3/30 C	Connector with spring-loaded terminals 3-row/30-pin	313 116
PSSu A RJ45-CAB 1.5M	Connection cable for PSSu XB F-T	314 094
PSSu A USB-CAB03	USB cable, 3 m length	312 992
PSSu A USB-CAB05	USB cable, 5 m length	312 993
SafetyNET p Cable	SafetyNET p cable, standard, 4-core	380 000
SN CAB RJ45s RJ45s, 0.5m	SafetyNET p cable RJ45 straight on RJ45 straight, 0.5m	380 001
SN CAB RJ45s RJ45s, 1m	SafetyNET p cable RJ45 straight on RJ45 straight, 1m	380 003
SN CAB RJ45s RJ45s, 2m	SafetyNET p cable RJ45 straight on RJ45 straight, 2m	380 005
SN CAB RJ45s RJ45s, 5m	SafetyNET p cable RJ45 straight on RJ45 straight, 5m	380 007
SN CAB RJ45s RJ45s, 10m	SafetyNET p cable RJ45 straight on RJ45 straight, 10m	380 009
SafetyNET p Connector RJ45s	SafetyNET p connector RJ45 straight IP20	380 400

Brackets PSSu A ET and PSSu A EC are supplied with a head module.

Markers and labelling

Product type	Features	Order No.
PSSu A ME0	Markers for base module supplies, 10 x 6 marking strips, blue	312 950
PSSu A ME1	Markers for base module supplies, 10 x 6 marking strips, red	312 951
PSSu A ME2	Markers for base module supplies, 10 x 6 marking strips, green	312 952
PSSu A ME3	Markers for base module supplies, 10 x 6 marking strips, black	312 953
PSSu A ME4	Markers for base module supplies, 10 x 6 marking strips, brown	312 954
PSSu A ME5	Markers for base module supplies, 10 x 6 marking strips, red / blue	312 955
PSSu A ME6	Markers for base module supplies, 10 x 6 marking strips, green / yellow	312 956
PSSu A ME7	Markers for base module supplies, 10 x 6 marking strips, white	312 957
PSSu A LA0	Labelling strips with separator, for laser printer, for labelling the terminals on the I/O modules (10 A4 sheets, each with 108 tags [1])	312 958
PSSu A LA1	Tags for labelling the terminals on the base modules (Dekafix, labelled 1..50, 10 x 50 tags)	312 959
PSSu A LA2	Tags for labelling the terminals on the base modules (Dekafix, labelled 51..100, 10 x 50 tags)	312 960
PSSu A LA3	Tags for labelling the terminals on the base modules (Dekafix, labelled 101..150, 10 x 50 tags)	312 961
PSSu A LA4	Tags for labelling the terminals on the base modules (Dekafix, labelled 151..200, 10 x 50 tags)	312 962
PSSu A LC 0.2	Labelling bracket for PSSu K F FCU (5 pieces)	312 965
PSSu A LC 0.1	Labelling bracket for PSSu compact modules (5 pieces)	312 966
PSSu A LA0.1	Labelling strips without separator, for laser printer, for labelling the terminals on the I/O modules (10 A4 sheets, each with 108 tags [1])	312 967

[1] The size of the tags is 5 x 40 mm.

Coding elements

Product type	Features	Order No.
PSSu A CE "A"	Yellow coding elements, A	312 903
PSSu A CE "B"	Yellow coding elements, B	312 904
PSSu A CE "C"	Yellow coding elements, C	312 905
PSSu A CE "D"	Yellow coding elements, D	312 906
PSSu A CE "E"	Yellow coding elements, E	312 907
PSSu A CE "E"	Yellow coding elements, F	312 908
PSSu A CE "F"	Yellow coding elements, G	312 909
PSSu A CE "H"	Yellow coding elements, H	312 910
PSSu A CE "I"	Yellow coding elements, I	312 911
PSSu A CE "J"	Yellow coding elements, J	312 912
PSSu A CE "K"	Yellow coding elements, K	312 913
PSSu A CE "L"	Yellow coding elements, L	312 914
PSSu A CE "M"	Yellow coding elements, M	312 915
PSSu A CE "N"	Yellow coding elements, N	312 916
PSSu A CE "O"	Yellow coding elements, O	312 917
PSSu A CE "P"	Yellow coding elements, P	312 918
PSSu A CE "Q"	Yellow coding elements, Q	312 919
PSSu A CE "R"	Yellow coding elements, R	312 920
PSSu A CE "A"	White coding elements, A	312 921
PSSu A CE "A"	Grey coding elements, A	312 923
PSSu A CE "B"	Grey coding elements, B	312 924
PSSu A CE "C"	Grey coding elements, C	312 925
PSSu A CE "D"	Grey coding elements, D	312 926
PSSu A CE "E"	Grey coding elements, E	312 927
PSSu A CE "F"	Grey coding elements, F	312 928
PSSu A CE "G"	Grey coding elements, G	312 929
PSSu A CE "H"	Grey coding elements, H	312 930
PSSu A CE "I"	Grey coding elements, I	312 931
PSSu A CE "J"	Grey coding elements, J	312 932
PSSu A CE "K"	Grey coding elements, K	312 933
PSSu A CE "L"	Grey coding elements, L	312 934
PSSu A CE "M"	Grey coding elements, M	312 935
PSSu A CE "N"	Grey coding elements, N	312 936

Coding elements

Product type	Features	Order No.
PSSu A CE "O"	Grey coding elements, O	312 937
PSSu A CE "P"	Grey coding elements, P	312 938
PSSu A CE "Q"	Grey coding elements, Q	312 939
PSSu A CE "R"	Grey coding elements, R	312 940

Scope of supply: 10 coding elements each.

Other accessories

Product type	Features	Order No.
SD Memory Card 512MB	512 MB SD memory card for PSSu head modules	313 100
Stripping tool	Assembly tool for SafetyNET p cable	380 070
PSSnet SLL 5T	Industrial Ethernet Switch, unmanaged, 5 x Standard 10/100 BASE TX, RJ45 Ports	380 600
PSSnet SHL 8T MRP	Industrial Ethernet Switch, managed, 8 x Standard 10/100 BASE TX, RJ45 Ports, ring redundancy MRP	380 601
PSSnet SHL 6T 2FMMSC MRP	Industrial Ethernet Switch, managed, 6 x Standard 10/100 BASE TX, RJ45 Ports, 2 x 100BASE-FX Multimode SC Ports, ring redundancy MRP	380 602
PSSnet SLL 4T 1FMMSC	Industrial Ethernet Switch, unmanaged, 4 x Standard 10/100 BASE TX, RJ45 Ports, 1 x 100BASE-FX Multimode SC Port	380 604
PSS-net SHL 6T 2FSMSC MRP	Industrial Ethernet Switch, managed, 6 x Standard 10/100 BASE TX, RJ45, 2 x 100BASE-FX Multimode SC Ports, ring redundancy MRP	380 650
PMImicro diag	Graphic diagnostic terminal	260 000

Support

Technical support is available from Pilz round the clock.

Americas
Brazil
+55 11 97569-2804
Canada
+1 888-315-PILZ (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 31 450 0680

Australia
+61 3 95446300

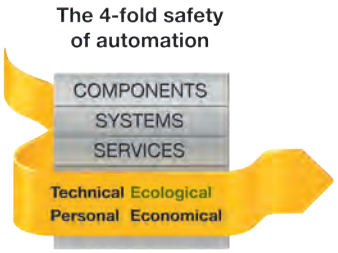
Europe
Austria
+43 1 7986263-0
Belgium, Luxembourg
+32 9 3217575
France
+33 3 88104000
Germany
+49 711 3409-444
Ireland
+353 21 4804983
Italy
+39 0362 1826711
Scandinavia
+45 74436332
Spain
+34 938497433
Switzerland
+41 62 88979-30
The Netherlands
+31 347 320477
Turkey
+90 216 5775552
United Kingdom
+44 1536 462203

You can reach our international hotline on:
+49 711 3409-444
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.

Energy saving by Pilz

BLUECOMPETENCE Alliance Member
Partner of the Engineering Industry Sustainability Initiative



Presented by:

pilz
Partner of:
The Best of German Engineering

Pilz GmbH & Co. KG
Felix-Wankel-Straße 2
73760 Ostfildern, Germany
Tel.: +49 711 3409-0
Fax: +49 711 3409-133
info@pilz.com
www.pilz.com

PILZ
THE SPIRIT OF SAFETY

1001264-EN-16, 2018-09 Printed in Germany