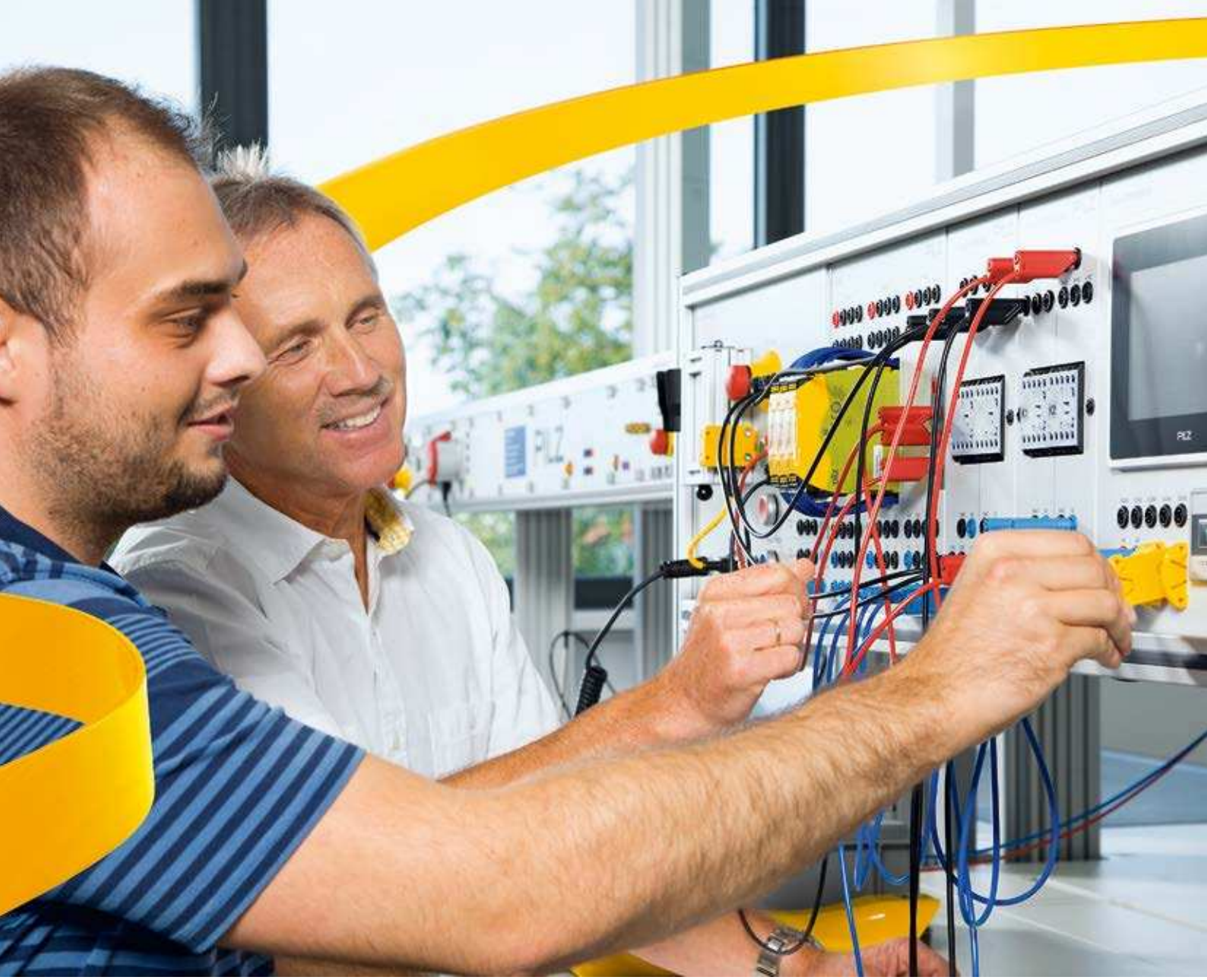


Pilz Education Systems (PES)

PILZ
THE SPIRIT OF SAFETY

Learning systems for the training sector




The optimal tool for knowledge transfer in the field of safe automation: Pilz Education Systems

Pilz Education Systems (PES)

Pilz is a solution supplier for all automation tasks, including standard control tasks.
Pilz's developments protect man, machine and the environment. We have combined our knowledge and experience to develop our Pilz Education Systems (PES). They are an optimal tool for knowledge transfer in the field of safe automation. The modular training systems simulate the functioning of a plant or machinery.
They are used for training support in companies with apprenticeship programs, schools and universities. In total, there are nine different operator boards that can be combined with one another from the sensor technology, control, operation and maintenance sectors as well a board that simulates a real plant.
Thanks to the use of genuine industrial components, the safety and automation functions of a plant or machinery can be realistically simulated.

Contents

Pilz is your solution supplier for all automation tasks. Including standard control functions. Pilz developments protect man, machine and the environment.

Pilz has a tradition as a family-run company stretching back over 60 years. Real proximity to customers is visible in all areas, instilling confidence through individual consultation, total flexibility and reliable service. Worldwide, round the clock, in 42 subsidiaries and branches, as well as 27 sales partners on every continent.

More than 2 200 staff, each one of them an ambassador for safety, make sure that your staff – your company's most valuable asset – can work safely and free from injury.

Automation solutions from Pilz – at home in every industry.

Learning systems for the training sector

Pilz Education Systems (PES) are modular training systems with modern, industrially implemented components for practical training in electrical engineering.

PES comprise different safety and automation functions that are clearly arranged on an operator board. The training systems allow apprentices, students or training participants to learn to program controllers or implement safety functions for plant and machinery in a practically orientated way.

The blocks can be modularly expanded and easily exchanged and used both in the laboratory and in training rooms.

The systems focus in particular on teaching how the Machinery Directive 2006/42/EC is correctly implemented and what requirements are placed on the safety functions for plant and machinery in accordance with DIN EN ISO 13849-1.

Pilz Education Systems (PES) provide perfect training support:

Knowledge transfer
Optimal tool for the communication of knowledge from the field of safe automation.

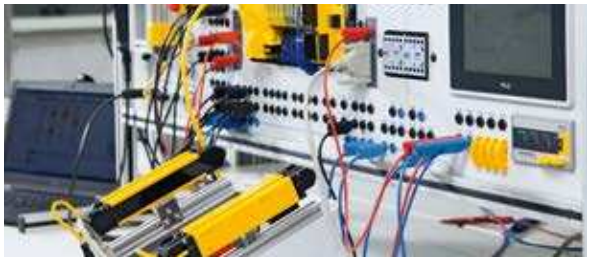
Machine simulation
Modules for practical training, that, in various combinations, simulate different functions of complete plant or machinery.

Application options
- For further in-house training of employees, e.g. of maintenance staff
- Training of trainees and apprentices within the company
- At universities in the areas of electrical engineering, automation technology and mechanical engineering, among others
- For self-study

Operator boards

The different PES operator boards take on varying formulations in order to simulate complete plant or machinery. Many modules can be used individually. One sensor module, one logic module and one actuator module are required to provide a simulation of a complete machine. Both actuator modules can be used together.

Structure and function of the operator boards



Sensor – Safeguard dangerous movement
Safeguarding dangerous movements together with various safety functions can be learned by using the three different versions of the PES sensor boards – always in compliance with the specifications from the Machinery Directive 2006/42/EC.

Operation and monitoring – A complete view of automation
The PES operation and monitoring board supports the practical learning of system visualisation – including diagnostic functions.

For fast learning success, the corresponding accompanying documentation for each system such as exercises, technical documentation or theoretical background information is included.

Logic – Configuring and programming
Safety circuits can be implemented with the three logic operator boards and the configuration of safety and automation functions with software support can be learned.

Actuator – Electrical power and protective devices
With maximum practical approach, the actuator boards clarify the switching of high electrical loads over contactors as well as the way in which optoelectronic protective devices work when reaching into a danger zone.

Keep up-to-date on the Pilz Education Systems (PES):

Webcode: web193919

Online information at www.pilz.com

Sensor boards

Sensor board I

Sensor board II

Sensor board III

Safeguard dangerous movement

The sensor boards help teach how a dangerous movement can be safeguarded together with safety functions.

In accordance with the Machinery Directive 2006/42/EC, plant and machinery must be fitted with an emergency stop device so that hazards can be averted or reduced in the event of an emergency. This is illustrated by the E-STOP pushbutton PITestop. A two-hand pushbutton or enabling switch is used to monitor processes in the danger zone while the safety gate is open. The coded safety switch PSENcode takes on the function of safety gate monitoring. Illuminated pushbuttons can be used to switch the dangerous movement on or off.

Learning objectives

- Learn about the application of the Machinery Directive 2006/42/EC as well as risk assessment for a machine or system
- Safeguard dangerous movements
- Implementation of different safety functions with functional safety
- Use of a two-hand pushbutton in different operating modes
- Use of an enabling switch while working in the danger zone
- Use of illuminated pushbuttons
- Designing a control circuit
- Performing a function test

Sensor board I

The sensor board I consists of an emergency stop device, a two-hand pushbutton PITjog to protect persons who monitor processes in the danger zone while the safety gate is open and a coded safety switch for monitoring the safety gate.

Sensor board I features

Sensor board I

Features	Quantity
E-STOP pushbutton PITestop: PIT es Set3s-5	1
Coded safety switch PSENcode: PSEN cs3.1n/PSEN cs3.1 1 Unit	1
Two-hand control relay PITjog: PIT js2	1
Illuminated pushbuttons	3
Fan (motor simulation)	1
Safety gate	1
Information	
Order number: G9000001	
Connections: 4 mm safety sockets	
Operating voltage: 24 V DC	
Dimensions (W x H x D) in mm: 297 x 399 x 230	
Net weight: 3.00 kg	
Usage: experimental frame or tabletop unit	
Accompanying documentation	
Operating manuals for components	
Documentation	
Machinery safety manual	
Exercises with solutions	
Required accessories	
Connection cable	25
Suitable expansion modules	
Operation and monitoring	
Logic board PNOZsigma, logic board PNOZmulti or logic board PSS 4000	
Actuator board contactor	
Actuator board conveyor	

Keep up-to-date on PES sensor boards:

Webcode: web194454

Online information at www.pilz.com

Note
Connection cables are not supplied with the device. Additional information on page 19.
Power supply to the module is provided by a connection with a logic module.

Sensor board II

The sensor board II consists of an emergency stop device, the three-stage enabling switch PITenable as manual controller when working in the danger zone and a coded safety switch for safety gate monitoring.

Sensor board II features

Sensor board II

Features	Quantity
E-STOP pushbutton PITestop: PIT es Set3s-5	1
Coded safety switch PSENcode: PSEN cs3.1n/PSEN cs3.1 1 Unit	1
Enabling switch PITenable: PIT en1.0a-5m-s	1
Illuminated pushbuttons	3
Fan (motor simulation)	1
Safety gate	1
Information	
Order number: G9000002	
Connections: 4 mm safety sockets	
Operating voltage: 24 V DC	
Dimensions (W x H x D) in mm: 297 x 399 x 200	
Net weight: 2.46 kg	
Usage: experimental frame or tabletop unit	
Accompanying documentation	
Operating manuals for components	
Documentation	
Required accessories	
Connection cable	25
Suitable expansion modules	
Operation and monitoring	
Logic board PNOZsigma, logic board PNOZmulti or logic board PSS 4000	
Actuator board contactor	
Actuator board conveyor	

Keep up-to-date on PES sensor boards:

Webcode: web194454

Online information at www.pilz.com

Note
Connection cables are not supplied with the device. Additional information on page 19.
Power supply to the module is provided by a connection with a logic module.

Sensor board III

The sensor board III is equipped with an emergency stop device, the three-stage enabling switch PITenable as manual controller when working in the danger zone and a coded safety switch for safety gate monitoring. The process is simulated at a safe, reduced speed while “Set-up mode” is active. Two initiators monitor the rotary disk of a motor.

Sensor board III features

Sensor board III

Features	Quantity
E-STOP pushbutton PITestop: PIT es Set3s-5	1
Coded safety switch PSENcode: PSEN cs3.1n/PSEN cs3.1 1 Unit	1
Enabling switch PITenable: PIT en1.0a-5m-s	1
Illuminated pushbuttons	3
DC motor	1
Proximity switch for speed monitoring	1
Safety gate	1
Information	
Order number: G9000003	
Connections: 4 mm safety sockets	
Operating voltage: 24 V DC	
Dimensions (W x H x D) in mm: 297 x 399 x 200	
Net weight: 2.60 kg	
Usage: experimental frame or tabletop unit	
Accompanying documentation	
Operating manuals for components	
Documentation	
Required accessories	
Connection cable	25
Suitable expansion modules	
Operation and monitoring	
Logic board PNOZsigma, logic board PNOZmulti or logic board PSS 4000	
Actuator board contactor	
Actuator board conveyor	

Keep up-to-date on PES sensor boards:

Webcode: web194454

Online information at www.pilz.com

Note
Connection cables are not supplied with the device. Additional information on page 19.
Power supply to the module is provided by a connection with a logic module.

Operation and monitoring board

A complete view of automation

How are the automation and safety functions of machines and systems visualised? The PES operation and monitoring board tackles this directly and supports the practical learning of system visualisation – including diagnostic functions.

The module maps the visualisation of a complete plant or machinery. This allows the functions of human machine interfaces to be illustrated and skills such as reading diagnostic data from different controllers and trouble-shooting can be developed. In addition to the visualisation terminal PMIvisu, including the visualisation software PASvisu for a comprehensive overview of the entire machine, the module also has the operating mode selector switch PITmode, which facilitates the selection of the machine control operating mode and manages the access authorisation for operating staff.

Learning objectives

- Visualisation of all safety and automation functions for a machine or plant
- Reading diagnostic data from different controllers
- Troubleshooting using the PMI (Pilz Human Machine Interface)
- Selection and allocation of operating modes

Operation and monitoring board features

Operation and monitoring

Features	Quantity
Human Machine Interface PMIvisu: PMI v507	1
Visualisation software PASvisu	1
Operating mode selector switch PITmode: PIT m3.2p	1
Transponder key [1] PIT m3 key2 mode 1-4	1
Transponder key [1] PIT m3 key2hq mode service	1
Information	
Order number: 5S000001	
Connections: 4 mm safety sockets	
Operating voltage: 24 V DC	
Dimensions (W x H x D) in mm: 297 x 266 x 160	
Net weight: 2.67 kg	
Usage: experimental frame or tabletop unit	
Accompanying documentation	
Operating manuals for components	
Documentation	
Visualisation projects	
Required accessories	
Connection cable	7
Suitable expansion modules	
Sensor board I, II or III	
Logic board PNOZmulti or logic board PSS 4000	
Actuator board contactor	
Actuator board conveyor	

[1] Five different access authorisations through pre-coded keys that are secure from manipulation thanks to RFID technology.

Keep up-to-date on the PES operation and monitoring board:

Webcode: web194246

Online information at www.pilz.com

Note

Connection cables are not supplied with the device. Additional information on page 19.
Power supply to the module is provided by a connection with a logic module.

Logic board PNOZsigma

Implement safety circuits

The practical implementation of simple safety circuits with fixed configurations can be learned with the PES logic board PNOZsigma. The requirements of EN ISO 13849 are conveyed by a practical example.

Further learning components of this module include understanding and actively operating the function of a safety relay with adjustable operating modes and times as well as rapid diagnostics.

Learning objective

Implementation of simple safety circuits with fixed configuration according to EN ISO 13849

Logic board PNOZsigma features

Logic board PNOZsigma

Features	Quantity
Safety relay PNOZsigma: PNOZs4	2
Safety relay PNOZsigma: PNOZs6	1
Information	
Order number: 2S000001	
Connections: 4 mm safety sockets	
Operating voltage: 24 V DC	
Dimensions (W x H x D) in mm: 297 x 266 x 190	
Net weight: 2.10 kg	
Usage: experimental frame or tabletop unit	
Accompanying documentation	
Operating manuals for components	
Documentation	
Required accessories	
Power supply	1
Suitable expansion modules	
Sensor board I	
Actuator board contactor	

Keep up-to-date on the PES logic board PNOZsigma:

Webcode: web194365

Online information at www.pilz.com

Note

The power supply is not supplied with the device. Additional information on page 19.
Appropriate connection cables are required for applications in combination with other operator boards.
Information regarding the number of units required is provided with the respective module.

Logic board PNOZmulti

Configuration of small controllers with software support

The PES logic board PNOZmulti facilitates learning about free configuration of the safety functions of a machine by using a parametrisation example – including speed monitoring and the connection of additional controllers.

The configuration is learned using the software tool PNOZmulti Configurator, which is already supplied with the device together with a sample project. Flexible connectivity as well as communication with other controller systems can also be learned. The integrated display shows how diagnostic data are output directly on the small controller. The operator board can also be used to demonstrate speed monitoring.

Learning objectives

- Learn free configuration of a mini-controller using the PNOZmulti Configurator software tool
- Monitoring of safety functions according to EN ISO 13849
- Speed monitoring
- Connection of and communication with other controllers

Logic board PNOZmulti features

Logic board PNOZmulti

Features	Quantity
Configurable small controller PNOZmulti 2: PNOZ m B1	1
Safe I/O module PNOZ m EF PDP Link	1
Safe I/O module PNOZ m EF 8DI4DO	1
Safe I/O module PNOZ m EF 8DI4DO	1
Safe I/O module PNOZ m EF 2MM	1
PNOZmulti Configurator	1
Licence key for PNOZmulti Configurator	1
Information	
Order number: 3S000001	
Connections: 4 mm safety sockets	
Operating voltage: 24 V DC	
Dimensions (W x H x D) in mm: 297 x 266 x 190	
Net weight: 2.10 kg	
Usage: experimental frame or tabletop unit	
Accompanying documentation	
Operating manuals for components	
Documentation	
Programming example	
Exercises with solutions	
Required accessories	
Power supply	1
Suitable expansion modules	
Sensor board I, II or III	
Operation and monitoring	
Actuator board contactor	

Keep up-to-date on the PES logic board PNOZmulti:

Webcode: web194291

Online information at www.pilz.com

Note

The power supply is not supplied with the device. Additional information on page 19.
Appropriate connection cables are required for applications in combination with other operator boards.
Information regarding the number of units required is provided with the respective module.

Logic board PSS 4000

Implementation of safety and automation functions in a single system

How can different machine functions be implemented in a single system? Using the PES logic board PSS 4000, this can easily be learned in combination with a programming tool.

The software platform PAS4000 can be used to program individual applications in various programming languages. Teachers can immediately start by using the example project provided.

Learning objectives:

- Practical training in the implementation of machine safety and automation functions in a single system
- Programming an automation system in different programming languages using the PAS4000 software platform.

Logic board PSS 4000 features

Logic board PSS 4000

Features	Quantity
Automation system PSS 4000: PSSu PLC1 FS SN SD	1
Electronic modules PSSu EF 4DI	3
Electronic module PSSu EF 2DOR 2	2
Electronic module PSSu EF DIOZ 2	1
Electronic module PSSu KS 8DI8DO	1
Electronic module PSSu KF EI	1
Software platform PAS4000	1
Information	
Order number: 4S000001	
Connections: 4 mm safety sockets	
Operating voltage: 24 V DC	
Dimensions (W x H x D) in mm: 297 x 399 x 180	
Net weight: 2.85 kg	
Usage: experimental frame or tabletop unit	
Accompanying documentation	
Operating manuals for components	
Documentation	
Programming example	
Exercises with solutions	
Required accessories	
Power supply	1
Connection cable	2
Suitable expansion modules	
Sensor board I, II or III	
Operation and monitoring	
Actuator board contactor	
Actuator board conveyor	

Keep up-to-date on the PES logic board PSS 4000:

Webcode: web194294

Online information at www.pilz.com

Note

The power supply is not supplied with the device. Additional information on page 19.
Additional connection cables are required for applications in combination with other operator boards.
Information regarding the number of units additionally required is provided with the respective module.

Actuator board contactor

Switching high electrical loads

The PES actuator board contactor shows how to switch high electrical loads using contactors. It also illustrates how electrical loads are actuated and how contact extensions are used.

The module represents the third part of a safety function, the output. As well as switching electrical loads, redundant shutdown is demonstrated and can be learned from a practical example.

Learning objectives

- Learn the requirements when switching high loads up to 16 A
- Control of electrical loads
- Use of contact extensions

Actuator board contactor features

Actuator board contactor

Features	Quantity
Auxiliary contactor 24 V DC	2
Information	
Order number: 1S000001	
Connections: 4 mm safety sockets	
Operating voltage: 24 V DC	
Dimensions (W x H x D) in mm: 297 x 133 x 160	
Net weight: 1.20 kg	
Usage: experimental frame or tabletop unit	
Accompanying documentation	
Documentation	
Required accessories	
Connection cable	9
Suitable expansion modules	
Sensor board I, II or III	
Operation and monitoring	
Logic board PNOZsigma, logic board PNOZmulti or logic board PSS 4000	
Actuator board conveyor	

Keep up-to-date on the PES actuator board contactor:

Webcode: web194457

Online information at www.pilz.com

Note

Connection cables are not supplied with the device. Additional information on page 19.
Power supply to the module is provided by a connection with a logic module.

Actuator board conveyor

Simulation of optoelectronic protective devices

The realistic application of the PES actuator board conveyor simulates reaching into a danger zone. The way in which optoelectronic protective devices work can be learned with a focus on practical application.

The module shows an application with a drill and a milling machine as a machining station and thus represents an absolutely realistic work situation. A light curtain is used as an example of an optoelectronic protective device.

Learning objectives:

- Programming and commissioning an application according to EN ISO 13849
- Learning project planning for safety and automation modules
- Understanding the mode of operation and applications of light curtains
- Performing the validation of safety systems

Actuator board conveyor features

Actuator board conveyor

Features	Quantity
Machine model with sliders, conveyor belts, drill/milling machine	1
Optoelectronic protective device PSENopt II Type 3	2
Information	
Order number: 6S000001	
Connections: 4 mm safety sockets	
Operating voltage: 24 V DC	
Dimensions (W x H x D) in mm: 297 x 266 x 220	
Net weight: 2.67 kg	
Usage: experimental frame or tabletop unit	
Accompanying documentation	
Operating manuals for components	
Documentation	
Required accessories	
Connection cable	4
Suitable expansion modules	
Sensor board I, II or III	
Operation and monitoring	
Logic board PSS 4000	
Actuator board contactor	

Keep up-to-date on the PES actuator board conveyor:

Webcode: web194244

Online information at www.pilz.com

Note

Connection cables are not supplied with the device. Additional information on page 19.
Power supply to the module is provided by a connection with a logic module.

Combination of operator boards

All PES operator boards can be combined with one another and augmented in different arrays. Information regarding the suitable expansion modules is provided with the respective operator board. Here we will show you some combination options for quickly achieving the best possible learning success. At www.pilz.com you can compile the ideal combination for your training purposes.

Training system set XS

- Sensor board I – Safeguard dangerous movement
- Logic board PNOZsigma – Implement safety circuits
- Actuator board contactor – Switching high electrical loads

Simple circuits for an initial overview of the topic of safety technology. The best possible introduction for someone with no previous knowledge.

Training system set L

- Sensor board III – Safeguard dangerous movement
- Operation and monitoring – A complete view of automation
- Logic board PNOZmulti – Configuration of small controllers with software support
- Actuator board contactor – Switching high electrical loads

The perfect combination for advanced participants: Control configuration incl. machine visualisation. People with solid previous knowledge can experience detailed learning about monitoring safety functions according to EN ISO 13849.

Training system set XXL

- Sensor board III – Safeguard dangerous movement
- Operation and monitoring – A complete view of automation
- Logic board PSS 4000 – Implementation of safety and automation functions in a single system
- Actuator board contactor – Switching high electrical loads
- Actuator board conveyor – Simulation of optoelectronic protective devices

This provides the maximum practical approach: The simulation of a real application shows how the automation and safety functions of a complete plant are programmed.

Accessories

Here you can find the right accessories for wiring and commissioning individual operator boards or connecting complete training systems to each other.

PES cable selection

PES test lead 4mm-bk

PES test lead 4mm p-rd

Type	Description	Features	Order number
PES test lead 4mm-bk	Highly flexible connection cable black	Connection: plug 4 mm, sprung, length: 1 m	1S000003
PES test lead 4mm-rd	Highly flexible connection cable red	Connection: plug 4 mm, sprung, length: 1 m	1S000004
PES test lead 4mm-bu	Highly flexible connection cable blue	Connection: plug 4 mm, sprung, length: 1 m	1S000005
PES test lead 4mm p-bk	Insulated highly flexible connection cable black	Connection: plug 4 mm, sprung, length: 1 m	1S000006
PES test lead 4mm p-rd	Insulated highly flexible connection cable red	Connection: plug 4 mm, sprung, length: 1 m	1S000007
PES test lead 4mm p-bu	Insulated highly flexible connection cable blue	Connection: plug 4 mm, sprung, length: 1 m	1S000008

PSS power supply

PES power supply

Type	Description	Features	Order number
PES power supply	Power supply	▸ Connection: DC barrel connector 5.5 x 2.1 mm ▸ Input voltage: 100 … 240 V AC ▸ Output voltage: 24 V DC, 2,000 mA ▸ Length: 88 mm	1S000002

Keep up-to-date on PES accessories:

Webcode: web194453

Online information at www.pilz.com

Note

- Information regarding the number of connection cables required for each operator board is provided with the respective module.
- One power supply is required for each operator board from the “logic” range. The power supply to the other connected modules is provided by a connection with a logic module. No additional power supplies are required.

Services:
Consulting, engineering and training

As a solution supplier, Pilz can help you in the global application of optimum safety strategies that comply with specifications. Our services ensure the highest safety for man and machine worldwide.

Training

Pilz supports you with a comprehensive range of training courses on all topics of machinery safety and automation.

And to progress to the expert level in machinery safety we offer the qualification of CMSE® – Certified Machinery Safety Expert.

Machinery safety

Risk Assessment
We review your machinery in accordance with the applicable standards and directives and assess the existing hazards.

Safety Concept
We develop detailed technical solutions for the safety of your plant and machinery through mechanical, electronic and organisational measures.

Safety Design
The aim of the safety design is to reduce or eliminate danger points through detailed planning of the necessary protective measures.

System Implementation
The results of the risk analysis and safety design are implemented to suit the particular requirements through selected safety measures.

Validation
In the validation, the risk assessment and safety concept are mirrored and inspected by competent, specialist staff.
And we perform collision measurement for human-robot applications in accordance with the limit values from ISO/TS 15066.

International compliance

CE Marking
We control all activities and processes for the necessary conformity assessment procedure, including the technical documentation that is required.

NR-12
As a complete supplier we can provide support from risk assessment to validation, technical documentation at the manufacturer's and final acceptance at the operator's in Brazil.

Workplace safety

Plant Assessment
We will prepare an overview of your entire plant in the shortest possible time. With an on-site inspection we will expose risks and calculate the cost of optimising your safeguards.

Lockout Tagout System
Our customised lockout tagout (LoTo) measures guarantee that staff can safely control potentially hazardous energies during maintenance and repair.

Inspection of Safeguarding Devices
With our independent, ISO 17020-compliant inspection body, which is accredited by the German Accreditation Body (DAkkS), we can guarantee objectivity and high availability of your machines.

Pilz GmbH & Co. KG, Ostfildern, operates an inspection body for plant and machinery, accredited by DAkkS.

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Printed on 100 % recycled paper for the good of the environment.

8-4-en-3-017, 2018-04 Printed in Germany

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