

Absolute encoder TRK/S3 with EtherCAT FSoE interface



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 65536 steps / 360° ↯ (16-bit)
- Measuring range: 4096 revolutions (12-bit)
- Protection class: up to IP69K
- Programmable via EtherCAT
- Also available as singleturn version

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 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](#)

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

Absolute encoder model TRK/S3

Technical data

Input data *

- 8 byte 4 byte position data, 2 byte speed data, 2 byte status word

Output data *

- 2 byte 2 byte control word (hardware version 1: plus 4 byte preset value)

Electrical data

- Sensor system: Magnetic
- Operating voltage: + 9 VDC to + 36 VDC (reverse voltage protection)
- Power consumption: < 3 W, switch-on current < 500 mA
- Resolution: HW version 1: 4096 or 8192 steps/360 °↵, HW version 2: 65536 steps/360 °↵
- Measuring range: 4096 revolutions
- Total number of steps: HW version 1: 24 bit or 25 bit, HW version 2: 28 bit
- Absolute accuracy of the position value: ± 0.2% (with reference to one revolution), singleturn version: ± 0,05 %
- Toleranz of the internal position monitoring 1,5 % (with reference to one revolution)
- Internal updating time of the position value: 2 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: 2 ms
- Bootup time 450 ms
- Programmable parameters: Preset, code sense, gate time and scaling of the speed value

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, HW version 2: 5000 rpm) **
- Angular acceleration: 10⁵ rad/s² max.
- Moment of inertia (rotor): 20 gcm²
- Operating torque: ≤ 8 Ncm (at 500 rpm)
- Starting torque: ≤ 4 Ncm
- Perm. shaft load: 250 N axial, 250 N radial
- Bearing service life **: > 10⁹ revolutions
- Weight: approx. 0.450 kg (stainless steel version approx.. 0.7 kg)

Environmental data

- Operating temperature range: -40°C to +70°C
- Storage temperature range: -40°C to +100 °C (without packaging)
- Resistance
 - To shock: 500 m/s²; 11 ms, DIN EN 60068-2-27
 - To vibration: 250 m/s²; 10 ... 2000 Hz, DIN EN 60068-2-6
- 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)
- Altitude: ≤ 2000 m
- Power frequency magnetic field immunity test (EN 6100-4-8): 30 A/m, test criterion A (±8 digit at 13 Bits output resolution)
100 A/m, test criterion B

* 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

EMV-Normen

| | |
|-------------------------------------|---|
| EN 61000-6-4:2006 + A1:2011 | EMC Part 6-4: Generic standards-Emission standard for industrial environments |
| EN 61000-6-2:2005 | EMC Part 6-2: Generic standards-Immunity for industrial environments |
| EN 61000-4-2:2009 | EMC Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test |
| EN 61000-4-3:2006 A1:2008 + A2:2010 | EMC Part 4-3: Testing and measurement techniques - Radiated, radio frequency, electromagnetic field immunity test |
| EN 61000-4-4:2004 | EMC Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test |
| EN 61000-4-5:2006 | EMC Part 4-5: Testing and measurement techniques - Surge immunity test |
| EN 61000-4-6:2009 | EMC Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields |
| EN 61000-4-8:2010 | EMC Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test Power frequency magnetic field immunity test: 30 A/m, test criterion A (± 16 digit) 100 A/m, test criterion B |
| EN 61000-4-29:2000 | EMC Part 4-8: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests |
| IEC 61326-3-2:2018 | Electrical equipment for measurement, control and laboratory use - EMC requirements Part 3-2: Immunity for safety-related systems and for equipment intended to perform safety related functions (functional safety) - industrial applications with specified electromagnetic environment |

Safety data

- According to DIN EN 61508:
 - PFH = tbd
 - SFF = tbd
 - HFT = 0
 - SIL2
- According to DIN EN ISO 13849-1:
 - MTTF_d = 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

Cable output EtherCAT

- Cable type:
 - PROFINET Type-C, 4 x 0,36 mm² (AWG22)
- Cable jacket:
 - PUR, color: green
- Temperatur range:
 - 40 °C to + 70 °C
- Outer diameter:
 - 6,5 mm \pm 0,2 mm
- Min. bend radius:
 - 5 x d fixed installation, 10 x d freely movable

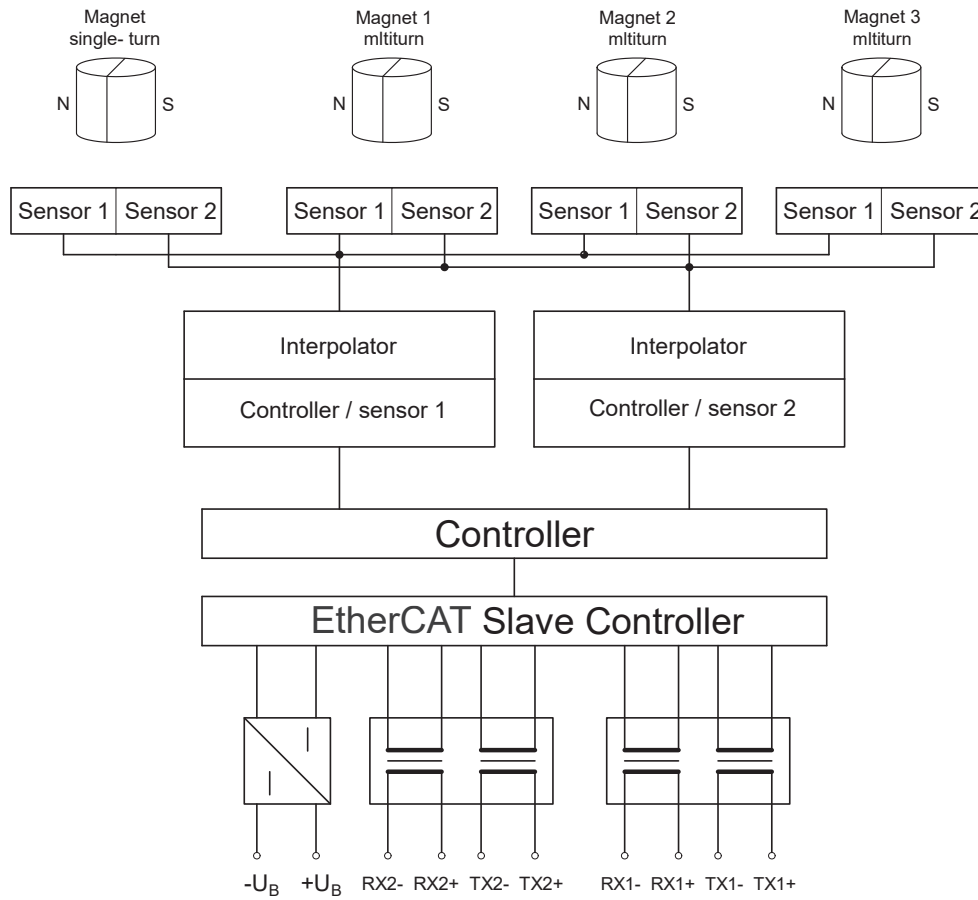
Cable output power supply

- Cable type:
 - 2 x 0,75 mm², 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

Absolute encoder model TRK/S3

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.

Absolute encoder model TRK/S3

Diagnosis LEDs

Diagnosis LEDs:

| UB | Link/ Activity (L/A) | Status (ST) | | Description |
|-------|----------------------------|----------------|-------------|--|
| | | green | red | |
| green | green | green | red | |
| on | | | | Operating voltage available |
| | on | | | Network connection established |
| | flashing | | | Network active |
| | | off | | Initialisation |
| | | 1 x flashing | | Safe-Operational |
| | | flashing | | Pre-Operational |
| | | on | | Operational |
| | | | off | Normal operating mode |
| | | | flickering | Boot error |
| | | | flashing | General configuration error |
| | | | 1x flashing | Change of EtherCAT state due to internal error |
| | | | 2x flashing | EtherCAT watchdog expired |
| | | | on | Critical communication controller error |

Absolute encoder model TRK/S3

Order number

Absolut encoder

| | | | | | | | | | | | | |
|---|-----------|----------|-----------|----------|--------------|----------|-------------|-----------|----------|----------|-----------|--------------------|
| TRK | 58 | - | KP | A | 65536 | R | 4096 | S3 | M | K | 01 | → Standard version |
| <p>Electrical and / or mechanical variants*</p> <p>01 Standard 02 Protection class IP69K (only with cable output)</p> <p>Output: K 100Base-TX</p> <p>Electrical connection: M M12 connector Kx Cable, x = length in m</p> <p>Profil: S1 FSoE, not certified sample devices S3 FSoE, SIL2 certified</p> <p>Measuring range: Singleturn version: leave blank 4096 Revolutions</p> <p>Output code: R Binary code</p> <p>Resolution: 4096 Steps / 360° ↵ 8192 Steps / 360° ↵ 65536 Steps / 360° ↵ standard (as of hardware version 2)</p> <p>Housing material: A Aluminium S Stainless steel (1.4305) V Stainless steel (1.4404)</p> <p>Flange:</p> <p>58 K Clamped flange, shaft 10 mm with flat KF Clamped flange, shaft 10 mm with woodruff key KP Clamped flange, shaft 10 mm with parallel key (recommended for safety) KZ Clamped flange, shaft for play-compensating toothed gear ZRS SN Synchronizer flange, clamping shaft 12 mm with groove for parallel key ST Synchro flange, shaft 6 mm with flat</p> <p>64 NZ Cam switch flange, shaft for play-compensating toothed gear ZRS 65 SP Synchro flange, shaft 12 mm with parallel key 66 K Clamped flange, shaft 10 mm with flat KP Clamped flange, shaft 10 mm with parallel key</p> <p>105 MP Mounting flange, shaft 12 mm with parallel key</p> <p>Design form</p> <p>Modell: TRK T series encoder with EtherCAT interface</p> | | | | | | | | | | | | |

* 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.

Absolute encoder model TRK/S3

Accessories, documentation, EDS file

Accessories (to be ordered separately)

- Straight mating connector
 - STK4GP81** for EtherCAT in/out (Zinc die-cast nickel-plated), see data sheet [STK14570](#)
 - STK4GP110** for EtherCAT in/out (stainless steel 1.4404), see data sheet [STK14569](#)
 - STK4GS60** for the supply voltage (Zinc die-cast nickel-plated), see data sheet [STK14572](#)
 - STK4GS104** for the supply voltage (stainless steel 1.4404), see data sheet [STK14571](#)
- Angled mating connector
 - STK4WP82** for EtherCAT in/out, see data sheet [STK14676](#)
 - STK4WS61** for the supply voltage, see data sheet [STK14675](#)
- Connecting cable - EtherCAT
 - 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), see data sheet [KBL14673](#)
 - KABEL-xxx-118** Industrial Ethernet data cable with M12 connector to RJ 45, IP 20 (xxx = length in metres), see data sheet [KBL14655](#)
- Connecting cable - power supply
 - KABEL-5-191** With moulded M12 connector, A-coded, straight, 2. side open, length 5m, see data sheet [KBL13411](#)
- 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 data sheet [ZMS12939](#)
- Further installation accessories and securing clamps are available according to data sheet [MZ10111](#).

Documentation, EDS file, etc.

The following documents plus the EDS file, a bitmap and example programmes can be found in the Internet under www.twk.de in the documentation area, model TRK.

- Data sheet No. TRK13348
- Manual No. [TRK13349](#)

Absolute encoder model TRK/S3

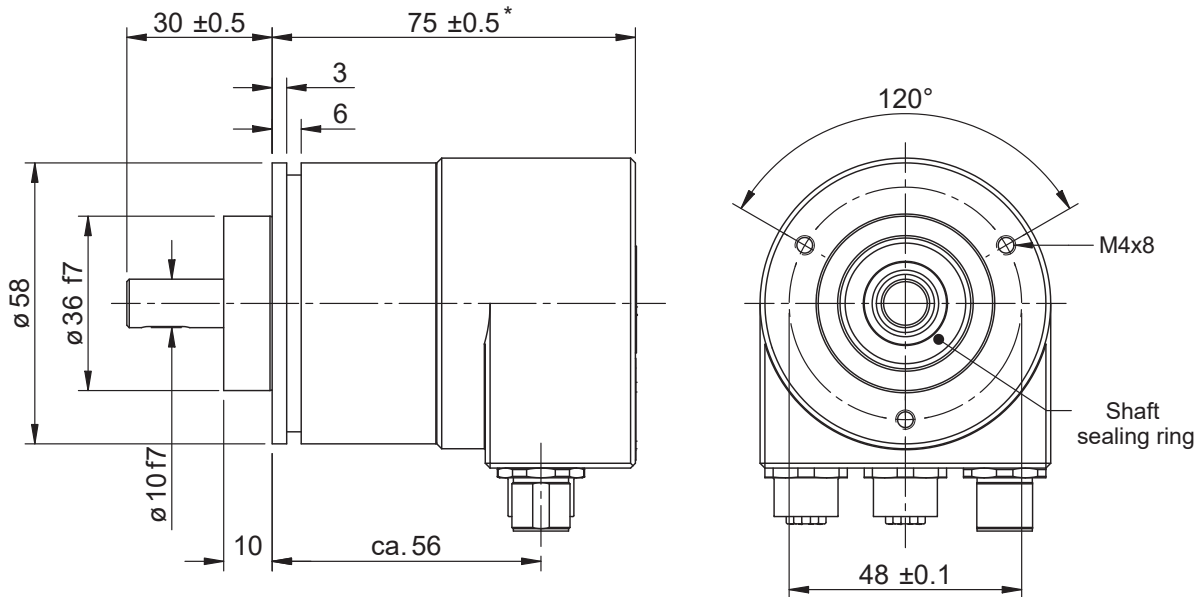
Installation drawings

Standard design

Design form 58 with clamped flange, order number: TRK58-KPA65536R4096S3MK01

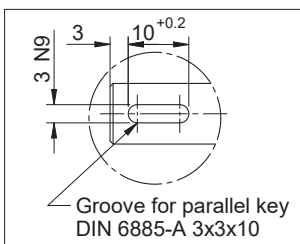
Shaft \varnothing 10 mm, with parallel key

Dimensions in mm

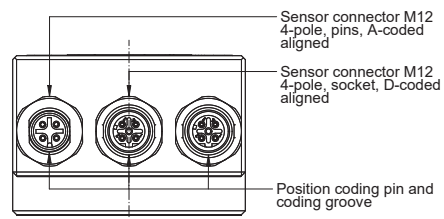


* Singleturn version 14 mm shorter

■ Shaft \varnothing 10 mm with groove and parallel key

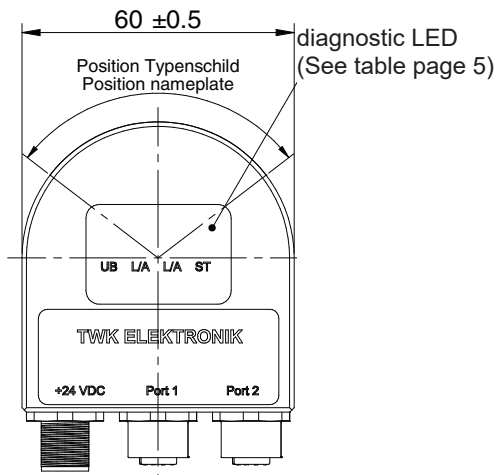


Connector view with M12-connector

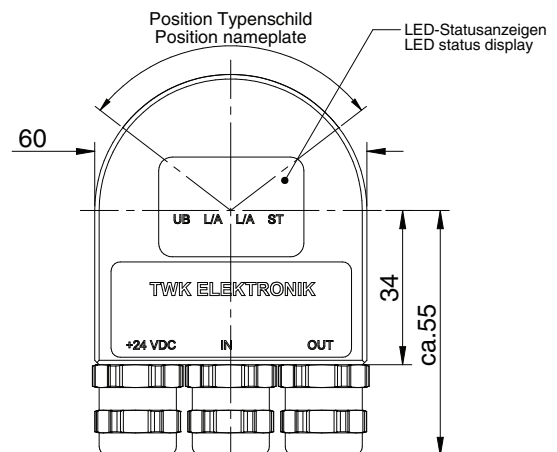


Note:
The connectors of the stainless steel version are not aligned.

Rear view with M12 connectors



Rear view with cable output



Absolute encoder model TRK/S3

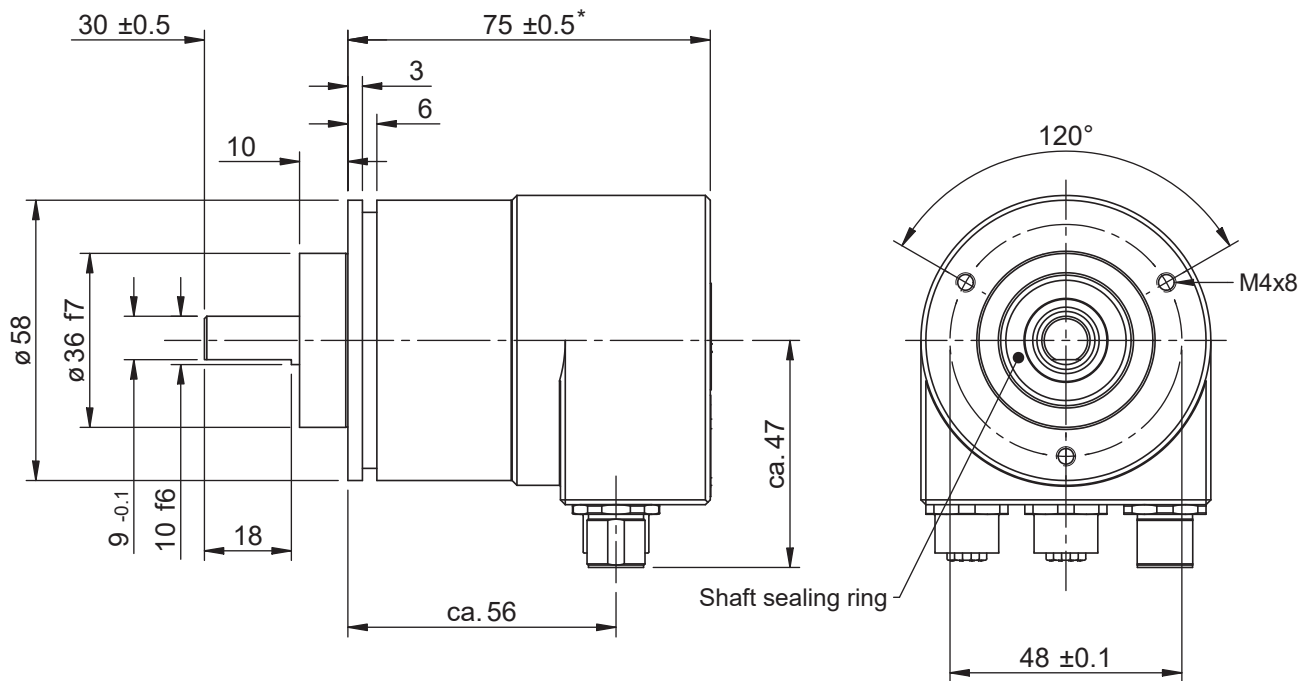
Installation drawings

Further possible designs

Design form 58 with clamped flange, order number: TRK58-KA65536R4096S3MK01

Shaft \varnothing 10 mm with flat

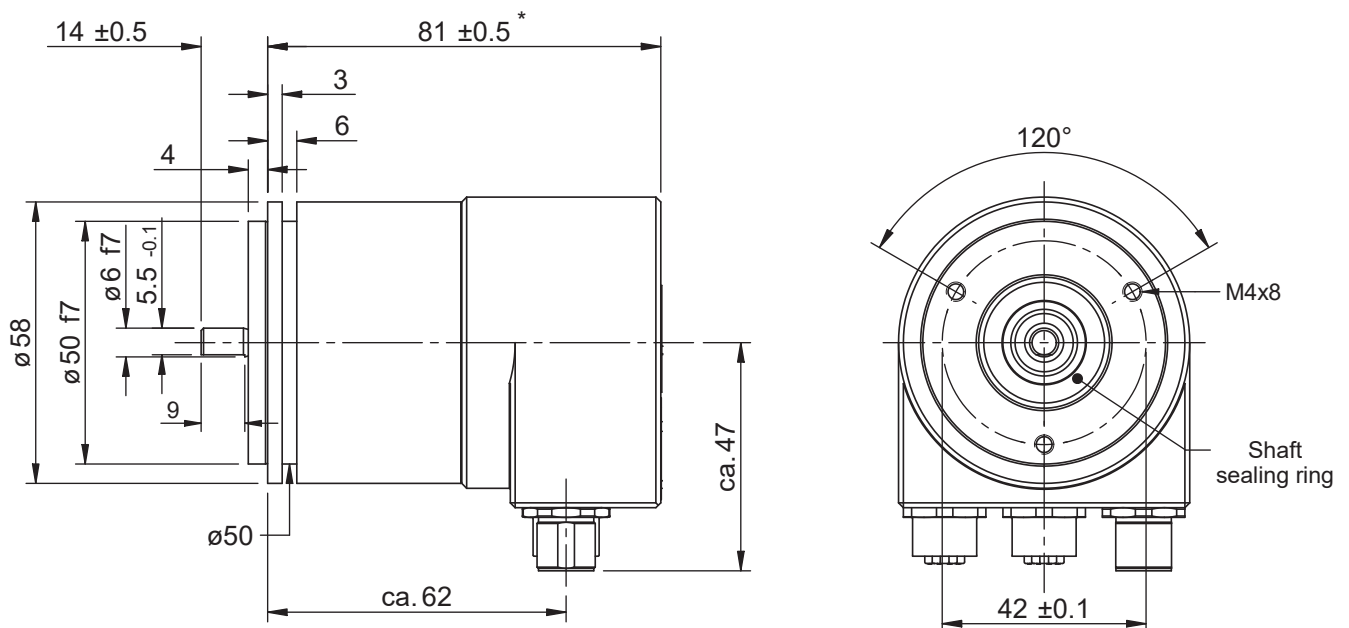
Dimensions in mm



* Singleturn version 14 mm shorter

Design form 58 with synchroniser flange, order number: TRK58-STA65536R4096S3MK01

Shaft \varnothing 6 mm with flat



* Singleturn version 14 mm shorter

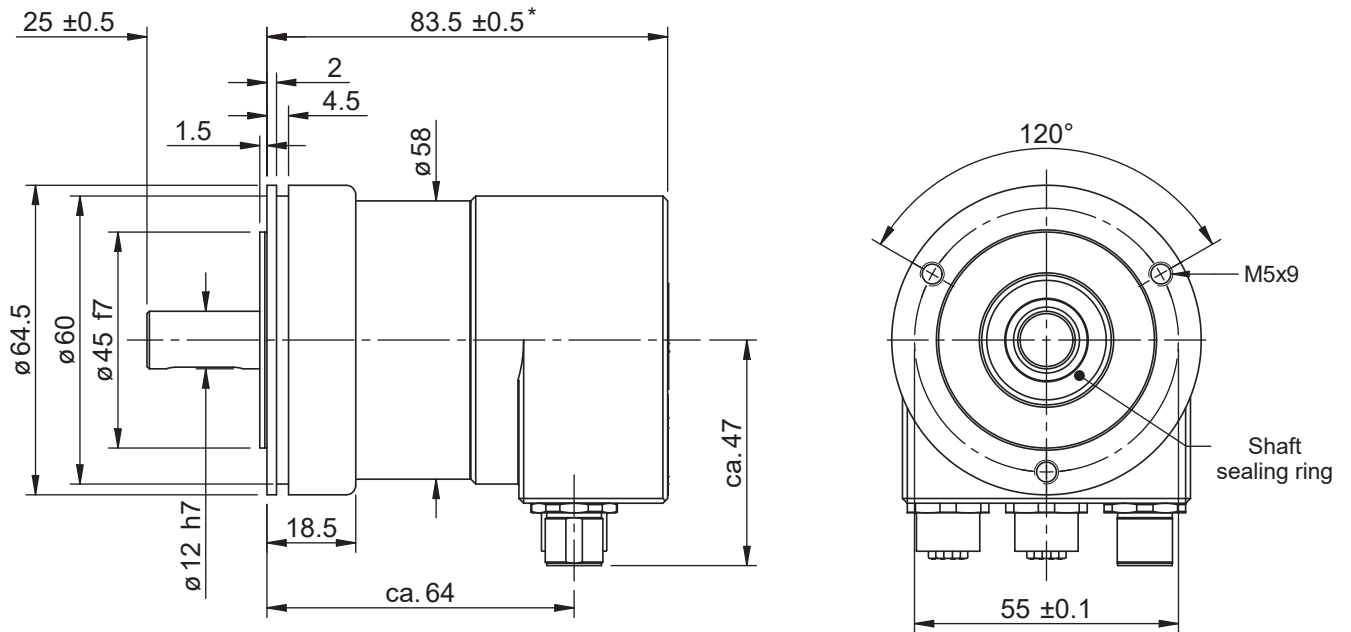
Absolute encoder model TRK/S3

Installation drawings

Design form 65 with synchroniser flange, order number: TRK65-SPA65536R4096S3MK01

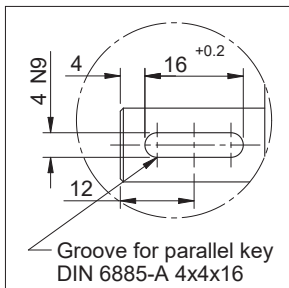
Shaft \varnothing 12 mm, with parallel key

Dimensions in mm



* Singleturn version 14 mm shorter

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



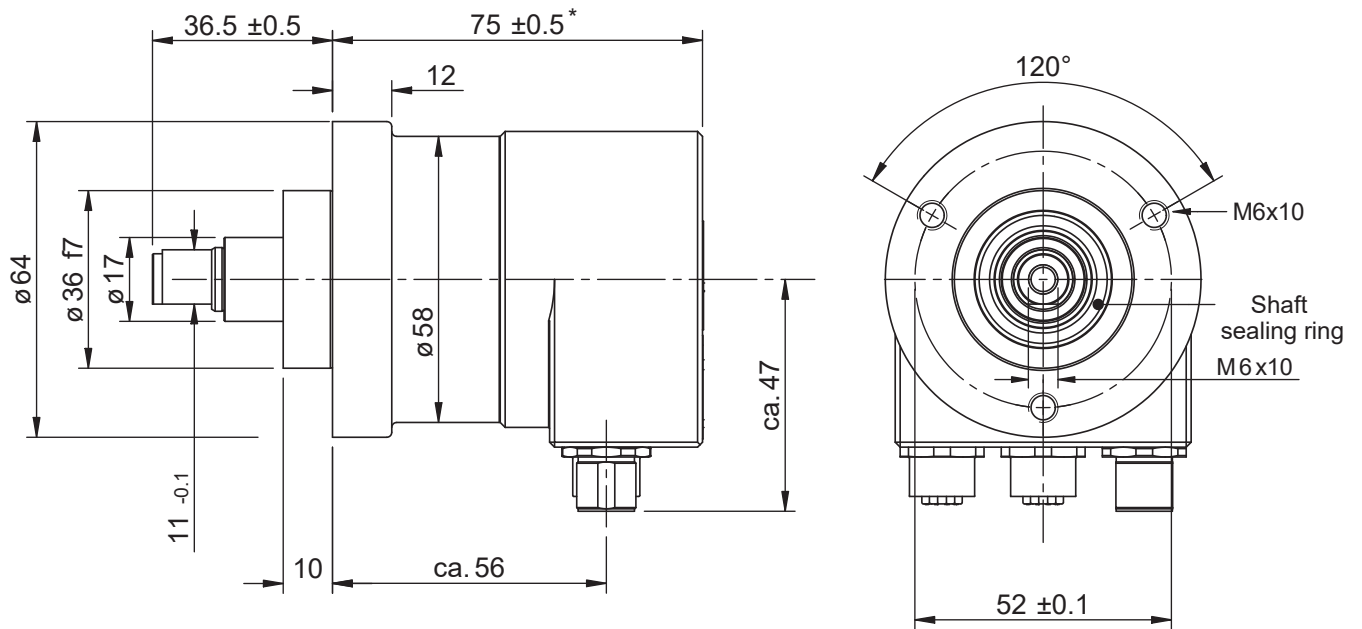
Absolute encoder model TRK/S3

Installation drawings

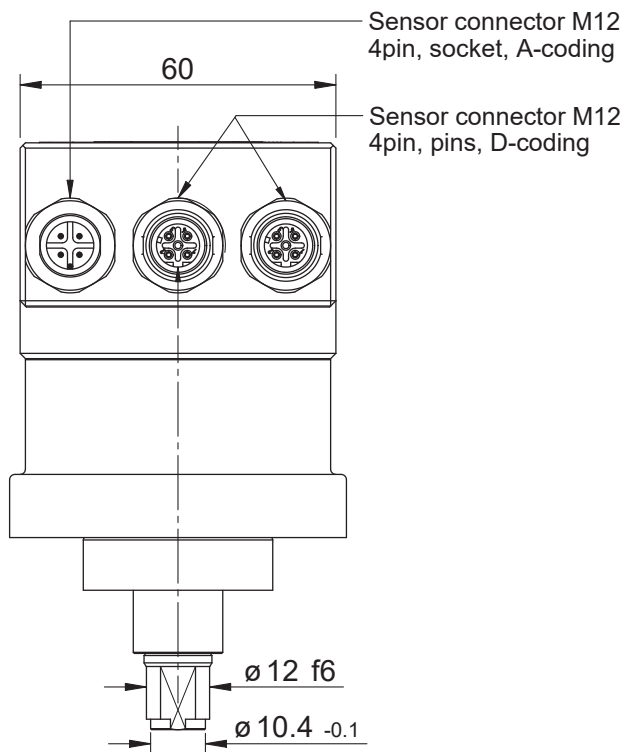
Design form 64 with switching cam encoder flange, order number: TRK64-NZA65536R4096S3MK01

Shaft \varnothing 12 mm with flattened area, for mounting the toothed gear

Dimensions in mm



Note:
The connectors of the stainless steel version are not aligned.



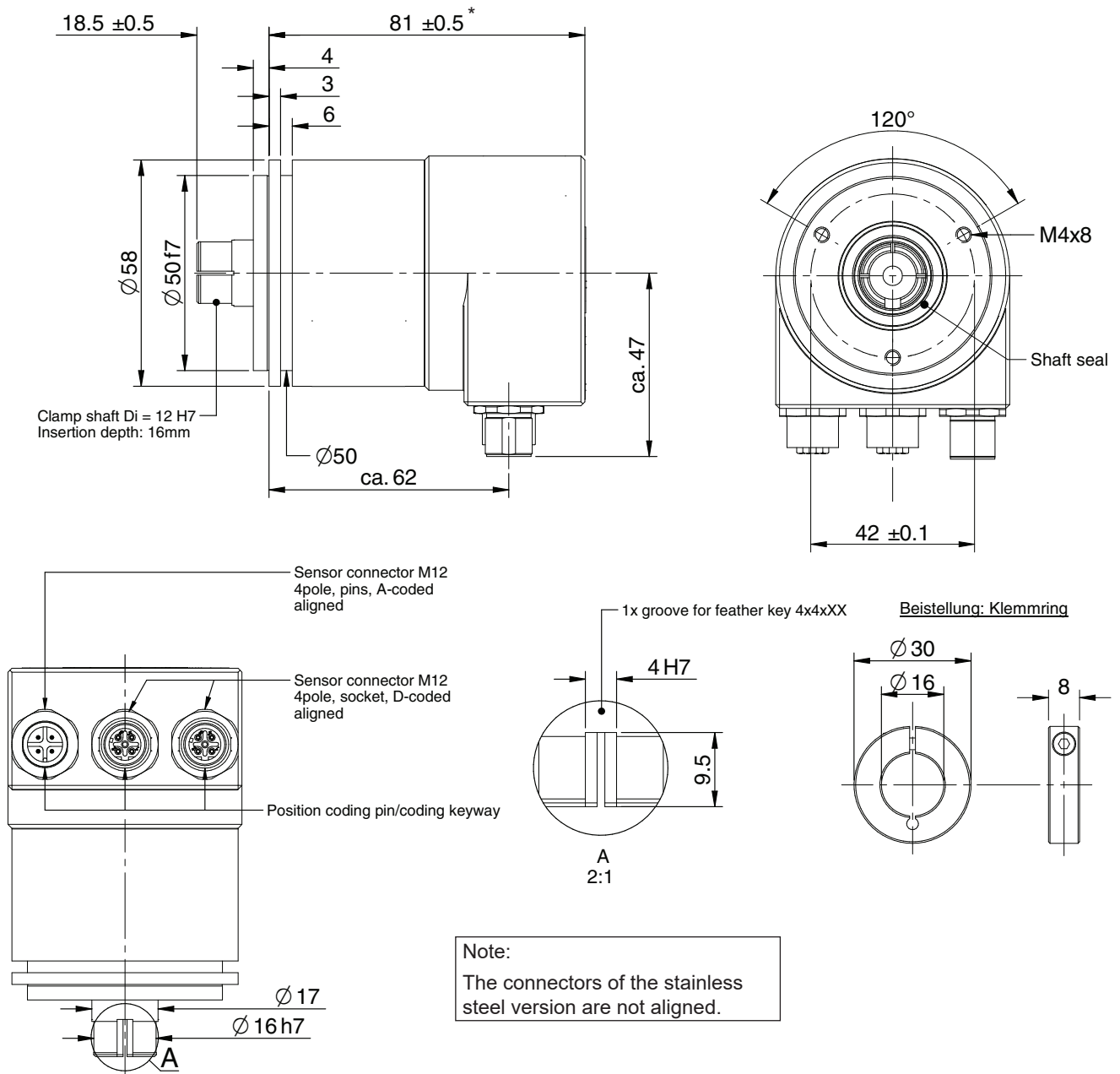
* Singleturn version 14 mm shorter

Absolute encoder model TRK/S3

Installation drawings

Design form 58 with synchroniser flange and clamping shaft, order number: TRK58-SNA65536R4096S3MK01
 Shaft \varnothing 12 mm (other diameters on request)

Dimensions in mm



* Singleturn version 14 mm shorter

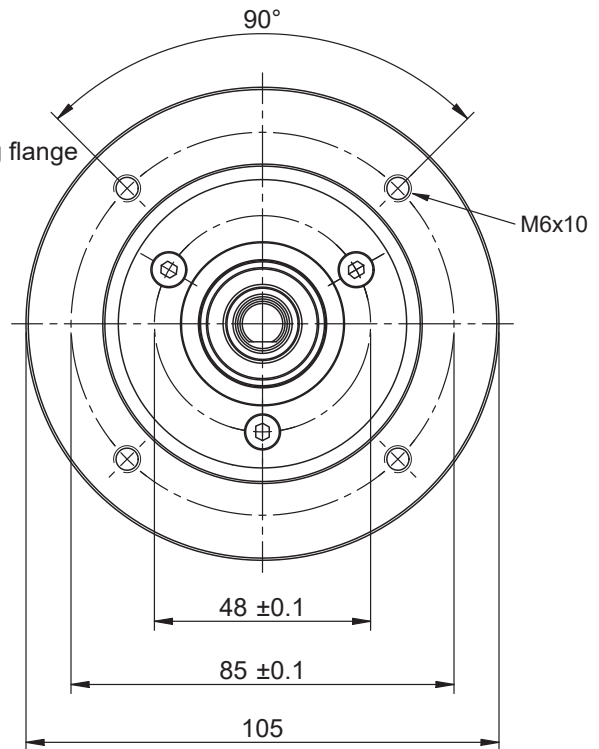
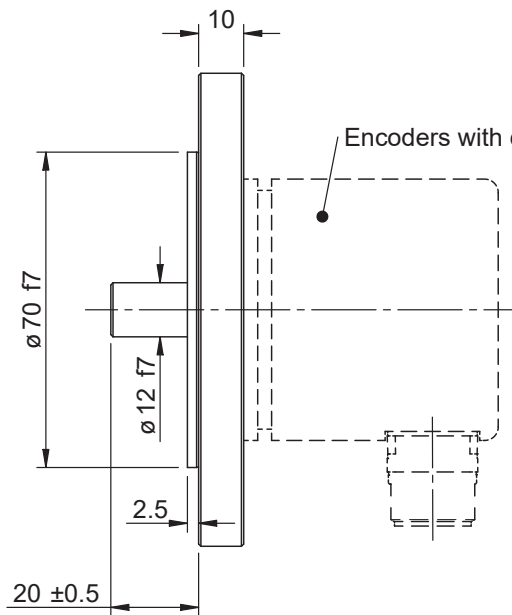
Absolute encoder model TRK/S3

Installation drawings

Design form 105, order number: TRK105-MPA65536R4096S3MK01

Shaft \varnothing 12 mm, with parallel key

Dimensions in mm



- Shaft \varnothing 12 mm with groove and parallel key

