CAMILLE BAUER

KINAX 3W2
Transmitter for Angular Position

Application

The **KINAX 3W2** (Figs. 1 to 3) converts the angular position of a shaft into a **load independent** direct current signal, proportional to the angular position. The unit is **contact free** and has **minimal mechanical abrasion** on the input shaft. It is a technically purposeful complement to the angle transmitter program. This compacter version is made possible by incorporating newly developed, highly integrated CMOS circuitry.

Features / Benefits

- **Measuring input: Angular position**

Measured variable	Measuring range limits
Angular position	0 … 5° to 0 … 270°

- **Capacitive scanning system / Non mechanical abrasion, low annual maintenance**
- **Low influence from bearing play, < 0.1%**
- **Accuarcy ≤ 0.5% for ranges ≤ 150°**
- **Torque < 0.001 Ncm**
- **Drive shaft fully rotatable without stops**
- **For building into other equipment and as an OEM product / Very compact made only 48 mm in diameter**
- **Marine version also available as per Lloyd's Register of Shipping**
- **Available in type of protecion "Intrinsic safey" Ex ia IIC T6 / Can be mounted within the hazardous area** (see "Table 3: Data on explosion protection)

Layout and mode of operation

The transmitter consists of 2 main parts: the differential screen capacitor D and the electronic circuitry E (see Fig. 4).

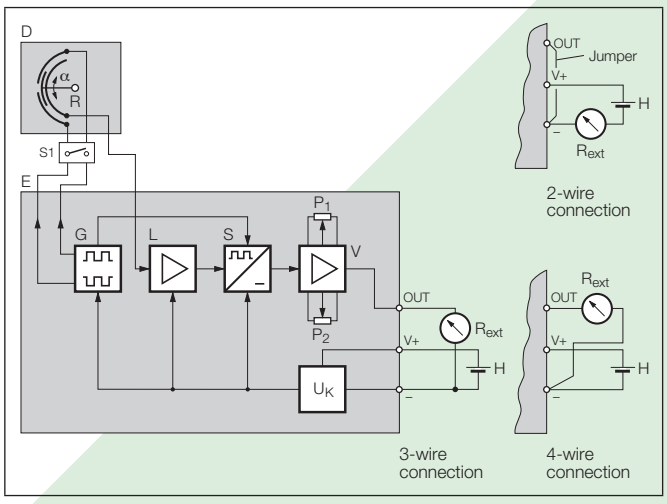

Fig. 4. Block diagram

CE 0102 Ex II 2 G GL

Fig. 1. KINAX 3W2 with shaft dia. 2 mm.

Fig. 2. KINAX 3W2 with shaft dia. 6 mm.

Fig. 3. Rear view with electrical connections and potentiometers for zero and FS.

S1 = Change-over switch sense of rotation for ∢ > 150°

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The angular deflection α of the device to be measured is transferred to the rotor R of the differential screen capacitor with the aid of a mechanical coupling. It is then converted into a change of capacitance proportional to the angle.

The generator G produces 2 square voltages of 8 kHz shifted in phase by 180 degrees. These voltages are applied to the differential screen capacitor.

Any change in the rotor position results in a change of current at the charge amplifier input L. This current is amplified, rectified with the synchronous rectifier S, and passes to the output amplifier V, which converts it into a load-independent DC current.

The constant voltage source U_K supplies the circuit with a stable voltage which is independent of power supply fluctuations. Zero setting and end value can be adjusted with the potentiometers P_1 and P_2.

Technical data

General

Measured quantity:	Angle of rotation α ∢°
Measuring principle:	Capacitive method Differential screen capacitor with contact-free, non-wearing positional pick-up. Drive shaft fully rotatable without stops

Measuring input ⊣►

Standard measuring ranges of rotation angle α:	0…10°, 0…30°, 0…60°, 0…90°, 0…180°, 0…270°
Drive shaft diameters:	2 or 6 mm resp. 1/4″
Frictional torque:	< 0.001 Ncm with shaft dia. 2 mm < 0.03 Ncm with shaft dia. 6 mm resp. 1/4″
Sense of rotation as seen from the shaft side:	∢ ≤ 150° possible in both senses of rotation (specify the required sense of rotation) ∢ > 150° to ≤ 270°, sense of rotation switchable with switch S1 (initial and end value must be readjusted)

Measuring output ⊣►

Output variable I_A:	Load-independent DC current, proportional to the input angle
Zero point correction:	Approx. ± 5%
Span adjustment:	Approx. + 5 / – 30%, see Feature 6
Current limitation:	I_A max. 40 mA
Standard ranges:	0…1 mA, 3- or 4-wire connection 0…5 mA, 3- or 4-wire connection 0…10 mA, 3- or 4-wire connection 4…20 mA, 3- or 4-wire connection 4…20 mA, 2-wire connection or 0…20 mA, 3- or 4-wire connection adjustable with potentiometer
Non-standard ranges:	0…> 1.00 to 0…< 20 mA 3- or 4-wire connection
External resistance (load):	R_{ext} max. [kΩ] = $\frac{H\ [V] - 12\ V}{I_A\ [mA]}$ H = DC power supply I_A = Output signal end value
Residual ripple in output current:	< 0.3% p.p.
Response time:	< 5 ms

Accuracy

Reference value:	Measuring range
Basic accuracy:	Limit of error ≤ ± 0.5% for ranges 0 … ≤ 150° Limit of error ≤ 1.5% for ranges from 0… > 150° to 0 … 270°
Reproducibility:	< 0,2%

Reference conditions

Ambient temperature	23 °C ± 2 K
Power supply	18 V DC
External resistance	R_{ext} = 0 Ω

Influence effects (maxima)
(included in basic error)

Linearity error:	± 0.4% for ranges 0…≤ 150° ± 1.4% for ranges from 0…> 150° to 0…270°
Dependence on external resistance Δ R_{ext} max.	± 0.1%
Power supply influence	± 0.1%

Additional errors (maxima)

Temperature influence (– 25…+ 70 °C)	± 0.2% / 10 K
Bearing play influence	± 0.1%

Power supply H →◯

DC voltage:
Version non intrinsically safe
12 … 33 V
Version intrinsically safe 12…**30** V
max. residual ripple 10% p.p.
(12 V must not be understepped)
Protected against wrong polarity

Installation data

Dimensions: See section "Dimensional drawings"

Housing: Chromated aluminium

Mounting position: Any

Electrical connections: Soldering terminals
Protection class IP 00 acc. to IEC 529

Permissible vibrations: 5 g every 2 h in 3 directions
f ≤ 200 Hz

Shock: 3 x 50 g
10 shocks each in 3 directions

Admissible static loading of shaft:

Drive shafts dia. Sense	2 mm	6 mm resp. 1/4 ˝
radial max.	16 N	83 N
axial max.	25 N	130 N

Weight: Approx. 100 g

Fixation: 3 cheesehead screws M3 or with 3 clamps

Regulations

Electromagnetic compatibility: The standards DIN EN 50 081-2 and DIN EN 50 082-2 are observed

Intrinsically safe: Acc. to EN 60 079-11: 2007

Impulse voltage withstand: 1 kV, 1,2/50 µs, 0.5 Ws
IEC 255-4, Cl. II

Housing protection: IP 50 acc. to IEC 529

Test voltage: All connections against housing
500 Veff., 50 Hz, 1 min.

Admissible common-mode voltage: 100 V, 50 Hz

Environmental conditions

Climatic rating: Standard version
Temperature –25 to + 70 °C
Annual mean
relative humidity ≤ 90%
or
Version with improved climatic rating
Temperature –40 to + 70 °C
Annual mean
relative humidity ≤ 95%
Ex-version
Temperature
– 40 to + 60 °C at T6
resp. – 40 to + 75 °C at T5

Transportation and storage temperature: –40 to 80 °C

Table 1: Stock versions

The following transmitter versions are available ex stock. It is only necessary to quote the Order No.:

Order Code *)	Version	Sense of rotation	Measuring range (angle)	Output signal/ power supply 12…33 V DC	Order No.
708 - 112D	**Standard** (non intrinsically safe) with shaft dia. 2 mm, length 6 mm	Clockwise	0… 30°	**4…20 mA 2-wire connection** or 0…20 mA 3- or 4-wire connection (adjustable with potentiometer)	989 759
708 - 113D			0… 60°		993 213
708 - 114D			0… 90°		993 221
708 - 116D			0…270°		993 239

*) See section "Specifications and ordering information"

Instruments ex stock are factory set to output 4…20 mA for use in 2-wire connection.

When changing from 2- to 3- or 4-wire connection the initial and end values must be readjusted with P1 and P2 respectively.

The complete Order Code 708 - .... and/or a description according to the section "Specifications and ordering information" should be stated for other versions.

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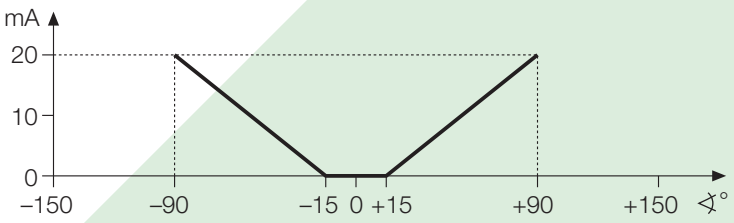
Table 2: Specification and ordering information

Features, Selection	*Blocking code	no-go with blocking code	Article No./ Feature
KINAX 3W2 **Order Code 708 - xxxx xxxx x**			708 –
Features, Selection			
1. Version of the transmitter (with standard shaft dia. 2 mm, at front **only**, length 6 mm*			
Standard, measuring output non intrinsically safe	A		1
Ex ia IIC T6, measuring output intrinsically safe	B		2
Customized, measuring output intrinsically safe (Japan, on request)	B		5
Ex ia IIC T6, measuring output intrinsically safe, FTZU (Czech republic)	B		6
Other versions on request	B		9
2. Sense of rotation			
Calibrated for sense of rotation clockwise	D		1
Calibrated for sense of rotation counterclockwise	D		2
For "V" characteristic	E		3
Both senses of rotation, calibrated and marked (for measuring ranges ≤ 90° only)	M		4
Lines 1 and 2: Angle ≤ 150° usable in both senses of rotation. Angle > 150° to ≤ 270° switchable to the other direction.			
3. Measuring range (measuring input) ⊕			
0 … 10 ∢°		E	1
0 … 30 ∢°		E	2
0 … 60 ∢°		E	3
0 … 90 ∢°		E	4
0 … 180 ∢°		EM	5
0 … 270 ∢°		EM	6
Non-standard 0 … ≥ 5 to 0 … < 270 [∢°]		E	9
With both senses of rotation calibrated, non-standard range, 0 to ≥ 5 till 0 to < 90°			
"V" characteristic [± ∢°]		DM	A
Specify start M_A and end M_E of measuring range! Observe the limits for (M_A [± ∢°] ≥ 10 and M_E [± ∢°] ≤ 150) and give both angles separated by an oblique stroke, e.g. [± ∢°] 15/90!			
 Example of a "V" characteristic for the measuring range [± ∢°] 15/90 and an output range of 0…20 mA			

* *Possible deviations see selection 7!*

Features, Selection	*Blocking code	no-go with blocking code	Article No./ Feature
KINAX 3W2 **Order Code 708 - xxxx xxxx x**			708 –
Features, Selection			
4. Output signal (measuring output) ⊖► **/ Connecting version** Power supply (12 … 33 V DC resp. 12 … **30 V** DC with **Ex version**)			
0 … 1 mA / 3- or 4-wire connection			A
0 … 5 mA / 3- or 4-wire connection			B
0 … 10 mA / 3- or 4-wire connection			C
4 … 20 mA / 2-wire connection or 0 … 20 mA / 3- or 4-wire connection (adjustable with potentiometer)			D
4 … 20 mA / 3- or 4-wire connection			E
Non-standard, 3- or 4-wire connection 0 … > 1.00 to 0 … < 20 [mA]			Z
R_{ext} max. see section “Technical data”, output signal			
5. Special features			
Without (order code complete)	Y		0
With special feature The features to be omitted must be marked hereafter with / (slant line) in the order code until reaching the required feature!			1
6. Adjustability (span adjustment)			
Increased adjustability + 5% / – 60% Restriction: for angle ≥ 60°, additional error 0.2%		Y	A
7. Drive shaft special			
Dia. 2 mm at front, length 12 mm, dia. 2 mm rear, length 6 mm		Y	C
Dia. 6 mm at front, length 12 mm		Y	D
Dia. 6 mm at front, length 12 mm, dia. 2 mm rear, length 6 mm		Y	E
Dia. 1/4 ″ at front, length 12 mm		Y	F
Dia. 1/4 ″ at front, length 12 mm, dia. 2 mm rear, length 6 mm		Y	G
8. Improved climatic rating			
Temperature – 40 to + 70 °C, annual mean relative humidity **≤ 95%** instead of ≤ 90% for the standard version		BY	H
With **Ex version** Temperature **– 40 to + 60 °C** at T6 resp. – 40 to + 75 °C at T5, annual mean relative humidity **≤ 95%**		AY	J
9. Marine version			
Version GL (“Germanischer Lloyd”)		Y	L

** Lines with letter(s) under «no-go» cannot be combined with preceding lines having the same letter under «Blocking code».*

Table 3: Data on explosion protection

Order Code	Type of protection “Intrinsically safe” Marking		Certificates	Mounting location of device
	Instrument	Measuring output		
708 - 2 ...	Ex ia IIC T6	U_i = 30 V I_i = 160 mA P_i = 1 W C_i = 10 nF L_i = 0	Type Examination Certificate ZELM 10 ATEX 0427 X	**Within** the hazardous area
708 - 5 ...	(Customized) on request		Japan	
708 - 6 ...	Ex ia IIC T6		Czech republic FTZU 98 Ex 0280	

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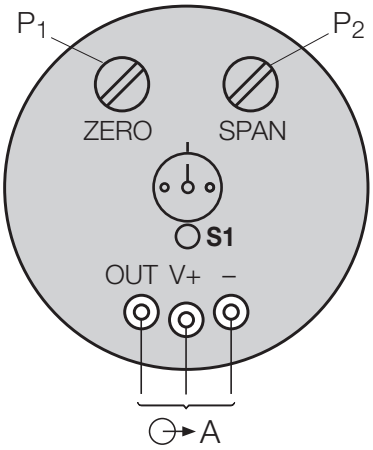
Electrical connections

Back



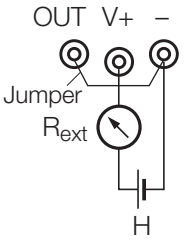
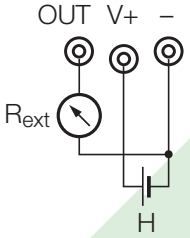
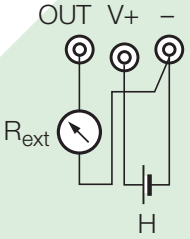
(3 soldering point terminals)

A = Measuring output (output/powering circuit) ...
... with 2-wire connection (4…20 mA signal)
... with 3- or 4-wire connection (different mA signals)
Power supply H = 12 … 33 V DC resp. H = 12 … **30 V** DC for **Ex** version
Layout of soldering points dependent on connection mode see table “Measuring output A”

ZERO = Potentiometer P1 for zero point

SPAN = Potentiometer P2 for measuring range end value

S1 = Switch for reversing rotation at $\sphericalangle$ > 150°

Measuring output A	
Connection mode	Terminal allocation
2-wire connection (4 … 20 mA)	
3-wire connection	
4-wire connection	

R_{ext} = External resistance
H = Power supply

P1, Potentiometer for zero point
P2, Potentiometer for measuring range end value

When changing from 2- to 3- or 4-wire connection the initial and end value must be readjusted with P1 and P2 respectively.

Dimensional drawings

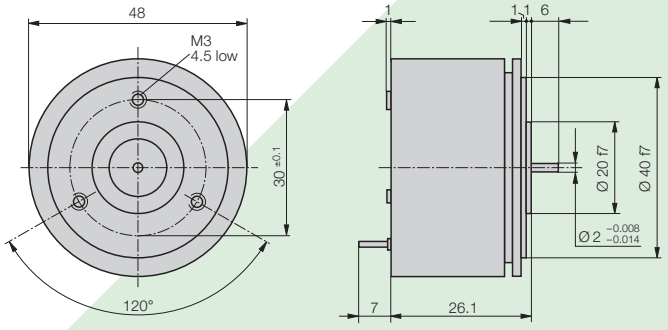


Fig. 5. KINAX 3W2 with shaft dia. 2 mm, length 6 mm, standard version.

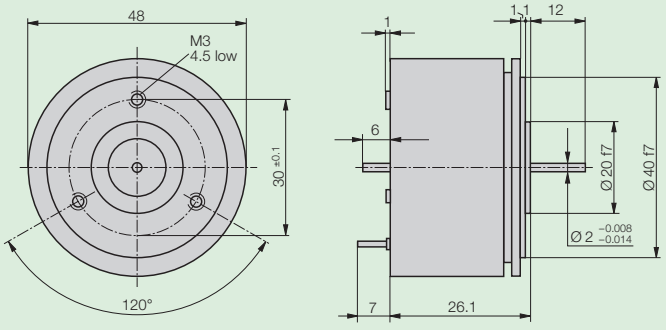


Fig. 6. KINAX 3W2 with shaft dia. 2 mm at front, length 12 mm, dia. 2 mm rear, length 6 mm.

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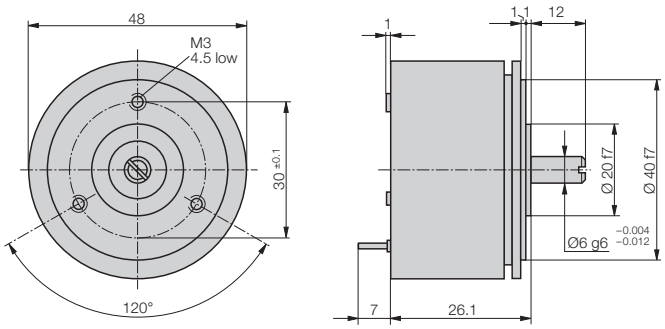

Fig. 7. KINAX 3W2 with shaft dia. 2 mm, length 12 mm.

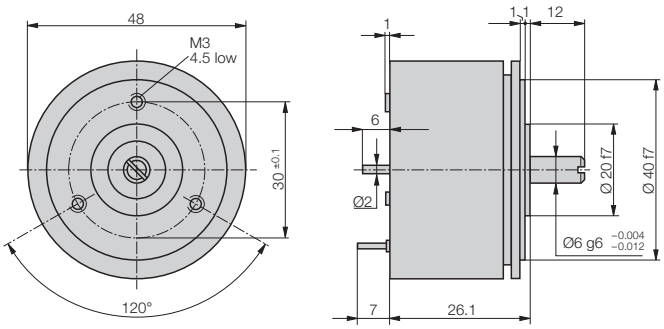

Fig. 8. KINAX 3W2 with shaft dia. 6 mm at front, length 12 mm, dia. 2 mm rear, length 6 mm.

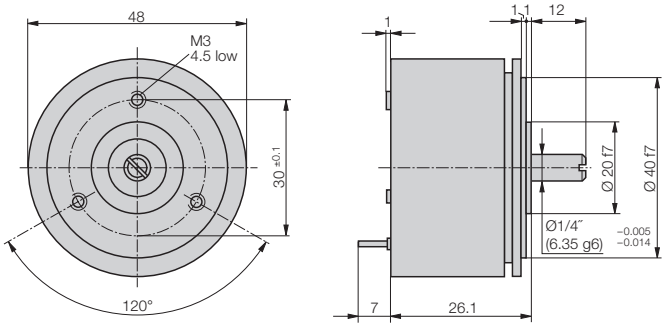

Fig. 9. KINAX 3W2 with shaft dia. 1/4", length 12 mm.

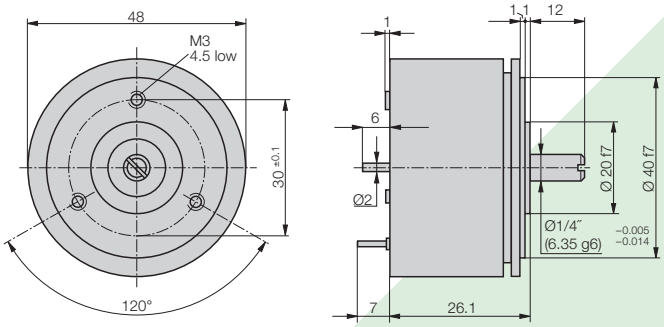

Fig. 10. KINAX 3W2 with shaft dia. 1/4", length 12 mm, dia. 2 mm rear, length 6 mm

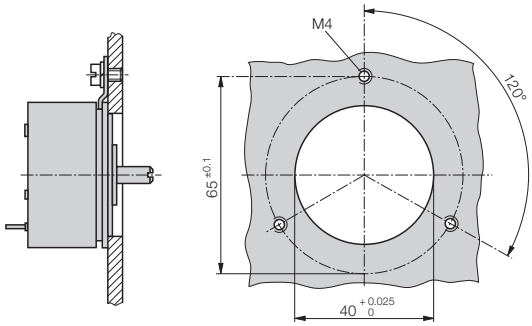

Fig. 11. Drilling plan for fixing with 3 spring clamps.

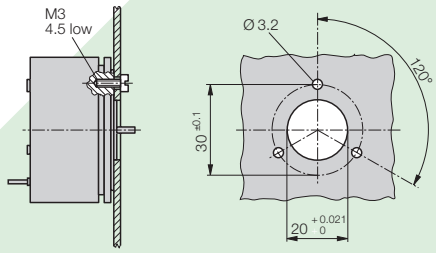

Fig. 12. Drilling plan for fixing with 3 cheesehead screws M3.

Standard accessories

3 clamps
1 Operating Instructions each in German, French and English
1 Ex approval (for instruments in Ex version only)

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