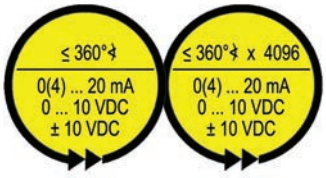
Absolute electro magnetic encoder
Series TBA / TRA Singleturn / Multiturn
Analogue output

SUPREME SENSORING
TWK

Data sheet No.: TBA/TRA 14269 DE
Date: 18.04.2019



- **Robust design for harsh applications e. g. cranes and construction machinery**
- **Magnetic Sensor system(s)**
- **Measuring ranges**
  TBA: **360°**
  TRA: **1,474,560°**
  (4096 revolutions x 360°)
- **Protection grade IP 65/ IP67**
  (IP 69K option)
- **TRA Option:**
  Redundant design (Data sheet - TRA 12665)

Design

- Robust housing (Wall thickness max. 5 mm) manufactured from seawater-proof aluminium (AlMgSi1 - 3.2315) or stainless steel (Material: 1.4305 or 1.4404).
- Shaft fitted with ball bearings bears the magnet for recording the angular position and the drive gear of the multiturn transmission for absolute revolution counting
- Design form in Ø 42, Ø 50, Ø 58 mm diameter and customer specific applications
- Magnetic sensor system(s) for position measurement
- Signal output via 12-Bit D/A converter
  Analogue Signal outputs:
  0 (4) to 20 mA, 0 to 10 VDC or ± 10 VDC available.
- Electrical connection via connector M12x1 or via cable

Function

The rotary encoder has an analogue interface. The D/A converter has a resolution of 12 bits, which are distributed over the maximum measuring range of 360° (TBA) or 360° x 4096 revolutions (TRA).

The sensor TBA has a measuring range of 360 degrees, that means one turn. The encoder TRA provides additionally the revolutions (max. 4096) absolute with a gear. The standard values are 360° at TBA and 1,474,560° (360° x 4096 revolutions) at TRA.

The output signal can be parameterised and referenced via Teach-in by means of two multifunction pins (MFP).

For both sensors TBA and TRA the Teach-in functionality is integrated.

Via the Teach-in functions following parameters can be changed: Set zero point, set final value, set Preset value (middle of the measuring range), code sense (CW or CCW) and also the setting of the default values.

With the functions set zero point and set final value the gradient of the signal output can be changed.

Technical Data

Electrical Data

■ Sensor system(s):	Magnetic Sensor system(s)
■ Supply voltage range:	Ø 58: 9 to 36 VDC (Output: A, B, C) ± 13 to ± 16 VDC (Output: D) Ø 42, Ø 50: 18 to 28 VDC (Output: A, B, C) ± 13 to ± 16 VDC (Output: D) protected against polarity reversal, short-circuit proof
■ Power consumption:	TBA: < 1 W TRA: < 1,5 W
■ Measuring range:	TBA: 360° TRA: 1,474,560° (4096 revolutions x 360°, Default-adjustment 3600°)
■ D/A-Converter:	12 Bit
■ Code sense:	CW* or CCW** adjustment possibility
■ Accuracy TBA:	± 0.15 %
■ Accuracy TRA:	± 0.3 %
■ Repeatability:	± 0.02 %
■ Temperature drift:	< 0.01 % / ° K typ.

Electrical output data

■ Current output A, B: Load resistance:	A: 0 to 20 mA; B: 4 to 20 mA 0 ... 500 Ω
■ Voltage output C, D Output current:	C: 0 to 10 VDC; D: ±10 VDC (optional) max. 5 mA correspond to a load resistance of ≥ 2 kΩ short-circuit proof

Mechanical data

■ Operating speed:	max. 1000 rpm (shaft sealing ring), max.10,000 rpm (Nilos ring)
■ Angle acceleration:	10^5 rad/s² max.
■ Moment of inertia (Rotor):	20 gcm²
■ Operating torque:	≤ 2 Ncm
■ Starting torque:	≤ 3 Ncm
■ Permanent shaft load:	250 N axial, 250 N radial
■ Bearing service live:	≥ 10^9 revolutions***
■ Weight:	TBA Ø 58: Aluminium approx. 0.3 kg, Stainless steel approx. 0.4 kg TRA Ø 58: Aluminium approx. 0.5 kg, Stainless steel approx. 0.7 kg

*) CW = Increasing when viewing the clockwise rotating shaft
**) CCW = Increasing when viewing the counter clock wise rotating shaft
***) This value applies for max. shaft load

Environmental data

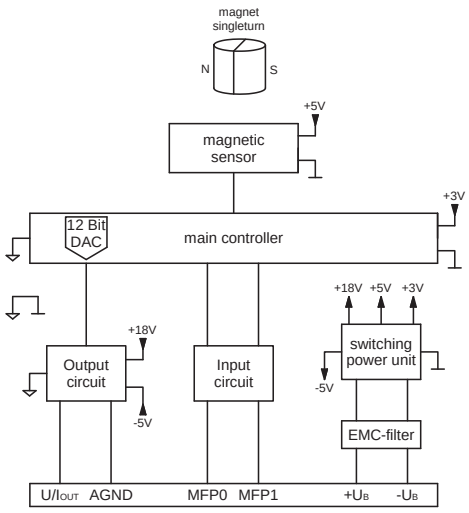
■ Operating temperature range:	- 40 °C to + 85 °C
■ Storage temperature range:	- 20 °C to + 60 °C (depending on packaging)
■ Resistance	
☐ to Shock:	250 m/s², 6 ms, 100 x each in 3 axes (higher values optional, e.g. 500 g) DIN EN 60068-2-27
☐ to Vibration:	100 m/s², 5 Hz ... 2000 Hz, 1 h each in 3 axes (higher values optional e. g 100 g) DIN EN 60068-2-6
■ EMC-standards:	DIN EN 61 000 - 6 - 2 Immission (Burst/ESD/ ...) DIN EN 61 000 - 6 - 4 Emission
■ Protection grade (DIN EN 60529):	Shaft side: IP 67 - Shaft sealing ring, IP 65 - Nilos ring Moulded Housing: IP67, Option IP 69K (potting)

(For higher protection grades and technical questions please contact our technical persons.)

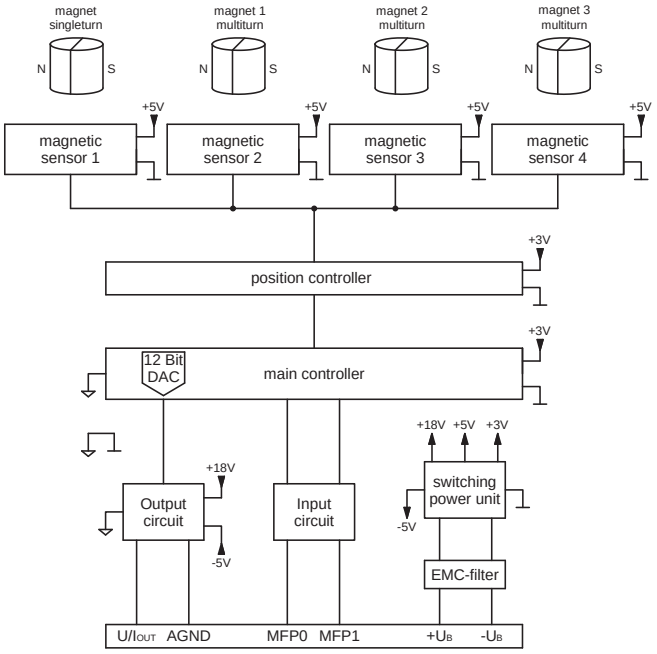
Principle diagrams

Principle diagrams TBA and TRA (Model Ø 58)

Model: TBA



Model: TRA



Setting of the measuring range

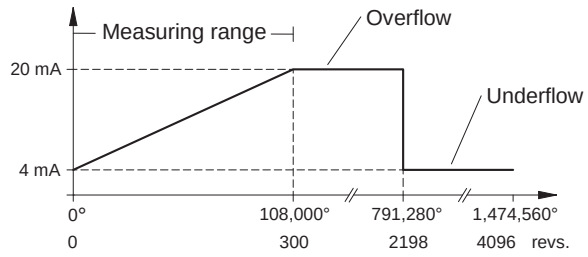
Standard TRA measuring range

The encoder TRA has a maximal measuring range of 1,474,560° (360° x 4096 revolutions).The standard setting is 3,600° (10 revolutions are the default value). With the Teach-in functionality (see MFPs) the encoder can be progammed customer specific e.g. to 4,096 revolutions or other values.

Deviating measuring ranges from the standard can be made in our factory. The customer must be specify this value in the order code number.

With the Multi-function pins (MFP) the predefined values can be adjusted by the customer. Depending from the measuring value for the revolutions ($\neq 2^n$) you can get a symmetric Over- and Underflow value in the signal output (see Characteristic curve 1) .

Characteristic curve 1: Measuring range 108,000° respectively 300 revolutions as an example (Output B)



On request customer specific signal outputs or outputs without Overflow or Underflow are feasible.

Note:

1. If you can not find the measuring range by turning the shaft please set Preset value via the MFPs. It is possible that the output signal is in the Over/Underflow area. In this case the encoder set the Mid-range of the signal output.

2. At setting of the zero point and the final value of the measuring value you need a certain distance (> 2.5 °) between both values. The programming of these both values at the same position is not feasible.

Adjustment via Multi-functional pins

Adjustment via Multi-functional pins

The customer specific parameter zero point, end value, preset value, code sense which depends on the application and the default values can be set via both Multi-functional pins 'MFP0' and 'MFP1'. The input circuit is E1 (see page 6). The logical level are '0' : 0 VDC or '1' : 24 VDC.

With the functions set zero point and set the end value the gradient of the signal output can be changed.

Table for Multi functional pins (MFP)

Function	MFP 0	MFP 1	Remark
Set zero point	1	0	Set pin MFP 0 to logical one for the duration of ~2 s.
Set end value	0	1	Set pin MFP 1 to logical one for the duration of ~2 s.
Set default value	1	1	Simultaneously set pins MFP 0 and MFP 1 to logical one for the duration of ~2 s. The default setting is restored.
Changing the signal path CW / CCW	1 0	0 1	Attention: with the same shaft position! Set pin MFP 0 to logical one for the duration of ~2 s. After a pause of at least 0.5 s: Set pin MFP 1 to logical one for the duration of ~2 s.
Set preset value (middle of measuring range)	1 1	0 0	Attention: with the same shaft position! Set pin MFP 0 to logical one for the duration of ~2 s. After a pause of at least 0.5 s: Set pin MFP 0 to logical one for the duration of ~2 s.
Normal operation	0	0	

Note:

1. If you can not find the measuring range by turning the shaft please set preset value via the MFPs. It is possible that the output signal is in the Over/Underflow area. In this case the encoder set the Mid-range of the signal output.

2. At setting of the zero point and the final value of the measuring value you need a certain distance (> 2,5 °) between bothvalues. The programming of these both values at the same position is not feasible.

Default values

	Parameter	TBA	TRA
	Measuring range	0 to 360°	0 to 360° x 4096 = 1,474,560°
Default values (ex works)	Measuring range*	360°	3600°
	Preset value*	180°	1800°
	Code sense*	CW	CW

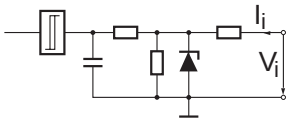
* Other values on request

To make programming and operation easy please use the Analogue Hand Programming device Model PMA-05 (see Datasheet PMA11443).

Input circuit E1, Timing diagrams and Output circuits

Input circuit for input E1 (MFP-Multi functional Pins)

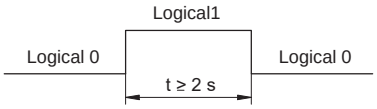
Input E1 active "high"



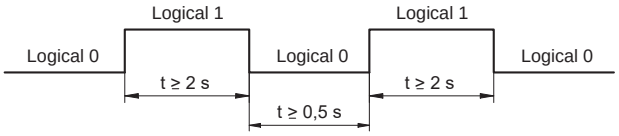
Log 0 < 5 V or not connected
Log 1 = 11 ... Vs
E1 specification

Timing diagrams for the MFP settings

1. Set MFP 0 or MFP 1 once
Set zero point (MFP 0)
Set end value (MFP 1)



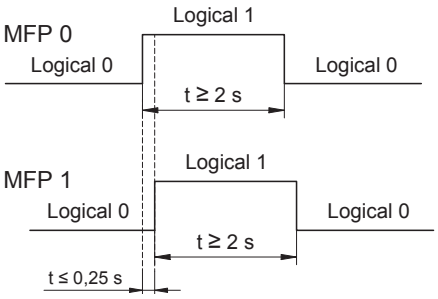
2. Set MFP 0 and/or MFP 1 twice with the same shaft position
Set preset value (2 x MFP 0)
Change the signal path (MFP 0 - MFP 1)



Without position change

3. Set MFP 0 and MFP 1 simultaneously

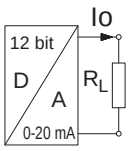
Time difference between MFP 0 and MFP 1 ≤ 0.25 s.



Output circuit

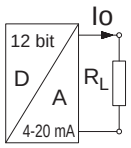
Output A

Io = 0 - 20 mA
R_L = 0 - 0.5 kΩ



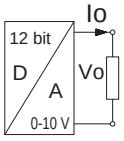
Output B

Io = 4 - 20 mA
R_L = 0 - 0.5 kΩ



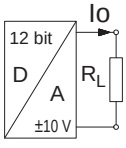
Output C

Vo = 0 ... 10 V
Io max. = 5 mA
R min. = 2 kΩ



Output D

Vo = -10 ... +10 V
Io max. = 5 mA
R min. = 2 kΩ



Electrical connection, Mating connectors, Contact arrangements

Electrical connection

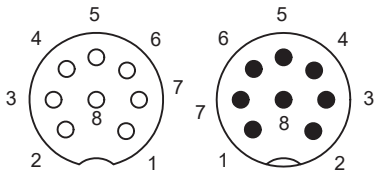
- TBA Ø 58: M12x1, Pin, 8-pole, A-coded or radial cable, 8-wire
  TRA Ø 58: M12x1, Pin, 8-pole, A-coded or radial cable, 8-wire
- The connection diagram is an integral part of the delivery and is enclosed with every device.

Mating connectors (must be ordered separately)

Order code number	STK 8GS54	STK 8WS86	STK 8GS105
Type	M12x1	M12x1	M12x1
Pole number	8	8	8
Version	socket, A-coded	socket, A-coded	socket, A-coded
Connector design	straight	angled	straight
Housing material	brass nickel-plated	brass nickel-plated	stainless steel
Cable ø (mm)	6 - 8	6 - 8	5.5 - 8.6
Connection	with screw	with screw	with screw
Protection grade	IP 67	IP 67	IP 67
Screening	on the housing	on the housing	on the housing
Max. connection cross section (mm²)	0.5	0.5	0.5

Please note: The position of the coding groove of the angled connector must be defined by the customer.

Contact arrangements M12x1



Socket, 8-pole, A-coded

Pin, 8-pole, A-coded

Connection diagrams

Connection diagram for signal outputs A, B, C

M12x1, 8-pole	Connected with
1	$+V_S$ = 9…36 VDC, P_D < 1 W (TBA) P_D < 1.5 W (TRA)
2	$-V_S$ = 0 VDC
3	I_O = 0 (4) … 20 mA (4096 steps = 12 Bit) or V_O = 0 ... 10 Volt
4	0V Analog common
5	Multi-functional input MFP0 (Input circuit E1)
6	Multi-functional input MFP1 (Input circuit E1)
7/8	Not connected

Connection diagramm for signal output D

M12x1, 8-pole	Connected with
1	$+V_S$ = + 13…+ 16 VDC, P_D < 1 W (TBA) P_D < 1.5 W (TRA)
2	$-V_S$ = - 13…- 16 VDC
3	V_O = - 10 ... + 10 VDC
4	0V Analog common
5	Multi-functional input MFP0 (Input circuit E1)
6	Multi-functional input MFP1 (Input circuit E1)
7/8	Not connected

Absolute electro magnetic encoder
Series TBA / TRA Singleturn / Multiturn
Analogue output

Order code number

TRA	58 -	K	A	3600	W	S	B	01

Model:
TBA Singleturn encoder with analogue output (design Ø 58 mm)
TRA Multiturn encoder with analogue output (design Ø 58 mm)

Design form:

Flanschart:
58 K Clamped flange, shaft Ø 10 mm with flat
KF Clamped flange, shaft Ø 10 mm with Woodruff key
KP Clamped flange, shaft Ø 10 mm with feather key
KZ Clamped flange, shaft for measuring gear ZRS acc. data sheet ZRS 11877
S Synchro flange, shaft Ø 6 mm
SR Synchro flange, clamped flange for Ø 12 mm (Stator coupling ZMS58, acc. ZMS 12939)
SP Synchro flange, shaft Ø 12 mm with feather key

Housing material:
A Aluminium 3.2315
S Stainless steel 1.4305
V Stainless steel 1.4404

Measuring range:**
360 Measuring range = 360° - TBA - standard
3600 Measuring range = 3600° - TRA - standard

Code sense:
W CW**
C CCW***

Electrical connections:
K 1 Cable length 1 m
S Device connector M12

Output signals:
A 0 - 20 mA
B 4 - 20 mA
C 0 - 10 VDC
D ± 10 VDC

Electrical and
01 mechanical variants*

* The basic versions in accordance with the data sheet bear the code number 01. Variations from the basic version are indicated with a consecutive number and are documented in our works.

** Indication in °

Assignment table for flange, sealing of bearings, rpm and protection grade

Assignment table for flange, sealing of bearings, rpm and protection grade (design Ø 58)

Flange type	Construction	rpm	Protection grade
Clamp flange K, KF, KP	Shaft sealing ring	max. 1000 rpm	IP67
			IP69K - housing side (option)
Clamp flange KZ	Shaft sealing ring	max. 1000 rpm	IP67
			IP69K - housing side (option)
Synchro flange S, SP	Shaft sealing ring	max. 1000 rpm	IP67
	Nilos ring	max. 10,000 rpm	IP65

Accessories

Analogue Hand Programming Device Model PMA-05

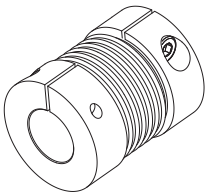
To program the encoder TRA/ TBA with Teach-in functionality

See data sheet PMA11443

Play free bellows coupling BKK 32 / x - y

x and y: bore diameter for shaft mounting

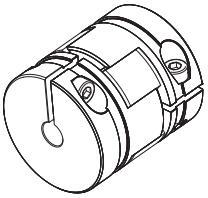
See data sheet BKK 11840



Play free clamp coupling KK14S / x - y (without groove)

x and y: bore diameter for shaft mounting

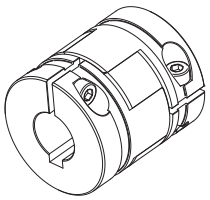
See data sheet KK 12301



Play free clamp coupling KK14N / x - y (with groove)

x and y: bore diameter for shaft mounting
With groove for keyway according to DIN 6885 Bl. 1 – JS9.

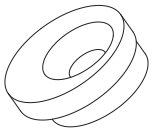
See data sheet KK 12301



KL 66-2-S

Mounting brackets for mounting encoders.

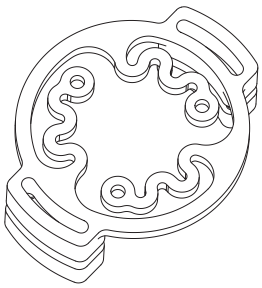
See data sheet MZ 10111



ZMS58

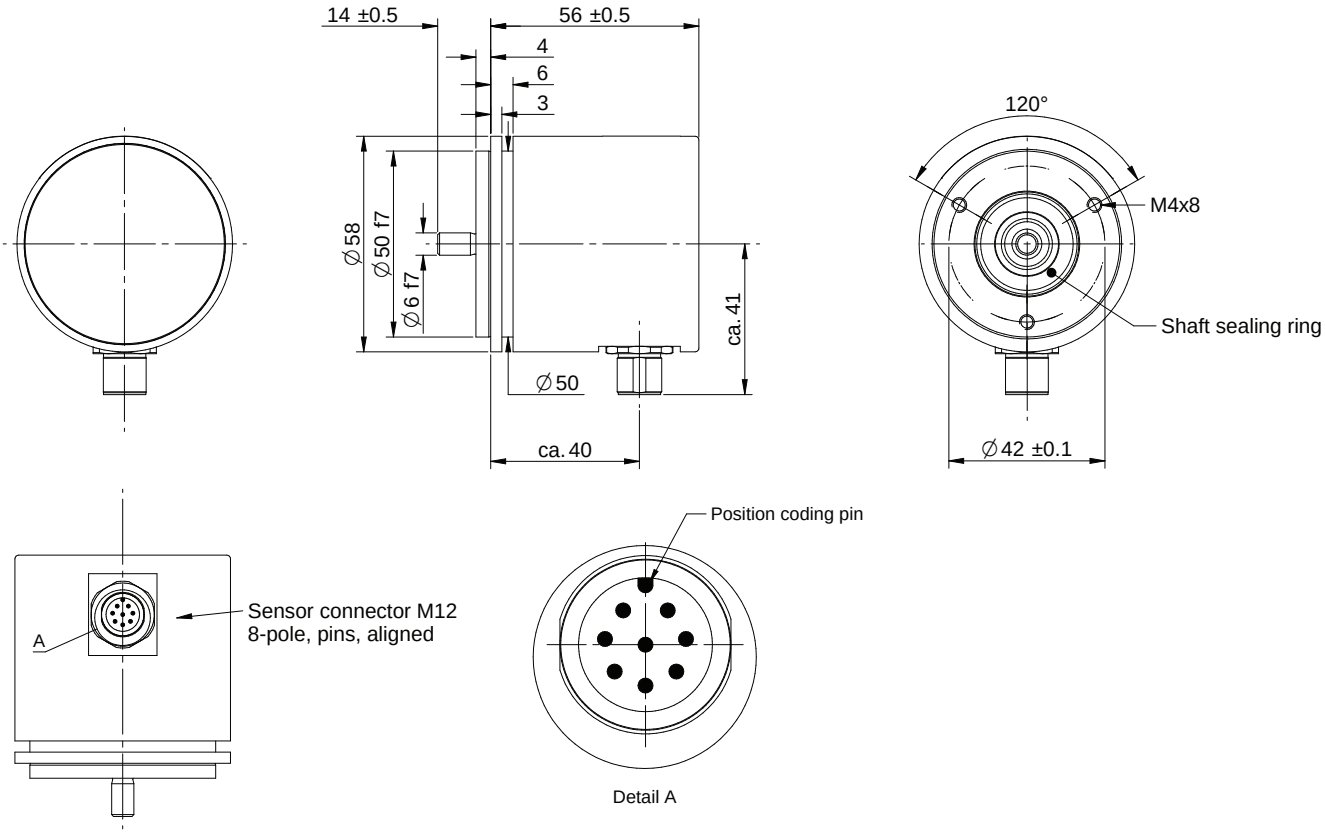
Torque arm/ stator. Can be used as encoder shaft holder for version 'clamp shaft' to compensate for radial and axial play of the drive shaft.

See data sheet ZMS 12939

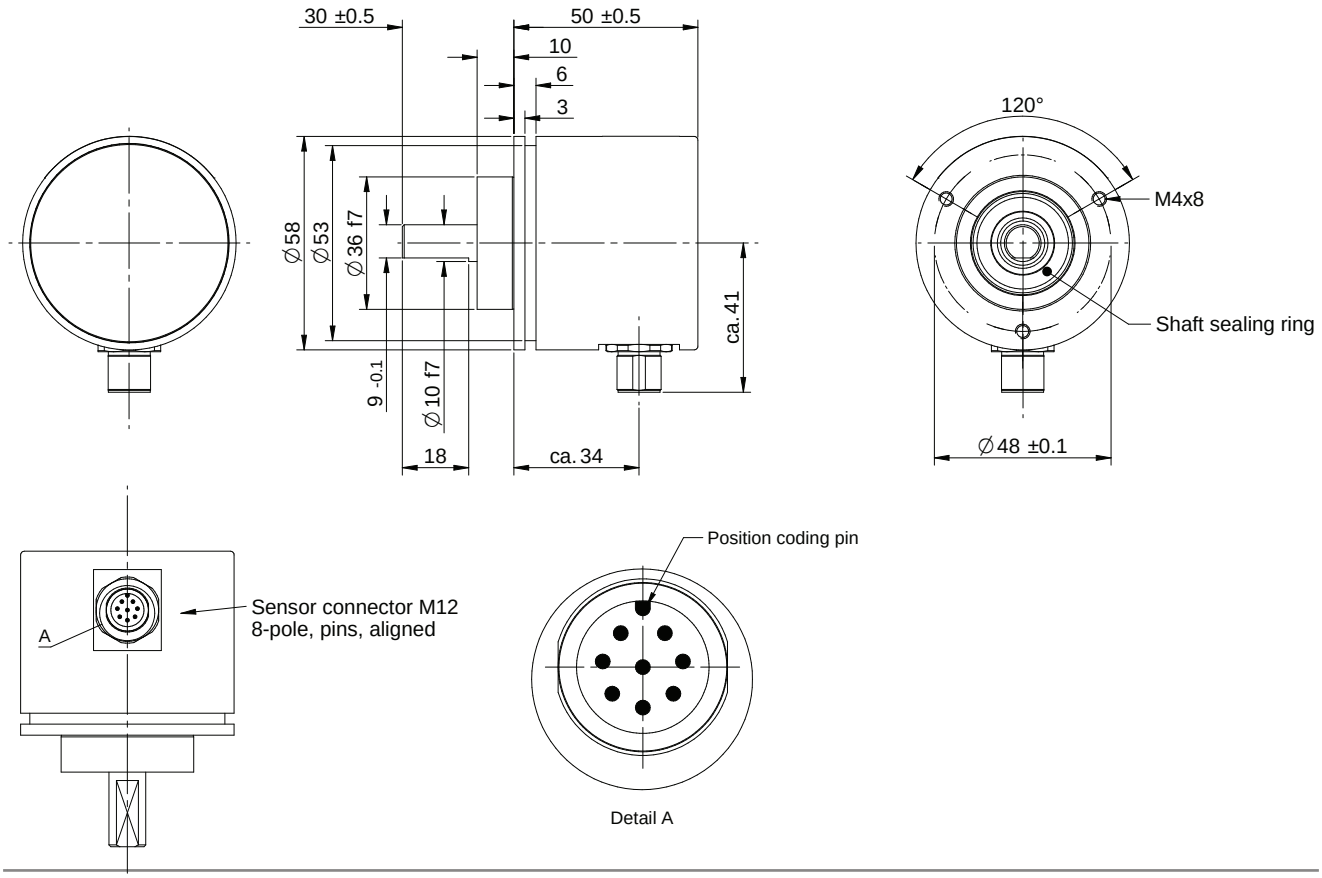


Drawings (data in mm)

Order code number: **TBA58 - SA 360 W S B01**

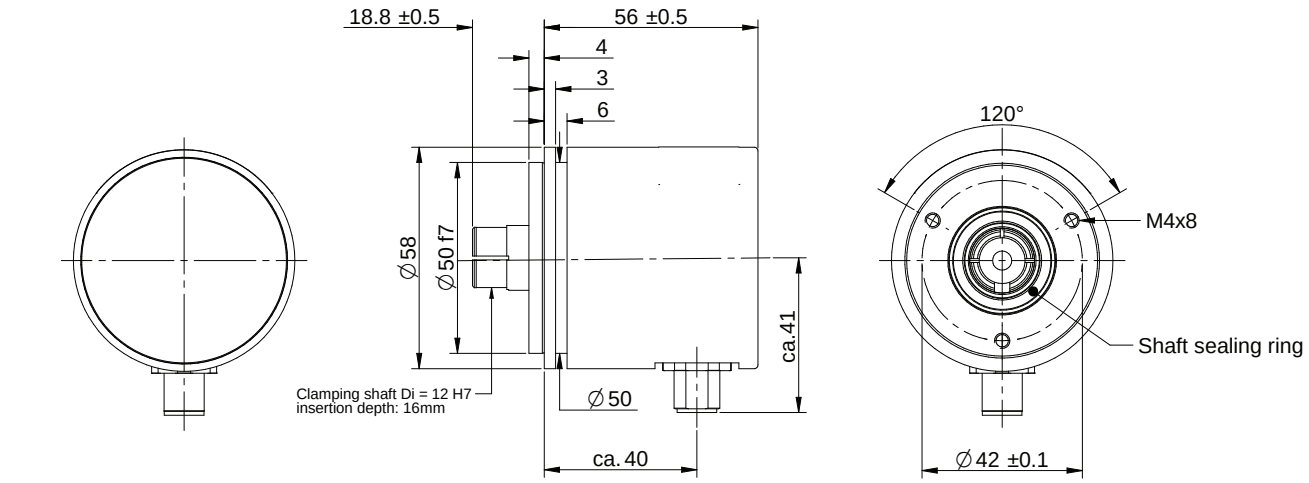


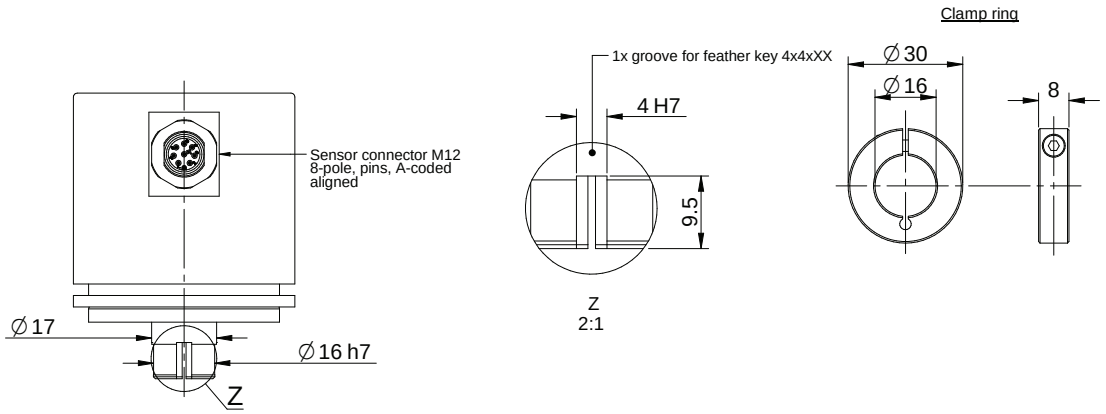
Order code number: **TBA58 - KA 360 W S B01**



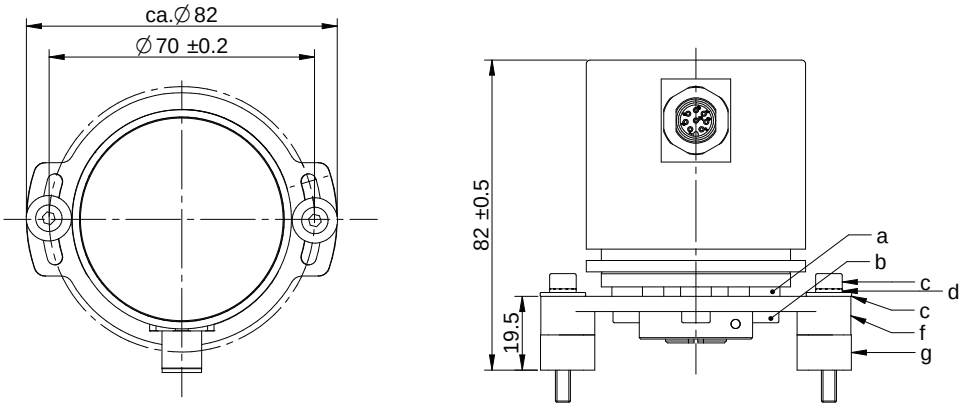
Drawings (data in mm)

Order code number: **TBA58 - SRA 360 W S B01**





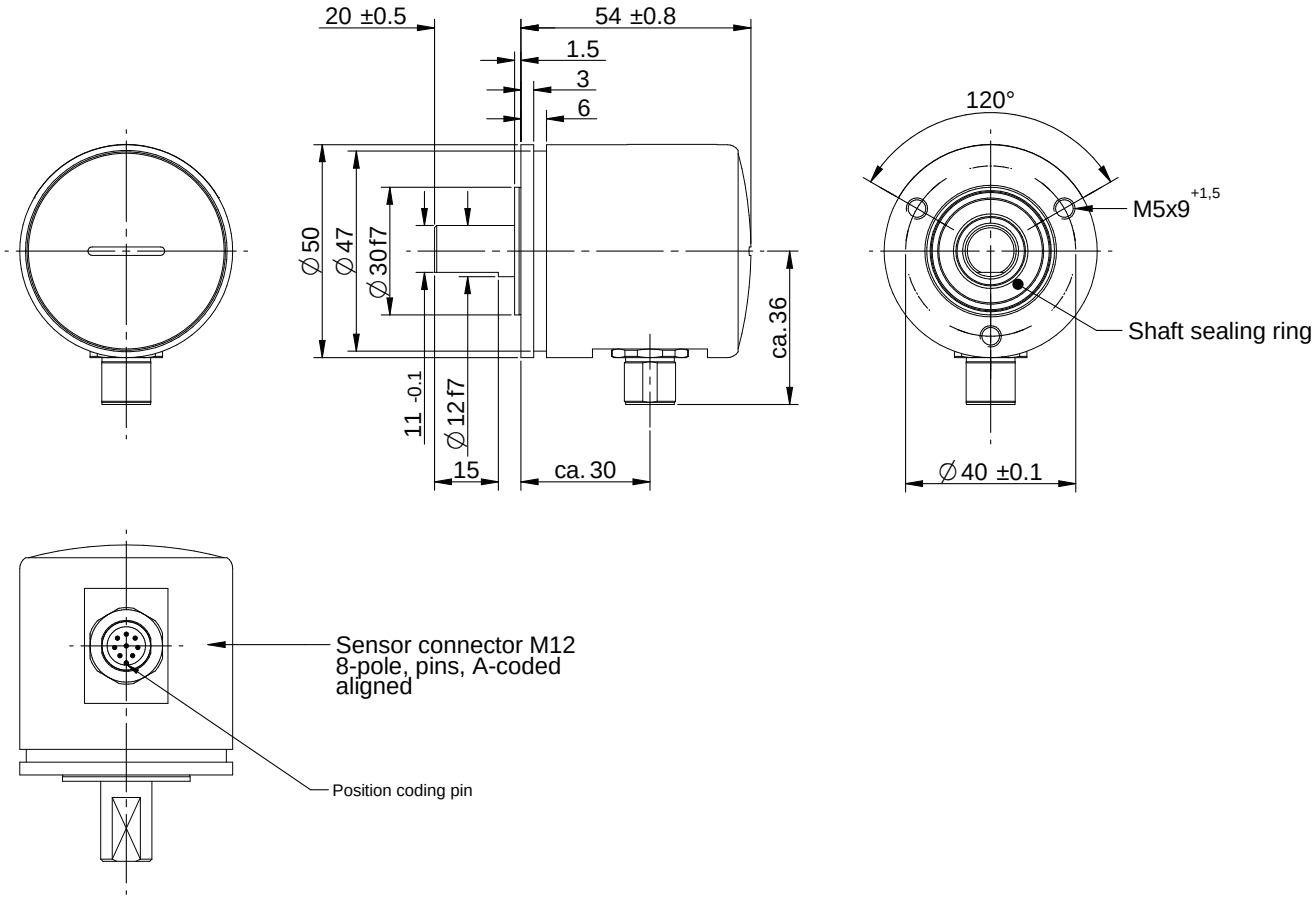
Stator coupling ZMS58-S-H1-K01



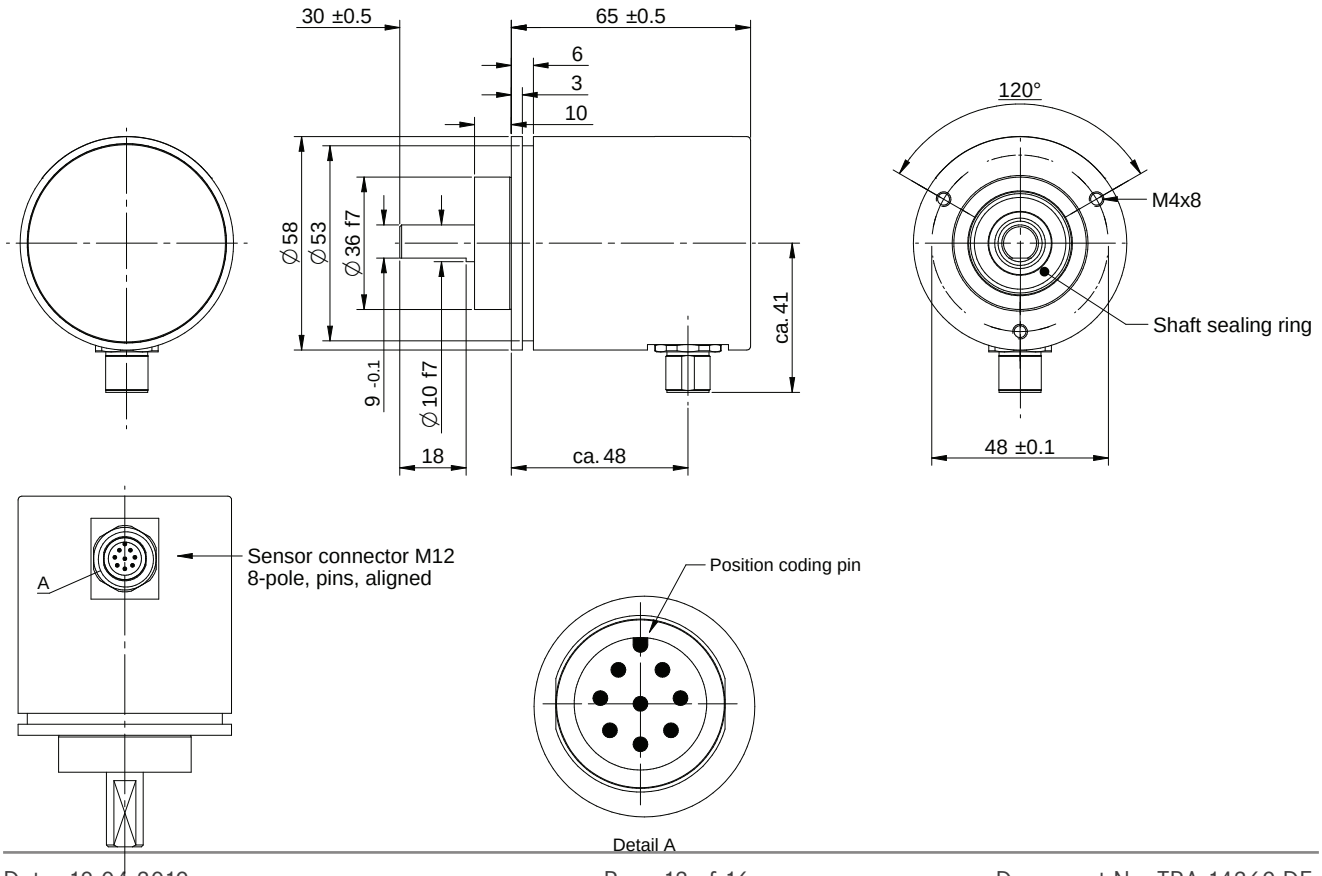
a = Lock washer made of PA
b = Bolt DIN912-M4x10 made of stainless steel
c = Bolt DIN912-M4x30 made of stainless steel
d = Lock washer made of stainless steel
e = Washer DIN9021-4,3
f = Torque support ZMS58-S-H1-K01
g = Height adapter

Drawings (data in mm)

Order code number: **TBA50 - SA 360 C S A01**

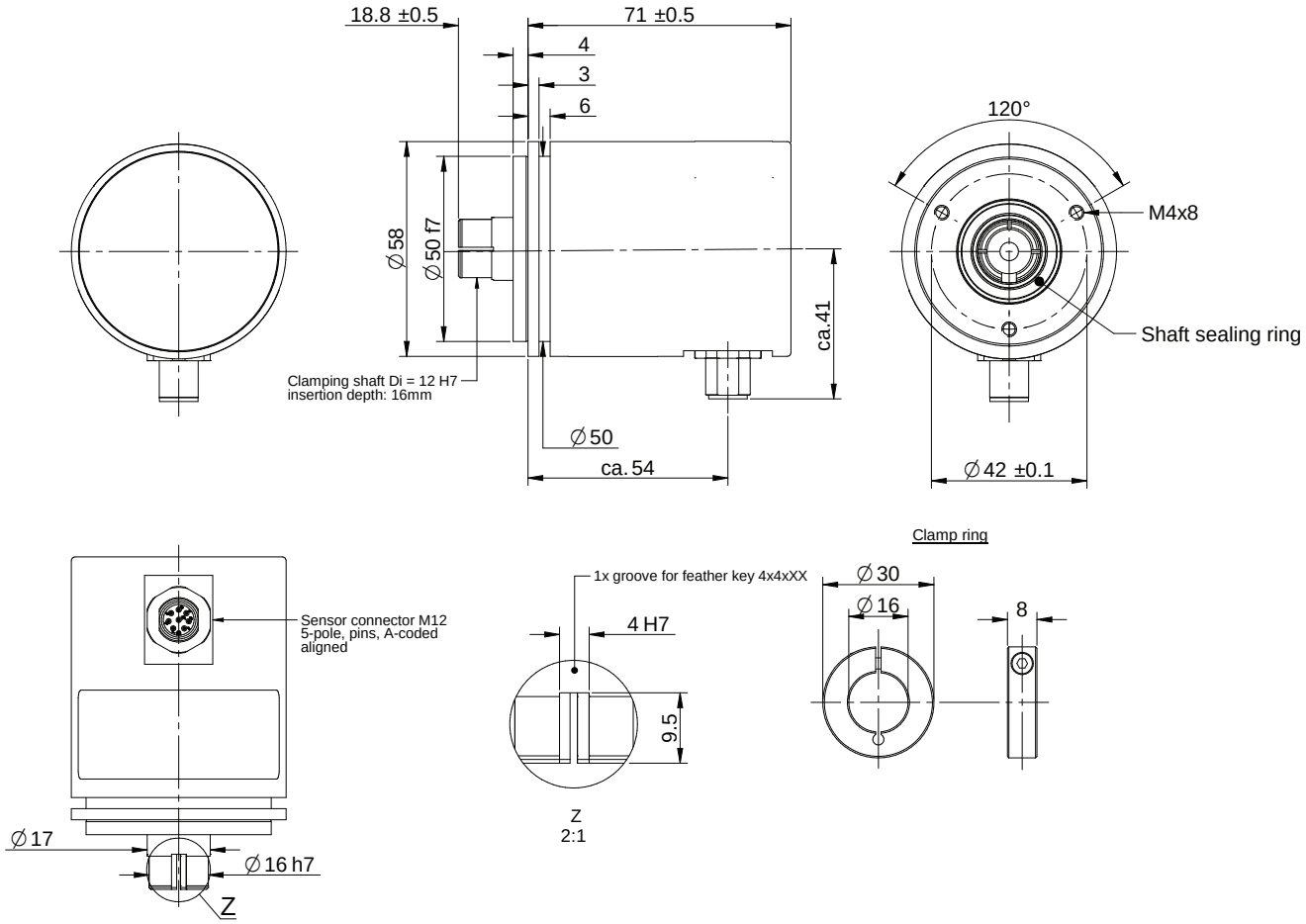


Order code number: **TRA58 - KA 3600 W S B01**

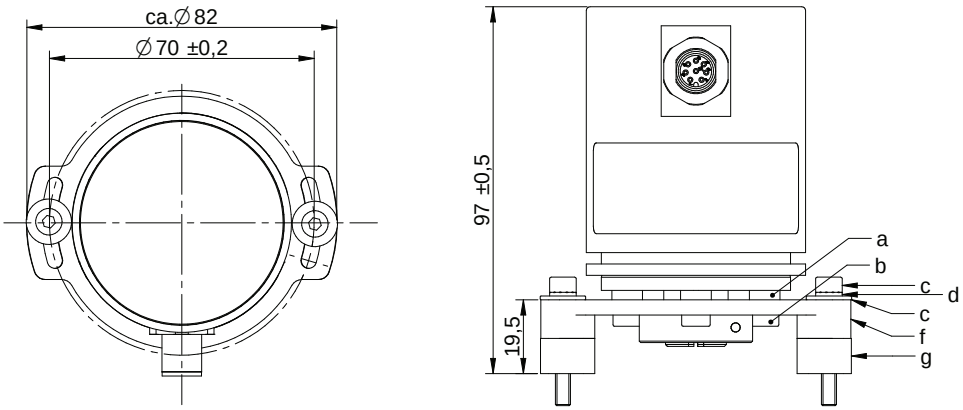


Drawings (data in mm)

Order code number: **TRA58 - SRA 3600 W S B01**



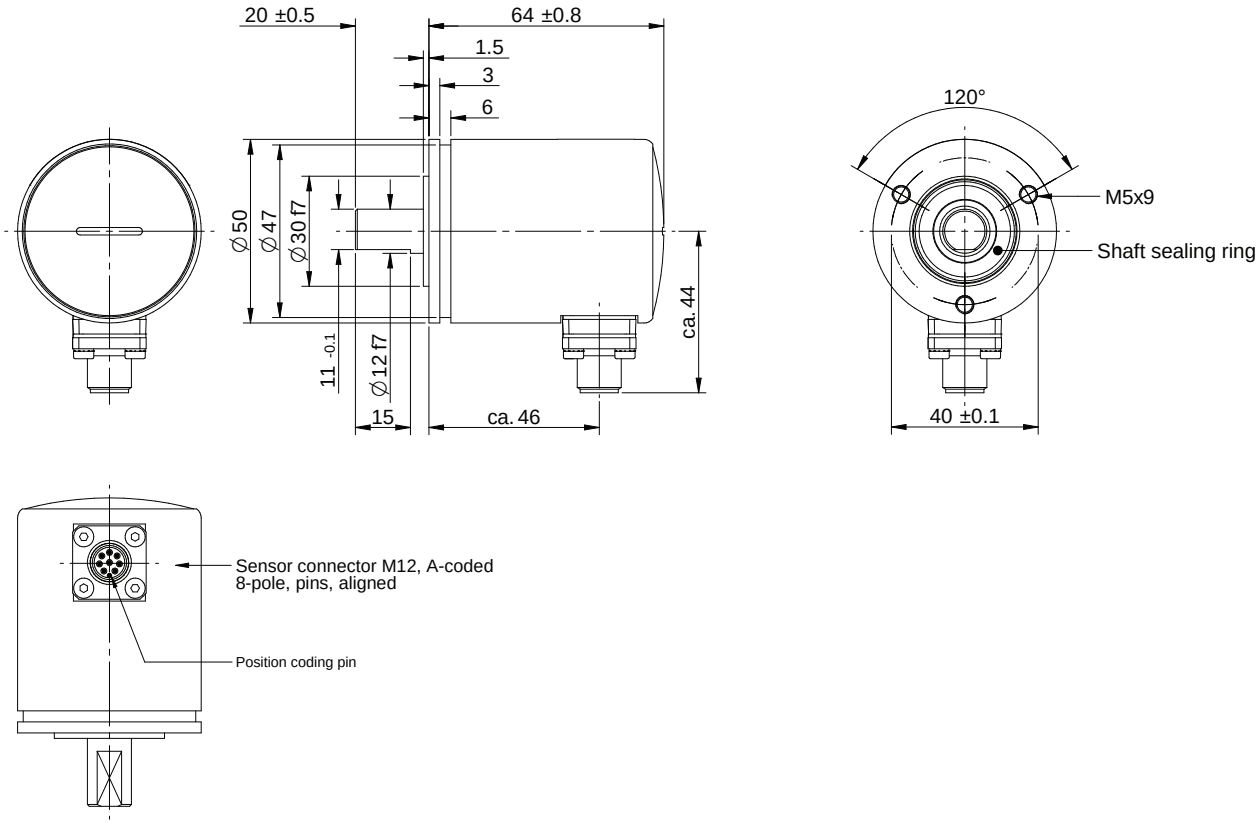
Stator coupling ZMS58-S-H1-K01



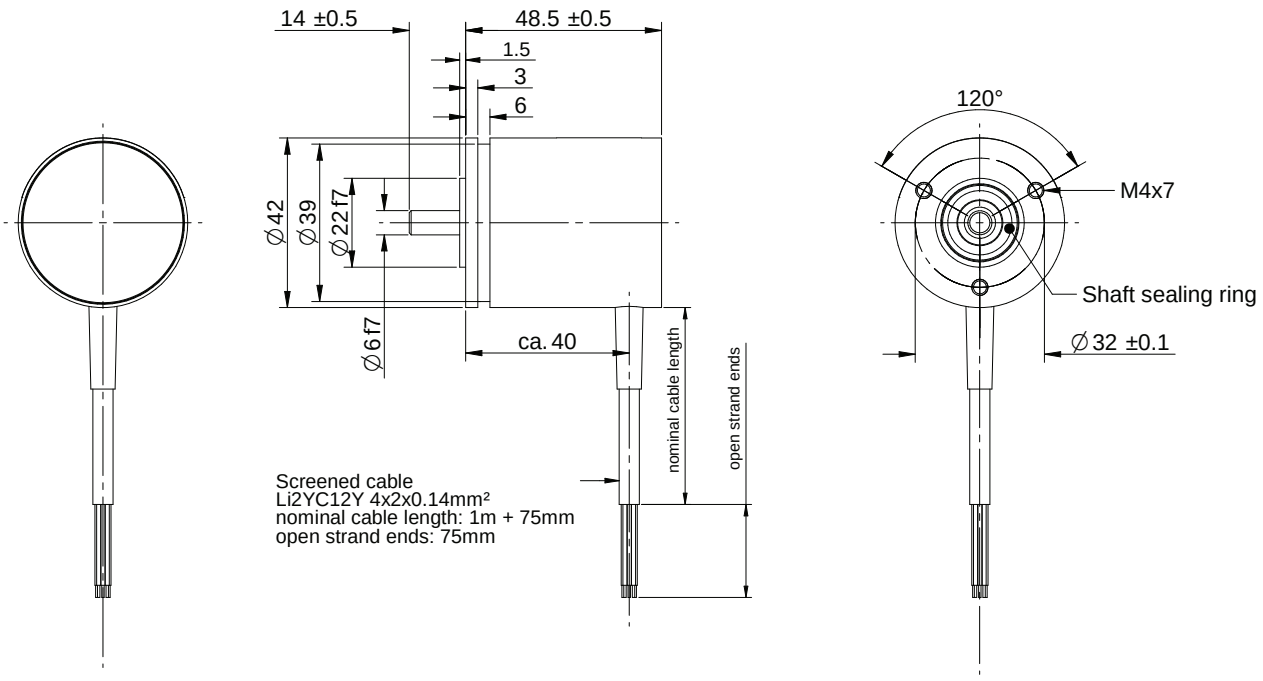
a = Sicherungsscheibe aus PA
b = Schraube DIN912-M4x10 aus VA
c = Schraube DIN912-M4x30 aus VA
d = Sicherungsscheibe aus VA
e = Scheibe DIN9021-4,3
f = Drehmomenstütze ZMS58-S-H1-K01
g = Höhenadapter

Drawings (data in mm)

Order code number: **TRA50 - SA 3600 W S C01**



Order code number: **TBA42 - SA 360 W K A01**



Drawings (data in mm)

Order code number: **TRA42 - SA 3600 W K B01**