

Absolute single-/multiturn encoder TRT/S3 with PROFIsafe on PROFINET interface



- Contactless, wear-free sensor system
- Also as singleturn respectively speed sensor sensor available (hardware version 2, in preparation)
- High vibration and shock resistance thanks to the robust mechanical design
- SIL2 and Performance Level d certified
- Safe position and safe speed signal
- Resolution: up to 8192 steps / 360° ↻ (13-bit) (HW version 2: 16384 (14 Bit))
- Measuring range: 4096 revolutions (12-bit)
- Protection type: up to IP69K
- Programmable via PROFINET

Design and function

Recording of the angular position and revolutions - absolute multiturn transmission for up to 4096 revolutions - data output plus parameterisation and diagnosis via PROFINET.

Robust housing manufactured from seawater-resistant aluminium or stainless steel - stainless steel shaft - ball bearing with radial shaft seal - magnetical sensor system - electrical connection via M12 connector or cable outlet.

The Profinet interface according to IEC 61158 / 61784 or PNO specifications order No. 2.712 and 2.722, version 2.2, is integrated into the model series TRT absolute encoders.

Real time classes 1 and 3 are supported, i.e. Real Time (RT) and Isochronous Real Time (IRT) plus the requirements of conformance class C.

To achieve the SIL2 level, the TRT/S3 contains additional internal monitoring mechanisms as well as safe communication via PROFIsafe. The PROFIsafe protocol is implemented according to the PROFIsafe Profile for Safety Technologie version 2.4 (PNO Order No. 3.192)

Setting the address, baud rate or terminating resistances is not necessary. A name, which is stored in the absolute encoder's non-volatile memory, is assigned via the PROFINET controller to address the device.

The integrated 2-fold switch enables the TWK PROFINET absolute encoders to be used in star, tree and line network topologies.

An exhaustive description of integration into a PROFINET network can be found in the TRT12886 manual.

PROFINET properties

- Real Time (RT) and Isochronous Real Time (IRT)
- Device exchange without interchangeable medium or programming device
- Prioritised start-up (Fast Start Up)
- Media redundancy possible
- Firmware update via Profinet
- Programming via Profinet

The hardware version 2 with a higher resolution (14 bit) and the max. rotation speed of 5000 U/min is in preparation. In the singleturn version the TRT/S3 represents a compact safe speed sensor.

Absolute single-/multiturn encoder model TRT/S3

Technical data

Input data *

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

Output data *

- 2-byte control word
- 4-byte reference 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: 4096 steps / 360° † - (12 bit) or 8192 steps / 360° † (13 bit)
(HW version 2: 14 Bit respectively 16384 steps)
- Measuring range: 4096 revolutions
- Total number of steps: 24-bit or 25-bit (HW version 2: 26 bit)
- Absolute accuracy of the position value: ± 0.2% (with reference to one revolution)
(HW version 2: 0,1 %, singleturn version: 0,05%)
- 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 path: 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

PROFINET data

- MAC address: 88:A9:A7:BX:XX:XX
The relevant, current MAC address is located on the model plate.
- Transfer technology: 100 Base-TX
- Transfer rate: 10 / 100 MBit/s
- Line length: Max. 100 m (between two subscribers)
- Minimum transmission cycle: 250 µs

Mechanical data

- Operating speed: 1000 rpm max. (2000 rpm optional) (HW version 2: optional 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: ca. 0.450 kg (stainless steel version ca. 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/s²; 11 ms, DIN EN 60068-2-27
 - To vibration: 250 m/s²; 10 ... 2000 Hz, DIN EN 60068-2-6
- EMC standards: EN 61000-6-4 (interference emission)
EN 61000 6-2 (interference immunity)
- Protection type: IP 66 / IP 67, with cable outlet IP68, IP69K (optional) (DIN EN 60529)
- Salt mist test: Test Kb according to IEC 60068-2-52

* From the point of view of the control system.

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

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Technical data

Safety data

- Certificat: TÜV No. 44 799 13172902
- According to EN 61508:2010: PFH = $9,889 \cdot 10^{-8}$ 1/h
SFF = 92,2%
HFT = 0
SIL2
- According to EN ISO 13849-1:2015: MTTF_d = 162 years
DC = 86,1 %
Categorie 2
Performance Level D
- Maximum service life: 20 years

Electrical connection

- PROFINET: 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 PROFINET (optional)

- 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 ± 0,2 mm
- Min. bend radius: 5 x d fixed installation, 10 x d freely movable

Cable output power supply (optional)

- 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

Programmable parameters

Parameter	Value range	Parameter description
Scaling	off / on	
Code path	CW / CCW	CW (clockwise): ascending values on rotation clockwise CCW (counter clockwise): descending values on rotation clockwise (viewed looking at the shaft)
Resolution [steps/360°]	1 ... 4096 (8192)* 4096 (with coding W)	Steps per revolution (360°)
Total number of steps [steps]	1 ... 16,777,216 (33,554,432)**	Overall measuring range
Reference value	0 ... total number of steps -1	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

(The values in brackets apply to the TRTxx-xxx8192x4096S3xTxx)

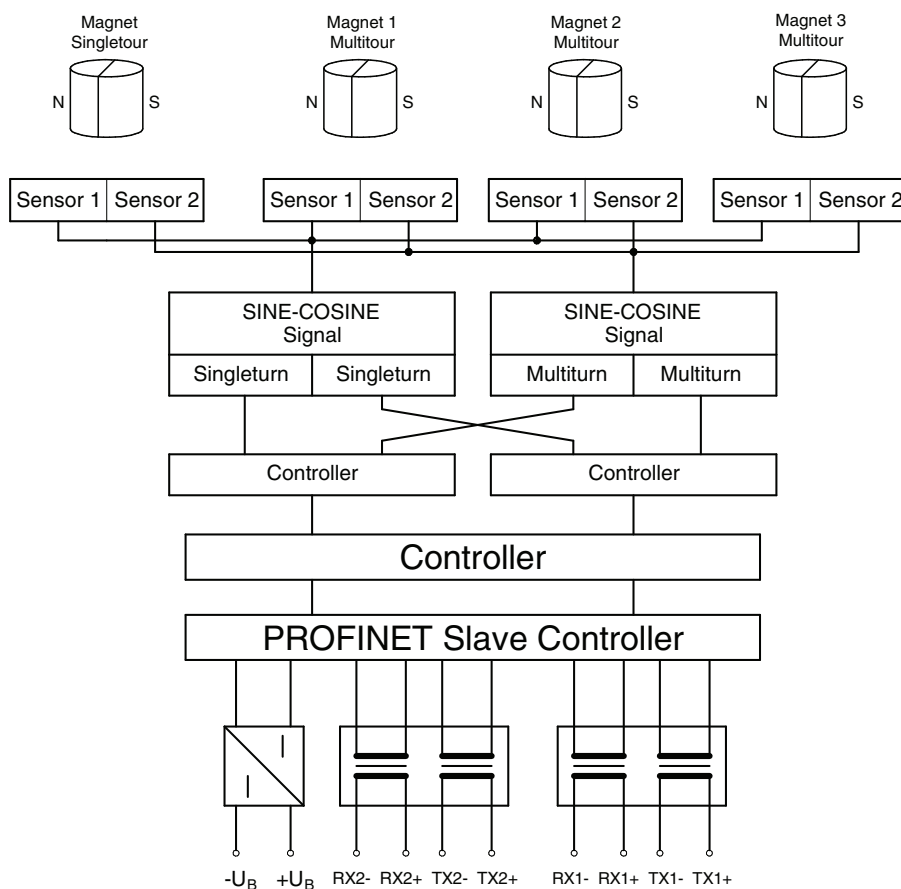
* HW-Version 2: 16384

** HW-Version 2: 67108864

Absolute single-/multiturn encoder model TRT/S3

Electrical connection

Block diagram



PROFINET M12 connection assignment connector / cable output (Port1 and Port 2)

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

Supply M12 connection assignment connector / cable output

PIN	1	2	3	4
Signal	+ UB (+ 24 VDC)	—	- UB (0 VDC)	—
Colour	white	—	brown	—

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

Absolute single-/multiturn encoder model TRT/S3**Diagnosis-LEDs**

UB (VS)	Link 1 (L1)	Link 2 (L2)	Status (NS)	Description
green	green	green	green/red	
on				Operating voltage available
	on			Network connection established
		on		Network connection established
			green	Data exchange, device in operation and OK
			green flashing	Network connection o.k. but no connection to a PROFINET controller
			red, slow flashing	Firmware download mode
			red flashing	Impermissible parameter or preset value, velocity too high or wrong module
			Fast red flashing	Device error
			red	Connection to the PROFINET controller disrupted

Absolute single-/multiturn encoder model TRT/S3

Order number

Absolut encoder

TRT	58	-	KP	A	8192	D	4096	S3	M	T	01	→ Standard version
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Electrical and / or mechanical variants*

- 01 Standard
- 02 Aligned device connectors, customer specific
- 03 Same as variant 02 but with gear wheel ZRS-12-12-A13

Output:

T 100Base-TX

Electrical connection:

- M Standard, 3 connectors radial
- Mx Connector output radial (x = number of outputs**)
- Ky Cable output radial (y = cable length)

Profile:

S3 PROFI-safe, SIL2 certified

Measuring range:

Singleturn: leave blank

4096 Revolutions

Output code:

- R Binary code, position value divided into two words
- W Binary code, position value divided into two words, 1. word multiturn data, 2. word singleturn data, resolution not adjustable
- D Binary code, position as double word (e.g. for Simatic TIA Portal with Safety Advance)

Resolution:

4096 steps / 360° ↯
8192
16384

Housing material:

- A Aluminium housing
- S Stainless steel housing 1.4305
- V Stainless steel housing 1.4404

Flange form:

- 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 Synchro flange, clamping shaft 12 mm with groove for parallel key
- ST Synchro flange, shaft 6 mm with flat
- 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
- 105 MP Mounting flange, shaft 12 mm with parallel key

Design form

TRT T series with PROFINET interface

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

** Number of outputs:
1 = Hybrid
2 = 1x power supply, 1x PROFINET
3 = 1x power supply, 2x PROFINET

Absolute single-/multiturn encoder model TRT/S3

Accessories, documentation, EDS file

Accessories (to be ordered separately)

- Straight mating connector
 - STK4GP81** for PROFINET in/out (Zinc die-cast nickel-plated), see data sheet [STK14570](#)
 - STK4GP110** for PROFINET 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 PROFINET in/out, see data sheet [STK14676](#)
 - STK4WS61** for the supply voltage, see data sheet [STK14675](#)
- Connecting cable - PROFINET
 - 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, GSD file, etc.

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

- Data sheet TRT12845
- Manual No. [TRT12846](#)

Absolute single-/multiturn encoder model TRT/S3

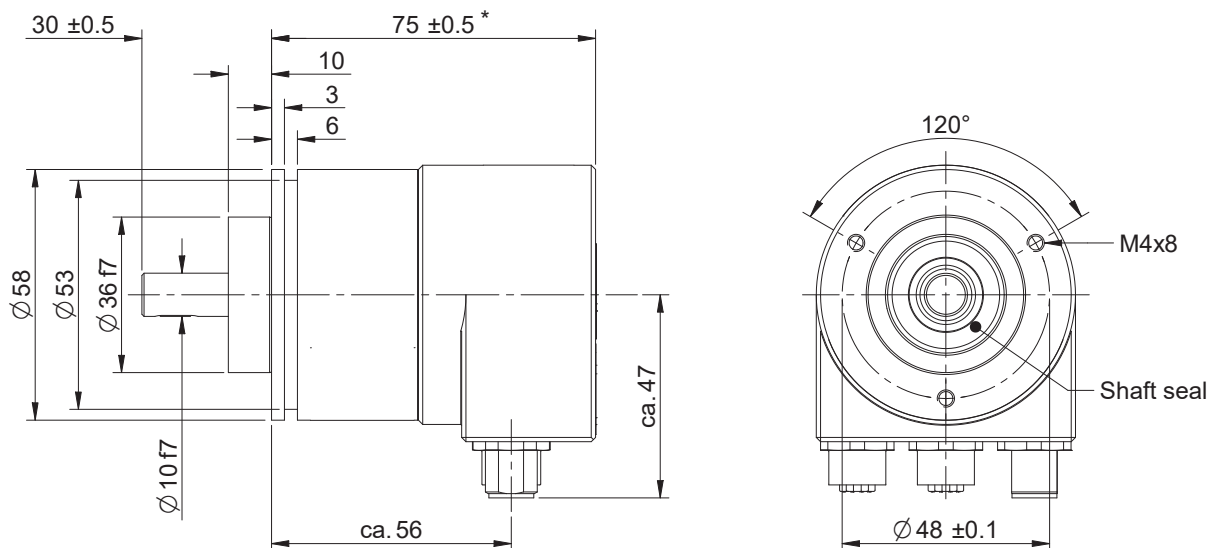
Installation drawings

Standard design

Design form 58 with clamped flange, order number: TRT58-KPA8192R4096S3MT01

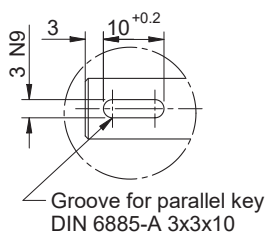
Shaft \varnothing 10 mm, with parallel key

Dimensions in mm

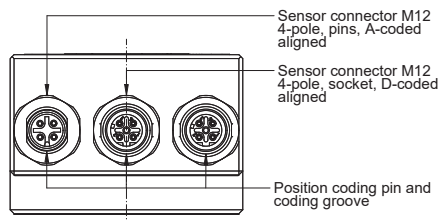


* Singleturn version 14 mm shorter

■ Shaft \varnothing 10 mm with groove and parallel key

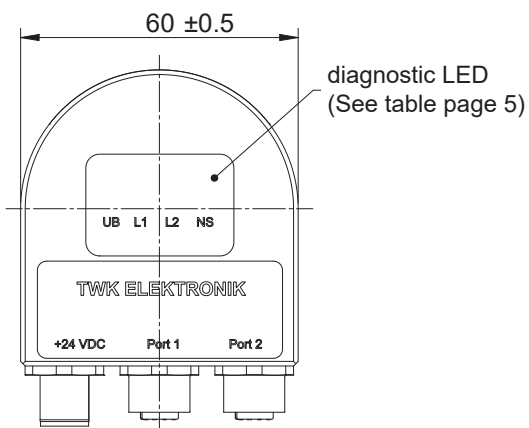


Connector view with M12-connector

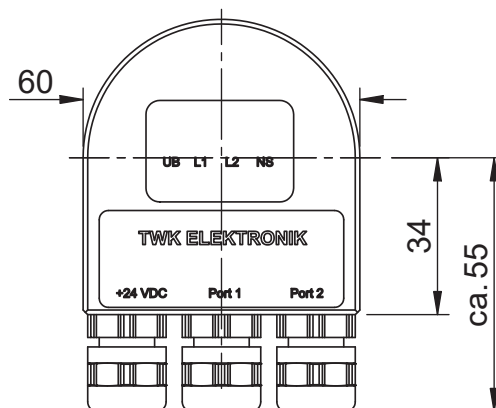


Note:
The connectors of the stainless steel version are not aligned.

Rear view with M12 connectors



Rear view with cable output



Absolute single-/multiturn encoder model TRT/S3

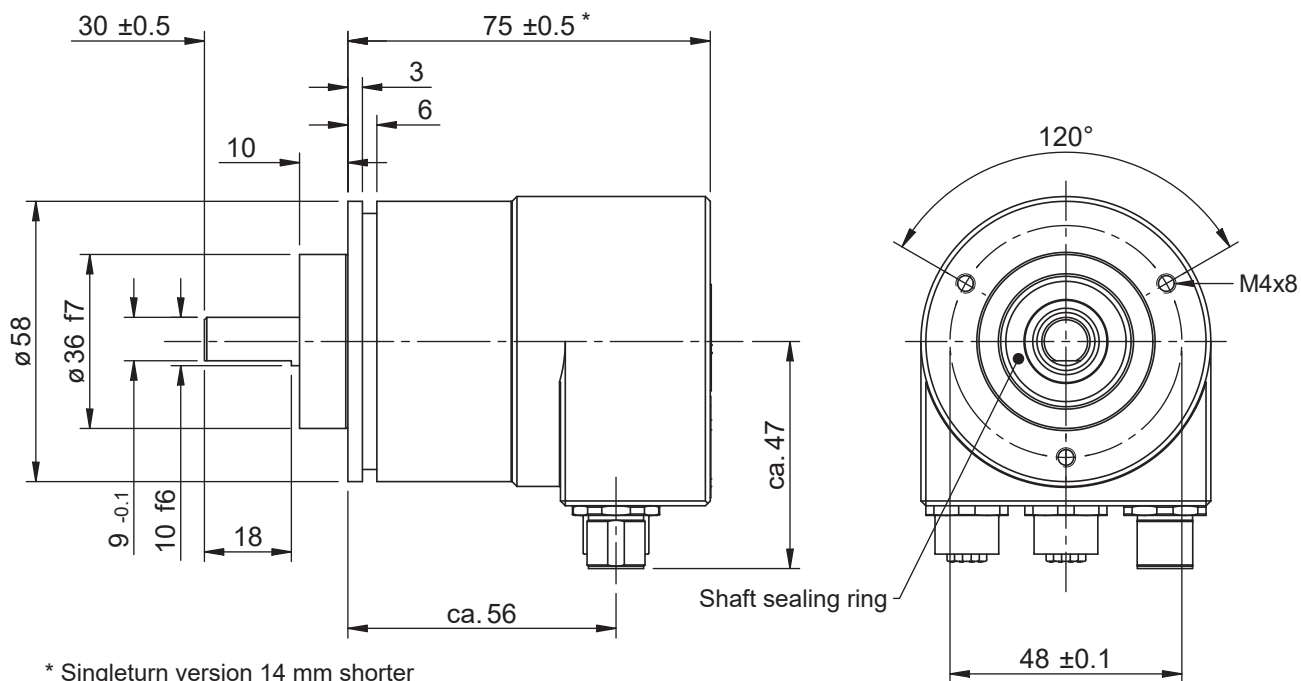
Installation drawings

Further possible designs

Design form 58 with clamped flange, order number: TRT58-KA8192R4096S3MT01

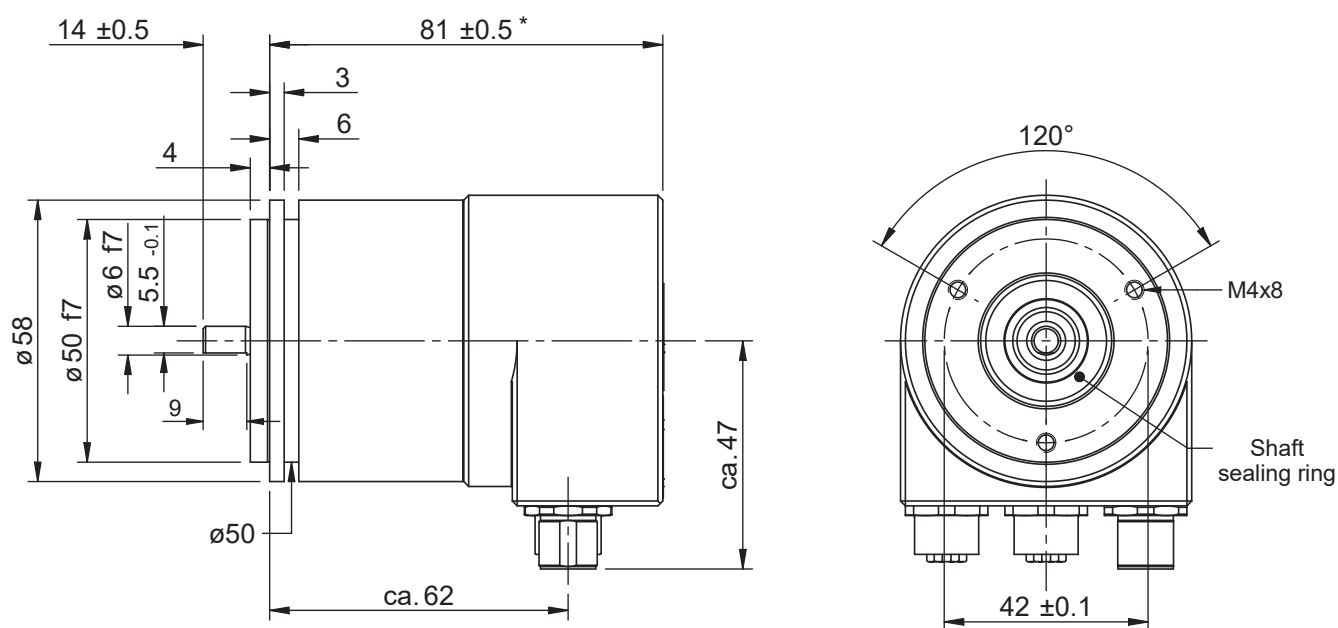
Shaft \varnothing 10 mm with flat

Dimensions in mm



Design form 58 with synchroniser flange, order number: TRT58-STA8192R4096S3MT01

Shaft \varnothing 6 mm with flat



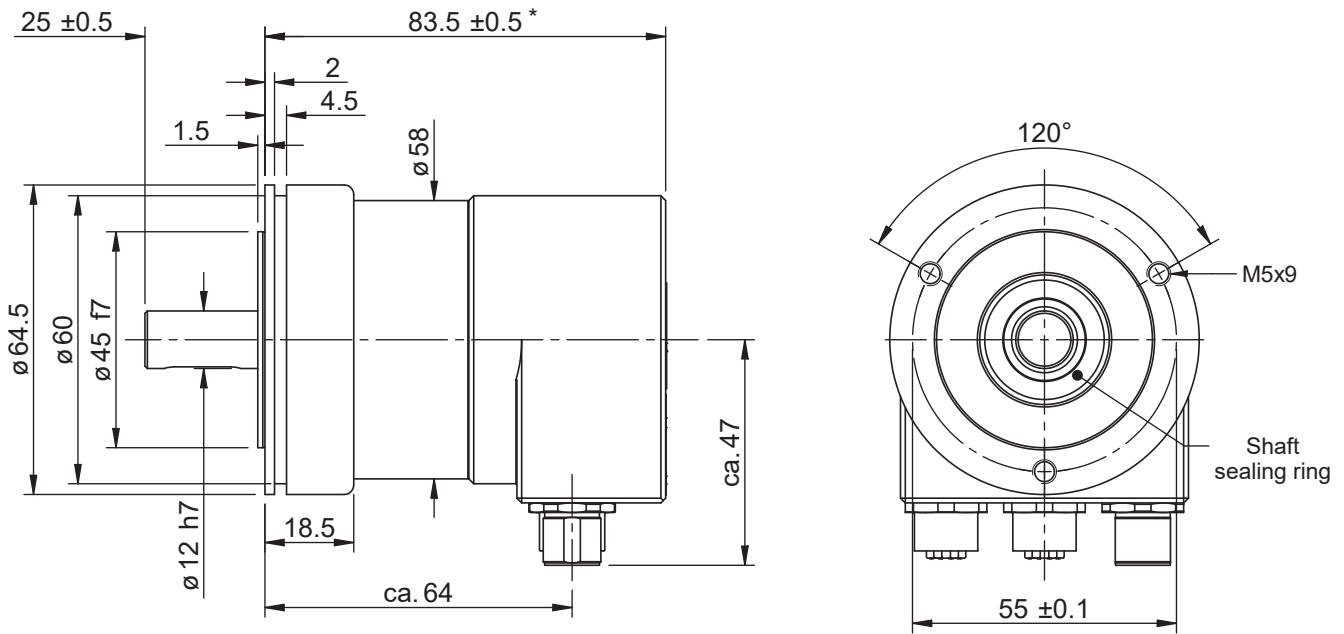
Absolute single-/multiturn encoder model TRT/S3

Installation drawings

Design form 65 with synchroniser flange, order number: TRT65-SPA8192R4096S3MT01

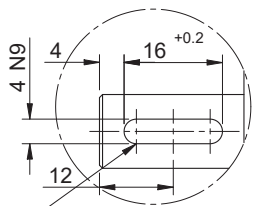
Shaft \varnothing 12 mm, with parallel key

Dimensions in mm



* Singleturn version 14 mm shorter

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



Groove for parallel key
DIN 6885-A 4x4x16

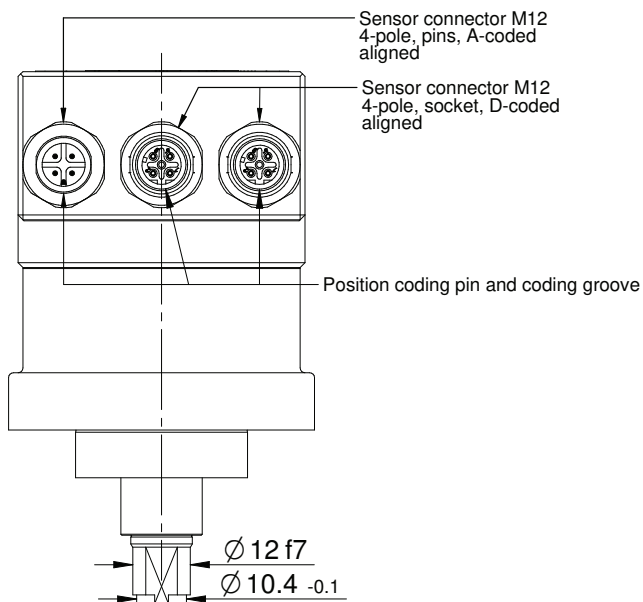
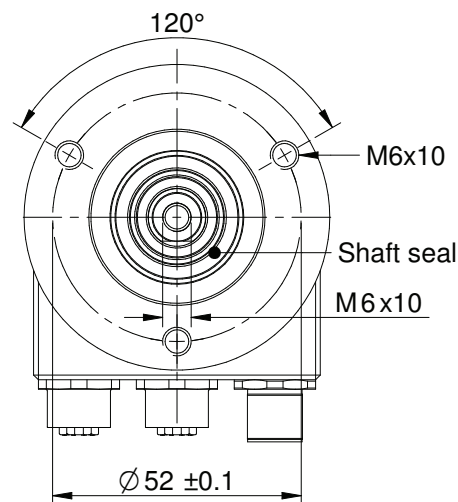
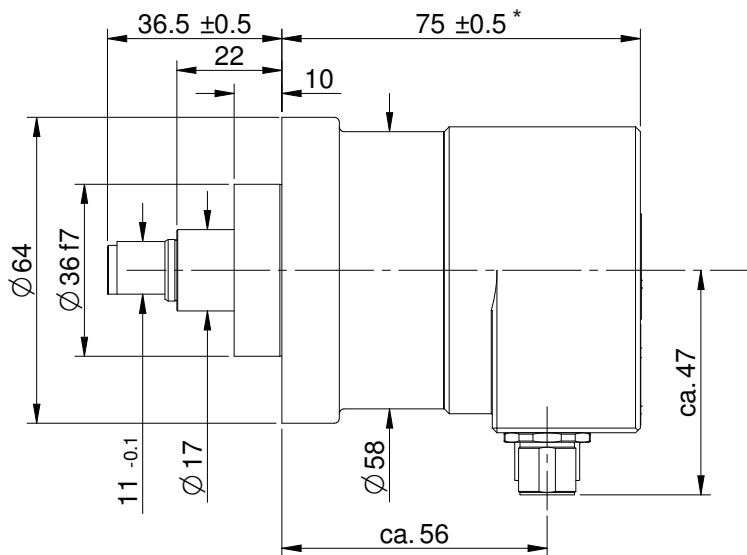
Absolute single-/multiturn encoder model TRT/S3

Installation drawings

Design form 64 with switching cam encoder flange, order number: TRT64-NZA8192R4096C4MT01

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

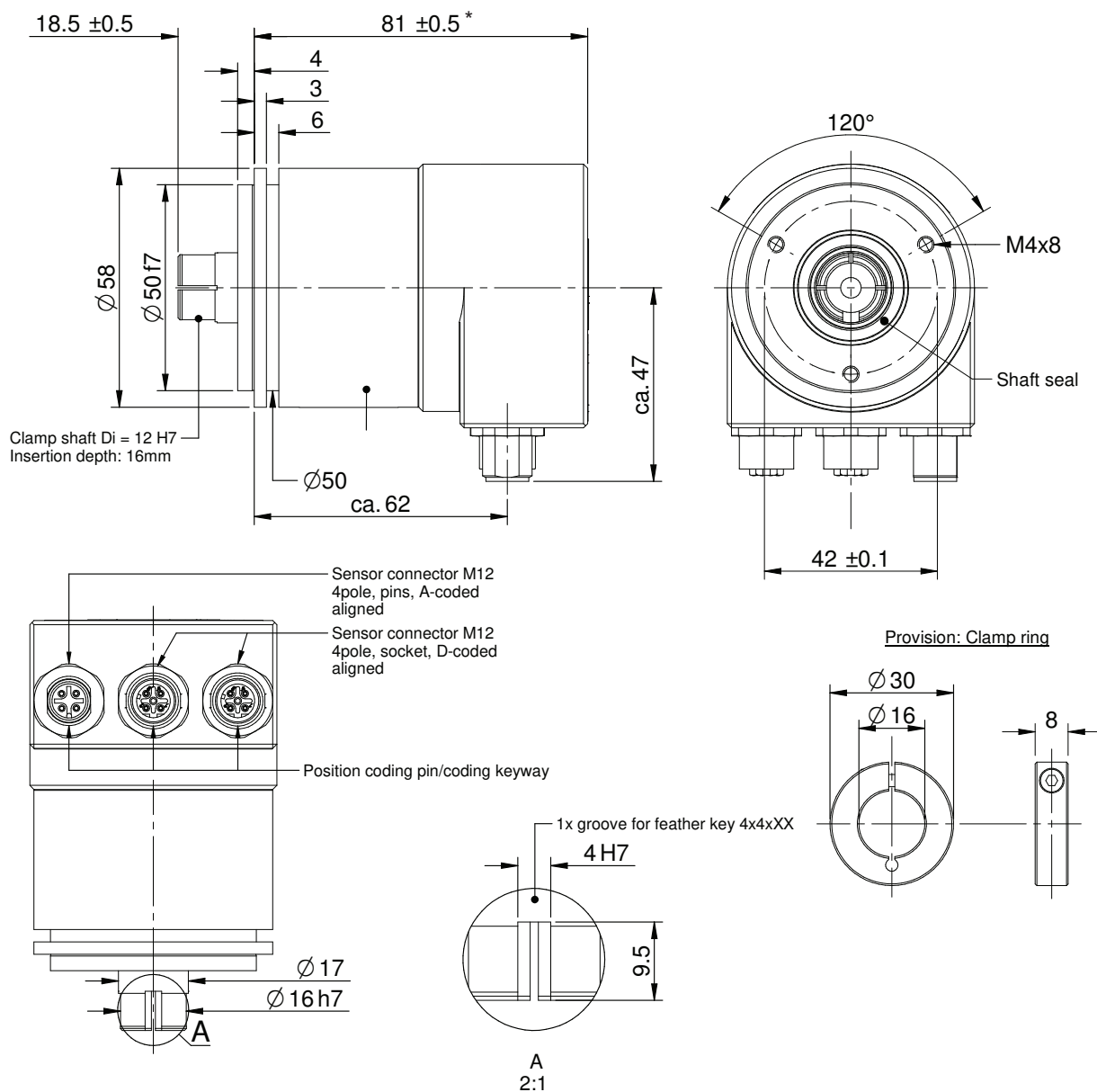
Absolute single-/multiturn encoder model TRT/S3

Installation drawings

Design form 58 with **synchroniser flange and clamping shaft**,
order number: TRT58-SNA8192R4096S3MT01

Shaft \varnothing 12 mm (Other shaft diameters on request)

Dimensions in mm



* Singleturn version 14 mm shorter

Note:

The connectors of the stainless steel version are not aligned.

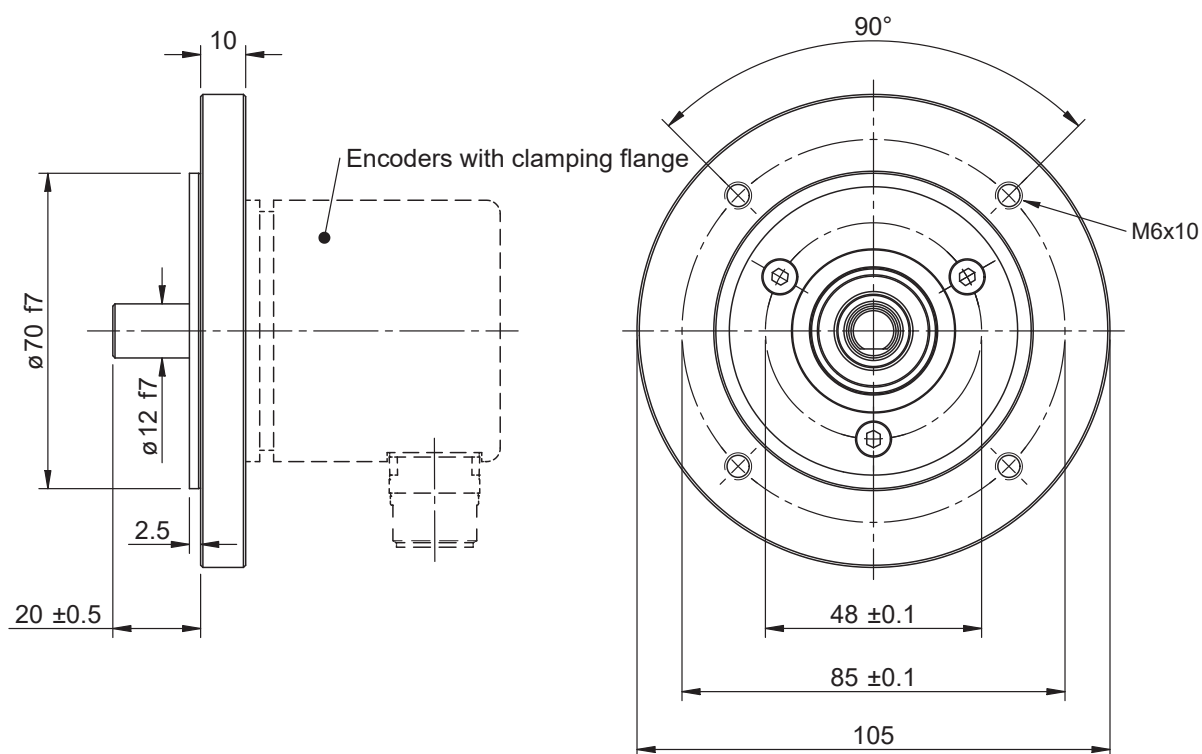
Absolute single-/multiturn encoder model TRT/S3

Installation drawings

Design form 105, order number: TRT105-MPA8192R4096S3MT01

Shaft \varnothing 12 mm, with parallel key

Dimensions in mm



- Shaft \varnothing 12 mm with groove and parallel key

