

Absolute encoder TRT with PROFINET interface



- Singleturn and multiturn versions
- Contactless, wear-free sensor system
- High vibration and shock resistance thanks to the robust mechanical design
- Position and speed signal
- Resolution: up to 8192 steps/360° ↯ (13-bit)
(HW version 2: 16384 (14 bit))
- Measuring range: up to 4096 revolutions
- Protection type: up to IP69K
- PI certified PROFINET interface
- Special slewing ring software for non-reversing operation available
- Encoder Profile 4.2
- Hardware version 2 in preparation

Design and function

Recording of the angular position and revolutions by means of Hall sensors - multiturn version with 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 - 3 are supported, i.e. Real Time (RT) and Isochronous Real Time (IRT) plus the requirements of conformance class C.

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 manual [TRT 12887](#).

In the version with code type "S" the TRT offers a slewing ring functionality. This converts the sensor shaft position value into the position of a slewing ring or a rotary table.

The slew ring encoder permits the adjustment of the number of teeth of the slew ring and of the encoder gear-wheel via the encoder parameters. In this way all gear ratios are possible and the encoder can be adapted to any slew ring by the user. The output values are the position of the slew ring in degrees (resolution adjustable) and his velocity in degree/time basis (time basis adjustable).

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

Absolute encoder model TRT

Technical data

Input / output data *

- Depending on the used profile
- Supported Telegrams 81 (according Encoder-Profil 4.2), and Class1 and Class2 Telegrams according Encoder Profil Version 1.1 (for HW version 2, otherwise only Encoder Profil 1.1)

Electrical data

- Sensor system: Magnetical
- Operating voltage: + 9 VDC to + 36 VDC (polarity reversal 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 bzw. 16384 steps)
4096 revolutions (only multiturn version)
Singleturn: 12 or 13 bit, multiturn: 24 or 25 bit
(HW version 2: 14 bzw. 26 bit)
- Measuring range: ± 0.2 % (with reference to one revolution), singleturn version ± 0.1 %
(HW version 2: 0,2 %, singleturn version 0,05%)
- Total number of steps: Singleturn: 12 or 13 bit, multiturn: 24 or 25 bit
(HW version 2: 14 bzw. 26 bit)
- Absolute accuracy: ± 0.2 % (with reference to one revolution), singleturn version ± 0.1 %
(HW version 2: 0,2 %, singleturn version 0,05%)
- Internal updating time: 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: 1.000 rpm max. (For protection type IP65 up to 10.000 rpm)
- Angular acceleration: 10^5 rad/s^2 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 (Flange form HP: 500 N axial and radial)
- Bearing service life **: > 10^9 revolutions
- Weight: ca. 0.450 kg

Environmental data

- Operating temperature range: - 40 °C to + 85 °C
- Storage temperature range: - 20 °C to + 60 °C (due to packaging)
- Resistance
 - To shock: 500 m/s²; 6 ms (DIN EN 60068-2-27)
 - To vibration: 250 m/s²; 5 ... 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 output IP 68, IP 69K optional (DIN EN 60529)
With nilos ring instead of shaft seal ring: IP65
- 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.

Technical data**Electrical connection**

- PROFINET: M12 connector D-coded 4-pin for bus in / bus out, socket or cable outlet
- Supply: M12 connector A-coded 4-pin, pins or cable outlet

Cable outlet 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 outlet 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

Absolute encoder model TRT

Technical data

Programmable parameters

Class2 (Encoder Profil 1.1)

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)*	Steps per revolution (360°)
Total number of steps [steps]	1 ... 16,777,216 (33,554,432) or 4096 (8192) for singleturn encoder**	Overall measuring range
Gate time	10 ... 1000 ms	Time basis for speed registration
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).

(The values in brackets apply to the TRTxx-xxx8192R4096C4xTxx)

* HW version 2: 16384, ** HW version 2: 67108864 or 16384

Class4 (Encoder Profil 4.2)

Parameter	Value range	Parameter description
Parameter initialisation control	PRM data block / internal memory	Controls whether the encoder parameters are initialized by the Profinet Controller during startup (PRM data block) or by the internal memory of the encoder
Parameter write protect	Write all / read only / write controller / write Supervisor	Controls the write access via the acyclic communication
Parameter 65005 write protect	Write all / read only	The parameter 65005 contains the bits (param. initialization, param. write protect and reset control protect)
Reset control protect	Write all / read only	Controls the write access on parameter 972 (drive reset).
Class 4 functionality	on / off	Enables the scaling, the preset function and the code sequence
Compatibility mode	off	Not supported
Code sequence	CW / CCW	CW (clockwise): ascending values on rotation clockwise CCW (counter clockwise): descending values on rotation clockwise (viewed looking at the shaft)
Preset function	off / on	Enables the preset function for G1_XIST1
Scaling function	off / on	Enables the scaling
Channel related diagnosis	off / on	Not supported
Encoder type	Rotary encoder	
Resolution [steps/turn]	1 ... 16384	Steps per turn (360°)
Total measuring range [steps]	1 ... 67.108.864 or 16384 for single turn encoder	Results from set resolution times desired number of revolutions. The maximum value is 16384 x 4096.
Maximum tolerated failures of Master Sign-Of-Life	0...255	Not supported
Velocity measuring unit	steps/s (100ms, 10ms), rpm, N2/N4 normalised	
Velocity reference value for N2/N4	3000.0000	Specifies the 100% value for the N2/N4 output

Absolute encoder model TRT

Technical data, Diagnosis LED

Slew ring encoder

Parameter	Value range	Parameter description
Code path	CW/CCW	CW (clockwise): ascending values on rotation clockwise CCW (counter clockwise): descending values on rotation clockwise (viewed looking at the shaft)
Number of teeth slewing ring	1 ... 65535	Number of teeth of the machine's slewing ring
Number of teeth encoder pinion	1 ... 65535	Number of teeth of the encoder pinion which gears in the slew ring
Resolution position [steps]	1 ... 8192 x i	Desired resolution of the slew ring position, e.g. 3600 for a resolution of 0,1°. The maximum possible value depends on the gear ratio i.
Resolution for speed calculation [steps]	1 ... 8192 x i	The resolution of the slew ring used for the velocity calculation. This parameter can be adjusted independent of the parameter "Resolution position", e.g. 36000 for a velocity resolution of 0,01° / gate time. The maximum possible value depends on the gear ratio i.
Gate time [ms]	10 ... 1000	Time basis of the velocity measurement
Reference value [steps]	1 ... resolution position	To adapt to the users application the encoder can be set to any value within the measuring range. The preset function is processed via the output values and can be executed in the user program of the PLC.

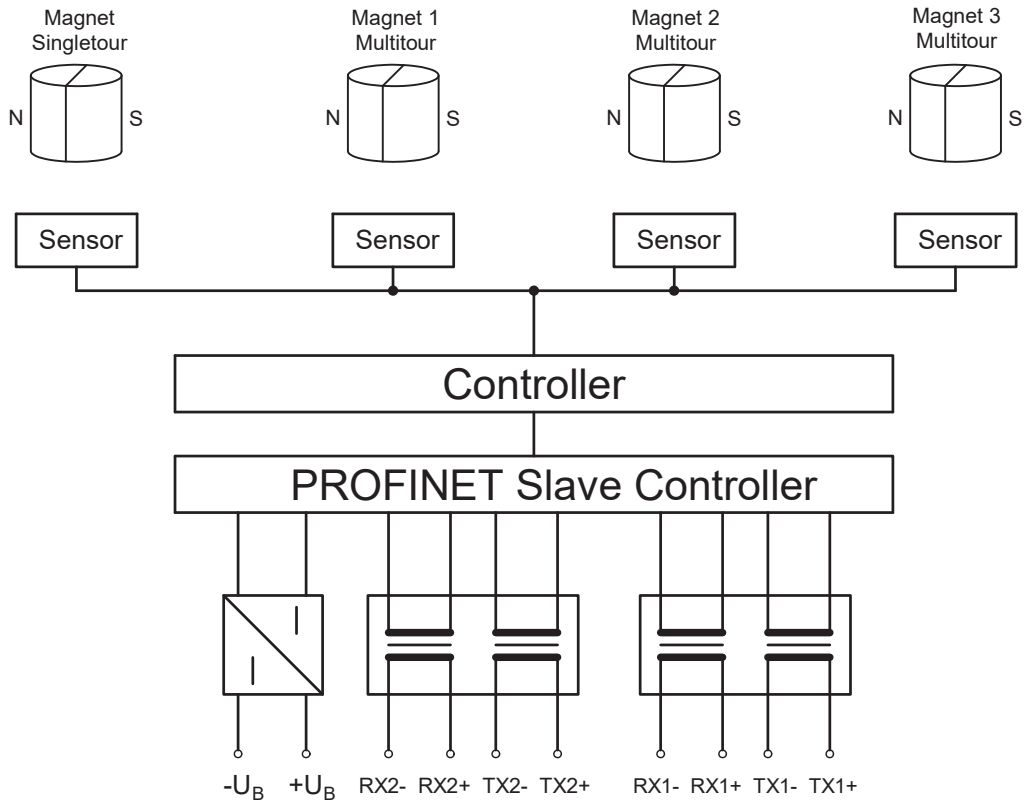
t = Gear ratio *Number of teeth slewing ring to Number of teeth encoder pinion*

Diagnosis LED

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
			Fast red flashing	Device error
			red	Connection to the PROFINET controller disrupted

Electrical connector

Block diagram



PROFINET M12 connector connection assignment
(Port1and Port 2)

Connection	Port 1 / Port 2			
Connector output Pin code	1	2	3	4
Cable output Core color *	yellow	white	orange	blue
Signal	TX+	RX+	TX-	RX-

Supply M12 connector connection assignment

Connection	+ 24 VDC			
Connector output Pin code	1	2	3	4
Cable output Core color *	white	—	brown	—
Signal	+ V _S (+ 24 VDC)	—	- V _S (0 VDC)	—

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

Absolute encoder model TRT

Order number

TRT	58	-	K	A	8192	R	4096	C4	M	T	01	→ Standard version
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Electrical and / or mechanical variants*:

- 01 Standard
- 11 Protection type IP69K
- 23 With Nilos ring instead of shaft seal ring

Output:

- T 100Base-TX

Electrical connection:

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

Profile:

- C4 Encoder-Profile 1.1 (Class2)
- E4 Encoder Profile 4.x (Class4)

Measuring range:

Singleturn: leave blank

1 ... 4096 Revolutions

Output code:

- R Binary code, position value format integer32
- W Binary code, position value format 2x integer16, resolution not adjustable
- S Binary code, position of the slew ring in integer32

Resolution:

- 4096 steps / 360° ↯ (for output code S enter always 8192)
- 8192
- 16384 (as of HW version 2)

Housing material:

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

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
- S Synchro flange, shaft 6 mm
- SR Synchro flange, clamping shaft 12 mm (torque plate see accessories)
- ST Synchro flange, shaft 6 mm with flat
- 64 HP Heavy duty flange for shaft loads up to 500 N, shaft 10 mm with parallel key
- NZ Cam switch flange, shaft for play-compensating toothed gear ZRS
- 65 S Synchro flange, shaft 12 mm
- 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
- 90 MP Mounting flange, shaft 12 mm with parallel key
- 105 M Mounting flange, shaft 12 mm
- MP Mounting flange, shaft 12 mm with parallel key

Design form:

TRT T-Series multi turn 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 encoder model TRT

Accessories, documentation, GSD 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

STK4WP116	for PROFINET in/out, see data sheet STK15518
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	24 V power supply cable with moulded M12 connectors A coded straight, 2. side open, length 5 m, see data sheet KBL13411
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■ 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
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■ Torque plate

ZMS	see data sheet ZMS12939
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■ 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/en in the documentation area, model TRT.

- Data sheet TRT12886
- Manual No. [TRT12887](#)

Installation drawings

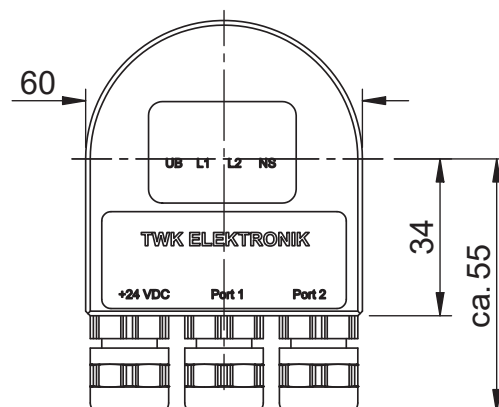
Shaft $\varnothing$ 10 mm

120°

M4x8

Radial shaft seal

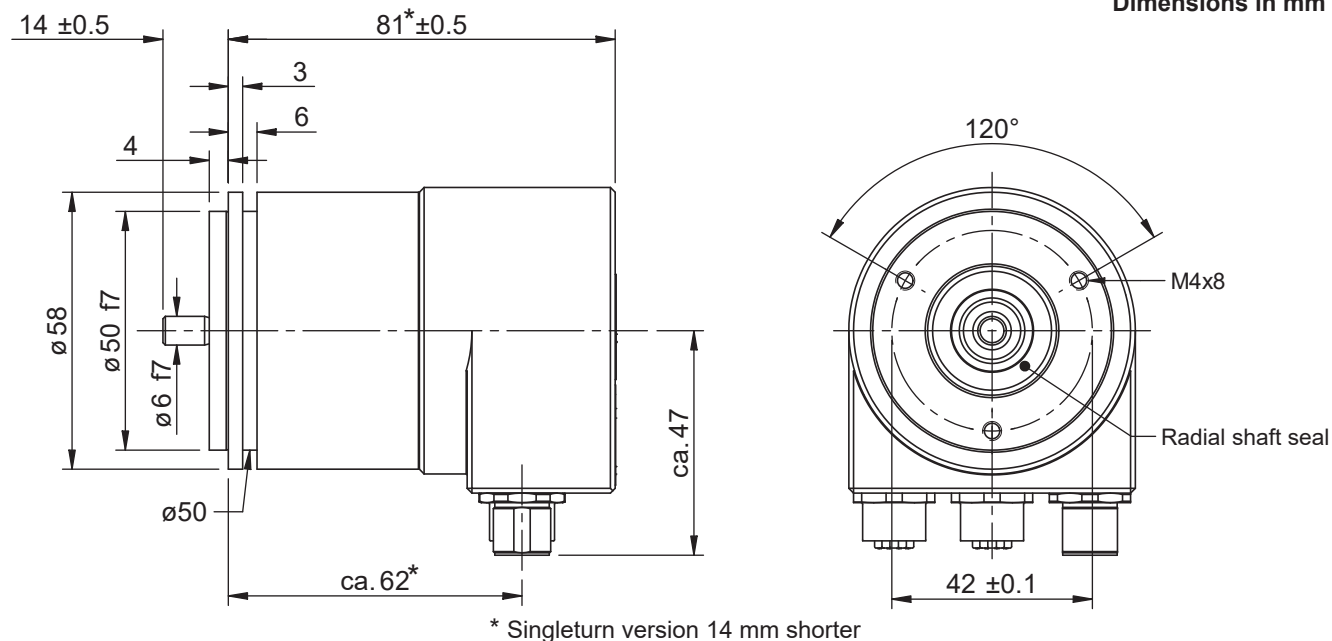
48 ± 0.1



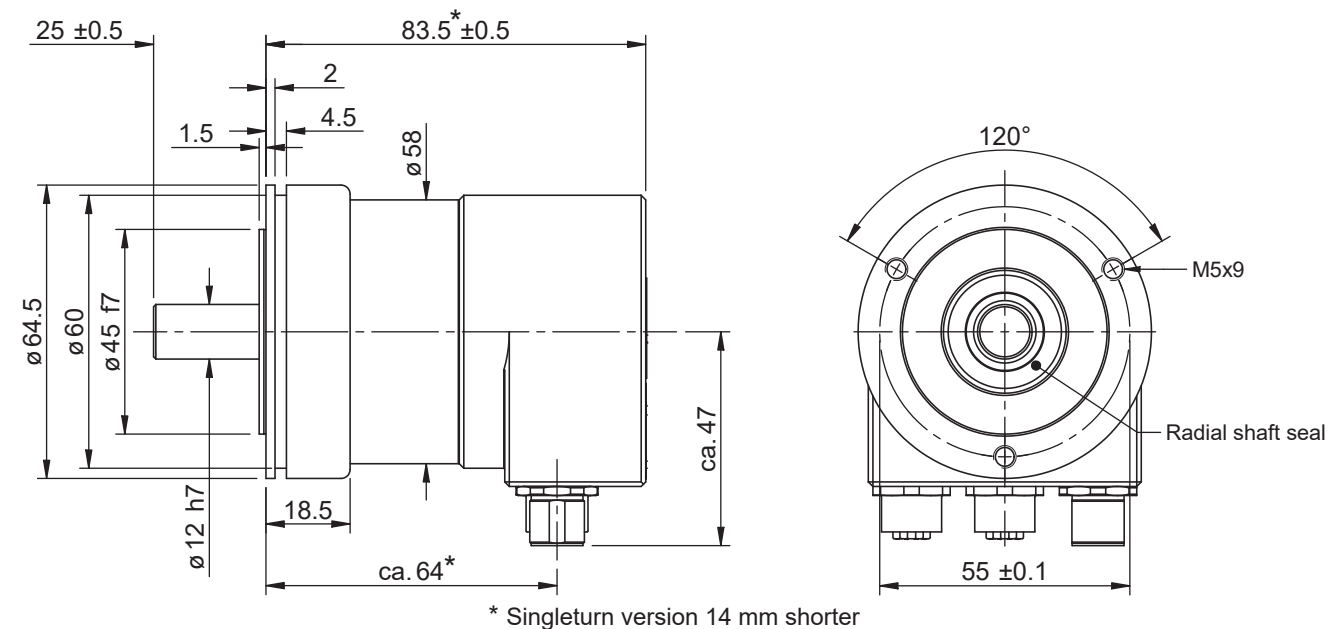
Installation drawings

Shaft $\varnothing$ 6 mm

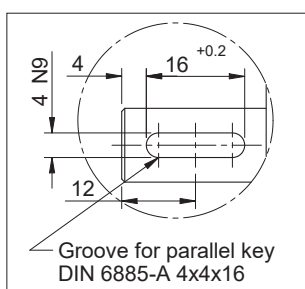
Dimensions in mm



Shaft $\varnothing$ 12 mm



- Optional: Shaft "P" with groove and parallel key



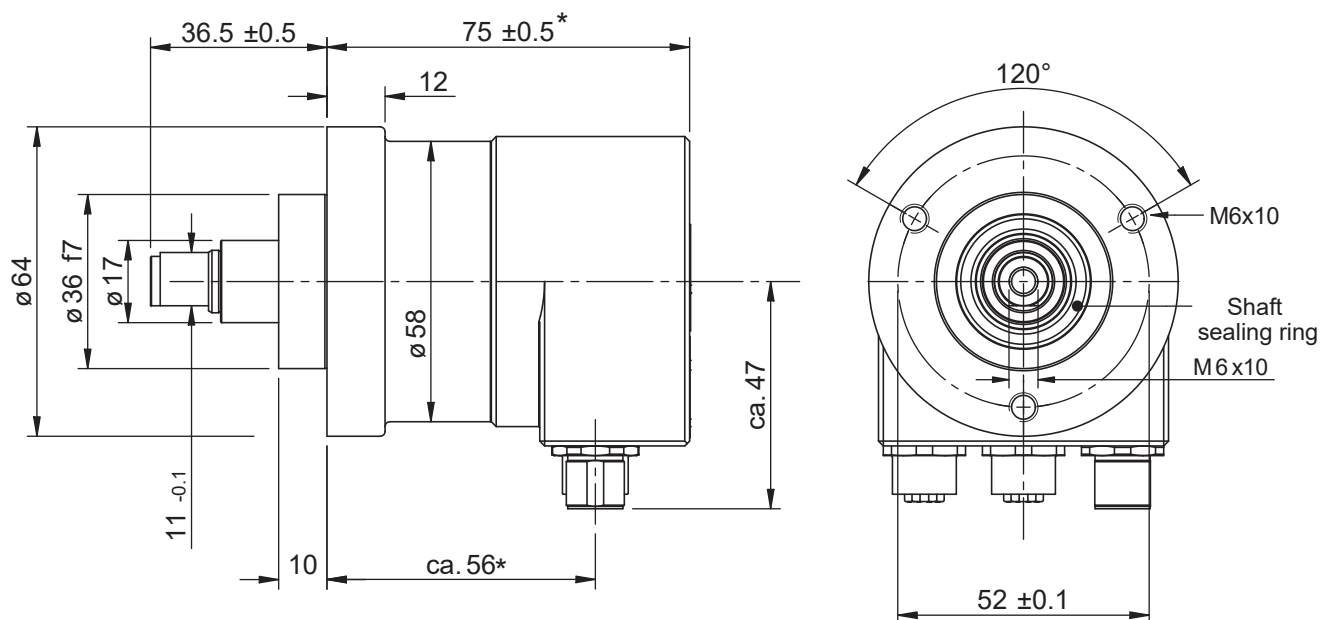
Absolute encoder model TRT

Installation drawings

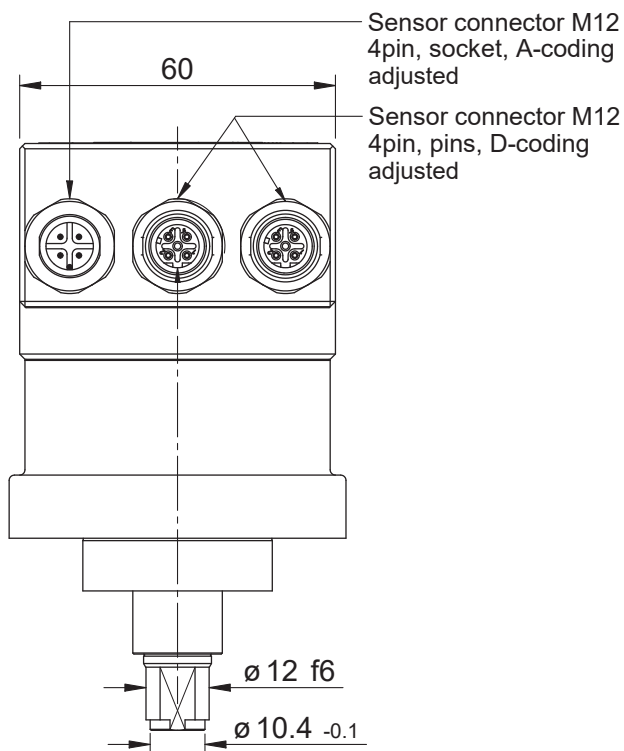
Design form 64 with switching cam encoder flange, order number: TRT64-NZA8192R4096C4MT01

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

Dimensions in mm

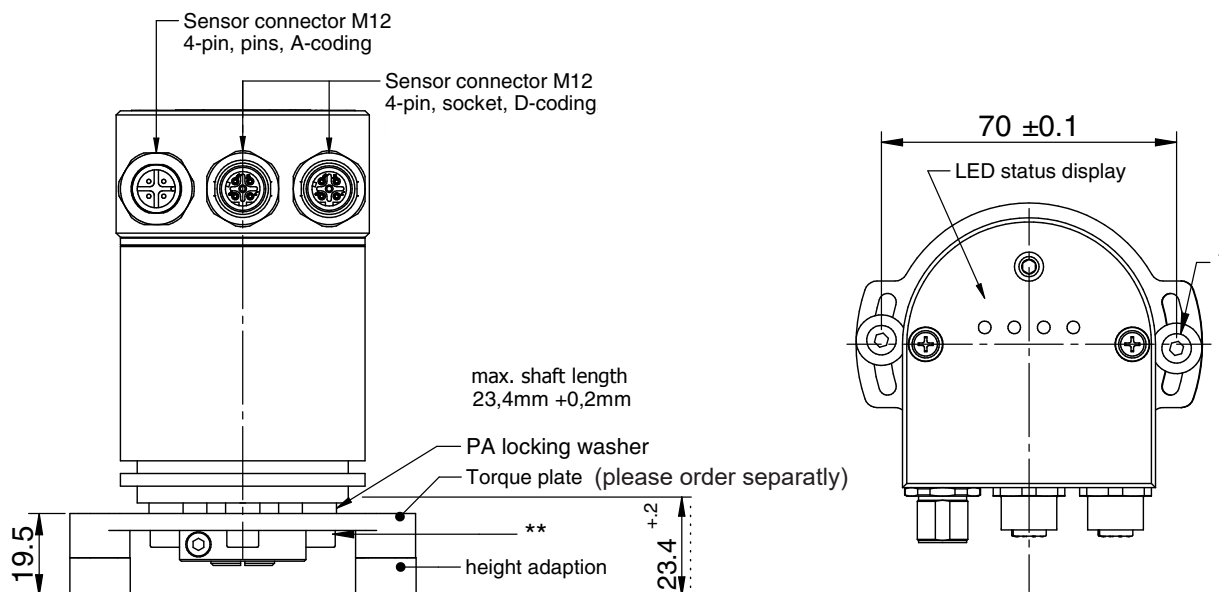


* Singleturn version 14 mm shorter

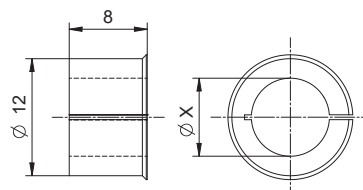
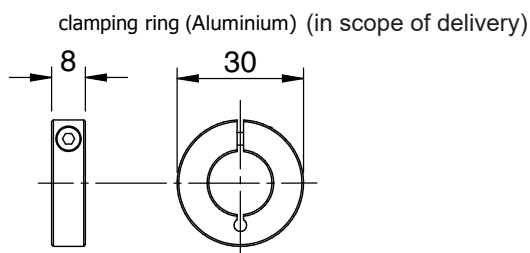


Installation drawings

Dimensions in mm



Ordering code: ZRH-A-12-X
X = 6, 6,35, 8, 9,53, 10



** 3x screw DIN 912 M4x10 (VA) with 3x locking washer (VA).

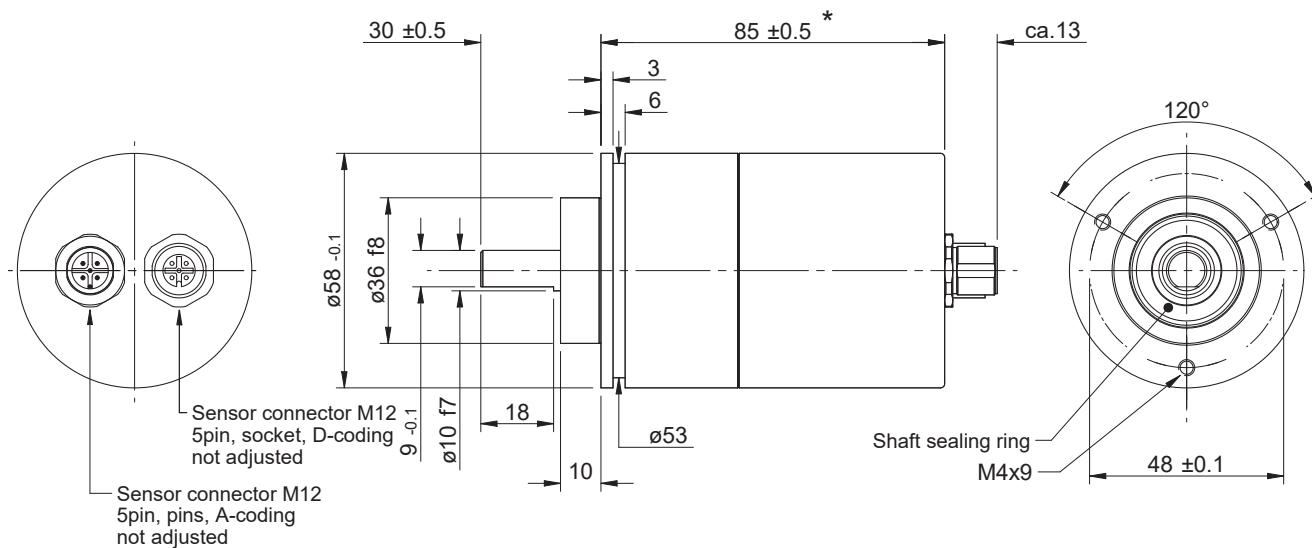
Absolute encoder model TRT

Installation drawings

Design form 58 with 2 axial connectors, order number: TRT58-KA8192R4096C4T2T01

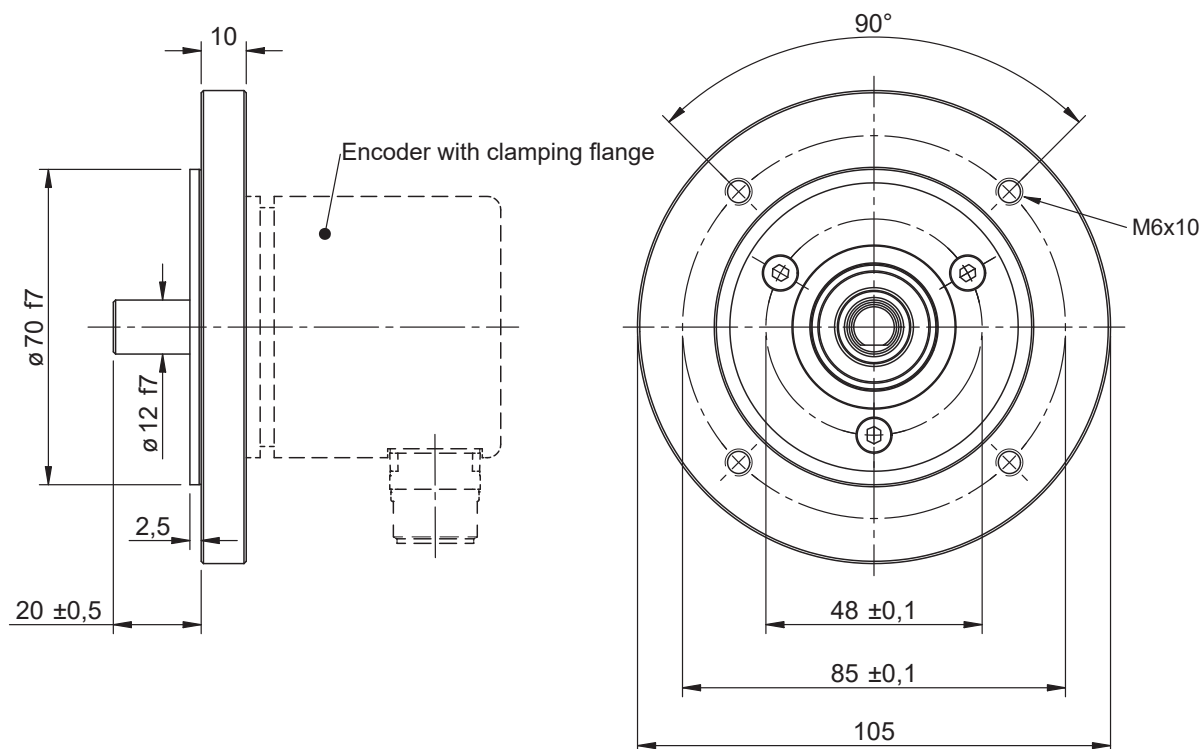
Shaft $\varnothing$ 10 mm with flat

Dimensions in mm



Design form 105, order number: TRT105-MA8192R4096C4MT01

Shaft $\varnothing$ 12 mm



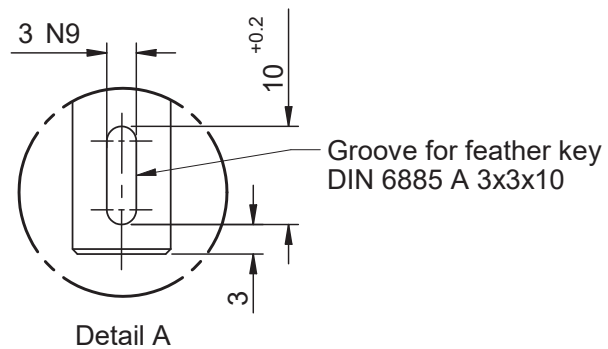
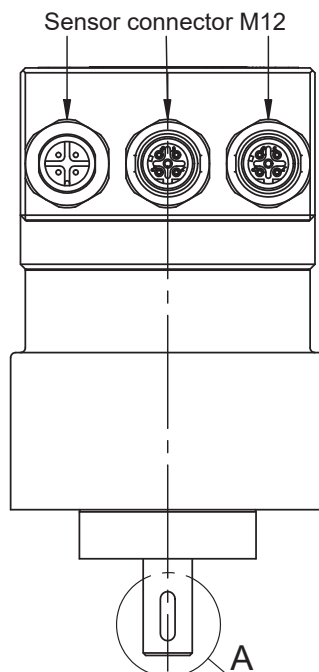
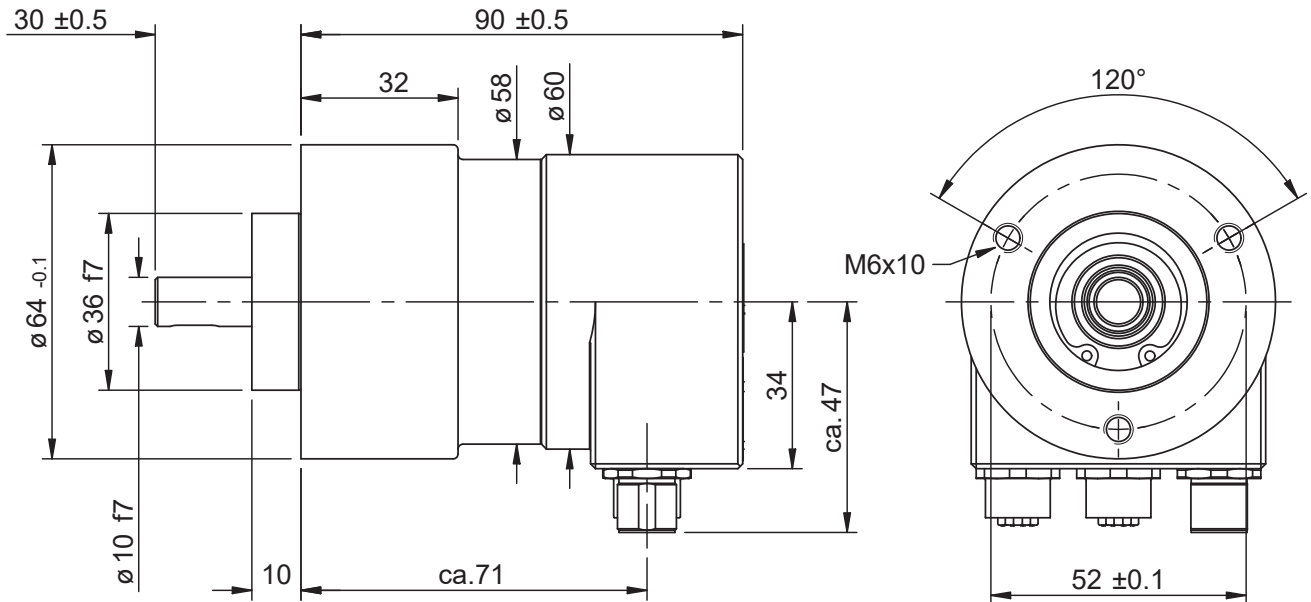
Absolute encoder model TRT

Installation drawings

Design form 64 with heavy duty flange, order number: TRT64-HPA8192R4096C4MT01

Shaft $\varnothing$ 10 mm with flat

Dimensions in mm



■ Suitable mounting bracket MW-S-03, see [MZ10111](#)