

# Angular Position Engineering

**Camille Bauer**

**Heavy current  
engineering**

**Angular position  
engineering**

**Process control  
engineering**



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## Angular Position Engineering at a glance

Only the best have always been working for us, i.e. our customers and the market with all of its changing and new challenges. This implies a permanent learning aptitude which is consistently implemented in our products - particularly in customised solutions. And this world-wide, always considering local requirements, conditions and regulations. We launch new products as announced. We adhere strictly to confirmed delivery dates. And: Our responsibility in relation to customers does not end upon the conclusion of a sale. Systematic and innovative thinking determines our actions. The concept of all product groups is comprehensive and integrative. In this respect, high priority is given to the interaction of hardware and software.

Our program may be subdivided as follows:

- Heavy current engineering
- Angular position engineering
- Process control engineering

Camille Bauer offers two options for orders: The versatile products of Camille Bauer have different product features. You can obtain products via Order Code or as stock versions.

The Order Code is stated on the data sheets on our homepage:

**[www.camillebauer.com](http://www.camillebauer.com)**.

For standard applications, use the 6-digit Article Number stated in this catalogue. These products are on stock and can be supplied within 3 days.

It is a matter of course that our competent sales partners in your country will support you in ordering (please see the inside of the rear cover or visit our homepage).

Our in-house area sales manager will support you in countries which are not listed.

**Heavy current engineering**

**Angular position engineering**

**Process control engineering**

**Introduction**


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**Position feedback transmitters**

**Inclination transmitters**

**Software and accessories**

**Basics**

 **CAMILLE BAUER**  
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Rely on us:  
We provide a  
3-year warranty for all  
Camille Bauer products.



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- ▲ Inclination transmitters

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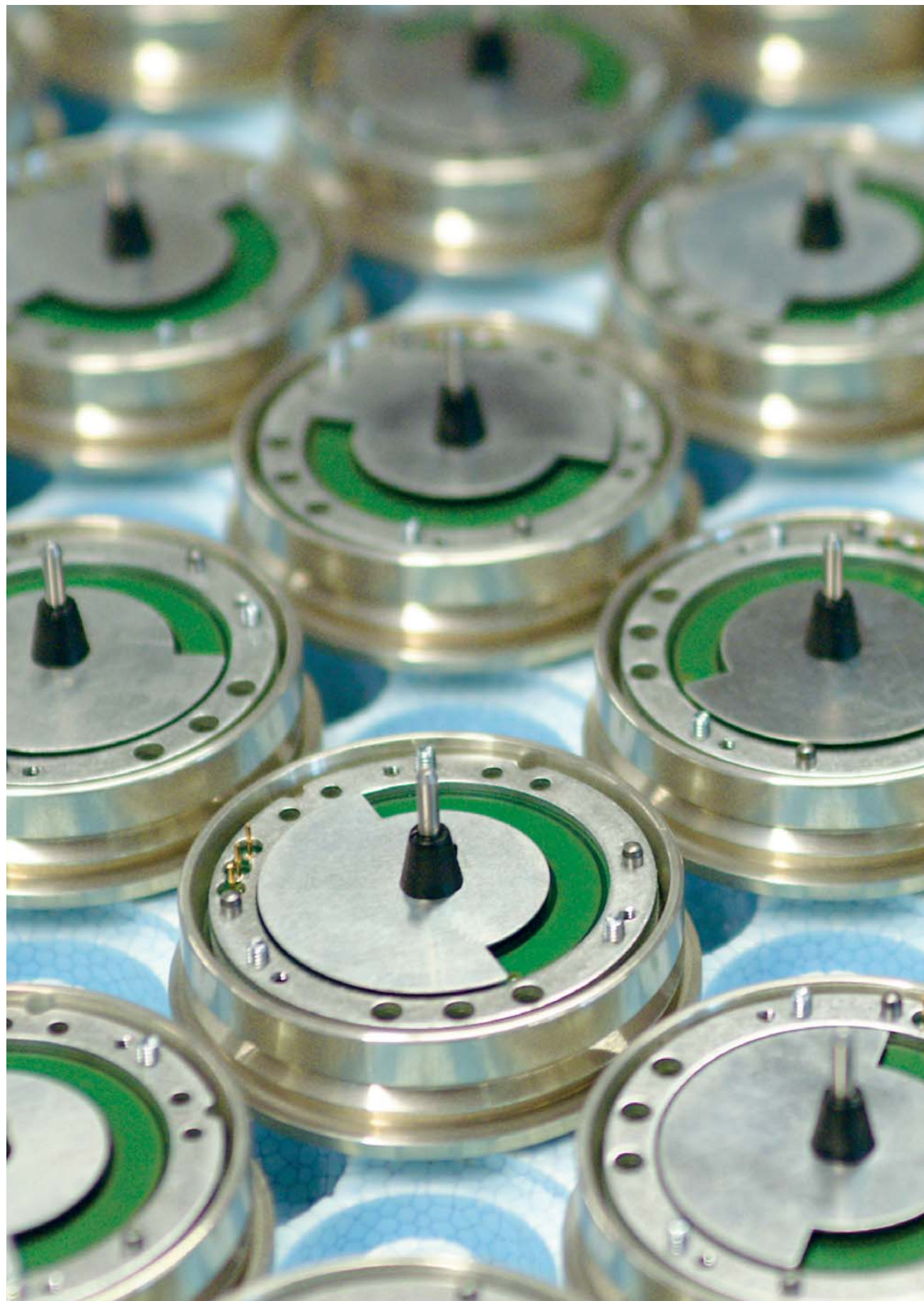
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## Transmitters for angular position

Positioning tasks have to be solved in all areas of machine and plant construction. Safety demands and requirements continually rise, particularly so if failures endanger people and the environment. Angular position, inclination or position transmitters are used for the exact acquisition and monitoring of positions. The ability of allocating an exact and unambiguous position value to a distance or angular position at any time make angular position transmitters one of the most important links between mechanical components and the control system.

Angular position transmitters acquire the angular position of a shaft and convert the mechanical movement into a proportionate DC signal. They may be divided into two main categories.

### Incremental angular position transmitters

An incremental encoder measures angles by counting measuring steps or the interpolation of signal periods always starting from an optional point of reference (zero). A pulse is emitted for each position step. This measuring method does not provide an absolute allocation of a position to the signal. This means that every time the control is activated or after an interruption of the supply voltage, a point of reference has to be set.

### Absolute angular position transmitters

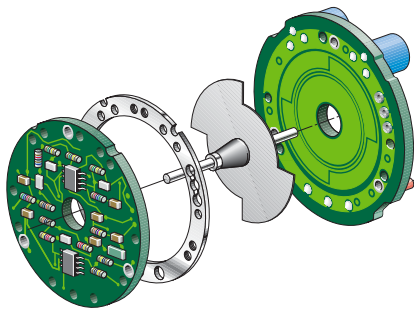
Absolute angular position transmitters provide an unambiguously allocated position immediately after activation or an interruption of the supply voltage. Contrary to incremental angular position transmitters, the time-consuming determination of a point of reference is not required.

The measuring task of an angular position transmitter may be solved by different measuring principles.

### Capacitive measuring principle

Capacitive measuring principles are among the best non-contact sensor scanning systems for analog and digital output signals. The principle of an ideal plate capacitor. The measured value generator consists of two capacitor plates fixed in a housing and facing each other at a short distance. An electric field is generated between the plates and influenced by a flag which can rotate around a central axis fixed on one axis. A spacer ring is arranged between the emitting and receiving electrode plate and ensures a

firm, defined distance of the electrode plates and the flag. The analysis electronics are positioned on the outer side of the capacitor plates where they are supplied with energy via feedthrough filters and read out. Together with the shells of the aluminium housing, these feedthrough filters form an effective protection against external electric fields influencing the angular position transmitter. If the axis is turned in relation to the housing, the capacities of the differential capacitors change in accordance with the angle position of the axis. These changes are acquired by the measuring circuit and correspondingly displayed. The measured value is thus issued as an absolute angle position.



### Magnetic measuring principle

Angular position encoders using a magnetic measuring principle consist of a rotatable shaft with a fixed permanent magnet and a sensor. The magnetic field generated by the permanent magnet is scanned by the sensor and the measured value is allocated to an unambiguous, absolute angle position.

### Optical measuring principle

Angular position encoders using an optical measuring principle consist of a rotatable shaft with a code disk and an optoelectronic scanning unit composed of an aperture and photoreceivers. Optical information is converted into electrically analysable signals. The system is predominantly limited to visible light, infrared radiation and ultraviolet light. The principle is based on the signal change caused by the quantum mechanical properties of light. This means that infrared light of a source penetrates the code disk and the aperture behind it. In each angle step, a different number of photoreceivers is covered due to the dark fields of the code disk.

### Single and multiturn angular position encoders

Angular position encoders which issue an absolute position by one revolution of the shaft, i.e. 360°, are called single turn angular position encoders. The entire measuring range has been covered after one revolution and starts again with its initial value. Many applications, e.g. spindles, engine shafts or cables require the acquisition of several revolutions. Multiturn angular position encoders provide in addition to the angle position of the shaft also information on the number of revolutions.

Camille Bauer AG offers a range of sophisticated and high-quality angular position transmitters. For a long time, the company has focussed on the patented capacitive measuring principle. The instruments are characterised by features and advantages which predestine them for heavy-duty operation. The emphasis is always on quality, reliability and robustness.

## Common applications

### Wind and solar energy plants

- Horizontal nacelle alignment to determine the wind direction, monitor the rotor blade position and speed of the rotor
- Exact alignment of solar panels and parabolic mirrors

### Guide vanes, throttle valves and slidegates of power plants

- Exact positioning and monitoring of guide vanes, turbine controls, throttle valves and slidegates

### Shipping

- Exact determination of rudder and propeller position

### Crane vehicles, fork-lift trucks and heavy-duty vehicles

- Exact positioning of crane jibs and the fork of fork-lift trucks
- Precise position measurement in industrial and dockside cranes as well as swivel measurement in heavy-duty vehicles

### Dredgers and drilling equipment

- Measurement of suction arm depths in suction dredgers
- Acquisition and positioning of dredger arms and depth measurement in rotary drilling equipment

### Inclination transmitter

The determination of the exact position of an object is important when monitoring moving objects. There is hardly any moving object whose position cannot be monitored by an inclination transmitter. They are the allrounders in instrumentation. Applications cover from the acquisition of the angular position of crane jibs, the lateral inclination of vehicles, the orientation of lifting platforms, of weir traps and similar facilities through to machine monitoring. Inclination transmitters work like a plummet. They measure the deviation from the horizontal or vertical within the reference point provided by the direction of gravity. In relation to angular position transmitters, inclination transmitters feature the advantage of a direct acquisition of inclination values in which they do not require any mechanical interconnection with the actuators.

One or two inclination axes are monitored depending on the application purpose of the object. For this reason, inclination transmitters are divided into two types.

#### One-dimensional inclination transmitters

As the name indicates, a one-dimensional inclination transmitter can only measure one axis.

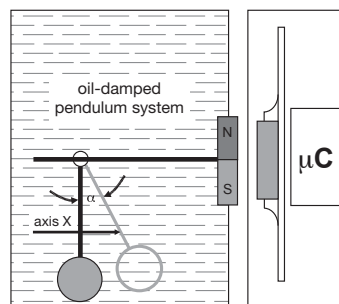
#### Two-dimensional inclination transmitters

Two axes can be measured simultaneously. A separate measured value is available for both axes. The base plate must be horizontally aligned, i.e. parallel to the horizontal plane.

The inclination angle in relation to the surface of the earth can be measured by different methods.

#### Oil-damped pendulum system

In this method, a test mass in form of a pendulum surrounded by oil is changed in its position by inclination or gravitational acceleration. The angle is measured by the pendulum swing.



#### Liquid level analysis

In liquid levels, the medium to be measured always aligns itself vertically in relation to gravity. Electrodes are arranged parallel to the tilting axis on the bottom of an electrolyte chamber filled with conductive liquid. If alternating current is applied between the two electrodes, a stray field develops. The stray field is constricted as tilting of the sensor reduces the liquid level. The constant conductivity of the electrolyte causes a resistance change related to the level. If electrodes are arranged in pairs on the right and left half of the bottom of the sensor cell in relation to the tilt axis, the inclination angle can be determined by the differential measurement principle.

#### Thermic method

The thermic method uses convection: A gas heated in a measuring cell always rises. Temperature sensors are arranged around the measuring cell which acquire the direction of the generated flow of heat according to a difference method. The inclination angle is determined on basis of the temperature change.

#### Microelectromechanical system (MEMS)

Another measuring method concerns the microelectromechanic system (MEMS). The design of the MEMS sensor element is based on a fixed and a movable electrode in form of two engaging comb structures (or interdigital structures). An acceleration in the direction of the measuring axis moves the mass and changes the capacity values between the fixed and the moveable electrodes. This capacity change is processed by the integrated ASIC and converted into an output signal which can easily be acquired for measuring purposes.

The one-dimensional inclination transmitters used by Camille Bauer are based on the magnetic measuring principle with an oil-damped pendulum system. The instruments are characterised by numerous special features which predestine them for heavy-duty operation. The emphasis is always on quality, reliability and robustness.

### Common applications

#### Solar energy plants

- Exact alignment of solar panels and parabolic mirrors

#### Throttle valves and slidegates of power plants

- Exact acquisition of weir trap positions

#### Shipping and offshore plants

- Exact acquisition of the lateral inclination of ships and offshore plants
- Exact acquisition of the position of a lifting platform

#### Crane vehicles, fork-lift trucks and heavy duty vehicles

- Exact positioning of a crane jib
- Exact acquisition of the lateral inclination of a vehicle

#### Dredgers and drilling equipment

- Exact acquisition and positioning of dredger arms
- Exact acquisition of the lateral inclination of a dredger or drill

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# Camille Bauer

## Transmitters for Angular Position

### Programmable shaft transmitter for angular position for heavy duty applications, dia. 58 mm

Converts the angular position of a shaft into a load independent direct current signal, proportional to the angular shaft position. The unit is contact free.

#### Main features

- Robust transmitter for angular position suitable for field applications
- Highest degree of mechanical and electrical safety
- Capacitive scanning system provides absolute position immediately after activation
- Measuring range and sense of rotation can be adjusted by a switch and two push-buttons
- Zero position and end position are independently adjustable
- Linear and V characteristic of the output value free programmable
- No wear, low annual maintenance and mountable anywhere
- Vibration and shock-resistant
- Analog output signal 4...20 mA, 2-wire connection

#### Technical data

Measuring range:	Free programmable between 0 ... 360°
Measuring output:	4 ... 20 mA, 2-wire connection
Power supply:	12 ... 30 V DC (protected against wrong polarity)
Output variable $I_A$ :	Load-independent DC current, proportional to the input angle
Max. residual ripple:	< 0.3% p.p.
Accuracy:	Error limit $\leq \pm 0.5\%$ (at reference conditions)
Sense of rotation:	Adjustable for sense of rotation clockwise or counterclockwise
Electrical connection:	Spring-type terminal block or plug connector M12, 4 poles

#### Mechanical data

Starting torque:	< 0.03 Nm
Clearance influence:	$\pm 0.1\%$
Drive shaft diameter:	10 mm 19 mm, with adapter flange NLB1019
Admissible static loading of shaft:	Max. 80 N (radial) Max. 40 N (axial)
Mounting position:	Any
Material:	Front: aluminium Back: aluminium anodized Shaft: rust-proof, hardened steel
Connections:	Cable gland metal or plug metal (M12 / 4 poles)
Weight:	Approx. 360 g Approx. 900 g, with adapter flange NLB1019

#### Environmental conditions

Temperature range:	-20 ... +85 °C -40 ... +85 °C with improved climatic rating)
Humidity:	Relative humidity max. $\leq 90\%$ , non-condensing Relative humidity max. $\leq 95\%$ , non-condensing (with improved climatic rating)
Housing protection:	IP 67 according to EN 60 529 IP 69k according to EN 40 050 - 9
Vibration:	IEC 60 068-2-6, 100 m/s <sup>2</sup> / 10 ... 500 Hz
Shock:	IEC 60 068-2-27, $\leq 500$ m/s <sup>2</sup> / 11 ms
Electromagnetic compatibility:	The standards for noise immunity EN 61 000-6-2 and interference emission EN 61 000-6-4 are observed

### KINAX WT720



with adapter flange NLB1019

# Camille Bauer Transmitters for Angular Position




## Programming:

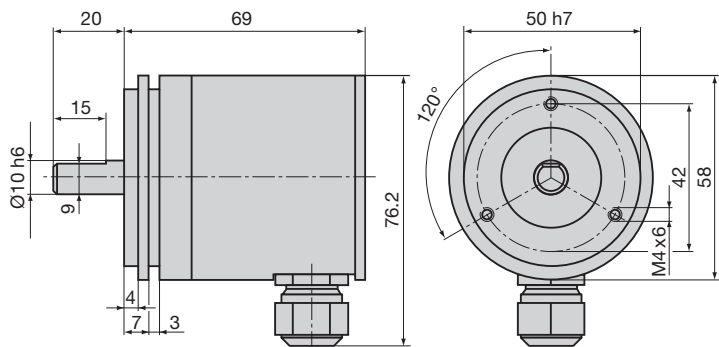
The transmitter is programmable via switch and push-button. These will be visible after opening the top cover.

Zero and end position can be independently programmed via push-buttons. The direction of rotation and the shape of the output curve (linear or V characteristic) are free adjustable via DIP switch.

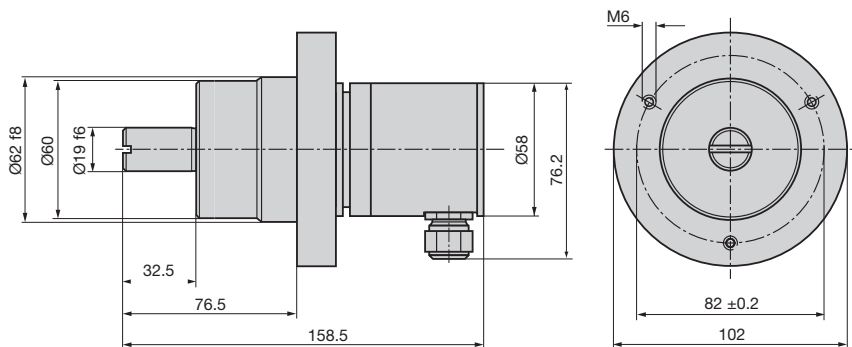
## Connection allocation plug

	Pin	Plug
	1	+
	2	-
	3	not connected
	4	⏏

## Dimensions



Dimensions KINAX WT720



Dimensions KINAX WT720 with adapter flange NLB1019

## Accessories

Article No.	Description	see page
168 105	Plug connector for M12 sensor plug, 5 poles	41
168 204	Mounting angle	40
168 212	Mounting plate	40
157 364	Kit mounting clamp	39

# Camille Bauer

## Transmitters for Angular Position

### Programmable hollow-shaft transmitter for angular position for heavy duty applications, dia. 78 mm

Converts the angular position of a shaft into a load independent direct current signal, proportional to the angular shaft position. The unit is contact free.

#### Main features

- Robust transmitter for angular position suitable for field applications
- Highest degree of mechanical and electrical safety
- Proven capacitive scanning system
- No wear, low annual maintenance and mountable anywhere
- Vibration and shock-resistant
- Measuring range, sense of rotation, zero position and linear/V characteristic can be adjusted by a switch and two push-buttons
- Analog output signal 4...20 mA, 2-wire connection
- Zero position and end position are independently adjustable
- Capacitive scanning system provides absolute position immediately after activation

#### Technical data

Measuring range:	Free programmable between 0 ... 360°
Measuring output:	4 ... 20 mA, 2-wire connection
Power supply:	12 ... 30 V DC (protected against wrong polarity)
Output variable $I_A$ :	Load-independent DC current, proportional to the input angle
Reproducibility:	< 0.1°
Accuracy:	Error limit $\leq \pm 0.35^\circ$ (at reference conditions)
Sense of rotation:	Adjustable for sense of rotation clockwise or counterclockwise
Electrical connection:	Spring-type terminal block or plug connector M12, 4 poles

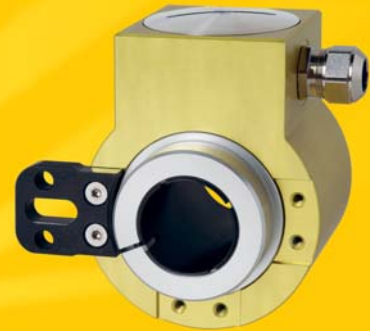
#### Mechanical data

Starting torque:	max 0.7 Nm
Clearance influence:	$\pm 0.1\%$
Hollow-shaft diameter:	30 mm, by reduction 10, 12, 16 or 20 mm
Mounting position:	Any
Material:	Front: aluminium Back: aluminium anodized Shaft: rust-proof, hardened steel
Connections:	Cable gland metal or plug metal (M12 / 4 poles)
Weight:	Approx. 820 g

#### Environmental conditions

Temperature range:	-40 ... +85 °C
Humidity:	Relative humidity max. $\leq 95\%$ , non-condensing
Housing protection:	IP 67 according to EN 60 529 IP 69k according to EN 40 050 - 9
Vibration:	IEC 60 068-2-6, 100 m/s <sup>2</sup> / 10 ... 500 Hz
Shock:	IEC 60 068-2-27, $\leq 1000$ m/s <sup>2</sup> / 11 ms
Electromagnetic compatibility:	The standards for noise immunity EN 61 000-6-2 and interference emission EN 61 000-6-4 are observed

KINAX HW730



# Camille Bauer

## Transmitters for Angular Position




### Programming:

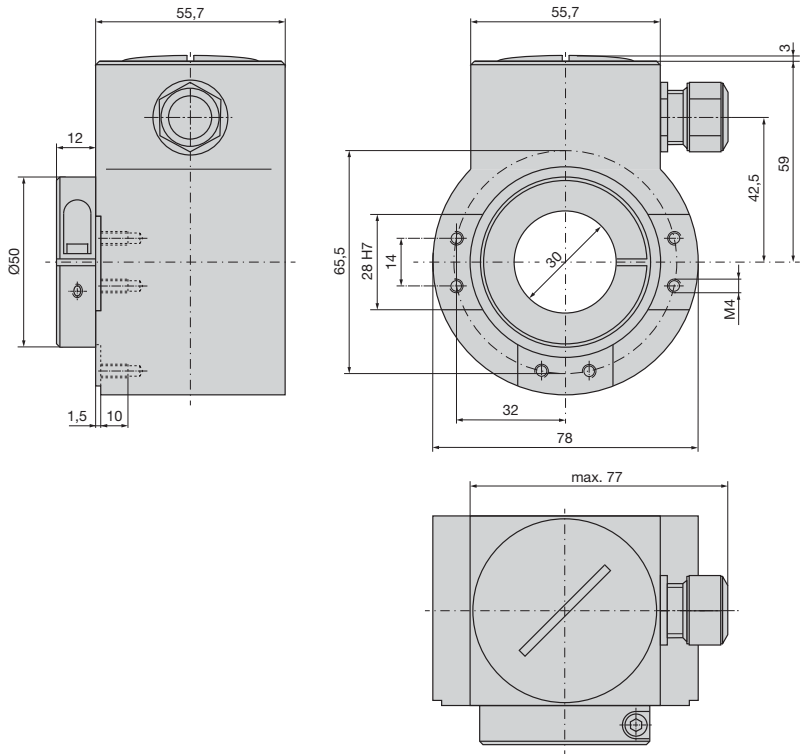
The transmitter is programmable via switch and push-button. These will be visible after opening the top cover.

Zero and end position can be independently programmed via push-buttons. The direction of rotation and the shape of the output curve (linear or V characteristic) are free adjustable via DIP switch.

### Connection allocation plug

	Pin	Plug
	1	+
	2	-
	3	not connected
	4	⏏

### Dimensions



### Accessories

Article No.	Description	see page
168 105	Plug connector for M12 sensor plug, 5 poles	41
168 874	Adapter sleeve ø10mm	39
168 882	Adapter sleeve ø12mm	39
168 907	Adapter sleeve ø16mm	39
168 915	Adapter sleeve ø20mm	39
169 749	Kit of torque support HW730	39

# Camille Bauer

## Transmitters for Angular Position

### Shaft transmitter for angular position for heavy duty applications, > dia. 100 mm

Converts the angular position of a shaft into a load independent direct current signal, proportional to the angular shaft position. The unit is contact free and has minimal mechanical abrasion.



#### Main features

- Robust transmitter for angular position in singleturn und multiturn suitable for field applications
- Highest degree of mechanical and electrical safety
- Capacitive scanning system provides absolute position immediately after activation
- No wear, low annual maintenance and mountable anywhere
- Zero position and end position are adjustable
- Small bearing play influence < 0.1%
- Available with explosion protection "Intrinsic safety" Ex ia IIC T6
- Can be mounted in hazardous area
- Also available as sea-water resistant version

#### Technical data

Measuring range:	0 ... 5°, 0 ... 10°, 0 ... 30°, 0 ... 60°, 0 ... 90°, 0 ... 180°, 0 ... 270° (without gear) 0 ... 10°, 0 ... 30°, 0 ... 60°, 0 ... 90°, 0 ... 180°, 0 ... 270° up to max. 1600 turns (with additional gear)
Measuring output:	0 ... 1 mA, 0 ... 5 mA, 0 ... 10 mA, 0 ... 20 mA, 4 ... 20 mA with 3 or 4-wire connection 4 ... 20 mA with 2-wire connection
Output variable $I_A$ :	Load-independent DC current, proportional to the input angle
Current limitation:	$I_A$ max. 40 mA
Residual ripple in output current:	<0.3% p.p.
Power supply:	DC and AC voltage (DC/AC power pack)

Nominal voltage UN	Tolerance
24 ... 60 V DC / AC	DC -15 ... +33%
85 ... 230 V DC / AC	AC ±15%

#### DC voltage only

12 ... 33 V DC (version non-intrinsically safe, without electric isolation)  
12 ... 30 V DC (version intrinsically safe, without electric isolation)  
Max. current consumption approx. 5 mA +  $I_A$   
Max. residual ripple 10% p.p. (must not fall below 12 V)

Accuracy:	Error limit ≤ 0.5% for ranges 0 ... ≤150° Error limit ≤1.5% for ranges of up 0 ... >150° to 0 ... 270°
Reproducibility:	<0.2%
Response time:	<5 ms
Electrical connection:	Plug connector or cable glands, connection print with screw terminals

#### Mechanical data

Starting torque:	Approx. 25 Ncm
Clearance influence:	±0.1%
Drive shaft diameter:	19 mm or 12 mm
Admissible static loading of shaft:	Max. 1000 N (radial) Max. 500 N (axial)
Mounting position:	Any
Material:	Housing flange standard: steel Housing flange sea-water: high-grade steel 1.4462 Housing cover with plug connector: plastic Housing cover with cable glands: aluminium Shaft: rust-proof hardened steel
Weight:	Approx. 2.9 kg (without additional gear) Approx. 3.9 kg (with additional gear)

### KINAX WT707



Version with plug connector



Sea-water resistant version

# Camille Bauer Transmitters for Angular Position



Version with additional gear



Sea-water resistant version  
with additional gear

## Environmental conditions

Temperature range:  $-25 \dots +70 \text{ }^{\circ}\text{C}$

$-40 \dots +70 \text{ }^{\circ}\text{C}$  (with improved climatic rating)

$-40 \dots +60 \text{ }^{\circ}\text{C}$  at T6 (version intrinsically safe)

$-40 \dots +75 \text{ }^{\circ}\text{C}$  at T5 (version intrinsically safe)

Humidity: Relative humidity max.  $\leq 90\%$ , non-condensing

Relative humidity max.  $\leq 95\%$ , non-condensing (with improved climatic rating)

Housing protection: IP 66 acc. to EN 60529

Vibration: IEC 60068-2-6, 10g continuously, 15g (every 2 h in 3 directions) / 0 ... 200 Hz

5g continuously, 10g (every 2 h in 3 directions) / 200 ... 500 Hz

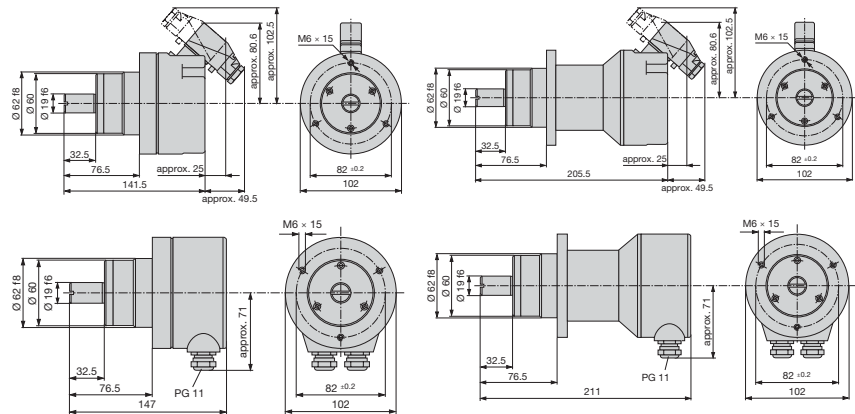
Shock: IEC 60068-2-27, 3 x 50g (10 pulses per axis and direction)

Electromagnetic compatibility:

The standards for noise immunity EN 61000-6-2 and interference emission EN 61000-6-4 are observed

Explosion protection: Intrinsically safe Ex II 2 G / Ex ia IIC T6 acc. to EN 60079-0: 2006 and EN 60079-11: 2007

## Dimensions



## Auxiliary transmission

Using an optimum auxiliary transmission KINAX WT707 can also be employed for multiturn applications. The selection of the correct gear ratio results in up to 1600 revolutions. You may choose auxiliary transmissions with a gear ratio from 2:1 up to 1600:1.

## Special sea water design

Using the special sea water design, KINAX WT707 can be employed under extreme environmental conditions. The special steel housing makes it particularly suited to applications in aggressive media like sea water, lyes, acids and cleaning agents.

## Data on explosion protection (type of protection "Intrinsic safety")

Order Code	Marking		Certificates	Mounting location of the instrument
	Instrument	Meas. output		
707 - 2 ...	Ex ia IIC T6	$U_i = 30 \text{ V}$ $I_i = 160 \text{ mA}$ $P_i = 1 \text{ W}$ $C_i \leq 10 \text{ nF}$ $L_i = 0$	ZELM 10 ATEX 0427X	Within the hazardous area, zone 1

## Accessories

Article No.	Description	see page
997 182	Mounting foot	40
997 190	Mounting flange	41

# Camille Bauer

## Transmitters for Angular Position

### Shaft transmitter for angular position for heavy duty applications, > dia. 100 mm

The KINAX WT707-SSI transmitter is a precision instrument. It serves the acquisition of angular position and rotation, processing and the provision of measured values as electric output signals for the downstream device.



#### Main features

- Robust SSI-transmitter for angular position in singleturn and multiturn suitable for field applications
- Highest degree of mechanical and electrical safety
- Absolute position immediately after activation
- No wear, low annual maintenance and mountable anywhere
- Zero setting input
- Also available as sea-water resistant version

#### Technical data

Measuring range:	0 ... 360°
Power supply:	10 ... 30 V DC
Power consumption:	Typ. 50 mA (at 24 V DC)
Measuring output:	SSI, antivalent RS422
Signal coding:	Binary or gray-code
Max resolution:	Singleturn 12 bit (1 measuring step = 5'16") Multiturn 13 bit (8192 turns)
Accuracy:	Error limit $\pm 1^\circ$
Repeatability:	0.3°
Max. clock rate:	1 MHz
Zero setting signal:	Zero setting: < 0.4 V, min. 2 ms Idle position: 3.3 V or open
Direction of rotation:	Looking at the flange in clockwise rotation increasing position values result
Electrical connection:	Plug connector M12, 8 poles

#### Mechanical data

Starting torque:	Approx. 25 Ncm
Clearance influence:	$\pm 0.1\%$
Drive shaft diameter:	19 mm or 12 mm
Admissible static loading of shaft:	Max. 1000 N (radial) Max. 500 N (axial)
Mounting position:	Any
Material:	Housing flange standard: steel Housing flange sea-water: high-grade steel 1.4462 Housing cover with plug connector: aluminium Shaft: rust-proof hardened steel
Weight:	Approx. 2.9 kg

#### Environmental conditions

Temperature range:	-20 ... +70 °C
Humidity:	Relative humidity max. $\leq 95\%$ , non-condensing
Housing protection:	IP 66 according to EN 60 529
Vibration:	IEC 60 068-2-6, $\leq 300 \text{ m/s}^2 / 10 \dots 2000 \text{ Hz}$
Shock:	IEC 60 068-2-27, $\leq 1000 \text{ m/s}^2 / 6 \text{ ms}$
Electromagnetic compatibility:	The standards for noise immunity EN 61 000-6-2 and interference emission EN 61 000-6-4 are observed

### KINAX WT707-SSI



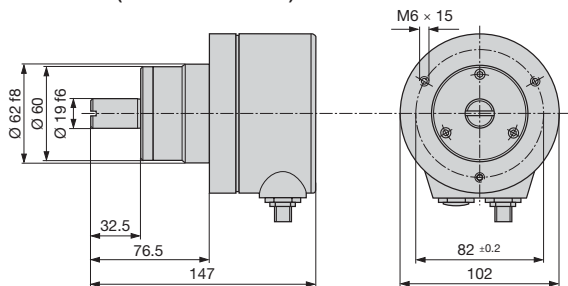
Sea-water resistant version

# Camille Bauer

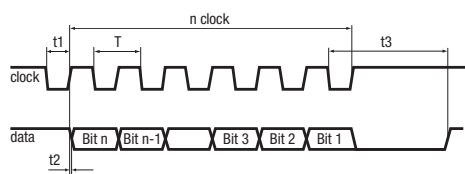
## Transmitters for Angular Position

13

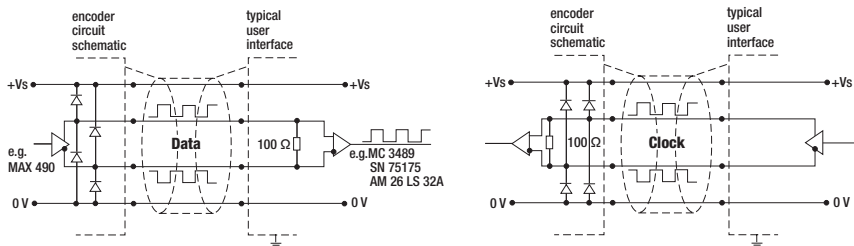
### Dimensions (without connector)



### Readout of positional values



### Output circuits



### Pin configuration of connector

Pin	Cable colour	Signals	Description
1	White	0 V	Power supply
2	Brown	+Vs	Power supply
3	Green	Clock +	Clocking lead
4	Yellow	Clock –	Clocking lead
5	Grey	Data +	Data line
6	Pink	Data –	Data line
7	Blue	Zero	Zero setting input
8	Red	open	Not connected
Shield			Housing

### Special sea water design

Using the special sea water design, KINAX WT707-SSI can be employed under extreme environmental conditions. The special steel housing makes it particularly suited to applications in aggressive media like sea water, lyes, acids and cleaning agents.

### Accessories

Article No.	Description	see page
168 113	Plug connector for M12 sensor plug, 8 poles	41
997 182	Mounting foot	40
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- Capacitive scanning system provides absolute position immediately after activation
- No wear, low annual maintenance and mountable anywhere
- Measuring range, sense of rotation, characteristic, switching point programmed using PC
- Adjustment / Independent fine adjustment of the analog output, zero position and measuring range
- Simulation of measured values / The testing of the subsequent device chain is already possible during the installation phase
- Measured value acquisition / Display of the instantaneous value and a trend graph of the measured value on the screen
- Characteristic of the output value / Programmable as a linear, V-characteristic, or any characteristic curve
- Small bearing play influence < 0.1%
- Available with explosion protection "Intrinsic safety" Ex ia IIC T6
- Can be mounted within the hazardous area
- Also available as sea-water resistant version

#### Technical data

Measuring range:	Programmable between 0 ... 10°, 0 ... 50°, 0 ... 350° (without gear) Programmable between 0 ... 10°, 0 ... 50°, 0 ... 350° up to max. 1600 turn (with gear)
Measuring output:	4 ... 20 mA with 2-wire connection
Output variable $I_A$ :	Load-independent DC current, proportional to the input angle
Current limitation:	$I_A$ max. 40 mA
Power supply:	12 ... 33 V DC (version non-intrinsically safe, without electric isolation) 12 ... 30 V DC (version intrinsically safe, without electric isolation)
Power consumption max.:	Approx. 5 mA + $I_A$
Residual ripple in output current:	< 0.3% p.p.
Accuracy:	Error limit $\leq \pm 0.5\%$
Reproducibility:	< 0.2%
Response time:	< 5 ms
Electrical connection:	Cable glands, connection print with screw terminal

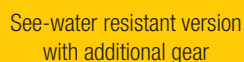
#### Mechanical data

Starting torque:	Approx. 25 Ncm
Clearance influence:	$\pm 0.1\%$
Drive shaft diameter:	19 mm or 12 mm
Admissible static loading of shaft:	Max. 1000 N (radial) Max. 500 N (axial)
Mounting position:	Any
Material:	Housing flange standard: steel Housing flange sea-water: high-grade steel 1.4462 Housing cover with cable glands: aluminium Shaft: rust-proof hardened steel
Weight:	Approx. 2.9 kg (without additional gear) Approx. 3.9 kg (with additional gear)

### KINAX WT717



Sea-water resistant version



<i>Article No.</i>	<i>Description</i>	<i>see page</i>
997 182	Mounting foot	40
997 190	Mounting flange	41

# Camille Bauer

## Transmitters for Angular Position

### Programmable shaft transmitter for angular position for heavy duty applications, > dia. 100 mm

Converts the angular position of a shaft into a load independent direct current signal, proportional to the angular shaft position. The unit is contact free and has minimal mechanical abrasion.



#### Main features

- Robust CANOpen-transmitter for angular position in singleturn and multiturn suitable for field applications
- Highest degree of mechanical and electrical safety
- Absolute position immediately after activation
- No wear, low annual maintenance and mountable anywhere
- Resolution and zero point may be programmable
- Also available as sea-water resistant version
- Magnetic measuring principle

#### Technical data

Measuring range:	0 ... 360°
Power supply:	10 ... 30 V DC
Max. power consumption:	Typ. 100 mA (at 24 V DC)
Measuring output:	CAN-Bus standard ISO/DIS 11 898
Protocol:	CANopen
Profil:	CANopen CIA, DS-301 V4.01 DSP-305 V1.0, DS-406 V3.0
CAN-specification:	CAN 2.0B
Operating mode:	Event-triggered / Time-triggered Remotely-requested Sync (cyclic) / Sync-Code
Signal coding:	Natural binary code
Max. resolution:	Singleturn 12 bit (1 measuring step = 5'16") Multiturn 13 bit (8192 turns)
Accuracy:	Error limit $\pm 1^\circ$
Repeatability:	0.3°
Max. Baudrate:	1 MBit/s
Direction of rotation:	Parameterisable, rising position values as a standard when viewing the flange side and clockwise rotation of the shaft
Electrical connections:	Plug connector M12, 8 poles

#### Mechanical data

Starting torque:	Approx. 25 Ncm
Clearance influence:	$\pm 0.1\%$
Drive shaft diameter:	19 mm or 12 mm
Admissible static loading of shaft:	Max. 1000 N (radial) Max. 500 N (axial)
Mounting position:	Any
Material:	Housing flange standard: steel Housing flange sea-water: high-grade steel 1.4462 Housing cover with cable glands: aluminium Shaft: rust-proof hardened steel
Weight:	Approx. 2,9 kg

#### Environmental conditions

Temperature range:	-20 ... +85 °C
Humidity:	Relative humidity max. $\leq 95\%$ , non-condensing
Housing protection:	IP 66 according to EN 60 529
Vibration:	IEC 60 068-2-6, $\leq 300 \text{ m/s}^2 / 10 \dots 2000 \text{ Hz}$
Shock:	IEC 60 068-2-27, $\leq 1000 \text{ m/s}^2 / 6 \text{ ms}$
Electromagnetic compatibility:	The standards for noise immunity EN 61 000-6-2 and interference emission EN 61 000-6-4 are observed

### KINAX WT707-CANopen

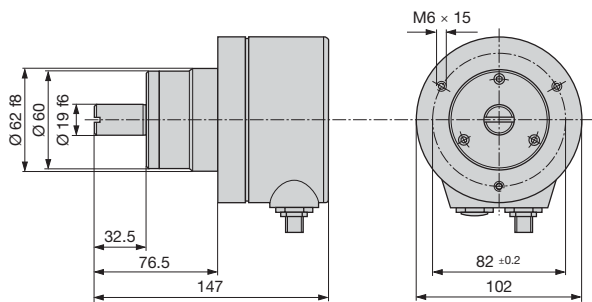


Sea-water resistant version

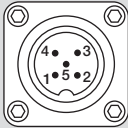
# Camille Bauer

## Transmitters for Angular Position

### Dimensions (without connector)



### Pin configuration of connector

	Pin	Signals
	1	CAN Shld
	2	+ 24 V DC
	3	GND
	4	CAN High
	5	CAN Low

### Special sea water design

Using the special sea water design, KINAX WT707-CANopen can be employed under extreme environmental conditions. The special steel housing makes it particularly suited to applications in aggressive media like sea water, lyes, acids and cleaning agents.

### Accessories

Article No.	Description	see page
168 105	Plug connector for M12 sensor plug, 5 poles	41
997 182	Mounting foot	40
997 190	Mounting flange	41

# Camille Bauer

## Transmitters for Angular Position

### Shaft transmitter for angular position to be installed

Converts the angular position of a shaft into a load independent direct current signal, proportional to the angular shaft position. The unit is contact free and has minimal mechanical abrasion.



#### Main features

- Compact transmitter for angular position to be installed into other equipments
- Capacitive scanning system provides absolute position immediately after activation
- No wear, low annual maintenance and mountable anywhere
- Adjustable zero point and measuring span
- Small bearing play influence < 0.1%
- Small starting torque < 0.001 Ncm
- Available with explosion protection "Intrinsic safety" Ex ia IIC T6
- Can be mounted within the hazardous area

#### Technical data

Measuring range:	0 ... 10°, 0 ... 30°, 0 ... 60°, 0 ... 90°, 0 ... 180°, 0 ... 270°
Measuring output:	0 ... 1 mA, 0 ... 5 mA, 0 ... 10 mA, 0 ... 20 mA, 4 ... 20 mA Each with 3 or 4-wire connection 4 ... 20 mA with 2-wire connection
Power supply:	12 ... 33 V DC (version non-intrinsically safe) 12 ... 30 V DC (version intrinsically safe)
Residual ripple in output current:	< 0.3% p.p.
Residual ripple max.:	10% p.p. (must not fall below 12 V)
Accuracy:	Error limit ≤ ±0.5% for ranges 0 ... ≤ 150° Error limit ≤ 1.5% for ranges of 0 ... > 150° to 0 ... 270°
Reproducibility:	< 0.2%
Response time:	< 5 ms
Electrical connection:	Soldering terminals (protection class IP 00 acc. to EN 60 529) or wiring print with screw terminals or wiring print with AMP connections or wiring print with pads or wiring print with trans-zorb-diode

#### Mechanical data

Starting torque:	< 0.001 Ncm with shaft 2 mm < 0.03 Ncm with shaft 6 mm resp. 1/4"
Clearance influence:	±0.1%
Drive shaft diameter:	2 mm, 6 mm or 1/4"

Admissible static loading of shaft :

Sense	Drive shaft diameter	
	2 mm	6 mm resp. 1/4"
radial max	16 N	83 N
axial max	25 N	130 N

Mounting position:	Any
Material:	Chromated aluminium Shaft: rust-proof hardened steel
Weight:	Approx. 100 g

### KINAX 3W2



Wiring print with screw terminals



Wiring print with AMP connections



Wiring print with pads



Wiring print with trans-zorb-diode

# Camille Bauer

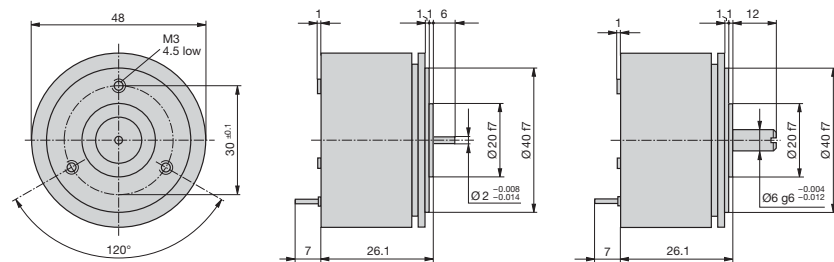
## Transmitters for Angular Position

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### Environmental conditions

Temperature range:	-25 ... +70 °C -40 ... +70 °C (with improved climatic rating) -40 ... +60 °C at T6 (intrinsically safe version) -40 ... +75 °C at T5 (intrinsically safe version)
Humidity:	Relative humidity max. ≤ 90%, non-condensing Relative humidity max. ≤ 95%, non-condensing (with improved climatic rating)
Housing protection:	IP 50 according to EN 60 529
Vibration:	IEC 60 068-2-6, 50 m/s <sup>2</sup> / 10 ... 200 Hz (every 2 h in 3 directions)
Shock:	IEC 60 068-2-27, ≤500 m/s <sup>2</sup> (10 pulses per axis and direction)
Electromagnetic compatibility:	The standards for noise immunity EN 61 000-6-2 and interference emission EN 61 000-6-4 are observed
Explosion protection:	Intrinsically safe Ex II 2 G / Ex ia IIC T6 acc. to EN 60 079-0: 2006 and EN 60 079-11: 2007

### Dimensions



### Data on explosion protection (Type of protection "Intrinsic safety")

Order Code	Marking		Certificate	Mounting location of the device
	Instrument	Meas. output		
708 - 2 ...	Ex ia IIC T6	U <sub>i</sub> = 30 V I <sub>i</sub> = 160 mA P <sub>i</sub> = 1 W C <sub>i</sub> ≤ 10 nF L <sub>i</sub> = 0	ZELM 10 ATEX 0427X	Within the hazardous area

# Camille Bauer

## Transmitters for Angular Position

### Programmable shaft transmitter for angular position to be installed

Converts the angular position of a shaft into a load independent direct current signal, proportional to the angular shaft position. The unit is contact free and has minimal mechanical abrasion.



#### Main features

- Compact transmitter for angular position to be installed into other equipments
- Capacitive scanning system provides absolute position immediately after activation
- No wear, low annual maintenance and mountable anywhere
- Measuring range, sense of rotation, characteristic, switching point programmed using PC
- Adjustment / Independent fine adjustment of the analog output, zero position and measuring range
- Simulation of measured values / The testing of the subsequent device chain is already possible during the installation phase
- Measured value acquisition / Display of the instantaneous value and a trend graph of the measured value on the screen
- Characteristic of the output value / Programmable as a linear, V-characteristic, or any characteristic curve
- Small bearing play influence < 0.1%
- Small starting torque < 0.001 Ncm
- Available with explosion protection "Intrinsic safety" Ex ia IIC T6
- Can be mounted within the hazardous area

#### Technical data

Measuring range:	Programmable between 0 ... 10°, 0 ... 50°, 0 ... 350°
Measuring output:	4 ... 20 mA with 2-wire connection
Power supply:	12 ... 33 V DC (non intrinsically safe version) 12 ... 30 V DC (intrinsically safe version)
Residual ripple in output current:	< 0,3% p.p.
Accuracy:	Error limit ≤ ±0.5%
Reproducibility:	< 0,2%
Response time:	< 5 ms
Electrical connections:	Soldering terminals (protection class IP 00 acc. to EN 60 529) or wiring print with screw terminals

#### Mechanical data

Starting torque:	< 0.001 Ncm with shaft 2 mm < 0.03 Ncm with shaft 6 mm resp. 1/4"
Clearance influence:	±0.1%
Drive shaft diameter:	2 mm, 6 mm or 1/4"
Admissible static loading of shaft:	

Sense	Drive shaft diameter	
	2 mm	6 mm resp. 1/4"
radial max	16 N	83 N
axial max	25 N	130 N

Mounting position:	Any
Material:	Chromated aluminium Shaft: rust-proof hardened steel
Weight:	Approx. 100 g

### KINAX 2W2



Wiring print with screw terminals

# Camille Bauer

## Transmitters for Angular Position

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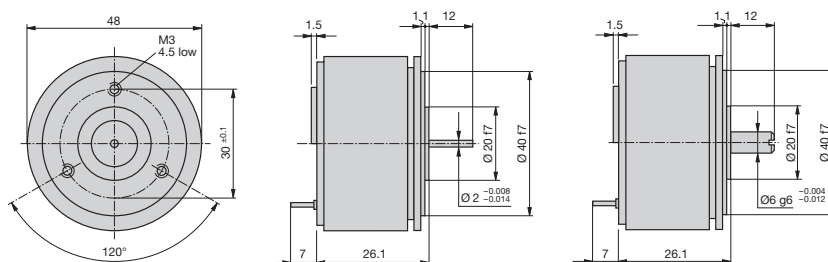
### Environmental conditions

Temperature range:	-25 ... +75 °C -40 ... +75 °C (with improved climatic rating) -40 ... +56 °C at T6 (intrinsically safe version) -40 ... +75 °C at T4 (intrinsically safe version)
Humidity:	Relative humidity max. ≤ 90%, non-condensing Relative humidity max. ≤ 95%, non-condensing (with improved climatic rating)
Housing protection:	IP 50 according to EN 60 529
Vibration:	IEC 60 068-2-6, 50 m/s <sup>2</sup> / 10 ... 200 Hz (every 2 h in 3 directions)
Shock:	IEC 60 068-2-27, ≤500 m/s <sup>2</sup> (10 pulses per axis and direction)
Electromagnetic compatibility:	The standards for noise immunity EN 61 000-6-2 and interference emission EN 61 000-6-4 are observed
Explosion protection:	Intrinsically safe Ex II 2 G / Ex ia IIC T6 acc. to EN 60 079-0: 2006 and EN 60 079-11: 2007

### Programming:

Interface:	Serial interface A PC, the programming cable PK610 plus ancillary cable and the configuration software 2W2 (see section "Software and accessories") are required to program the KINAX 2W2.
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### Dimensions



### Basic configuration

Order Code	Mechanical angle range	Measuring range	Switching point	Sense of rotation	Characteristic of output variable
760 - 1111 100	50°	0 ... 50°	55°	Clockwise	linear
760 - 1211 100	350°	0 ... 350°	355°	Clockwise	linear

### Data on explosion protection (Type of protection "Intrinsic safety")

Order Code	Marking	Certificate	Mounting location of the instrument
Instrument	Meas. output		
760 - 2 ...	Ex ia IIC T6 U <sub>i</sub> = 30 V I <sub>i</sub> = 160 mA P <sub>i</sub> = 1 W C <sub>i</sub> = 6.6 nF L <sub>i</sub> = 0	ZELM 03 ATEX 0123	Within the hazardous area, zone 1

# Camille Bauer

## Transmitters for Angular Position

### Shaft transmitter for angular position for surface mounting

Converts the angular position of a shaft into a load independent direct current signal, proportional to the angular shaft position. The unit is contact free and has minimal mechanical abrasion.



#### Main features

- Transmitter for angular position for surface mounting for building onto other equipments in singleturn and multiturn
- Capacitive scanning system provides absolute position immediately after activation
- No wear, low annual maintenance and mountable anywhere
- Adjustment of the zero position and measuring range
- Small bearing play influence < 0.1%
- Small starting torque < 0.001 Ncm
- Available with explosion protection "Intrinsic safety" Ex ia IIC T6
- Can be mounted within the hazardous area

#### Technical data

Measuring range:	0 ... 5°, 0 ... 10°, 0 ... 30°, 0 ... 60°, 0 ... 90°, 0 ... 180°, 0 ... 270° (without gear) 0 ... 10°, 0 ... 30°, 0 ... 60°, 0 ... 90°, 0 ... 180°, 0 ... 270° up to max. 48 turns (with additional gear)						
Measuring output:	0 ... 1 mA, 0 ... 5 mA, 0 ... 10 mA, 0 ... 20 mA, 4 ... 20 mA each with 3 or 4-wire connection 4 ... 20 mA with 2-wire connection						
Nominal voltage:	<table border="1"> <thead> <tr> <th>Nominal voltage <math>U_N</math></th><th>Tolerance</th></tr> </thead> <tbody> <tr> <td>24 ... 60 V DC / AC</td><td>DC -15 ... +33%</td></tr> <tr> <td>85 ... 230 V DC / AC</td><td>AC ±15%</td></tr> </tbody> </table>	Nominal voltage $U_N$	Tolerance	24 ... 60 V DC / AC	DC -15 ... +33%	85 ... 230 V DC / AC	AC ±15%
Nominal voltage $U_N$	Tolerance						
24 ... 60 V DC / AC	DC -15 ... +33%						
85 ... 230 V DC / AC	AC ±15%						
Power supply:	12 ... 33 V DC (non intrinsically safe version) 12 ... 30 V DC (intrinsically safe version)						
Residual ripple in output current:	< 0.3% p.p.						
Max. residual ripple:	10% p.p. (must not fall below 12 V)						
Accuracy:	Error limit ≤ ±0.5% for ranges 0 ... ≤ 150° Error limit ≤ 1.5% for ranges of 0 ... > 150° to 0 ... 270°						
Reproducibility:	< 0.2%						
Response time:	< 5 ms						
Electrical connections:	Screw type terminals and cable glands						

#### Mechanical data

Starting torque:	< 0.001 Ncm with shaft 2 mm (without additional gear) < 0.03 Ncm with shaft 6 mm resp. 1/4" Welle (without additional gear) 0.6 ... 3.2 Ncm depending on transmission ratio (with additional gear)
Clearance influence:	±0.1%
Drive shaft diameter:	2 mm, 6 mm or 1/4"
Admissible static loading of shaft:	

Sense	Drive shaft diameter	
	2 mm	6 mm resp. 1/4"
radial max	16 N	83 N
axial max	25 N	130 N

Mounting position:	Any
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### KINAX WT710



# Camille Bauer

## Transmitters for Angular Position

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**Material:** Housing: aluminium, corrosion resistant finish  
Plastic protection cap  
Shaft: rust-proof hardened steel

**Weight:** Approx. 550 g (without additional gear)  
Approx. 900 g (with additional gear)

### Environmental conditions

**Temperature range:** -25 ... +70 °C  
-40 ... +70 °C (with improved climatic rating)  
-40 ... +60 °C at T6 (intrinsically safe version)  
-40 ... +75 °C at T5 (intrinsically safe version)

**Humidity:** Relative humidity max. ≤ 90%, non-condensing  
Relative humidity max. ≤ 95%, non-condensing (with improved climatic rating)

**Housing protection:** IP 43 according to EN 60 529 (without additional gear)  
IP 64 according to EN 60 529 (with additional gear)

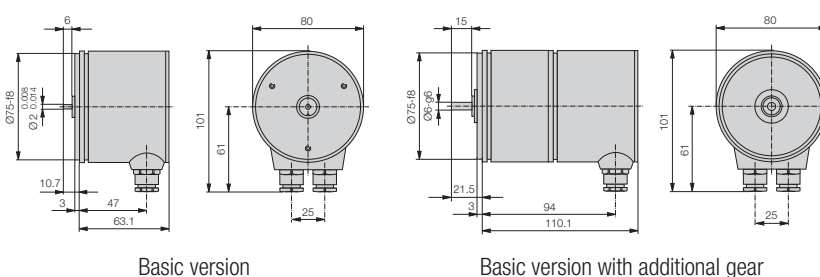
**Vibration:** IEC 60 068-2-6, 50 m/s<sup>2</sup> / 10 ... 200 Hz (every 2 h in 3 directions)

**Shock:** IEC 60 068-2-27, ≤500 m/s<sup>2</sup> (10 pulses per axis and direction)

**Electromagnetic compatibility:** The standards for noise immunity EN 61 000-6-2 and interference emission EN 61 000-6-4 are observed

**Explosion protection:** Intrinsically safe Ex II 2 G / Ex ia IIC T6 acc. to EN 60 079-0: 2006 and EN 60 079-11: 2007

### Dimensions



### Additional gear for multiturn

Order Code	Transmission	Shaft
G	1 : 4	Shaft dia. 6 mm, length 15 mm
H	4 : 1	
J	32 : 1	
K	64 : 1	
N	1 : 1	

### Data on explosion protection (Type of protection "Intrinsic safety")

Order Code	Marking		Certificate	Mounting location of the instrument
	Instrument	Meas. output		
710 - 2 ...	Ex ia IIC T6	U <sub>i</sub> = 30 V I <sub>i</sub> = 160 mA P <sub>i</sub> = 1 W C <sub>i</sub> ≤ 10 nF L <sub>i</sub> = 0	ZELM 99 ATEX 0006	Within the hazardous area, zone 1

# Camille Bauer

## Transmitters for Angular Position

### Programmable shaft transmitter for angular position for surface mounting

Converts the angular position of a shaft into a load independent direct current signal, proportional to the angular shaft position. The unit is contact free and has minimal mechanical abrasion.



#### Main features

- Transmitter for angular position for surface mounting for building onto other equipments in singleturn and multiturn
- Capacitive scanning system provides absolute position immediately after activation
- No wear, low annual maintenance and mountable anywhere
- Measuring range, sense of rotation, characteristic, switching point programmed using PC
- Adjustment / Independent fine adjustment of the analog output, zero position and measuring range
- Simulation of measured values / The testing of the subsequent device chain is already possible during the installation phase
- Measured value acquisition / Display of the instantaneous value and a trend graph of the measured value on the screen
- Characteristic of the output value / Programmable as a linear, V-characteristic, or any characteristic curve
- Small bearing play influence < 0.1%
- Small starting torque < 0.001 Ncm
- Available with explosion protection "Intrinsic safety" Ex ia IIC T6
- Can be mounted within the hazardous area

#### Technical data

Measuring range:	Programmable between 0 ... 10°, 0 ... 50°, 0 ... 350°
Measuring output:	4 ... 20 mA with 2-wire connection
Power supply:	12 ... 33 V DC (non intrinsically safe version) 12 ... 30 V DC (intrinsically safe version)
Residual ripple in output current:	< 0.3% p.p.
Accuracy:	Error limit $\leq \pm 0.5\%$
Reproducibility:	< 0.2%
Response time:	< 5 ms
Electrical connections:	Screw type terminals and cable glands

#### Mechanical data

Starting torque:	< 0.001 Ncm with shaft dia. 2 mm (without additional gear) < 0.03 Ncm with shaft dia. 6 mm resp. 1/4" (without additional gear) 0.6 ... 3.2 Ncm depending on transmission (with additional gear)
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Clearance influence:	$\pm 0.1\%$
Drive shaft diameter:	2 mm, 6 mm or 1/4"

Admissible static loading of shaft:

Sense	Drive shaft diameter	
	2 mm	6 mm resp. 1/4"
radial max	16 N	83 N
axial max	25 N	130 N

Mounting position:	Any
Material:	Housing: aluminium, corrosion resistant finish Plastic protection cap Shaft: rust-proof hardened steel
Weight:	Approx. 550 g (without additional gear) Approx. 900 g (without additional gear)

### KINAX WT711



# Camille Bauer

## Transmitters for Angular Position

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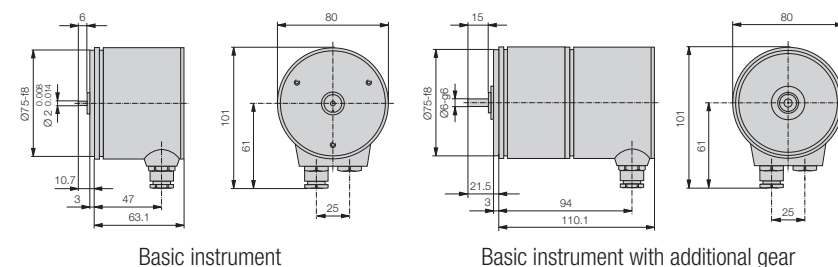
### Environmental conditions

Temperature range:	-25 ... +70 °C -40 ... +70 °C (with improved climatic rating) -40 ... +60 °C at T6 (intrinsically safe version) -40 ... +75 °C at T5 (intrinsically safe version)
Humidity:	Relative humidity max. ≤ 90%, non-condensing Relative humidity max. ≤ 95%, non-condensing (with improved climatic rating)
Housing protection:	IP 43 according to EN 60 529 (without additional gear) IP 64 according to EN 60 529 (with additional gear)
Vibration:	IEC 60 068-2-6, 50 m/s <sup>2</sup> / 10 ... 200 Hz (every 2 h in 3 directions)
Shock:	IEC 60 068-2-27, ≤500 m/s <sup>2</sup> (10 pulses per axis and directions)
Electromagnetic compatibility:	The standards for noise immunity EN 61 000-6-2 and interference emission EN 61 000-6-4 are observed
Explosion protection:	Intrinsically safe Ex II 2 G / EEx ia IIC T6 acc. to EN 60 079-0: 2006 and EN 60 079-11: 2007

### Programming:

Interface:	Serial interface A PC, the programming cable PK610 plus ancillary cable and the configuration software 2W2 (see section "Software and accessories") are required to program the KINAX WT 711.
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### Dimensions



### Additional gear for multiturn

Order Code	Transmission	Shaft
G	1 : 4	Shaft dia. 6 mm, Length 15 mm
H	4 : 1	
J	32 : 1	
K	64 : 1	
N	1 : 1	

### Basic configuration

Order Code	Mechanical angle range	Measuring range	Switching point	Sense of rotation	Characteristic of output variable
760 - 1111 100	50°	0 ... 50°	55°	Clockwise	linear
760 - 1211 100	350°	0 ... 350°	355°	Clockwise	linear

### Data on explosion protection (Type of protection "Intrinsic safety")

Order Code	Marking	Certificate	Mounting location of the instrument
	Instrument	Meas. output	
760 - 2 ...	EEx ia IIC T6	U <sub>i</sub> = 30 V I <sub>i</sub> = 160 mA P <sub>i</sub> = 1 W C <sub>i</sub> ≤ 10 nF L <sub>i</sub> = 0	ZELM 99 ATEX 0006 Within the hazardous area, zone 1



**Content Position feedback transmitters**

Transmitter for position feedback  
KINAX SR709 ..... 28

Programmable transmitter for position feedback  
KINAX SR719 ..... 30

# Camille Bauer

## Position Feedback Transmitters

### Transmitter for position feedback

The transmitter is used for to measure and transmit linear displacement (stroke) on various types of control valves and other control devices. The output is a load independent DC signal.



#### Main features

- Robust transmitter for position feedback
- Capacitive scanning system provides absolute position immediately after activation
- No wear, low annual maintenance and mountable anywhere
- Setting of the measuring range is achieved via adjusting the lever system pivot point
- Available in type of protection "Intrinsic safety" Ex ia IIC T6
- Can be mounted within the hazardous area

#### Technical data

Measuring range: 0 ... 10 mm, 0 ... 140 mm  
 Measuring output: 0 ... 1 mA, 0 ... 5 mA, 0 ... 10 mA, 0 ... 20 mA, 4 ... 20 mA  
 each with 3 or 4-wire connection  
 4 ... 20 mA with 2-wire connection

Nominal voltage:

Nominal voltage $U_N$	Tolerance
24 ... 60 V DC / AC	DC - 15 ... +33%
85 ... 230 V DC / AC	AC $\pm 15\%$

Output variable  $I_A$ : Load-independent DC current, proportional to the input angle  
 Current limitation:  $I_A$  max. 40 mA  
 Power supply: 12 ... 33 V DC (non intrinsically safe version)  
 12 ... 30 V DC (intrinsically safe version)

Max. current consumption: Approx. 5 mA +  $I_A$

Residual ripple in output current: < 0.3% p.p.

Max. residual ripple: 10% p.p.

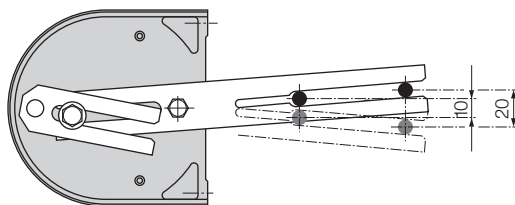
Accuracy: Linearity error  $\leq 0.5\%$

Electrical connections: Screw type terminals or cable glands

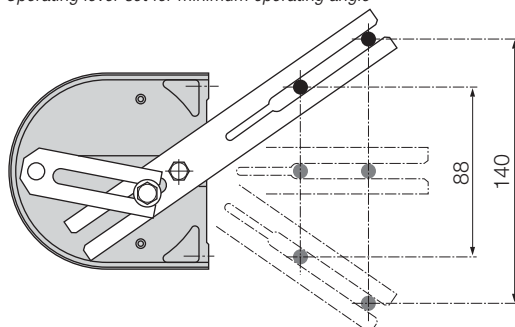
#### Mechanical data

Mounting position: Any

Operating angle:



Operating lever set for minimum operating angle



Operating lever set for maximum operating angle

### KINAX SR709



# Camille Bauer

## Position Feedback Transmitters

Material:                   Housing: aluminium  
Weight:                    Approx. 1100 g

**Environmental conditions**

Temperature range:    −25 ... +70 °C  
                                  −40 ... +70 °C (with improved climatic rating)  
                                  −40 ... +60 °C at T6 (intrinsically safe version)  
                                  −40 ... +75 °C at T5 (intrinsically safe version)

Humidity:               Relative humidity max. ≤ 90%, non-condensing  
                                  Relative humidity max. ≤ 95%, non-condensing (with improved climatic rating)

Housing protection:   IP 54 according to EN 60 529

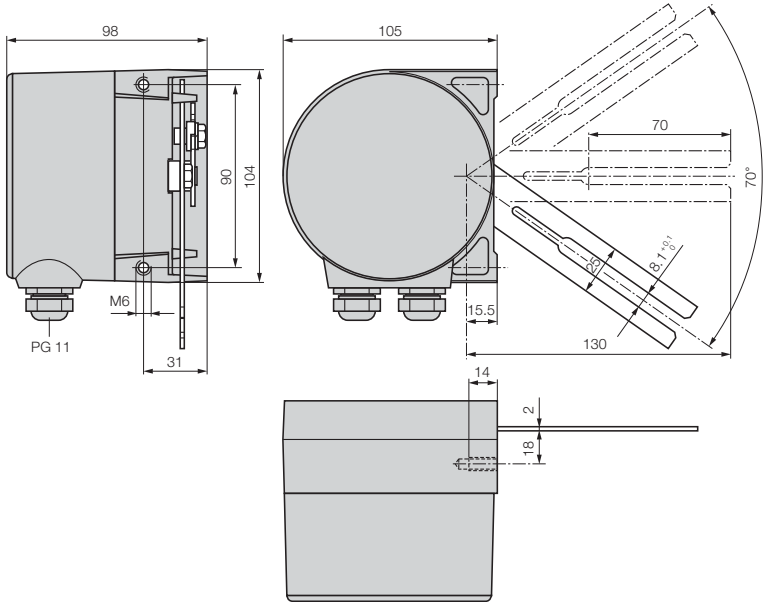
Vibration:              IEC 60 068-2-6, 10g continuously, 15g (each 2h in 3 directions) /  
                                  20 ... 200 Hz  
                                  IEC 60 068-2-6, 5g continuously, 10g (each 2 h in 3 directions) /  
                                  200 ... 500 Hz

Shock:                   IEC 60 068-2-27, 3 x 50g (10 pulses per axis and direction)

Electromagnetic compatibility:   The standards for noise immunity EN 61 000-6-2 and interference emission EN 61 000-6-4 are observed

Explosion protection:   Intrinsically safe Ex II 2 G / Ex ia IIC T6 acc. to EN 60 079-0: 2006 and EN 60 079-11: 2007

**Dimensions**



**Data on explosion protection** (Type of protection “intrinsic safety”)

Order Code	Marking		Certificate	Mounting location of the instrument
	Instrument	Meas. output		
709 - 2 ...	Ex ia IIC T6	$U_i = 30\text{ V}$ $I_i = 160\text{ mA}$ $P_i = 1\text{ W}$ $C_i \leq 10\text{ nF}$ $L_i = 0$	ZELM 10 ATEX 0427X	Within the hazardous area

**Accessories**

Article No.	Description
866 288	NAMUR mounting part

# Camille Bauer

## Position Feedback Transmitters

### Programmable transmitter for position feedback

The transmitter is used for to measure and transmit linear displacement (stroke) on various types of control valves and other control devices. The output is a load independent DC signal.

#### Main features

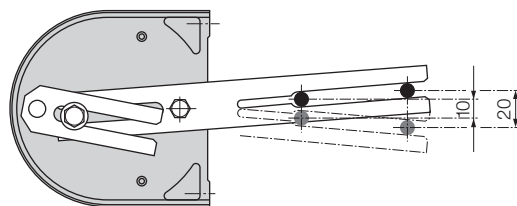
- Robust transmitter for position feedback
- Capacitive scanning system provides absolute position immediately after activation
- No wear, low annual maintenance and mountable anywhere
- Setting of the measuring range is achieved via adjusting the lever system pivot point
- Adjustment / Independent fine adjustment of the analog output, zero position and measuring range
- Simulation of measured values / The testing of the subsequent device chain is already possible during the installation phase
- Measured value acquisition / Display of the instantaneous value and a trend graph of the measured value on the screen
- Characteristic of the output value / Programmable as a linear, V-characteristic, or any characteristic curve

#### Technical data

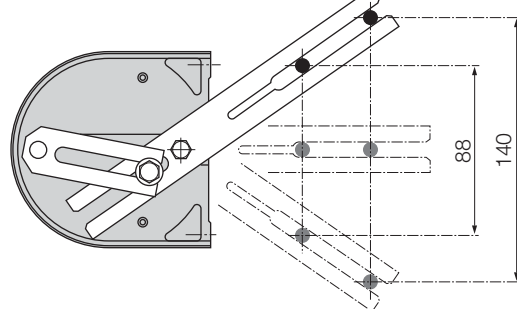
Measuring range:	0 ... 10 mm, 0 ... 140 mm
Measuring output:	4 ... 20 mA with 2-wire connection
Output variable $I_A$ :	Load-independent DC current, proportional to the input angle
Current limitation:	$I_A$ max. 40 mA
Power supply:	12 ... 33 V DC (non intrinsically safe version)
Max. current consumption:	Approx. 5 mA + $I_A$
Residual ripple in output current:	< 0.3% p.p.
Accuracy:	Linearity error $\leq 0.5\%$
Electrical connections:	Screw type terminals or cable glands

#### Mechanical data

Mounting position:	Any
Operating angle:	



Operating lever set for minimum operating range



Operating lever set for maximum operating angle

Material:	Housing: aluminium
Weight:	Approx. 1100 g

### KINAX SR719



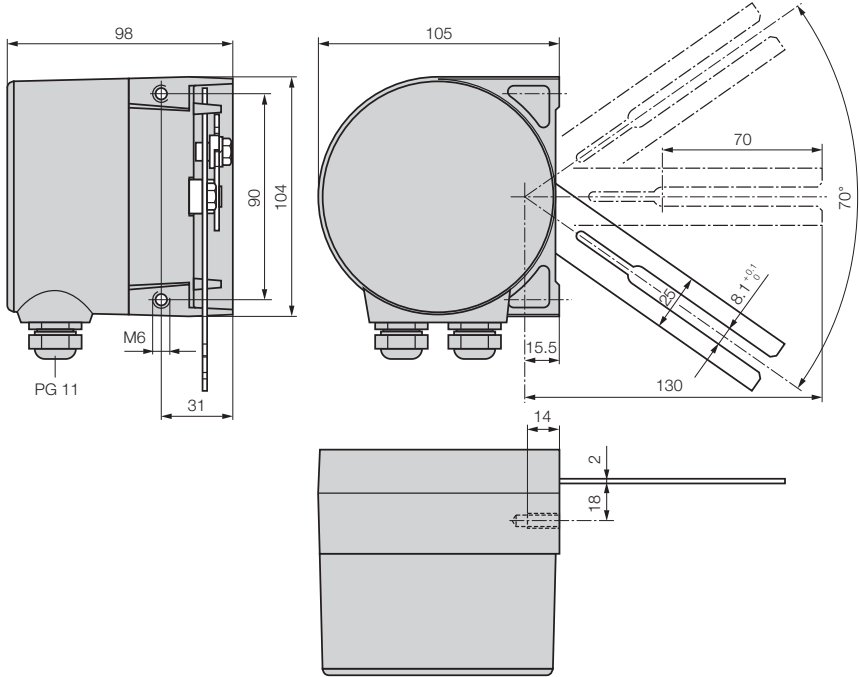
### Environmental conditions

Temperature range:	-25 ... +70 °C -40 ... +70 °C (with improved climatic rating) -40 ... +60 °C at T6 (intrinsically safe version) -40 ... +75 °C at T5 (intrinsically safe version)
Humidity:	Relative humidity max. ≤ 90%, non-condensing Relative humidity max. ≤ 95%, non-condensing (with improved climatic rating)
Housing protection:	IP 54 according to EN 60 529
Vibration:	IEC 60 068-2-6, 10g continuous, 15g (each 2 h in 3 directions) / 20 ... 200 Hz IEC 60 068-2-6, 5g continuous, 10g (each 2 h in 3 directions) / 200 ... 500 Hz
Shock:	IEC 60 068-2-27, 3 x 50g (10 pulses per axis and direction)
Electromagnetic compatibility:	The standards for noise immunity EN 61 000-6-2 and interference emission EN 61 000-6-4 are observed

### Programming:

Interface:	Serial interface A PC, the programming cable PK610 plus ancillary cable and the configuration software 2W2 (see section "Software and accessories") are required to program the KINAX SR 719.
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### Dimensions



### Accessories

Article No.	Description
866 288	NAMUR mounting part



**Content Inclination transmitters**

**Inclination transmitter unidimensional**

KINAX N702 .....	34
KINAX N702-CANopen .....	35
KINAX N702-SSI .....	36

# Camille Bauer

## Inclination Transmitters

### Inclination transmitter unidimensional

The transmitter converts the tilt angle into a direct current signal, proportional to the angle. Tilt angle values of a platform stand for important measuring data as a part of the safety and control system of that type of machinery.

#### Main features

- Robust magnetoresistive angular position transmitter, contact free, freely rotatable without stops
- With oil-damped pendulum system
- The sensor is contact free and has minimal abrasion on the pendulum
- Measuring range, sense of rotation and zero position programmed directly at the transmitter

#### Technical data

Measuring principle:	Magnetoresistive angular position transmitter, contact free, freely rotatable
Measuring range:	0 ... 360°, freely programmable
Measuring output:	4 ... 20 mA with 3-wire connection
Power supply:	18 ... 33 V DC
	No protection against wrong polarity
Current consumption:	< 80 mA
Load resistant:	Max. 600 Ω
Accuracy:	±0.2°
Resolution:	14 Bit
Transient response:	By 25° tilts < 1 sec.
Electrical connection:	Connector M12 x 1, 5 poles

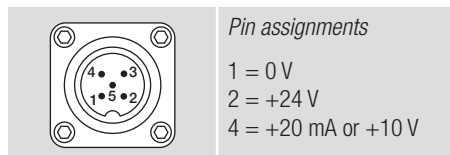
#### Mechanical data

Pendulum damping:	With silicon oil
Mounting position:	Any
Material:	Housing: coated aluminium
Weight:	Approx. 300 g

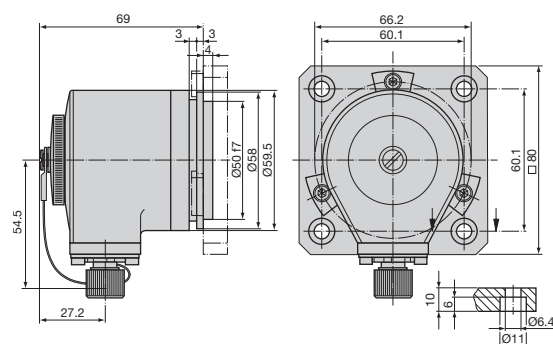
#### Environmental conditions

Temperature range:	−30 ... +70 °C
Humidity:	Relative humidity max. ≤ 90%, non-condensing
Housing protection:	IP 66 according to EN 60 529
Vibration:	IEC 60 068-2-6, 40 m/s <sup>2</sup> / 0 ... 100 Hz

#### Pin configuration of connector M12



#### Dimensions



### KINAX N702



## KINAX N702-CANopen



## Inclination transmitter unidimensional

The transmitter converts the tilt angle into a direct current signal, proportional to the angle. Tilt angle values of a platform stand for important measuring data as a part of the safety and control system of that type of machinery.

**CANopen**

### Main features

- Robust magnetoresistive CANopen angular position transmitter, contact free, freely rotatable without stops
- With oil-damped pendulum system
- The sensor is contact free and has minimal abrasion on the pendulum
- Pendulum shaft has no mechanical stops and can be 360° infinitely rotated
- Reduced wiring expenditure
- Autoconfiguration of the network
- Comfortable access of all instrument parameters
- Instrument synchronisation, simultaneous data read-in and read-out

### Technical data

Measuring principle:	Magnetoresistive angular position transmitter, contact free, freely rotatable
Measuring range:	0 ... 360°
Tilt angle:	-180° ... +179.9°
Measuring output:	CAN-Bus interface
Protocole:	CANopen
Power supply:	18 ... 33 V DC, no protection against wrong polarity
Power consumption:	< 80 mA
Baudrate:	1 MBit/s
Accuracy:	±0,2°
Resolution:	14 Bit
Transient response:	By 25° tilts < 1 sec.
Electrical connection:	Connector M12 x 1, 5 poles

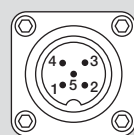
### Mechanical data

Pendulum damping:	With silicon oil
Mounting position:	Any
Material:	Housing: coated aluminium
Weight:	Approx. 300 g

### Environmental conditions

Temperature range:	-30 ... +70 °C
Humidity:	Relative humidity max. ≤ 90%, non-condensing
Housing protection:	IP 66 according to EN 60 529
Vibration:	IEC 60 068-2-6, 40 m/s² / 0 ... 100 Hz

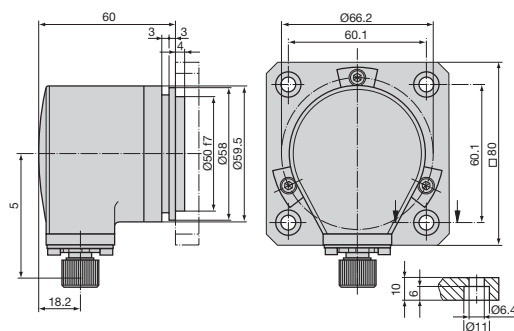
### Pin configuration of connector M12



#### Pin assignments

1 = CAN Shld	4 = CAN High
2 = +24 V DC	5 = CAN Low
3 = GND	

### Dimensions



# Camille Bauer

## Inclination Transmitters

### Inclination transmitter unidimensional

The transmitter converts the tilt angle into a direct current signal, proportional to the angle. Tilt angle values of a platform stand for important measuring data as a part of the safety and control system of that type of machinery.



#### Mains feature

- Robust magnetoresistive angular position transmitter with interface SSI, contact free, freely rotatable without stops
- With oil-damped pendulum system
- The sensor is contact free and has minimal abrasion on the pendulum
- Measuring range, sense of rotation, zero position and measuring span programmed directly at the transmitter

#### Technical data

Measuring principle:	Magnetoresistive angular position transmitter, contact free, freely rotatable
Measuring range:	0 ... 360°, freely programmable
Measuring output:	SSI binary code
Power supply:	9 ... 33 V DC, no protection against wrong polarity
Power consumption:	< 100 mA
Accuracy:	±0.2°
Resolution:	14 Bit
Transient response:	By 25° tilts < 1 sec.
Electrical connection:	Connector M12 x 1, 8 poles
Max. clock rate:	1 MHz

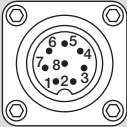
#### Mechanical data

Pendulum damping:	With silicon oil
Mounting position:	Any
Material:	Housing: coated aluminium
Weight:	Approx. 300 g

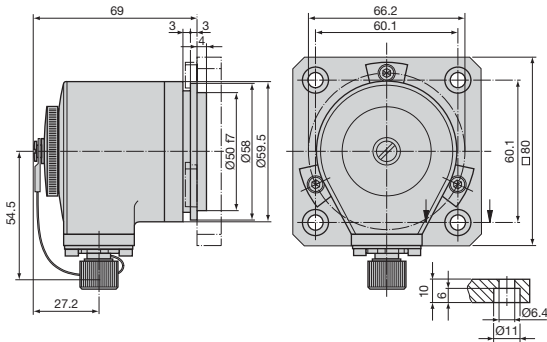
#### Environmental conditions

Temperature range:	–30 ... +70 °C
Humidity:	Relative humidity max. ≤ 90%, non-condensing
Housing protection:	IP 66 according to EN 60 529
Vibration:	IEC 60 068-2-6, 40 m/s <sup>2</sup> / 0 ... 100 Hz

#### Pin configuration of connector M12

	Pin	Cable colour	Signals	Description
	1	White	0 V	Operating voltage
	2	Brown	+Vs	Operating voltage
	3	Green	Clock +	Clocking line
	4	Yellow	Clock –	Clocking line
	5	Grey	Data +	Data line
	6	Pink	Data –	Data line
	7	Blue	open	Not used
	8	Red	open	Not used
Screening				Housing

#### Dimensions



KINAX N702-SSI



## **Content Software and accessories**

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# Camille Bauer Software and Accessories

## Configuration software

to parameterise programmable CB devices

All software products of Camille Bauer can be used ONLINE (connected to the device) and OFFLINE (without a connected device). In this way, parameterising and the documentation for all devices to be used can be performed and stored prior to commissioning. The CD contains the following PC software for angular position transmitters.

### 2W2

- Programming of angle position range
- Programming of a characteristic of the output values linear, V-characteristic (with or without offset) or any characteristic curve
- Determination of the direction of rotation
- Independent fine adjustment of the analog output, zero position and measuring span
- Simulation of measured values for testing of the subsequent device chain during the installation phase
- Measured value acquisition and display for a longer period of time on the screen of a PC
- Password protection

The CD contains further PC software for heavy current and process control engineering.

### Content of the CD

Software	for instruments	Language	Operating system
2W2	KINAX 2W2, WT711, WT717 and SR719	D, E, F, N	9x, NT4.x, 2000, ME, XP
V600plus	SINEAX VK616, VK626, V608, V624, V611, SIRAX V606	D, E, F, N, I, S	9x, NT4.x, 2000, ME, XP
VC600	SINEAX/EURAX V604, VC603, SIRAX V644	D, E, F, N	9x, NT4.x, 2000, ME, XP
TV800plus	SINEAX TV809	D, E, F, N	9x, NT4.x, 2000, ME, XP
DME 4	SINEAX/EURAX DME4xx	D, E, F, N, I	9x, NT4.x, 2000, ME, XP
M560	SINEAX M561, M562, M563	D, N, F, N, S	9x, NT4.x, 2000, ME, XP
A200plus	SINEAX A210, A220, A230, A230s with EMMOD201 or EMMOD203	D, E, F, N	9x, NT4.x, 2000, ME, XP
A200plus Handheld	A210-HH, A230-HH	D, E, F, N	9x, NT4.x, 2000, ME, XP

Article No.	Description
146 557	Configuration software (on CD)

## Programming and ancillary cable

serve programming of the instruments in connection with the respective configuration software and using a PC

### Customer benefits

- Programming operation with or without power supply connection
- Programming of transmitters in standard and Ex version
- Safe galvanic isolation of instrument and PC

Article No.	Description	2W2	WT717	WT711	SR719
137 887	Programming cable PK610 (Ex)	•	•	•	•
141 440	Ancillary cable	•	•	•	•

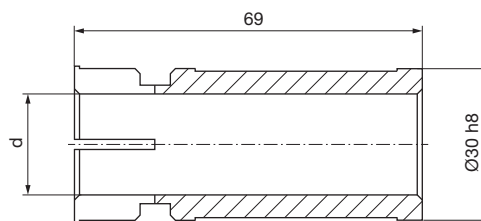




## Adapter sleeve

serve to reduce the shaft diameter for the KINAX HW730

Article No.	Description	diameter <i>d</i>
168 874	Adapter sleeve HW730	10 mm/H8
168 882	Adapter sleeve HW730	12 mm/H8
168 907	Adapter sleeve HW730	16 mm/H8
168 915	Adapter sleeve HW730	20 mm/H8



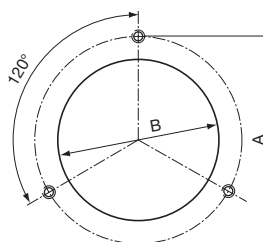
## Kit of torque support HW730

are used for mounting and resistance against rotation of the KINAX HW730

Article No.	Description
169 749	Torque support set HW730 (Bracket, pin, screws)

## Kit mounting clamp

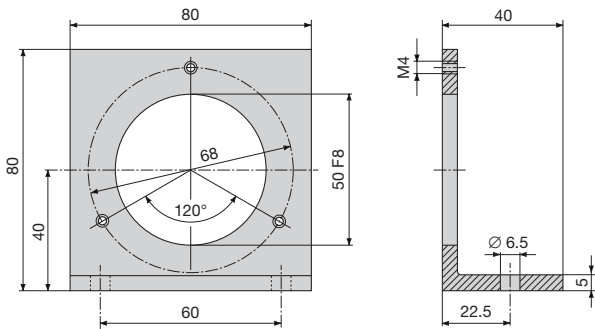
At least three mounting clamps are required to mount angular position transmitters and inclination sensors. The M4 screws are not included in the scope of delivery.



Article No.	Description	A	B
157 364	Kit mounting clamp for KINAX WT720	68	50 F8
168 353	Kit mount. clamp for KINAX N702, N702-CANopen and N702-SSI	66.2	50 F8
168 387	Kit mounting clamp for KINAX 2W2 and 3W2	65	40 F8

Mounting angle

Simple mounting option of angular position transmitters using synchroflange. Additional three clamping bracket are required to mount the transmitter on the angle (see mounting clamp kit).

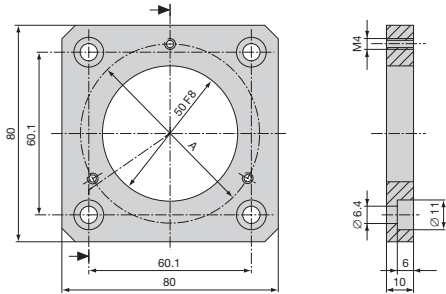


Article No.	Description
168 204	Mounting angle for WT720

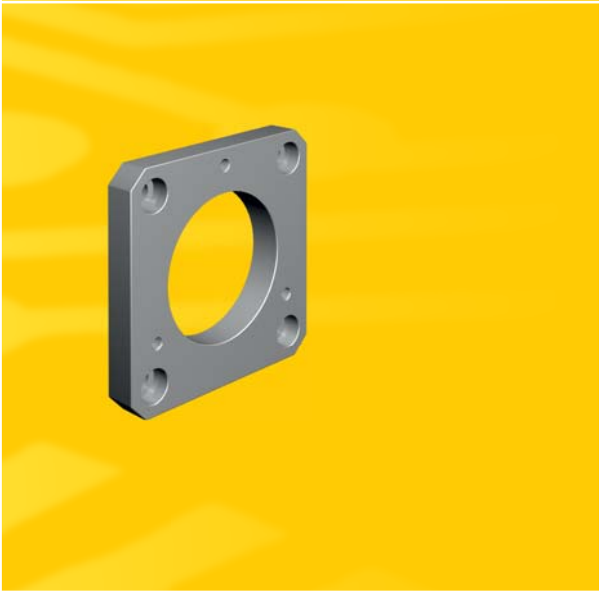


Mounting plate

To fasten angular position transmitters for robust applications, dia. 58 mm and inclination sensors. Additional three clamping bracket are required to mount the transmitter on the angle (see mounting clamp kit).

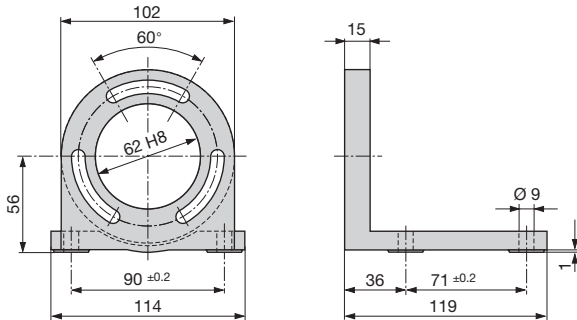


Article No.	Description	A
168 212	Mounting plate for WT720	68
168 379	Mount. plate for KINAX N702, N702-CANopen and N702-SSI	66.2



Mounting foot

To fasten angular position transmitters for robust applications, dia. > 100 mm



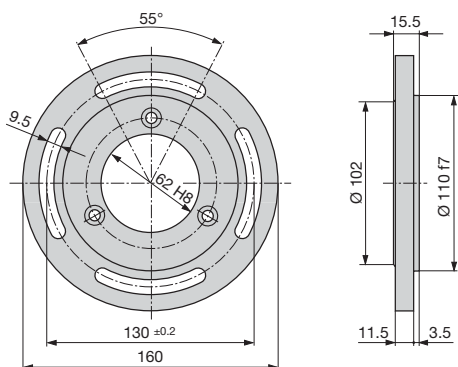
Article No.	Description
997 182	Mounting foot for KINAX WT707, WT707-SSI, WT707-CANopen and WT717





## Mounting flange

To fasten angular position transmitters for robust applications, dia. > 100 mm



Article No.	Description
997 190	Mounting flange for KINAX WT707, WT707-SSI, WT707-CANopen and WT717



## Plug connector

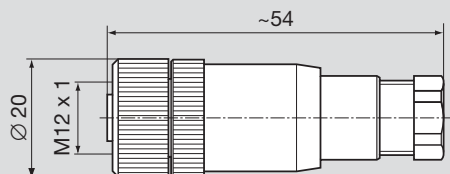
- Straight, field-wired plug
- For simple on-site assembly without soldering

### Technical data

Plug connector serie 713 (M12 x 1)

Article No.	168 105	168 113
Number of poles	5	8
Locking	M12 x 1	
Cable diameter max.	4 ... 6 mm	
Connection mode	Screws	
Connection cross section	max. 0.75 mm <sup>2</sup>	
Mechanical useful life	> 500 plugging cycles	
Protection	IP 67	
Temperature range	-40° ... +85°	
Rated voltage	125 V	60 V
Rated surge voltage	1500 V	800 V
Rated current (40 °C)	4 A	2 A
Contact pins	CuZn (Brass)	
Contact sleeve	CuSn (Bronze)	
Plug body	PA 66 (UL 94 HB)	
Sleeve body	PA 66 (UL 94 HB)	
Housing cable plug	PBT (UL 94 V-0)	

Dimensions



### Bellow coupling

- Backlash-free transmission with angular synchronism
- Optimum compensation of misalignments
- Very high torsion spring stiffness, small retractive force
- Vibration-damping
- Special steel bellow and threaded hubs

#### Technical data

	Unit	BKXX1624	BKXX2429	BKXX3030	BKXX4048
Max. speed	min <sup>-1</sup>	10 000	10 000	10 000	5 000
Torque max.	Ncm	40	80	200	10
Max. shaft misalignm. radial	mm	±0.25	±0.25	±0.3	±0.3
Max. shaft misalignm. axial	mm	±0.45	±0.4	±0.4	±0.5
Max. shaft misalignm. angular	Degree	±4	±4	±4	±1,5
Torsion spring stiffness	Nm/rad	85	150	250	350
Radial spring stiffness	N/mm	20	25	80	150
Moment of inertia	gcm <sup>2</sup>	2,2	15	37	316
Max. torque screws	Ncm	50	100	100	500
Temperature range	°C	-30...+120	-30...+120	-30...+120	-30...+120
Weight	g	6.5	17	31	92
Material flange		Aluminium, corrosion resistant finish			
Material bellow		High-grade steel			

#### Ordering data

Description		Article No.	d1	d2
BKXX1624		164 715	2	2
		164 723	2	4
		164 731	2	6

#### Ordering data

BKXX2429		164 757	6	6
		164 765	6	8
		164 773	6	10
		164 781	6	12

#### Ordering data

BKXX3030		164 799	10	8
		164 806	10	10
		164 814	10	12
		164 822	10	14
		164 830	10	16

#### Ordering data

BKXX4048		169 690	19	16
		169 707	19	18
		169 715	19	19
		169 723	19	20
		169 731	19	22

**BKXX1624**



**BKXX2429**



**BKXX3030**



**BKXX4048**



### WKAK1625



### WKAK2532



### SKAK4048



## Helical and cross-slotted coupling

- Backlash-free transmission with angular synchronism
- Optimum compensation of misalignments
- Very high torsion spring stiffness, small retractive force
- Vibration-damping
- No moving parts
- Manufactured from one piece with clamping hub for shaft connection without damage

### Technical data

	Unit	WKAK1625	WKAK2532	SKAK4048
Max. speed	min <sup>-1</sup>	6000	6000	5000
Torque max.	Ncm	60	100	1500
Max. shaft misalignment radial	mm	±0.2	±0.35	±0.3
Max. shaft misalignment axial	mm	±0.3	±0.5	±0.3
Max. shaft misalignment angular	Grad	±3.5	±4	±1
Torsion spring stiffness	Nm/rad	5.5	16	335
Radial spring stiffness	N/mm	30	45	230
Moment of inertia	gcm <sup>2</sup>	3,8	29	245
Max. torque screws	Ncm	50	100	500
Temperature range	°C	-30...+150	-30...+150	-30...+120
Weight approx.	g	10	34	100
Material flange	Aluminium, corrosion resistant finish			

### Ordering data

Description		Article No.	d1	d2
WKAK1625		164 848	2	2
		164 856	2	4
		164 864	2	6

### Ordering data

Description		Article No.	d1	d2
WKAK2532		164 872	6	6
		164 880	6	8
		164 898	6	10
		164 905	6	12
		164 913	10	8
		164 921	10	10
		164 939	10	12

### Ordering data

Description		Article No.	d1	d2
SKAK4048		164 947	19	16
		164 955	19	18
		164 963	19	19
		164 971	19	20
		164 989	19	22

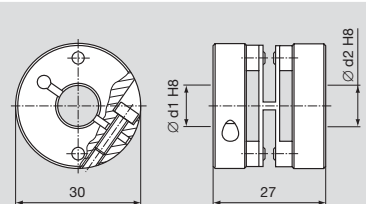
Spring washer coupling

- Backlash-free transmission with angular synchronism
- Optimum compensation of misalignments
- Very high torsion spring stiffness, middle retractive force
- Vibration-damping
- Electrically isolating, pluggable (only FSKK 3027)

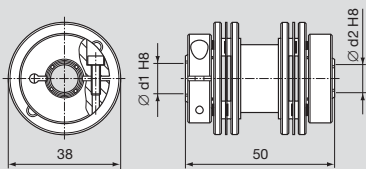
Technical data

	Einheit	FSKK3027	FSXK3850
Max. speed	min <sup>-1</sup>	12000	8000
Torque max.	Ncm	60	200
Max. shaft misalignment radial	mm	±0.3	±0.8
Max. shaft misalignment axial	mm	±0.4	±0.8
Max. shaft misalignment angular	Grad	±2.5	±2.5
Torsion spring stiffness	Nm/rad	30	250
Radial spring stiffness	N/mm	40	12
Moment of inertia	gcm <sup>2</sup>	37	106
Max. torque screws	Ncm	80	100
Temperature range	°C	-10...+80	-30...+120
Weight	g	32	63
Material flange		Aluminium, corrosion resistant finish	
Material diaphragm		Polyamide 6.6	High-grade steel

Ordering data

Description		Article No.	d1	d2
FSKK3027		164 997	6	6
		165 002	6	10
		165 010	10	10
		165 028	10	12
		165 036	12	12

Ordering data

Description		Article No.	d1	d2
FSXK3850		165 044	6	6
		165 052	10	10
		165 060	10	12
		165 078	12	12
		165 086	12	14

FSKK3027



FSXK3850



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Mounting instructions ..... 54

## Electromagnetic compatibility

### What is it all about?

Electromagnetic compatibility (EMC) signifies that electrical and electronical products work safely at their place of use. To safeguard this, the interfering emission of electromagnetic signals of devices, systems or plants must be limited. On the other hand, it must also be safeguarded that devices, systems or plants are not impaired by the interfering signals present in their environment. These relatively simple facts are stipulated in the EMC Directive 89/336/EC and can only be achieved if all those involved play the game. All manufacturers are obliged to test their products accordingly or have them tested.

The CE-mark is the basic precondition that a product may be put into circulation in Europe. In this way, manufacturers confirm that their products conform to applicable directives for their type of product. The EMC directive is an integral part of this requirement profile. Outside of Europe, other identification obligations are partly applicable. These are now harmonised to such an extent that also in relation to EMC comparable requirements can be assumed.

### The problem

The increase of electrical and electronical products in the industrial environment but also in products of daily use is still immense. More and more functionality with even higher performance is implemented in these products. Processor systems with increasingly higher clock frequencies are being used. They generate higher and higher levels of interference unintentionally and also become more and

more sensitive to interfering sources in their environment.

To make matter worse, the applications using radio frequencies are also increasing. For example, mobile telephones must be in a position of sending and receiving signals. Though their transmission output is limited, incompatibilities might result if they are used inconsiderately in the vicinity of sensitive devices. Systems may be interfered with to such an extent that they provide wrong signals or break down completely. This is the reason, why their use is often limited, e.g. in aircrafts or also in hospitals where sensitive medical devices might be affected. The awareness of EMC problems in aircrafts has been established over years but must still be pointed out to passengers prior to every take-off. When entering a hospital hardly anybody turns of his or her mobile telephone despite warning messages on the walls. Operational managers of power plants are often not aware of the fact that the use of mobile telephones in the vicinity of measuring, controlling and regulating units can be critical. Radio and television stations, mobile radio antennae or remote controls also work with frequencies which might interfere with sensitive devices and impair their operation.

### Sources of interference

In the industrial environment, frequency converters, motors and other consumers are increasingly operated parallel to sensitive measuring and control systems. Higher levels of interference must generally be expected in all

places where high power is applied, switched or pulsed or electronic systems with high pulse frequencies are used.

The use of wireless telecommunication facilities or networks also increases the probability of incompatible levels of interference in the environment of sensitive equipment.

### Standards

Applicable specific basic standards define the requirements of products and systems for use in their original environment. A limited number of tests with evaluation criteria and the expected operating behaviour are determined using defined measuring and test procedures. Specific basic standards contain details of the measuring method and general conditions. Specific EMC standards are available for certain products or product groups and have priority over the general requirements mentioned above.

EMC safety can only be achieved by a complete examination in accordance with standards. Since all standards are interrelated only their sum total provides a satisfactory result. Partial examination is not permitted, however still done by some manufacturers due to lacking measuring equipment or for reasons of costs.

Meeting standards does not necessarily provide smooth operation. A device may be subjected to higher loads in operation than envisaged by the standard. This might be caused by insufficient protection of the equipment or by EMC-incompatible wiring. In such a case, the behaviour of the device is largely undefined since it has not been tested.

### Tests at Camille Bauer

Camille Bauer has its own EMC laboratory where the complete scope of all required tests (see below) can be performed. Even if our laboratory is not accredited, comparative measurements at the premises of respective service providers as well as subsequent checks by customers confirmed our test results in each case.

We also test our devices under higher loads than demanded by the standard even if this is not explicitly stated in our data sheets.

### Specific basic standards

IEC / EN 61 000-6-2

Immunity standard for industrial environments

IEC / EN 61 000-6-4

Emission standard for industrial environments



Measurement of the behaviour of the devices in voltage dips, brief interruptions or voltage fluctuations of the power supply

## Basic standards

### *IEC / EN 61 000-4-2*

Immunity to static discharge which occurs as potential differences - mainly caused by friction electricity - are reduced. The most known effect is surely when persons get charged as they walk across a carpet and discharged with the generation of a spark when they touch a metal part. If this is, e.g., the plug of an electronic device the brief current impulse might be sufficient to destroy the device.

### *IEC / EN 61 000-4-3*

Immunity to high-frequency electromagnetic fields. Typical sources of interference are radiotelephones used by the operating, maintenance or service staff, mobile telephones and transmitting facilities needing these fields. Coupling happens via the air. Unintentional fields also occur in welding facilities, thyristor-controlled inverters or

fluorescent lamps. Coupling might as well be generated via the line in such cases.

### *IEC / EN 61 000-4-4*

Immunity to fast transient interference variables (bursts) which are generated in switching operations (interruption of inductive loads or bouncing of relay contacts)..

### *IEC / EN 61 000-4-5*

Immunity to impulse voltages (surges) which are generated in switching operations or lightning and arrive at the device via the connecting lines.

### *IEC / EN 61 000-4-6*

Immunity to conducted disturbances, induced by high-frequency fields which are typically generated by radio transmission facilities. Coupling takes place via the connecting line of the device. For further sources of interference see 61000-4-3.

### *IEC / EN 61 000-4-8*

Immunity to magnetic fields with power frequencies. Strong magnetic fields result, e.g., in the immediate vicinity of power lines or bus bars.

### *IEC / EN 61 000-4-11*

Immunity to voltage dips, brief interruptions and voltage fluctuations. Dips and brief interruptions of the supply voltage result from errors in the supply system or when large loads are switched. Voltage fluctuations are caused by fast-changing loads, e.g. in arc furnaces, and also generate flickering.



*Determination of device behaviour under the influence of a magnetic external field generated by a Helmholtz coil*

### Environmental testing

#### What is it all about?

Products are exposed to many environmental impacts during their useful life. These are not limited to impacts during operation in the intended application in the field but also comprise detrimental influences during storage or transport to customers. The impacts include temperature, climate, water and dust conditions but also mechanical stress like vibration or shock.

The tests have the objective of checking the resistance against possible environmental impacts and to ensure reliability in later operation. Assumptions are made, e.g. concerning the reference range for environmental temperature or the annual average relative humidity. Users must compare these details with their own requirements (see data sheet). It is only after this check that they can be certain that the device suits their applications and will show the desired behaviour.

#### Standards

The requirement of testing the behaviour of devices in changing environmental conditions is derived from product group standards for Camille Bauer products, e.g. EN / IEC 60 688 „Electrical measuring transducers for converting a.c. electrical quantities to analogue or digital signals“. The normal place and type of use and the prevailing environmental conditions to which these instruments are exposed are known. Tests and test criteria which the device has to meet are derived from this information. For firmly installed instruments these tests concern the operational behaviours in changing temperatures (cold, dry and humid heat) as well as the influence of vibration and shocks.

#### Operation

The ambient temperature in which a device is operated can change quickly, e.g. if a part of the plant in which the device has been installed heats up due to operational demands or because of the difference of day and night temperatures in rooms which are not heated. Usually, devices heat themselves up. This can occur due to dissipated heat of passive components or self-heating of processors. Depending on the season and the environment, the heat may be dry or humid, i.e. precipitating or not precipitating. Thermic testing might take hours or days. The device is operated under normal conditions, i.e. with input signals and loaded outputs. The ambient temperature is changed step by step in regular intervals, kept constant and then

changed again, either positively or negatively. In this way, the entire operating temperature range of the device is applied upwards and downwards. Any change in the behaviour of the device and the extent of the same is verified after each step. On the one hand, the test shows whether the instrument meets the accuracy requirements within the reference range and, on the other hand, the temperature influence outside of the reference range is checked.

If the devices are installed in the vicinity of rotating machines, assembled in ships or transported to customers by lorries and aeroplanes, they are exposed to permanent vibration. This might lead to larger components being cut off or mechanical locking devices of the housings being opened. Vibration testing in which the tested object is exposed to repeated harmonic vibration helps to find weak points and to eliminate them. Shock testing, on the other hand, subjects the device to a specified form of shock through acceleration and breaking at irregular intervals. In this way, the behaviour of the device can be tested if it is dropped from a certain level.

#### Special measurements

Not all instruments are used in applications covered by standard tests. Earthquake vibration tests, for example, require low-frequency vibration of a high amplitude. Our test facilities cannot process the required test schedule exactly. Therefore, the measurements have to be done externally. Normally, customers assume the costs for this service. Upon request, we will be pleased to make test instruments available if you intend to perform the tests yourself.

Standard tests can also be performed with changed general conditions. Whether and to what extent customers participate in the costs incurred will be decided in each case.

#### Tests at Camille Bauer

Camille Bauer has test facilities to perform all required product tests in-house.

#### Overview of tests

EN / IEC 60 068-2-1 – cold  
EN / IEC 60 068-2-2 – dry heat  
EN / IEC 60 068-2-78 – humid heat  
EN / IEC 60 068-2-6 – vibration  
EN / IEC 60 068-2-27 – shock

## Explosion protection through intrinsic safety

Camille Bauer I&C instruments for the acquisition of signals in potentially explosive atmospheres are designed to comply with the explosion protection category "intrinsically safe". Intrinsically safe electrical circuits are incapable of igniting potentially explosive atmospheres either by means of sparking or thermal effect under the fault conditions specified below. To this end, the electrical energy of the circuit is restricted by voltage and current limiters. The term intrinsic safety is generally abbreviated to the letter „i“.

### Categories ia and ib

Electrical circuits do not cause ignition during normal operation:

ia	If a single fault or a combination of any two faults occurs
ib	If a single fault occurs

### Zones and Gases

The zones in which potentially explosive atmospheres occur are classified as follows:

Zone 0	Gas is present continuously or for long periods
Zone 1	Gas is likely to occur
Zone 2	Gas is seldom present and only for short periods of time

The large number of various gases are categorised into explosion groups IIA, IIB and IIC. The danger of explosion is greatest for Category IIC.

### Intrinsically safe equipment

- All circuits are intrinsically safe
- Installation within the explosion hazard area

Marking and Electrical Data, e.g.: Ex ia IIC T6

Ex	Complies with EN 50...
ia	Type of protection
IIC	Explosion group
T6	Temperature class

$U_i$	Max. permissible input voltage
$I_i$	Max. permissible input current
$P_i$	Max. permissible input power
$C_i$	Internal capacitance
$L_i$	Internal inductance

The temperature class indicates the max. surface temperature of the apparatus:

T1	450 °C	T4	135 °C
T2	300 °C	T5	100 °C
T3	200 °C	T6	85 °C

The lowest ignition temperature of the potentially explosive atmosphere must be greater than the max. surface temperature.

### Associated Electrical Apparatus

- Electrical circuits are intrinsically safe and non intrinsically safe
- Installation outside of the potentially explosive atmosphere

Marking and Electrical Data, e.g.: [Ex ia] IIC

[ ]	Associated electrical apparatus
Ex	Complies with EN 50...
ia	Type of protection
IIC	Explosion group

$U_o$	Max. output voltage
$I_o$	Max. output current
$P_o$	Max. output power
$C_o$	Max. permissible external capacitance
$L_o$	Max. permissible external inductance

The manufacturer, the device type, the  $\text{Ex}$  mark and the test number from the testing authority are affixed to both apparatus types.

### Guideline RL 94/9/EG / ATEX

This guideline has been in effect since 1.7.2003. The most important part is the conformity evaluation procedure.

This requires that a manufacturer classifies his Ex device into one of three categories, which is then assigned to a zone. Depending on the category, various QA measures must be implemented for the manufacture of explosion protected devices. E.G., Category 1 requires QS production. The ref. number of the notified body (NB) is located next to the CE mark. The group, category and letter G (gas) or D (dust) explosion protection must appear next to the Ex mark on the label.

Marking with Type Examination Certificate: PTB 97 ATEX 2074 X

97	Year of approval
ATEX	EC guideline
2074	Test laboratory no
X	Special condition(s)

Marking:  $\text{Ex}$  II (1) G  $\text{CE}$  0102

$\text{Ex}$	Identification of Ex protection
II	Group
(1)	Category, with ( ) = associated, without ( ) = intrinsically safe equipment
G	G = Gas explosion protection D = Dust-Ex
0102	NB number (production monitoring body) 0102 = PTB

The CAMILLE BAUER AG product range is designed for Zone 1. Explosion Group IIC. It is thus permissible to use them in zone 2 and also as Group IIB or IIA devices. All Category ia devices with electrical insulation and Category 1 devices conforming to Guideline 94/9/EC fulfil the requirements for Zone 0. Note, however, that Category 1 is only one of the conditions required for Zone 0.

### Installation according to EN 60079-14

Additional specifications for intrinsic safety are given in Section 12 of EN 60079-14 which is in force as VDE 0165 in Germany. Most importantly, this standard sets forth installation rules for Zones 1 and 2, supplementary precautions for Zone 0 and the wiring requirements for and verification of intrinsic safety. The following applies where active and passive devices are interconnected:

$$U_i \geq U_o \text{ and } I_i \geq I_o \text{ and } P_i \geq P_o$$

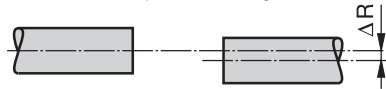
Providing the circuit does not include energy storing components, the cable length is determined on the basis of its C and L values. The maximum permissible cable length is given by  $C_o - C_i$  and  $L_o - L_i$  and the specific C and L of the cable.

## Selection criteria for shaft couplings

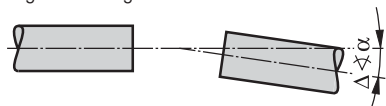
Manufacturing and assembling tolerances as well as bearing backlash, temperature influences and wearout of shaft bearings cause misalignments between shafts in drive systems and lead to considerable stress on bearings. Consequently, increased wear and significantly shorter runtimes of machines or plants occur. Shaft couplings can compensate these misalignments and reduce the stress on bearings to a minimum.

Three different misalignments occur:

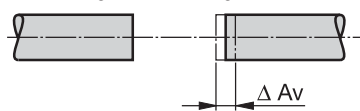
Radial, lateral or parallel misalignment



Angular misalignment



Axial or longitudinal misalignment



While in backlash-free, torsionally rigid but resiliently flexible shaft couplings axial shaft shifting generates static forces only in the coupling, radial and angular shifting results in alternating stress, retractive forces and torques which can strain the adjacent components, primarily the shaft bearings. Depending on the type of coupling, special attention has to be paid to radial shaft shifting, which must be kept as small as possible. Further useful properties of shaft couplings are the mechanical, thermic and - in some designs - also electric decoupling of the shaft encoder of the drive or machine. To avoid natural resonance and thus the tendency of vibration of the control loop in which the shaft coupling is located, the torsion spring stiffness should be sufficient. Depending on the design principle of the coupling, an increasing torsion spring stiffness unfortunately also causes increased retractive forces. These intensify, as stated above, the bearing load. In principle, this is applicable to the selection of a shaft coupling:

The torsion spring stiffness must be as high as required and the retractive forces as low as possible.

### Assembly instructions:

1. Check shafts for misalignment.
2. Align couplings on the shafts.
3. Fasten tightening screws/clamping bolts carefully. Avoid excessive fastening.
4. Protect the coupling against damage and excessive bending during assembly.

### Selection:

In the selection of the correct coupling, the torsion spring stiffness ( $C_t$ ) of the coupling is decisive. To calculate the torsional angle, the coupling torque must be known. The same results from:

$$M_k = M_{\max} \cdot K \cdot J_K$$

The transfer error by elastic deformation of the flexible part results from:

$$f_i = (180 / ) \cdot (M_k / C_t)$$

The unit of the torsion spring stiffness ( $C_t$ ) of shaft couplings is stated physically correct as [Nm/rad]. In small couplings, this unit is frequently also stated in fractions (e.g. [Ncm/rad]). Some providers also refer to "degree" (full circle amounts to 360°) in the denominator. To get an impression how elastic a shaft coupling is in the direction rotation or how much this coupling twists as a rotatory force bears on it, many mechanics find the "degree" unit more helpful.

The conversion of "rad" ( $360^\circ = 2 \cdot \pi \cdot \text{rad}$ ) into the more common "degree" unit is thus unavoidable.

If, for example, 200 Nm/rad are to be converted into a "degree value" in the denominator, proceed as follows:

$$200 \text{ Nm/rad} = \frac{200 \text{ Nm}}{\text{rad}} \cdot \frac{[1 \text{ rad} = 360^\circ]}{2}$$

Insertion leads to the torsion spring stiffness related to angle degrees:

$$200 \text{ Nm/rad} = \frac{200 \text{ Nm} \cdot 2}{360^\circ} = 3,49 \text{ Nm/Grad}$$

It should be stated that this value [Nm/rad] is extrapolated to the standardised unit, for if a torsionally stiff, resiliently flexible coupling were twisted by an angle of 1 rad (1 rad =  $360/2\pi = 57.296^\circ$ ), it would be destroyed.

### Legend:

$f_i$ =	Torsional angle in degrees
$C_t$ =	Torsion spring stiffness in Nm/rad
$M_k$ =	Coupling torque in Nm
$M_{\max}$ =	Acceleration torque of the drive
$K$ =	Load factor (2...3)
$J_K$ =	Moment of inertia in kgm <sup>2</sup>

### Questions concerning the selection of couplings

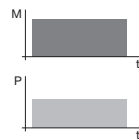
- Which shaft diameters must be connected and which installation space is available for the couplings?
- Is the frictional connection between the encoder shaft and the coupling hub to be achieved via a screw or clamp connection?
- Which is the maximum speed the coupling must be able to transfer?
- Which torque acts on the coupling?
  - Starting torque = break-away torque
  - Inertia of the encoder
  - Acceleration value of the drive
- Which maximum lateral, angular and axial misalignment must be offset?
- To which climatic conditions is the coupling exposed?
  - Temperature, moisture, aggressive media, pressure, vacuum
- Is electric insulation required?
- Is the torsional stiffness sufficient for the application?
  - Resolution of the encoder
  - Exact positioning
- Is the coupling in harmony with the control time constant of the control loop?
- Is the coupling available as a serial product also for later replacements at short notice?

## Important drive system variables

Every electrical machine must be designed for a certain mode of operation which is determined by the designated use of the machine. For example, a motor which continually starts and stops must be designed larger than a motor running with a constant load. In turn, a motor in temporary operation can be designed smaller. The mode of operation must be defined in order not to overload the motor. EN60 034-1 differentiates between the following modes of operation.

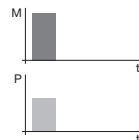
### Continuous operation S1

Operation with a constant load sufficient in duration for the drive to reach the thermal balance. This corresponds to the nominal operation.



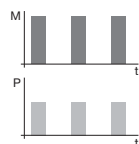
### Temporary operation S2

Operation with a constant load not sufficient in duration for the drive to reach the thermal balance.



### Temporary operation S3

Operation composed of a succession of the same cycles of which each one comprises a time with constant load and an idle time with zero-current windings.



Gear or reduction ratio [-]

$$i = \frac{x_1}{x_2}$$

Circumference [mm]

$$U = d \cdot \pi$$

Torque [Nm]

$$M = F \cdot r$$

$$M = \frac{9.55 \cdot P}{n}$$

Gear torque [Nm]

$$M_{\text{gear}} = M_{\text{motor}} \cdot i \cdot \eta$$

Work (energie) [Nm = Ws = Joule]

$$W = F \cdot s = m \cdot g \cdot s$$

$$W = \frac{J \cdot n^2}{182.5}$$

### Operating ratio $f_B$

The operating ratio of a machine results from the impact factor, the average operating time/day and the average number of switching operations/hour. The impact factor results from the mass acceleration factor of the machine.

$$FJ = \frac{J_{\text{red}}}{J_{\text{mot}}}$$

$$M_{\text{Nutz}} = f_B \cdot M_{\text{max}}$$

Impact factor	FJ	Oper. time hour/day	Switching per hour			
			< 10	10 ... 100	100 ... 200	> 200
			Operating ratio $f_B$			
I - uniform	0 ... 0.2	< 8	0.8	1.0	1.2	1.3
		8 ... 16	1.0	1.2	1.3	1.4
		16 ... 24	1.2	1.3	1.4	1.5
II - moderate impacts	0.2 ... 3	< 8	1.1	1.3	1.4	1.5
		8 ... 16	1.3	1.4	1.5	1.7
		16 ... 24	1.5	1.6	1.7	1.8
III - strong impacts	3 ... 10	< 8	1.4	1.6	1.7	1.8
		8 ... 16	1.6	1.7	1.8	2.0
		16 ... 24	1.8	1.9	2.0	2.1

Type of load	Imp. factor	Examples of load types of gears and gear motors
I	Uniform	Light conveyor screws, fans, assembly belts, light conveyor belts, small agitators, cleaning machines, filling machines
II	Moderate impacts	Hoists, medium-sized agitators and mixers, heavy conveyor belts, sliding gates, wood processing machines, gear pumps
III	Strong impacts	Heavy mixers, shearing machines, presses, centrifuges, punches, stone crushers, vibrators, breakers, rolling mills, bucket conveyors

Output [W]

Stroke motion

$$P = \frac{m \cdot g \cdot v}{\eta}$$

Translation

$$P = F_R \cdot v = \frac{F_R \cdot s}{t}$$

$$F_R = \mu \cdot m \cdot g$$

Rotation

$$P = M \cdot \omega = \frac{M \cdot 2\pi n}{60} = \frac{M \cdot n}{9.55}$$

Acceleration or deceleration time [s]

Stroke motion

$$t_a = \frac{J \cdot n}{9.55 \cdot M_a}$$

Acceleration or deceleration time [1/min]

$$n_{\text{gear}} = \frac{n_{\text{motor}}}{i}$$

### Legend

F	Force [N]
r	Moment arm (radius) [m]
P	Output [W]
n	Speed [1/min]
s	Distance [m]
m	Mass [kg]
n	Speed [1/min]
g	Gravity acceleration (9.81) [m/s <sup>2</sup> ]
J	Moment of inertia [kgm <sup>2</sup> ]
F <sub>R</sub>	Force [N]
f <sub>B</sub>	Operating ratio
v	Velocity [m/s]
η	Efficiency in decimal fraction
μ	Friction coefficient
M	Torque [Nm]
ω	Angular velocity
M <sub>a</sub>	Acceleration/deceleration torque [Nm]
M <sub>gear</sub>	Gearbox output axis [Nm]
M <sub>max</sub>	Permitted maximum torque
M <sub>NUTZ</sub>	Effective torque
i	Gearbox reduction
U	Circumference [mm]
d	Shaft diameter [mm]
F <sub>J</sub>	Mass acceleration factor
J <sub>red</sub>	All external mass moments of inertia reduced to the motor
J <sub>mot</sub>	Mass moment of inertia of the motors

### Technical definitions

#### Protection classes

In many applications, electric and electronic devices must work safely under difficult environmental conditions for many years. The penetration of moisture and foreign matter, e.g. dust, is to be avoided to safeguard reliable operation.

Systems are classified in so-called IP codes which relate to their suitability for different environmental conditions. According to DIN standard, the abbreviation IP stands for International Protection while in English Ingress Protection is used. DIN EN 60 529 contains these classes under the heading of Classes of Protection by Housings (IP code). The description is always composed of the letters IP to which a two-digit number is added showing the scope of protection a housing provides in relation to contact or foreign matter (first digit) and moisture (second digit).

If one of the two digits is not required, it is replaced by the letter X (e.g. "IPX1").

#### Protection class for contact and foreign matter (1st digit)

Digit	Protection against contact	Protection against foreign matter
0	No protection	No protection
1	Protection against large-area body parts Ø50mm	Large foreign bodies (from Ø50mm)
2	Finger protection (Ø12mm)	Medium-sized foreign bodies (from Ø12.5mm, length up to 80mm)
3	Tools and wires (from Ø2.5mm)	Small foreign bodies (from Ø2.5mm)
4	Tools and wires (from Ø1mm)	Grain-shaped foreign bodies (from Ø1mm)
5	Wire protection (like IP 4) dust-protected	Dust deposits
6	Wire protection (like IP 4) dust-tight	No dust penetration

#### Protection class water protection (2nd digit)

Digit	Protection against water
0	No protection
1	Protection against vertically falling water drops
2	Protection against diagonally falling (up to 15°) water drops
3	Protection against falling spray water up to 60° against the plumb line
4	Protection against splash water from all sides
5	Protection against jets of water from any angle
6	Protection against strong jets of water (flooding)
7	Protection against temporary immersion
8	Protection against permanent immersion
9k	Protection against water in high-pressure /steam cleaning

#### Baud rate

The baud rate states the transmission frequency of a serial interface in bits per second.

#### Resolution

The resolution represents the capability of a facility to separate physical variables of the same dimension from each other. The resolution thus indicates the smallest distinguishable difference. In physical instruments, the resolution is often confused with accuracy. The resolution states in which degree of detail the measured value can be read out while it does not have to agree with the respective accuracy. The resolution is thus generally higher than the accuracy. In single-turn angular position transmitters, the resolution states the number of measuring steps per revolution. In multiturn angular position transmitters, it states the number of measuring steps per revolution and the number of revolutions.

$$\text{Resolution} = \frac{\text{Circumference}}{\text{Accuracy}} = \frac{U}{G}$$

#### Accuracy

The absolute accuracy states the degree of agreement between the indicated and true value.

Bits	Angle/bit	Resolution
9	0.703125	512
10	0.3515625	1024
11	0.1757813	2048
12	0.0878906	4096
13	0.0439453	8192
14	0.0219727	16384

#### Error limit

The error limit refers to the maximum deviation of all measured values from the set point of a reference standard during a 360° revolution.

#### Repeatability

According to DIN 32 878, the repeatability indicates the maximum dispersion of measured values of at least five successive deviation diagrams taken in the same direction of rotation.

#### Code types

##### Binary code

The binary code is structured in accordance with the decimal system. Messages can be represented by sequences of two different symbols (e.g. 1/0 or correct/incorrect).

##### Gray code

The Gray code is a single-step code in which adjacent code words differ only in one dual digit. This ensures that only one bit changes from item to item.

If one uses a certain part of the complete Gray code, a symmetrically capped Gray code results. In this way, an even-numbered division is obtained.

If the shaft of the encoder turns clockwise, the code values ascend. With an inversion of the highest-order bit, while the shaft is turning clockwise, also descending code values may be generated.

##### Decimal BCD code

To avoid the conversion of a decimal figure into a binary figure, often the natural binary

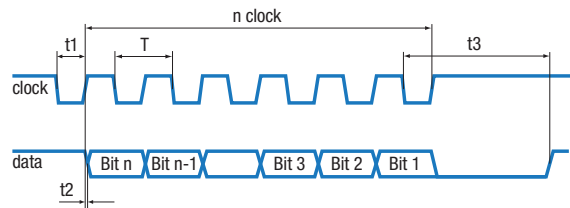
code is not used but only the individual digits of the decimal figure are binarily encoded.

Synchronous Serial Interface (SSI)

The SSI function provides absolute information on the position via a serial interface. It is particularly suited for applications requiring reliability and robustness in an industrial environment. The SSI design is very simple, only two conduction pairs are required (for clock and data) and in the sensor little more than a shift register and a monoflop to control the same. This provides a cost-effective design. SSI also facilitates the connection of up to three encoders to one common clock. This enables the read-out of several sensors at a defined point in time.

Data transmission is effected as follows: The pulse provided by the control synchronises the data transmission between the encoder and the higher-ranking system. To a transmitted pulse group, the sensor responds with the transmission of position data. The time and speed is thus determined exactly.

Clock and data lines are on high level in idle state. The first trailing edge starts the transmission. The respectively rising edge outputs



the data bits successively to the data line starting with MSB. The multiturn value output occurs first. The transmission of a complete data word requires n+1 rising edges (n = resolution in bits), e.g. 14 clock signals for a complete readout of a 13 bit encoder. After the last positive edge of the clock signal, the data line remains on low for t3 until the encoder is ready for a new data word. The

clock line must stay just as long on high and can subsequently start a new read-out sequence of the encoder with a trailing edge.

Twisted pair data and clock lines should be used for wiring. In case of line lengths above 100m, data and clock lines with a cross section of at least 0.25mm<sup>2</sup> and supply voltage with at least 0.5mm<sup>2</sup> should be installed. The clock rate is 1MHz. The SSI clock rate depends on the max. line length and should be adapted as follows:

Line length	SSI clock rate
12.5 m	810 kHz
25 m	750 kHz
50 m	570 kHz
100 m	360 kHz
200 m	220 kHz
400 m	120 kHz
500 m	100 kHz

Clock rate SSI

The clock rate of angular position transmitters with an SSI is the frequency of the clock signal during data transmission. The clock rate is provided by subsequent electronics and must range in the respective limits.

Clock +, clock -

These are SSI control lines for synchronous data transmission. Clock + and clock - form a current loop for the assumption of the clock rate free of potential in SSI angular position transmitters.

Zero adjustment

In SSI angular position transmitters, zero may be set at any point of the resolution range without any mechanical adjustment.

CANopen

CANopen is a communication protocol based on CAN and used mainly in automation engineering and networking in complex devices. CANopen is predominantly used in Europe. However, user numbers are increasing both in North America and Asia. CANopen was developed by CiA (CAN in automation), the user and manufacturer association for CANopen, and has been standardised in the European EN 50 325-4 Standard since the end of 2002.

Basic services of CANopen

Several basic services are defined in CANopen:

- *Request:* Request of a CANopen service by the application
- *Indication:* Report to the application that a result or a certain message is available
- *Response:* Response of the application to an indication
- *Confirmation:* Confirmation to the application that a CANopen service is being performed

Communication objects

CANopen uses four communication objects:

- Service Data Objects (SDO) to parameterise object directory entries,
- Process Data Objects (PDO) to transport realtime data,
- Network Management Objects (NMT) to control the finite state machine of the CANopen device and to monitor nodes,
- Further objects like synchronisation objects, time stamps and error messages.

Object directory

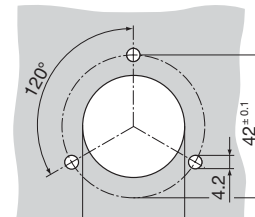
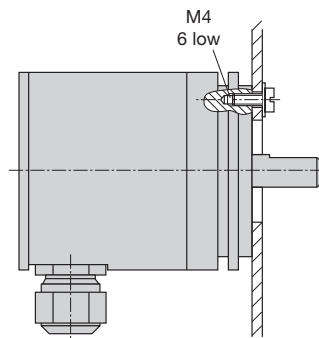
All of the device parameters are included in an Object Directory (OD). In the CANopen device model, the object directory is the link between the application and the CANopen communication unit and contains the description, data type and structure of the parameters as well as the address (index). The object directory is subdivided into 3 parts:

- Communication profile
- Device profile
- Manufacturer-specific part.

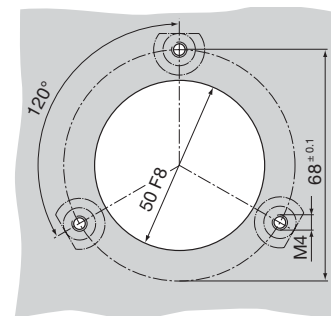
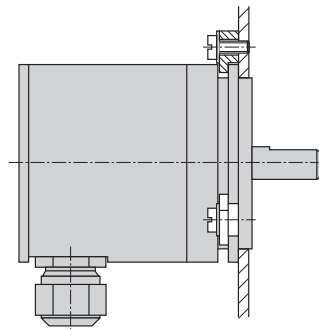
Further information under [www.can-cia.org](http://www.can-cia.org)

## Mounting instructions for KINAX WT720

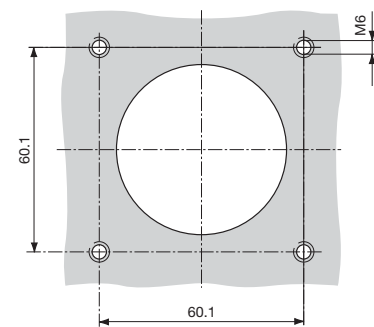
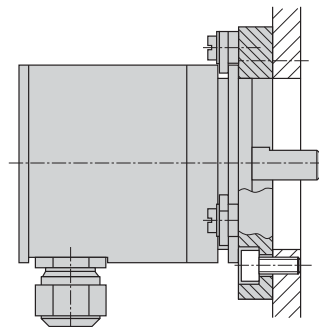
Directly mounting with  
3 cheese head screws M4



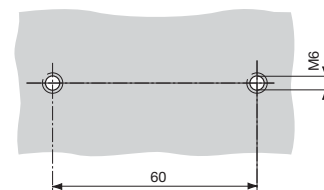
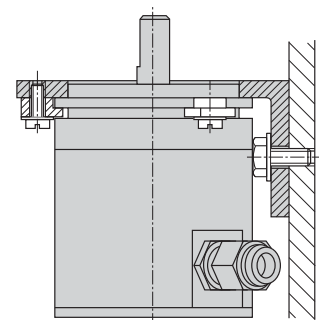
Directly mounting with  
3 mounting clamps and  
3 cheese head screws M4



Mounting with mounting plate,  
3 mounting clamps,  
3 cheese head screws M4 and  
4 cheese head screws M6

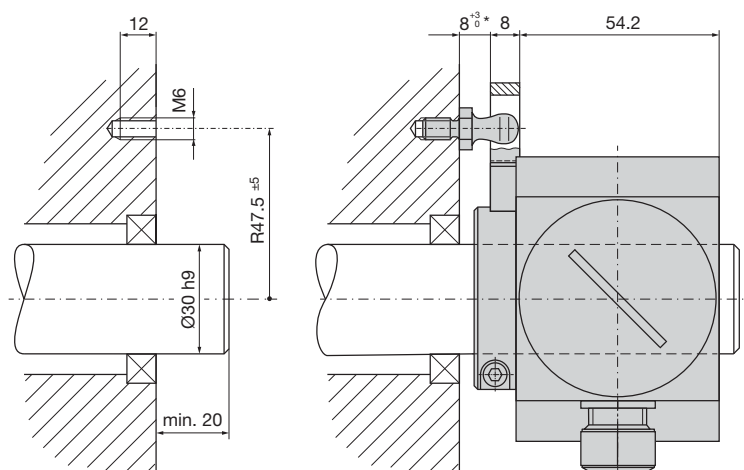
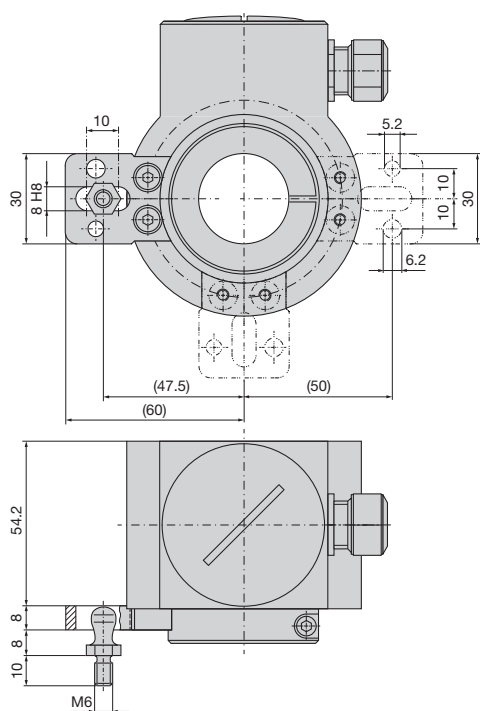


Mounting with mounting angle,  
3 mounting clamps,  
3 cheese head screws M4 and  
2 cheese head screws M6



## Mounting instructions for KINAX HW730

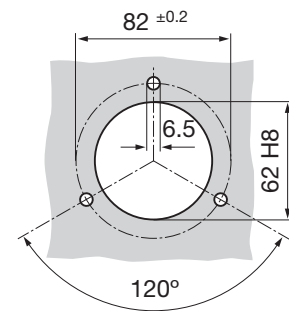
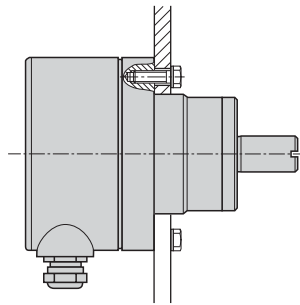
Installation example



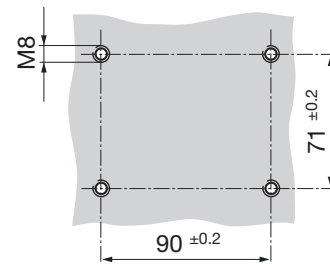
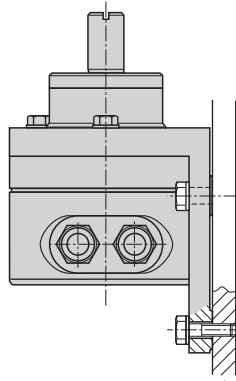
\* With spacers, this measure will be increased.

**Mounting instructions for KINAX WT707, WT707-SSI, WT707-CANopen and WT717**

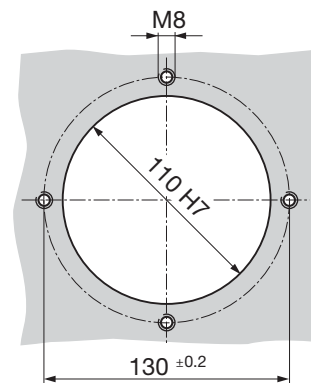
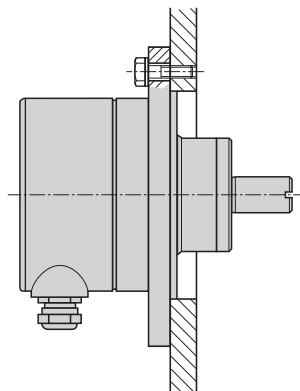
Directly mounting with  
3 cheese head screws M6,  
3 spring washers and  
3 washers 6.4/12.5 x 1.6



Mounting with mounting foot, with  
3 cheese head screws M6,  
3 spring washers,  
3 washers 6.4/12.5 x 1.6 and  
4 cheese head screws M8,  
4 spring washers,  
4 washers 8.4/18 x 2



Mounting with mounting flange, with  
3 cheese head screws hexagon socket M6,  
3 spring washers,  
3 washers 6.4/12.5 x 1.6 and  
4 cheese head screws M8,  
4 spring washers and  
4 washers 8.4/18 x 2





# Camille Bauer

## Products for Heavy Current Engineering

### Display units

Multifunctional display units are used to monitor energy consumption in distribution facilities. They can replace numerous analogue indicators, have an integrated energy counter and partly network analysis functions. They may be connected to a PLC or control system via I/Os or bus connections (Modbus, Profibus, Ethernet, LON). Network configuration and connection parameters can be conveniently set via buttons or via PC software. Some versions permit customised parameterising of display data, e.g. the suppression of displays, priority displays or changing displays with interval control.

### Transducers

The properties of multifunctional heavy current transducers can be completely programmed. They measure any variable of an electric network. The application (network configuration) and the behaviour of the analogue and digital outputs can be set by PC software without hardware variants. Measured value acquisition during operation is also supported via the programming or bus interface (Modbus, Profibus, Ethernet or LON). Programmable transducers are more resistant to interference in comparison with indicators and designed for more dynamic behaviour of the input signals.

Unifunctional transducers are of an analogue design. They are customised to the required measuring task during the manufacturing process. The DC signal proportionate to the measured value can be used for visualising via analogue indicators or further PLC processing. Converters are available for all basic variables in the electric network

### Power quality

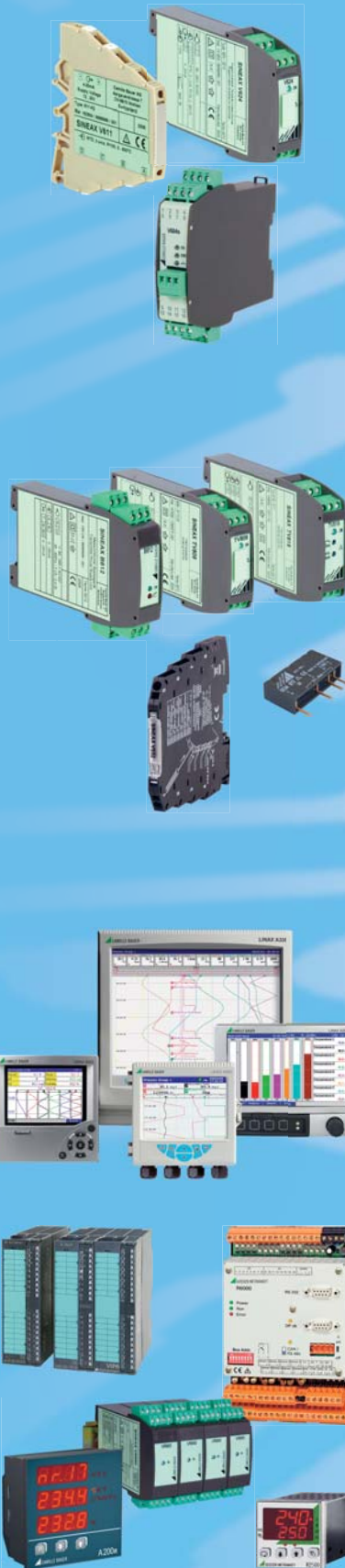
The quality of energy available in electric networks is determined by the consumers connected. Their power consumption is often non-linear and influences the network quality negatively. This may impair the smooth operation of sensitive consumers (e.g. computers). The quality of network voltage which a power supplier has to provide is thus determined by international standards. But also energy consumers and equipment manufacturers must limit their feedback to the power system. For monitoring the compliance with standard values devices for temporary, mobile use and firm installation in the facility part to be monitored are available.

### Energy management

Acquisition, analysis and optimising of the energy consumption and its allocation to generating cost centres is one of the central tasks of any company. To perceive the same on every level, we offer different product groups:

- Active power meters (calibrateable)
- Summation stations. To record meter readings centrally via pulse inputs or via LON bus.
- Peak load optimisers: To avoid power peaks the current energy requirement is determined and optimised by direct consumer control.
- Energy Control System (ECS): The solution for energy data acquisition in the industrial environment. This system provides the data for cost centre allocation and the basis for consumer and load optimising.





## Temperature

Temperature is the most measured variable in industry. However, the requirements of temperature measuring points vary from one application to the other. Camille Bauer offers extensive temperature transducers in the most varied designs for the analysis, conversion and transmission of temperature sensor signals.

### Head transmitters

Head transmitters are directly installed in the connecting head of the temperature sensor. The sensor signal is converted into a 4...20 mA signal, HART signal or Profibus PA signal directly on site. The head transmitters may be freely programmed and parameterised.

### Transmitter for top-hat rail assembly

Intelligent terminals in 2-wire technology are suited to the installation in subdistributor systems close to the process or control cabinets. Their very small dimensions permit a space-saving installation. Temperature transmitters are directly assembled in the control cabinet and mainly use 4-wire technology. Measured variables and measuring ranges can be fully programmed which facilitates universal usage and cost-saving stocks. All of our devices are galvanically isolated, on principle, and also available in Ex-variants.

## Signal conversion

As a link between the actual physical process and control engineering, we provide an extensive program for safe isolation, conversion and amplifying of signals, also for Ex-zones. Safety has the first priority also at this point.

### Power Supply Units

Our power supply units provide 2-wire transducers with DC power and transmit the measuring signal 1:1 galvanically separated to the measuring output.

### Isolation amplifiers

Active isolation amplifiers have the task of galvanically separating input signals from output signals, amplifying them and/or converting them to another level or type of signal (current or voltage). Different Ex-variants are also available.

### Passive isolators

Passive DC signal isolators serve the galvanic isolation of a direct current signal which is transferred to a direct current or direct voltage signal depending on the device variant. They prevent the diversion of interference voltages and interference currents and solve earthing problems.

## Process Management

### Videographic recorders

The videographic recorders of the LINAX A300 family are paperless recorders of the latest generation. Their modular concept facilitates the flexible adaptation to the most varied needs. Depending on the type and design of the device users have up to 36 universal input channels at their disposal. Digital inputs and outputs, relay outputs, Ethernet interface, RS485 (Modbus) interface as well as transducer power supply are additional properties of the LINAX videographic recorders.

### Temperature control systems

The goal of any control is to correct the change of the setpoint and the influence of interfering variables without overshooting and swinging. However, this is only possible if the controller behaves dynamically and is adjusted to the time behaviour of the controlling system. Our controllers and controller systems are the professional tool for optimum and high-quality control.

A specially developed PDPI control action and optimising procedure corrects changes without overshooting and swinging. The integrated data loggers and histories register all relevant control process data in real time thus facilitating a detailed analysis of interferences. User-friendly software tools for commissioning (configuration, parameterising), remote diagnosis and remote maintenance support and simplify all relevant tasks. Our controller program comprises compact controllers, control modules for Simatic platforms, OEM control modules, software controllers (control algorithm) and modular temperature control systems.

### Overview/Index

#### Overview

○ = <i>Optionally</i>															
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For surface mounting							●	●			●	●	●	●	●
To be installed									●	●					
Programmable	●	●				●		●		●				●	
Capacitive measuring system	●	●	●			●	●	●	●	●	●	●			
Magnetic measuring system				●	●								●	●	●
Multiturn				●	●										
Multiturn with additional gear			○			○	○	○							
Singleturn	●	●	●	●	●		●	●	●	●					
Ex version			○			○	○	○	○	○	○				
GL			●			●			●						
Sea-water resistant			○	○	○	○									
With SSI interface				●										●	
With CANopen interface					●										●

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