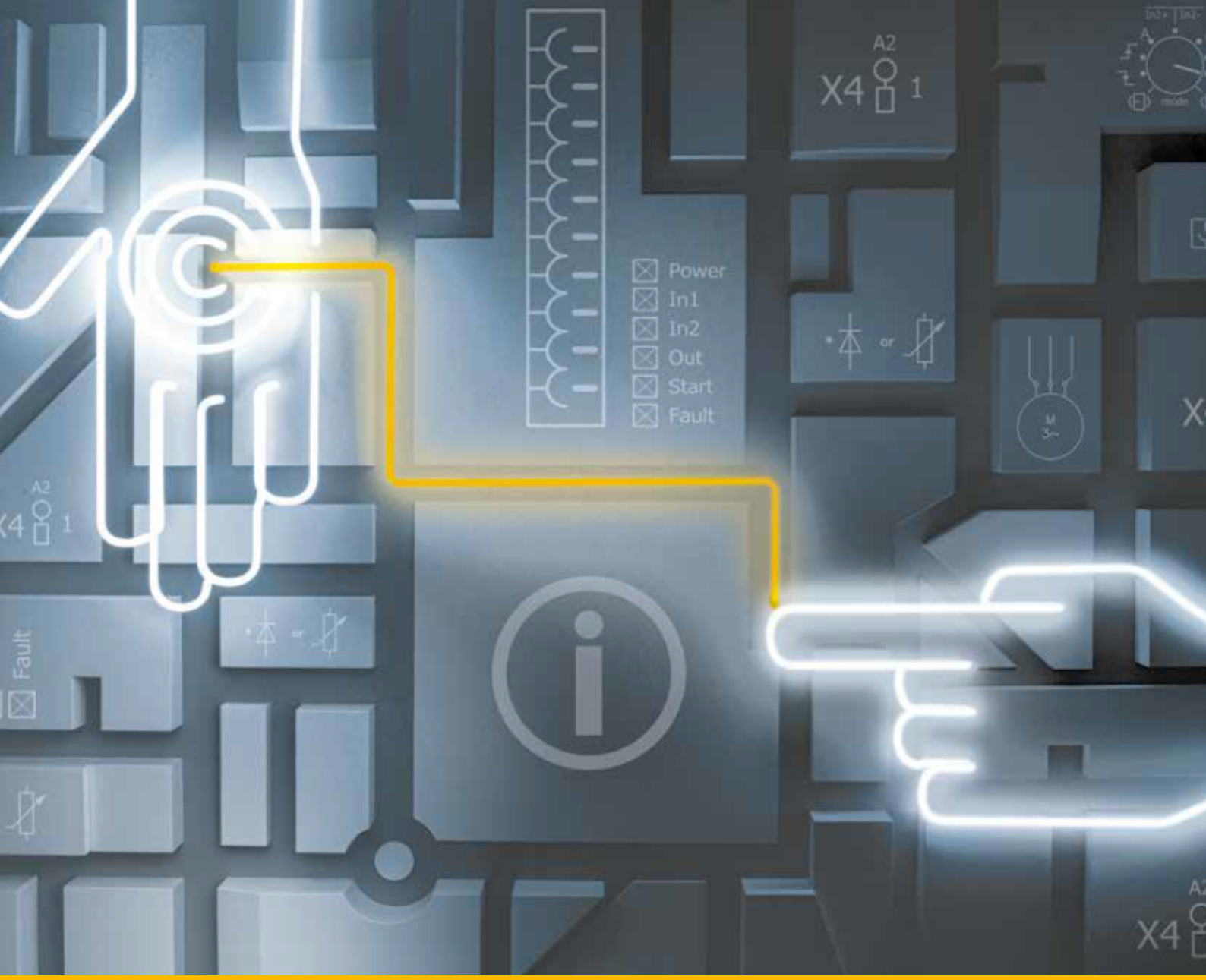


PSSu K F FAU B
PSSu K F FAU P

PILZ
THE SPIRIT OF SAFETY

Operating Manual-1003434-EN-07

- Decentralised system PSSuniversal I/O




This document is the original document.

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

1 Introduction

1.1 Validity of documentation

This documentation is valid for the product PSSu K F FAU. It is valid until new documentation is published.

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

1.1.1 Retaining the documentation

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

1.1.2 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
- **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

The module PSSu K F FAU is exclusively for use in system environment B (automation system PSS 4000).

1.2 Definition of symbols

Information that is particularly important is identified as follows:

DANGER!

This warning must be heeded! It warns of a hazardous situation that poses an immediate threat of serious injury and death and indicates preventive measures that can be taken.

WARNING!

This warning must be heeded! It warns of a hazardous situation that could lead to serious injury and death and indicates preventive measures that can be taken.

CAUTION!

This refers to a hazard that can lead to a less serious or minor injury plus material damage, and also provides information on preventive measures that can be taken.

NOTICE

This describes a situation in which the product or devices could be damaged and also provides information on preventive measures that can be taken. It also highlights areas within the text that are of particular importance.

INFORMATION

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

2 Overview

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.

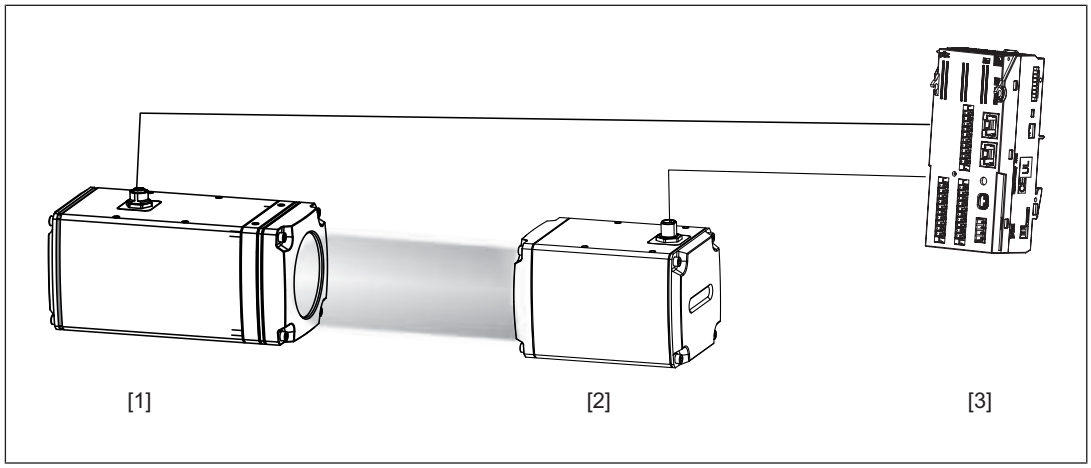


Fig.: Components of the PSENvip

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.

Further information on the PSENvip system can be found in the operating manual PSENvip R, PSENvip E

2.1 Module structure

The module combines the function unit (inputs or outputs, interfaces) and connection levels in one housing.

Wiring is via a Mini-IO socket, male connector and RJ45 connector (connection to HMI of the press controller).

2.1.1 Module features

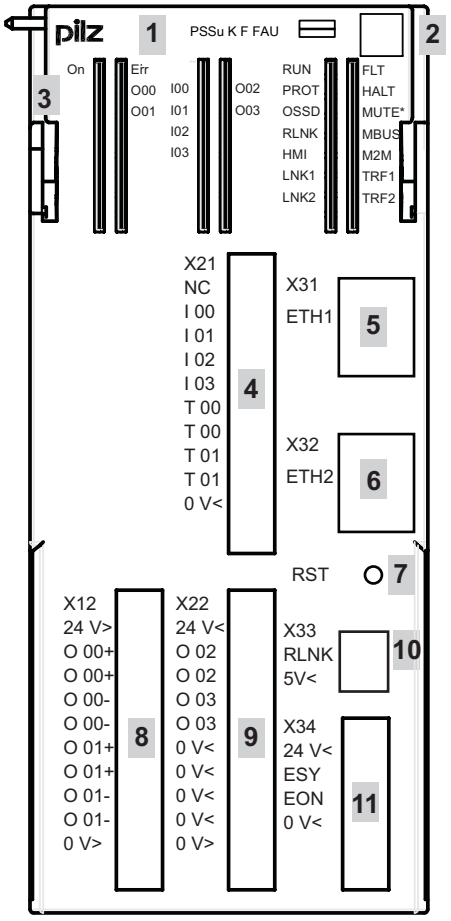
- For failsafe applications in system environment B (automation system PSS 4000)
- Interface for connecting the PSENvip receiver
- Interface for connecting the PSENvip transmitter
- 4 Digital inputs
- Configurable input filter time
- 2 Independent test pulse outputs that use different test pulses
- 2 Digital outputs
  - Semiconductor technology
  - Single-pole
  - Positive-switching
  - Current load capacity per output: 1,75 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-)
  - Current load capacity: 3 A
  - Short circuit-proof
  - Overload-proof
  - High discharge voltage
  - Free from feedback
- 2 Ethernet Interfaces
- Reset button
- LEDs for:
  - Switch status of each input/output
  - Module error

– Module status

Accessories:

- Connector with spring-loaded terminals (necessary for operation)

2.2 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: 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

3 Safety

3.1 Intended use

The module may be used for failsafe applications in system environment B (automation system PSS 4000).

It provides interfaces for connecting the PSENvip.

It provides type 1 failsafe inputs in accordance with IEC 61131-2.

It provides type 1 single and dual-pole failsafe outputs in accordance with IEC 61131-2.

The outputs may be used to switch:

- Resistive loads
- Inductive loads
- Capacitive loads (refer to the characteristics "Capacitance C on single-pole outputs dependent on load current I" and "Capacitance C on dual-pole outputs dependent on load current I")

Intended use includes making the electrical installation EMC-compliant. Please refer to the guidelines stated in the "PSSuniversal Installation Manual". The module is designed for use in an industrial environment. It is not suitable for use in a domestic environment, as this can lead to interference.

The following is deemed improper use in particular:

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

NOTICE

Overvoltages can damage the module.

Test and evaluate the potential implications of overvoltage on the module. In doing so, consider the duration and level of the overvoltage.

The module is supported by PAS4000 from Version 1.10.0.

INFORMATION

Only use PSENvip transmitters and receivers from Version 1.0 with a special module PSSu K F FAU B/PSSu K F FAU P from hardware version 01 and software version 01 (1.0.0).

INFORMATION

Configuration of the muting end point is supported by the PSSu K F FAU P from hardware version 2 and software version 1.1.

INFORMATION

Configuration of braking ramp monitoring is supported by the PSSu K F FAU P from hardware version 3 and software version 2.0.

INFORMATION

Measurement mode is supported by the PSSu K F FAU B/P from hardware version 3 and software version 2.2.

3.1.1 Third-party manufacturer licence information

The product contains open source software, whose terms of use could further limit the product's application area. It is essential that you observe the third-party manufacturer licence information.

Further information is available in the document "Third-party manufacturer licence information PSENvip R, PSSu K F FAU B/P" (document number 1003852) at www.pilz.com.

3.2 Safety regulations

3.2.1 Use of qualified personnel

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

A competent person is a qualified and knowledgeable person who, because of their training, experience and current professional activity, has the specialist knowledge required. In order to inspect, assess and handle products, devices, systems, plant and machinery, this person must be familiar with the state of the art and the applicable national, European and international laws, directives and standards.

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

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

3.2.2 Warranty and liability

All claims to warranty and liability will be rendered invalid if

- The product was used contrary to the purpose for which it is intended,
- Damage can be attributed to not having followed the guidelines in the manual,
- Operating personnel are not suitably qualified,
- Any type of modification has been made (e.g. exchanging components on the PCB boards, soldering work etc.).

3.2.3 Disposal

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

4 Security

The term "security" refers to information security in plants, systems, machines and networks. This includes protection from external attacks (remote access) as well as protection from attacks from insiders. Measures are taken that protect the integrity and confidentiality of sensitive data and guarantee plant/machine availability. So all measures that concern the integrity, availability, confidentiality and authenticity of data fall under the term "security" (see also the IEC 62443 series of standards).

Planning and implementation

Securing plants, systems, machines and networks against cyberthreats requires a holistic industrial security concept that is state of the art and is continuously developed further.
All plants, systems, machinery and networks that require protecting must be assessed individually. The assessment must take into account organisational as well as technical measures. If necessary, seek advice from Pilz Customer Support.
Planning and implementation should be carried out in accordance with a defined security process. For example, your security process should take the following into account:

- Note the regulatory specifications and requirements from the locally applicable safety and application standards with regard to protection from manipulation.
- Perform a risk analysis (e.g. in accordance with IEC 62443-3-2) and then plan the resulting security measures carefully.
- Where possible, counter the security risks using a multi-layered concept (e.g. defence-in-depth concept).
- Name the necessary security measures and document them.
- Check the security measures after implementation.
- Carry out a new risk analysis after every change and adapt the security measures if necessary.
- It is advisable to review the security measures regularly, for example annually.

Defence-in-depth concept

In accordance with IEC 62443-4-1, the defence-in-depth concept is an approach in which multiple layers of independent security methods are used.

The defence-in-depth concept is based on the following rationale:

- Every protective measure can be overcome, and probably will be overcome.
- A multi-layer structure (e.g. onion model) implements several concerted and coordinated measures.
- Due to independent defence mechanisms in each layer, successful exploitation of a weakness in one layer is prevented, or made more difficult, by a measure in another layer.
- Generally with the defence-in-depth concept, an attack is made more difficult because the attacker has to circumvent different, independent security measures, one after the other.

The standard series IEC 62443 distinguishes between the following three areas of responsibility:

- Manufacturer
- System integrator

- Operator

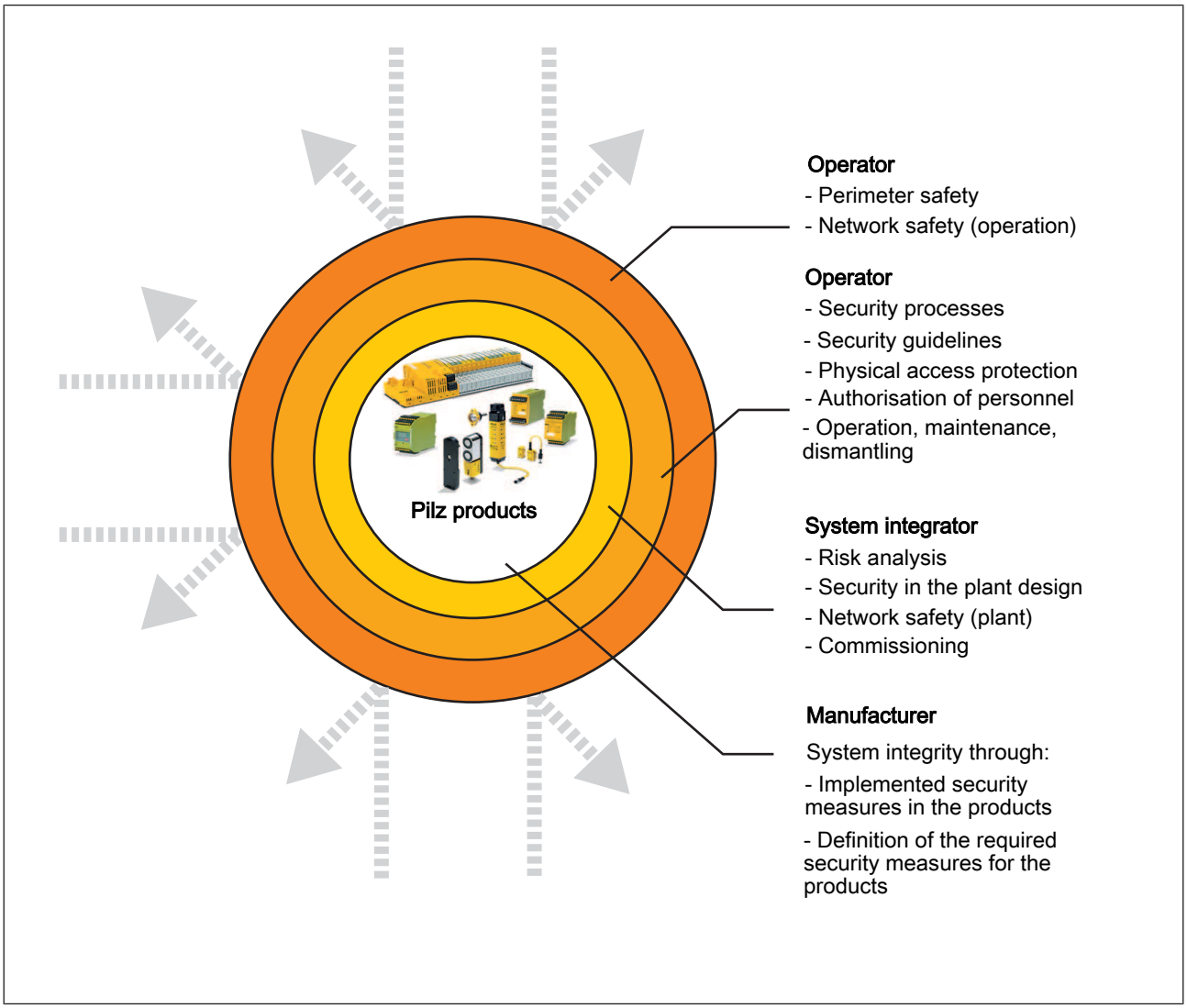


Fig.: Roles and responsibilities in the defence-in-depth onion model

Security incident management

Should the product have a security vulnerability, this will be published in a security advisory. You'll find the security advisories under www.pilz.com/security. You can also report any security problems there.

4.1 Implemented security measures

- The product firmware is certified. As a result, only official, tested firmware can be loaded via a firmware update.
- No firmware downgrades are allowed. This prevents outdated firmware with vulnerabilities from being loaded onto the product.

4.2 Required security measures

- The product is not protected from physical manipulation or from reading of memory contents during physical access. Use appropriate measures to ensure that there is no physical access by unauthorised persons. You should also use security seals so that you can detect any manipulation of the product or interfaces. Installation inside a lockable control cabinet is recommended as a minimum measure.
- Protect the product from unauthorised data exchange via the network by using a firewall or providing other appropriate measures. Only allow the data exchange that's required for the application. Any data exchange that is not required for the application must be prevented by the firewall.
- Make sure that the product is in a closed, secured network. The safety controller from the automation system PSS 4000 and the special module PSENvip IPM can also be operated in this network.
- Logical separation between the network adapters on the HMI (dual homed host) can be used as an alternative to operation in a closed, secured network. Make sure that protective separation of the networks is guaranteed through the HMI.
- An external computer that accesses the product for diagnostic purposes or firmware updates, for example, must be protected from attacks by a firewall or other suitable measures. We recommend that a virus scanner is used on this computer and is updated regularly.
- If necessary, protect the configuration computer and the product from unauthorised use by assigning passwords and taking further measures if required. We also recommend that the user logged on to this configuration computer does not have administrator rights.
- Only assign strong passwords and handle the passwords carefully. Be guided by generally accepted guidelines such as NIST 800-63b for example.
- As soon as possible, install firmware updates that Pilz provides for the product.
- Before disposal, the product must be safely decommissioned. To do this, all the data must be deleted from the device.
  - Set the configuration back to its default settings or delete the configuration.
  - Switch off the product.

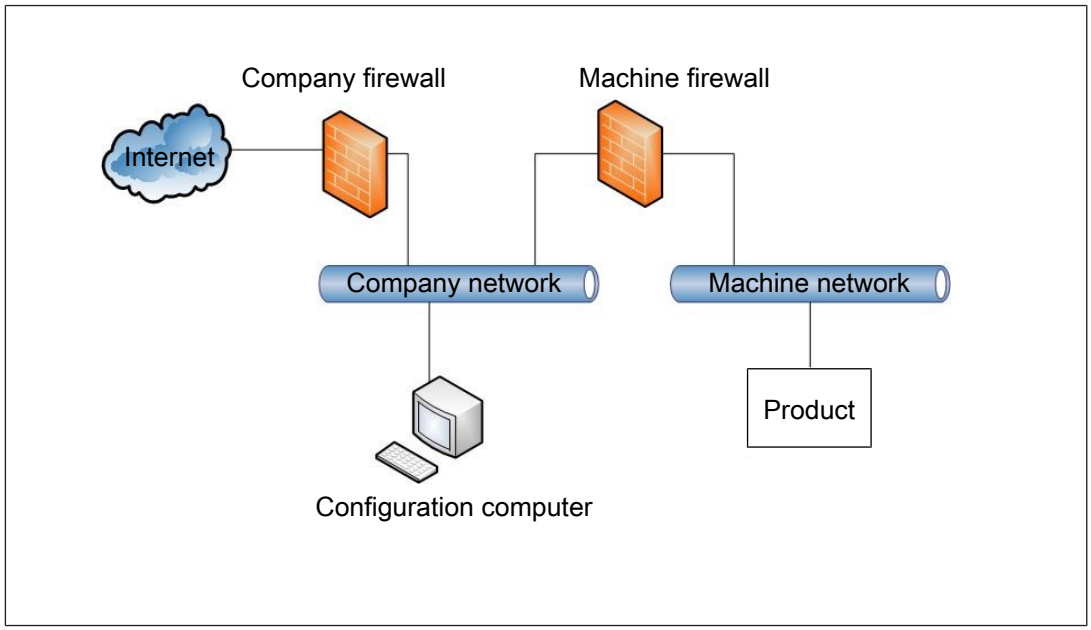


Fig.: Example network topology

5 Function description

5.1 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.

5.2 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.

5.3 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 [📖 25].

NOTICE

Possible loss of safety functions by using test pulses!

The duration of the test pulse can be longer than the configured input filter time, whereby input signals are not detected. That way, an output may not safely shut down and, depending on the application, may cause serious injury and death.

Make sure that you always use an input pair for an input signal and that you assign test pulse T0 to one input in the input pair and test pulse T1 to the other input in the input pair.

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.

5.4 Outputs

5.4.1 Single-pole 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 [📖 68]
  - 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 [📖 68]
  - 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.

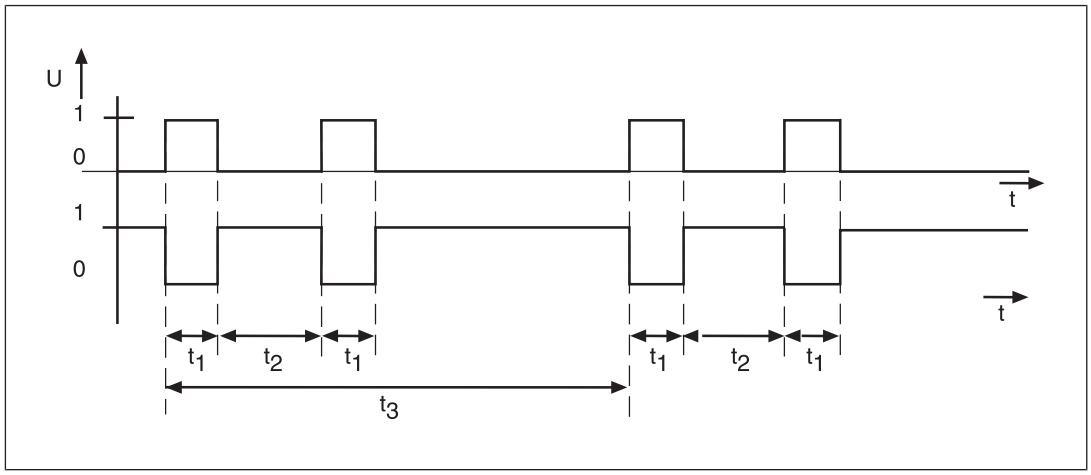


Fig.: On and off test for single-pole outputs

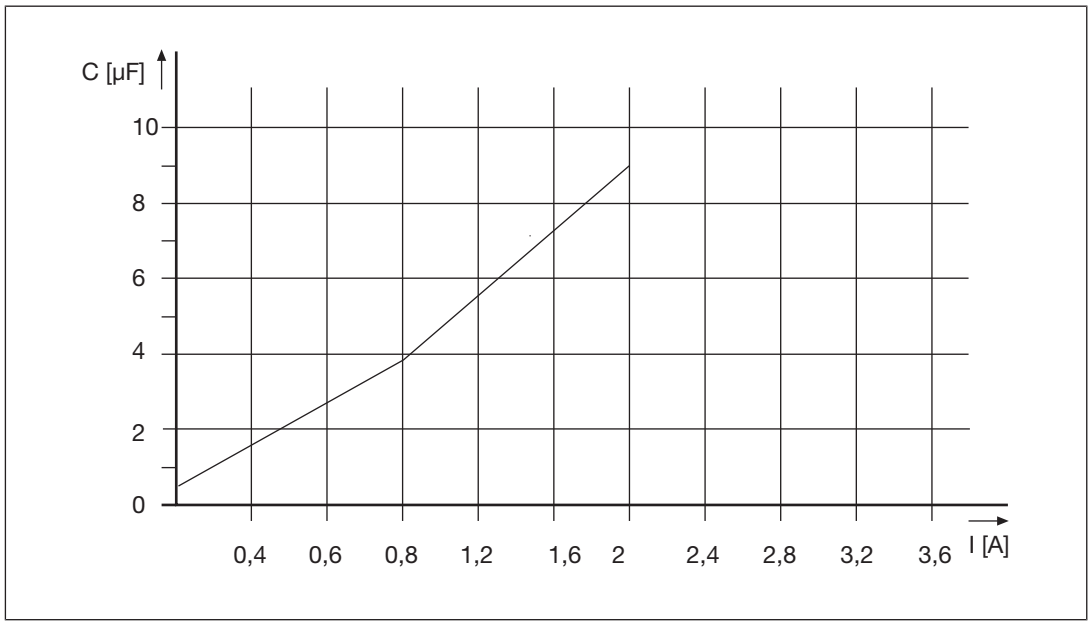
Legend

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



5.4.2 Dual-pole outputs

- 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 [📖 68]
  - 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 [📖 68]
  - 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.
- Connected loads with an impedance of greater than 0,17 kOhm are 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.

NOTICE

Risk from high discharge voltage!

The discharge voltage when switching off an inductive load is up to -185 V.

The connected load can be damaged by the discharge voltage.

- Limit the discharge voltage if the connected load can be damaged by this discharge voltage.

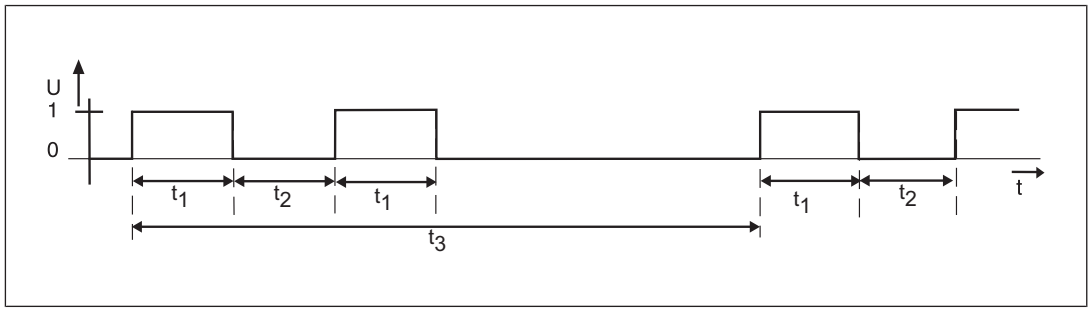


Fig.: On test for dual-pole outputs

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)

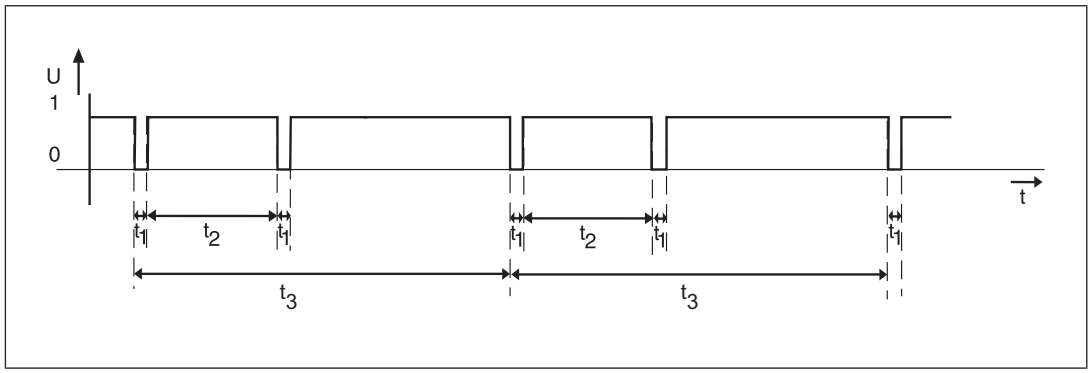


Fig.: Off test for dual-pole outputs

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)

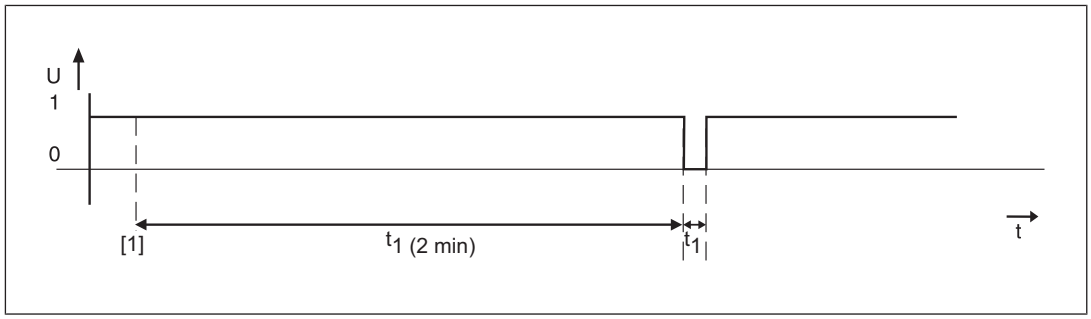


Fig.: Discharge voltage test

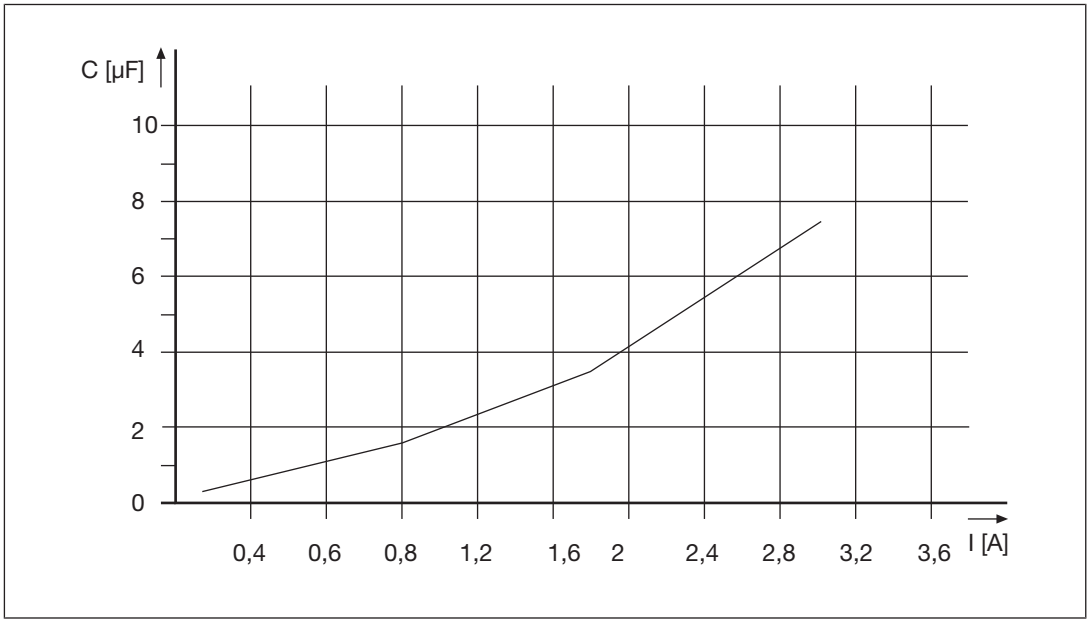
Legend

[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



5.4.3 Notes

WARNING!

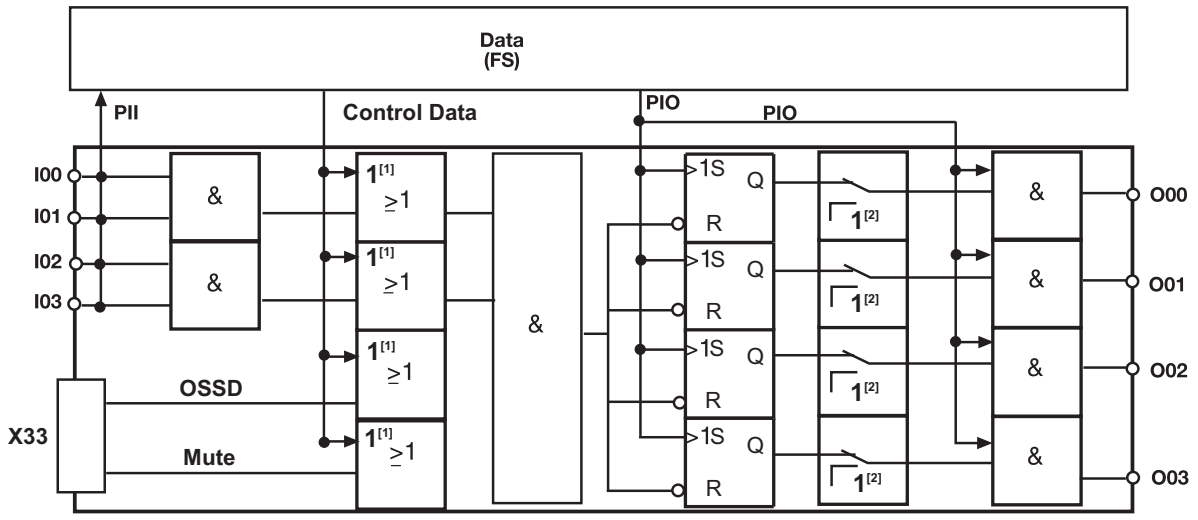
When wiring an output with capacitance it is essential to note the pulse duration, repetition period and scan time of the power-up test, otherwise the load may switch on unintentionally.

- 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.

5.5 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 [25]).



[1] Deactivate fast shutdown for inputs
[2] Deactivate fast shutdown for outputs

5.6 Reaction times with fast shutdown

The overall reaction time with fast shutdown is independent of the PSSu cycle time.

5.6.1 Reaction time after protected field is interrupted

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

5.6.2 Reaction time after signal changes at one of the input pairs

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)

5.7 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.

5.8 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

5.9 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 [📖 27].
- 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.

INFORMATION

If the input filter times are short, the module's electromagnetic immunity towards electromagnetic faults will deteriorate.

NOTICE

Signal times are only guaranteed if input pairs (I00 and I01, I02 and I03) are used.

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

5.9.1 Access to I/O data types

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 measurement field not interrup-ted, overrun not too long FALSE: Overrun measurement inactive or overrun measurement 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 not triggered the fast shutdown
		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

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 – INIT state: Start-up phase after supply voltage is switched on. The system is not yet ready for operation. 0x02 – RUN state: Normal mode. Protected field monitoring has been activated 0x03 - HALT state; minor, recoverable error 0x04 – TEST state system check 0x05 – ADJUSTMENT state: State to support alignment of the transmitter and receiver 0x06 – TOOL CHANGE: Tool adjustment during tool change 0x07 – STANDBY state: Set-up mode. Transmitter and receiver are switched off 0x08 – IDLE state: PSENvip in waiting or rest state 0x09 – Internal state 0x0A - MEASUREMENT state: Can only be requested and ended via the add-on module PSENvip IPM 0x0F - ERROR 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 [📖 30]

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: PSENvip switches from RUN to STANDBY state FALSE: PSENvip switches from STANDBY to RUN state
		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 [📖 30]
		PressCycleState: SAFEBYTE	The user program sends the current press status TRUE: In preparation FALSE: In preparation

5.10 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.

5.10.1 Communication of tool classes

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

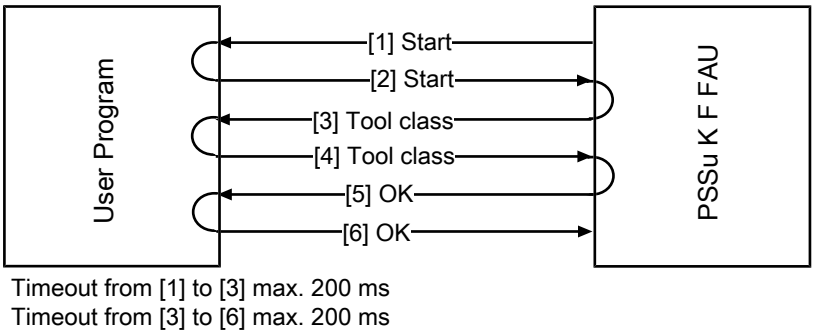
The user program sends the information about the detected tool classes to the module in the O-data type "SensorControl".

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

Value (Hex)	Meaning
0x06	The user program in the safety system starts the communication
0x10	The user program requests the tool class

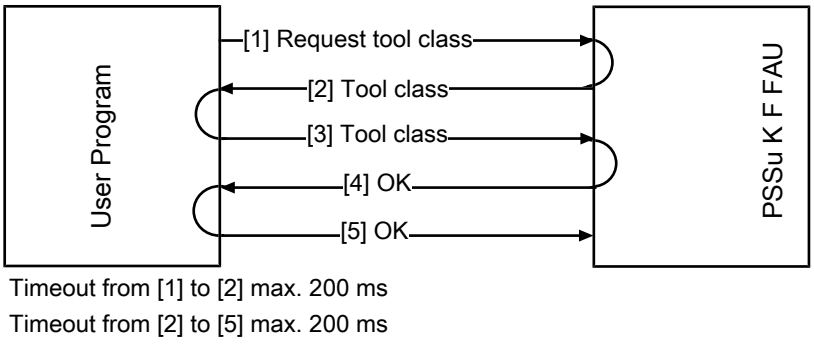
Communication sequence during adjustment after tool change or after a module reset



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.
- [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.

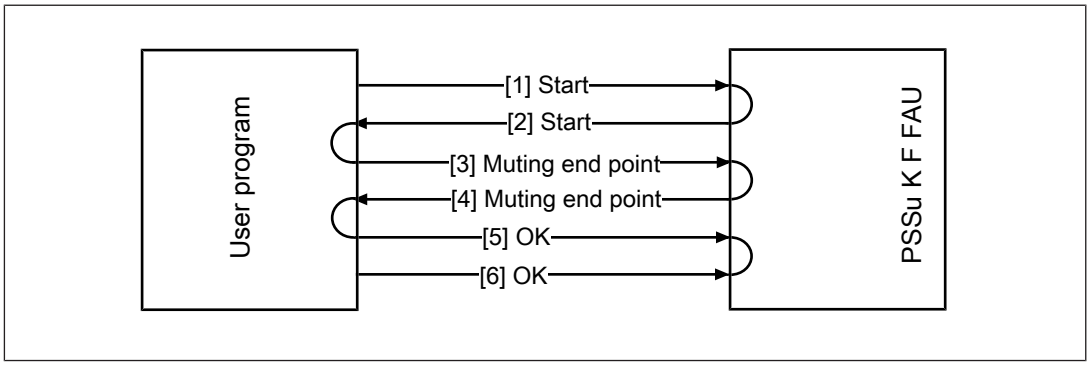
INFORMATION

The requirements of the user program in the safety system are described in the operating manual PSENvip R, PSENvip E under "System Connections".

5.10.2 Communication regarding configuration of the muting end point

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.



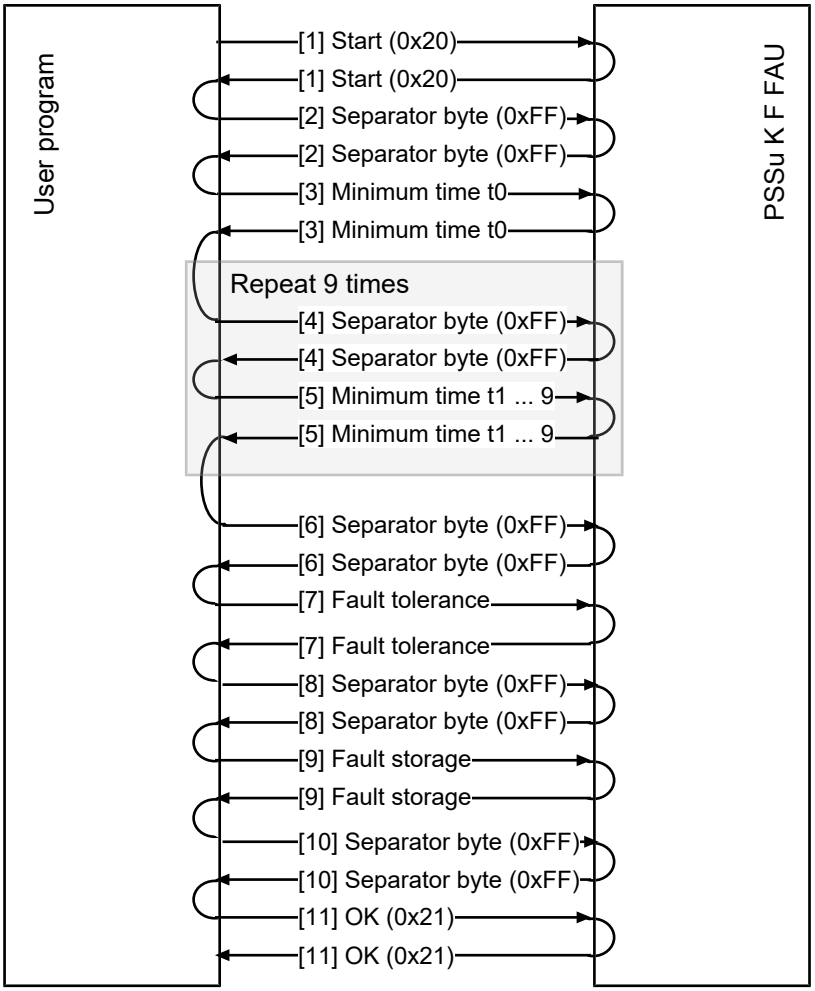
Communication sequence:

- [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.
  - 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.

5.10.3 Communication for configuration of braking ramp monitoring

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

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.

5.11 Operating states

INIT and IDLE state

The INIT and IDLE states are waiting or rest states of the PSENvip and are triggered by an inactive safety controller. PSENvip is not ready for operation in INIT and IDLE state; i.e. requests from the web interface or the add-on module PSENvip IPM will not be processed.

- Switching to INIT state after a restart

  After the supply voltage is switched on (restart), PSENvip initially switches to INIT state. PSENvip exits INIT state as soon as the safety controller signals the operating state "Device in RUN state without error". After the initialisation process and various start-up tests, PSENvip switches to RUN state, provided all devices are operating without error.

- Switching from RUN to IDLE state

  PSENvip switches from RUN state to IDLE state as soon as the safety controller is no longer in the operating state "Device in RUN state without error". This is the case, for example, when there is an error, after a reboot command, stop command, reset command or when downloading a PSS 4000 user program.

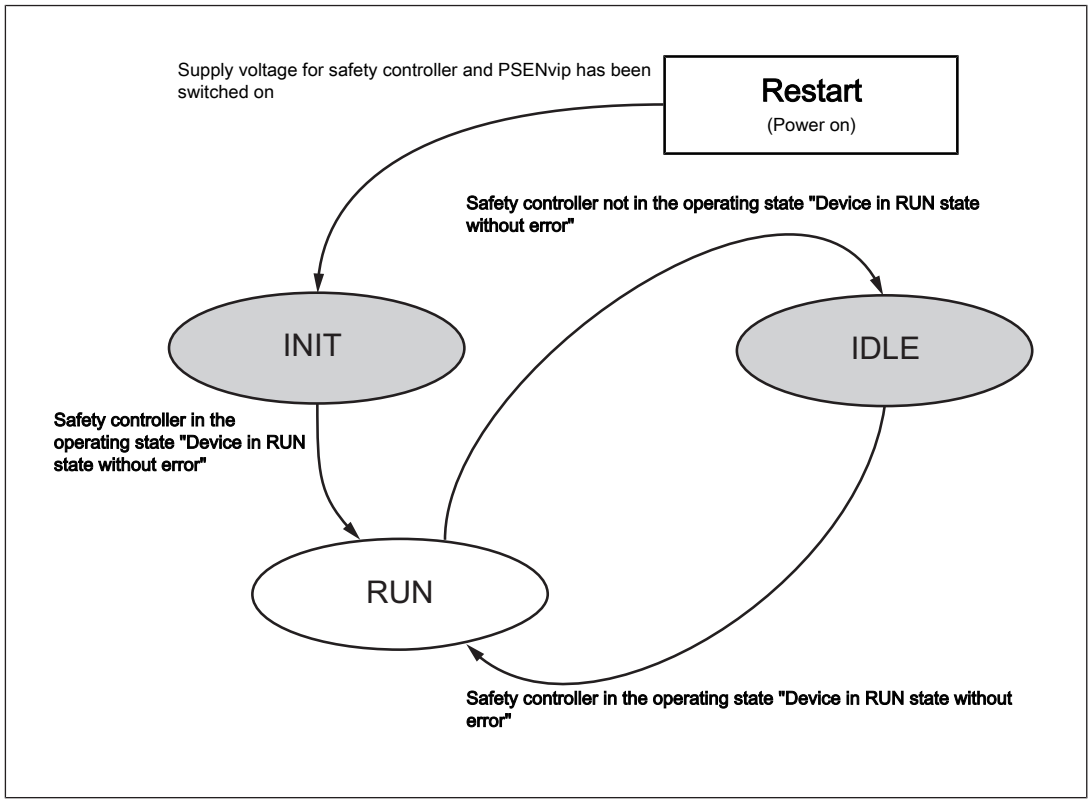


Fig.: INIT and IDLE state

RUN state

RUN state on the PSENvip corresponds to normal mode or productive mode. "Normal mode" or "Productive mode" is the operating mode in which a plant/machine performs its intended function; i.e. PSENvip is in protected field monitoring mode.
PSENvip switches to RUN state when all devices are operating without error; i.e. safety controller with special module, PSENvip E and PSENvip R are each in their respective RUN state and are operating without error.
While PSENvip is in RUN state it is possible to request all the other operating states.

RUN state is achieved under the following conditions:

- Switching from INIT or IDLE to RUN state

  PSENvip exits INIT or IDLE state as soon as the safety controller signals the operating state "Device in RUN state without error" (see INIT and IDLE state). After the initialisation process and various start-up tests, PSENvip switches to RUN state, provided all devices are operating without error.
- Switching from one of the other operating states to RUN state

  In one of the other operating states, PSENvip can be prompted to switch back to RUN state, depending on the operating state.

RUN state is exited under the following conditions:

- Switching to IDLE state

  The safety controller is no longer in the operating state "Device in RUN state without error" (see IDLE state).
- Switching to STANDBY state

  STANDBY state can be requested via the PSS 4000 user program (see STANDBY state).
- Switching to ADJUSTMENT state

  Users can request ADJUSTMENT state via the web interface (see ADJUSTMENT state).
- Switching to TOOL CHANGE state

  Users can request TOOL CHANGE state via the web interface (see TOOL CHANGE state).
- Switching to MEASUREMENT state

  MEASUREMENT state can only be requested via the add-on module PSENvip IPM (see MEASUREMENT state).
- Switching to HALT state

  In the event of a minor error, PSENvip automatically switches to HALT state (see HALT state).
- Switching to ERROR state

  In the event of a major error, PSENvip automatically switches to ERROR state (see ERROR state).

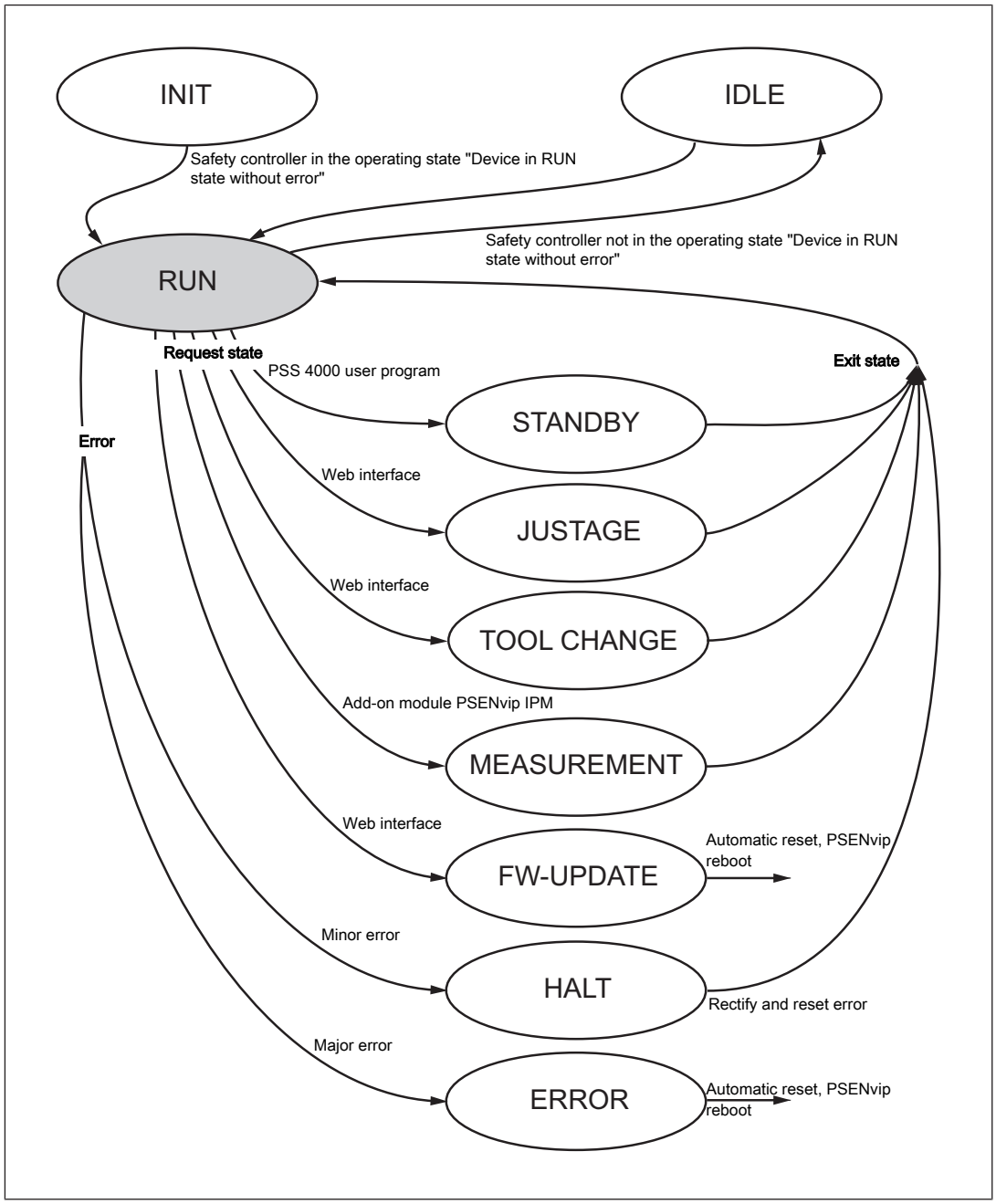


Fig.: RUN state

STANDBY state

PSENvip's STANDBY state can be requested via the PSS 4000 user program on the safety controller. The output data type ***PowerOffTransmitter*** is available on the special module PSSu K F FAU P for this purpose. STANDBY state is needed for PSENvip's setup mode. It is also used to enable the receiver to be disconnected / connected in tandem mode. PSENvip is inactive in STANDBY state and the transmitter and receiver are switched off (power removed). STANDBY state can be requested during all of PSENvip's operating states. STANDBY state can be ended either via the output data type ***PowerOffTransmitter*** or via an operating state with higher priority (e.g. HALT state, ERROR state, IDLE state due to ending the operating state "Device in RUN state without error" on the safety controller).

NOTICE

If PSENvip is in STANDBY state, the press is prevented from operating in normal mode or productive mode. So for efficient operation, the time at which STANDBY state is requested must be tailored to the operations of the press.

In STANDBY state, PSENvip will not process the following requests:

- Switching to MEASUREMENT state (request via the add-on module PSENvip IPM)
- Switching to ADJUSTMENT state (request via the web interface)

  The ***Adjustment*** option is deactivated in the web interface.
- Switching to TOOL CHANGE state (request via the web interface)

  The***Tool Change*** option is deactivated in the web interface.
- Firmware update (request via the web interface)

  The firmware update option is deactivated in the web interface.

The PSS 4000 user program requests/exits STANDBY state via the special module PSSu K F FAU P as follows:

- ***PowerOffTransmitter***=TRUE

  PSENvip switches from RUN to STANDBY state.
- ***PowerOffTransmitter***=FALSE

  PSENvip switches from STANDBY to RUN state.

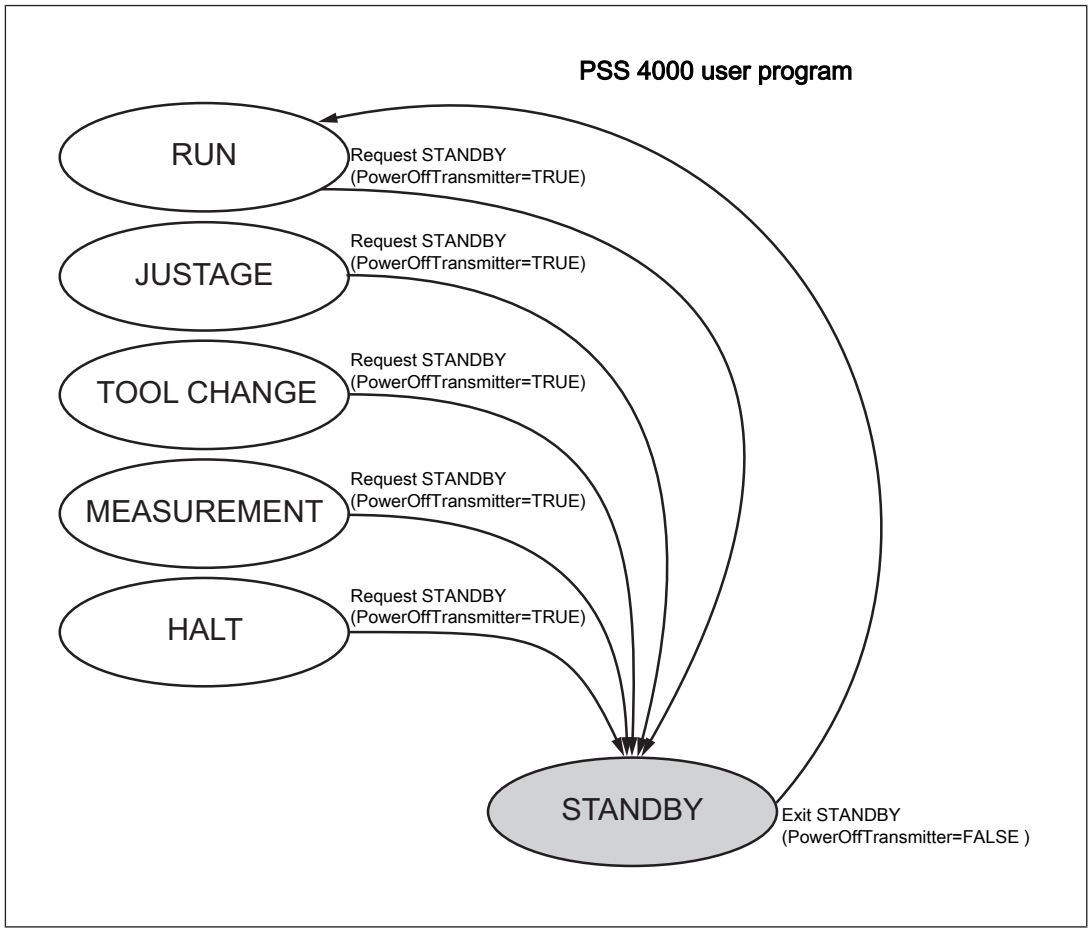


Fig.: Request/exit STANDBY state

ADJUSTMENT state

Users can request ADJUSTMENT state via the web interface (see web interface: ***Adjustment***). In ADJUSTMENT state users can adjust the tool during initial commissioning and tool change. ADJUSTMENT state can be ended either via the web interface or via an operating state with higher priority (e.g. requesting STANDBY state via the PSS 4000 user program, HALT state, ERROR state, IDLE state due to ending the operating state "Device in RUN state without error" on the safety controller).

In ADJUSTMENT state, PSENvip will not process the following requests:

- Switching to MEASUREMENT state (request via the add-on module PSENvip IPM)
- Firmware update (request via the web interface)

  The firmware update option is deactivated in the web interface.

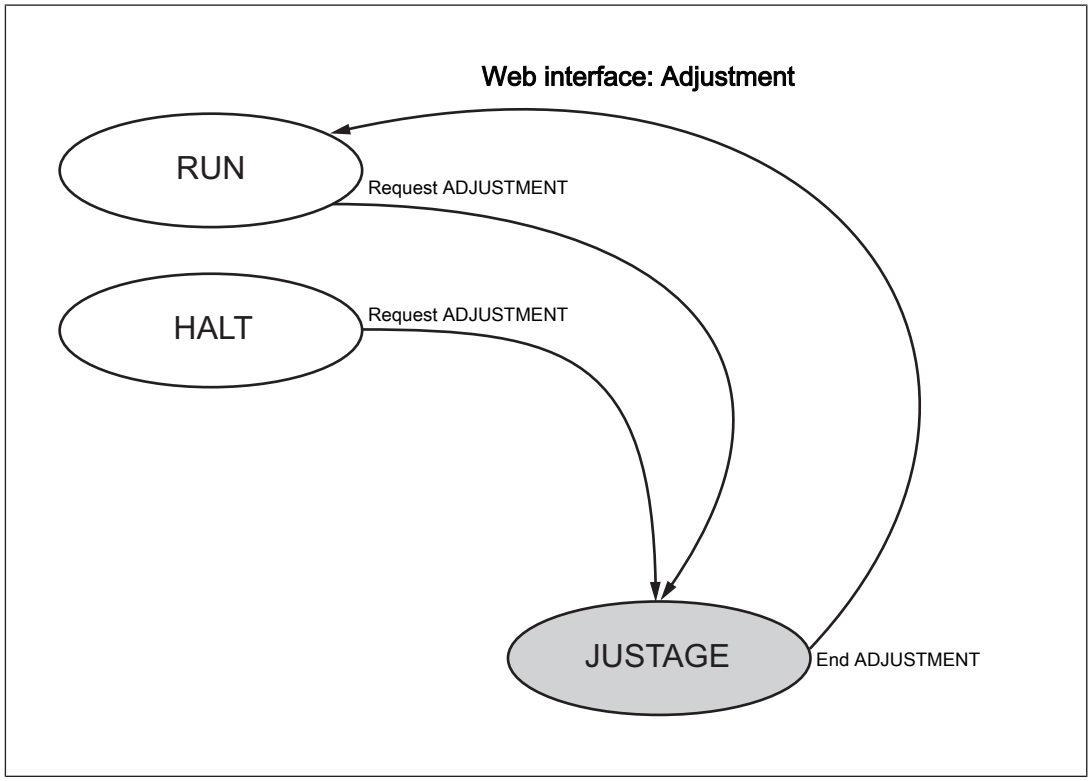


Fig.: Request/end ADJUSTMENT state

TOOL CHANGE state

Users can request TOOL CHANGE state via the web interface (see web interface: ***Tool Change***). In TOOL CHANGE state the tool contour is identified and a tool class assigned. TOOL CHANGE state can be ended either via the web interface or via an operating state with higher priority (e.g. requesting STANDBY state via the PSS 4000 user program, HALT state, ERROR state, IDLE state due to ending the operating state "Device in RUN state without error" on the safety controller).

In TOOL CHANGE state, PSENvip will not process the following requests:

- Switching to MEASUREMENT state (request via the add-on module PSENvip IPM)
- Firmware update (request via the web interface)

  The firmware update option is deactivated in the web interface.

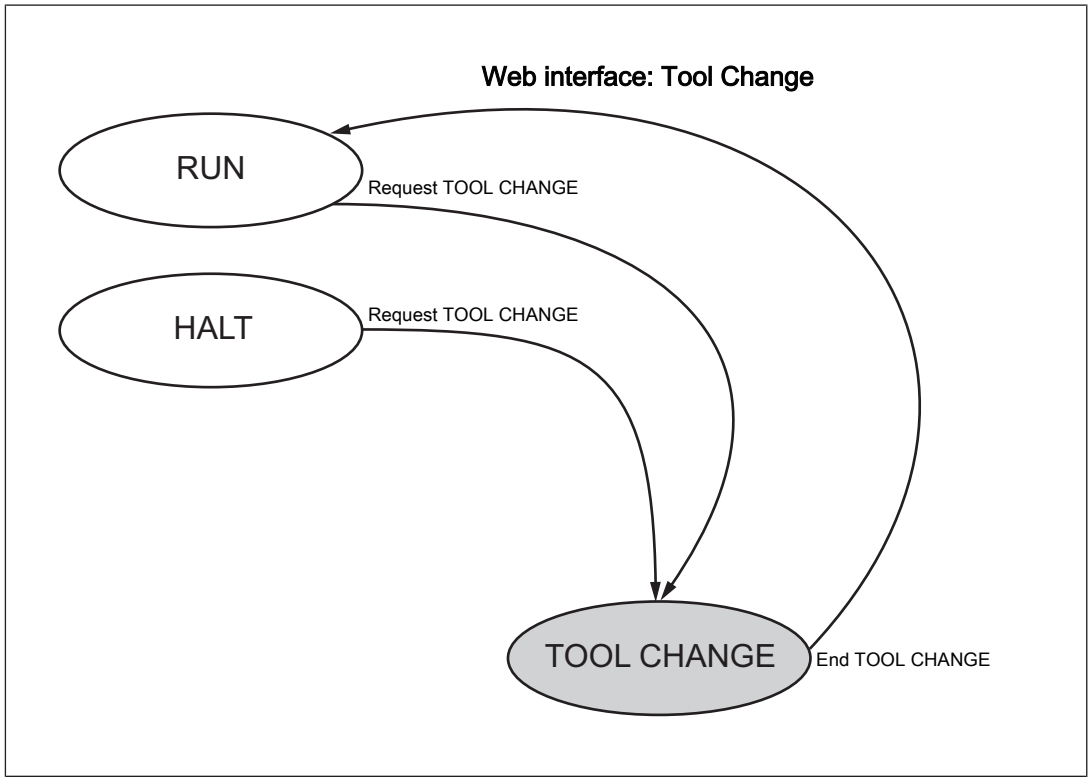


Fig.: Request/end TOOL CHANGE state

MEASUREMENT state

MEASUREMENT mode can only be requested and ended via the add-on module PSENvip IPM. The request to switch to measurement mode or to end measurement mode must be sent to the special module PSENvip IPM by the press controller.

- Switching to MEASUREMENT state

  It is only possible to switch to MEASUREMENT state when PSENvip is in RUN state. The press controller sends the command to start measurement mode to the add-on module PSENvip IPM. The start command causes PSENvip to switch from RUN state to MEASUREMENT state.

  In MEASUREMENT state it is not possible to switch to ADJUSTMENT state and TOOL CHANGE state (web interface). The ***Adjustment*** and ***Tool Change*** options are deactivated in the web interface. Other requests are possible, but MEASUREMENT state will be ended as a result.

- End MEASUREMENT state

  The press controller sends the command to stop measurement mode to the add-on module PSENvip IPM. The stop command causes PSENvip to switch from MEASUREMENT state to RUN state.
  MEASUREMENT state can also be ended via an operating state with higher priority (e.g. requesting STANDBY state via the PSS 4000 user program, ERROR state, IDLE state due to ending the operating state "Device in RUN state without error" on the safety controller).

NOTICE

If PSENvip is in MEASUREMENT state, the press is prevented from operating in normal mode or productive mode. So for efficient operation, the time at which measurement mode is requested must be tailored to the operations of the press.

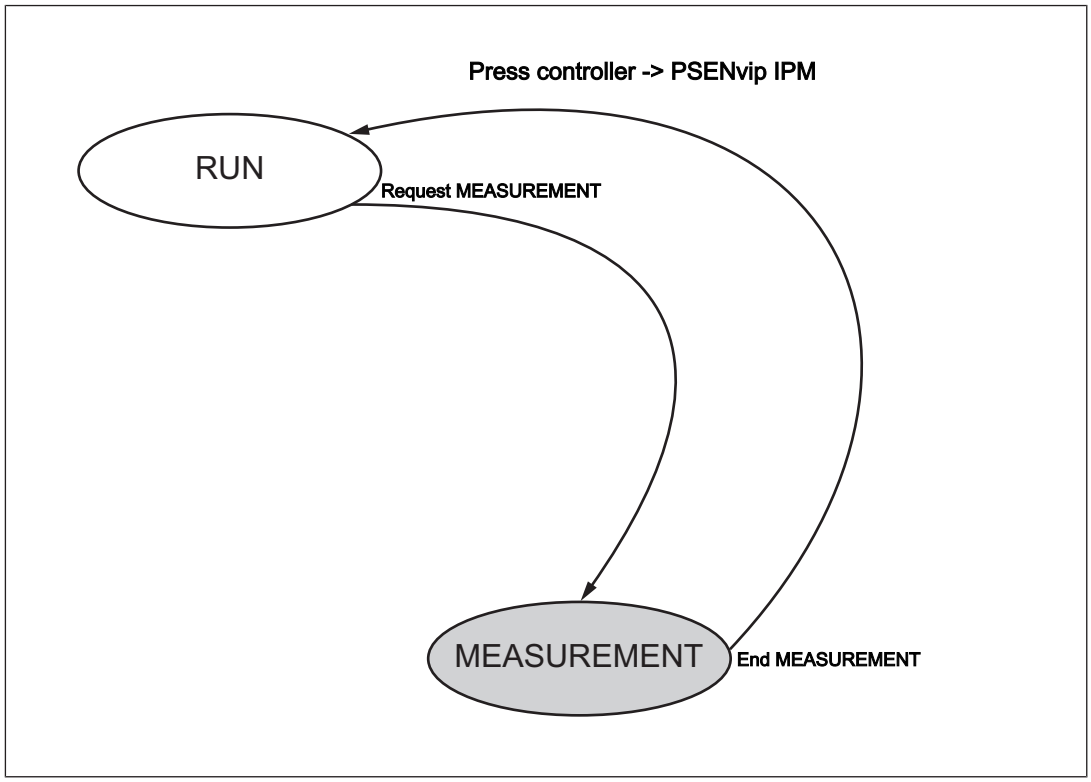


Fig.: Request/end MEASUREMENT state

FW-UPDATE state

Users can transfer the PSENvip to the operating state "FW-Update" via the web interface (see web interface: ***Settings -> Update***). In this operating state the PSENvip firmware is updated. PSENvip exits this operating state automatically when the update is either executed without error or is aborted with an error:

- Firmware has been updated without error

  PSENvip is reset automatically. PSENvip is rebooted with initialisation and self-test.

- Firmware update is aborted with a major error

  See ERROR state

In FW-UPDATE state, PSENvip will not process any requests.

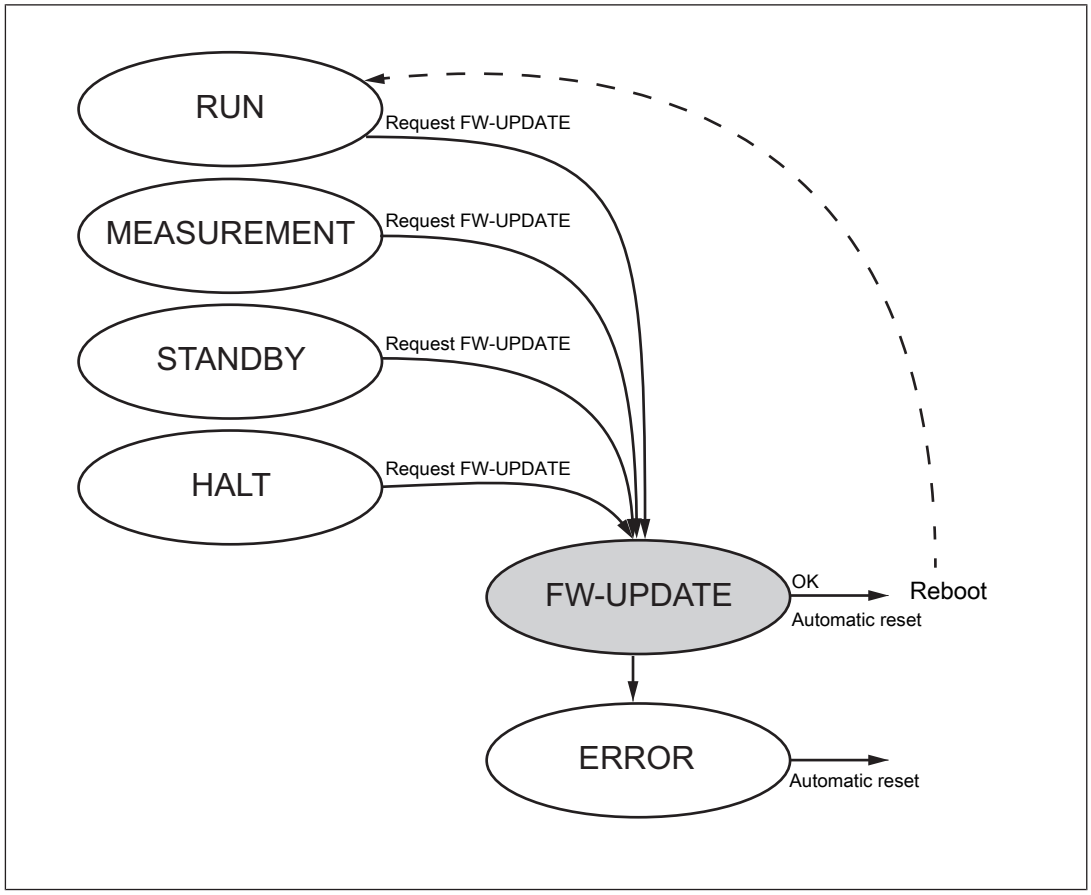


Fig.: Request/exit FW-UPDATE state

HALT state

HALT state is an error state that PSENvip assumes automatically when there is a recoverable error (see chapter entitled "Diagnostics and troubleshooting" in the PSENvip operating manual). The error is displayed via the web interface. To exit HALT state, the error must first be rectified and then reset via the web interface. As the result of the reset PSENvip switches to a RUN state.

Note:

- An error on the safety controller PSS 4000 will cause the safety controller to exit the operating state "Device in RUN state without error" (see description of the operating states in the PSS 4000 System Description). PSENvip then switches to IDLE state.
- Errors on the special module PSSu K F FAU are handled on the safety controller (see operating manual PSSu K F FAU B, PSSu K F FAU P).

In HALT state the PSENvip will not process a request to switch to MEASUREMENT state. Other requests are possible in HALT state, with the result that HALT state is exited. However, if the error has not been rectified beforehand, then PSENvip will immediately and automatically switch back to HALT state.

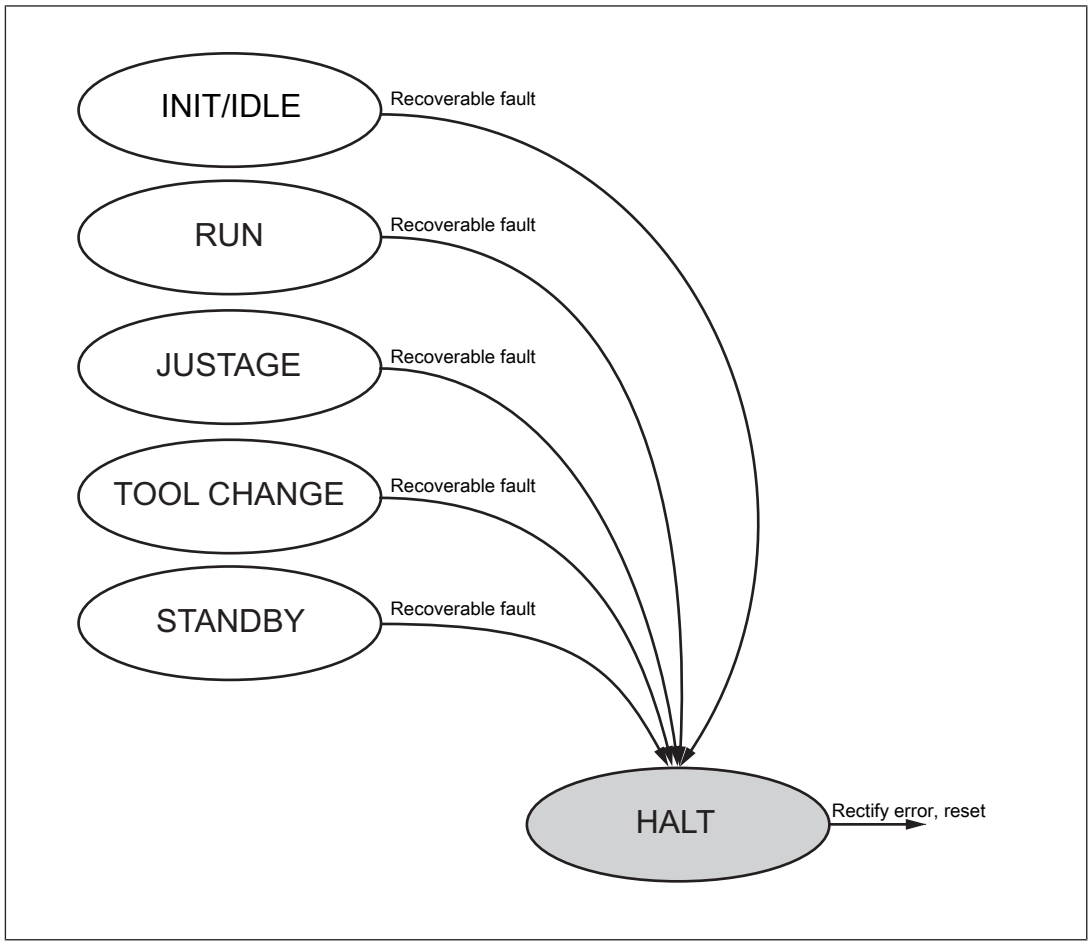


Fig.: HALT state

ERROR state

If a major error occurs in an operating state, PSENvip automatically switches to ERROR state (see chapter entitled "Diagnostics and troubleshooting" in the PSENvip operating manual). After a major error, PSENvip is automatically restarted (reboot). The reboot is carried out up to 3 times. If the error is still present afterwards, PSENvip remains switched off. The error is displayed via the web interface (if possible) and is reported to the diagnostics on the safety controller.

Note:

- A major error on the safety controller PSS 4000 will cause the safety controller to exit the operating state "Device in RUN state without error" (see description of the operating states in the PSS 4000 System Description).
- Errors on the special module PSSu K F FAU are handled on the safety controller (see operating manual PSSu K F FAU B, PSSu K F FAU P).

No requests will be processed in ERROR state.

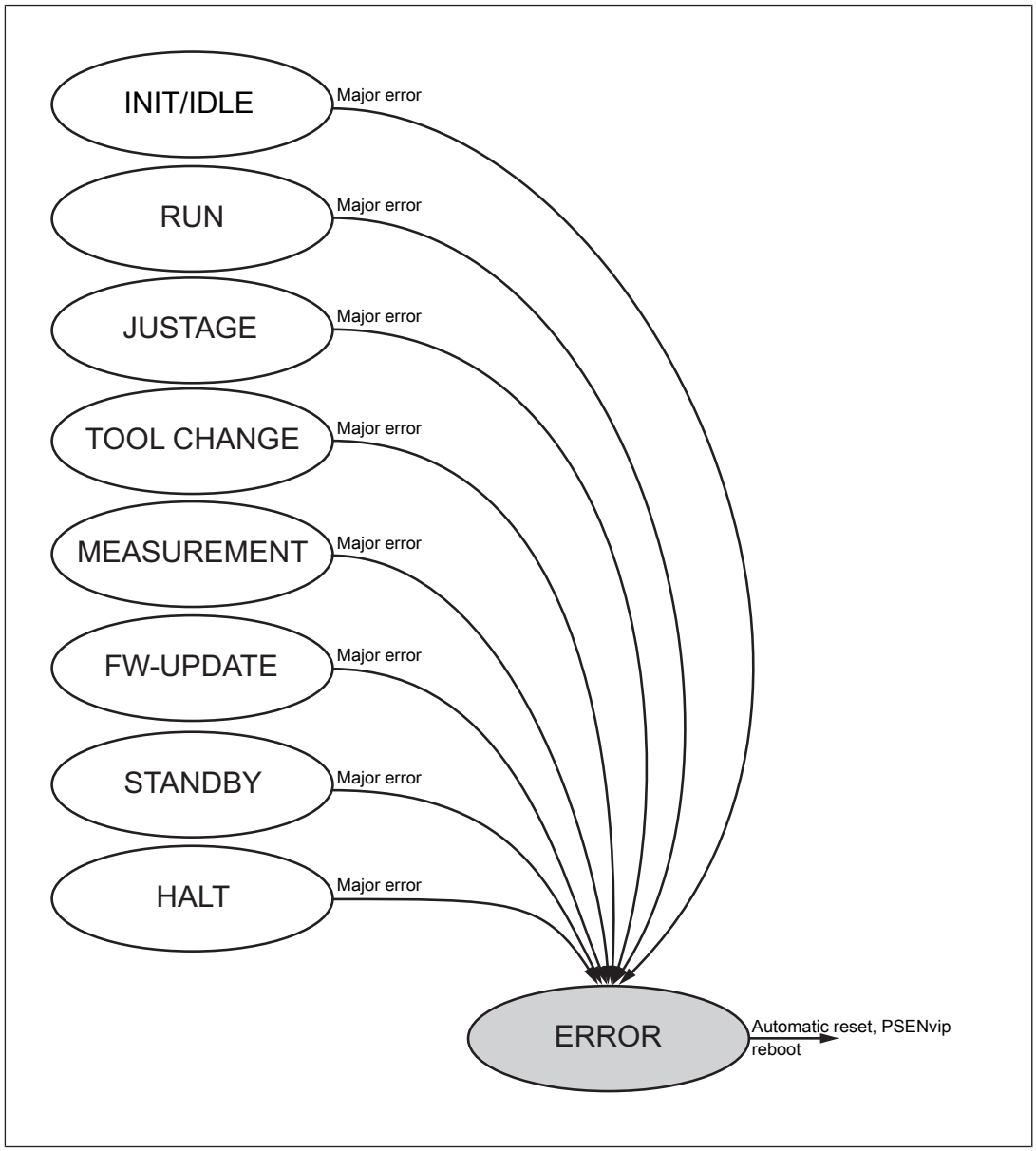


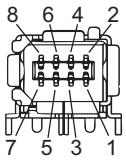
Fig.: ERROR state

6 Interfaces

6.1 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

6.2 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.

6.3 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.

INFORMATION

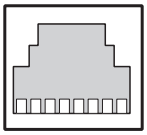
The connected subscribers must support the autosensing/autonegotiation function. If not, the communication partner must be set permanently to "10 Mbit/s, half duplex".

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.

7 Installation

7.1 General installation guidelines

Please refer also to the PSSuniversal Installation Manual.

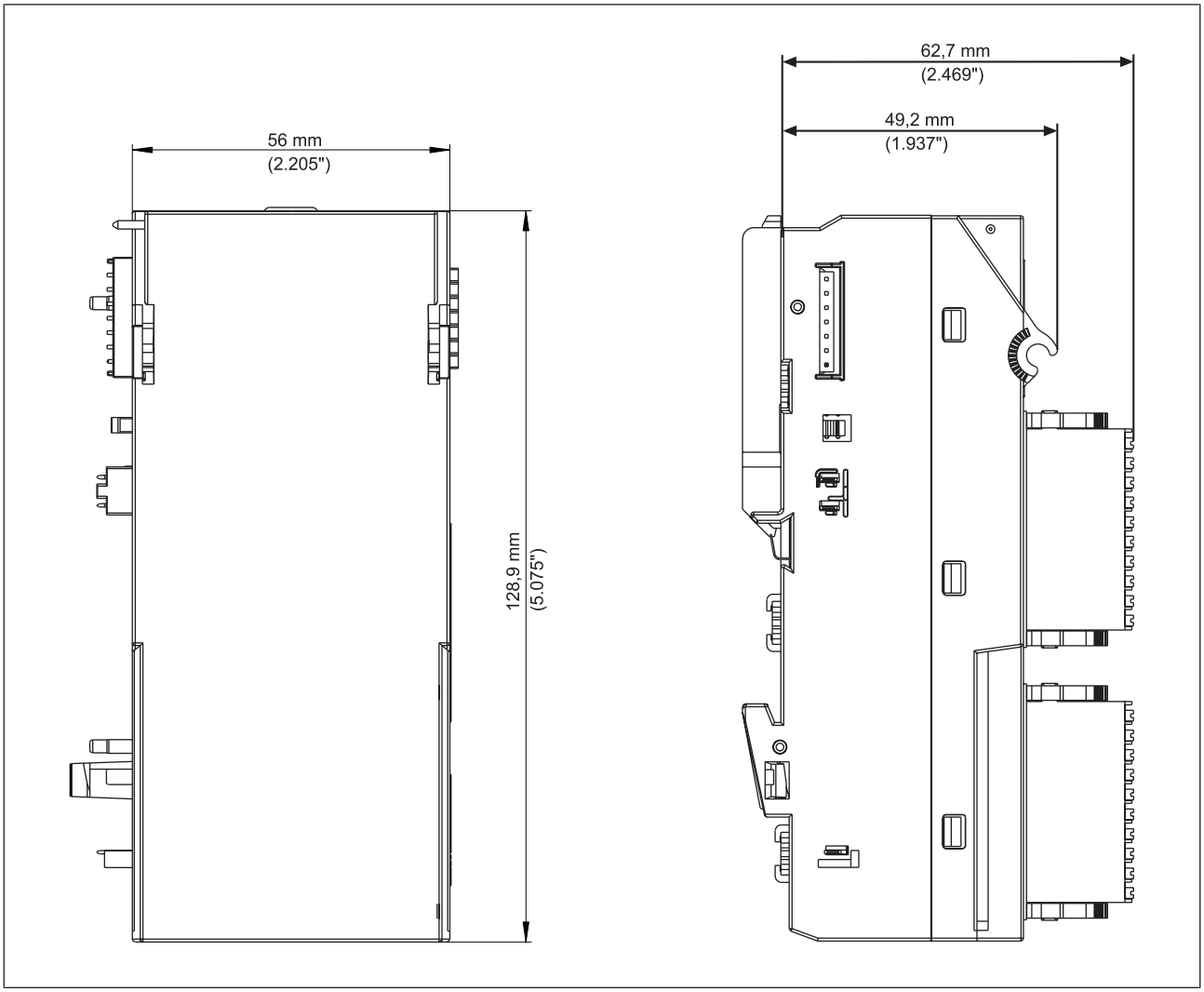
NOTICE

Damage due to electrostatic discharge!

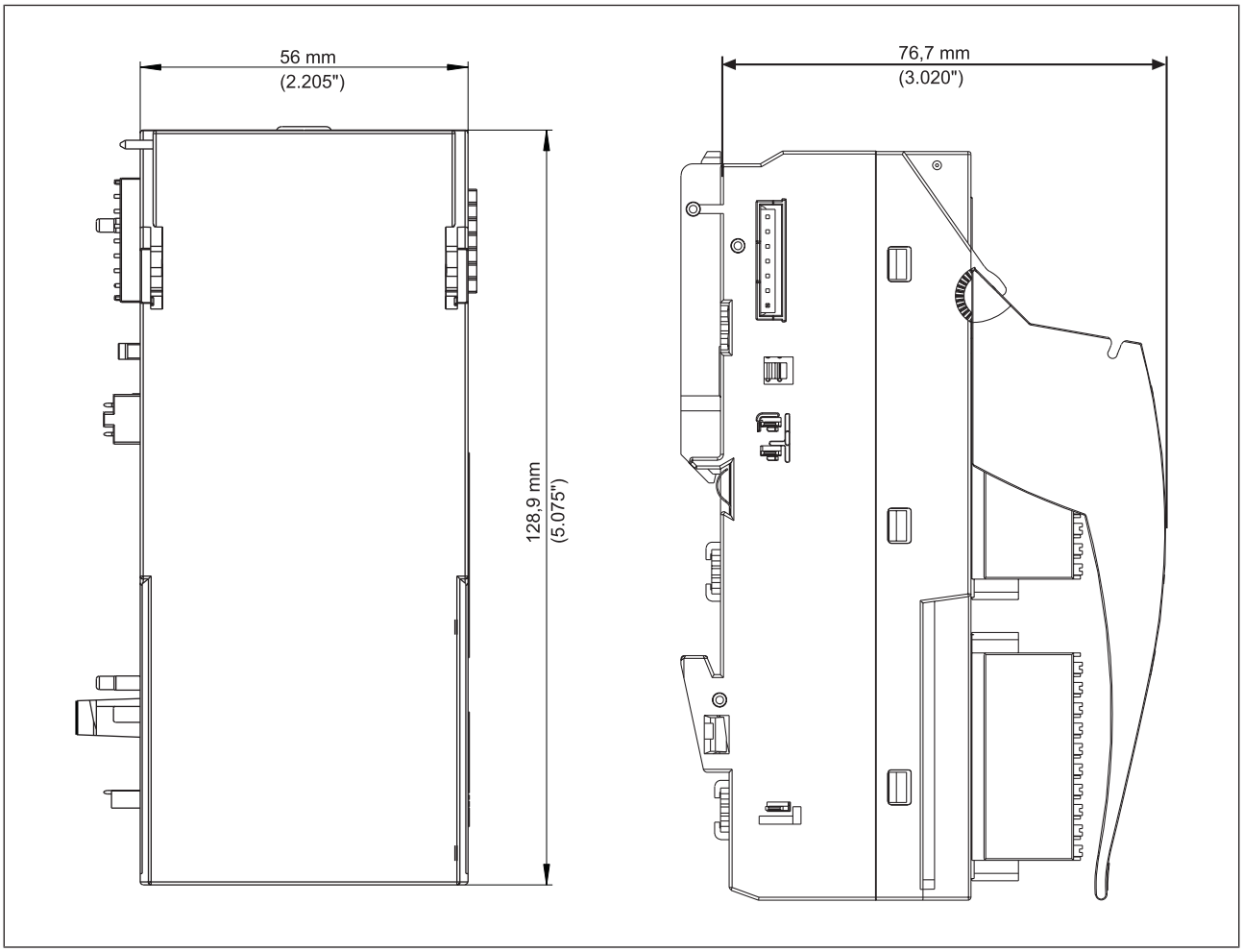
Electrostatic discharge can damage components. Ensure against discharge before touching the product, e.g. by touching an earthed, conductive surface or by wearing an earthed armband.

7.1.1 Dimensions

Module with connector:



Module with connector and labelling bracket:



7.2 Install compact module

Prerequisite:

- The head module must be installed.
- If the head module does not have an integrated power supply, a supply voltage module must be installed to the right of the head module.
- A base module with screw terminals may not be installed to the left of the compact module.

Please note:

- All contacts should be protected from contamination.
- The mechanics of the compact modules are designed for 50 plug in/out cycles.

Procedure:

- Slot the groove on the compact module on to the mounting rail from below [1].
- Push the compact module back as far as it will go [2].
- Make sure that the locking mechanism [3] is pushed downwards, connecting the module firmly to the mounting rail.
- On the mounting rail, slide the compact module to the left.

NOTICE

Potential contact damage due to twisting!

The contacts for the Module Supply and Periphery Supply can be bent by twisting the compact modules on the mounting rail.

– On the mounting rail, carefully slide the compact module to the left, in parallel to the adjoining module, until you hear the lateral mounting hooks on the adjacent module lock into position [4].

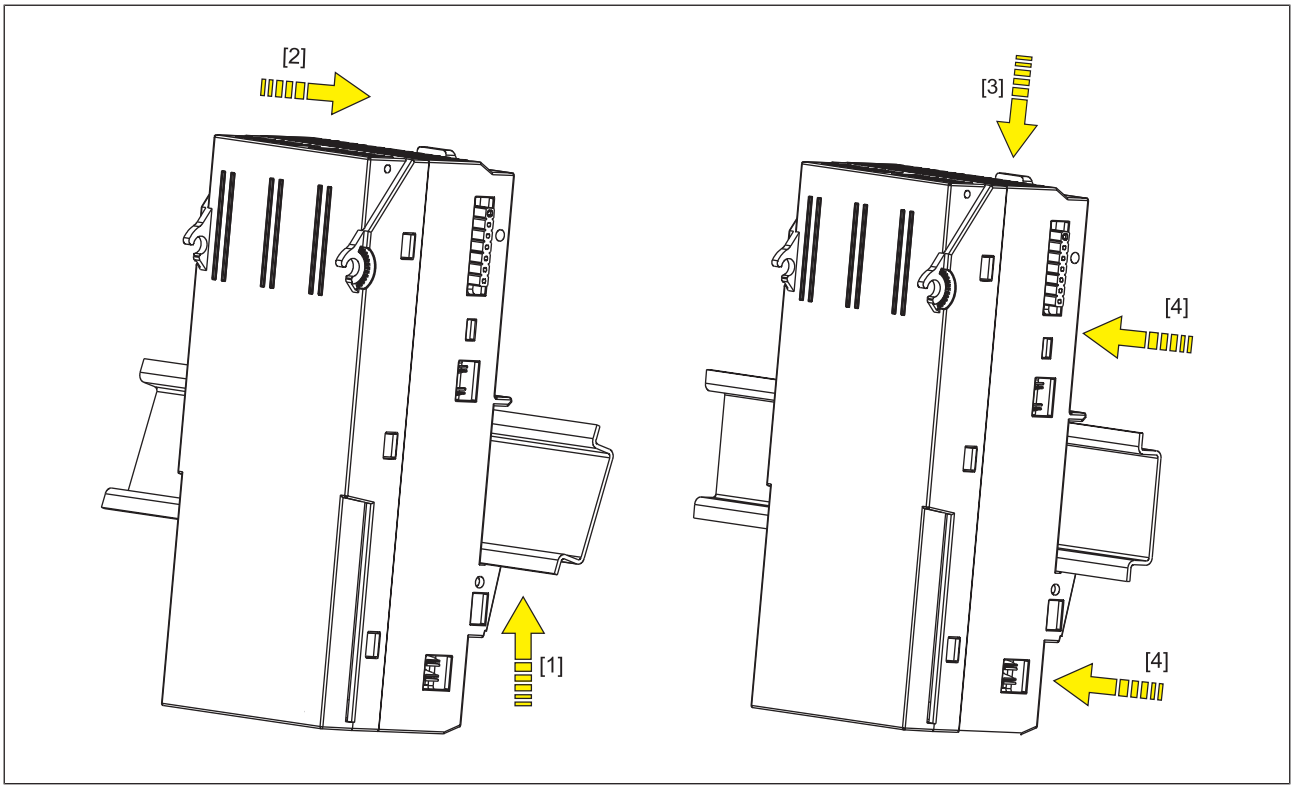


Fig.: Install compact module

7.3 Install/uninstall connector

We recommend that the connectors with spring-loaded terminals are wired before they are plugged in.

Please note:

- All contacts should be protected from contamination.
- The mechanics of the connector are designed for 25 plug in/out cycles.

Installation procedure:

- Plug the connector into the required connector strip until you hear it lock into position [1].

INFORMATION

The two locking levers automatically hook into place when plugged in. As a result the connector is firmly connected to the module.

Uninstallation procedure:

- Push both locking levers to the left, as far as they will go [1].

INFORMATION

This will automatically lift the connector, which can then be removed from the module.

NOTICE

As you remove the connector, grasp the connector housing and not the cable harness.

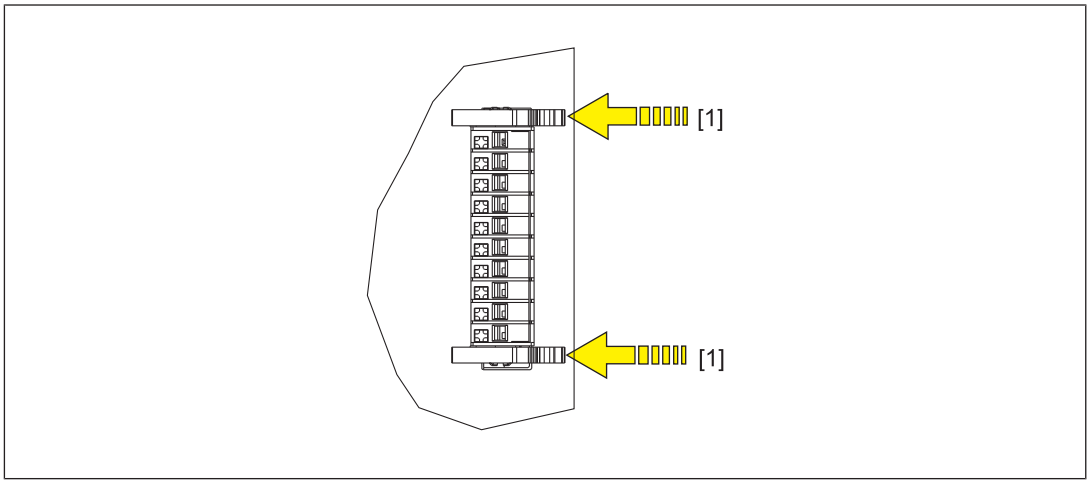


Fig.: Install/uninstall connector

8 Wiring

8.1 General wiring guidelines

Please note:

- The sensors and actuators may be connected using unshielded cables.
- The outputs do not need suppression for inductive loads.
- Use copper wiring
- Use Pilz pre-assembled cable to connect the module to the receiver
- Use shielded cables to connect the module to the transmitter. The shield should be connected to a shielded terminal in the control cabinet.

8.2 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

8.3 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].

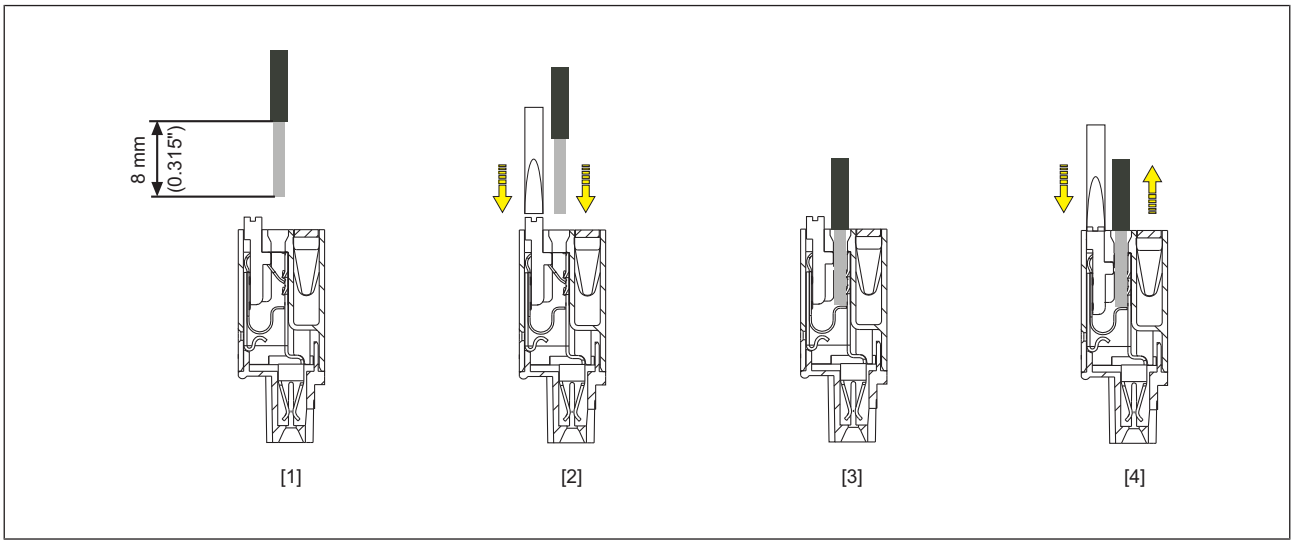
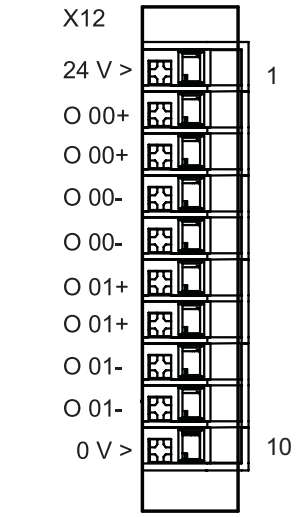
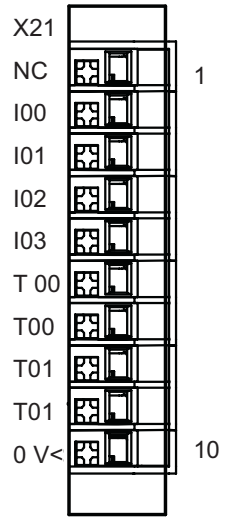
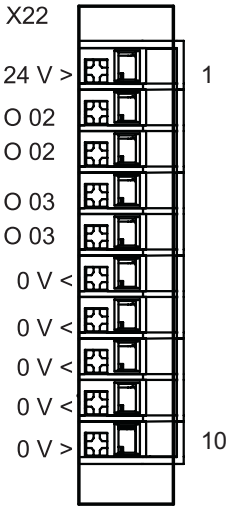
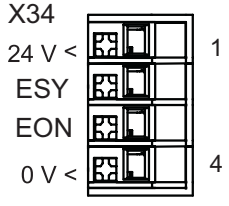


Fig.: Connect and disconnect the cables

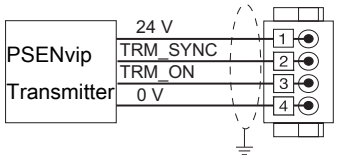
8.4 Terminal configuration

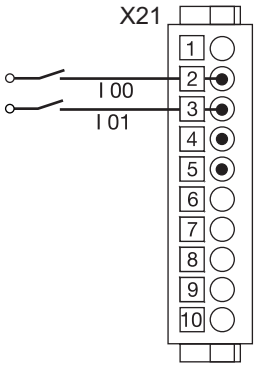
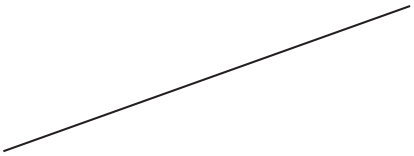
Pin assignment of connector with spring-loaded terminals (1-row/10-pin): PSSu A Con 1/10 C	
X12: 24 V: +24 V (external periphery supply) O 00+: Output 1, dual-pole positive-switching O 00+: Output 1, dual-pole positive-switching O 00-: Output 1, dual-pole negative-switching O 00-: Output 1, dual-pole 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)	

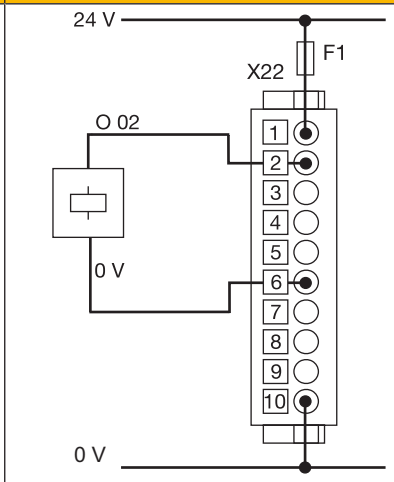
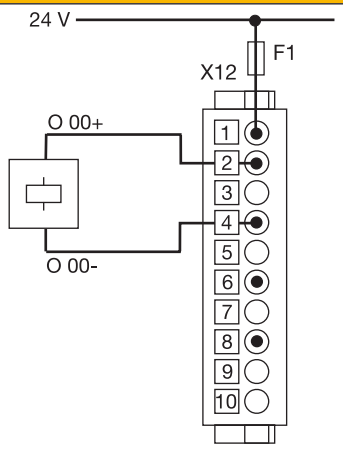
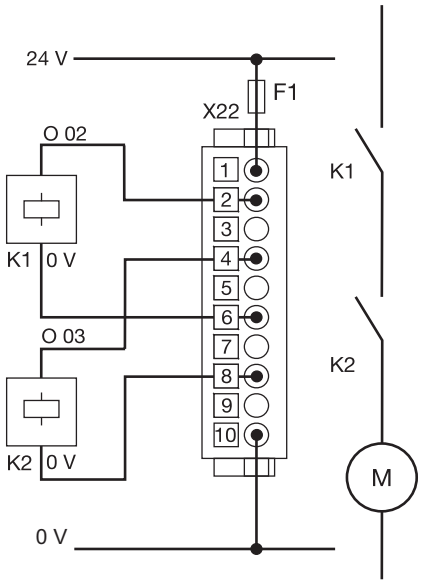
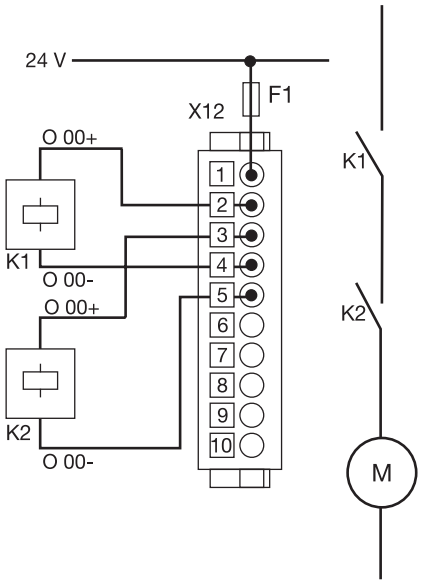
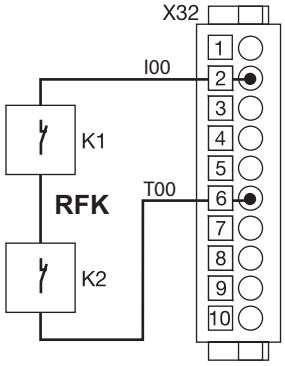
Pin assignment of connector with spring-loaded terminals (1-row/10-pin): PSSu A Con 1/10 C	
X21: n.c.: not connected I 00: Input 0 I 01: Input 1 I 02: Input 2 I 03: Input 3 T 00: Test pulse output T0 or +24 V output (periphery supply) T 00: Test pulse output T0 or +24 V output (periphery supply) T 01: 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)	
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)	

8.5 Connecting the module

Interface to transmitter	
	

Input circuit for fast shutdown		
Foot switch, light beam devices		

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.

8.6 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.

INFORMATION

The short circuit test must be performed on the load and not on the output terminal.

9 Operation

INFORMATION

During commissioning of a PSENvip with a **new receiver**, data are transferred between the receiver and the special module PSSu K F FAU. The transfer of data leads to two restarts of the special module an to a fault on the control system PSSu PLC. The "DIAG" LED on the system's head module flashes red.

Procedure:

– Wait until the data have been transferred and loaded.
  The LEDs "ON" and "RUN" on the special module light up green.
  Furthermore, the LED "PROT" lights up green or the LED "HALT" lights up red on the special module.
– Restart the control system.

9.1 Messages

A module error is displayed via the "Err" LED, signalled to the head module and then entered in the head module's diagnostic log.

The module can detect the following errors:

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.
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.
Temperature error: too warm	Ambient temperature too high: Error stack entry/diagnostic log entry	Ensure there is sufficient ventilation in the control cabinet or prevent overload.
Input error	Error during the cyclical input test. Possible cause: Input defective.	Change faulty module.
Output error	Error during cyclical output test for short circuit. Possible causes: Short circuit, or output defective. Open circuit detected on dual-pole outputs.	Rectify the open circuit, short circuit or change the faulty module.

Module error	Statement	Remedy
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.

9.2 Display elements

Legend

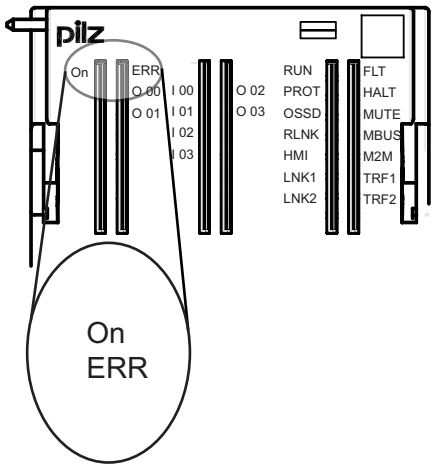
☼ LED on

◐ LED flashes

● LED off

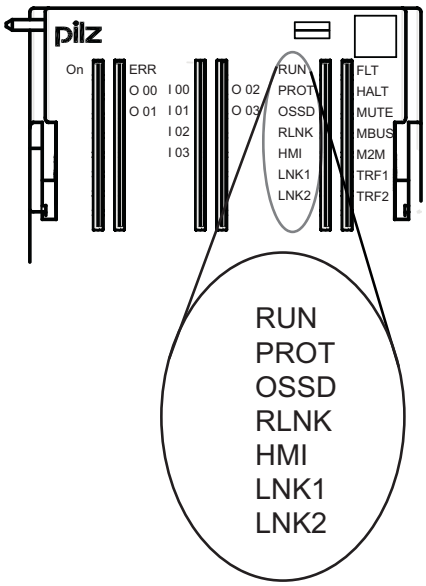
9.2.1 Display elements for module diagnostics

The module has an LED for displaying operating states ("On" LED) and module errors ("Err" LED).

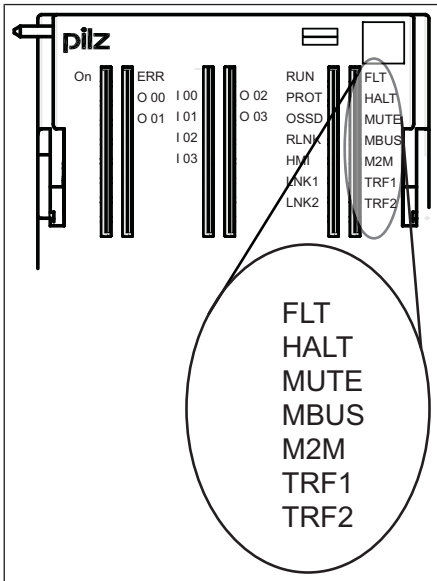


LED			Meaning
Designation	Colour	Status	
On	- - -	●	Module is not in operation
	Green	☼	Module in operation
Err	- - -	●	No error
	Red	☼	Module is faulty
	Red	◐	External error on the inputs/outputs or in the supply voltage for the periphery supply

The module has 14 LEDs to display the status of the PSENvip interface (further information on diagnostics is available in the operating manual "PSENvip-2", under "Troubleshooting and diagnostics".



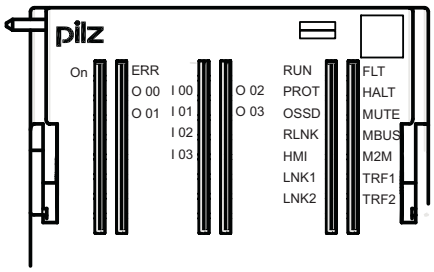
LED			Meaning
Designation	Colour	Status	
RUN	- - -	●	PSENvip part of the module not in operation
	Green	☼	PSENvip part of the module in operation
PROT	- - -	●	Protected field monitoring inactive
	Green	☼	Protected field monitoring active
OSSD	- - -	●	Protected field monitoring inactive or protected field interrupted
	Green	☼	Protected field monitoring active and protected field clear
RLNK	- - -	●	No connection to receiver
	Green	☼	Connection to receiver active
HMI	- - -	●	No operator logged into the system
	Green	☼	Operator logged into the system
LNK1/2	- - -	●	Network connection via the interface ETH1/2 inactive
	Green	☼	Network connection active via the interface ETH1/2



LED			Meaning
Designation	Colour	Status	
FLT	- - -	●	No fault
	Red	☼	PSENvip part faulty
HALT	- - -	●	No STOP status, start-up, error, protected field monitoring
	Red	☼	0x03 - STOP status; minor, recoverable error
MUTE (PSSu K F FAU P only)	- - -	●	Protected field monitoring inactive / dynamic muting active
	Green	☼	Protected field monitoring active and no dynamic muting active
MBUS	- - -	●	No data connection
	Green	☼	Data connection to head module active
M2M	- - -	●	Ethernet communication with the CNC inactive
	Green	☼	Ethernet communication with the CNC active
TRF1/2	- - -	●	No data traffic
	Green	☼	Data traffic is error-free

9.2.2 Display elements for input and output status

Each input and output is assigned an LED to display the status



LED			Meaning	
Designation	Colour	Status	Signal	Output
O00	- - -	●	0 signal	dual-pole O00+
O01	Green	☼	1 signal	O 01+
O02	- - -	●	0 signal	Single-pole O 02
O03	Green	☼	1 signal	O03
Designation	Colour	Status	Signal	Input
I00	- - -	●	0 signal	With fast shutdown
I04	Green	☼	1 signal	

10 Technical details

Where standards are undated, the 2022-01 valid editions apply.

General	312420	312421
Certifications	**CE, EAC, TIIS, TÜV, UKCA, UL Listed, cULus Listed**	**CE, EAC, TIIS, TÜV, UKCA, UL Listed, cULus Listed**
Application range	**Failsafe**	**Failsafe**
Module's device code	**0F23**	**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**
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**

Electrical data	312420	312421
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**
Quantity	**4**	**4**
Quantity	**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**
Output	**O0 ... O3**	**O0 ... O3**
Number of positive-switching single-pole semiconductor outputs	**2**	**2**
Voltage	**24 V**	**24 V**
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**

Semiconductor outputs	312420	312421
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 loads	**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**
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	**EN 61131-2**	**EN 61131-2**

Times	312420	312421
Max. reaction time of fast shutdown when signal changes from "1" to "0"	**0,45 - 3,55 ms**	**0,45 - 3,55 ms**
Max. reaction time of fast shutdown when signal changes from "0" to "1"	**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 SL	**2000 m**	**2000 m**
EMC	**EN 61000-6-2, EN 61000-6-4, EN 61131-2 (Zone B)**	**EN 61000-6-2, EN 61000-6-4, EN 61131-2 (Zone B)**
Vibration		
in accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 150 Hz**	**10 - 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	**150 m/s²**	**150 m/s²**
Duration	**11 ms**	**11 ms**
Airgap creepage		
in accordance with the standard	**EN 61131-2**	**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**
Mechanical data	**312420**	**312421**
Mounting position	**vertical**	**vertical**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**

Mechanical data	312420	312421
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**

10.1 Safety characteristic data

NOTICE

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

Unit	Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN IEC 62061 SIL CL/ max. SIL	EN IEC 62061 61508 PFH_D [1/h]	EN/IEC 61511 61508 SIL	EN/IEC 61511 61508 PFD	EN ISO 13849-1: 2015 T_M [year]
Logic								
Logic	–	**PL e**	**Cat. 4**	**SIL CL 3**	**4,32E-10**	**SIL 3**	**3,62E-05**	**20**
Input								
Digital inputs	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**3,61E-10**	**SIL 3**	**3,04E-05**	**20**
Digital inputs	**1-ch., pulsed light barrier**	**PL e**	**Cat. 4**	**SIL CL 3**	**1,59E-09**	**SIL 3**	**1,41E-04**	**20**
Output								
SC outputs (1-pole)	**1-channel**	**PL d**	**Cat. 2**	**SIL CL 2**	**1,14E-08**	**SIL 2**	**1,00E-03**	**20**
SC outputs (1-pole)	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**2,50E-10**	**SIL 3**	**2,13E-05**	**20**
SC outputs (2-pole)	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**2,39E-10**	**SIL 3**	**2,04E-05**	**20**
Sensor								
–	–	**PL e**	**Cat. 4**	**SIL CL 3**	**3,30E-09**	**SIL 3**	**2,91E-04**	**20**

Explanatory notes for the safety-related characteristic data:

- T_M is the maximum mission time in accordance with EN ISO 13849-1. The value also applies as the retest interval in accordance with EN/IEC 61508-6 and EN/IEC 61511 and as the proof test interval and mission time in accordance with EN IEC 62061

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

INFORMATION

A safety function's SIL/PL values are **not** identical to the SIL/PL values of the units that are used and may differ from these.

11 Order reference

11.1 Product

Product type	Features	Order no.
PSSu K F FAU B	Compact module for evaluation of PSENvip, base type	312420
PSSu K F FAU P	Compact module with dynamic muting for evaluation of PSENvip, base type	312421

11.2 Accessories

Terminals

Product type	Features	Order no.
PSSu A Con 4 C	Connector with spring-loaded terminals 4pin, scope of supply: 1 piece	313118
PSSu A Con 1/10 C	Connector with spring-loaded terminals 1-row/10-pin, scope of supply: 2 pieces	313115

12 EC declaration of conformity

This product/these products meet the requirements of the directive 2006/42/EC on machinery of the European Parliament and of the Council. The complete EC Declaration of Conformity is available on the Internet at www.pilz.com/downloads.
Representative: Pilz GmbH & Co. KG, Felix-Wankel-Str. 2, 73760 Ostfildern, Germany

13 UKCA-Declaration of Conformity

This product(s) complies with following UK legislation: Supply of Machinery (Safety) Regulation 2008.
The complete UKCA Declaration of Conformity is available on the Internet at www.pilz.com/downloads.

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

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