PSSu E S 4DI-D

▷ Decentralised system PSSuniversal I/O

PILZ
THE SPIRIT OF SAFETY

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.

SD means Secure Digital

Contents

1 Introduction

1.1 Validity of documentation

This documentation is valid for the product PSSu E S 4DI-D. 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

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

2.1 Module structure

A module consists of

▸ Electronic module and

▸ Base module with

    – Screw terminals or

    – Cage clamp terminals

The base modules are the carrier units for the electronic modules and are used to connect the field wiring. The electronic modules are inserted on to the base modules and determine the module's function.

Details of the base modules that can be used are available in the chapter entitled "Intended Use".

2.2 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

2.3 Front view
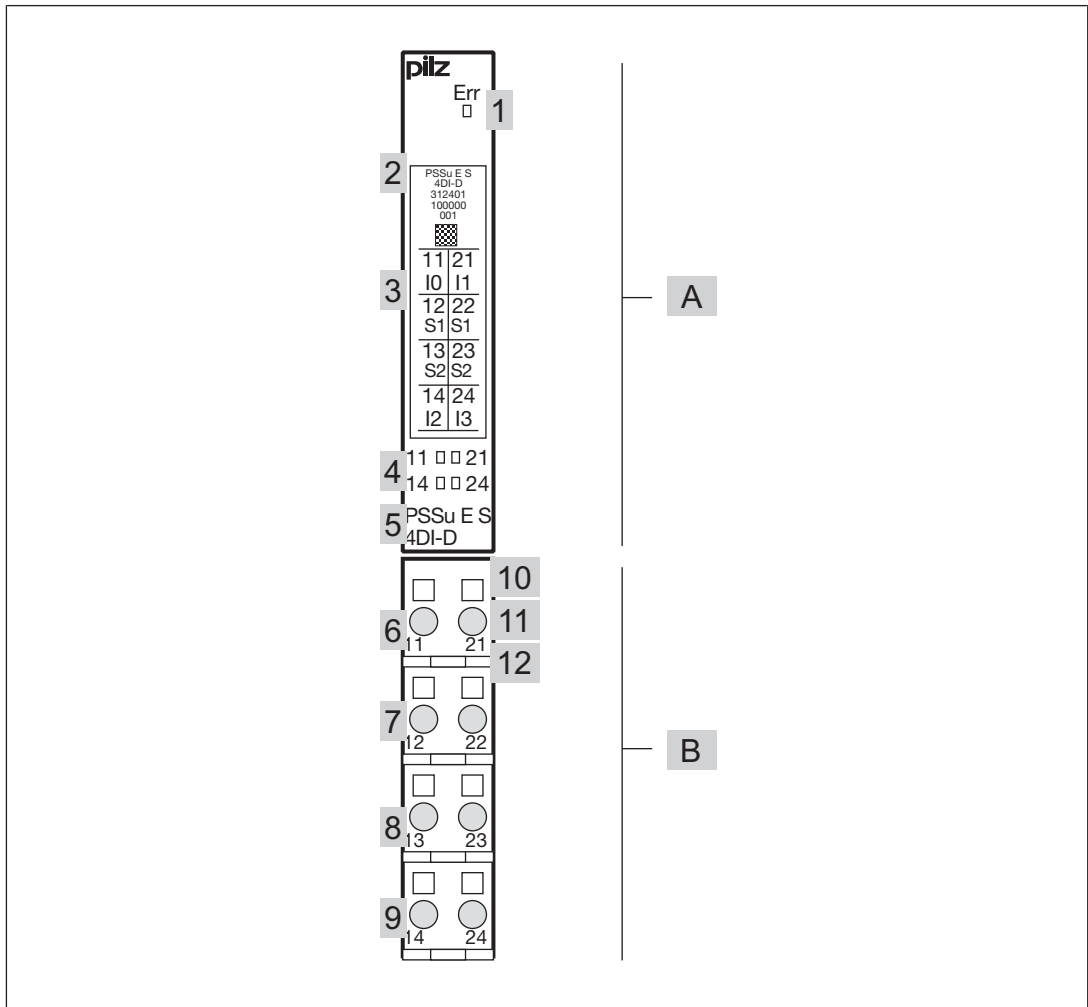
Legend:

▸ 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

▸ 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)

3 Safety

3.1 Intended use

The module may be used for standard applications in system environment A and B.

The module provides type 1 inputs in accordance with IEC 61131-2. It may be used as an input module for standard functions.

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.

> **INFORMATION**
>
> The module is supported by:
>
> ▸ PSSuniversal Configurator and PSSuniversal Assistant from Version 1.9.0.
>
> ▸ PAS4000 from Version 1.8.0
>
>   – We recommend that you always use the latest version (download from www.pilz.com).

The PSSu E S 4DI-D module may be used in conjunction with the following base modules:

▸ PSSu BP 1/8 S

▸ PSSu BP 1/8 C

▸ PSSu BP 1/12 S

▸ PSSu BP 1/12 C

▸ PSSu BP-C1 1/12 S

▸ PSSu BP-C1 1/12 C

3.2 Safety regulations

3.2.1 Use of qualified personnel

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

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

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

▸ Are familiar with the basic regulations concerning health and safety / accident prevention,

▸ Have read and understood the information provided in the section entitled Safety

▸ Have a good knowledge of the generic and specialist standards applicable to the specific application.

3.2.2 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 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 Function description

4.1 Block diagram
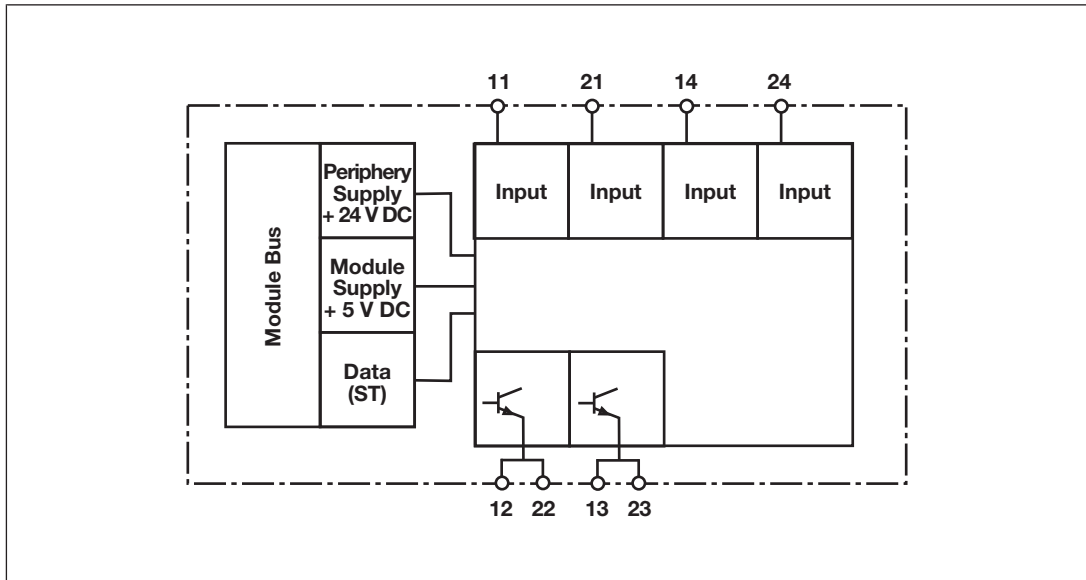
4.2 Module features

4.2.1 Functions

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

4.2.2 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

▸ ST communication error

▸ Bus termination error

▸ Output overload

▸ Temperature error: too warm

▸ Temperature error: too hot

4.2.3 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".

4.3 Configuration

4.3.1 PSSu assignment in system environment A

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.

4.3.1.1 Addresses in the process image

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	- - -

> **INFORMATION**
>
> Further information on the structure and contents of the status byte can be found under "Operation".

4.3.1.2 Status byte

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

Bit number	Signal	Meaning
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

4.3.2 PSSu assignment in system environment B

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.

5 Installation

5.1 General installation guidelines
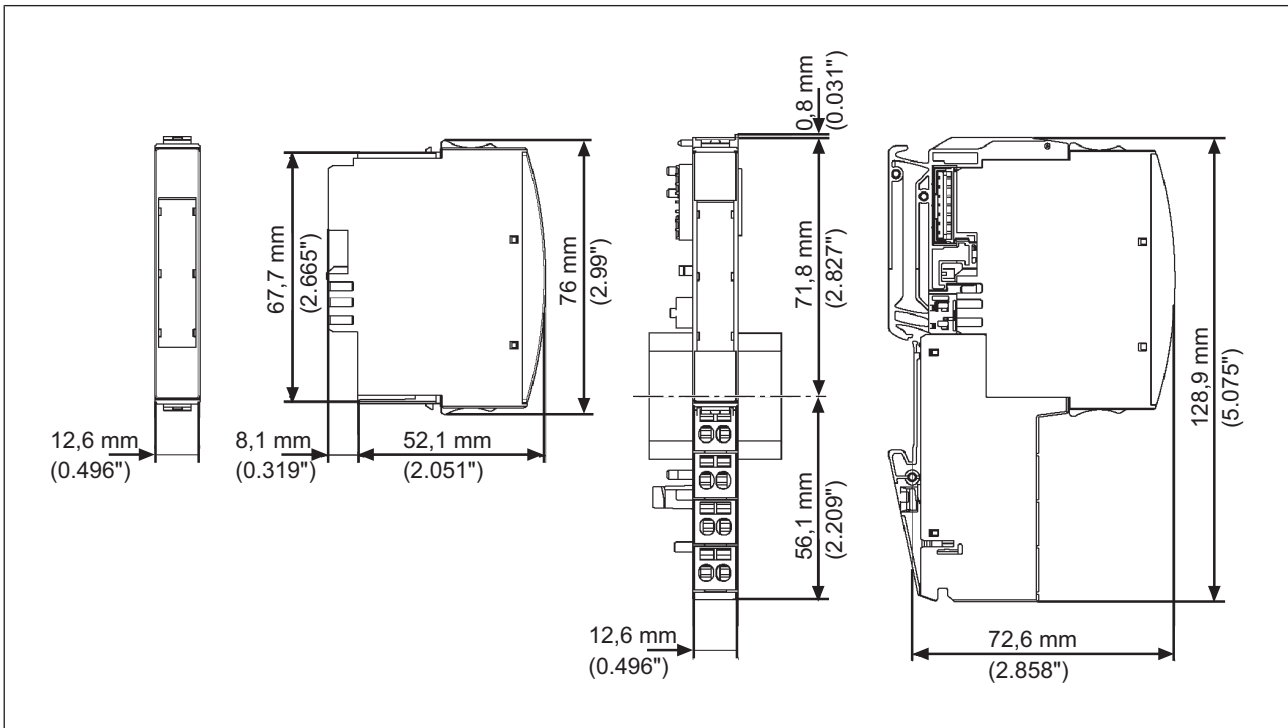
Please also refer to the PSSuniversal Installation Manual.

> **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.
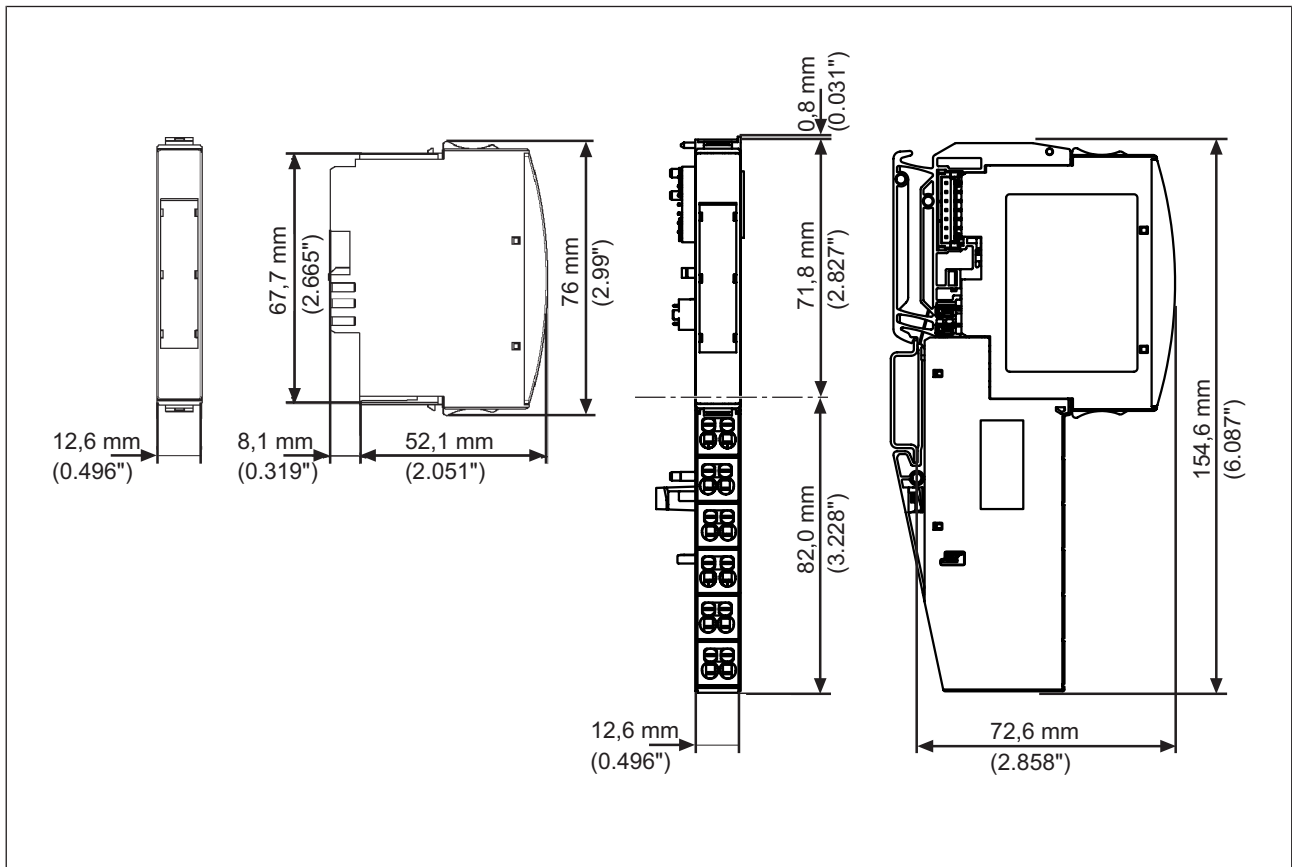
5.1.1 Dimensions

Base modules with four connection levels:

Base modules with six connection levels:

5.2 Installing the base 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.
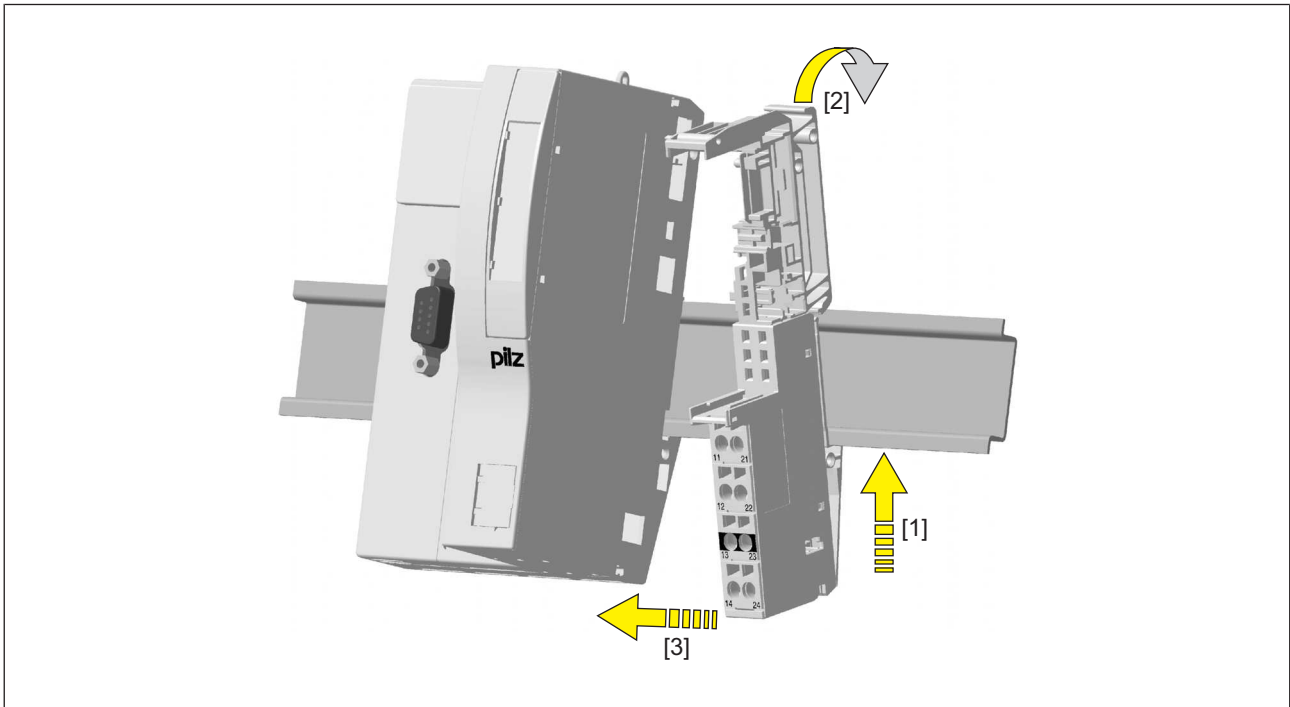
Please note:

▸ For mechanical reasons it is not possible to mix base modules with screw terminals and base modules with cage clamp terminals.

▸ All contacts should be protected from contamination.

▸ The mechanics of the base modules are designed for 50 plug in/out cycles.

Procedure:

▸ We recommend that you wire up the base modules before inserting the electronic modules.

▸ Slot the groove on the base module on to the mounting rail from below [1].

▸ Push the base module back [2] until you hear it lock into position.

▸ On the mounting rail, slide the base module to the left until you hear the two lateral mounting hooks on the adjacent module lock into position [3].

Schematic representation:

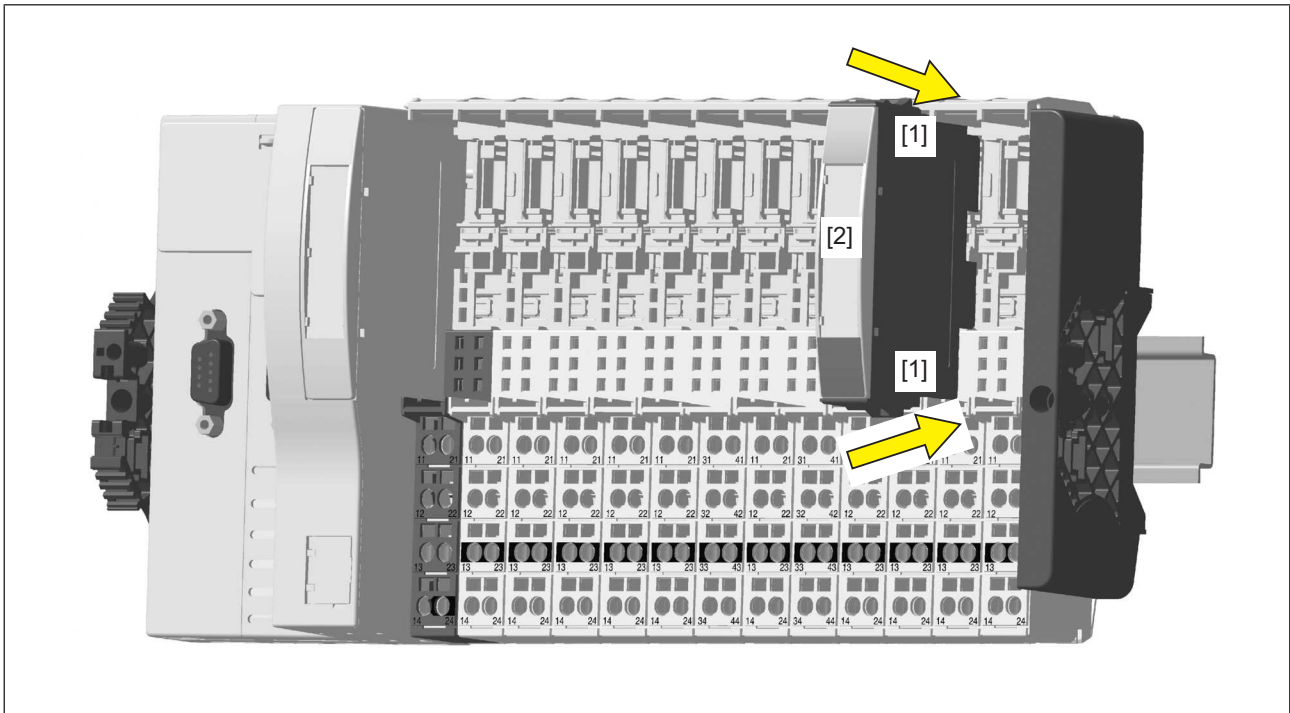## 5.3 Inserting and removing an electronic module

Please note:

▶ Only insert on to base modules that are already installed.

▶ Preferably these base modules should be ready wired.

▶ Electronic modules with outputs may only be inserted and removed when the load is switched off. Unforeseeable error reactions may be triggered if modules are inserted and removed under load.

▶ 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 mechanics of the electronic modules are designed for 50 plug in/out cycles.

5.3.1 Inserting an electronic module

Procedure:

▸ The electronic module must audibly lock into position [1].

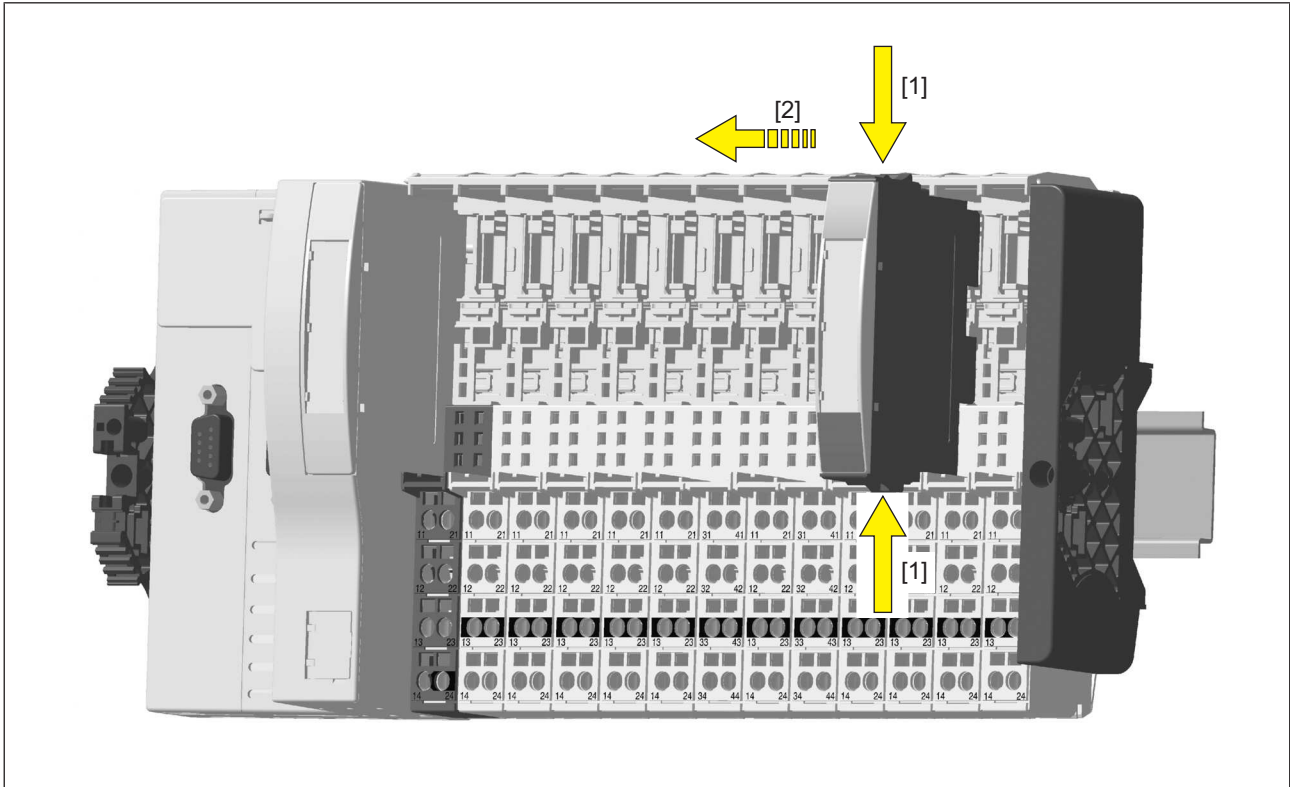▸ Mark the electronic module using the labelling strips [2].

Schematic representation:

5.3.2 Removing an electronic module

Procedure:

▸ Press the locking mechanisms [1] together simultaneously.

▸ Pull out the electronic module [2].

Schematic representation:

5.3.3 Changing an electronic module during operation

It is possible to change an electronic module during operation. The configuration data is retained when a module is changed.

Effects:

▸ System environment A:

– In the event of a potential FS communication error, the FS section of the PSSu system and all relevant I/O-Groups (SafetyBUS p) switch to a STOP condition.

▸ System environment B:

– All FS hardware outputs on the PSSu system switch to a safe condition.

– The substitute values are used for the modules' FS outputs, with Valid Bits = FALSE.

> ⚠ **CAUTION!**
>
> Sparking can cause interference and errors!
>
> Only change the module when the load is switched off!

6 Wiring

6.1 General wiring guidelines

Please note:

▸ Signal lines do not have to be shielded.

▸ The terminal configuration as stated on the front plate applies for base modules without C-rail. The terminal configuration as stated in the technical documentation applies for all other base modules.

6.1.1 Mechanical connection of the base modules

Procedure:

▸ Use a flat blade screwdriver (DIN 5264-A)!

DIN 5264-A
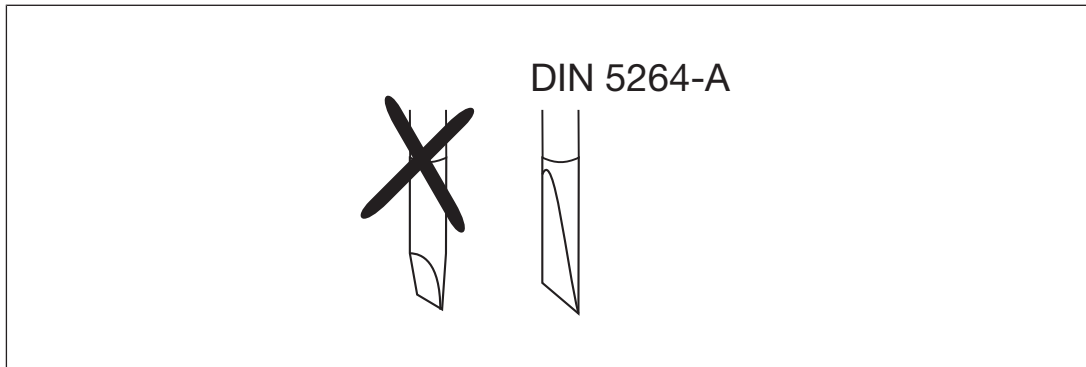
▸ Strip the wire back 8 mm.

▸ If necessary, label the connection level with a colour marker [3].

▸ Base module with screw terminals:

– Use a screwdriver to loosen the screw on the screw terminal [1]

– Insert the stripped cable into the round fixing hole [2], as far as it will go.

– Tighten up the screw on the screw terminal.

– Check that the cable is firmly seated.

▸ Base module with cage clamp terminals:

– Insert the screwdriver [4] into the square hole [1].

– Insert the stripped cable into the round fixing hole [2], as far as it will go [5].

– Pull out the screwdriver [6].

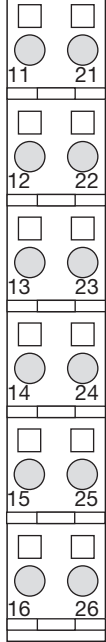– Check that the cable is firmly seated.
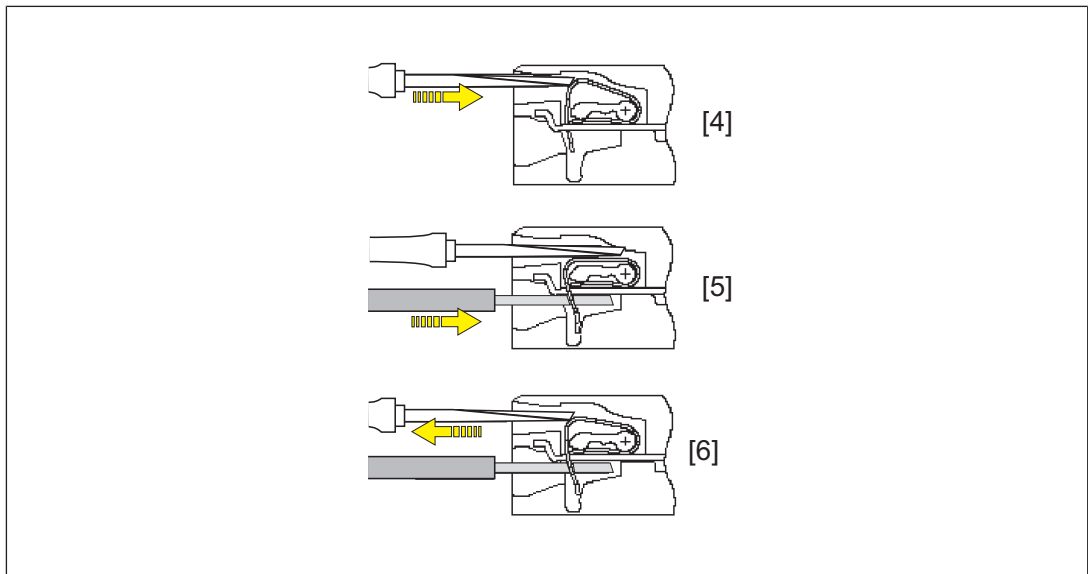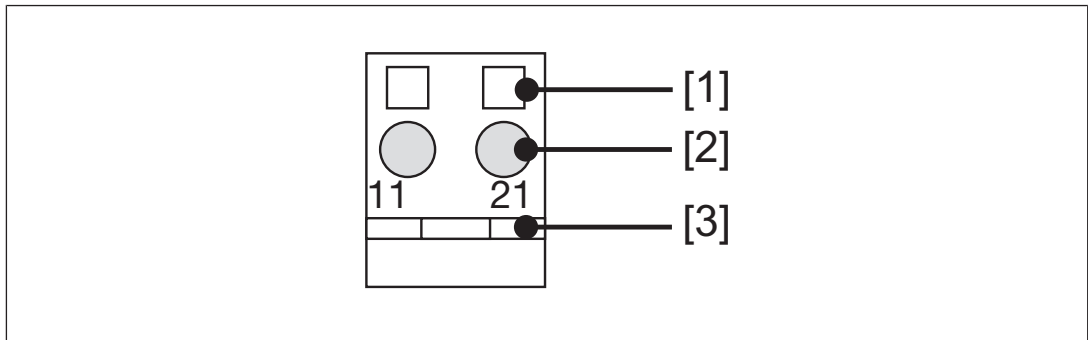
Please note:

▸ 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 mm² (AWG16)

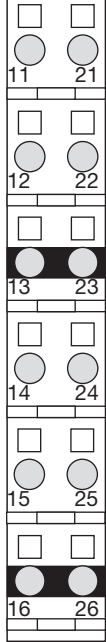- Power supply: 2.5 mm² (AWG12)

- Functional earth: 2.5 mm² (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.

6.2 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	

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)	

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)	

6.3 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		

7 Operation

7.1 Messages

An error will be signalled to the head module and will be entered in the head module's error stack. A module error will also be displayed via the "Err" LED (see section entitled "Display elements").

The module can detect the following errors:

Error	Explanation	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.
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.
Overload/short circuit	Load on supply output too high	Rectify overload or short circuit.
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: Supply outputs are switched off	Ensure there is sufficient ventilation in the control cabinet or prevent overload.

([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 switches off the supply outputs.

▸ After the "too hot" message has been received, if the temperature drops back below the "too warm" threshold value, the supply outputs will switch back on.

Further information on PSSu error messages is available in the online help for the system software PSSuniversal Configurator or PSSuniversal Startup.
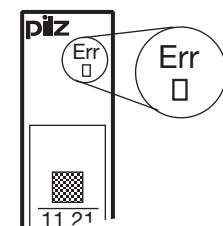
7.2 Display elements
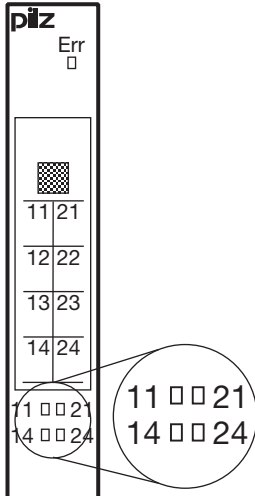
Legend

-�� LED on

● LED off

7.2.1 Display elements for module diagnostics

The "Err" LED is used to indicate a module error and a missing periphery supply.

LED			Meaning
Name	Colour	State	
Err	- - -	●	No fault
	Red	-☆-	Periphery supply is missing or module is faulty

7.2.2 Display elements for input status

Each input is assigned an LED for displaying the input status (LEDs "11", "21", "14" and "24").

LED			Meaning		
Designation	Colour	Status	Signal	Input	Terminal
11	- - -	●	0 signal	I0 (Input 1)	11
	Green	-☆-	1 signal		
21	- - -	●	0 signal	I1 (Input 2)	14
	Green	-☆-	1 signal		
14	- - -	●	0 signal	I2 (Input 3)	21
	Green	-☆-	1 signal		
24	- - -	●	0 signal	I3 (Input 4)	24
	Green	-☆-	1 signal		

8 Technical Details

General	
Certifications	**CE, UKCA, 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**
Permitted loads	**inductive, capacitive, resistive**

Voltage outputs	
Number of outputs for periphery supply	**2**
Function of outputs for periphery supply	**Sensor supply**

Voltage outputs	
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**
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.

9 Order reference

9.1 Product

Product type	Features	Order No.
PSSu E S 4DI-D	Electronic module, base type	312 401

9.2 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

▶ Support

Technical support is available from Pilz round the clock.

Americas

Brazil
+55 11 97569-2804

Canada
+1 888 315 7459

Mexico
+52 55 5572 1300

USA (toll-free)
+1 877-PILZUSA (745-9872)

Asia

China
+86 21 60880878-216

Japan
+81 45 471-2281

South Korea
+82 31 778 3300

Australia and Oceania

Australia
+61 3 95600621

New Zealand
+64 9 6345350

Europe

Austria
+43 1 7986263-0

Belgium, Luxembourg
+32 9 3217570

France
+33 3 88104003

Germany
+49 711 3409-444

Ireland
+353 21 4804983

Italy, Malta
+39 0362 1826711

Scandinavia
+45 74436332

Spain
+34 938497433

Switzerland
+41 62 88979-32

The Netherlands
+31 347 320477

Turkey
+90 216 5775552

United Kingdom
+44 1536 462203

You can reach our international hotline on:
+49 711 3409-222
support@pilz.com

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

BLUeCOMPETENCE
Alliance Member
Partner of the Engineering Industry Sustainability Initiative

BRANDS OF THE CENTURY
PILZ
2019
GERMAN STANDARDS

Quality Management
DQS
ISO 9001:2015
REG. NO. 2462

Environmental Management
DQS
ISO 14001
REG. NO. 2462

Energy Management
DQS
ISO 50001
REG. NO. 2462

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

PILZ
THE SPIRIT OF SAFETY