

Measurement and Sensor Systems



Tilt Angle Sensor

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Tilt angle values of a platform, e. g. on

- **Cranes and heavy duty vehicles**
- **Excavators and drilling machines**
- **Ships and offshore facilities**

stand for important measuring data as a part of the safety and control system of that type of machinery. Angular measurement is, for instance for equipment levelling, performed in such cases by means of dual axis pendulum systems.

Single axis pendulum systems detect e. g.

- **Angular positions of a crane jib**
- **Lateral inclination of a vehicle**
- **Orientation of lifting platform, weir trap or of comparable facilities**

Transducers of that type contain inside a robust splash-proof aluminium case of protection degree IP 65 to IP 68 oil-damped pendulum systems, the tilt angle dependant swing of which is measured, depending on the application, either by a non-contact, inductive optoelectronic or a magneto-resistive angular encoder. For measurements relevant to safety, we recommend inclination systems without pendulum of the redundant micro-electromechanic type (MEMS).

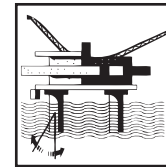
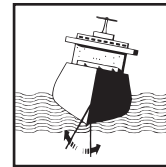
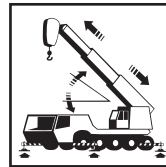
The output signal, representing the tilt angles, is provided either in form of an analogue resistance, current or voltage variation or as a digital signal – with interface bus – as well.

For the application as tilt actuated switch, e. g. on lifting platforms, crane vehicles or heeling control systems on board of cargo ships, uniaxial transducers can be provided with built-in min/max. comparators.

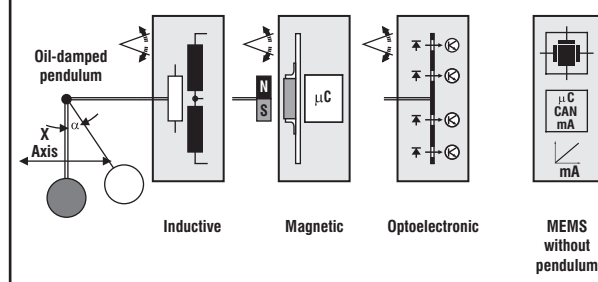
For signal indication and limit monitoring of measured tilt angle values we offer:

- **Coordinate displays (x/y-indicators)**
- **Min/max switchgears**

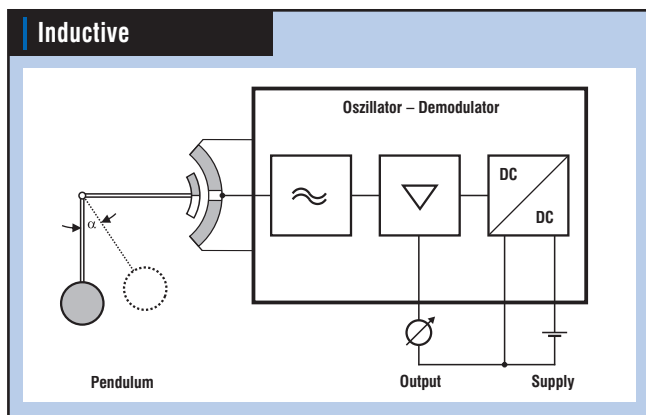
Application range



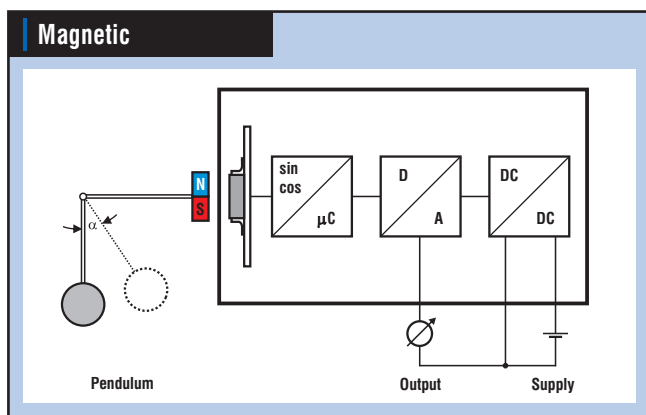
Measuring systems



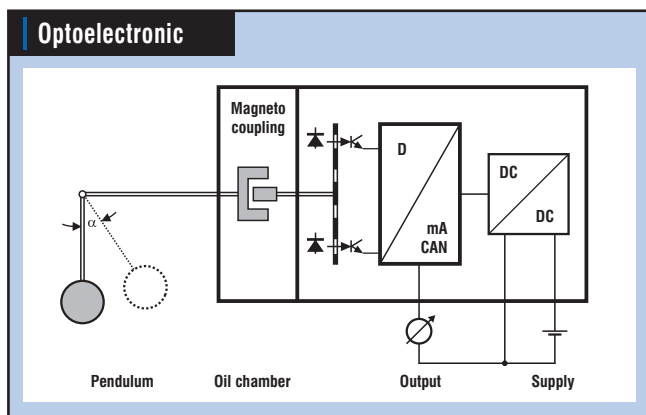
Measuring systems



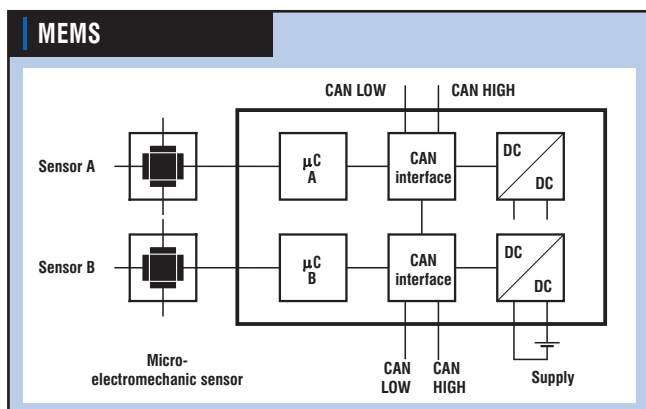
- Single-axis pendulum up to $\pm 45^\circ$
- Dual-axis pendulum up to $\pm 15^\circ$
- Angular accuracy $< \pm 0,5 \%$
- Resolution ∞
- Current output 4 - 12 - 20 mA



- Single-axis pendulum up to 360°
- Angular accuracy $\pm 0,2^\circ$
- Resolution 12 bit
- Current output 4 - 12 - 20 mA
- Bus output CANopen







- Single-axis pendulum up to 360°
- Angular accuracy $< \pm 0,01 \%$
- Resolution 12 bit
- Current output 4 - 12 - 20 mA
- Bus output CANopen



Redundant micro-electromechanic inclination system suitable for SIL application, i. e. IEC 61508

- Single-axis pendulum up to 360°
- Dual-axis pendulum up to $\pm 60^\circ$
- Angular accuracy $\pm 0,02^\circ$
- Resolution up to $0,01^\circ$
- Bus output CANopen

Specifications

Measuring systems	Inductive		Magnetic	
Models				
Series	PE 4000 X	PE-X/Y	PE-MR-X	PE-MR-X/P
Single-axis pendulum transmitter / Dual-axis pendulum transmitter	Single-axis pendulum transmitter	Dual-axis pendulum transmitter	Single-axis pendulum transmitter	Single-axis pendulum transmitter
Redundant electronics	on request	on request	redundant electronics	redundant electronics
Damping of pendulum	by silicone oil			
Damping response	at 25° swing < 1 sec			
Angular range	max. ± 45°	each axis max. ± 15°	up to 360°	up to 360°
Angular accuracy	< ± 0,5 %	< ± 0,5 %	< ± 0,2°	< ± 0,2°
Resolution	∞	∞	14 bit	14 bit
TC	0,05 % / 10 K			
IP code (casing)	up to IP 68	up to IP 68	up to IP 68	up to IP 65
Electrical connection	plug or cable	plug	plug M12x1	plug M12x1
Weight	1 kg	1,5 kg	0,5 kg	0,5 kg
Current output	4 - 20 mA, R _i ≤ 600Ω			
Bus output	–	–	CANopen	CANopen
Supply	18 - 33 VDC			
Current consumption	< 80 mA	< 120 mA	< 80 mA	< 80 mA
Signal adjustment	firm adjustment	firm adjustment	firm adjustment / CAN-Bus	key programming / CAN-Bus
Parent item	1870 S10 ...	1898 Z10 ...	5790 Z02 ...	5790 Z02 ...

General Data	
Emitted interference	EN 61 000-6-4
Immunity to interference	EN 61 000-6-2
Voltage output	on request
Current output	3-wire system, 4-wire system on request
Temperature range	– 30° C up to +70° C
Casing material	aluminium, anodised, partly coated, special version: salt fog proof Hart-Coat coating
Test voltage	500 V, 50 Hz, 1 min

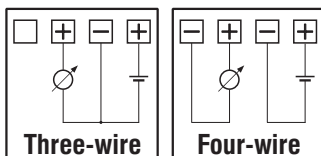
Special versions

Tilt switch PE-MEMS with

Contact and signal output 4 - 20 mA through $\sqrt{x^2 + y^2}$ (vector calculation)

Measuring systems	Optoelectronic	Micro-electromechanic (MEMS)	
Models			
Series	PE-XA-X	PE-MEMS-X	PE-MEMS-X/Y
Single-axis pendulum transmitter / Dual-axis pendulum transmitter	Single-axis pendulum transmitter	Single-axis pendulum transmitter	Dual-axis pendulum transmitter
Redundant electronics		optional	
Damping of pendulum	by silicone oil	electronic	electronic
Damping response	at 25° swing < 1 sec	adjustable > 0,5 sec by 90°	adjustable > 0,5 sec by 90°
Angular range	up to 360°	up to 360°	up to ± 60°
Angular accuracy	< ± 0,01 %	up to ± 0,1°	up to ± 0,02°
Resolution	12 bit	up to 0,01°	up to 0,01°
TC	< 0,01 % / 10 K	0,05° / 10 K	0,05° / 10 K
IP code (casing)	up to IP 65	IP 65 up to IP 68	IP 65 up to IP 68
Electrical connection	plug	plug	flange plug and flange socket M12x1
Weight	2,2 kg	0,4 kg	0,4 kg
Current output	4 - 20 mA, $R_i \leq 600\Omega$		
Bus output	CANopen		
Supply	18 - 33 VDC	9 / 18 - 33 VDC	9 / 18 - 33 VDC
Current consumption	< 120 mA		
Signal adjustment	firm adjustment	key programming / CAN-Bus	firm adjustment / CAN-Bus
Parent item	1848 S10 ...	1885 S12 ...	1885 S12 ...

Wiring



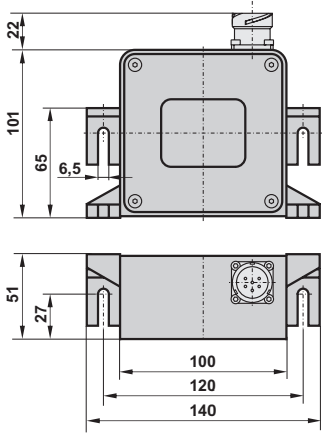
On request also available in version according to IEC 61508, SIL (Safety Integrated Level) or ISO 13849, PL (Performance Level) possible



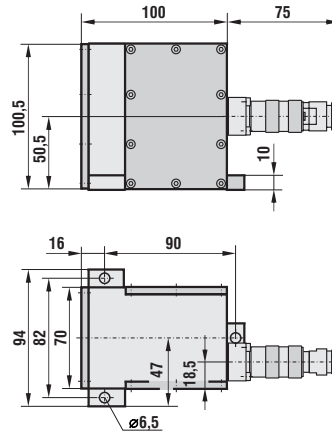
GL certificate available on request

Models

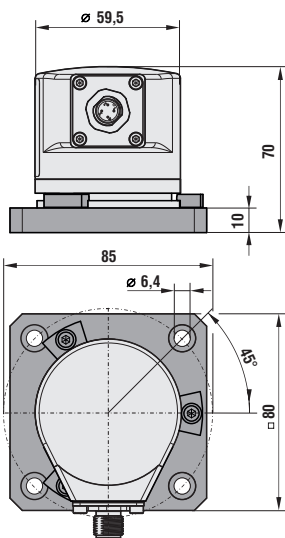
PE 4000 X



PE-X/Y

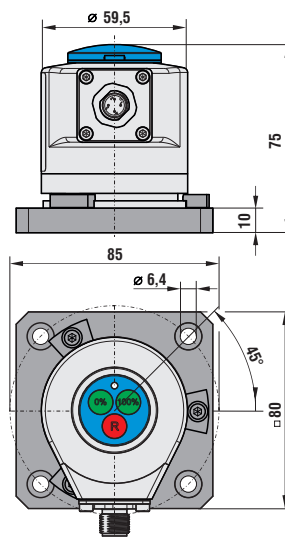


PE-MR-X



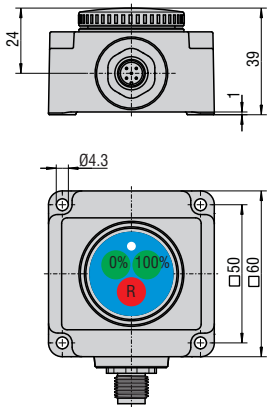
Firm adjustment angular signal

PE-MR-X/P

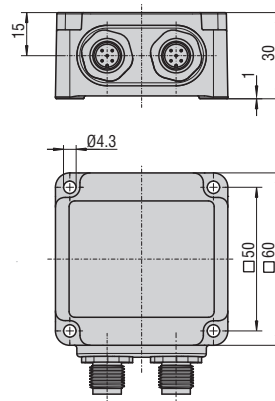


Angular signal programmable

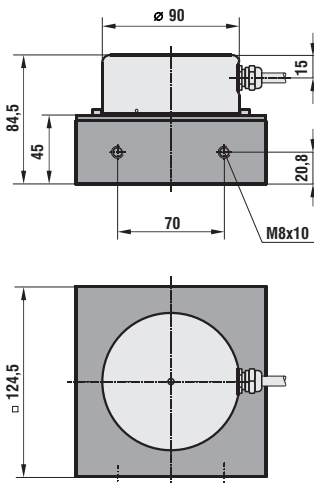
PE-MEMS-X



PE-MEMS-X/Y



PE-XA-X





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