Drive technology PMC

PILZ
THE SPIRIT OF SAFETY

- Motion control systems
- Servo amplifiers
- Motors
- Safe motion monitoring




Pilz drive technology – Safe, open, energy efficient, productive

Individual solutions

As market and technology leader, Pilz offers overall solutions for safety and automation. Part of these solutions is Pilz drive technology. Pilz motion control – PMC provides overall solutions for automating your machine. From control systems to servo amplifiers, right up to servo motors: at Pilz you can buy everything from one source. Embedded within the respective system environment, including all safety aspects plus the relevant accessories. The focus is always on your application. Whether it's individual components or the complete solution: with Pilz drive technology, there are no limits.

Contents

Scan the QR code with your smartphone to see the 3D animation for drive technology PMC.

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 32 subsidiaries and branches, as well as 21 sales partners on every continent.

More than 2000 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.

Further information:
www.pilz.com +
Webcode: web0837

Automation solutions from Pilz – at home in every industry.

Pilz automation solutions – All in One: Safety & Automation

Pilz offers you solutions for complete automation. From sensor technology to control and drive technology – with safety and automation included. On all components and systems, simple commissioning, simple handling and simple diagnostics play an important role!

Profit from flexible automation solutions for small machines or even large, networked plants. Regardless of whether you want to standardize your safety, implement safety and automation in the periphery or are looking for the solution for complete automation.

Pilz solutions are embedded into the relevant system environment – whether a new structure or a retrofit – and open for a variety of interfaces and functionalities.

The perfect combination:

Control technology enables numerous application options, including monitoring of electrical and functional safety, through to complete machine control.

All in One: Safety & Automation

- Full diagnostic options for reduced machine downtimes
- Open communication for high flexibility
- Innovative software solutions for easy configuration, programming and visualization
- High scalability for individual solutions
- One system for safety and automation

In combination with the various control systems, safe **sensors** and **decentralized modules** guarantee the efficient use of plant and machinery in compliance with standards. Ready-to-install systems and universally compatible solutions offer high potential savings.

In the area of **drive technology,** the offer includes drive-integrated safety functions, safe logic functions and the connection of visualization, sensor and actuator technology.

Your plant or machinery are completed with **operator and graphics devices** from Pilz.

Design, programming, configuration, commissioning, diagnostics and visualization can be achieved quickly and simply using Pilz **automation software.**

Pilz offers scalable solutions to suit each requirement – from sensor technology to control and drive technology.

Pilz drive technology – Safe, energy efficient, open, productive

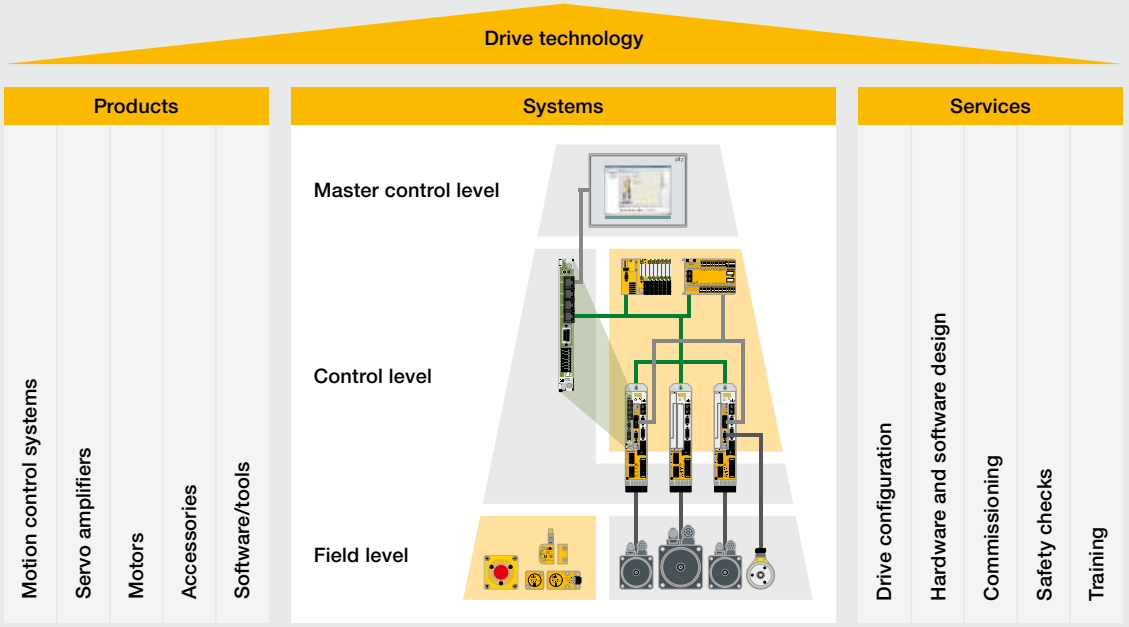
Pilz motion control provides overall and energy-efficient solutions for your machine automation. The portfolio comprises both individual components and complete solutions: from motion control systems and servo amplifiers to servo motors, including all safety aspects. Pilz drive technology is embedded into the relevant system environment – whether a new structure or a retrofit – and is open for a variety of interfaces and functionalities.

Expert advice on all issues relating to your drive

From planning to implementation, Pilz is right there beside you as your competent partner. The range of services extends from risk assessment to drive configuration, hardware and software design through to commissioning. Regular safety checks and a comprehensive range of training measures complete our range.

Your benefits at a glance

- Safe: up to PL e of EN ISO 13849-1 for each piece of feedback
- Energy efficient: high energy savings thanks to efficient servo technology
- Open: highly flexible because various fieldbus systems, feedback systems and functionalities can be used
- Productive: short cycle times enable high performance
- Simple parameter setting and diagnostics thanks to intuitive commissioning tools



Pilz drive technology: Products, services, systems – the one stop shop.

Minimize downtimes

Thanks to the PVIS diagnostic concept, system messages from the PMC control systems and servo amplifiers can be displayed in plain text. Remedy messages are displayed for each event. PVIS significantly reduces downtimes in the case of a fault. Thanks to pre-defined messages, even project configuration is child's play.

Open and flexible connection

Safe drive technology – safe motion – is open for connection to all standard PLC and motion control systems. Benefit from the high flexibility of our solutions, e.g. if only part of the machine is renovated during a retrofit.

Your benefits at a glance

- For simple to high end applications
- Solution is always expandable thanks to the modular design
- Fast to commission and simple to service thanks to universal programming in accordance with IEC 61131-3
- Complete automation solution or individual components – depending on your requirement
- Customized solutions incorporating all safety aspects
- Individual advice and customer care

PVIS® Professional diagnostic solution

Overview of control systems and servo amplifiers

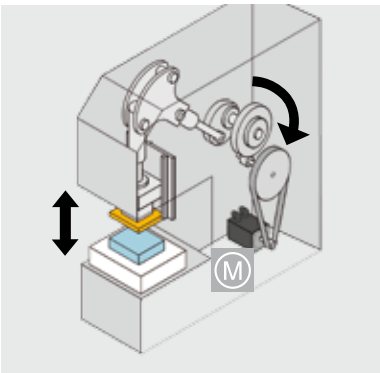
	Control systems		Servo amplifiers	
	Controller-based	Safe drive-based		
	 PMCprimo MC	 PMCprimo DriveP	 PMCtendo DD5	 PMCprotego DS
Soft PLC programming in accordance with IEC 61131-3	◆	◆		
Motion control	◆	◆		
Servo amplifiers		◆	◆	◆
Safe Torque Off		◆	◆	◆
Additional safety functions		◆		◆

Keep up-to-date on drive technology PMC:

Webcode: web5261

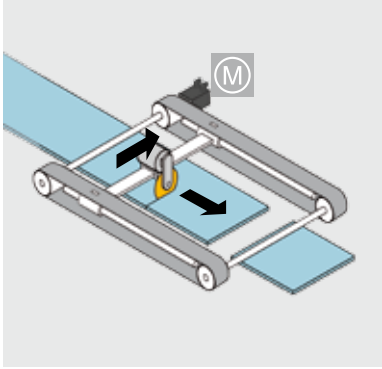
Online information at www.pilz.com

For a wide range of applications



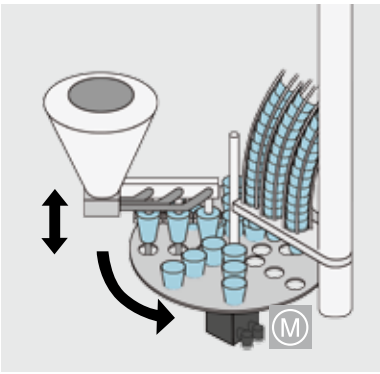
Servo press

Presses with servo drive increase the output rate compared with conventional presses and provide maximum flexibility. The safe motion solution is suitable for implementation of the necessary safety level PL e of EN ISO 13849-1 and SIL CL 3 of EN/IEC 62061. Functions such as “Safely Limited Speed” in setup mode, “Safe Direction” during the light grids’ muting phase and “Safe Brake Control” enable operators to work safely within the danger zone.



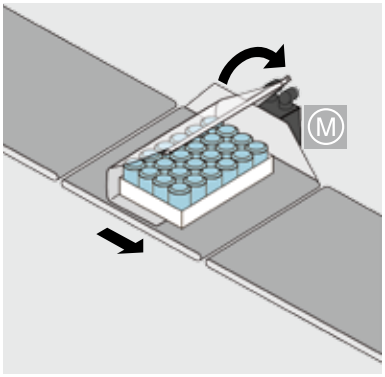
Flying saw

When cutting endless material such as wood or sheet metal for example, the flying saw moves synchronously with the material to be cut, so that the machining process does not need to be stopped. Once machining is finished, the cycle is restarted. If you add a safety aspect to this classic motion control function, the flying saw can be set up without risk at “Safely Reduced Speed”, for example.



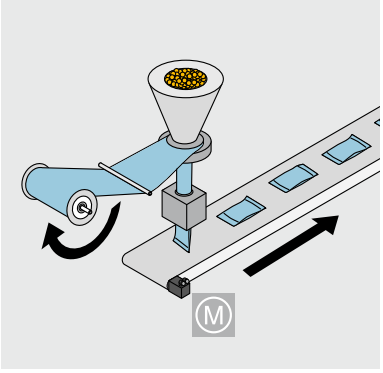
Filling

When filling liquid or paste products, axis movements are precisely co-ordinated. Motion sequences for setting dosing plungers and lifters can be set individually. Filling is so accurate that no material is spilt. The packaging size and associated fill volume can be modified. Recipes can also be incorporated for different fillings or weights. With Pilz motion control, the challenges of filling operations are like child’s play.



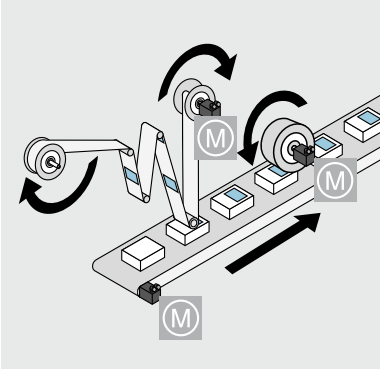
Wraparound

The wraparound application places high demands on precision and on the synchronicity of axis movements. The position of the product to be wrapped is identified first, then the film is unwound and the imprint is positioned precisely in the designated place. Plus the film is cut before the product is fully wrapped. An intelligent motion control system is a prerequisite for synchronizing the relevant axes.



Flow wrapping machine

When flow wrap bags are filled, various motion sequences are synchronized, such as unwinding the flow wrap bags, packing the product and transporting it to the end packing station. The motion control system with its functions and reaction times has considerable influence on process quality. Fast inputs for print mark sensors enable a rapid reaction to print marks on the overwrap film and the necessary adjustment of the motion curves.

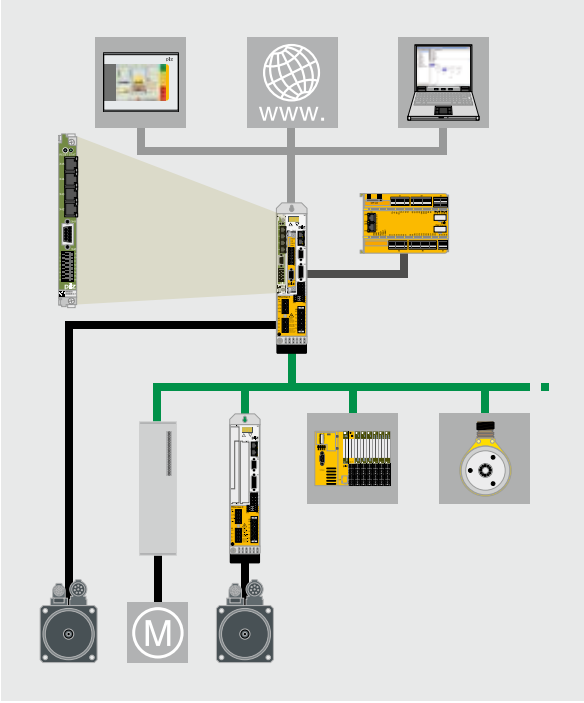


Labelling

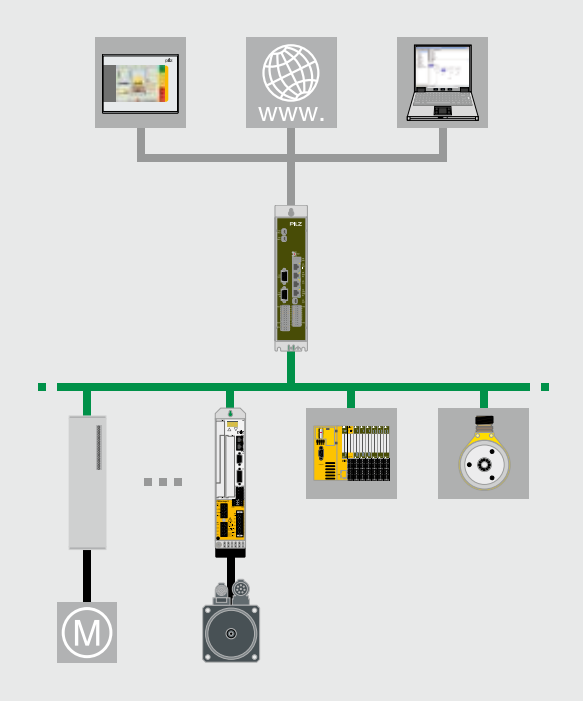
The unwind shaft and conveyor must be synchronized in order to position labels precisely. A sensor detects the label and sends a signal to the motion control system, in order to compensate for the tolerances that occur by adapting the motion paths. Short cycle times and fast digital inputs on the motion control system guarantee optimum synchronization of the relevant axes and precision label placement.

Motion control systems PMCprimo®

Control systems PMCprimo MC and PMCprimo Drive are used for all types of motion and control functions. They consist of PLC and motion technology. They perform the automation within a plant, including management of all the movements for several physically separate servo axes.



Safe drive-based control system PMCprimo DriveP.



Open, controller-based control system PMCprimo MC.

Universal programming under IEC 61131-3 in one project, covering standard PLC to motion control functionality, provides the basis for a wide range of functions:

- (Shock-free) positioning
- Virtual main shaft
- Electrical gearbox
- Cam mechanism
- Integral “flexible cam”
- Register control
- Web tension control
- PLC functionality
- Linear and circular interpolation
- Electronic camshaft
- Fast inputs to detect print marks

Selection guide – Motion control systems PMCprimo

Type	Bus systems
PMCprimo DriveP	PROFIBUS-DP Slave, CANopen, SafetyNET p RTFL [1) 2)]
PMCprimo MC	Modbus, PROFIBUS-DP Slave, CANopen

Combining economy with safety

A compact and cost-effective solution is available with the drive-based control systems PMCprimo Drive. From the second axis onwards, the servo amplifiers are simply connected to the drive bus. This reduces the space requirement in the control cabinet, plus you have an economical solution for your application.
This solution also provides the "Safe Torque Off" (STO) function by connecting the servo amplifier PMCtendo DD5.

All-in-one motion control

The safe drive-based control system PMCprimo DriveP is suitable when the demand is for control tasks with a particularly high performance level. Incorporate the motion control card PMCprimo C into the servo amplifier PMCprotego D and the result is an extremely compact, high-performance system. The number of axes is almost doubled, i.e. up to 16, at the same cycle time. As an option, safety functions can also be expanded using the safety card PMCprotego S.

Flexibility through openness

PMCprimo MC offers a flexible solution because the control system can be used centrally or as part of a network. The controller-based hardware platform provides the basis for an open system. The controller is cascadable, so PMCprimo MC can also be used for large-scale applications.

Your benefits at a glance

- Solution is always expandable thanks to the modular design
- Two hardware platforms, providing the optimum hardware basis for each application
- Combination of PLC and power element (PMCprimo Drive) provides an economical solution
- Open for house standards and customer requirements thanks to a wide range of interfaces
- Fast to commission and simple to service thanks to universal programming in accordance with IEC 61131-3
- Suitable for simple to complex applications

Number of axes	Hardware platform	Safety functions
1 to 16	Safe drive-based	(SLS, SDI, SBT, SBC, SOS, SS1, SS2, SSR, STO, SLI, SLP)[3]
1 to 16	Controller-based	-

[1] In preparation [2] Additional bus systems on request [3] When PMCprotego S is used

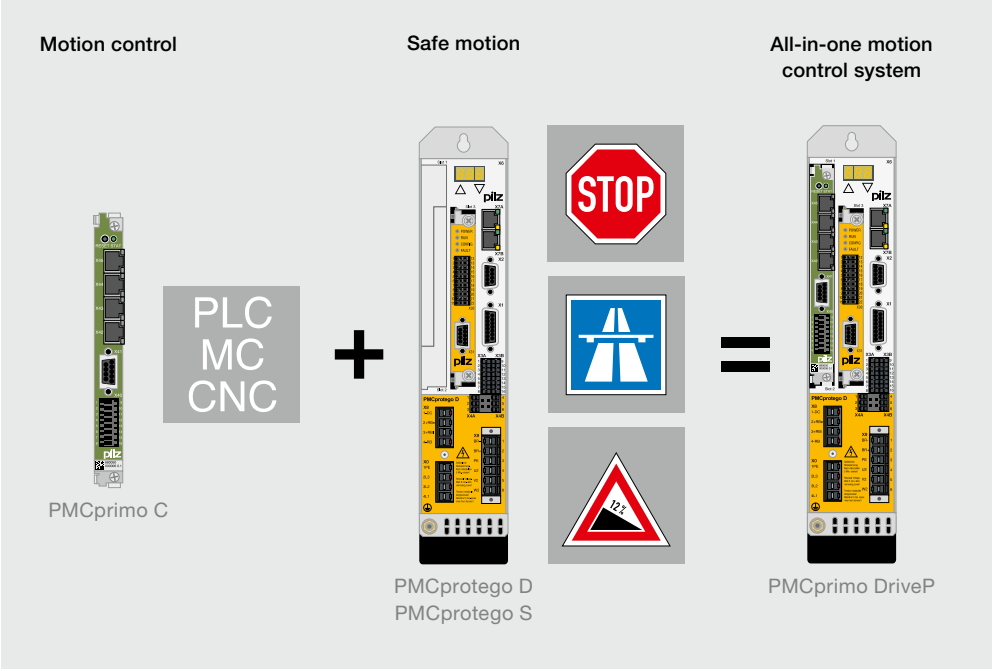
Keep up-to-date on control systems PMCprimo:

Webcode: web5531

Online information at www.pilz.com

Control system PMCprimo DriveP: All-in-one mo

The motion control system PMCprimo DriveP can resolve all control tasks relating to your motion control application at the highest performance level. Plug the motion control card PMCprimo C into the servo amplifier PMCprotego D and the result is an extremely compact, high-performance motion control system.



All-in-one with safe motion

The servo amplifier is used in safety-related applications up to PL e of EN ISO 13849-1 and SIL 3 of EN/IEC 62061. The safety card PMCprotego S can also be used as an option to expand the PMCprotego D with drive-integrated safety functions in accordance with EN 61800-5-2 – thus completing the all-in-one motion control system from Pilz. Further information on Pilz safe motion is available from page 26.

Compact solution

Due to the compact dimensions, motion control, PLC and safety functions can be combined in one unit – making it the most compact solution on the market. Clear, user-friendly software tools simplify commissioning of the motion control system and can save time through clear project documentation.

Technology leader

The motion control system uses the Intel® x86 Atom processor, enabling short cycle times plus high performance, as well as increasing the process quality of your application. This processor is the very latest available on the market, guaranteeing your investment and assuring long-term availability of spares.

Fieldbus communication lightens the load on the processor thanks to the FPGA chip, enabling the implementation of more complex plants with multiple axes. The integration of multiple communication stacks reduces the number of product types as well as storage costs. High performance communication between processor and FPGA also reduces the system reaction times.

tion control

The high processing power of the motion control system PMCprimo DriveP also enables low process tolerances. Thanks to the parallel operation of two CANopen networks, short cycle times with up to 16 axes can be achieved. This increases the process quality due to shorter bus cycle times.

Economical due to additional inputs and outputs

The inputs and outputs on the servo amplifier can be evaluated and controlled by the servo amplifier PMCprimo C as well as the six digital input and outputs on the motion control system. The additional inputs and outputs offer an economical solution and provide the highest flexibility for your application. The wide range of interfaces also offer openness to suit individual requirements. The use of fast inputs on the motion control card PMCprimo C in the servo amplifier also enables print mark detection on each axis. As a result, faster system reaction times are achieved, enabling more axes and therefore larger machines and systems to be controlled at the same time.

All the configuration data is stored on the SD memory card, so no additional components such as PC, software or cables are required when exchanging units or expanding the system. The memory card can simply be inserted into the new device.

Your benefits at a glance

- Short cycle times and high performance
- Long availability through use of the latest Intel® processors
- Higher performance thanks to shorter scan times
- More space in the control cabinet thanks to the compact, drive-integrated solution
- Simple, fast commissioning
- High productivity thanks to short reaction times
- Fast digital inputs (5 µs) enable higher material speed
- Fast, user-friendly introduction and project documentation as a result of clear software tools

Feedback

Resolver

EnDat

Hiperface

BiSS

Incremental encoder

Sensorless

Bus interfaces PMCprotego D + DS

EtherCAT

CANopen

SafetyNET p [1)]

Optional:

PROFINET

PROFIBUS

Bus interfaces PMCprimo DriveP

CANopen

PROFIBUS

SafetyNET p [1)]

[1)] SafetyNET p RTFL in preparation

Technical details – PMCprimo DriveP

Safe drive-based motion control system PMCprimo DriveP

PMCprimo DriveP

Technical details

Motion control card PMCprimo C

- CPU 0.6 GHz
- 1 Ethernet port for Modbus TCP/IP (communication/programming)
- 2 ports for SafetyNET p (linear structure)
- Fieldbus interfaces:
  - 2 x CANopen
  - CANopen + PROFIBUS-DP-S
- 6 digital inputs and outputs
- I/O on the servo amplifier can be used
- Encoder input incremental/SSI
- Memory: remanent (512 KB), RAM (128 MB), mass storage (512 MB)
- Up to 30 subscribers available
- Freely definable synchronization between axes and encoder
  - Electronic gearing (linear/non-linear)
  - Master-Slave mode
- Print mark detection
- Freely programmable
- Unlimited number of target positions

Servo amplifier PMCprotego D

- Position controller with max. 200 motion tasks
- Electronic gearing
- Master-Slave mode
- Encoder emulation
- Universal voltage range
- Intermediate circuits can be connected in parallel
- Encoder: up to 2 encoder inputs, 3 encoder inputs with additional card, 1 encoder output if one encoder input is omitted
- Digital inputs: 2 x 5 µs, 2 x 250 µs, 2 x STO Enable
- 2 x digital inputs or outputs: 250 µs
- Analog inputs: 2 x 16 Bit, ±10 V
- CANopen profiles (DS301, DS402)
- Serial interface RS 232
- Read/write device for SD card (SD Memory Card 512 MB, order number: 313100)
- Safe Torque Off (STO) up to SIL 3 of EN/IEC 62061, PL e of EN ISO 13849-1
- Integrated mains filter
- Internal brake resistor (size 01 … 24)
- Protection type: IP20
- Mounting position: vertical
- CE certification and UL approval
- TÜV-approved safety

Options

Hardware options:

- As an option, slot 3 of the servo amplifier PMCprotego D can be configured with:
  - PMCprotego S1-2
  - PMCprotego S2-2
  - PosI/O with fast bidirectional 5 V I/O for position encoder emulation (ROD or SSI) or RS 485 signals for encoder control or Master/Slave
  - PosI/O-AIO for PosI/O functions; Analog input ±10 V, 16 Bit; Analog output ±10 V, 16 Bit

Software options:

- Dynamic curve calculation
- Soft PLC in accordance with IEC 61131-3
- Path interpolation

Type code

Type/Order number	Mains voltage
PMCprimo DriveP. _ _ /_ _ _ /_ /_ /_ /	208 … 480 VAC

Current A	Size
1.5	**01**
3	**03**
6	**06**
12	**12** [1]
24	**24** [1]
48	**48**
72	**72**

		Hardware: PMCprimo C	AA0	AA1	AA2	AAC	AAD	AB0	AB1	AB2	ABC	ABD
Slot 1/2	A	CPU 0.6 GHz										
		Hardware: Bus system										
	A	CANopen/CANopen										
	B	CANopen/PROFIBUS-DP-S										
Slot 3	0	None										
	1	PosI/O [3]										
	2	PosI/O-AIO [4]										
	C	PMCprotego S1-2										
	D	PMCprotego S2-2										

Standard bus systems: CANopen

We reserve the right to change technical details

Features		Unit	Size (other sizes in preparation)								
			01	03	06	12	12P	24	24P	48	72
Nominal data											
Mains voltage (power)		VAC	3 x 208 … 3 x 480 V ±10 %								
Frequency range		Hz	50 … 60								
Max. motor voltage		VAC	Mains voltage less 4 V					Mains voltage less 6 V			
Continuous output current (at 400 VAC)		A_{eff}	1.5	3	6	12		24		48	72
Peak output current (max. 2 s)		A_{eff}	4.5	9	18	24	30	48	72	96	140
Peak output current (max. 5 s)		A_{eff}	3	6	12	24	24	48		96	140
Power consumption in S1 mode		kVA	1.1	2.2	4.5	9		18		35	50
Output stage clock frequency at I_{rms}		kHz	8/16 (50 % I_{rms})								
Supply voltage (electronics/with brake)		VDC	24 0 … +15 % (approx. 1 A/max. 3 A)							(approx. 2 A/ max. 5 A)	
Power dissipation at I_{rms}		W	40	70	100	160		330		635	1 005
Ballast circuit											
Internal brake resistor:											
Continuous output		W	50		75	100		200		-	
Max. peak output for max. 1 s		kW	15					23		-	
External brake resistor:		Ω	33					23		15	10
Max. continuous output		kW	0.3	1		1.5		4		6	6
Max. peak output for max. 5 s		kW	4 … 21					6 … 30		16 … 70	16 … 70
Environmental conditions											
Ventilation			Forced ventilation through built-in fans								
Ambient temperature		°C	0 … +40 at rated power, +40 … +55 with power derating 2.5 %/K								
Rel. humidity during operation		%	85, non-condensing								
Storage temperature		°C	-25 … +55								
Installation height		m above sea level	Up to 1 000 at rated power, 1 000 … 2 500 with current reduction of around 1.5 %/100 m								
Mechanics											
Weight		kg	4.4					5.5		13	
Dimensions (excl. connector)	Height	mm	345					348		385	
	Width	mm	70					100		190	
	Depth	mm	243								

Further technical details in the operating manuals:
- PMCprotego D
- PMCprimo C

Software option	2	3	4	5	6	7
None	■					
Dyn. curve calculation		■		■		■
IEC-61131-3 programming			■	■	■	■
Path interpolation					■	■

Firmware option	1
SafetyNET p [2]	■

Options	0	P
Standard	■	
I_{peak} = 3x [1]		■

[1] With increased peak output current as an option
[2] In preparation
[3] Expansion card without analog outputs
[4] Expansion card with analog inputs/outputs

Technical details – PMCprimo MC

Motion control system PMCprimo MC

PMCprimo MC

Technical details

- CPU 1.3 GHz
- 1 Ethernet port
  - Modbus TCP for devices/device communication
  - TCP/IP for programming
- 2 ports for SafetyNET p (linear structure)
- Interfaces: 4 x CANopen
- Alternative configuration:
  3 x CANopen + 1 x PROFIBUS-DP-S (DPV0)
- USB interface for data backup (external USB stick)
- 16 digital inputs:
  of which 6 x input filters can be set 5 µs/600 µs
- 16 digital outputs, 0.5 A
- I/O on the servo amplifier can be used
- 3 x encoder input incremental/SSI
- Memory: remanent (512 KB),
  RAM (512 MB), application (512 MB)
- Up to 30 subscribers available
- Freely definable synchronization
  between axes and encoder:
  - Electronic gearing (linear/non-linear)
  - Master-Slave mode
- Print mark detection
- Freely programmable
- Unlimited number of target positions

Options

- Dynamic curve calculation
- Soft PLC in accordance with IEC 61131-3
- Path interpolation

Type code

Type/Order number	Mains voltage
PMCprimo MC. _ /_ _ _ _ _ _ /_	24 VDC

CPU	C
1.3 GHz	

Hardware	
16DIDO	

Software option	2	3	4	5	6	7
None						
Dynamic curve calculation						
IEC-61131-3 programming						
Path interpolation						

We reserve the right to change technical details

Features		Unit	Performance data
Nominal data			
Supply voltage		VDC	24
Voltage tolerance		%	–15/+20
Environmental conditions			
Cooling			Fan
Ambient temperature		°C	0 … +40
Rel. humidity during operation		%	93 % r.h. at 40 °C
Storage temperature		°C	-40 … +70
Max. operating height above sea level		m	2 000
Airgap creepage (EN 61131-2)			
- Pollution degree			2
- Overvoltage category			II
Mechanics			
Dimensions (excl. connector)	Height	mm	270.6
	Width	mm	60
	Depth	mm	183

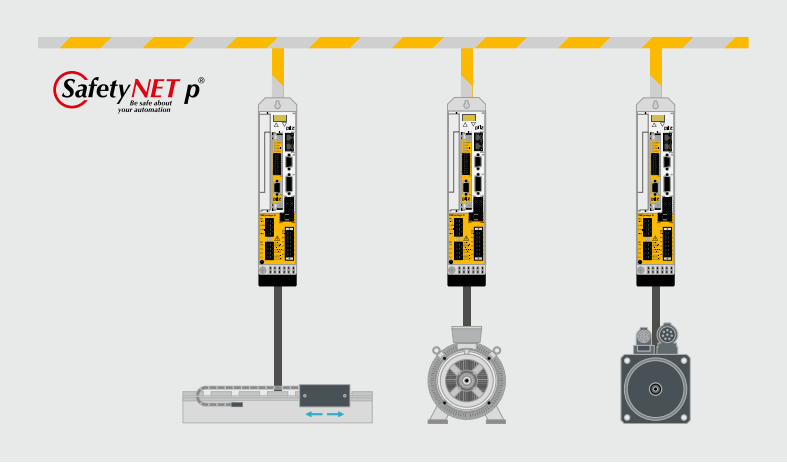
Further technical details in the operating manual

Servo amplifiers PMCprotego D and PMCtendo DD

Intelligent servo amplifiers from Pilz are used as drive controllers for the widest range of motor technologies. They can be used to operate all common types of motors, from servo motors to asynchronous and linear motors, including rotary direct drives, linear servo motors and applications with special motors. Take advantage of the benefits of the servo amplifier during design, control, application and operation.

These modern servo amplifiers do much more than just drive the motor:

- Positioning (driven via bus or inputs)
- Ability to store up to 200 motion tasks
- Implementation of complex motion sequences through motion tasks
- Speed control
- Torque control
- Electric gear function



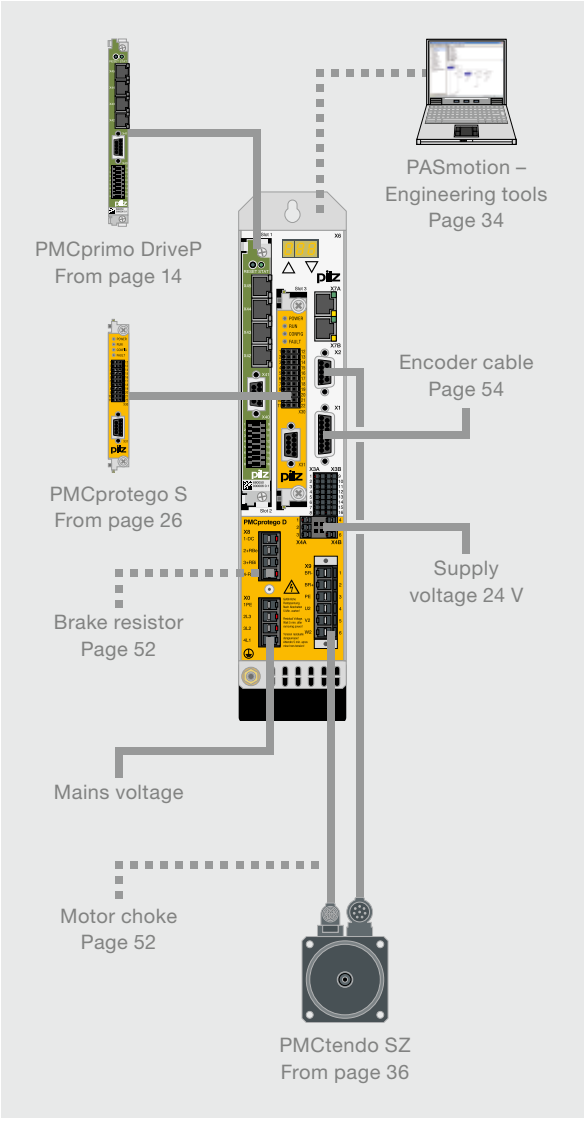
Servo amplifiers PMCprotegoD and PMCtendoDD can be used with the widest range of motor technologies.

Universal application

The servo amplifiers PMCprotego D and PMCtendo DD are designed for stand alone operation. Even the basic version provides all the functions necessary to operate a brushless motor in asynchronous or synchronous technology. More than 20 different feedback systems can be connected directly for operating the widest range of motor technologies. The servo amplifiers are compatible with a wide range of control systems thanks to the optional bus cards.

Selection guide – Servo amplifiers PMCprotego D and PMCtendo DD

Type	Rated current	Power supply
PMCprotego D	1.5 … 72 A	208 … 480 VAC
PMCtendo DD5	3.0 … 10 A 1.5 … 6 A	110 … 230 VAC 208 … 480 VAC



Selection guide PMCprotego D

Open for option cards

Expansion cards for almost all relevant fieldbus systems or PLCs can simply be plugged into the option slot on the servo amplifier. As a result, all amplifier functions can be accessed directly. The intermediate circuit connection with intelligent ballast circuit enables an optimum energy balance. So frequently there is no need for external brake resistors, even on critical axes.

Safe motion and motion control can be integrated

All servo amplifiers include the “Safe Torque Off” function, even in their basic configuration. The safety card PMCprotego S is used for additional safety functions (from page 26).

The motion control system PMCprimo C can also be integrated into the servo amplifier as a plug-in card, creating the all-in-one motion control solution from Pilz (from page 14).

PMCtendo DD

The compact series of the servo amplifier PMCtendo DD includes the “Safe Torque Off” function. Additional safe drive functions are implemented externally.

Size	Safe Torque Off	Additional safe drive functions	
		External solution	Drive-integrated solution
Standard	◆	◆	◆
Compact	◆	◆	

Keep up-to-date on:
▸ SafetyNET p

Webcode:
web6548

▸ Servo amplifiers PMCprotego D and PMCtendo DD

Webcode:
web5270

Online information at www.pilz.com

Technical details – PMCprotego D

Servo amplifier PMCprotego D

PMCprotego D
(size 01 … 12)

PMCprotego D
(size 48/72)

Technical details

- Position controller with max. 200 motion tasks
- Electronic gearing
- Master-Slave mode
- Encoder emulation
- Universal voltage range
- Intermediate circuits can be connected in parallel
- 2 encoder inputs
- 1 encoder output
- 2 digital inputs, STO Enable
- 2 digital inputs, 5 µs
- 2 digital inputs, 250 µs
- 2 digital inputs or outputs, 250 µs
- 2 analog inputs ±10 V, 16 Bit
- CANopen
  - DS301 communication profile
  - DS402 drive profile
- Ethernet-based bus communication EtherCAT
- Serial interface RS 232
- Read/write device for SD card
  (SD Memory Card 512 MB, order number: 313 100)
- Safe Torque Off (STO) up to
  SIL 3 of EN/IEC 62061,
  PL e of EN ISO 13849-1
- Integrated mains filter
- Internal brake resistor (size 01 … 24)
- Protection type: IP20
- Mounting position: vertical
- CE certification and UL approval
- TÜV-approved safety

Options

- As an option, slot 1 can be configured with:
  - D1 I/O expansion card
    with 14 inputs and 8 outputs
  - Fieldbus: PROFIBUS-DP-S
  - PMC expansion card PROFINET
- As an option, slot 2 can be configured with:
  - PosI/O with fast bidirectional 5 V I/O for
    position encoder emulation (ROD or SSI)
    or RS 485 signals for encoder control
    or Master/Slave
  - PosI/O monitor for PosI/O-AIO functions;
    2 analog inputs ±10 V, 16 Bit;
    2 analog outputs ±10 V, 16 Bit
- Slot 3 optionally configurable with safety card:
  - PMCprotego S1-2
  - PMCprotego S2-2
  - PosI/O with fast bidirectional 5 V I/O
    for position encoder emulation (ROD or SSI)
    or RS 485 signals for encoder control
    or Master/Slave
  - PosI/O monitor for PosI/O functions;
    analog input ±10 V, 16 Bit;
    analog output ±10 V, 16 Bit
- Coated: increased protection from
  particle-loaded ambient air
- Increased peak output current:
  I_{peak} = 3x I_{nenn} for size 12 and 24

Type code

Type/Order number	Mains voltage
PMCprotego D. _ _ / _ _ _ / 0 / _ / _ /	208 … 480 VAC

Current A	Size
1.5	**01**
3	**03**
6	**06**
12	**12** [1]
24	**24** [1]
48	**48**
72	**72**

Hardware option			000	100	200	A00	101	201	A01	102	202	A02	10C	20C	A0C	10D
Slot 1	0	None	■													
	1	I/O expansion		■			■			■			■			■
	2	PROFIBUS			■			■			■			■		
	A	PROFINET				■			■			■			■	
Slot 2	0	None	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	1	PosI/O [2]														
	2	PosI/O-AIO [3]														
Slot 3	0	None	■	■	■	■										
	1	PosI/O [2]					■	■	■							
	2	PosI/O-AIO [3]								■	■	■				
	C	PMCprotego S1-2											■	■	■	
	D	PMCprotego S2-2														■
	E	PMCprotego S1-2-C [4]														
	F	PMCprotego S2-2 C [4]														

We reserve the right to change technical details

Features		Unit	Size (other sizes in preparation)								
			01	03	06	12	12P	24	24P	48	72
Nominal data											
Supply voltage (power)		VAC	3 x 208 … 3 x 480 V ±10 %								
Frequency range		Hz	50 … 60								
Max. motor voltage		VAC	Mains voltage less 4 V					Mains voltage less 6 V			
Continuous output current (at 400 VAC)		A_{eff}	1.5	3	6	12		24		48	72
Peak output current (max. 2 s)		A_{eff}	4.5	9	18	24	30	48	72	96	140
Peak output current (max. 5 s)		A_{eff}	3	6	12	24	24	48		96	140
Power consumption in S1 mode		kVA	1.1	2.2	4.5	9		18		35	50
Output stage clock frequency at I_{rms}		kHz	8/16 (50 % I_{rms})								
Supply voltage (electronics/with brake)		VDC	24 0 … +15 % (approx. 1 A/max. 3 A)							(approx. 2 A/ max. 5 A)	
Power dissipation at I_{rms}		W	40	70	100	160		330		635	1 005
Ballast circuit											
Internal brake resistor:											
Continuous output		W	50		75	100		200		-	
Max. peak output for max. 1 s		kW	15					23		-	
External brake resistor:		Ω	33					23		15	10
Max. continuous output		kW	0.3	1		1.5		4		6	6
Max. peak output for max. 5 s		kW	4 … 21					6 … 30		16 … 70	16 … 70
Environmental conditions											
Ventilation			Forced ventilation through built-in fans								
Ambient temperature		°C	0 … +40 at rated power, +40 … +55 with power derating 2.5 %/K								
Rel. humidity during operation		%	85, non-condensing								
Storage temperature		°C	-25 … +55								
Installation height		m above sea level	Up to 1 000 at rated power, 1 000 … 2 500 with current reduction of around 1.5 %/100 m								
Mechanics											
Weight		kg	4.4					5.5		13	
Dimensions (excl. connector)	Height	mm	345					348		385	
	Width	mm	70					100		190	
	Depth	mm	243								

Further technical details in the operating manual

20D	A0D	001	002	00C	00D	00E	00F	010	01C	01D	020	02C	02D

Options	0	P	C
Standard			
I_{peak} = 3x[1]			
coated[4]			

Firmware option	1	2
SafetyNET p[5]		
EtherCAT		

Fieldbus standard: CANopen/EtherCat

[1] Devices with increased peak output current; see optional supplement
[2] Expansion card without analog inputs/outputs
[3] Expansion card with analog inputs/outputs
[4] Coated PCBs
[5] SafetyNET p RTFL in preparation

Technical details – PMCtendo DD5

Servo amplifier PMCtendo DD5

PMCtendo DD5

Technical details

- Position controller with max. 200 motion tasks
- Universal voltage range
- Intermediate circuits can be connected in parallel
- Supply voltage for control element 24 VDC
- 1 master encoder input
- 1 rotary encoder output
- CANopen
- Safe Torque Off (STO) up to SIL 2 of EN/IEC 62061, PL d of EN ISO 13849-1
- Integrated mains filter
- Internal brake resistor
- 4 digital inputs and 2 digital outputs
- 2 analog inputs: +/–10 V, 14/12 Bit
- Protection type: IP20
- Mounting position: vertical
- CE certification and UL approval

Options

- D1 I/O expansion card with 14 inputs and 8 outputs
- Fieldbuses:
  - EtherCAT
  - PROFIBUS-DP-S
  - PMC expansion card PROFINET

Type code

Type/Order number	Mains voltage
PMCtendo DD5. _ _ / _ _ _ / 0 / 0 /_ /	_ _ _ _ VAC

	Current A	Size
230 V series	3	**03**
	6	**06**
	10	**10**
480 V series	1.5	**01**
	3	**03**
	6	**06**

Hardware option			**000**	**100**	**200**	**500**	**A00**
Slot	0	Without					
	1	I/O expansion					
	2	PROFIBUS					
	5	EtherCAT					
	A	PROFINET					

Firmware option	**0**	**1**
Without		
SafetyNET p [4]		
Without		

Standard bus systems: CANopen

[4] In preparation

We reserve the right to change technical details

Features			Size					
			03	06	10	01	03	06
Nominal data								
Mains voltage (power)		VAC	1 x 110 … 1 x 230 V ±10 %, 3 x 110 … 3 x 230 V ±10 %			3 x 208 … 3 x 480 V ±10 %		
Frequency range		Hz	50 … 60					
Max. motor voltage		VAC	Mains voltage less 5 V					
Continuous output current (at 3 x 230 V)		A_{eff}	3	6	10	-		
Peak output current (max. 5 s at 3 x 230 V)		A_{eff}	9	15	20	-		
Continuous output current (at 3 x 400 V)		A_{eff}	-			1.5	4	6
Peak output current (max. 5 s at 3 x 400 V)		A_{eff}	-			4.5	7.5	12
Power consumption in S1 mode		kVA	1.1	2.4	4	1.2	2.5	5
Output stage clock frequency at I_{rms}		kHz	8/16 (50 % I_{rms})					
Supply voltage (electronics/with brake)		VDC	24 0 … +15 % (approx. 1 A/max. 2.5 A)					
Power dissipation at I_{rms}		W	35	60	90	40	60	90
Ballast circuit								
Internal brake resistor:								
Continuous output		W	20	50		20	50	
Max. peak output for max. 1 s		kW	3 [1]			7 [2]		
External brake resistor:		Ω	66			91		
Max. continuous output		kW	0.3	1		0.3	1	
Max. peak output for max. 5 s		kW	3 [1]			7 [2]		
Environmental conditions								
Ventilation [3]			Without	With		Without	With	
Ambient temperature		°C	0 … +40 at rated power, +40 … +55 with power derating 2.5 %/K					
Rel. humidity during operation		%	85, non-condensing					
Storage temperature		°C	-25 … +55					
Installation height		m above sea level	Up to 1 000 at rated power, 1 000 … 2 500 with current reduction of around 1.5 %/100 m					
Mechanics								
Weight		kg	2.6			2.7		
Dimensions (excl. connector)	Height	mm	279					
	Width	mm	70					
	Depth	mm	171					

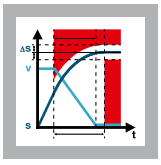
[1] At 230 V [2] At 400 V [3] Forced ventilation through built-in fans

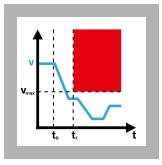
Further technical details in the operating manual

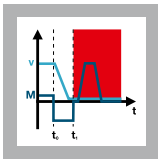
230 V series	**110 … 230 VAC**
480 V series	**208 … 480 VAC**

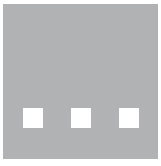
Safe motion – Safety card PMCprotego S

The combination of the safety card PMCprotego S and the servo amplifier PMCprotego D produces the safe drive solution – safe motion. It is open for all standard PLC and motion control systems. Benefit from the high flexibility of our solution.









Safe motion – Safety card PMCprotego S.

Protection of man and machine

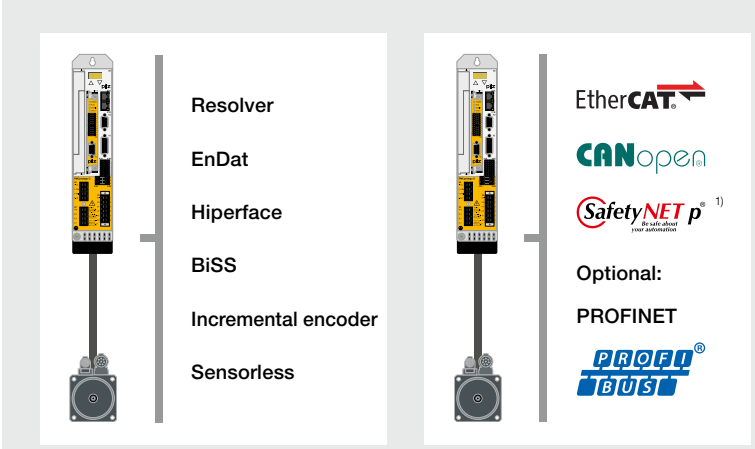
Safe motion describes the implementation of safety functions for one or more drive axes. This is necessary to prevent uncontrollable movements. At the same time it guarantees the safety of personnel during operation, setup, format change or maintenance.

Open for individual requirements

The PMCprotego DS provides safe inputs and outputs to activate the safety functions. It also provides a variety of encoder interfaces plus a connection to all common bus systems.

Economical operation

Safe motion opens up new possibilities for co-operation between man and machine. For example, it's possible to set up machinery at "Safely Reduced Speed". This reduces the setup time and increases the availability of the process.



Openness thanks to a variety of encoder interfaces and bus systems.
1) In preparation

Complete one-stop automation solution

With the safety card PMCprotego S, the automation solution from Pilz is complete. You benefit from a complete one-stop solution. Compatible products and tools reduce the work involved in training and documentation. Optimum integration of the safety card PMCprotego S brings significant cost savings.

Safety with a standard encoder

Safety on the servo amplifier PMCprotego DS is based on the evaluation of internal system variables. The servo motor's existing standard feedback system is all that's needed for implementation. A second encoder is not required in order to achieve SIL 3, PL e, which reduces the overall costs.

Safe networking

Safe, sophisticated multi-axis applications are the result when the PMCprotego DS is connected to a control system with the real-time Ethernet SafetyNET p as the safe drive bus.

Simple diagnostics

Thanks to the PVIS diagnostic concept, system messages from the safe servo amplifiers PMCprotego DS are displayed in plain text on the diagnostic device PMI via the motion controller PMCprimo. Remedy messages are displayed for each event. PVIS significantly reduces downtimes in the case of a fault. Thanks to pre-defined messages, even project configuration is child's play.

Reduced reaction times

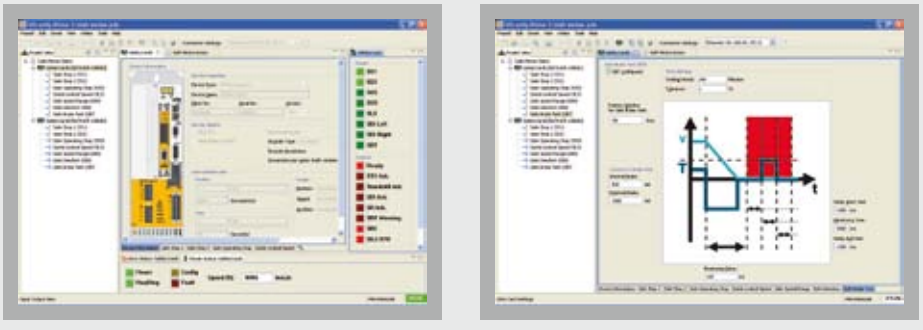
The servo amplifiers PMCprotego DS have integrated safety functions, opening up new possibilities for safe drive solutions. Motion is monitored precisely where it arises. Reaction times are reduced considerably as a result. This is very significant for safety, particularly with highly dynamic drives. Costs are reduced at the same time, as there are fewer external safety components.

Your benefits at a glance

- Highly dynamic, short reaction times
- Costs are reduced because the highest safety category PL e is achieved with one encoder (standard feedback system)
- Simple, fast commissioning
- Easy-to-use software tool
- Devices are easy to exchange thanks to the SD memory card (standard and safety configuration)
- Integrated diagnostics PVIS
- Less wiring
- Greater functionality and convenience, as internal system variables can be used
- Integrated mains filter enables costs to be reduced as the wiring work is no longer required (EMC standards are met)

Centralized view of decentralized safety – One tool covers every axis

The parameters for several safety cards are set centrally via a software tool. The cards that are used are displayed in a tree structure. Thanks to the clear graphical interface, parameters can be set simply and quickly. The current status of the safety card can be displayed online. This means that the operating status, error stack and other data can be monitored continuously.



Clear user interface for simple parameter setting.

Technical details – PMCprotego S

Safety cards PMCprotego S

Common features

- Electrical data
  - External supply voltage U_B: 24 VDC
  - Power consumption (with no load): approx. 3 W
- Inputs
  - Galvanic isolation: Yes
  - Signal level at “0”: -3 … 5 V
  - Signal level at “1”: 15 … 30 V
- Single-pole/dual-pole outputs
  - Galvanic isolation: Yes
  - Electronic short circuit protection: Yes
  - Signal level at “0”: 0 VDC
  - Signal level at “1”: 24 VDC
- Environmental data
  - Protection type: IP20
  - Ambient temperature: 0 … 40 °C
  - Storage temperature: -25 … +55 °C
- Mechanical data
  - Dimensions in mm (H x W x D): 142 x 103 x 18.5
  - Installation: in PMCprotego D, Slot 3
  - Weight: 150 g

PMCprotego S

Features
Reaction times
Inputs/outputs (single-pole)
Output to control an external brake (dual-pole)
Brake
Encoder input
Standards
Coating (-C)
Safety functions
Order number

We reserve the right to change technical details

	PMCprotego S1-2/(-C)	PMCprotego S2-2/(-C)
Error reaction time in ms	2	3
Response time of the safety functions in ms	4	5
Number of inputs	9	8
Number of single-pole outputs 0.5 A	7	5
Number of dual-pole outputs 2 A	1	-
Galvanic isolation	Yes	-
Control external brake < 2 A	via PMCprotego S1	-
Control external brake > 2 A	via external brake module	-
Number of external encoders	1 [1]	-
Encoder type	SSI/incremental encoder	-
	SIL CL 3 of EN/IEC 62061, PL e of EN ISO 13849-1	SIL CL 2 of EN/IEC 62061, PL d of EN ISO 13849-1
	Uncoated / (coated)	Uncoated / (coated)
Safe Torque Off (STO)	◆	◆
Safe Stop 1 (SS1)	◆	◆
Safe Stop 2 (SS2)	◆	◆
Safe Operating Stop (SOS)	◆	◆
Safely Limited Speed (SLS)	◆	◆
Safe Speed Range (SSR)	◆	◆
Safe Direction (SDI)	◆	◆
Safely Limited Increment (SLI)	◆	◆
Safely Limited Position (SLP)	◆ [1] [2]	
Safe Brake Control (SBC)	◆	
Safe Brake Test (SBT)	◆	
	680004 / (680008)	680006 / (680009)

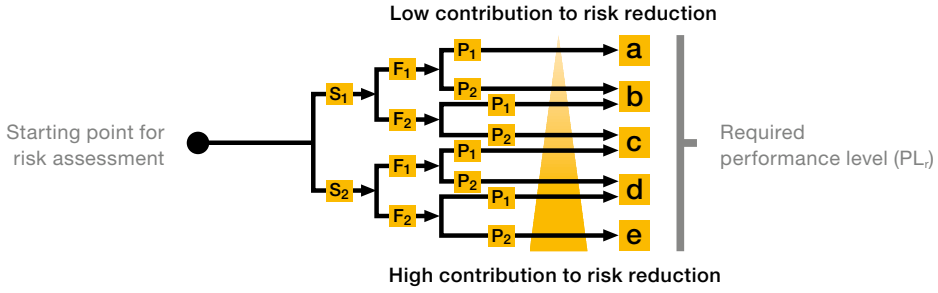
[1] The Pilz solution is already safe with the servo motor's feedback system. If the risk assessment of the mechanical drive train requires a second encoder, a second, external encoder can be connected.
[2] Requires the connection of an additional encoder.

Risk assessment

Risk assessments are the key to machinery safety. They pave the way for risk reduction that is both effective and economical. Many activities carried out by operators and maintenance staff represent a high risk. Pilz supports you in issues of risk assessment and machine safety based on applicable standards and directives.

1. Risk estimation

Determination of the required performance level (PL_r)



S – Severity of injury
- S1 = Slight (normally reversible injury)
- S2 = Serious (normally irreversible injury including death)

F – Frequency and/or duration of exposure to a hazard
- F1 = Seldom to less often and/or the exposure time is short
- F2 = Frequent to continuous and/or the exposure time is long

P – Possibility of avoiding the hazard
- P1 = Possible under specific conditions
- P2 = Scarcely possible

Product standards

EN 61496
Safety on electrosensitive protective equipment

EN 61800-5-2
Safety functions for drives

Design specifications

EN ISO 13855
- Safety of machinery
- Layout of safety devices

EN ISO 12100
- Safety of machinery
- Principles for design and risk analysis
- General principles for design – Risk assessment and risk reduction

Application standards

EN 60204-1
Safety of electrical equipment

EN 61326-3
EMC and functional safety

EN 62061
Functional safety for machinery (electrical incl. EMC)

EN 61508
Functional safety, generic standard

EN ISO 13849
Safety-related parts of machinery (electrical and non-electrical)

EN 61511
Safety systems for the process industry

Drive-integrated safety

According to the Machinery Directive, the risks caused by the drive need to be considered when drive functions are designed, as well as the operating functions. The basis for this is IEC 61800-5-2. All the safety functions available on the PMCprotego DS meet the safety requirements stipulated by this standard. All the functions can be divided into safe stop, motion and brake functions.

Servo amplifiers PMCprotego D are also designed for SIL 3 of EN/IEC 62061 and PL e of EN ISO 13849-1.

Stop functions

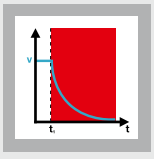
Safe motion functions

Safe brake functions

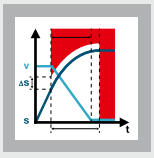
2. Selection of the measures required to minimize risk

In accordance with the Machinery Directive, every machine manufacturer is obliged to carry out a risk assessment. DIN EN ISO 12100 provides general guidelines for performing the risk assessment and identifying the hazards. Safe stop functions are used to prevent an unexpected start-up or to stop the plant safely in hazardous situations.

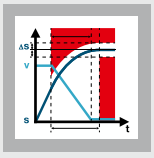
Safe stop functions – Overview



Safe Torque Off (STO)
With the “Safe Torque Off” function, the power to the motor is safely removed directly within the servo amplifier. The drive cannot generate any hazardous movements. If the STO is activated when the drive is moving, the motor will run down in an uncontrolled manner.



Safe Stop 1 (SS1)
With a “Safe Stop 1” function, the drive is brought to a controlled stop and then the power to the motor is safely removed. Once at a standstill, the drive cannot generate any hazardous movements. On gravity-loaded axes, the drive must also be secured by a mechanically-based braking concept.

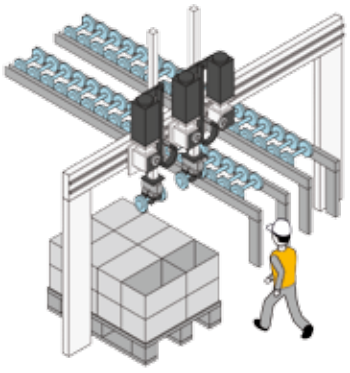
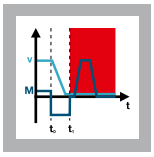
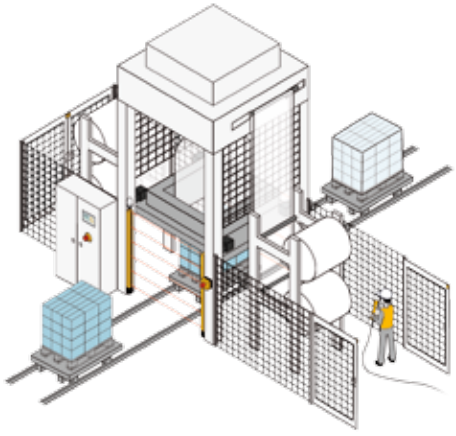
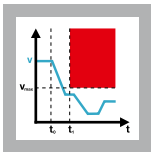
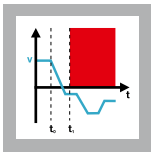
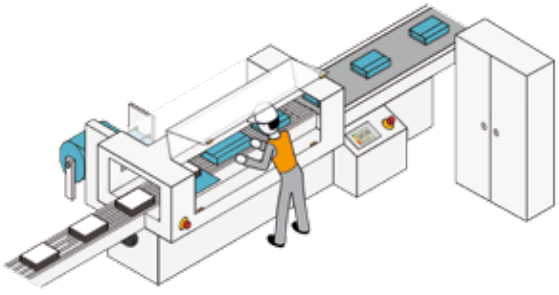
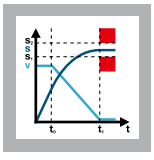


Safe Stop 2 (SS2)
With a “Safe Stop 2” function, the drive is brought to a controlled stop and then a “Safe Operating Stop” is initiated. In a "Safe Operating Stop", the drive’s control functions are maintained in full.

M = Torque, s = Distance, t = Time, v = Velocity

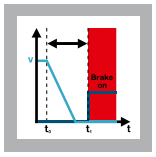
Various requirements from the Machinery Directive concern operating modes that necessitate human intervention on the machine. This intervention can also take place while safeguards are partially disconnected. Various solutions are allowed, depending on the design or the duration of exposure. While in many applications switching off a motor is usually a safe solution, in the case of vertical axes, switching off could present a danger.

Risk reduction measures

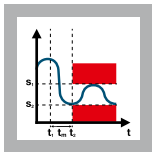
Risk	Measures
Suspended loads/vertical axes 	 **Safe Brake Test (SBT)** The “Safe Brake Test” function checks the function of the brake. This test can be used to identify any faults in the brake’s control and mechanics. The brake test may be carried out in each production cycle or only every 24 hours, depending on the specific application and the requirement from the risk analysis.
Setup 	 **Safely Limited Speed (SLS)** The “Safely Limited Speed” function monitors the drive to check that a defined maximum speed is not exceeded. If the speed limit value is exceeded, the drive is shut down safely.  **Safe Direction (SDI)** The “Safe Direction” function guarantees that a drive can only move in one (defined) direction. If the specified direction is violated, the drive is shut down safely.
Intervention in the process 	 **Safe Operating Stop (SOS)** The “Safe Operating Stop” function monitors the stop position reached by the axis and prevents any deviation from the position window. The drive’s control functions are maintained in full. If the position strays outside of the monitored window, the drive is shut down safely. On gravity-loaded axes, the drive must also be secured by a mechanically-based braking concept.

Additional possible measures for risk reduction are the safe stop functions: Safe Torque Off (STO), Safe Stop 1 (SS1), Safe Stop 2 (SS2).
More information on page 31.

Benefits

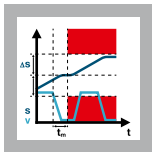


Safe Brake Control (SBC)
The “Safe Brake Control” function enables brakes to be controlled safely, thereby preventing suspended loads from falling.

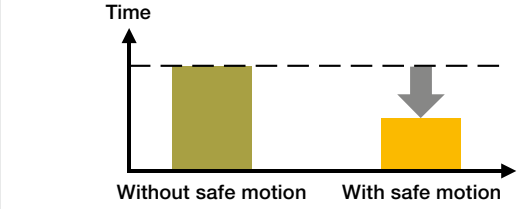


Safely Limited Position (SLP)
The “Safely Limited Position” function monitors the end positions of previously defined ranges. If a limit value is violated, the drive is shut down safely.

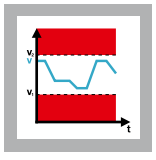
Safe brake functions automatically test the braking action, leading to
- Reduced maintenance
- Increased productivity and availability
- Higher level of safety



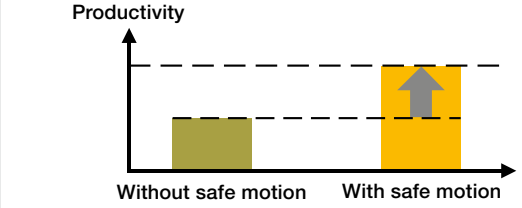
Safely Limited Increment (SLI)
The “Safely Limited Increment” function monitors the movements of the drive for compliance with a defined increment. The reference position is defined when monitoring is activated. If a limit value is violated, the drive is shut down safely.



Working safely with the guards open leads to
- Reduced setup times as there is a better insight into the setup area
- Greater work safety by guaranteeing that the direction of movement corresponds to the selected jog function
- Greater work safety due to safely limited setup speeds



Safe Speed Range (SSR)
The “Safe Speed Range” function adds minimum speed monitoring to the SLS function. In other words, the maximum speed must not exceed a certain value, and the minimum speed must not drop below a certain value. If either of these limits is violated, the drive is shut down.

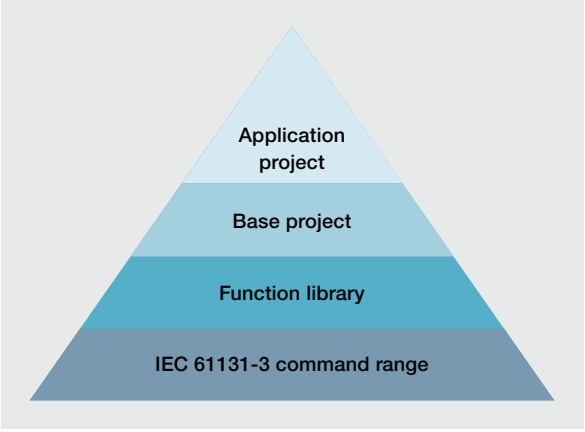


Safe Operating Stop (SOS and SSR) leads to higher productivity because
- Axis synchronization is maintained
- Plants are restarted quickly and more simply
- Safety level is higher as the plant is protected against unexpected restart

M = Torque, s = Distance, t = Time, v = Velocity

PASmotion – PMC engineering tools

Motion control made simple – professional tasks require professional tools. Use our comprehensive software to configure, program and monitor your machine.



Universal programming in accordance with IEC 61131-3 guides you through an application, from planning to production. All the key components for commissioning an automation system are integrated.

From the rapid generation of motion curves through to simple drive parameterization: nothing presents a problem thanks to the integrated commissioning tools.

Programming environment under IEC 61131-3
The basis for the entire programming is a soft PLC under IEC 61131-3. Individual programming requirements are considered thanks to the five editors. The tool is used to program the Pilz motion control systems. External devices are easy to integrate via various bus systems thanks to the resource manager.

Function libraries
A large number of standard libraries provide all common PLC and motion control functions. The function libraries for curve and drive parameterization are a particular feature. They form the interface to the graphical auxiliary programs and act as a memory cell for the calculated data.

Software with integrated motion control functions (base project)
The base project's ready-made program structures simplify the implementation of the application considerably, as the motion part is pre-programmed and fully functional. All that's left is to adapt the specific parameters and program the calls for the various operating states.

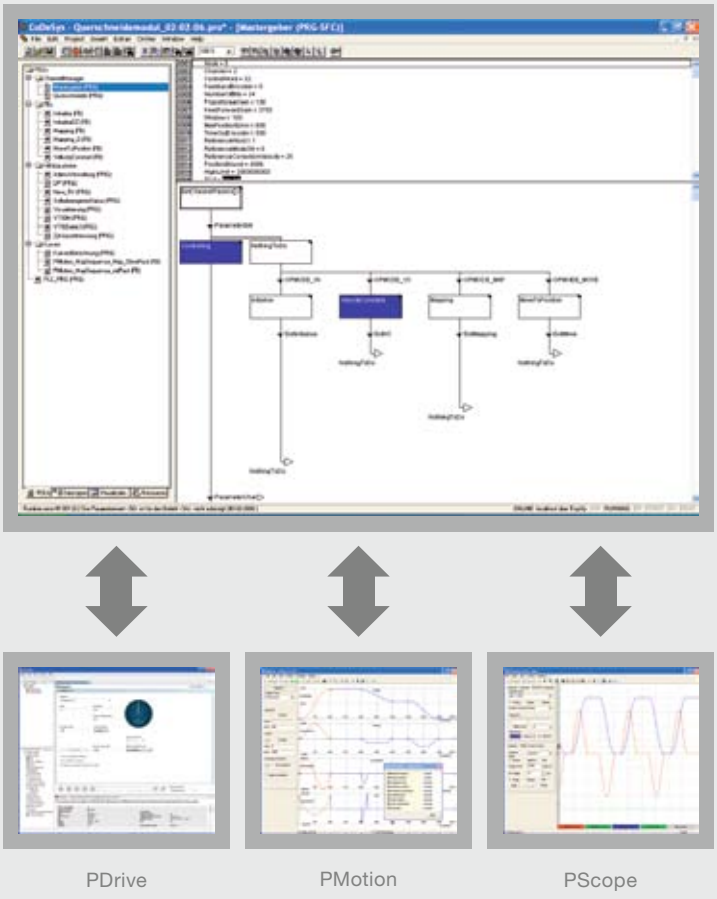
Parameterization instead of programming (application project)
Ready-made application projects can be employed if common functions such as cross cutting, flying saw, synchronization or similar are used on your machine, whether individually or in combination. You can dispense with time-consuming programming; all you need to do is adapt the application-specific parameters on the operator terminal.

PMC configuration tools

PASmotion

Type	Application
PASmotion [1)]	Configuration software for motion control devices
PMC programming tool [1)]	IEC-61131-3 programming environment
PASconfig SDrive [1)]	Parameter software for safety cards PMCprotego S (safe motion)

[1)] Download from www.pilz.com/support/downloads/



Your benefits at a glance

- Parameterization instead of programming thanks to base projects/application projects
- Safe handling of all automation data and programs, as everything is combined in one project
- Save time thanks to simple operation and ready-made function blocks
- Your drives can be commissioned quickly and easily thanks to graphic tools and a storage oscilloscope
- From planning to production: everything in one project file thanks to universal programming in accordance with IEC 61131-3

Setting parameters for the servo amplifier with PDrive

A complete parameter database is available for all common servo amplifier/motor combinations.

Curve generation with PMotion

Master-Slave relationships can be created quickly and easily using the sophisticated plotting program PMotion. It is possible to display the angle assignment, as well as speed, acceleration and shock for the motor and mechanical design. The Master-Slave relationships created graphically with PMotion can be influenced by offsets in the PLC program at runtime. It is also possible to switch between the various Master-Slave tables during operation.

Graphical diagnostics with PScope

PScope is a powerful diagnostic tool. All relevant analog and digital processes in the control system and drives are displayed graphically on the PC.

Parameter software for safe motion

Thanks to the clear, graphical interface of the PASConfig SDrive tool, parameters for the safety cards PMCprotego S can be set simply and quickly.

Keep up-to-date on Pilz motion control tools software:

Webcode: web8636

Online information at www.pilz.com

Servo motors PMCtendo SZ

PMCtendo SZ servo motors represent a modern range of servo motor. Here you'll find the right motor for each specific application. Whether the focus is on dimensions, dynamics, controllability or feedback systems.

PMCtendo SZ (convection-cooled)

PMCtendo SZ (forced air-cooled)

PMCtendo SZ (water-cooled)

Good controllability
The excellent controllability of the PMCtendo SZ motors is achieved using the high resolution absolute encoder as a feedback system. Through this you can read out the absolute position of the motors during operation. Even when the machine has been switched off or there is a power failure, the absolute position will still be available.

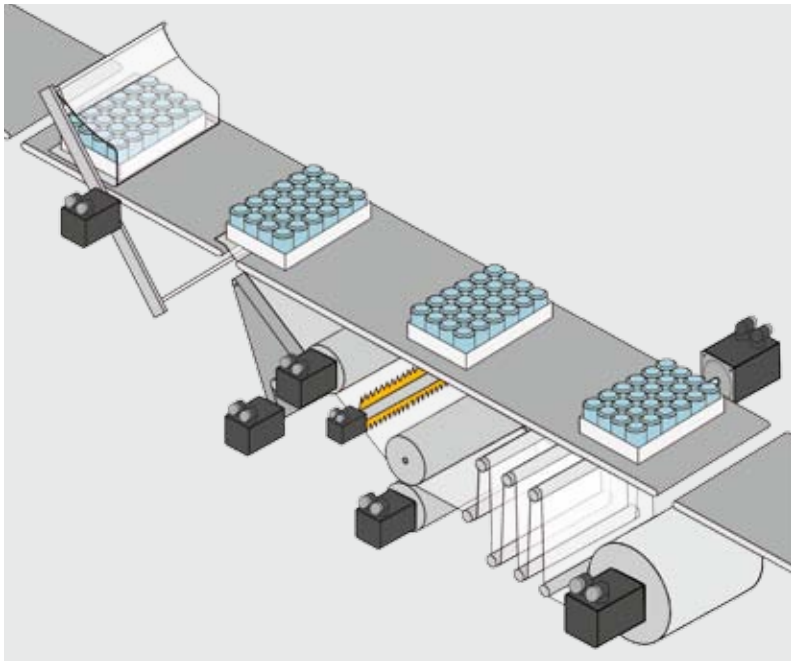
More than just motors
All motors are available with a range of gearings. Special versions, forced air fans, water coolers etc. are also available.

Support with your motor design
Three different motor sizes are available in the standard product range. On request we can also supply customized solutions. And of course, Pilz application engineers will provide support with the motor design and definition of the power transmission.

Compact design, high performance
Thanks to their high power density, the servo motors PMCtendo SZ have an extremely short overall length and are also lightweight. As a result they are particularly suitable where conditions are cramped and for on-board axes. Precise motor synchronization, due to low cogging torques, provides constantly high process quality.

Selection guide – Servo motors PMCtendo S

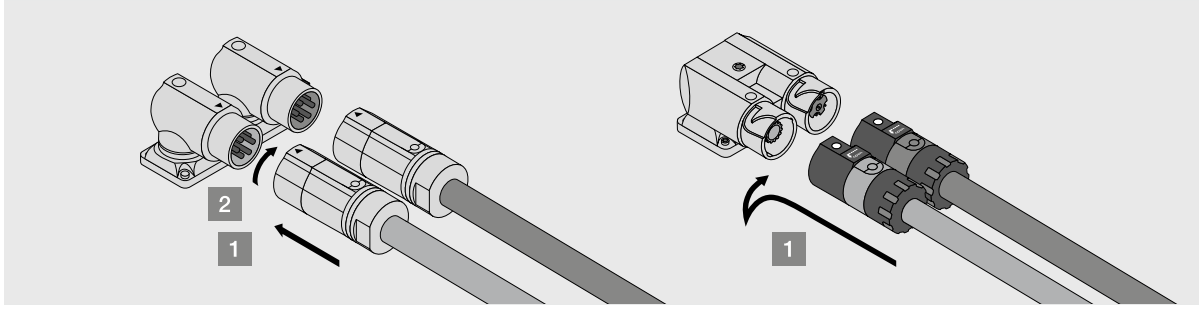
Type
PMCtendo SZ3x
PMCtendo SZ4x
PMCtendo SZ5x
PMCtendo SZ7x
PMCtendo SZ8x



Your benefits at a glance

- High dynamics and torque stability
- Excellent ratio between torque/moment of inertia
- Extremely quiet operation in all speed ranges
- Smooth operation at low speed
- High reliability even in extreme working conditions
- High resolution absolute value encoder systems for highest performance and absolute positioning
- Competent support with your motor design

The appropriate, decentralized drive for every detail.



Servo motors PMCtendo can be commissioned quickly using quick-lock speedtec® and springtec® connectors.

sZ

Standstill torque			Rated speed	Flange
Convection M_0 in Nm	Forced air fan M_0 in Nm	Water cooling M_0 in Nm	n_N in rpm	in mm
0.95 … 2.25	-	-	3000, 6000	60
2.80 … 8.60	3.5 … 11.2	3.35 … 11.3	3000, 6000	95
4.40 … 16.00	5.7 … 23.4	5.55 … 21.5	3000; 4500	110
7.90 … 30.20	10.2 … 41.8	10.40 … 39.4	3000; 4500	130
34.50 … 66.10	47.4 … 94.0	46.90 … 90.1	2000; 3000; 4500	180

Keep up-to-date on servo motors PMCtendo SZ:

Webcode: web5284

Online information at www.pilz.com

Technical details – PMCtendo SZ

PMCtendo SZ

Servo motors PMCtendo SZ

General technical details

- Extremely short overall length
- Smooth shaft
- High dynamics due to low inertia
- Rotary speedtec connector
- Therm. winding protection PTC
- Protection type: IP56
- Surface: black, matt RAL 9005
- EnDat absolute encoder: single-turn or multi-turn
- UL approval and CSA certification for the motor insulation system

The performance data in the tables below refers to the following boundary conditions:

- Rated voltage: 400 V
- Operating mode: S1 at rated operation
- Maximum heating: 100 K
- Cooling: Convention in accordance with IC410
- Ambient temperature:
  - Convection cooling: -15 … +40 °C
  - Water cooling: +5 … +40 °C
- Heat class: F
- Installation height up to 1 000 m above sea level

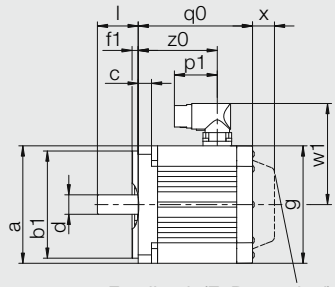
Options

- Holding brake: 24 VDC
- Increased inertia
- Protection type: IP66
- External IP44 fan to IC416
- Water cooling, A-side motor flange

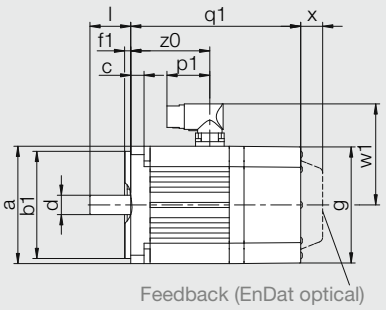
Motor size	Common dimensions in mm				
	øb1 [1]	øe1 [2]	ød [3]	l	a
31	60j6	75	14k6	30	72
32	60j6	75	14k6	30	72
33	60j6	75	14k6	30	72
41	95j6	115	14k6	30	98
42	95j6	115	19k6	40	98
44	95j6	115	19k6	40	98
51	110j6	130	19k6	40	115
52	110j6	130	19k6	40	115
53	110j6	130	24k6	50	115
55	110j6	130	24k6	50	115
71	130j6	165	24k6	50	145
72	130j6	165	24k6	50	145
73	130j6	165	24k6	50	145
75	130j6	165	32k6	58	145
82	180j6	215	32k6	58	190
83	180j6	215	38k6	80	190
85	180j6	215	38k6	80	190

Convection-cooled:

PMCtendo SZ:
convection-cooled, without brake

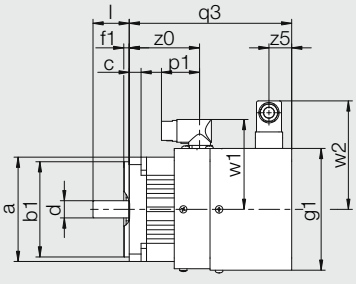


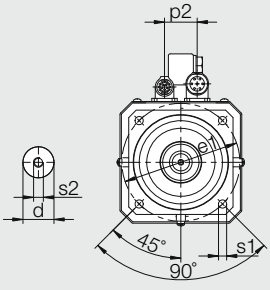
PMCtendo SZ:
convection-cooled, with brake



Forced air-cooled:

PMCtendo SZ:
forced air--cooled, without brake



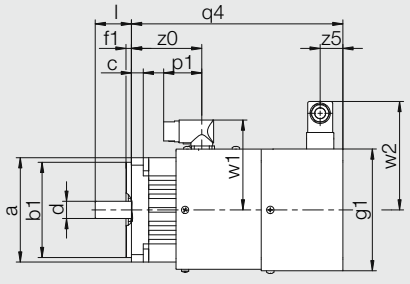


We reserve the right to change technical details

								Convection-cooled				Forced air-cooled					Water-cooled	
c	**f1**	**p1**	**p2**	**øs1**	**øs2**	**w1**	**z0**	**g**	**q0**	**q1**	**x**	**g1**	**q3**	**q4**	**w2**	**z5**	**w3**	**z7**
7.0	3.0	45	19	6	M5	56	80.5	72	116.0	156.0	21	-	-	-	-	-	-	-
7.0	3.0	45	19	6	M5	56	102.5	72	138.0	178.0	21	-	-	-	-	-	-	-
7.0	3.0	45	19	6	M5	56	124.5	72	160.0	200.0	21	-	-	-	-	-	-	-
9.5	3.5	40	32	9	M5	91	76.5	98	118.5	167.0	22	118	175	224	111	25	49	12.5
9.5	3.5	40	32	9	M6	91	101.5	98	143.5	192.0	22	118	200	249	111	25	49	12.5
9.5	3.5	40	32	9	M6	91	151.5	98	193.5	242.0	22	118	250	299	111	25	49	12.5
10.0	3.5	40	36	9	M6	100	74.5	115	109.0	163.5	22	135	179	234	120	25	70	10.5
10.0	3.5	40	36	9	M6	100	99.5	115	134.0	188.5	22	135	204	259	120	25	70	10.5
10.0	3.5	40	36	9	M8	100	124.5	115	159.0	213.5	22	135	229	284	120	25	70	10.5
10.0	3.5	40	36	9	M8	100	174.5	115	209.0	263.5	22	135	279	334	120	25	70	10.5
10.0	3.5	40	42	11	M8	115	83.0	145	121.0	180.0	22	165	213	272	134	40	72	10.5
10.0	3.5	40	42	11	M8	115	108.0	145	146.0	205.0	22	165	238	297	134	40	72	10.5
10.0	3.5	40	42	11	M8	115	133.0	145	171.0	230.0	22	165	263	322	134	40	72	10.5
10.0	3.5	71	42	11	M12	134	184.0	145	226.0	285.0	22	165	318	377	134	40	72	10.5
15.0	3.5	71	60	13.5	M12	157	168.0	190	222.0	299.0	22	215	322	399	160	40	95	15.0
15.0	3.5	71	60	13.5	M12	157	209.0	190	263.0	340.0	22	215	363	440	160	40	95	15.0
15.0	3.5	71	60	13.5	M12	157	291.0	190	345.0	422.0	22	215	445	522	160	40	95	15.0

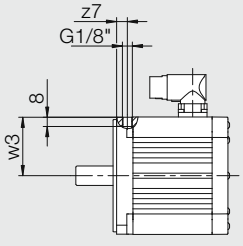
[1] Centering [2] Bolt hole [3] Shaft

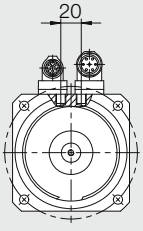
PMCtendo SZ:
forced air--cooled, with brake



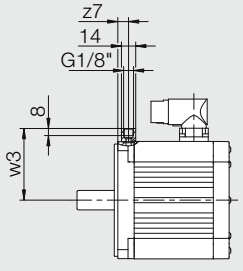
Water-cooled:

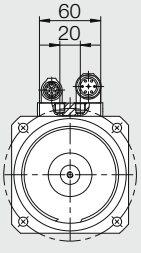
PMCtendo SZ4x and
PMCtendo SZ5x: water-cooled





PMCtendo SZ7x:
water-cooled





Further dimensions are the same as for
the “convection-cooled“ version.

Technical details – PMCtendo SZ

Performance data PMCtendo SZ convection-cooled

Motor size	Rated speed	Constant standstill torque	Rated torque	Peak torque	Moment of inertia Without brake	Torque constant	Constant standstill current (eff.)
	n_N min^{-1}	M_0 Nm	M_N Nm	M_{max} Nm	J 10^{-4} kgm^2	K_M Nm/A	I_0 A
31	6 000	0.95	0.89	2.8	0.19	0.490	2.02
	3 000	0.95	0.93	2.8	0.19	0.490	2.02
32	6 000	1.68	1.5	5.0	0.29	0.494	3.48
	3 000	1.68	1.59	5.0	0.29	1.030	1.67
33	6 000	2.25	1.96	7.0	0.40	0.645	3.55
	3 000	2.19	2.07	7.0	0.40	1.304	1.71
41	6 000	2.8	2.3	8.5	0.93	0.530	5.36
	3 000	3.0	2.8	8.5	0.93	1.056	2.88
42	6 000	4.9	3.5	16.0	1.63	0.665	7.43
	3 000	5.2	4.7	16.0	1.63	1.092	4.80
44	6 000	8.4	5.8	29.0	2.98	0.863	9.78
	3 000	8.6	6.9	29.0	2.98	1.309	6.60
51	6 000	4.4	3.4	16.0	2.90	0.769	5.80
	3 000	4.7	4.3	16.0	2.90	1.190	4.00
52	6 000	7.8	5.2	31.0	5.20	0.802	9.80
	3 000	8.0	7.4	31.0	5.20	1.399	5.76
53	6 000	10.6	6.2	43.0	7.58	0.921	11.60
	3 000	11.1	9.7	43.0	7.58	1.455	7.67
55	4 500	15.3	9.5	67.0	12.20	1.148	13.40
	3 000	16.0	13.5	67.0	12.20	1.606	10.00
71	6 000	7.9	5.2	20.0	8.50	0.868	9.38
	3 000	8.3	7.4	20.0	8.50	1.068	8.00
72	6 000	14.3	7.2	41.0	13.70	0.879	16.50
	3 000	14.4	12.0	41.0	13.70	1.525	9.60
73	4 500	20.0	12.1	65.0	21.60	1.137	17.80
	3 000	20.8	16.5	65.0	21.60	1.503	14.00
75	4 500	30.0	16.4	104.0	34.00	1.200	25.20
	3 000	30.2	21.3	104.0	34.00	1.561	19.50
82	4 500	34.5	10.5	100.0	58.00	1.045	33.30
	3 000	37.1	22.3	100.0	58.00	1.677	22.30
83	3 000	48.2	26.6	145.0	83.50	1.559	31.10
85	2 000	66.1	43.7	205.0	133.00	1.752	37.90

All technical details are values for the dynamic version of motors.
Technical details for increased inertia can be found on page 44.
All the stated data applies to motors with a rated voltage of 400 V.
We reserve the right to amend technical details.

Peak current (eff.)	Rated output	EMF voltage constant	Weight Without brake
I_{max} A	P_N kW	K_E V/1000 min^{-1}	m kg
12.7	0.56	40	1.5
12.7	0.29	40	1.5
17.8	0.94	42	2.1
8.55	0.50	86	2.1
16.9	1.20	55	2.6
8.25	0.65	109	2.6
33.0	1.40	47	4.0
16.5	0.88	96	4.0
43.5	2.20	60	5.1
26.5	1.50	94	5.1
51.0	3.60	78	7.2
35.0	2.20	116	7.2
31.0	2.10	68	5.0
22.0	1.40	97	5.0
59.0	3.30	72	6.5
33.0	2.30	121	6.5
63.5	3.90	84	8.0
41.0	3.10	119	8.0
73.0	4.50	103	10.9
52.0	4.20	141	10.9
31.0	3.30	76	8.3
25.0	2.30	95	8.3
60.5	4.50	82	10.8
36.0	3.80	133	10.8
78.0	5.70	99	12.8
62.0	5.20	122	12.8
114.0	7.70	106	18.3
87.0	6.70	140	18.3
135.0	5.00	90	26.6
84.0	7.00	136	26.6
124.0	8.40	131	32.7
155.0	9.20	142	45.8

Technical details – PMCtendo SZ

Performance data PMCtendo SZ forced air-cooled

Motor size	Rated speed	Constant standstill torque	Rated torque	Peak torque	Moment of inertia Without brake	Torque constant	Constant standstill current (eff.)	Peak current (eff.)	Rated output	EMF voltage constant	Weight Without brake
	n_N min^{-1}	M_0 Nm	M_N Nm	M_{max} Nm	J 10^{-4} kgm^2	K_M Nm/A	I_0 A	I_{max} A	P_N kW	K_E V/1000 min^{-1}	m kg
41	6 000	3.5	2.9	8.5	0.93	0.518	6.83	33.0	1.8	47	5.4
	3 000	3.7	3.4	8.5	0.93	1.039	3.60	16.5	1.1	96	5.4
42	6 000	6.4	5.1	16.0	1.63	0.690	9.34	43.5	3.2	60	6.5
	3 000	6.3	5.9	16.0	1.63	1.093	5.80	26.5	1.9	94	6.5
44	6 000	10.5	8.0	29.0	2.98	0.878	12.00	51.0	5.0	78	8.6
	3 000	11.2	10.2	29.0	2.98	1.292	8.70	35.0	3.2	116	8.6
51	6 000	5.7	4.5	16.0	2.90	0.768	7.50	31.0	2.8	68	7.0
	3 000	5.8	5.4	16.0	2.90	1.172	5.00	22.0	1.7	97	7.0
52	6 000	10.5	8.2	31.0	5.20	0.788	13.40	59.0	5.2	72	8.5
	3 000	11.2	10.3	31.0	5.20	1.380	8.16	33.0	3.2	121	8.5
53	6 000	14.8	10.4	43.0	7.58	1.068	15.9	63.5	6.5	84	10.0
	3 000	15.9	14.4	43.0	7.58	1.353	11.8	41.0	4.5	119	10.0
55	4 500	22.0	16.4	67.0	12.20	1.138	19.4	73.0	7.7	103	12.9
	3 000	23.4	20.2	67.0	12.20	1.596	14.7	52.0	6.4	141	12.9
71	6 000	10.2	7.5	20.0	8.50	0.842	12.4	31.0	4.7	76	13.3
	3 000	10.5	9.7	20.0	8.50	1.074	10.0	25.0	3.1	95	13.3
72	6 000	19.3	12.5	41.0	13.70	0.886	22.1	60.5	7.9	82	15.8
	3 000	19.3	16.6	41.0	13.70	1.515	12.9	36.0	5.2	133	15.8
73	4 500	27.2	19.8	65.0	21.60	1.134	24.2	78.0	9.3	99	17.8
	3 000	28.0	24.0	65.0	21.60	1.412	20.0	62.0	7.5	122	17.8
75	4 500	39.4	27.7	104.0	34.00	1.209	32.8	114.0	13.0	106	23.3
	3 000	41.8	33.8	104.0	34.00	1.586	26.5	87.0	11.0	140	23.3
82	4 500	47.4	30.6	100.0	58.00	1.058	45.1	135.0	14.0	90	31.6
	3 000	47.9	34.3	100.0	58.00	1.668	28.9	84.0	11.0	136	31.6
83	3 000	66.7	49.0	145.0	83.50	1.584	42.3	124.0	15.0	131	37.7
85	2 000	94.0	77.2	205.0	133.00	1.749	53.9	155.0	16.0	142	51.8

All technical details are values for the dynamic version of motors.
Technical details for increased inertia can be found on page 44.
All the stated data applies to motors with a rated voltage of 400 V.
We reserve the right to amend technical details.

Performance data PMCtendo SZ water-cooled

Motor size	Rated speed	Constant standstill torque	Rated torque	Peak torque	Moment of inertia Without brake	Torque constant	Constant standstill current (eff.)	Peak current (eff.)	Rated output	EMF voltage constant	Weight Without brake
	n_N min^{-1}	M_0 Nm	M_N Nm	M_{max} Nm	J 10^{-4} kgm^2	K_M Nm/A	I_0 A	I_{max} A	P_N kW	K_E V/1000 min^{-1}	m kg
41	6 000	3.35	2.55	8.5	0.93	0.488	6.95	33.0	1.6	47	4.0
	3 000	3.55	3.30	8.5	0.93	0.921	3.90	16.5	1.0	96	4.0
42	6 000	6.45	5.00	16.0	1.63	0.669	9.70	43.5	3.1	60	5.1
	3 000	6.35	5.85	16.0	1.63	1.065	6.00	26.5	1.8	94	5.1
44	6 000	10.60	7.70	29.0	2.98	0.865	12.30	51.0	4.8	78	7.2
	3 000	11.30	10.40	29.0	2.98	1.274	8.90	35.0	3.3	116	7.2
51	6 000	5.55	4.30	16.0	2.90	0.774	7.25	31.0	2.7	68	5.0
	3 000	5.65	5.40	16.0	2.90	1.177	4.85	22.0	1.7	97	5.0
52	6 000	10.30	8.10	31.0	5.20	0.803	12.90	59.0	5.1	72	6.5
	3 000	11.00	10.20	31.0	5.20	1.409	7.85	33.0	3.2	121	6.5
53	6 000	14.20	9.95	43.0	7.58	0.938	15.20	63.5	6.3	84	8.0
	3 000	15.20	13.50	43.0	7.58	1.350	11.30	41.0	4.2	119	8.0
55	4 500	20.20	14.20	67.0	12.20	1.178	17.20	73.0	6.7	103	10.9
	3 000	21.50	17.90	67.0	12.20	1.655	13.10	52.0	5.6	141	10.9
71	6 000	10.40	7.00	20.0	8.50	0.834	12.70	31.0	4.4	76	8.3
	3 000	10.40	10.20	20.0	8.50	1.064	10.00	25.0	3.2	95	8.3
72	6 000	19.30	12.00	41.0	13.70	0.856	22.50	60.5	7.5	82	10.8
	3 000	19.30	17.10	41.0	13.70	1.470	13.10	36.0	5.4	133	10.8
73	4 500	26.70	19.10	65.0	21.60	1.139	23.70	78.0	9.0	99	12.8
	3 000	27.50	22.50	65.0	21.60	1.415	19.60	62.0	7.1	122	12.8
75	4 500	37.20	24.10	104.0	34.00	1.185	31.60	114.0	11.0	106	18.3
	3 000	39.40	30.30	104.0	34.00	1.561	25.40	87.0	9.5	140	18.3
82	4 500	46.90	30.70	100.0	58.00	1.058	44.60	135.0	15.0	90	26.6
	3 000	48.90	32.20	100.0	58.00	1.662	29.60	84.0	10.0	136	26.6
83	3 000	65.70	46.70	145.0	83.50	1.583	41.70	124.0	15.0	131	32.7
85	2 000	90.10	72.10	205.0	133.00	1.742	51.90	155.0	15.0	142	46.8

Technical details – PMCtendo SZ

Technical details: Increased inertia and brake

Motor size	Additional values for motors with increased inertia		Brake			
			Static torque	Brake current	Mass moment of inertia	Weight of brakes
	ΔJ 10^{-4} kgm²	Δm kg	M_{BS} Nm	I_B A	J_B 10^{-4} kgm²	m_B kg
31	-	-	2.5	0.51	0.186	0.55
32	-	-	4.0	0.75	0.186	0.55
33	-	-	4.0	0.75	0.186	0.55
41	0.2	0.08	4.0	0.75	0.192	0.76
42	0.4	0.15	8.0	0.75	0.566	0.97
44	0.8	0.31	8.0	0.75	0.566	0.97
51	-	-	8.0	0.75	0.571	1.19
52	1.1	0.22	8.0	0.75	0.571	1.19
53	2.0	0.43	15.0	1.00	1.721	1.62
55	4.1	0.87	15.0	1.00	1.721	1.62
71	-	-	15.0	1.00	1.743	1.94
72	4.4	0.41	15.0	1.00	1.743	1.94
73	6.3	0.81	32.0	1.10	5.680	2.81
75	13.6	1.60	32.0	1.10	5.680	2.81
82	14.9	1.30	65.0	1.70	16.460	5.40
83	22.3	1.90	65.0	1.70	16.460	5.40
85	37.2	3.20	115.0	2.10	55.460	8.40

Type code

Type/Order number	Size	Brake	Feedback	Design	Connection	Cooling	Voltage	Speed	Option
PMCtendo SZ.	_ _	_	_	_	_	_	_	_ _	_ _

Dimensions/overall length	
PMCtendo SZ3x	**3x**
PMCtendo SZ4x	**4x**
PMCtendo SZ5x	**5x**
PMCtendo SZ7x	**7x**
PMCtendo SZ8x	**8x**

Without brake	**0**
With brake	**1**
Without brake/increased mass inertia	**2**
With brake/increased mass inertia	**3**

EnDat 2.2 inductive single-turn ECI 1118 [1]	**1**
EnDat 2.2 optical multi-turn EQN 1135 [2]	**2**

B5, smooth shaft	**2**

[1] EnDat 2.2 inductive single-turn: 18 bit resolution per revolution
[2] EnDat 2.2 optical multi-turn: 23 bit resolution per revolution, each with 12 Bit

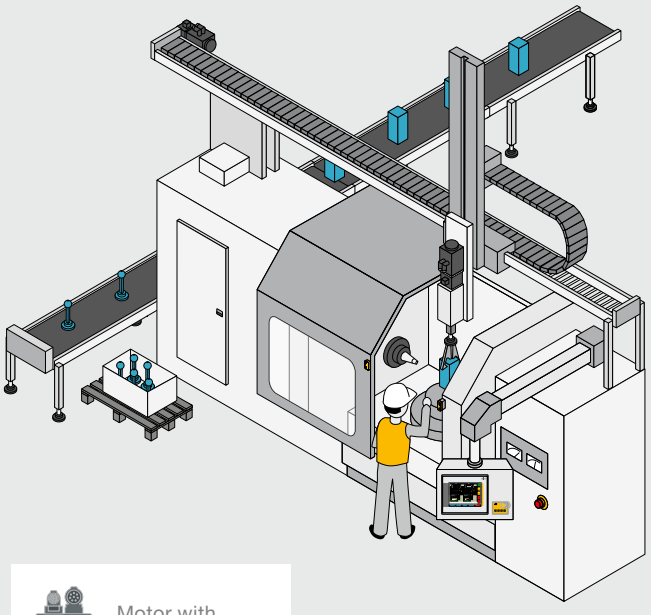
Technical details: Fan

Motor size	Connection voltage	Frequency	Current	Rated power	Fresh air flow rate	Noise	Weight Without brake
	U_F V	F Hz	I_F A	P_F W	Q_F m^3/h	G_F dBA	m_F kg
4x	230 ±5 %	50/60 Hz	0.07	10	59	41	1.4
5x	230 ±5 %	50/60 Hz	0.10	14	160	45	1.9
7x	230 ±5 %	50/60 Hz	0.10	14	160	45	2.9
8x	230 ±5 %	50/60 Hz	0.20	26	420	54	5.0

00	Standard
20	2000 min^{-1}
30	3000 min^{-1}
45	4500 min^{-1}
60	6000 min^{-1}
H	400 V
K	Convection-cooled
F	Forced air-cooled
W	Water-cooled
7	Angled swivel connector for motor and feedback

We reserve the right to change technical details

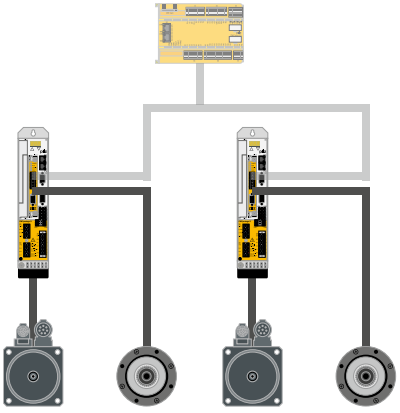
Safe motion monitoring on vertical axes



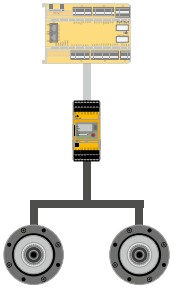
Motor with integrated brake

External brake

Safe motion – PMCprotego DS (from page 48)



Safety relay PNOZ s50 (from page 50)



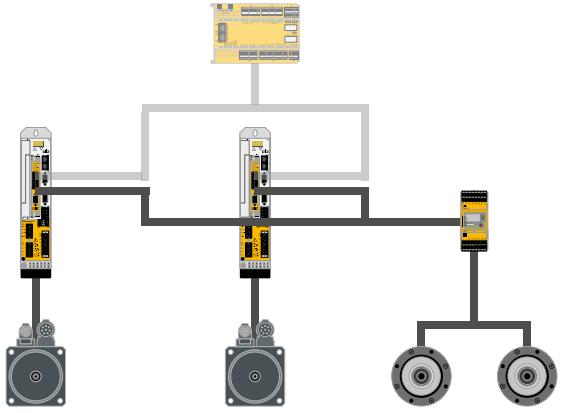
Safe setup on a lathe with linear robot.

There is an enormous amount of danger in automated production, particularly from gravitational forces in the case of vertical movements, if a power failure occurs or a braking device fails. A risk assessment must consider the risks of unintended descent and define measures to minimize the risk.

Pilz offers various solutions in the field of safe motion monitoring on vertical axes:

- Safe motion – Drive-integrated safety functions for safeguarding holding brakes and safety brakes with cyclical testing
- Safety relay PNOZs50 – Safe brake control and monitoring of holding brakes or safety brakes

The combined solution



This safe motion solution gives users a safe, overall solution containing functions such as safe brake test and safe brake control.

The PNOZ s50 is also available for controlling high-performance external brakes and for the cyclical function check of the brake's open position. Non-wearing brake control is possible due to the safe semiconductor outputs (contactless) of the PNOZ s50.

So it is possible to control and monitor internal and external brakes through a combination of the safe motion solution and PNOZ s50.

As such the solution represents an intelligent, very efficient combination for all applications with the very highest safety requirements on vertical axes.

Cyclical testing of holding brakes with safe motion

The holding brake that exists for process reasons does not normally offer sufficient protection against falling suspended loads. That is because mechanical wear or oil contamination can mean that the rated braking torque of the brake is not reached. This can result in the axis collapsing.

Safe motion – Servo amplifier PMCprotego D with integrated safety card PMCprotego S.

Depending on the risk assessment, a holding brake with cyclical testing may suffice as a protective measure. This presupposes that the probability of descent is rated lower, as either a protective structure prevents access below the vertical axis or the length of stay for particular activities is low.

Safe working on vertical axes

PMCprotego DS uses the “Safe Brake Test” (SBT) to check the function of the brake. The brake test may be carried out in each production cycle or only every 8 hours, depending on the specific application and the requirement from the risk analysis. During the test the brake is loaded with additional torque. If the position changes during testing, this is identified as an inadmissible state and results in a message that prevents further operation. The plant is shut down safely to allow the brake to be repaired.

As well as the “Safe Brake Test” (SBT), safe motion also enables other safety functions to be realized. Motion functions such as “Safely Limited Speed” (SLS) and stop functions such as "Safe Torque Off" (STO) enable reduced set-up times and increase availability for the process.

All safety functions with PMCprotego DS meet the requirements of the Machinery Directive based on IEC 61800-5-2 and are designed up to PL e of EN ISO 13849-1 and SIL CL 3 of EN/IEC 62061.

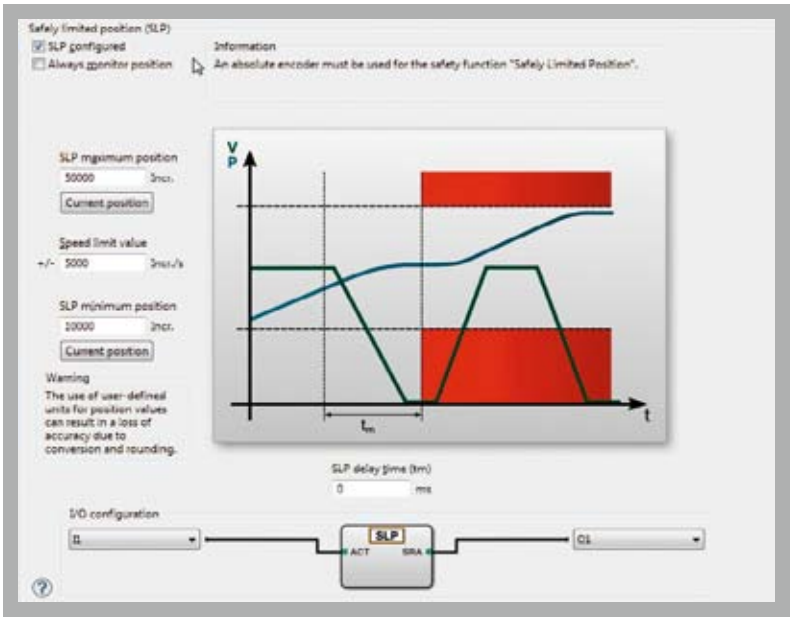
– PMCprotego DS

Flexible connection

The safe motion solution can easily be integrated into any existing system environment, as the PMCprotego DS is suitable for connecting or integrating motion control systems PMCprimo directly in the servo amplifier, but is also open for connecting to standard PLC and motion control systems through interfaces such as analog/digital, CANopen, S7 – PROFIBUS-DP or EtherCAT, for example.

Your benefits at a glance

- Very short reaction times of up to 2 ms at maximum performance level due to the integrated stop functions
- Simple integration within an existing system environment thanks to open interfaces
- High flexibility thanks to safe digital inputs and outputs that are compatible with all programmable safety systems on the market
- Safe, dual-pole, digital output for activating a brake
- Mechanical fault exclusion is not required because breaks are monitored through an additional external encoder
- Reduction in total costs because the highest safety category – PL e – is achieved with one encoder
- Maximum safety thanks to wear monitoring with SBT



Easy parameterization with PASconfig SDrive

Configuration of the safety card is simple and user-friendly with PASconfig SDrive. Thanks to its informative graphics, this software tool is a part of the Pilz safety concept because user information helps to prevent invalid entries. The inputs and outputs of the safety card S1-2 can be flexibly assigned to one or more safety functions in the configurator. Functions such as “Safely Limited Speed” (SLS) and “Safe Direction” (SDI) can be started via a common input and can be connected to a digital output on the safety card separately or together. This reduces the work involved in programming and wiring.

Keep up-to-date on the PMCprotego DS:

Webcode: web5263

Online information at www.pilz.com

Safety relay PNOZ s50 for safe brake control

The stand-alone safety relay PNOZ s50 offers an economical solution for controlling two brakes up to category PL e of EN ISO 13849-1. The contactless technology allows very short reaction times to be achieved, enhancing personal protection. You can take advantage of the full flexibility and the individual shutdown options for your application of this manufacturer-independent solution.

SAFE BRAKE CONTROL

PNOZ s50

Safe, contactless braking - so it's non-wearing

PNOZ s50 helps to make your plant energy efficient: application cycle times are shortened because temporary overexcitation is followed by selectable voltage reduction (pulse width modulation PWM). The safety relay enables rapid switching in emergency situations and slow, low-wearing switching in normal operation, thereby helping to reduce maintenance costs.

As an addition to the PNOZsigma product range, PNOZ s50 has a rotary knob for menu navigation and a display for showing setup parameters and diagnostic messages.

Both motor brakes and safety brakes can be safely controlled and monitored with the safety relay PNOZ s50. Safety is significantly improved due to "wear monitoring", particularly on motor-integrated holding brakes (but not holding brakes).

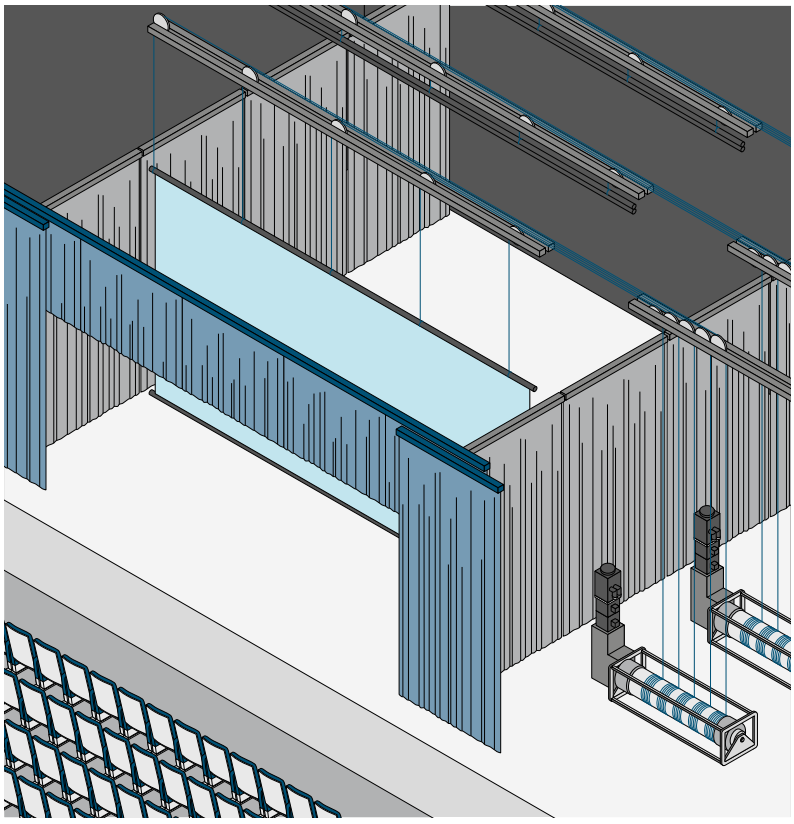
Find out more in the animation on the safety relay PNOZ s50

Safety relay PNOZ s50

PNOZ s50

Technical features

- Stand-alone device
- 2 brakes up to PL e of EN ISO 13849-1 / SIL CL 3 of EN/IEC 62061
- 1 brake up to PL d of EN ISO 13849-1 / SIL CL 3 of EN/IEC 62061
- 2 x 2-pole safe electronic digital outputs for 24 VDC, each 4.5 A
- Temporary overexcitation with subsequent voltage reduction
- Ambient temperature: 0 … 45 °C
- Number of inputs:
  - Failsafe: 4
  - Standard: 4
- Number of failsafe semiconductor outputs:
  - 1-pole: 3
  - 2-pole: 2



In many applications it is necessary to safeguard an additional brake alongside the holding brake. In the field of stage technology, for example, winches are operated with a dual brake.

Your benefits at a glance

- Highest level of safety up to PL e when controlling 2 brakes (holding brakes or safety brakes)
- Contactless technology up to 4.5 A per brake enables short reaction times, a long-lasting solution and high availability
- Reduced cycle times through temporary overexcitation with subsequent voltage reduction
- High safety and low wear on the brake thanks to fast and slow shutdown of the power circuits
- Rapid diagnostics by means of display
- Manufacturer-independent brake control thanks to safe, digital inputs

- Supply voltage:
  - 1-pole: 24 VDC
  - 2-pole: 24 VDC, 48 VDC
- Voltage tolerance:
  - 1-pole: -15 % … +20 %
  - 2-pole: -10 % … +10 %
- Output current of semiconductor outputs (1-pole): 0.1 A
- Test pulse outputs of semiconductor outputs (1-pole): 2
- Reduced voltage of semiconductor outputs (2-pole): 6 V, 8 V, 12 V, 16 V, 24 V
- Output current of semiconductor outputs (2-pole):
  - 24 VDC supply voltage:
    Continuous duty (1 output/2 outputs): 1 x 6.5 A/2 x 4.5 A
    Overexcitation (1 output/2 outputs): 1 x 6.5 A/ ∑ = 10
  - 48 VDC supply voltage:
    Continuous duty (1 output/2 outputs): 1 x 3.25 A/2 x 2.25 A
    Overexcitation (1 output/2 outputs): 1 x 3.25 A/2 x 3.25 A

Order number

751 500 (with spring-loaded terminals)

Technical documentation on safety relays PNOZ s50:

Webcode: web5229

Online information at www.pilz.com

Selection guide – Accessories for drive technology

Here you will find a selection of our wide range of accessories: from gearing to individually customized cable and connection types, through to appropriate feedback systems for the application.

Accessories: motor choke and gearing

Type	Features
Motor choke	-
Gearing	-

Accessories: CAN adapters

PMCprotego D.CAN-Adapter 01-24A

Type	Features
PMCprotego D.CAN-Adapter 01-24A	Networking aid in the amplifier, terminating resistor can be connected
PMCprotego D.CAN-Adapter 48-72A	
PMCprimo DriveP.CAN-CAN-Adapter 01-24	
PMCprimo DriveP.CAN-CAN-Adapter 48-72	
PMCprimo DriveP.CAN-PROFI-Adapter 01-24	
PMCprimo DriveP.CAN-PROFI-Adapter 48-72	
PMCtendo DD4.CAN-Adapter Slot version	

Accessories: brake resistor for PMCtendo DD5 and PMCprotego D

Resistance

Type	Features
Brake resistor 300W/66R/T/U	Used to remove excess energy from the system. Due to the compact design, the various sizes are suitable for wall mounting or for assembly on or in the control cabinet.
Brake resistor 300W/91R/T/U	
Brake resistor 600W/66R/T/U	
Brake resistor 600W/91R/T/U	
Brake resistor 600W/33R/T/U	
Brake resistor 1600W/33R/T/U	
Brake resistor 600W/23R/T/U	
Brake resistor 1600W/23R/T/U	
Brake resistor 1600W/15R/T/U	
Brake resistor 1600W/10R/T/U	

Accessories: Mains filter

Mains filter

Type	Features
Mains filter for DD FFU 3X07K-KK	For advanced environmental protection against mains-bound interference
Mains filter for DD FFU 3X16K-KK	
Mains filter for DD FFU 3X30K-KK	
Mains filter for DD FFU 3X42K-KK	
Mains filter for DD FFU 3X100K-KK	

PMC

Individually customized accessories are available for your application on request. Please contact us!

Suitable for	Electrical data
PMCprimo Drive P, PMCtendo DD5, PMCprotego D	Mains voltage: up to 3 x 400 VAC, Rated current: n stages up to 3 x 25 A
PMCtendo SZ	Calculated from the design of the power transmission

Suitable for	Connection options	Order number
PMCprotego D up to 24 A rated current	D-Sub connector for 2 x CANopen and 1 x RS 232; terminating resistor can be connected	8176300
PMCprotego D 48 … 72 A rated current		8176470
PMCprimo C in PMCprotego D up to 24 A rated current		680040 [1]
PMCprimo C in PMCprotego D 48 … 72 A rated current		680042 [1]
PMCprimo C in PMCprotego D up to 24 A rated current	D-Sub connector for 1 x CANopen, 1x PROFIBUS-DP and 1 x RS 232; terminating resistor can be connected	680041 [1]
PMCprimo C in PMCprotego D 48 … 72 A rated current		680043 [1]
PMCtendo DD5	D-Sub connector for 2 x CANopen and 1 x RS 232; terminating resistor and monitoring voltage switch can be connected	8163583

[1] incl. RJ45 cable to connect the fieldbus junction box to the PMCprimo DriveP

Suitable for	Rated power [2] W	Resistance Ω	Order number
PMCtendo DD5, 110 … 230 VAC	300	66	8176378
PMCtendo DD5, 208 … 480 VAC	300	91	8176092
PMCtendo DD5, 110 … 230 VAC	600	66	8176380
PMCtendo DD5, 208 … 480 VAC	600	91	8176188
PMCprotego D.01 … D.12	600	33	8176372
PMCprotego D.01 … D.12	1 600	33	8176374
PMCprotego D.24	600	23	8176332
PMCprotego D.24	1 600	23	8176334
PMCprotego D.48	1 600	15	8176376
PMCprotego D.72	1 600	10	8176364

[2] at 40 °C ambient temperature and 100 % continuous duty

Rated current	Leakage current at 50 Hz		Power dissipation	Order number
	typ.	max.		
A	mA	mA	W	
7	< 35	100	4	8171507
16	< 35	100	8	8171509
30	< 35	100	12	8170535
42	< 35	100	15	8166771
100	< 35	100	24	8176382

Selection guide – Cable accessories

Cable accessories and connectors

PMCcable FD/D4B6/005/Q25/S1

PMCcable M2/B1B2/005/1Q5/S1

PMCcable M2/C2B2/005/1Q5/S1

PMCcable M2/C2B3/005/2Q5/S1

PMCcable M2/C1B3/005/4Q0/S1

PMCprotego motor connector kit

Type
PMCcable FD/D4B6/005/Q25/S1
PMCcable FD/D4B6/010/Q25/S1
PMCcable FD/D4B6/015/Q25/S1
PMCcable FD/D4B6/020/Q25/S1
PMCcable M2/B1B2/005/1Q5/S1
PMCcable M2/B1B2/010/1Q5/S1
PMCcable M2/B1B2/015/1Q5/S1
PMCcable M2/B1B2/020/1Q5/S1
PMCcable M2/C2B2/005/1Q5/S1
PMCcable M2/C2B2/010/1Q5/S1
PMCcable M2/C2B2/015/1Q5/S1
PMCcable M2/C2B2/020/1Q5/S1
PMCcable M2/C2B2/005/2Q5/S1
PMCcable M2/C2B2/010/2Q5/S1
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PMCcable M2/C2B2/020/4Q0/S1
PMCcable M2/C2B3/005/2Q5/S1
PMCcable M2/C2B3/010/2Q5/S1
PMCcable M2/C2B3/015/2Q5/S1
PMCcable M2/C2B3/020/2Q5/S1
PMCcable M2/C2B3/005/4Q0/S1
PMCcable M2/C2B3/010/4Q0/S1
PMCcable M2/C2B3/015/4Q0/S1
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PMCcable M2/C1B3/010/4Q0/S1
PMCcable M2/C1B3/015/4Q0/S1
PMCcable M2/C1B3/020/4Q0/S1
PMCcable M2/C1B3/005/6Q0/S1
PMCcable M2/C1B3/010/6Q0/S1
PMCcable M2/C1B3/015/6Q0/S1
PMCcable M2/C1B3/020/6Q0/S1
PMCprotego motor connector kit

Features	Suitable for	Length [1]	Order number
▸ Feedback cable for EnDat 2.2 ▸ M23 speedtec encoder connector	▸ PMCtendo DD5 ▸ PMCprotego D ▸ PMCtendo SZ	5 m	8 177 101
		10 m	8 177 102
		15 m	8 177 103
		20 m	8 177 104
▸ Power cable ▸ 4 x 1.5 + 1 x (2 x 1.0) ▸ M23 speedtec motor connector	▸ PMCtendo DD5 ▸ PMCtendo SZ	5 m	8 177 141
		10 m	8 177 142
		15 m	8 177 143
		20 m	8 177 144
▸ Power cable ▸ 4 x 1.5 + 1 x (2 x 1.0) ▸ M23 speedtec motor connector	▸ PMCprotego D.01-24 ▸ PMCtendo	5 m	8 177 151
		10 m	8 177 152
		15 m	8 177 153
		20 m	8 177 154
▸ Power cable ▸ 4 x 2.5 + 1 x (2 x 1.0) ▸ M23 speedtec motor connector	▸ PMCprotego D.01-24 ▸ PMCtendo SZ	5 m	8 177 161
		10 m	8 177 162
		15 m	8 177 163
		20 m	8 177 164
▸ Power cable ▸ 4 x 4.0 + 1 x (2 x 1.5) ▸ M23 speedtec motor connector	▸ PMCprotego D.01-24 ▸ PMCtendo SZ	5 m	8 177 171
		10 m	8 177 172
		15 m	8 177 173
		20 m	8 177 174
▸ Power cable ▸ 4 x 2.5 + 1 x (2 x 1.0) ▸ M40 speedtec motor connector	▸ PMCprotego D.01-24 ▸ PMCtendo SZ	5 m	8 177 181
		10 m	8 177 182
		15 m	8 177 183
		20 m	8 177 184
▸ Power cable ▸ 4 x 4.0 + 1 x (2 x 1.5) ▸ M40 speedtec motor connector	▸ PMCprotego D.01-24 ▸ PMCtendo SZ	5 m	8 177 191
		10 m	8 177 192
		15 m	8 177 193
		20 m	8 177 194
▸ Power cable ▸ 4 x 4.0 + 1 x (2 x 1.5) ▸ M40 speedtec motor connector	▸ PMCprotego D.48-72 ▸ PMCtendo SZ	5 m	8 177 201
		10 m	8 177 202
		15 m	8 177 203
		20 m	8 177 204
▸ Power cable ▸ 4 x 6.0 + 1 x (2 x 1.5) ▸ M40 speedtec motor connector	▸ PMCprotego D.48-72 ▸ PMCtendo SZ	5 m	8 177 211
		10 m	8 177 212
		15 m	8 177 213
		20 m	8 177 214
▸ Consisting of X9 connector and shielded terminal ▸ On 48 A and 72 A versions, the screw terminals are connected directly to the servo amplifier	▸ PMCprotego D up to 24 A ▸ PMCprimo DriveP up to 24 A	-	8 176 330

[1] Additional lengths on request

Selection guide – Cable accessories

Cable accessories and connectors

PMCcable M2/C2B5/005/1Q0/S1

PMCcable FD/D4B8/005/Q25/S1

Type
PMCcable M2/C2B5/005/1Q0/S1
PMCcable M2/C2B5/010/1Q0/S1
PMCcable M2/C2B5/015/1Q0/S1
PMCcable M2/C2B5/020/1Q0/S1
PMCcable M2/B1B5/005/1Q0/S1
PMCcable M2/B1B5/010/1Q0/S1
PMCcable M2/B1B5/015/1Q0/S1
PMCcable M2/B1B5/020/1Q0/S1
PMCcable FD/D4B8/005/Q25/S1
PMCcable FD/D4B8/010/Q25/S1
PMCcable FD/D4B8/015/Q25/S1
PMCcable FD/D4B8/020/Q25/S1

Features	Suitable for	Length [1]	Order number
▸ Power cable ▸ 4 x 1 + 1 x (2 x 0.75) ▸ M15 springtec motor connector	▸ PMCprotego D ▸ PMCtendo SZ	5 m	8 177 251
		10 m	8 177 252
		15 m	8 177 253
		20 m	8 177 254
▸ Power cable ▸ 4 x 1 + 1 x (2 x 0.75) ▸ M15 springtec motor connector	▸ PMCtendo DD5 ▸ PMCtendo SZ	5 m	8 177 261
		10 m	8 177 262
		15 m	8 177 263
		20 m	8 177 264
▸ Feedback cable for EnDat 2.2 ▸ M15 springtec encoder connector	▸ PMCtendo DD5 ▸ PMCprotego D ▸ PMCtendo SZ	5 m	8 177 271
		10 m	8 177 272
		15 m	8 177 273
		20 m	8 177 274

[1] Additional lengths on request

Green light for energy savers

Energy efficiency in drive technology should always take a holistic approach, including every component. If energy is saved, then the power dissipation in the control cabinet will also be lower, depending on the measures taken, so that cooling can at least be reduced, if not removed all together. Cooler control cabinets and a longer service life for the components are the direct result. Energy efficiency also increases process stability and ensures higher machine availability.

Energy saving by Pilz

BLUEcoMPETENCE Alliance Member
Partner of the Engineering Industry Sustainability Initiative

Potential savings with safe drive technology PMC

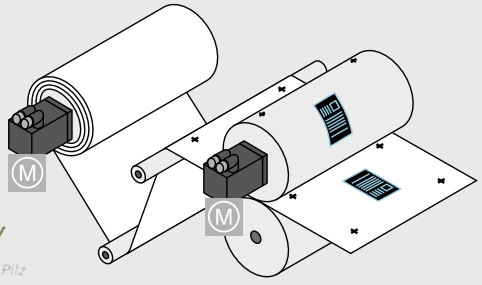
Connection to master computer

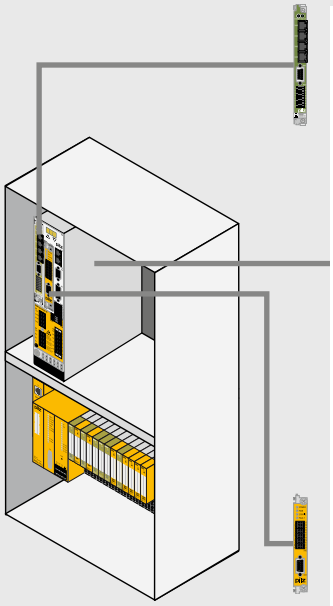
EtherCAT

PROFIBUS

Drive technology PMC

+30% Availability/ productivity





Motion control system PMCprimo

+50% Positioning accuracy

Servo amplifiers PMCprotego

+50% Synchronization

+25% No. of cycles

Safety card PMCprotego S

PL e Safety

Servo motors PMCtendo SZ

-50% Energy consumption

-20% Noise level

Software PMC Tools

-40% Setup and commissioning time

Potential savings with Pilz motion control PMC

The control system PMCprimo DriveP from Pilz combines motion control, CNC, PLC and safety functions in one device and requires little space in the control cabinet. PMCprimo DriveP is designed for applications with a varying number of axes and high requirements for performance and synchronized movements. Fast digital inputs in conjunction with short system reaction times enable functions such as print mark detection to compensate for process-related tolerances.

Appropriate software tools help users get started. Clear project documentation helps to save time.

If a safety-related application is required, PMCprimo DriveP can also be expanded with the safety card PMCprotego S. With this expansion it is possible to use standard motor feedback systems to achieve SIL 3/PL e for a wide range of safety functions, such as “Safely Reduced Speed”. The result is an all-in-one motion control solution for drive, control and safety.

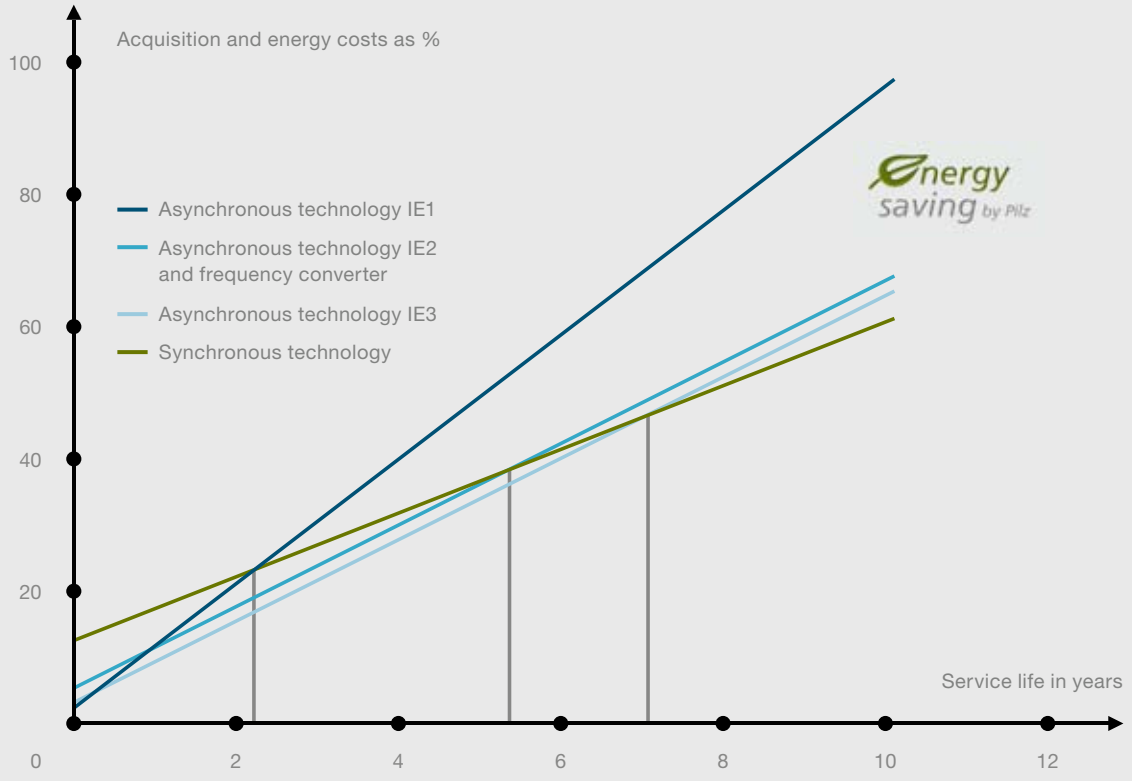
Use of the very latest energy-saving servo motors is particularly worthwhile because in many cases it is possible to save up to half of the absorbed energy. The noise level can also be reduced significantly.

Your benefits at a glance

- All-in-one solution combines motion control, safe motion and PLC in one device
- Energy-efficient servo technology: maximum no. of cycles/ machine output
- Flexible connection to master computer
- Parameters are easy to set using PMC tools

Green light for energy savers

Overall costs of synchronous technology over asynchronous technology



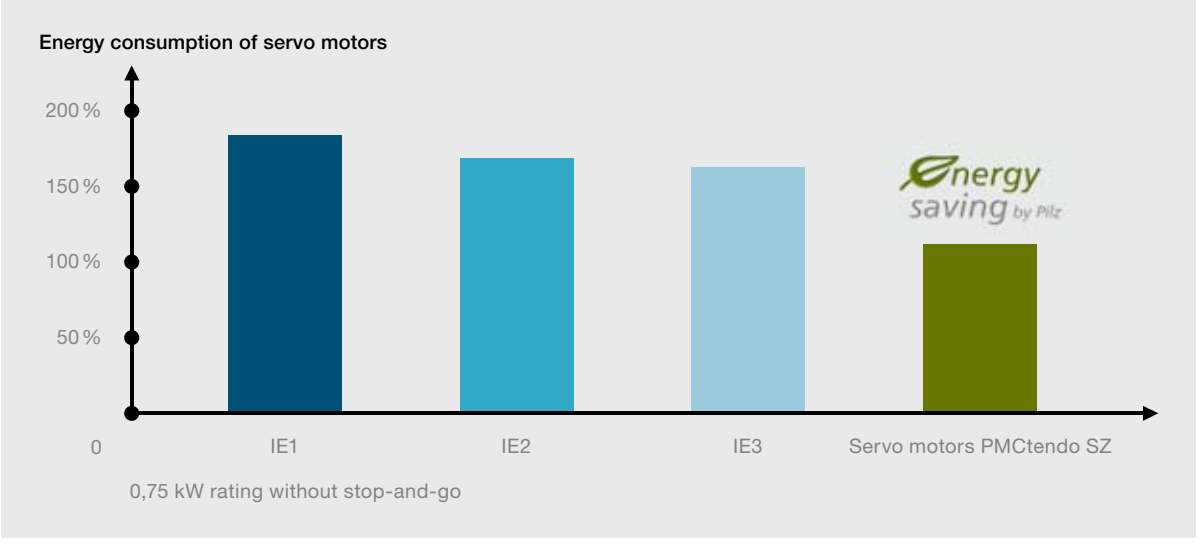
After > 2 years, synchronous technology is already more economical than asynchronous technology.

Complete solutions with synchronous motors are generally the better choice in terms of energy balance. If the machine builder considers that the previous price advantage of asynchronous technology is significantly reduced with the new standard IEC 60034-30, the conversion to synchronous motors makes sense for many applications. Pilz offers efficient solutions in this area, which help you to implement not only safety but also the required energy efficiency in drive technology.

Servo motors ensure efficient energy provision
Servo motors PMCtendo SZ have a high power density – thanks to their extremely short overall length and low weight. Thanks to their high efficiency factor, these motors are particularly energy-saving; in many applications they exceed the requirements of the international efficiency class IE4, as specified by the standard. Even heat dissipation is optimized, ensuring permanently high performance. High resolution absolute value encoder systems guarantee high performance and a fast system start without a reference run. PMCtendo SZ are characterized by extremely quiet operation and high process quality thanks to low cogging torques.

As a result, the servo motors are ideal for use:
- When the motors are also moved
- Where there are frequent speed changes
- In cramped conditions

The new servo motors PMCtendo SZ are available with different cooling types - as water coolers, forced air fans or with natural convection. Water-cooled motors achieve around 30 per cent higher performance than the basic convection model, while motors with forced air fans achieve a performance around 35 per cent higher. The additional cooling types enable applications to be implemented that would not be possible using standard cooling.



Energy saving on servo motors PMCtendo SZ is better than IE4 in many performance ranges, due to the high efficiency factor.

Consulting, engineering and training

As a solution supplier, Pilz can help you to apply optimum safety strategies worldwide. Services encompass the whole machine lifecycle. Our training package with practical, up-to-date course content completes the offering.

We are your reliable service provider for plant and machinery safety

Your projects belong in our safe hands!

Risk assessment

We inspect your machinery in accordance with the applicable national and/or international 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 organizational measures.

Safety design

The aim of the safety design is to reduce or eliminate danger points through detailed planning of the necessary safeguards.

System implementation

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

Our management system was certified in the field of system integration to EN/IEC 61508.

Safety validation

In the safety validation, the risk assessment and safety concept are mirrored and inspected by competent, specialist staff.

CE marking

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

Services related to machinery safety:

Webcode: web7792

Online information at www.pilz.com

International compliance services

We conduct the evaluation process and develop the necessary strategies in order to enable compliance with the relevant ISO, IEC, ANSI, EN or other national or international standards.

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 optimizing your safeguards.

Inspection of safeguards

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

DAkkS Deutsche Akkreditierungsstelle D-IS-12033-01-01

Pilz GmbH & Co. KG, Ostfildern, operates an independent inspection body in accordance with DIN EN ISO/IEC 17020:2012 for the plant and machinery sectory, accredited by the German Accreditation Body (DAkkS).

LOTO System

Our customized Lock Out Tag Out (LOTO) measures guarantee that staff can safely control potentially hazardous energies during maintenance and repair.

Training

Pilz offers two types of courses: Product-neutral seminars on machinery safety and product-specific courses

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

Knowledge is a competitive edge – Pilz training courses:

Webcode: web0218

Online information at www.pilz.com

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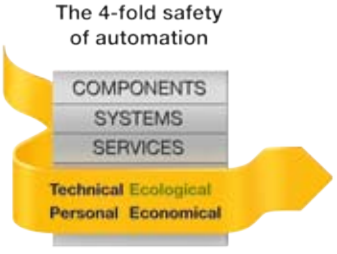

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