

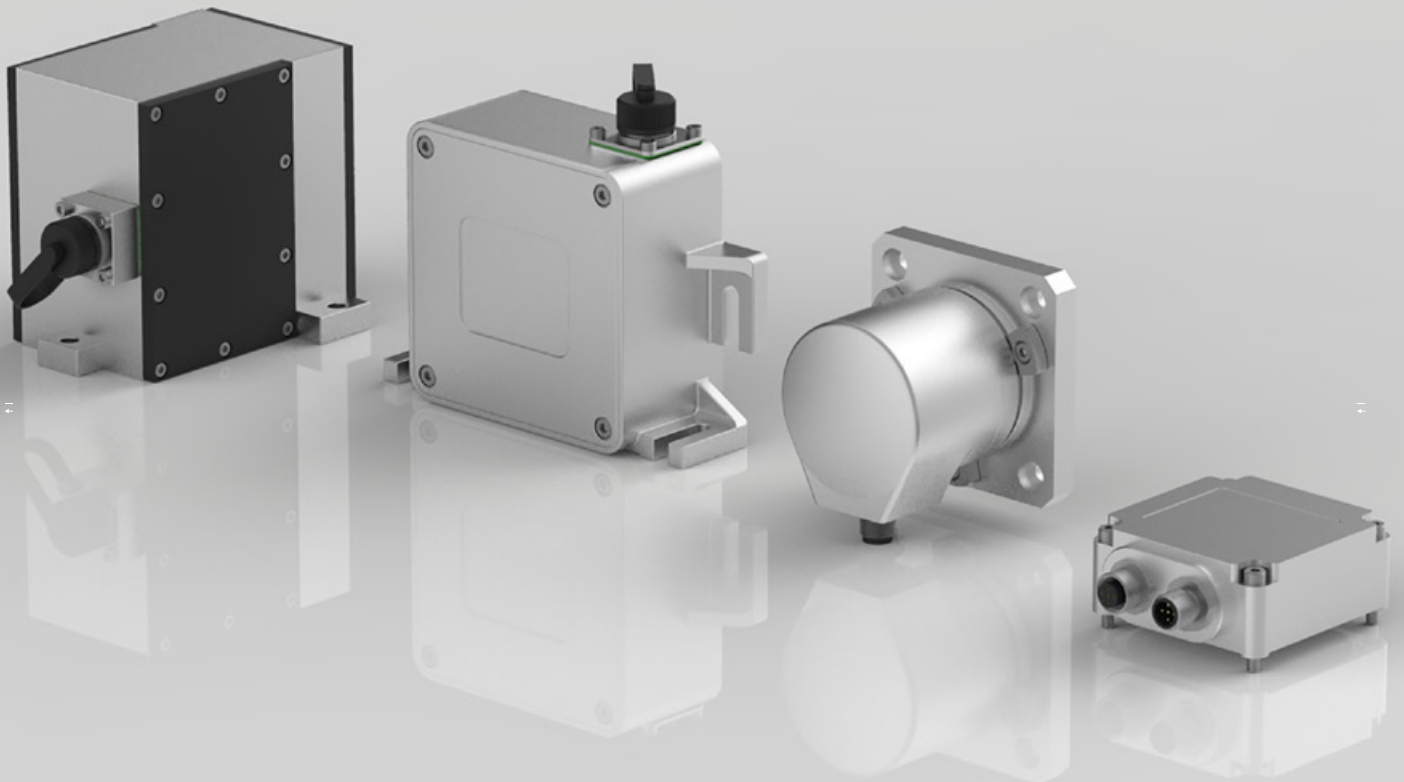
Rope Length Transmitter
Angular Position Transducer

Tilt Angle Sensor

Joystick

Pedal Actuated Transmitter

Wind Sensor



THE TILT ANGLE SENSOR

Detection of tilt angles on

- Cranes or excavators
- Ships and offshore facilities
- Weir traps or solar panels

stands for important measuring data as a part of the safety and control system of that type of machinery. By means of single and dual axis transmitters these angles are recorded and detected e. g. on

- levelling of installations
- angular position of a crane jib
- orientation of a weir trap or lifting platform

Encoders of that type contain inside a robust splash-proof aluminium case of IP code IP 65 to IP 69k oil-damped pendulum systems, the tilt

angle deflection of which is measured either by non-contact, inductive, optoelectronic or magnetoresistive angular transducers, depending on the application.

As an alternative to oil-damped pendulum systems we recommend use of the redundant micro-electromechanic inclinaton systems (MEMS). By means of an additional gyro sensor these systems are optimally suited to compensate interferences (such as lateral acceleration, permanent or continued vibrations or strong impacts)

The output signal, representing the tilt angles, is provided either analogue in form of current or voltage change or digitally with bus interface.

A pure switching signal in form of min/max comparators is also a suitable possibility to control important thresholds and to switch them accordingly.





HIGH IP PROTECTION

By default all magnetic or optical FSG encoders provide a casing protection between IP65 and IP67, depending on model. Special versions, e. g. magnetic encoders without own driving shaft and bearing position, can easily reach protection IP68 or IP69K. These features are especially required in the construction machinery field or commercial vehicle sector, water management or energy production.



ROBUST CASING FOR ALL AREAS

Seawater-resistant aluminium casings of our encoders usually offer sufficient protection against mechanical damages and for outdoor applications. For special applications and requirements, e. g. oil platforms, supply vessels or in the chemical industry, encoder versions with V4A stainless steel casings are available.



FLEXIBLE SIGNAL SETTING

Depending on the model, our sensors may be adjusted by user with analogue output signals, via membrane keypad or via additional control cables and thus be calibrated to angular ranges actually required.



SECURITY

The majority of FSG tilt angle transmitters is fitted with redundant sensors. Depending on the electrical circuit these sensors meet the requirements of functional safety according to ISO guidelines EN 13849 and EN61508.



SIGNAL OUTPUTS

For all sensor versions a great number of analogue and digital interfaces is available: 0 – 10V DC / 4 – 20mA / HART - interface CANopen / CANopen-safety



CUSTOMER-SPECIFIC VERSIONS

Standard versions of tilt angle sensors can be adapted - independent to quantity - to special applications and customer-specific requirements with regard to their electrical interfaces and mechanical design.







EXPLOSION PROTECTION

For use in potentially explosive environments we offer intrinsically safe tilt angle sensors of ATEX or IECEx certified design. Together with safety relevant requirements, e. g. in the oil and gas industry, we offer intrinsically safe encoders with additional SIL2 approval.



DNV / GL APPROVAL



Tilt angle transmitters for application in ships and offshore facilities often require an approval, ensuring a trouble-free operation. For that reason you will find in our range of products tilt angle transmitters with redundant analogue or digital interfaces having DNV / GL approval.

Measuring systems	inductive	magnetic	magnetic / MEMS
			
Mechanical Data			
Series	PE 4000-WD/E	PE-MH/1023-MU	PE-MH/1023-CAN
Casing	100 x 100 mm	Ø 60 mm	Ø 60 mm
Casing material	Alu	Alu / stainless steel	Alu / stainless steel
Casing length without shaft	100 mm	60 mm	60 mm
IP code of casing up to	IP68	IP68	IP68
Tilt recording	Single-axis sensor	Single-axis sensor	Single-axis sensor
Signal recording	Pendulum system	Pendulum system	Pendulum system
Damping	Silicone oil	Silicone oil	Silicone oil
Tilt angle max.	± 45° / 0 - 90°	0 - 360°	0 - 360°
Temperature range	-30°C up to +70°C	-30°C up to +70°C	-30°C up to +70°C
Shock	5g, 6 ms	5g, 6 ms	5g, 6 ms/50g, 6 ms
Vibration	0 - 100 Hz, 4 g	0 - 100 Hz, 4 g	0 - 100 Hz, 4 g/5 - 200 Hz, 4 g
Connection	plug/cable	plug/cable	plug/cable
Weight	1000 g	500 g/700 g	500 g/700 g
Electrical Data			
Electronics	single	single/redundant	single/redundant
Voltage output	0 - 10 V	0 - 10 V	-
Current output	0/4 - 20 mA	0/4 - 20 mA (HART)	-
Min. burden voltage output	10 KΩ	10 KΩ	-
Max. burden current output	600 Ω	600 Ω	-
Bus output	-	-	CANopen/CANopen-safety
Signal calibration	Firm calibration	Firm calibration/Key programming	CAN-Bus
Angular accuracy	< ±0.5 %	±0.2°	±0.20°
Resolution	∞	14 bit	14 bit
Supply ¹⁾	18 - 33 V DC	9/18 - 33 V DC	9 - 33 V DC
Current consumption	< 80 mA	< 80 mA	< 80 mA
Temperature coefficient	0.05°/10 K	0.1°/10 K	0.1°/10 K
Test voltage	500 V, 50 Hz, 1 min	500 V, 50 Hz, 1 min	500 V, 50 Hz, 1 min
Immunity standard	EN 61 000-6-2	EN 61 000-6-2	EN 61 000-6-2
Emission standard	EN 61 000-6-4	EN 61 000-6-4	EN 61 000-6-4
Other			
Customized features			
Optional	-		-
Article number	1870S10	5790Z03	5790Z03

¹⁾ other on request

Measuring systems	MEMS	MEMS	MEMS	MEMS
				
Mechanical Data				
Series	PE-MEMS-X-360-MU/GS60	PE-MEMS-X-360-CAN/GS70	PE-MEMS-X-360-CAN/G/GS70	PE-MEMS-x-i/GS60L
Casing	60 x 60 mm	70 x 70 mm	70 x 70 mm	60 x 50 mm
Casing material	Alu	Alu	Alu	synthetic
Casing length	30 mm	30 mm	30 mm	42 mm
IP code of casing up to	IP68	IP68	IP68	IP67
Tilt recording	Single-axis sensor	Single-axis sensor	Single-axis sensor	Single-axis sensor
Signal recording	Acceleration sensor	Acceleration sensor	Acceleration sensor + gyro sensor	Acceleration sensor
Damping	Firm averaging	Firm averaging	Firm averaging + gyro sensor	Firm averaging
Tilt angle max.	0 - 360°	0 - 360°	0 - 360°	±60°
Temperature range	-30°C up to +70°C	-30°C up to +70°C	-30°C up to +70°C	-30°C up to +70°C
Shock	50 g, 6 ms	50 g, 6 ms	50 g, 6 ms	50 g, 6 ms
Vibration	5 - 200 Hz, 4 g	5 - 200 Hz, 4 g	10 - 1000 Hz, 4 g	5 - 200 Hz, 4 g
Connection	plug/cable	plug/cable	plug/cable	plug
Weight	300 g	300 g	300 g	150 g
Electrical Data				
Electronics	single/redundant	single/redundant	single/redundant	single
Voltage output	0 - 10 V	-	-	4 - 20 mA each tilt axis
Current output	0/4 - 20 mA	-	-	4 - 20 mA
Min. burden voltage output	10 KΩ	-	-	-
Max. burden current output	600 Ω	-	-	je 500 Ω
Bus output	-	CANopen/CANopen-safety	CANopen/CANopen-safety	-
Signal calibration	Firm calibration/ Key programming	CAN-Bus	CAN-Bus	-
Angular accuracy	±0.2°	0.05° - 0.3° ²⁾	0.05° - 0.3° ²⁾	±0.25°
Resolution	14 bit	14 bit	14 bit	3000 Digits/16 mA
Supply ¹⁾	18 - 33 V DC	9 - 33 V DC	9 - 33 V DC	9 - 36 V DC
Current consumption	< 120 mA	< 120 mA	< 120 mA	< 65 mA
Temperature coefficient	0.05°/10 K	0.05°/10 K	0.05°/10 K	0.15°/10 K
Test voltage	500 V, 50 Hz, 1 min	500 V, 50 Hz, 1 min	500 V, 50 Hz, 1 min	500 V, 50 Hz, 1 min.
Immunity standard	EN 61 000-6-2	EN 61 000-6-2	EN 61 000-6-2	EN 61 000-6-2
Emission standard	EN 61 000-6-4	EN 61 000-6-4	EN 61 000-6-4	EN 61 000-6-4
Other				
Customized features				Low-Cost Sensor
Optional	2-switching contacts	-	-	-
Article number	1885S12	1887F13	1887F13	1895S1

¹⁾ other on request²⁾ angel-dependent

Measuring systems	inductive	MEMS	MEMS
			
Mechanical Data			
Series	PE-WD-XY/E	PE-MEMS-X/Y-MU/GS60	PE-MEMS-x/y-i/GS60L
Casing	70 x 100 mm	60 x 60 mm	60 x 60 mm
Casing material	Alu	Alu	Synthetic
Casing length	100 mm	30 mm	25 mm
IP code of casing up to	IP67	IP68	IP67
Tilt recording	x-/y-axis	x-/y-axis	x-/y-axis
Signal recording	Pendulum system	Acceleration sensor	Acceleration sensor
Damping	Silicone oil	Firm averaging	Firm averaging
Tilt angle max.	±15°	±60°	±180°
Temperature range	-30°C up to +70°C	-30°C up to +70°C	-30°C up to +70°C
Shock	5 g, 6 ms	50 g, 6 ms	50 g, 6 ms
Vibration	0 - 100 Hz, 4 g	5 - 200 Hz, 4 g	5 - 200 Hz, 4 g
Connection	plug	plug/cable	plug/cable
Weight	1500 g	400 g	200 g
Electrical Data			
Electronics	single	single/redundant	single
Voltage output	–	–	–
Current output	0/4 - 20 mA	0/4 - 20 mA	4 - 20 mA
Min. burden voltage output	–	–	–
Max. burden current output	600 Ω	600 Ω	600 Ω
Bus output	–	–	–
Signal calibration	Firm calibration	Firm calibration	Firm calibration
Angular accuracy	±0.05 %	±0.2°	±0.25°
Resolution	analogue	0,01°	3000 Digits/16 mA
Supply ¹⁾	18 - 33 V DC	18 - 33 V DC	18 - 36 V DC
Current consumption	< 80 mA	< 120 mA	< 65 mA
Temperature coefficient	0.05°/10 K	0.05°/10 K	0.15°/10 K
Test voltage	500 V, 50 Hz, 1 min	500 V, 50 Hz, 1 min	500 V, 50 Hz, 1 min
Immunity standard	EN 61 000-6-2	EN 61 000-6-2	EN 61 000-6-2
Emission standard	EN 61 000-6-4	EN 61 000-6-4	EN 61 000-6-4
Other			
Customized features			Low-Cost Sensor
Optional	–	4-switching contacts	–
Article number	1898Z10	1885S12	1895S10

¹⁾ other on request

Measuring systems	MEMS	MEMS	MEMS
			
Mechanical Data			
Series	PE-MEMS-XY-CAN/GS70	PE-MEMS-XY/CAN/G/GS70	PE-MEMS-X/Y-2i/GS
Casing	70 x 70 mm	70 x 70 mm	85 x 85 mm
Casing material	Alu	Alu	Alu
Casing length	30 mm	30 mm	30 mm
IP code of casing up to	IP68	IP68	IP68
Tilt detection	x/y-axis	x/y-axis	x/y-axis
Signal recording	Acceleration sensor	Acceleration sensor + gyro sensor	Acceleration sensor
Damping	Firm averaging	Firm averaging + gyro sensor	Firm averaging
Tilt angle max.	± 60°	± 60°	± 60°
Temperature range	-30°C up to +70°C	-30°C up to +70°C	-40°C up to +70°C
Shock	50 g, 6 ms	50 g, 6 ms	50 g, 6 ms
Vibration	10 - 1000 Hz	10 - 1000 Hz	5 - 200 Hz, 4 g
Connection	plug/cable	plug/cable	cable
Weight	300 g	300 g	600 g
Electrical Data			
Electronics	single/redundant	single/redundant	single/redundant
Voltage output	-	-	-
Current output	-	-	4 - 20 mA
Min. burden voltage output	-	-	-
Max. burden current output	-	-	250 Ω (10 - 17 V DC), 500 Ω (18 - 33 V DV)
Bus output	CANopen/CANopen-safety	CANopen/CANopen-safety	-
Signal calibration	CAN-Bus	CAN-Bus	Firm calibration
Angular accuracy	0.01° - 0.3° ²⁾	0.01° - 0.3°	0.1° - 1°
Resolution	14 bit	14 bit	14 bit
Supply ¹⁾	9 - 33 V DC	9 - 33 V DC	10 - 33 V DC
Current consumption	< 120 mA	< 120 mA	< 140 mA
Temperature coefficient	0.05°/10 K	0.05°/10 K	0.05°/10 K
Test voltage	500 V, 50 Hz, 1 min	500 V, 50 Hz, 1 min	500 V, 50 Hz, 1 min
Immunity standard	EN 61 000-6-2	EN 61 000-6-2	EN 61 000-6-2
Emission standard	EN 61 000-6-4	EN 61 000-6-4	EN 61 000-6-4
Other			
Customized features	SIL IEC 61508	PL EN 13849	Additional angle level
Optional	-	-	-
Article number	1887F13	1887F13	1892S10

¹⁾ other on request²⁾ angel-dependent



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