

# KINAX WT 707

## Transmitter for angular position



Ruggedized version



### Application

The KINAX WT 707 (Figs. 1 to 6) converts the angular position of a shaft into a **load-independent** direct current signal, proportional to the angular position. The unit is **contact free**. The robust housing has made this unit ideal for machines and ship building.

### Features / Benefits

- Measuring input: Angular position

Measured variable	Measuring range limits
Angular position	0...5 to 0...270 $\curvearrowright$ °

- Measuring output: DC current signal (load-independent, 2-, 3- or 4-wire connection)
- Potentiometer for adjusting span / Optimum matching of desired measuring range
- Direction of rotation: output signal increases for clockwise or counter-clockwise rotation
- Capacitive scanning system / No wear and low annual maintenance
- Continuous shaft rotation / No damage when overshooting angle measuring range
- Available with type of protection "Intrinsic safety" EEx ia IIC T6 / Can be mounted in hazardous areas (see "Table 4: Data on explosion protection")
- Ancillary unit in ruggedized housing / Vibration and shock-resistant, for applications on large machines and in ship building
- Marine version also available as per Lloyd's Register of Shipping



Fig. 1. KINAX WT 707 with plug-in connector.



Fig. 2. KINAX WT 707 with plug-in connector and foot.



Fig. 3. KINAX WT 707 with screw terminals, cable glands and foot.



Fig. 4. KINAX WT 707 with additional gear, plug-in connector and foot.



Fig. 5. KINAX WT 707 with additional gear, plug-in connector and mounting flange.



Fig. 6. KINAX WT 707 with additional gear, screw terminals, cable glands and foot.

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### Technical data

#### Measuring input $\rightarrow$

Measured quantity:	Angle of rotation $\alpha$ $\curvearrowright^\circ$
Measuring principle:	Capacitive method Differential capacitor with contact-free, non-wearing positional pick-up. Drive shaft fully rotatable without mechanical stops
Measuring ranges:	0... $\geq$ 5 to 0... $\leq$ 270 $\curvearrowright^\circ$ (without gear)  Preferred ranges 0...10, 0...30, 0...60, 0...90, 0...180 or 0...270 $\curvearrowright^\circ$  0... $\geq$ 10 $\curvearrowright^\circ$ to 0...1600 turns (with additional gear)
Frictional torque:	Approx. 25 Ncm
Sense of rotation:	Clockwise or counterclockwise (seen from the shaft side).  The same transmitter can be used for both directions of rotation. A switch has to be changed, however, to reverse the direction on transmitters with ranges 0... $>$ 150 to 0... $\leq$ 270 $\curvearrowright^\circ$ , see "Settings".  See Feature 13 and 14 in "Table 3: Specification and ordering information" for direction of rotation on transmitters with additional gear.

#### Measuring output $\rightarrow$

Output variable $I_A$ :	Load-independent DC current, proportional to the input angle
Zero point correction:	Approx. $\pm$ 5%
Span adjustment:	Approx. + 5 / - 30%, see "Feature 9"
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, 2-wire connection or 0...20 mA, 3- or 4-wire connection adjustable with potentiometer  4...20 mA, 3- or 4-wire connection 0...20 mA, 4-wire connection
Non-standard ranges:	0... $>$ 1.00 to 0... $<$ 20 mA 3- or 4-wire connection

External resistance (load):	$R_{\text{ext}} \text{ max. [k}\Omega] = \frac{12 \text{ V}}{I_A \text{ [mA]}}$  (for instruments with <b>DC/AC</b> power supply by AC/DC power pack, <b>with</b> electric isolation)  $R_{\text{ext}} \text{ max. [k}\Omega] = \frac{H \text{ [V]} - 12 \text{ V}}{I_A \text{ [mA]}}$  (for instruments with <b>DC</b> power supply, <b>without</b> electric isolation)  $I_A$ = Output signal end value
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Residual ripple in output current:	$<$ 0.3% p.p.
Response time:	$<$ 5 ms

#### Accuracy

Reference value:	Measuring range
Basic accuracy:	Limit of error $\leq$ 0.5% for ranges 0... $\leq$ 150 $\curvearrowright^\circ$ Limit of error $\leq$ 1.5% for ranges from 0... $>$ 150 to 0...270 $\curvearrowright^\circ$
Reproducibility:	$<$ 0.2%

#### Reference conditions:

Ambient temperature	23 °C $\pm$ 2 K
Power supply	H = 18 V
External resistance	$R_{\text{ext}} = 0 \Omega$

#### Influence effects (maxima): (included in basic error)

Linearity error	$\pm$ 0.4% for ranges 0... $\leq$ 150 $\curvearrowright^\circ$ $\pm$ 1.4% for ranges from 0... $>$ 150 to 0...270 $\curvearrowright^\circ$
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Dependence on external resistance $\Delta R_{\text{ext}} \text{ max.}$	$\pm$ 0.1%
Power supply influence	$\pm$ 0.1%

#### Additional errors (maxima):

Temperature influence (-25...+ 70°C)	$\pm$ 0.2% / 10 K
Bearing play influence	$\pm$ 0.1%

#### Power supply H $\rightarrow$

DC and AC voltage:	Nominal voltages and tolerances see "Table 1"
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Table 1:

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

(only possible with standard version, non-Ex, **with** electric isolation, with AC/DC power pack (DC and 45...400 Hz)

Power consumption:	< 0.9 W resp. < 1.8 VA
Power supply effect on accuracy:	≤ 0.1% within the admissible power supply tolerance
DC voltage <b>only</b> <sup>1</sup> :	12...33 V (possible with standard version, non-Ex, <b>without</b> electric isolation) 12... <b>30 V</b> (necessary with <b>Ex</b> version, type of protection “Intrinsic safety” EEx ia IIC T6, <b>without</b> electric isolation)
Max. residual ripple:	10% p.p.
Max. current consumption:	Approx. 5 mA + I <sub>A</sub>
Power supply effect on accuracy:	< 0.2% within the admissible power supply tolerance

### Mechanical withstand

Permissible vibration: (without additional gear)	0...200 Hz, 10 g continuous, 15 g for 2 h 200...500 Hz, 5 g continuous, 10 g for 2 h
Shock:	3 × 50 g every 10 impulses in all 3 axes
Permissible static load on the shaft:	Max. 1000 N (radial) Max. 500 N (axial) If subjected to vibration the shaft load should be as low as possible to ensure optimum life of the bearing
Mounting position:	Any

### Housing data

Material of housing: (main part)	Steel Finish QPQ (nitro-carbonated)
Material of back:	<b>Plastic</b> (polyester), when <b>plug-in cable</b> specified or <b>metal</b> (aluminium), when cable access via <b>screw terminals</b> and <b>cable glands</b>
Material of plug-in connector:	Plastic
Material of cable glands:	Metal

The **plug-in connector** consists of a socket mounted on the transmitter and plug on the end of the connecting cable (screw gland) with 7 screw terminals (wire gauges up to 1 mm<sup>2</sup>). The socket can be mounted so that the cable is routed to either the rear (see Fig. 7) or the front (see Fig. 8).

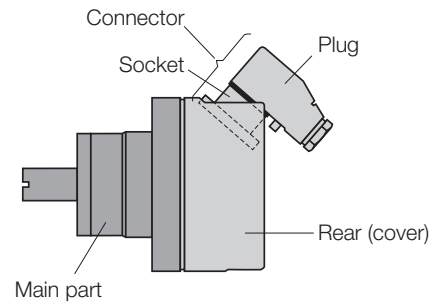


Fig. 7. Cable routed to rear.

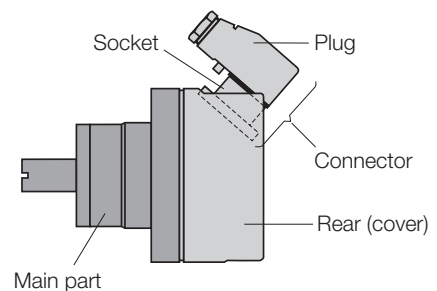


Fig. 8. Cable routed to front.

On units with **screw terminals** and **cable glands PG 11** (see Fig. 9) there are 4 screw terminals and a grounding terminal in the rear cover. The screw terminals accept gauges up to 1.5 mm<sup>2</sup> and are accessible after removing the cover.

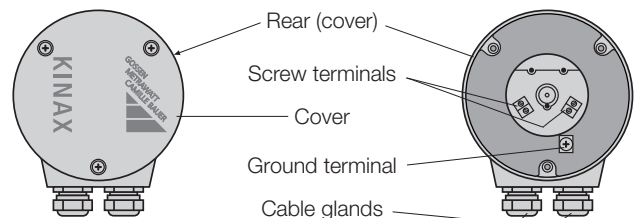


Fig. 9. KINAX WT 707 with screw terminals and cable glands.

Mounting:	Directly (instrument without foot, without flange) Mounting with foot Mounting with flange
Weight:	See Table 2

Table 2:

Weight	Description of parts
Approx. 2.9 kg	KINAX WT 707 <b>without</b> additional gear (also without foot or without flange)
Approx. 3.9 kg	KINAX WT 707 <b>with</b> additional gear (also without foot or without flange)
0.5 kg	Foot (on its own)
0.5 kg	Flange (on its own)

<sup>1</sup> Polarity reversal protection. The voltage must not fall below 12 V.

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### Regulations

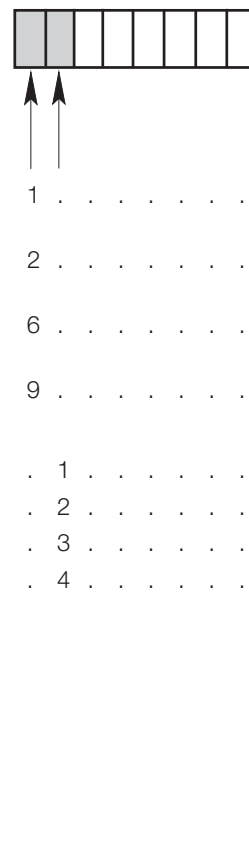
Electromagnetic compatibility:	The standards DIN EN 50 081-2 and DIN EN 50 082-2 are observed
Intrinsic safety:	Acc. to EN 50 020: 1994
Test voltage:	2.2 kVrms, 50 Hz, 1 min. between... ... power supply and housing ... power supply and measuring output (with DC/AC power supply, with electric isolation) 500 Vrms, 50 Hz, 1 min. all electrical connections to housing (with DC power supply, without electric isolation)
Housing protection:	IP 66 acc. to EN 60 529
Impulse voltage withstand:	1 kV, 1.2/50 µs, 0.5 Ws IEC 255-4, Cl. II
Permissible 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%
Transportation and storage temperature:	Ex-version Temperature – 40 to + 60 °C at T6 resp. – 40 to + 75 °C at T5  –40 to 80 °C

**Table 3: Specification and ordering information**

Order Code <b>707</b> –			
Features, Selection	*SCODE	no-go	
<b>1. Version of the transmitter</b>			
1) Standard, Measuring output non intrinsically safe	A		1 . . . . .
2) EEx ia IIC T6, Measuring output intrinsically safe	B	ATEX	2 . . . . .
6) Ex ia IIC T6, Measuring output intrinsically safe	B	FTZU (Czech republic)	6 . . . . .
9) Other versions on request	B		9 . . . . .
<b>2. Sense of rotation</b>			
1) Clockwise	D		. 1 . . . . .
2) Counterclockwise	D		. 2 . . . . .
3) V characteristic	E		. 3 . . . . .
4) Both senses of rotation, marked and calibrated	M		. 4 . . . . .
Lines 1 and 2: Instruments with ranges 0...≥ 5 to 0...≤ 150 ↺° are usable in both senses of rotation. Instruments with ranges 0...> 150 to 0...≤ 270 ↻° can be changed to the other direction. (Beginning and end of the measuring range must be readjusted) Sense of rotation for transmitters with additional gear see "Feature 13 and 14" Line 3: V characteristic not possible for instruments with gear Line 4: For measuring ranges ≤ 90° only			

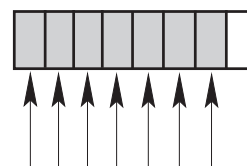


Order Code 707 –					
Features, Selection		*SCODE	no-go		
<b>3. Measuring range</b> (measuring input) $\rightarrow$					
1) 0... 10 $\angle$ °			E	1	.
2) 0... 30 $\angle$ °			E	2	.
3) 0... 60 $\angle$ °			E	3	.
4) 0... 90 $\angle$ °			E	4	.
5) 0...180 $\angle$ °			EM	5	.
6) 0...270 $\angle$ °			EM	6	.
9) Non-standard $[\angle$ °]			E	9	.
0... $\geq$ 5 to 0... < 270					
A) V characteristic $[\pm \angle$ °]			DM	A	.
<p>Line A: Specify start <math>M_A</math> and end <math>M_E</math> of measuring range!            Observe the limits for (<math>M_A [\pm \angle</math>°] <math>\geq</math> 10 and <math>M_E [\pm \angle</math>°] <math>\leq</math> 150) and give both angles separated by an oblique stroke, e.g. <math>[\pm \angle</math>°] 15 / 90!</p> <p>Example of a "V" characteristic for the measuring range <math>[\pm \angle</math>°] 15 / 90 and an output range of 0...20 mA</p> <p>Line 9: With both senses of rotation calibrated, non-standard range: 0 to <math>\geq</math> 5 till 0 to &lt; 90°</p>					
<b>4. Output signal</b> (measuring output) $\rightarrow$					
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)		H		.	D
E) 4...20 mA, 3- or 4-wire connection				.	E
F) 0...20 mA, 4-wire connection		L		.	F
Z) Non-standard, 3- or 4-wire connection [mA]				.	Z
0... > 1.00 to 0... < 20					
<p>Lines A to Z: <math>R_{ext}</math> max. see Section "Technical data".            4-wire connection, <b>with</b> electric isolation only possible with DC/AC power supply (AC/DC power pack).            2-, 3- or 4-wire connection, <b>without</b> electric isolation only possible with DC power supply.            Line F: Only possible with DC/AC power supply (AC/DC power pack)</p>					
<b>5. Power supply</b> $\rightarrow$					
1) 24 ... 60 V DC/AC, <b>with</b> electric isolation		F	BH	.	1
2) 85 ... 230 V DC/AC, <b>with</b> electric isolation		F	BH	.	2
A) 12 ... 33 V DC, <b>without</b> electric isolation		K	BL	.	A
B) 12 ... 30 V DC (Ex), <b>without</b> electric isolation		K	AL	.	B
<p>Lines 1 and 2: Not possible for DC/AC power supply at output signal "Feature 4, line D"!</p>					

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Features, Selection	*SCODE	no-go	
<b>6. Mounting mode</b>			
0) Without foot, without flange			0 . . . . .
1) With foot (mounted)			1 . . . . .
2) With flange (mounted)			2 . . . . .
<b>7. Material of transmitter rear cover / Routing of connecting cable</b>			
1) Plastic / connector <b>less</b> cable plug, socket mounted for cable routed to the <b>rear</b> (see Fig. 7, but less plug)			. 1 . . . . .
2) Plastic / connector <b>less</b> cable plug, socket mounted for cable routed to the <b>front</b> (see Fig. 8, but less plug)			. 2 . . . . .
3) Plastic / connector <b>with</b> cable plug, cable routed to the <b>rear</b> (see Fig. 7)			. 3 . . . . .
4) Plastic / connector <b>with</b> cable plug, cable routed to the <b>front</b> (see Fig. 8)			. 4 . . . . .
5) Metal / screw terminals and PG 11 glands (see Fig. 9)			. 5 . . . . .
Line 5: Recommended for DC/AC power supply, 4-wire connection <b>with</b> electric isolation			
<b>8. Special features</b>			
0) Without	Y		. . 0 . . . . .
1) With			. . 1 . . . . .
Without special features (line 0): Order code complete. With special features (line 1): The features to be omitted must be replaced by an oblique stroke (/) in the order code until reaching the required features			
<b>9. Settings (span adjustment)</b>			
A) Extended setting range + 5% / – 60% Restriction: for angle $\geq 60^\circ$ , supplementary error 0.2% (also possible on versions with additional gear)		Y	. . . A . . . . .
<b>10. Improved climatic rating</b>			
H) Temperature – 40 to + 70 °C, annual mean relative humidity $\leq 95\%$		BY	. . . . H . . . .
J) With <b>Ex</b> version Temperature – 40 to + 60 °C at T6 resp. – 40 to + 75 °C at T5, annual mean relative humidity $\leq 95\%$		AY	. . . . J . . . .
<b>11. Marine version</b>			
L) Version GL (“Germanischer Lloyd”)		Y	. . . . . L . . .
<b>12. Increased vibration resistance</b>			
M) Version with DC power supply, <b>without</b> electric isolation	G	FY	. . . . . M .
N) Version <b>with</b> DC/AC power supply (AC/DC power pack), <b>with</b> electric isolation	G	KY	. . . . . N .
0...200 Hz, <b>25 g</b> continuous, <b>30 g</b> for 2 h 200...500 Hz, <b>15 g</b> continuous Not possible with additional gear			



0 . . . . .

1 . . . . .

2 . . . . .

. 1 . . . . .

. 2 . . . . .

. 3 . . . . .

. 4 . . . . .

. 5 . . . . .

. . 0 . . . . .

. . 1 . . . . .

. . . A . . . . .

. . . . H . . . .

. . . . J . . . .

. . . . . L . . .

. . . . . M .

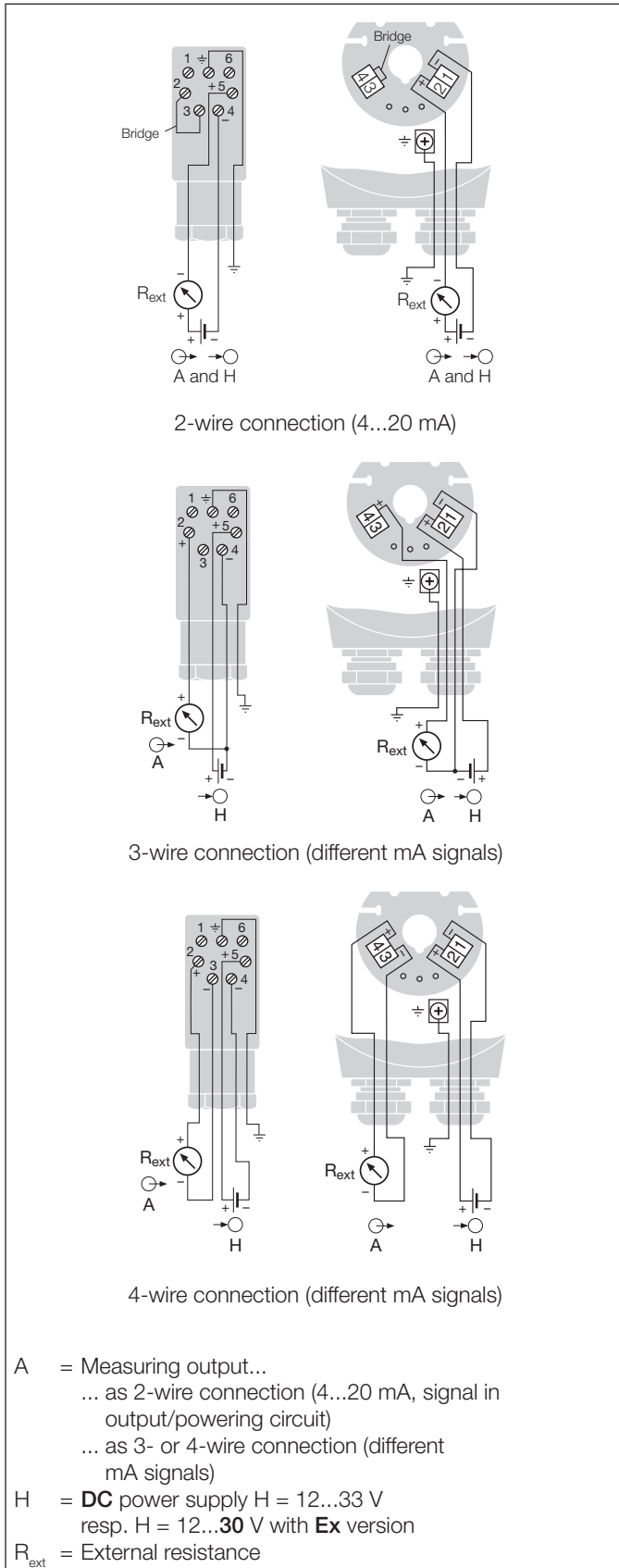
. . . . . N .

Order Code 707 –																													
Features, Selection										*SCODE					no-go														
<p><b>13. Additional gear 2 : 1 to 144 : 1</b></p> <p>Choose the full scale value of KINAX WT 707 (without gear)  ME ≤ 150 <math>\angle^\circ</math>.  Limit of error: ≤ 0.5% for ME ≤ 150 <math>\angle^\circ</math> and  ≤ 1.5% for ME &gt; 150 <math>\angle^\circ</math>.</p> <p>Determine the required reduction ratio to the following formula:</p> $i = \frac{n \cdot 360 [\angle^\circ]}{ME [\angle^\circ]}$ <p>i = Reduction ratio  n = No. of turns (end of range of object being measured)</p> <p>ME = Full scale value of KINAX WT 707 (without gear).</p> <p>If "ME" is higher but max. 150 <math>\angle^\circ</math> and "i" is as small as possible then the hysteresis error will be smaller.</p> <p>Example of calculation of the error of the hysteresis; known are:  n = 4.1 rotations, i = 10, ME = 147.6 <math>\angle^\circ</math> and j = approx. 1.0 <math>\angle^\circ</math>  j = gear backlash</p> $F \% = \frac{100\% \cdot j \cdot i}{n \cdot 360^\circ} = \frac{100 \cdot 1,0 \cdot 10}{4,1 \cdot 360} = \text{approx. } 0.68 \% \text{ error of the hysteresis}$ <p>Gear backlash approx. 1.0 <math>\angle^\circ</math> for 2 ≤ i ≤ 12,5  approx. 1.5 <math>\angle^\circ</math> for 12,5 &lt; i ≤ 60  approx. 2,0 <math>\angle^\circ</math> for 60 &lt; i ≤ 1600</p>																													
1) Transformation 2 : 1 → / →										J					EGY					1 . . . . .									
2) Transformation 4 : 1 → / →										J					EGY					2 . . . . .									
3) Transformation 5 : 1 → / ←										J					EGY					3 . . . . .									
4) Transformation 6 : 1 → / ←										J					EGY					4 . . . . .									
5) Transformation 8 : 1 → / ←										J					EGY					5 . . . . .									
A) Transformation 10 : 1 → / →										J					EGY					A . . . . .									
B) Transformation 12 : 1 → / →										J					EGY					B . . . . .									
C) Transformation 12,5 : 1 → / ←										J					EGY					C . . . . .									
D) Transformation 15 : 1 → / →										J					EGY					D . . . . .									
E) Transformation 16 : 1 → / →										J					EGY					E . . . . .									
F) Transformation 20 : 1 → / ←										J					EGY					F . . . . .									
G) Transformation 22 : 1 → / ←										J					EGY					G . . . . .									
H) Transformation 24 : 1 → / ←										J					EGY					H . . . . .									
J) Transformation 25 : 1 → / →										J					EGY					J . . . . .									
K) Transformation 30 : 1 → / →										J					EGY					K . . . . .									
L) Transformation 32 : 1 → / ←										J					EGY					L . . . . .									
M) Transformation 36 : 1 → / →										J					EGY					M . . . . .									
N) Transformation 40 : 1 → / →										J					EGY					N . . . . .									
O) Transformation 50 : 1 → / ←										J					EGY					O . . . . .									
P) Transformation 60 : 1 → / ←										J					EGY					P . . . . .									
Q) Transformation 64 : 1 → / →										J					EGY					Q . . . . .									
R) Transformation 72 : 1 → / ←										J					EGY					R . . . . .									
S) Transformation 75 : 1 → / →										J					EGY					S . . . . .									
T) Transformation 80 : 1 → / ←										J					EGY					T . . . . .									
U) Transformation 100 : 1 → / →										J					EGY					U . . . . .									
V) Transformation 120 : 1 → / →										J					EGY					V . . . . .									
W) Transformation 144 : 1 → / →										J					EGY					W . . . . .									

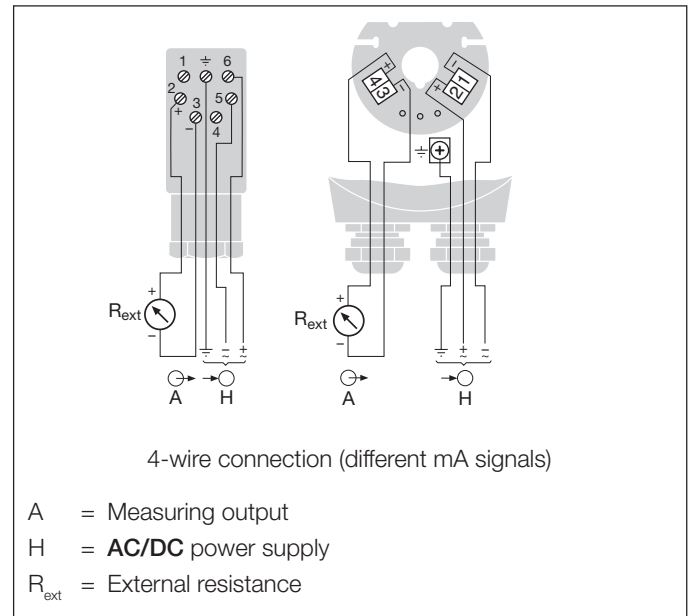


## Electrical connections

2-, 3- or 4-wire connection **without** electric isolation



4-wire connection **with** electric isolation



## Settings

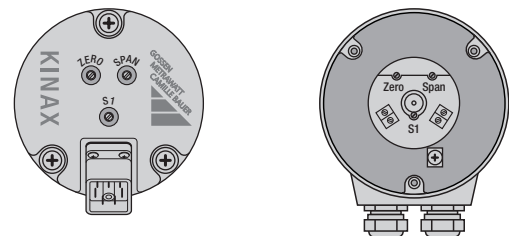


Fig. 10. Position of settings.

Left: Transmitter with plug-in connector.

Right: Transmitter with screw terminals and cable glands.

ZERO = Potentiometer for zero point

SPAN = Potentiometer for measuring range end value

S1 = Switch for reversing direction of rotation for  $\alpha > 150^\circ$ .

Transmitters with the ordering code 707 – ...**D** (see “Table 3: Specification and ordering information”) are designed for either a 2-wire connection with an output range of 4...20 mA or a 3- or 4-wire connection with an output range of 0...20 mA.

If, however, a transmitter be changed from one to the other (see “Electrical connections”), the beginning and end of the measuring range, ZERO and SPAN must be readjusted.

A switch is provided on angular transmitters with a measuring range  $> 150^\circ$  for reversing the direction of rotation. It is marked S1.

## Standard accessories

- 1 Operating Instructions in three languages: German, French, English
- 1 Ex approval, for instruments in Ex version only

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### Dimensional drawings

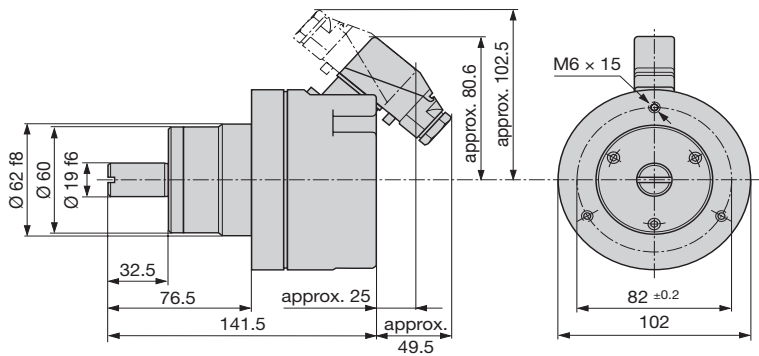


Fig. 11. KINAX WT 707 with plug-in connector.

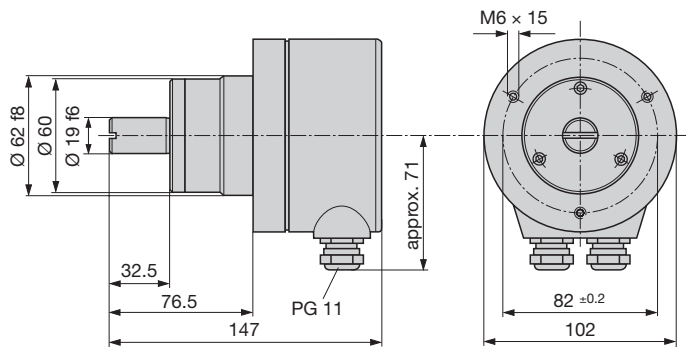


Fig. 12. KINAX WT 707 with screw terminals and cable glands.

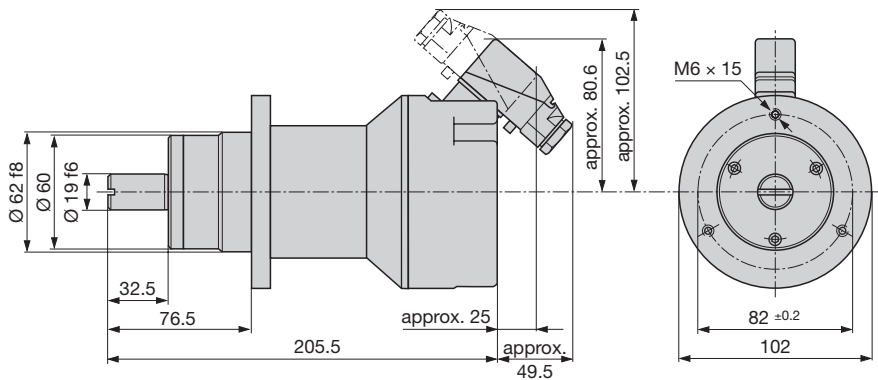


Fig. 13. KINAX WT 707 with additional gear and plug-in connector.

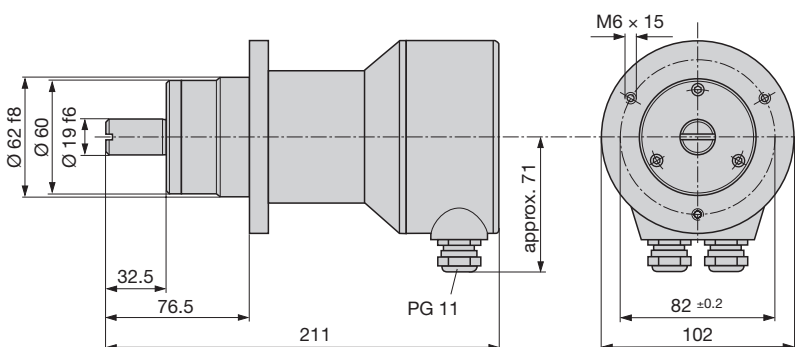


Fig. 14. KINAX WT 707 with additional gear, screw terminals and cable glands.

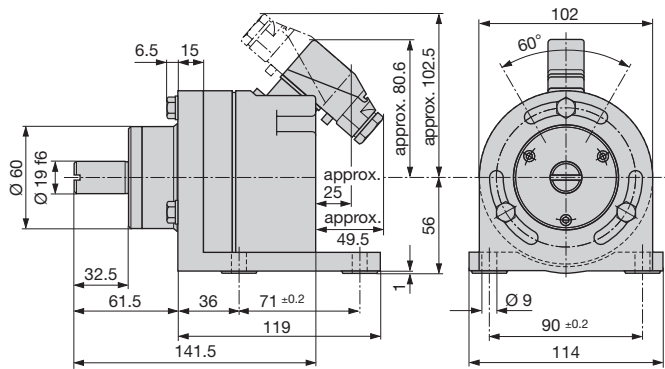


Fig. 15. KINAX WT 707 with plug-in connector and foot.

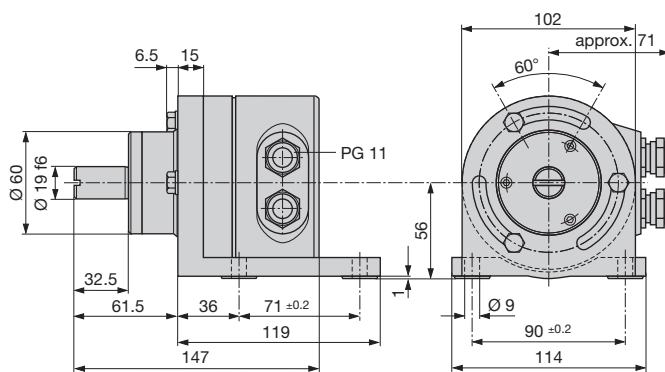


Fig. 16. KINAX WT 707 with screw terminals, cable glands and foot.

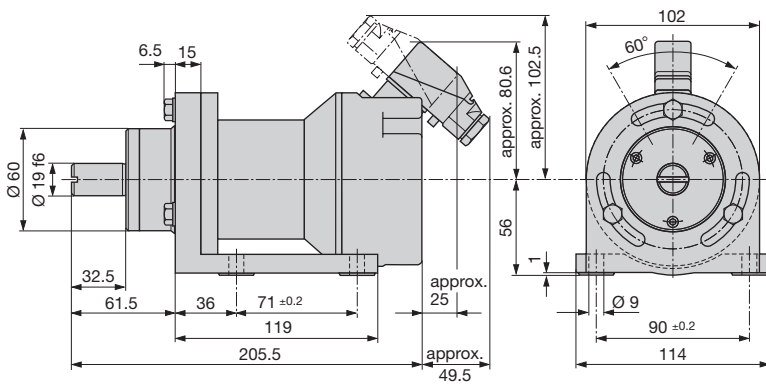


Fig. 17. KINAX WT 707 with additional gear, plug-in connector and foot.

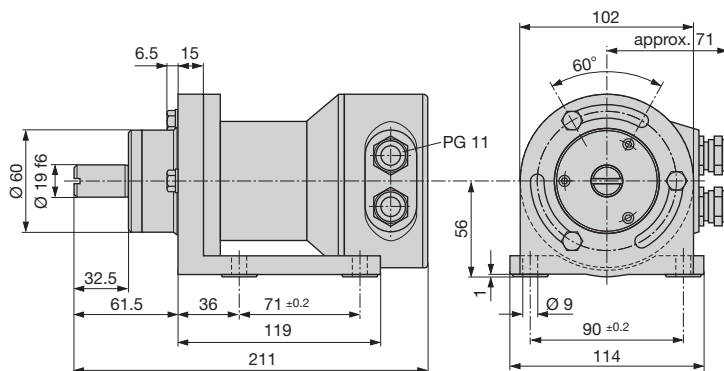


Fig. 18. KINAX WT 707 with additional gear, screw terminals, cable glands and foot.

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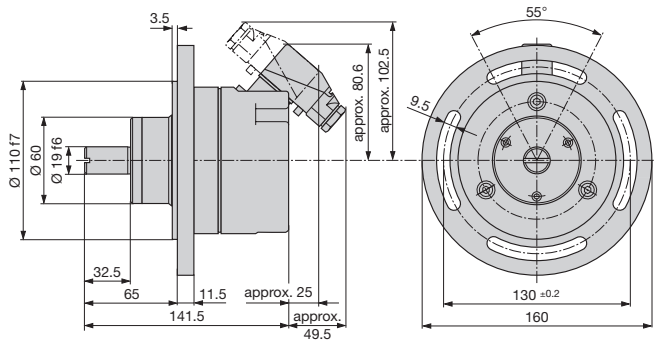


Fig. 19. KINAX WT 707 with plug-in connector and flange.

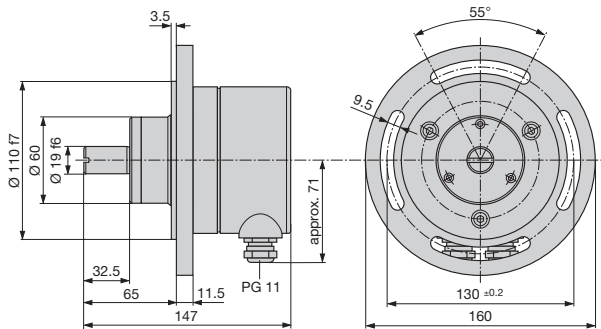


Fig. 20. KINAX WT 707 with screw terminals, cable glands and flange.

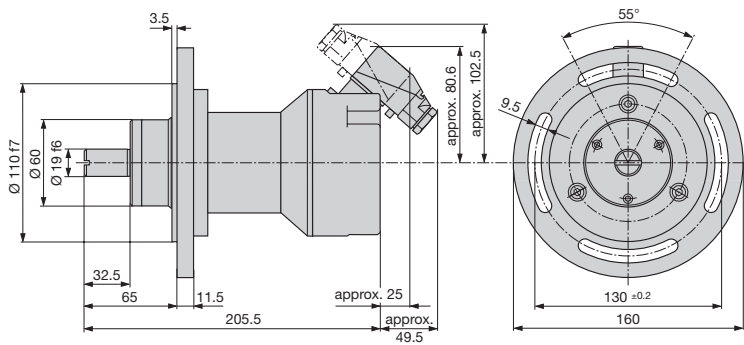


Fig. 21. KINAX WT 707 with additional gear, plug-in connector and flange.

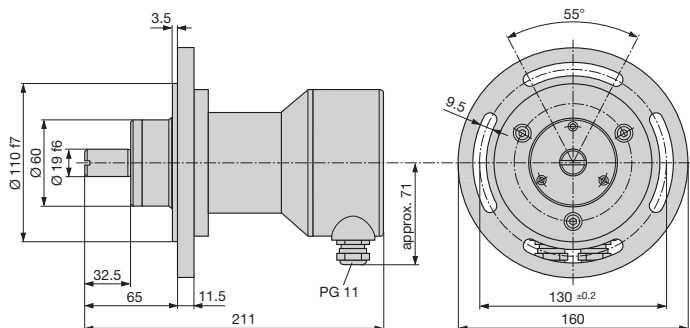


Fig. 22. KINAX WT 707 with additional gear, screw terminals, cable glands and flange.

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