

Measurement and Sensor Systems

with conception



Tilt Angle Sensor

Tilt Angle Sensor

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).

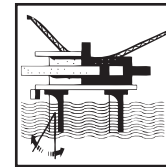
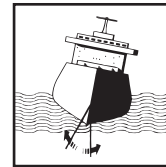
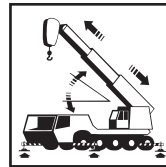
The output signal, representing the tilt angles, is provided either in form of an analogue resistance, current or voltage variation or as a digital signal – with interface bus – as well.

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.

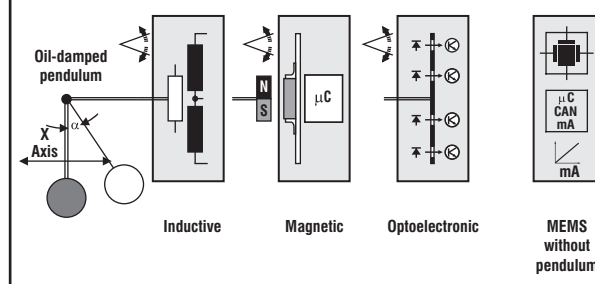
For signal indication and limit monitoring of measured tilt angle values we offer:

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

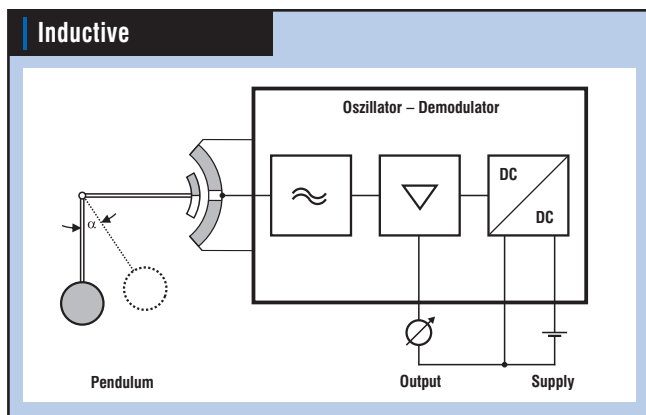
Application range



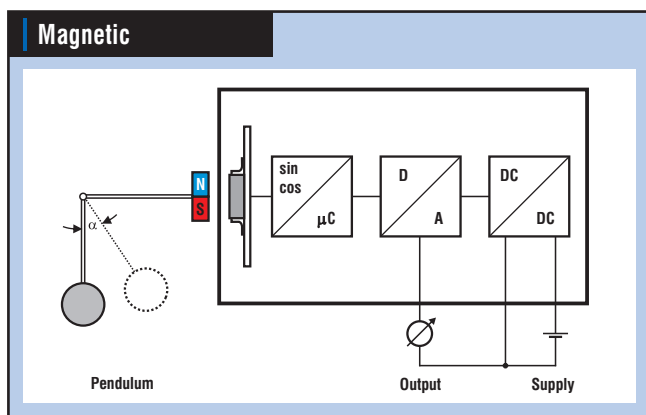
Measuring systems



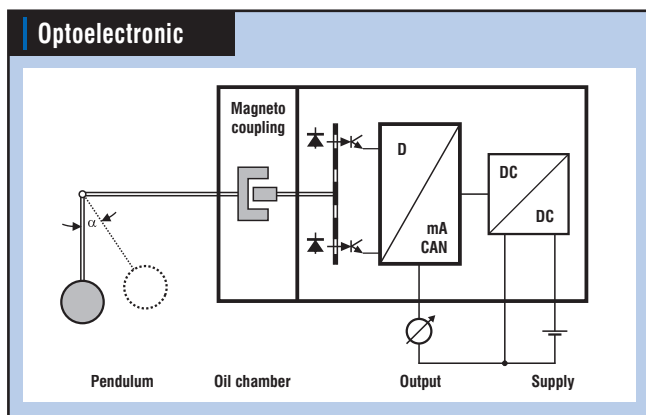
Measuring systems



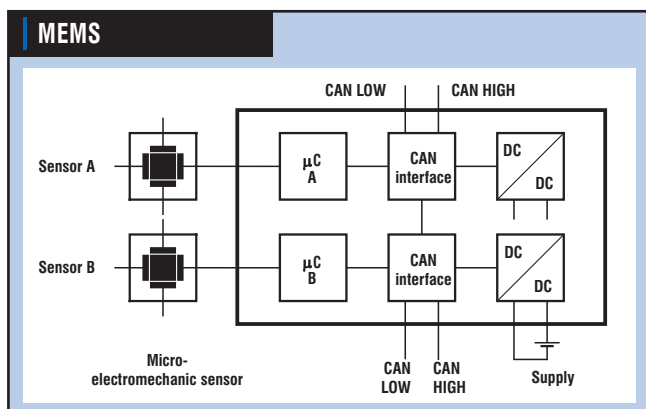
- Single-axis pendulum up to $\pm 45^\circ$
- Dual-axis pendulum up to $\pm 15^\circ$
- Angular accuracy $< \pm 0,5 \%$
- Resolution ∞
- Current output 4 - 12 - 20 mA



- 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 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 |

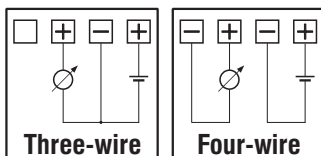
Special versions

Tilt switch PE-MEMS with

Contact and signal output 4 - 20 mA 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



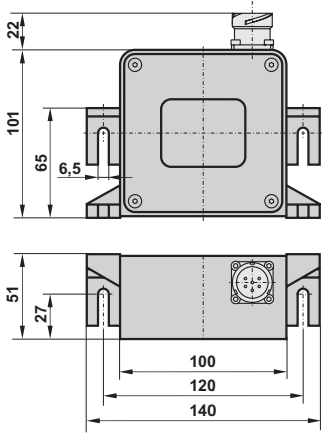
On request also available in version according to IEC 61508, SIL (Safety Integrated Level) or ISO 13849, PL (Performance Level) possible



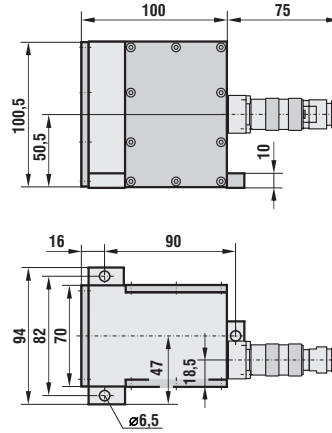
GL certificate available on request

Models

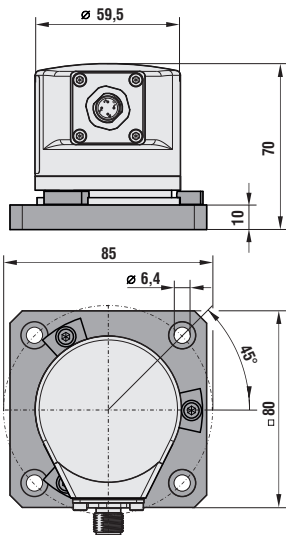
PE 4000 X



PE-X/Y

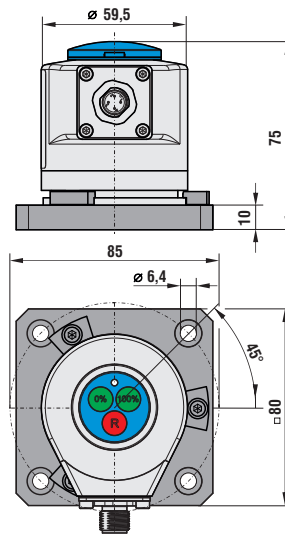


PE-MR-X



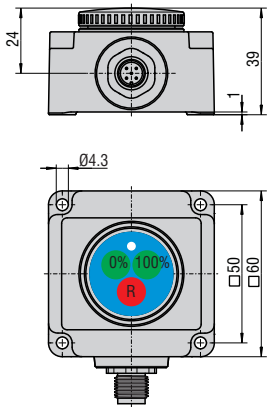
Firm adjustment angular signal

PE-MR-X/P

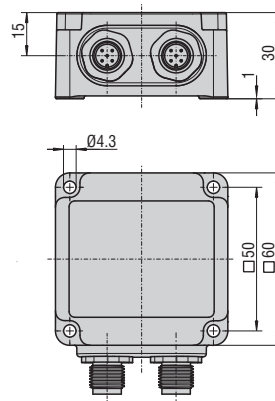


Angular signal programmable

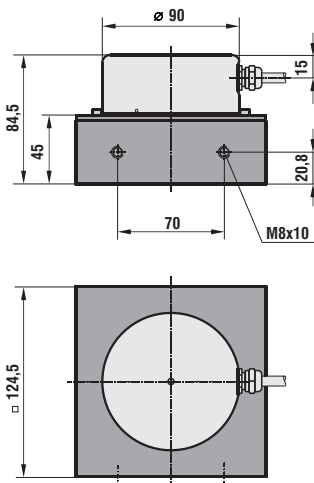
PE-MEMS-X



PE-MEMS-X/Y



PE-XA-X





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