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.

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.

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%**
- **Accuracy ≤ 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 protection "Intrinsic safety" EEx 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).

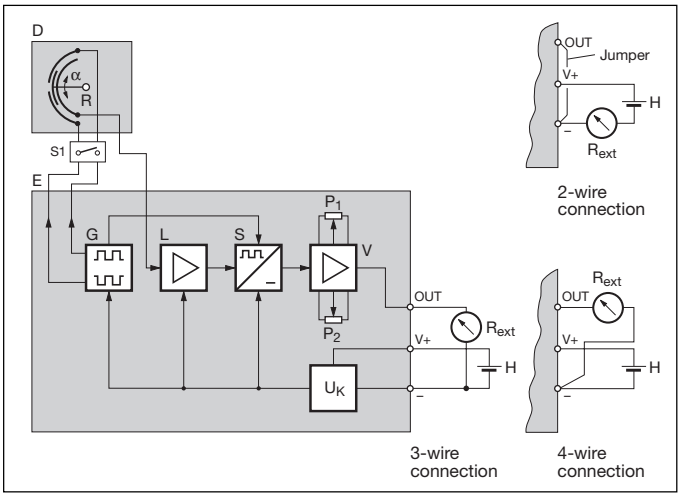


Fig. 4. Block diagram.

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] = (Power supply [V] – 12 V) / (Output signal end value [mA])
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	H = 18 V
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:	3×50 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 50 020: 1994
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.

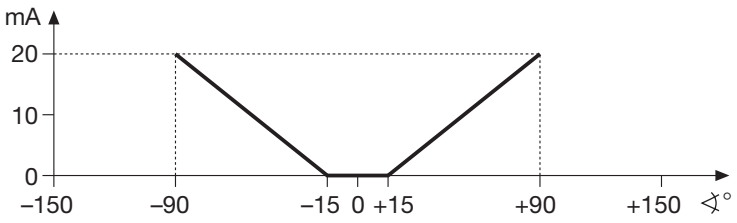
When changing from 2- to 3- or 4-wire connection the initial and end values must be readjusted with P1 and P2 respectively.

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

Order Code **708 –**		*SCODE	no-go	
Features, Selection				
1. Version of the transmitter (with standard shaft dia. 2 mm, at front **only** , length 6 mm*				
1) Standard, Measuring output non intrinsically safe		A		1 . . . . .
2) EEx ia IIC T6 Measuring output intrinsically safe		B		2 . . . . .
5) Customized, Measuring output intrinsically safe	(Japan) (on request)	B		5 . . . . .
6) Ex ia IIC T6, Measuring output intrinsically safe	FTZU (Czech republic)	B		6 . . . . .
9) Other versions on request		B		9 . . . . .
2. Sense of rotation				
1) Calibrated for sense of rotation clockwise		D		. 1 . . . . .
2) Calibrated for sense of rotation counterclockwise		D		. 2 . . . . .
3) For "V" characteristic		E		. 3 . . . . .
4) Both senses of rotation, calibrated and marked		M		. 4 . . . . .
Lines 1 and 2: Angle ≤ 150° usable in both senses of rotation. Angle > 150° to ≤ 270° switchable to the other direction Line 4: For measuring ranges ≤ 90° only				
3. Measuring range (measuring input) ⊖⊕				
1) 0... 10∢ °			E	. . 1 . . . .
2) 0... 30∢ °			E	. . 2 . . . .
3) 0... 60∢ °			E	. . 3 . . . .
4) 0... 90∢ °			E	. . 4 . . . .
5) 0...180∢ °			EM	. . 5 . . . .
6) 0...270∢ °			EM	. . 6 . . . .
9) Non-standard 0... ≥ 5 to 0...< 270	[∢ °]		E	. . 9 . . . .
A) "V" characteristic	[± ∢ °]		DM	. . A . . . .
Line 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 Feature 7.*

Order Code **708 –**			
Features, Selection	*SCODE	no-go	
4. Output signal (measuring output) ⊖► **/ Connecting version** Power supply (12...33 V DC resp. 12...**30** V DC with **Ex** version)			
A) 0 ... 1 mA / 3- or 4-wire connection			A . . . . .
B) 0 ... 5 mA / 3- or 4-wire connection			B . . . . .
C) 0 ... 10 mA / 3- or 4-wire connection			C . . . . .
D) 4...20 mA / 2-wire connection or 0...20 mA / 3- or 4-wire connection (adjustable with potentiometer)			D . . . . .
E) 4 ... 20 mA / 3- or 4-wire connection			E . . . . .
Z) 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			
0) Without	Y		. 0 . . . . .
1) With			. 1 . . . . .
Without special features (line 0): Order code complete. With special feature (line 1): The features to be omitted must be marked hereafter with / (slant line) in the order code until reaching the required feature			
6. Adjustability (span adjustment)			
A) Increased adjustability + 5% / – 60 % Restriction: for angle ≥ 60°, additional error 0.2 %		Y	. . A . . . .
7. Drive shaft special			
C) Dia. 2 mm at front, length 12 mm, dia. 2 mm rear, length 6 mm		Y	. . . C . . .
D) Dia. 6 mm at front, length 12 mm		Y	. . . D . . .
E) Dia. 6 mm at front, length 12 mm, dia. 2 mm, length 6 mm		Y	. . . E . . .
F) Dia. 1/4″, length 12 mm		Y	. . . F . . .
G) Dia. 1/4″, length 12 mm, dia. 2 mm rear, length 6 mm		Y	. . . G . . .
8. Improved climatic rating			
H) Temperature –40 to + 70 °C, annual mean relative humidity ≤ **95%** instead of ≤ 90% for the standard version		BY	. . . . H . .
J) 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			
L) Version GL ("Germanischer Lloyd")		Y	. . . . . L .

** Lines with letter(s) under "no-go" cannot be combined with preceding lines having the same letter under "SCODE".*

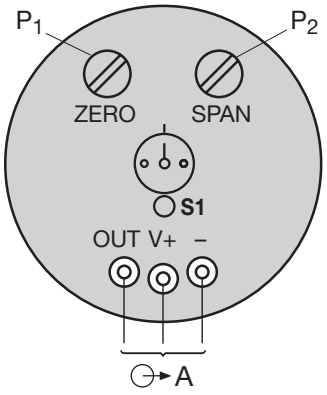
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Table 3: Data on explosion protection

Order Code	Type of protection "Intrinsically safe" Marking		Certificates	Mounting location of device
	Instrument	Measuring output		
708 - 2 …	EEx 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 PTB 97 ATEX 2271	**Within** the hazardous area
708 - 5 …	(Customized) on request		Japan	
708 - 6 …	Ex ia IIC T6		Czech republic FTZU 98 Ex 0280	

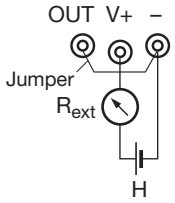
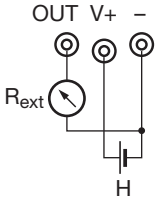
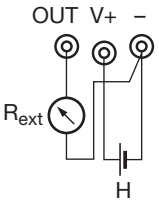
Electrical connections



(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 ∢ > 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 values must be readjusted with P1 and P2 respectively.

Dimensional drawings

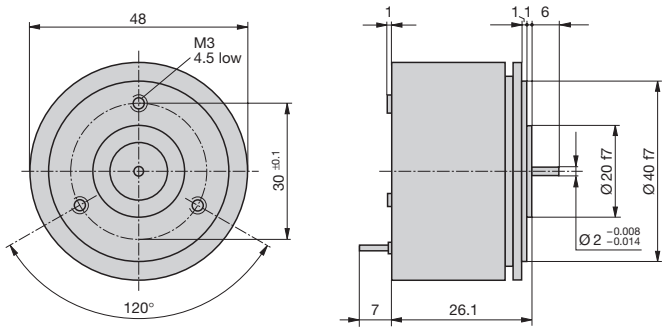


Fig. 5. KINAX 3W2 with shaft dia. 2 mm, length 6 mm, standard version.

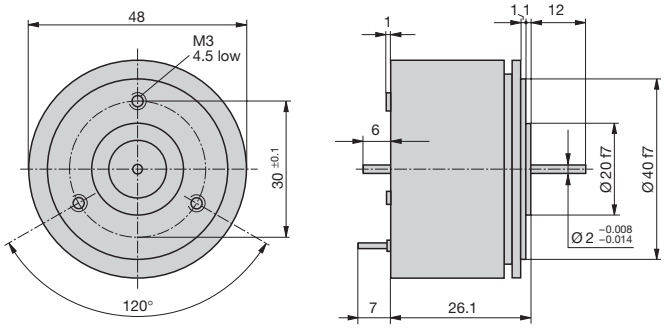


Fig. 6. KINAX 3W2 with shaft dia. 2 mm at front, length 12 mm, dia. 2 mm rear, length 6 mm.

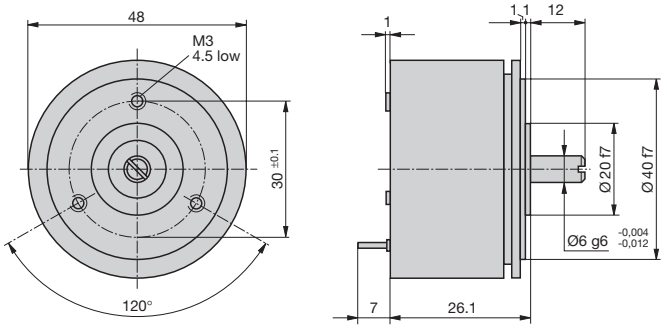


Fig. 7. KINAX 3W2 with shaft dia. 6 mm, length 12 mm.

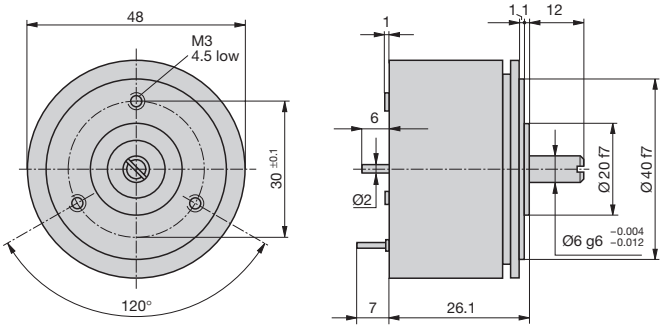


Fig. 8. KINAX 3W2 with shaft dia. 6 mm at front, length 12 mm, dia. 2 mm rear, length 6 mm.

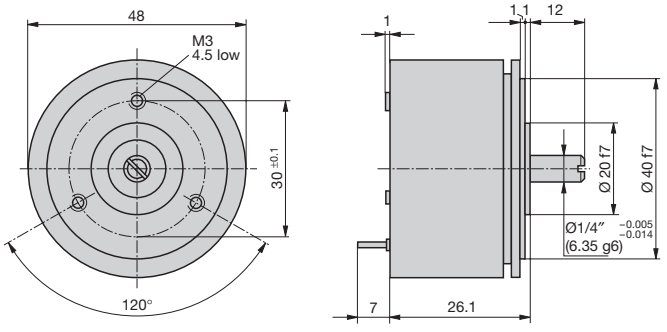


Fig. 9. KINAX 3W2 with shaft dia. 1/4″, length 12 mm.

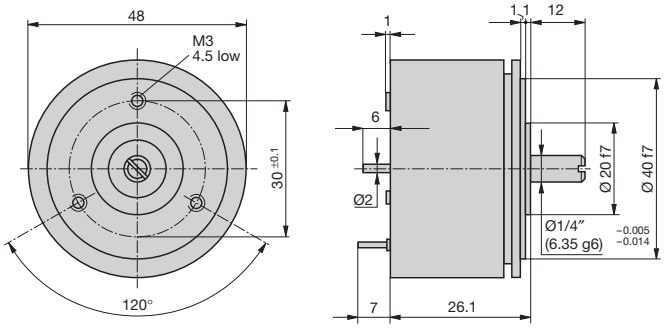


Fig. 10. KINAX 3W2 with shaft dia. 1/4″, length 12 mm, dia. 2 mm rear, length 6 mm.

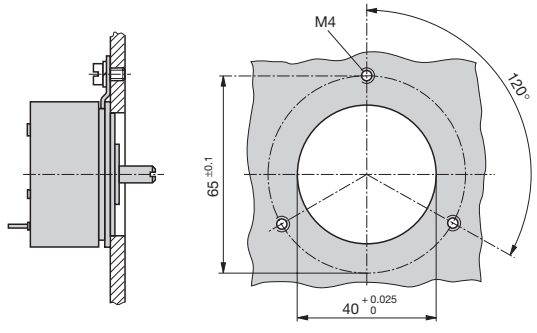


Fig. 11. Drilling plan for fixing with 3 spring clamps.

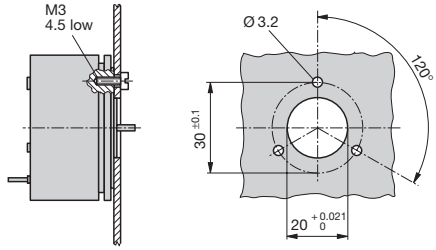


Fig. 12. Drilling plan for fixing with 3 cheesehead screws M3.

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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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