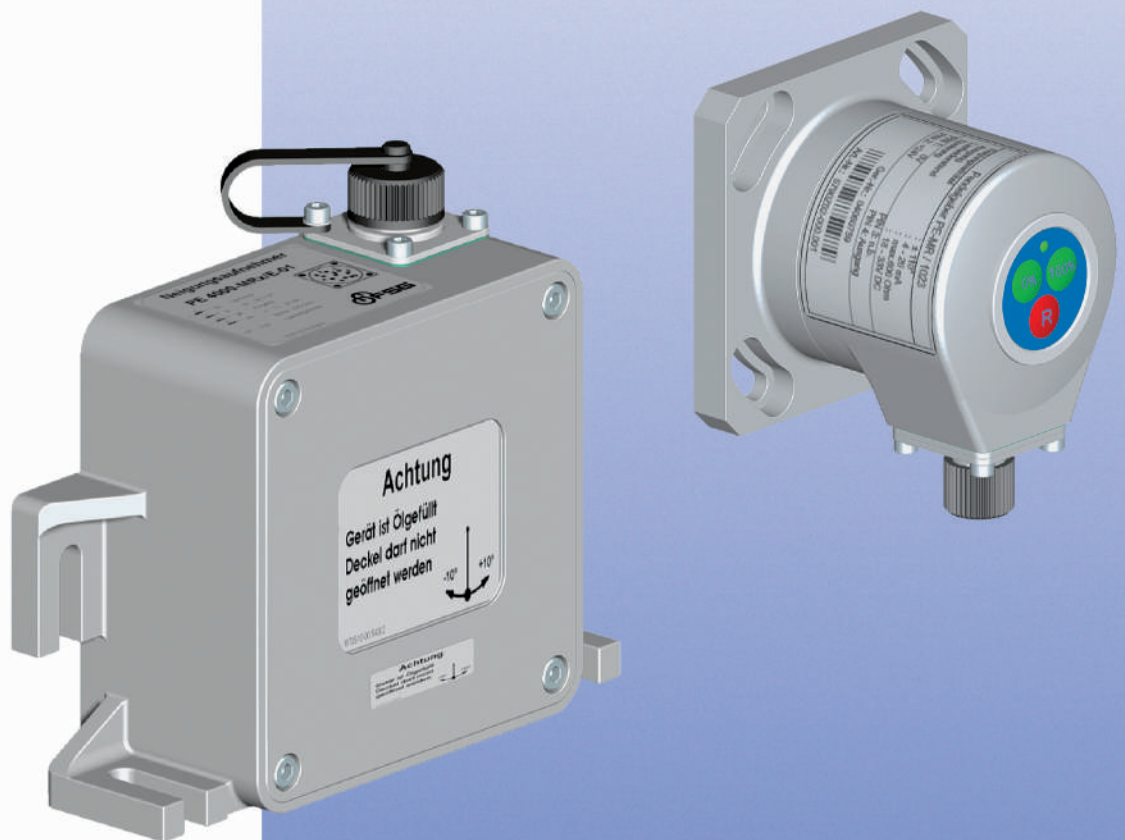
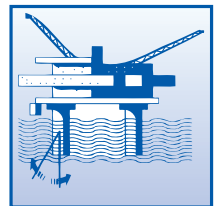
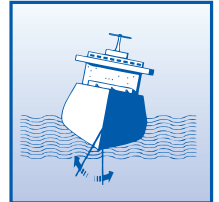
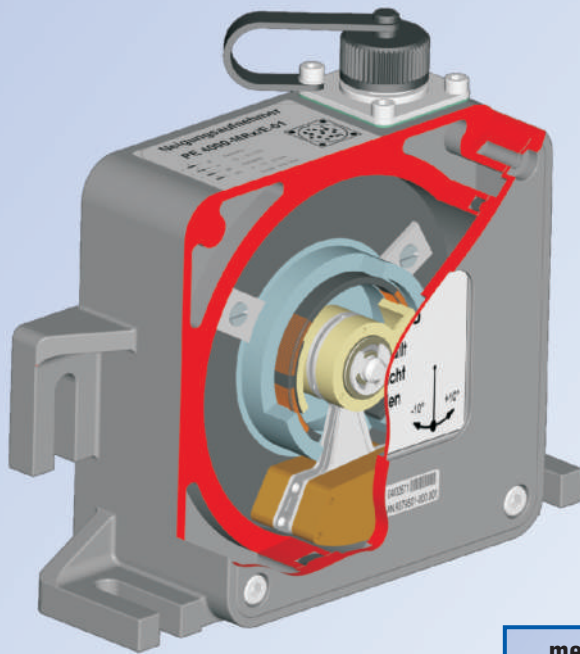


# Tilt Angle Transmitters

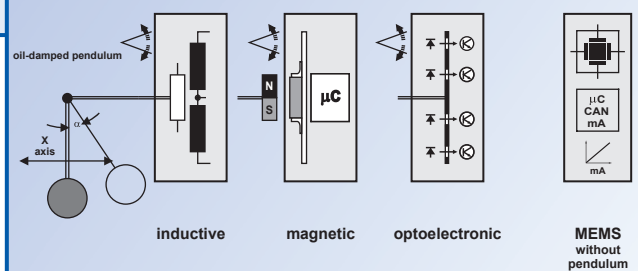


# Tilt Angle Transmitters

## ...construction



## ...measuring systems



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 magnetoresistive 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.

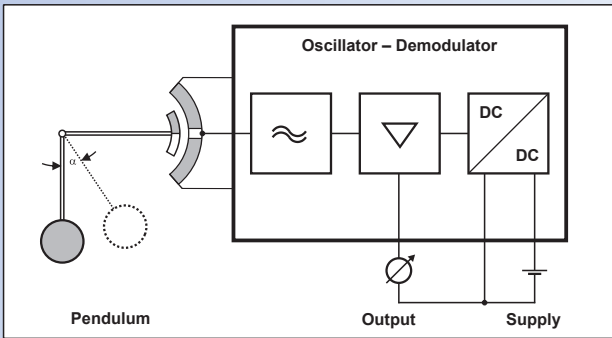
For the application as **tilt actuated switch**, e. g. on lifting platforms, crane vehicles or heeling control systems on board of cargo ships, uniaxial transducers can be provided with built-in min/max. comparators.

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

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

# ...Measuring systems

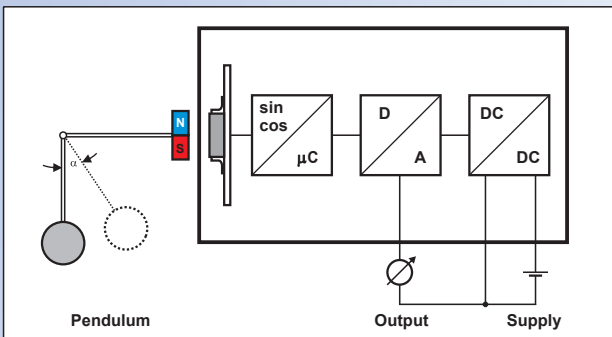
## Measuring principle



## inductive

- Single-axis pendulum up to  $\pm 45^\circ$
- Dual-axis pendulum up to  $\pm 15^\circ$
- Angular accuracy  $< \pm 0.5 \%$
- Resolution  $\infty$
- Current output 4 - 12 - 20 mA

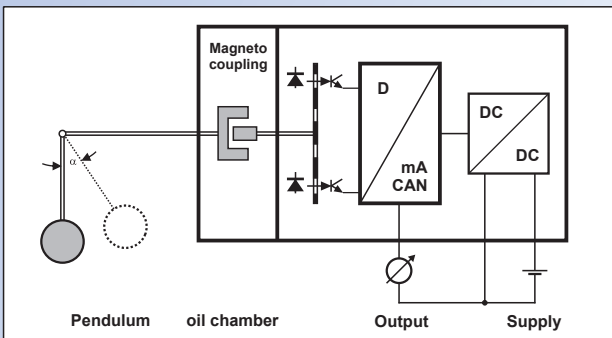
## Measuring principle



## Magnetic

- Single-axis pendulum up to  $360^\circ$
- Angular accuracy  $\pm 0.2^\circ$
- Resolution 12 bit
- Current output 4 - 12 - 20 mA
- Bus output CANopen

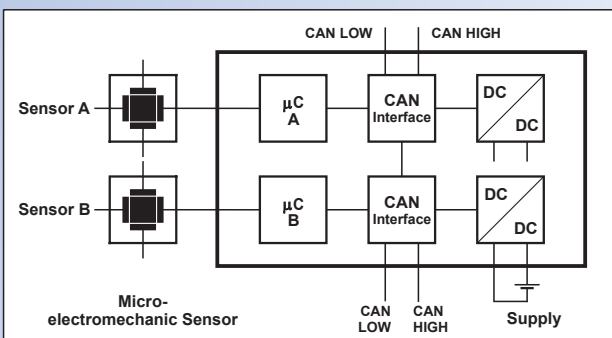
## Measuring principle



## Optoelectronic

- Single-axis pendulum up to  $360^\circ$
- Angular accuracy  $< \pm 0.01 \%$
- Resolution 12 bit
- Current output 4 - 12 - 20 mA
- Bus output CANopen

## Measuring principle







## MEMS

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

- Single-axis pendulum up to  $360^\circ$
- Dual-axis pendulum up to  $\pm 60^\circ$
- Angular accuracy  $< \pm 0.03^\circ$  up to  $< \pm 0.5^\circ$
- Resolution  $0.07^\circ$
- 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	by silicone oil	by silicone oil	by silicone oil
Damping response	at 25° swing < 1 sec	at 25° swing < 1 sec	at 25° swing < 1 sec	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	0.05 % / 10 K	0.05 % / 10 K	0.05 % / 10 K
IP code (casing)	up to IP 68	up to IP 68	up to IP 68	up to IP 68
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 <sub>L</sub> ≤ 600 Ω	4 - 20 mA, R <sub>L</sub> ≤ 600 Ω	4 - 20 mA, R <sub>L</sub> ≤ 600 Ω	4 - 20 mA, R <sub>L</sub> ≤ 600 Ω
Bus output	-	-	CANopen	CANopen
Supply	18 - 33 VDC	18 - 33 VDC	18 - 33 VDC	18 - 33 VDC
Current consumption	< 80 mA	< 120 mA	< 80 mA	< 80 mA
Signal adjustment	firm adjustment	firm adjustment	firm adjustment	key programming
Parent item #	1870 S10 ...	1898 Z10 ...	5790 Z02 ...	5790 Z02 ...

## General Data

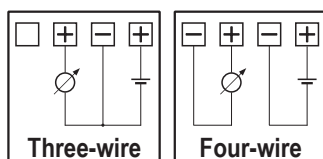
Emitted interference	EN 50 081-1
Immunity to interference	EN 50 082-2
Voltage output	on request
Current output	3-wire system, 4-wire system on request
Temperature range	- 30° C up to +70° C
Casing material	aluminium, anodised, partly coated, special version: salt fog proof Hart-Coat coating
Test voltage	500 V, 50 Hz, 1 min

## Special versions

Tilt switch PE-MEMS with  
Contact and signal output 4 - 20 mA aus  $\sqrt{x^2 + y^2}$  (vector calculation)

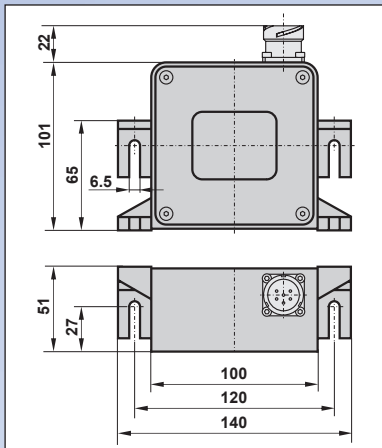
Measuring systems	optoelectronic	micro-electromechanic (MEMS)	
Models			
Series	PE-XA-X	PE-MEMS-X	PE-MEMS-X/Y
Single-axis pendulum transmitter/ Dual-axis pendulum transmitter	Single-axis pendulum transmitter	Single-axis pendulum transmitter	Dual-axis pendulum transmitter
Redundant electronics	Redundant electronics	Redundant electronics	Redundant electronics
Damping of pendulum	by silicone oil	electronic	electronic
Damping response	at 25° swing < 1 sec	adjustable < 1 sec	adjustable < 1 sec
Angular range	up to 360°	up to 360°	up to ± 60°
Angular accuracy	< ± 0.01 %	< ± 0.03° bis < ± 0.1°	< ± 0.1° bis < ± 0.5°
Resolution	12 bit	0.07°	0.07°
TC	< 0.01 % / 10 K	< 0.07° / 10 K	< 0.07° / 10 K
IP code (casing)	up to IP 65	IP 65 up to IP 68	IP 65 up to IP 68
Electrical connection	plug	flange plug and flange socket M12x1	flange plug and flange socket M12x1
Weight	2.2 kg	0.4 kg	0.4 kg
Current output	4 - 20 mA, $R_L \leq 600 \Omega$	4 - 20 mA, $R_L \leq 600 \Omega$	4 - 20 mA, $R_L \leq 600 \Omega$
Bus output	CANopen	CANopen	CANopen
Supply	18 - 33 VDC	9 / 18 - 33 VDC	9 / 18 - 33 VDC
Current consumption	< 120 mA	< 120 mA	< 120 mA
Signal adjustment	firm adjustment	firm adjustment	firm adjustment
Parent item #	1848 S10 ...	1887 S10 ...	1887 S10 ...

## Wiring

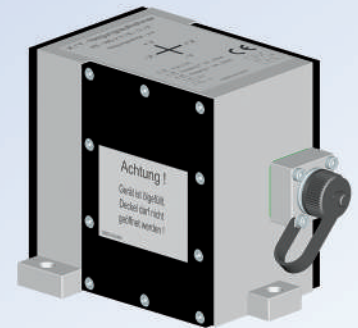
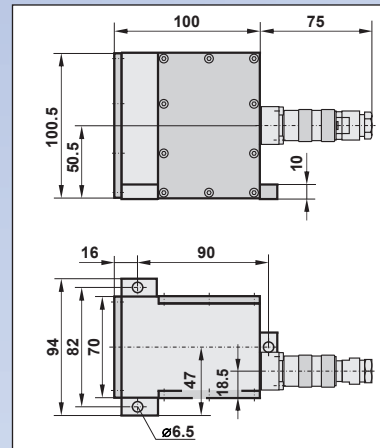


On request also available in version according to IEC 61508, SIL (Safety Integrated Level) or ISO 13849, PL (Performance Level) possible

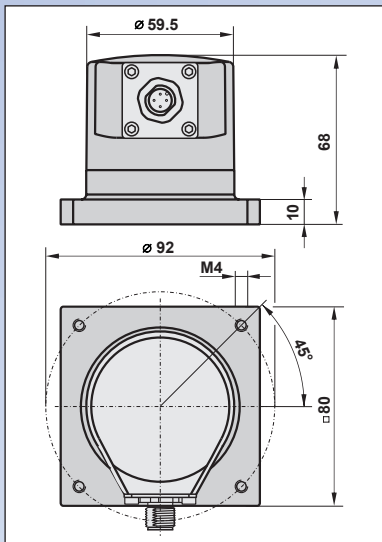
## ...Models



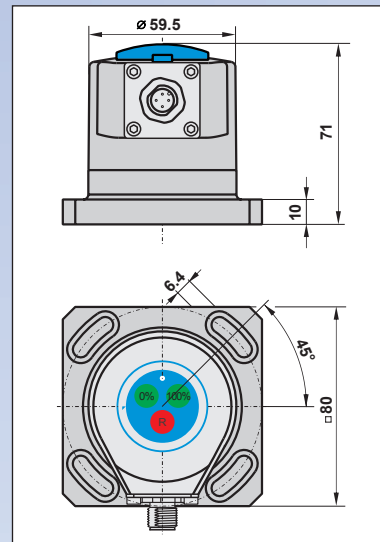
PE 4000 X



PE-X/Y



PE-MR-X  
Firm adjustment angular signal



PE-MR-X/P  
Angular signal programmable



## ...Models



**PE-MEMS-X**



PE-MEMS-X/Y



**PE-XA-X**