



Safety over  
**EtherCAT®**



- Contactless, wear-free sensor system according to the Hall principle
- High vibration and shock resistance thanks to the robust mechanical design
- SIL2 and Performance Level d
- Safe position and safe speed signal
- Resolution: up to 8192 steps / 360° ÷ (13-bit)
- Measuring range: 4096 revolutions (12-bit)
- Protection class: up to IP69K
- Programmable via EtherCAT
- Option: Draw wire version with integrated encoder: TRK125-D

## Design and function

Recording of the angular position and revolutions by means of Hall sensors - absolute multiturn transmission for up to 4096 revolutions - data output plus parameterisation and diagnosis via EtherCAT.

Robust housing manufactured from seawater-resistant aluminium or stainless steel - stainless steel shaft - ball bearing with radial shaft seal - sensor circuit consisting of ASIC with Hall elements - electrical connection via M12 connector or cable outlet.

In the model series TRK absolute encoders, the EtherCAT interface is integrated according to IEC 61158-2 to 6 and encoder profile CiA DSP406.

The use of the CANopen over EtherCAT message and the CANopen encoder profile enable parameter and diagnostic data handling as familiar from CANopen. These are contained in an object directory under the same indices as in CANopen.

To achieve the SIL2 level, the TRK/S3 contains a redundant sensor system and additional internal monitoring mechanisms as well as safe communication via the FSoE (failsafe over EtherCAT) protocol. The FSoE protocol is implemented according to the Safety over EtherCAT specification ETG.5100 version 1.2.0.

The draw wire version with integrated encoder offers a very

compact solution for length measurement up to 10 m. See datasheet [125-D13794](#) for mechanical design.

The detailed description of the integration and commissioning of a TWK absolute encoder with EtherCAT interface is described in detail in the user manual TRK 13349, which is available on request.

## EtherCAT® features

- Failsafe over EtherCAT protocol (FSoE)
- Complex slave with CANopen over EtherCAT (CoE)
- "Full slave" - all addressing modes except segment addressing
- All EtherCAT write/read services
- Field-bus Memory Management Unit (FMMU)
- Sync-manager

EtherCAT® is a registered brand and patented technology licensed by Beckhoff Automation GmbH, Germany.

## Technical data

### Input data \*

- 4-byte position data
- 2-byte speed data

### Electrical data

- Sensor system: ASIC with Hall elements
- Operating voltage: + 14 VDC to + 36 VDC (reverse voltage protection)
- Power consumption: < 3 W, switch-on current < 500 mA
- Resolution: 4096 steps / 360°< - (12-bit) or 8192 steps / 360 °<) (13-bit)
- Measuring range: 4096 revolutions
- Total number of steps: 24-bit or 25-bit
- Absolute accuracy of the position value: ± 0.2% (with reference to one revolution)
- Toleranz of the internal position monitoring 1,5 % (with reference to one revolution)
- Internal updating time of the position value: 1 ms
- Output code: Binary
- Code sense: CW / CCW
- Speed signal: 16-bit, with prefix, unit: steps / gate time  
(gate time adjustable in the 10 ... 1000 ms range, default: 10 ms)
- Internal updating time of the speed signal: 1 ms
- Bootup time 450 ms

### EtherCAT data

- Transfer technology 100 Base-TX
- Transfer rate 100 MBit/s
- Cable length Max. 100 m (between two subscribers)

### Mechanical data

- Operating speed: 1.000 rpm max. (2.000 rpm optional)
- Angular acceleration: 10<sup>5</sup> rad/s<sup>2</sup> max.
- Moment of inertia (rotor): 20 gcm<sup>2</sup>
- Operating torque: ≤ 8 Ncm (at 500 rpm)
- Starting torque: ≤ 4 Ncm
- Perm. shaft load: 250 N axial, 250 N radial
- Bearing service life \*\*: > 10<sup>9</sup> revolutions
- Weight: approx. 0.450 kg (stainless steel version approx.. 0.7 kg)

### Environmental data

- Operating temperature range: - 40°C to + 85°C
- Storage temperature range: - 40°C to + 100 °C (without packaging)
- Resistance
  - To shock: 500 m/s<sup>2</sup>; 11 ms, DIN EN 60068-2-27
  - To vibration: 250 m/s<sup>2</sup>; 10 ... 2000 Hz, DIN EN 60068-2-6
- EMC standards: EN 61000-6-4 (interference emission)  
EN 61000 6-2 (interference immunity)  
EN 61326-3-1 (EMC for functional safety devices)
- Protection class: IP 66 / IP 67, with cable outlet IP68, IP69K (optional) (DIN EN 60529)
- Salt mist test: Test Kb according to IEC 60068-2-52
- Corrosion resistance: C4 long (EN ISO 12944)

\* From the point of view of the control system.

\*\* These values apply at maximum shaft load. Higher values are achievable at lower loads.

## Technical data

### Safety data

- According to DIN EN 61508: PFH = tbd  
SFF = tbd  
HFT = 0  
SIL2
- According to DIN EN ISO 13849-1: MTTF<sub>d</sub> = tbd  
DC = tbd  
Categorie 2  
Performance Level D
- Maximum service life 20 years

### Electrical connection

- EtherCAT: - M12 connector D-coded 4-pin for bus in / bus out, socket or  
- cable output via cable glands
- Supply: - M12 connector A-coded 4-pin, pins or  
- cable output via cable glands

### EtherCAT mating connector

- Connection type: M12 connector D-coded 4-pin
- Housing: Die-cast zinc, nickel-plated
- Contacts: Pins, gold
- Wire connection: Cage clamp
- Connection cross-section: Max. 0.75 mm<sup>2</sup>
- Cable diameter: 6 - 8 mm
- Protection class: IP 67

### Supply mating connector

- Connection type: M12 connector A-coded 4-pin
- Housing: Die-cast zinc, nickel-plated
- Contacts: Socket, gold
- Wire connection: Screw connection
- Connection cross-section: Max. 0.75 mm<sup>2</sup>
- Cable diameter: 4-6 mm
- Protection class: IP 67

### Pre-assembled Industrial Ethernet data cable

- Connection type: M12 connector D-coded 4-pin
- Contacts: Pins, gold
- Cable type: PUR, halogen-free, PROFINET type C
- Cable cross-section: 4 x 0.38 mm<sup>2</sup> (AWG 22)
- Cable diameter: 6.2 mm
- Protection class: IP 67

### Cable output EtherCAT

- Cable type: PROFINET Type-C, 4 x 0,36 mm<sup>2</sup> (AWG22)
- Cable jacket: PUR, color: green
- Temperatur range: - 40 °C to + 70 °C
- Outer diameter: 6,5 mm ± 0,2 mm
- Min. bend radius: 5 x d fixed installation, 10 x d freely movable

### Cable output power supply

- Cable type: 2 x 0,75 mm<sup>2</sup>, shielded
- Cable jacket: PUR, color: gray
- Temperatur range: - 40 °C to + 80 °C fixed installation, - 5 °C to + 70 °C freely movable
- Outer diameter: 6 mm
- Min. bend radius: 6 x d fixed installation, 15 x d freely movable

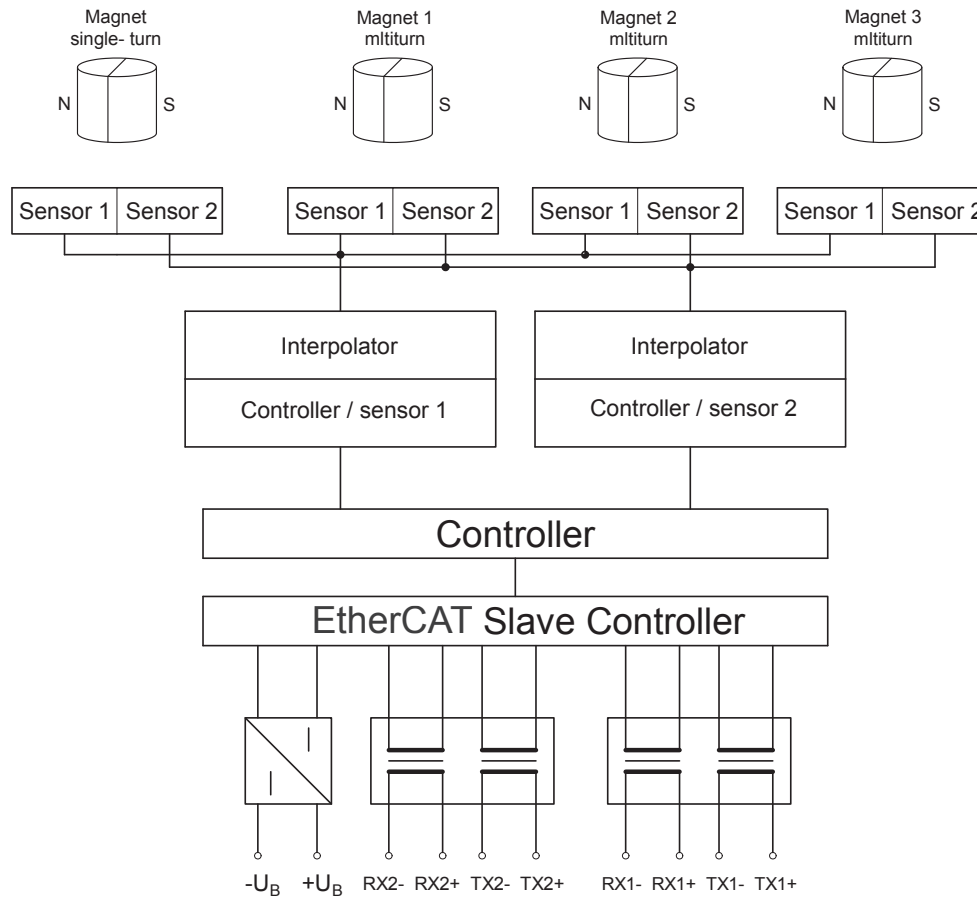
## Technical data

### Programmable parameters

| Parameter       | Value range                                                            | Parameter description                                                                                                                                                                                |
|-----------------|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Code path       | CW / CCW                                                               | CW (clockwise): ascending values on rotation clockwise<br>CCW (counter clockwise): descending values on rotation clockwise (viewed looking at the shaft).                                            |
| Reference value | 0 ... 33.554.431<br>(0 ... 16.777.215 for the TRKxx-xx4096R4096S3MK01) | For adaptation to the application, the position value can be set to any value within the measuring range. Once programmed, a reference value can be set via bit 0 in the control word (output data). |
| Gate time       | 10 ... 1000 ms                                                         | Time basis for speed registration                                                                                                                                                                    |

## Electrical connection

### Block diagram



### EtherCAT M12 connector connection assignment (Port1 and Port 2)

| PIN     | 1      | 2     | 3      | 4    |
|---------|--------|-------|--------|------|
| Signal  | TX+    | RX+   | TX-    | RX-  |
| Colour* | yellow | white | orange | blue |

### Supply M12 connector connection assignment

| PIN    | 1               | 2 | 3            | 4 |
|--------|-----------------|---|--------------|---|
| Signal | + UB (+ 24 VDC) | — | - UB (0 VDC) | — |

\* Industrial Ethernet cable colours according to ISO / IEC 8802-3.

Diagnosis-LEDs

| UB    | Link/<br>Activity1<br>(L/A1) | Link/<br>Activity2<br>(L/A2) | Status<br>(NS)                  | Description                       |
|-------|------------------------------|------------------------------|---------------------------------|-----------------------------------|
| green | green                        | green                        | green/red                       |                                   |
| on    |                              |                              |                                 | Operating voltage available       |
|       | on                           |                              |                                 | Network connection established    |
|       | Flashing                     |                              |                                 | Network active                    |
|       |                              | on                           |                                 | Network connection established    |
|       |                              | Flashing                     |                                 | Network active                    |
|       |                              |                              | off                             | Initialisation                    |
|       |                              |                              | green/<br>1 x flashing          | Safe operational                  |
|       |                              |                              | green/<br>normal flashing (1Hz) | Pre-operational                   |
|       |                              |                              | green on                        | Operational                       |
|       |                              |                              | red flashing                    | Invalid parameter or preset value |
|       |                              |                              | red on                          | No response from the master       |

## Order number

### Absolut encoder

|     |    |   |    |   |      |   |      |    |   |   |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----|----|---|----|---|------|---|------|----|---|---|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TRK | 58 | - | KP | A | 8192 | R | 4096 | S3 | M | K | 01 | → Standard version                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|     |    |   |    |   |      |   |      |    |   |   |    | <b>Electrical and / or mechanical variants*</b><br>01 Standard<br>02 Protection class IP69K (only with cable output)<br><b>Output:</b><br>K 100Base-TX<br><b>Electrical connection:</b><br>M M12 connector<br>Kx Cable, x = length in m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|     |    |   |    |   |      |   |      |    |   |   |    | S3 FSoE, SIL2 certified<br><b>Measuring range:</b><br><b>Singleturn version: leave blank</b><br>4096 Revolutions<br>10 Length in meter for draw wire version. Possible values: 6 and 10<br><b>Output code:</b><br>R Binary code<br><b>Resolution:</b><br>4096 Steps / 360° ↺ or at draw wire: steps / drum circumference (248 mm)<br>8192<br><b>Housing material:</b><br>A Aluminium<br>S Stainless steel (1.4305)<br>V Stainless steel (1.4404)                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|     |    |   |    |   |      |   |      |    |   |   |    | <b>Flange:</b><br>58 K Clamped flange, shaft 10 mm with flat<br>KF Clamped flange, shaft 10 mm with woodruff key<br>KP Clamped flange, shaft 10 mm with parallel key (recommended for safety)<br>KZ Clamped flange, shaft for play-compensating toothed gear ZRS<br>SN Synchronizer flange, clamping shaft 12 mm with groove for parallel key<br>ST Synchro flange, shaft 6 mm with flat<br>64 NZ Cam switch flange, shaft for play-compensating toothed gear ZRS<br>65 SP Synchro flange, shaft 12 mm with parallel key<br>66 K Clamped flange, shaft 10 mm with flat<br>KP Clamped flange, shaft 10 mm with parallel key<br>90 MP Mounting flange, shaft 12 mm with parallel key<br>105 MP Mounting flange, shaft 12 mm with parallel key<br>125 D Draw wire version with integrated TRK/S3 rotary encoder, see datasheet <a href="#">125-D13794</a><br>See remaque at page 8. |
|     |    |   |    |   |      |   |      |    |   |   |    | <b>Design form</b><br><b>Modell:</b><br>TRK T series encoder with EtherCAT interface                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

\* The basic versions according to the data sheet have the number 01. Deviations are identified with a variant number and are documented in the factory.

## Accessories (to be ordered separately)

- Documentation on CD
  - TWK-CD-01** CD-ROM with documentation, device description file, bitmap and example programme
- Straight mating connector
  - STK4GP81** for EtherCAT in/out (die-cast zinc, nickel-plated)
  - STK4GP110** for EtherCAT in/out (stainless steel 1.4404)
  - STK4GS60** for supply voltage (die-cast zinc, nickel-plated)
  - STK4GS104** for supply voltage (stainless steel 1.4404)
- Angled mating connector (can only be used with aligned device connectors (option))
  - STK4WP82** for EtherCAT in/out
  - STK4WS61** for supply voltage
- Connecting cable
  - KABEL-xxx-114** Industrial Ethernet data cable with M12 connectors, D-coded, moulded on at both ends.  
Standard lengths: 1, 2, 3 and 5 m (xxx = length in metres)
  - KABEL-xxx-118** Industrial Ethernet data cable with M12 connector to RJ 45, IP 20 (xxx = length in metres)
- Couplings
  - BKK** folding bellows coupling, large, see data sheet [BKK11840](#)
  - BKM** folding bellows coupling, small, see data sheet [BKM11995](#)
  - KK14N** clamp coupling, see data sheet [KK12301](#)
- Toothed gear
  - ZRS** play-compensating toothed gear [ZRS11877](#)
- Torque plate
  - ZMS** see datasheet [ZMS12939](#)
- Further installation accessories and securing clamps are available according to data sheet [MZ10111](#) .

The following documents plus the EDS file, a bitmap and example programmes can be found in the Internet under [www.twk.de](http://www.twk.de) in the documentation area, model TRK.

- Data sheet TRK13348
- Manual No. TRK13349

Optionally, a CD-ROM can be supplied. (Please specify article No. TWK-CD-01 on ordering.)

## Remark for draw wire version with integrated encoder

The safety certificate is only valid for the integrated rotary encoder. The validity of the certificate ends at the shaft of the rotary encoder. A safe length measurement is therefore only possible in combination with monitoring measures in a safe control unit. Please contact us for further information.



## Installation drawings

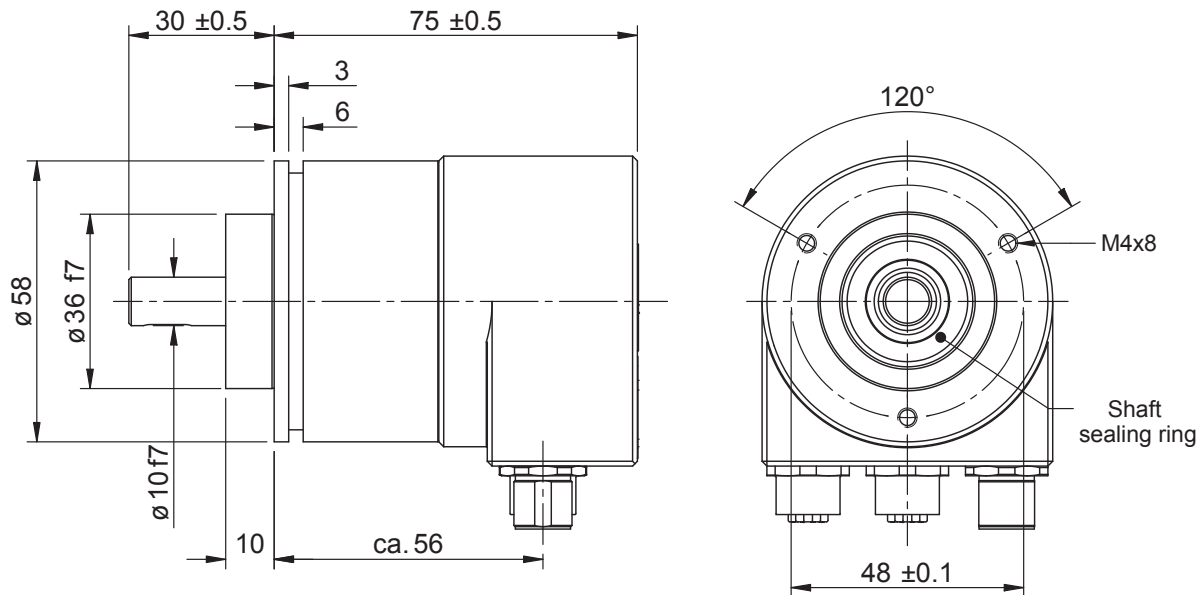
### Standard design

#### Design form 58 with

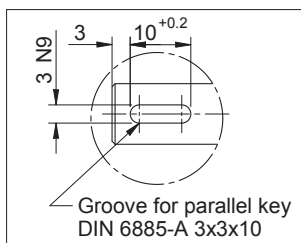
Shaft  $\varnothing$  10 mm, with parallel key

order number: TRK58-KPA8192R4096S3MK01

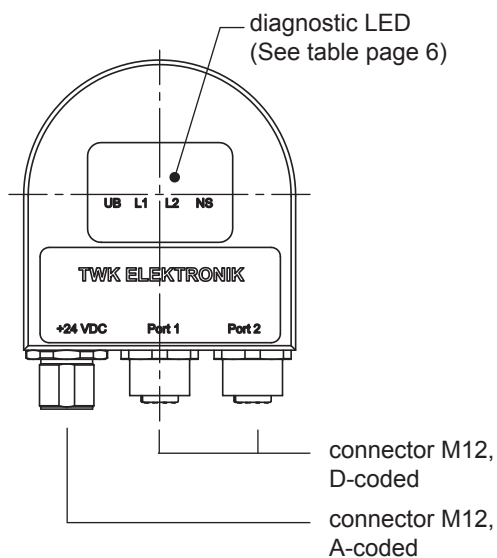
### Dimensions in mm



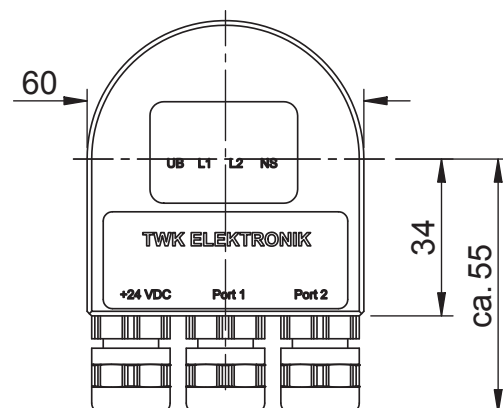
#### ■ Shaft $\varnothing$ 10 mm with groove and parallel key



### Rear view with M12 connectors



### Rear view with cable output

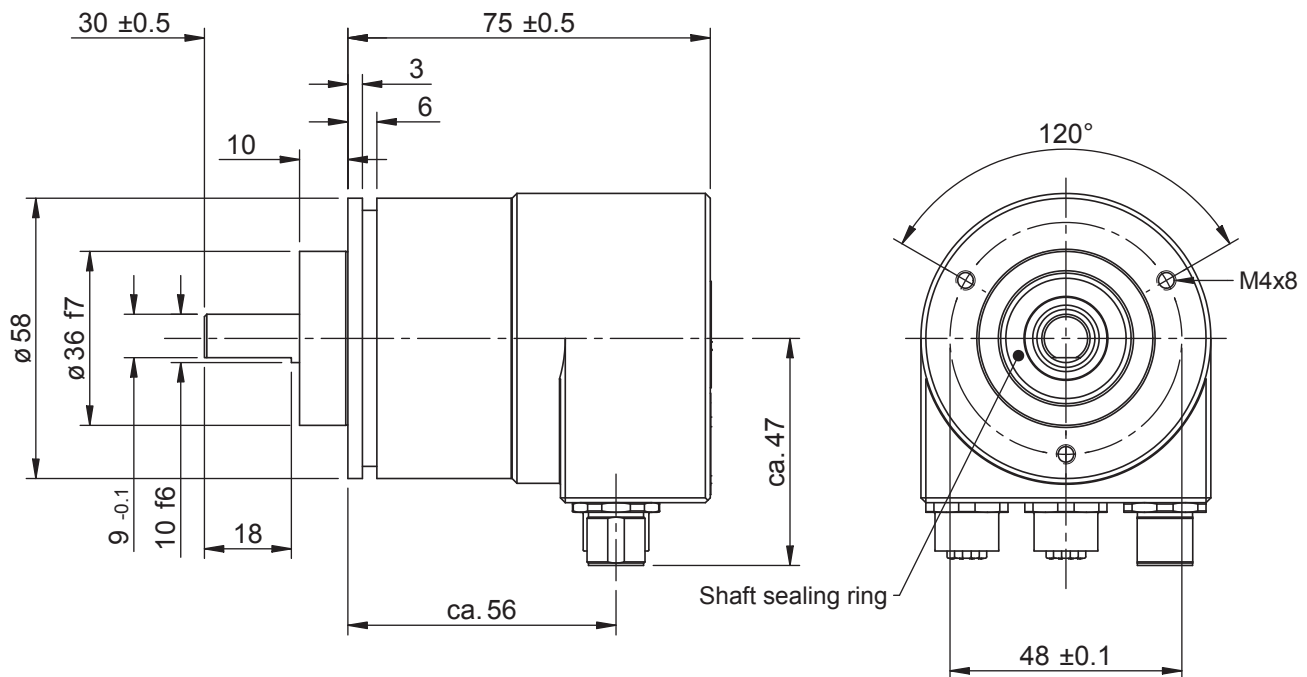


## Further possible designs

**Design form 58 with**  
Shaft  $\varnothing$  10 mm with flat

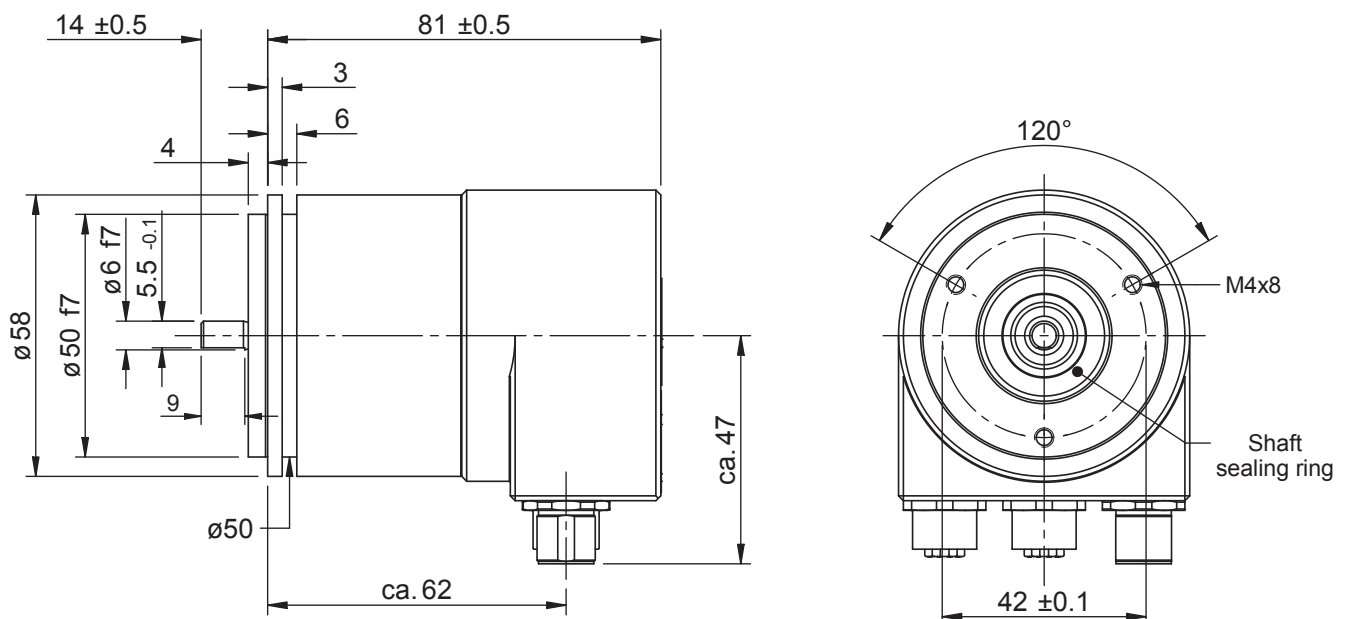
**, order number: TRK58-KA8192R4096S3MK01**

### Dimensions in mm



**Design form 58 with**  
Shaft  $\varnothing$  6 mm with flat

**, order number: TRK58-STA8192R4096S3MK01**



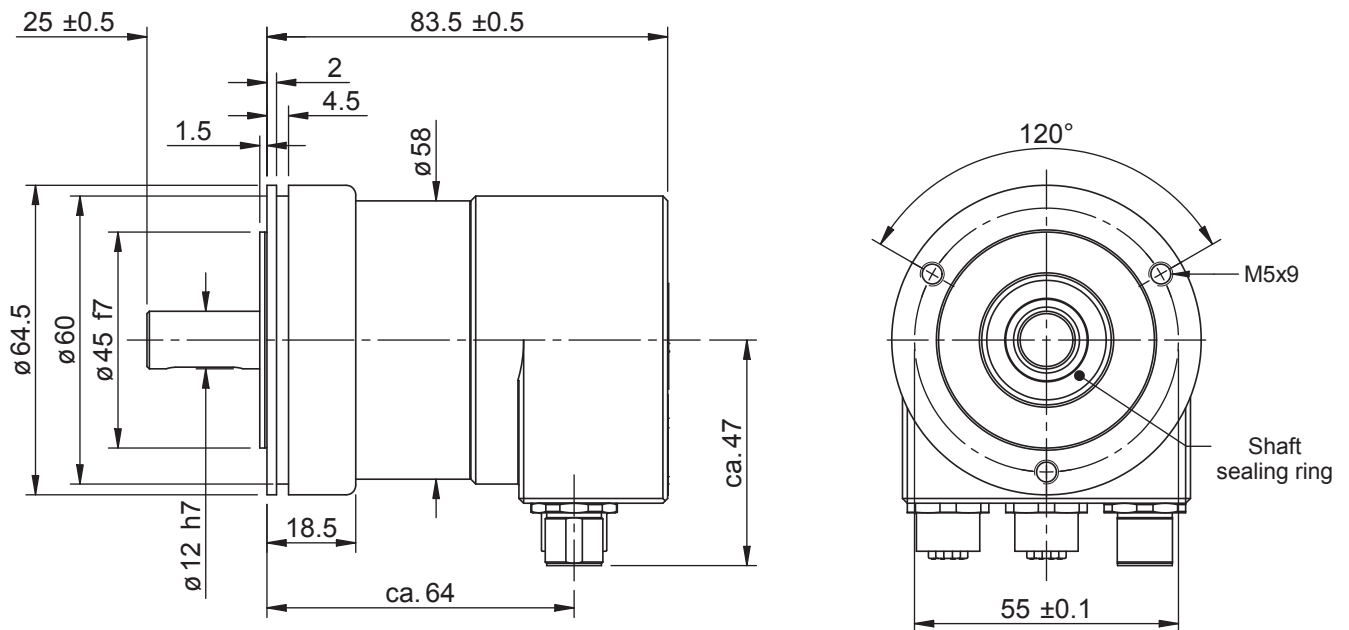
Installation drawings

Design form 65 with

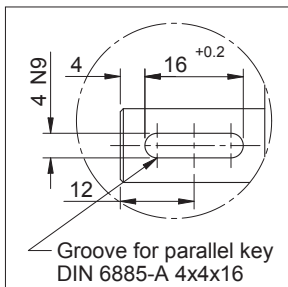
Shaft  $\varnothing 12$  mm, with parallel key

, order number: TRK65-SPA8192R4096S3MK01

Dimensions in mm



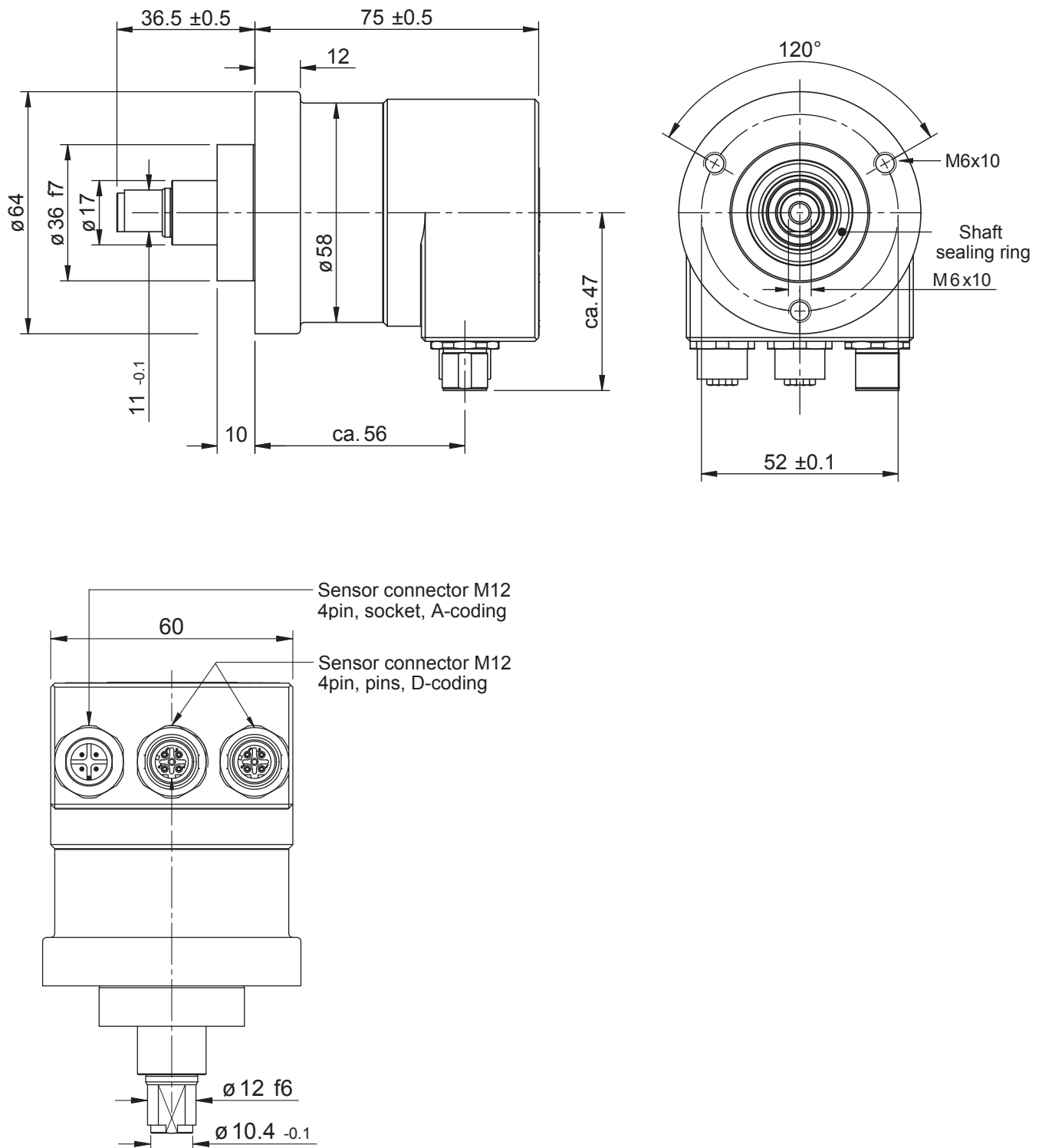
■ Shaft  $\varnothing 12$  mm, with groove and parallel key



Installation drawings

**Design form 64 with** , order number: TRK64-NZA8192R4096S3MK01  
 Shaft  $\varnothing$  12 mm with flattened area, for mounting the toothed gear

Dimensions in mm



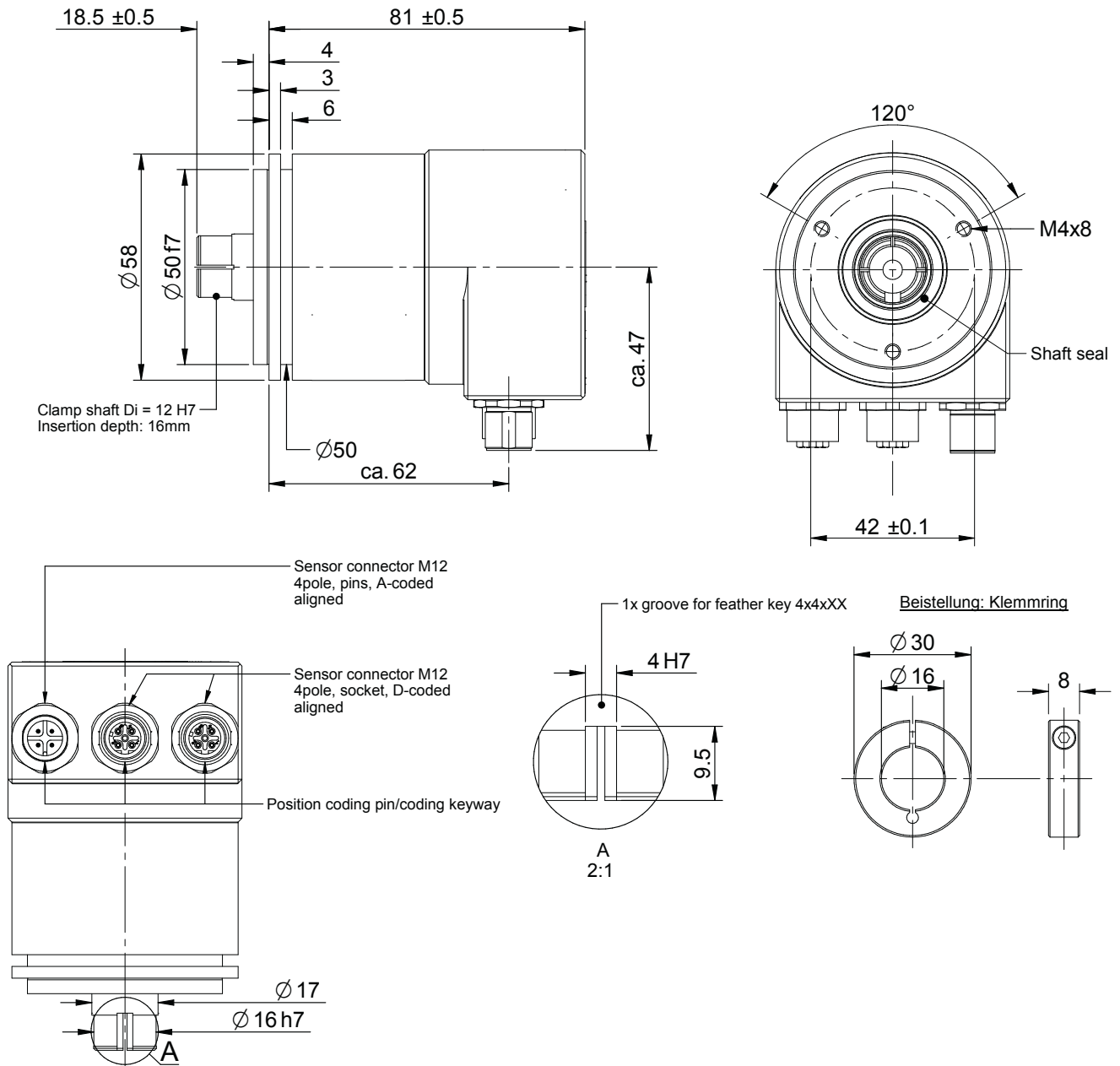
## Installation drawings

### Design form 58 with

Shaft  $\varnothing$  12 mm (other diameters on request)

, order number: TRK58-SNA8192R4096S3MK01

### Dimensions in mm

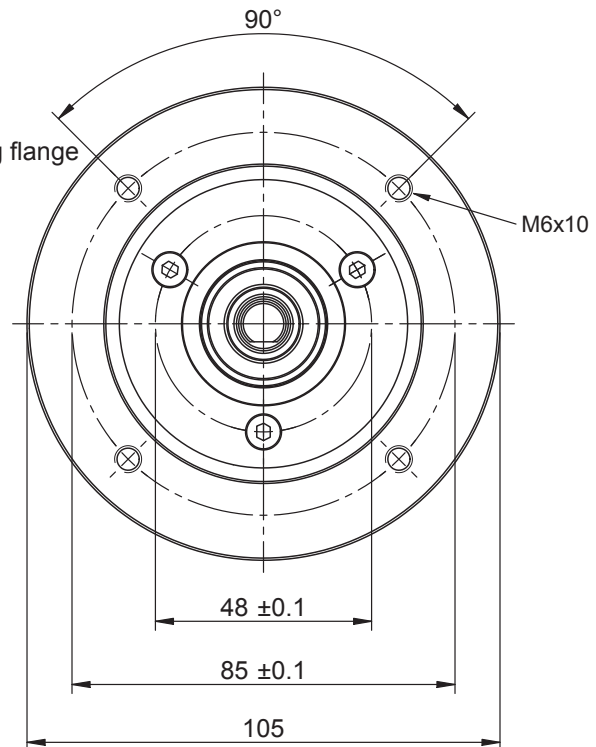
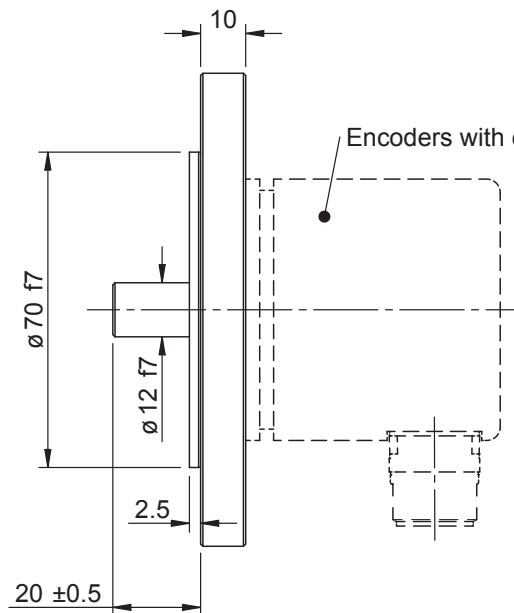


## Installation drawings

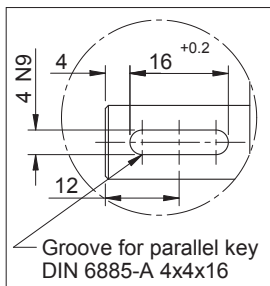
**Design form 105, order number: TRK105-MPA8192R4096S3MK01**

Shaft  $\varnothing$  12 mm, with parallel key

Dimensions in mm



- Shaft  $\varnothing$  12 mm with groove and parallel key



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