

TRT42/S3 - ABSOLUTE ROTARY ENCODER

INTERFACE:
PROFISAFE OVER PROFINET



The illustration shows the single turn version with radial connector outlet.

FEATURES

- Ultra compact version with a diameter of 42 mm
- Contactless, wear-free sensor system
- Available as singleturn or multiturn sensor
- High vibration and shock resistance thanks to the robust mechanical design
- SIL2 and PLd certified
- Safe position and safe speed signal
- Resolution: up to 65536 steps / 360° (16 bit)
- Programmable via PROFINET
- Slewing ring function



KEY INFORMATION OVERVIEW

DESIGN & FUNCTION

The TRT42/S3 sensor is used to detect the angular position of a shaft. Absolute single-turn or multi-turn for up to 4096 revolutions. The position of its shaft is magnetically scanned and output as an absolute value via PROFINET/PROFISafe. A speed value is determined from the change in position over a specified time and output at the same time as the current position value. Position and speed scalings, other parameterizations and diagnosis can be done by the user via PROFINET.

The robust housing manufactured from seawater-resistant aluminum or stainless steel with a stainless steel shaft, the magnetic sensor system and the electrical connection via M8 connector make the TRT42/S3 to a robust and ultra compact device that can be used in many industrial applications where space is an issue.

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

With the code type "S", the TRT42/S3 offers a safe slewing ring functionality. This translates the position value of the sensor shaft into the position of a slewing ring or a rotary table, with any transmission ratio between the slew ring and the encoder pinion.

FEATURES INTERFACE

The Profinet interface according to IEC 61158 / 61784 or PNO specifications order No. 2.712 and 2.722, version 2.45 is integrated into the model series TRT42/3 absolute encoders.

To achieve the SIL2 level, the TRT42/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 Technology (PNO Order No. 3.192) version 2.4 and 2.6.

An exhaustive description of integration into a PROFINET network can be found in the **TRT 12846** manual.

- Real Time (RT) and Isochronous Real Time (IRT, not clocksynchronised)
- Device exchange without interchangeable medium or programming device
- Prioritized start-up (Fast Start Up)
- Media redundancy possible
- Firmware update via Profinet
- Programming via Profinet

If the device is used in a manner not specified by the manufacturer, the protective effect of the device may possibly be impaired.

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TECHNICAL DATA

ELECTRICAL DATA / RELATED TO THE NODE

Sensor system	magnetic
Operating voltage	+ 9 VDC to + 36 VDC (reverse voltage protection)
Power consumption	< 3 W
Switch-on current	< 500 mA
Resolution	up to 65536 steps / 360°
Measuring range	4096 revolutions (multiturn version)
Total number of steps	up to 28 bit
Absolute accuracy of the position value	± 0.2 % (with reference to one revolution) ± 0.1 % (singleturn version) up to ± 0,1 % (bearingless version, flange type „E“)*
Absolute accuracy of the speed value	± 0.8 % (related to the maximum value of 32767 steps/gate time) ± 0.4 % (singleturn version) up to ± 0,4 % (bearingless version, flange type „E“)*
Internal updating time of the position value	2 ms
Internal updating time of the speed signal	2 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)

INPUT DATA**

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

OUTPUT DATA**

2-byte control word
 4-byte reference value

PROFINET DATA

Profinet specification	IEC 61158 / 61784 or PNO specification No. 2.712 and 2.722, version 2.45
Profisafe profile	PNO specification No. 3.192, version 2.4 and 2.6
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

DIAGNOSIS LEDS (ONLY AT VERSION WITH RADIAL CONNECTORS)

LED 1 (L1, green)	link 1
LED 2 (L2, green)	link 2
LED 3 (VS, green)	power supply
LED 4 (NS, green/red)	device and network status

MECHANICAL DATA

Operating speed	5000 rpm max.
Angular acceleration	10 ⁵ rad/s ² max.
Moment of inertia (rotor)	1 gcm ²
Operating torque	≤ 3 Ncm (at 500 rpm)
Starting torque	≤ 1 Ncm
Perm. shaft load	50 N axial and 50 N radial
Bearing service life *	> 10 ⁹ revolutions
Weight	ca. 0.15 kg (stainless steel version ca. 0.5 kg)

* Depending on the installation situation

** From the point of view of the control system (PLC)

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TECHNICAL DATA

SAFETY DATA

Safety values acc. to EN 61508	PFH	1.66*10E-08 (Single-turn)
	PFH	1.74*10E-08 (Multi-turn)
	SFF	98.73 % (Single-turn)
	SFF	98.76 % (Multi-turn)
	HFT	0
	SIL	SIL2
Safety values acc. to EN 13849-1	MTTFd	100 years (calculated 224 years) (Singleturn)
	MTTFd	100 years (calculated 199 years) (Multiturn)
	DC	96.04 % (Single-turn)
	DC	96.37 % (Multi-turn)
	Category	2
	Performance Level	PLd
Max. operating life		20 years (please contact us for longer service lives)
Tolerance of the internal position monitoring		0.8% (with reference to one revolution)
		Smaller values possible with reduction of max. speed. Please contact us.

PROGRAMMABLE PARAMETERS

ENCODER WITH OUTPUT CODE D

Scaling	OFF / ON	
Code sense	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 to 65536	Steps per 1 revolution (360°).
Total number of steps [steps]	1 to 268435456	Overall measuring range.
Reference value [steps]	0 to 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.
Gate time [ms]	10 to 1000	Time basis of the velocity measurement.

ENCODER WITH OUTPUT CODE S

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).
Number of teeth slewing ring	1 to 65535	Number of teeth of the machine's slewing ring.
Number of teeth encoder pinion	1 to 65535	Number of teeth of the encoder pinion which gears in the slewing ring.
Resolution position [steps]	1 to 65536 x i*	Desired resolution of the slewing 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 [ms]	1 to 65536 x i*	The resolution of the slewing 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 to 1000	Time basis of the velocity measurement.
Reference value [steps]	0 to resol. position-1	To adapt to the users application the encoder can be set to any value within the measuring range. In case of the slewing ring encoder this means 0 to resolution position -1 (= max. value). The preset function is processed via the output data and can be executed in the user program of the PLC.

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

PRODUCT CHARACTERISTICS: SLEWING RING FUNCTIONALITY
DESCRIPTION

For applications in wind turbines, cranes, transport units, etc. it is desirable to emulate the function of a mechanical gearbox. For example, if the rotary encoder is coupled to the drive axle of a gearbox or if the position of a slewing ring is to be detected using a measuring gear with coupled rotary encoder.

Software version 'S' provides this function. The encoder is located on the fast gear axis (drive wheel) and calculates the position of the slow gear axis (output wheel) via the transmission ratio. The transmission ratio and the resolution of the output axis (digit per revolution) can be freely selected. The output code is consistent beyond the code range of the encoder, regardless of the selected transmission ratio. The transmission ratio can be even or odd.

The user does not have to evaluate the gear revolutions and can run through any number of gear periods in one direction. This means that non-reversing operation is possible.

The algorithm of the slew ring software ensures that a full gear period is always available, even at the end of the encoder's code range. For the correct function of the slew-ring-module, the encoder may only be rotated a pre-determined number of revolutions in a de-energized state (1024 to 2047 revolutions in each direction by default depending on the gear ratio i). Please see manual for slewing ring functionality **TRT12846** for further details.

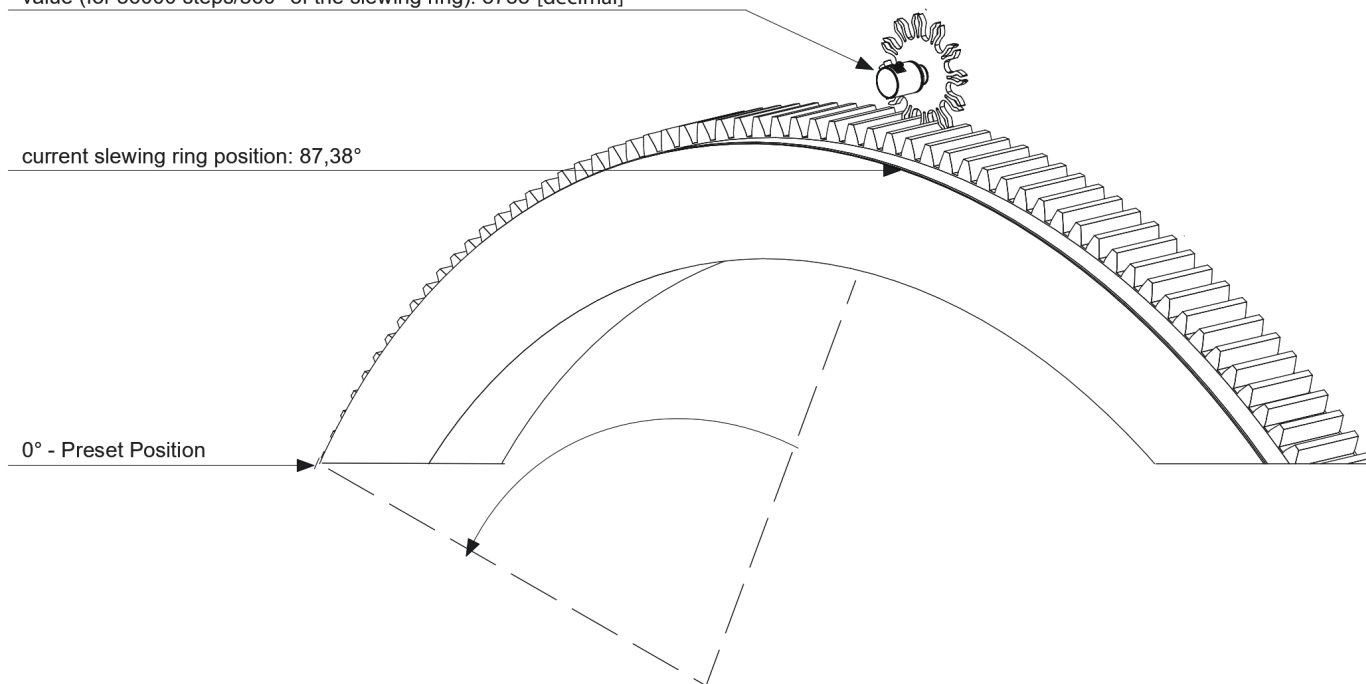
ENCODER OUTPUT

The output resolution, the numbers of teeth of slew ring and drive wheel can be parameterized by the customer via PROFINET parameters. Depending on the gear ratio, i , different resolutions can be parameterized e.g. $1/100^\circ$ (36,000 steps/360°-slewing ring rotation) or $1/1\,000^\circ$ (360,000 steps/360°-slewing ring rotation). For further details please refer to manual **TRT12846**

value (for 36000 steps/360° of the slewing ring): 8738 [decimal]

current slewing ring position: 87,38°

0° - Preset Position

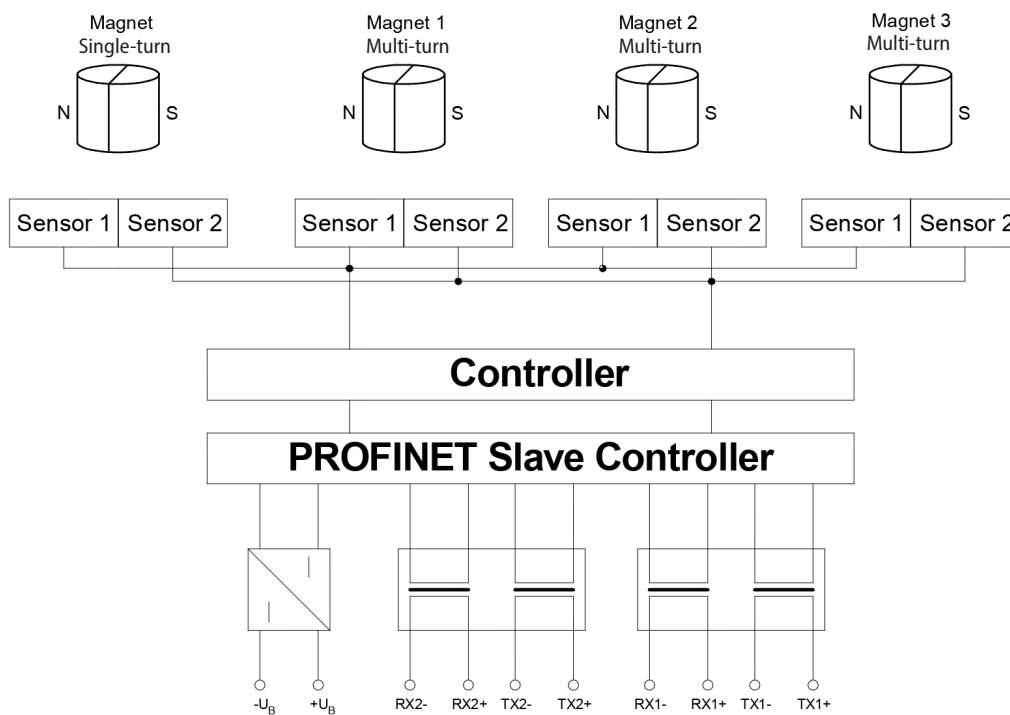


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TECHNICAL DATA

PRINCIPAL CIRCUIT DIAGRAM



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ELECTRICAL CONNECTION - PINOUT

ELECTRICAL CONNECTION

PROFINET M8 connector axial, D-coded, 4 pins, female for port 1 and port 2

Power supply M8 connector axial, A-coded, 4 pins, male

PROFINET CONNECTOR, 2 X M8, D-CODED, FEMALE

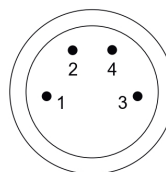
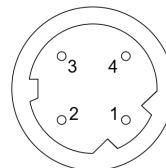
PIN Function

- 1 TX+
- 2 RX+
- 3 TX-
- 4 RX-

SUPPLY CONNECTOR, M8, A-CODED, MALE

PIN Function

- 1 +VS (+24 VDC)
- 2 not used
- 3 -VS (0 VDC)
- 4 not used



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ORDER CODE FORMAT

STANDARD VERSION

TRT	42 -	ST	A	65536	D	4096	S3	M	T	160
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TRT	TRT Multiturn encoder with Profinet/Profisafe interface									
42	Design form	42	Design form 42							
ST	Flange and shaft	SN SP ST SZ E	Synchro flange, clamping shaft 10 mm with groove for parallel key Synchro flange, shaft 10 mm with parallel key Synchro flange, shaft 6 mm with flattened area Synchro flange, shaft for play-compensating toothed gear ZRS Bearingless "KIT Encoder" with external magnet							
A	Housing material	A S V U	Aluminium 3.2315 (AlMgSi1) Stainless steel 1.4305 (AISI 303) Stainless steel 1.4404 (AISI 316L) Stainless steel 1.4104 (AISI 430F) for shielding strong magnetic fields							
65536	Resolution in Steps/360°	65536	16 bit (parameterisable)							
D	Code	D S	Binary code, position as 32 Bit double word Binary code, slewing ring function, position as 32 Bit double word							
4096	Measuring range	4096	Number of revolutions (Single turn version: leave blank)							
S3	Profile	S3	SIL2/PLd certified according to this data sheet							
M	Electrical connection	M	3 x M8 connector axial							
T	Output	T	PROFINET 100Base-TX							
160	Electrical and mechanical variants*	160	Standard							

* The basic versions according to the data sheet bear the number 160. Deviations are marked with a variant number and documented at EPC.

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ACCESSORIES (SELECTION) - TO BE ORDERED SEPARATELY

CONNECTION CABLE - PROFINET

- KABEL-x-246** Industrial Ethernet data cable with M8 connectors, D-coded, moulded on at both ends
 x = length in meters, standard lengths: 1, 2, 5, 10 m, see datasheet **KBL17516**
- KABEL-x-247** Industrial Ethernet data cable with M8 connector D-coded to RJ 45
 x = length in meters, standard lengths: 1, 2, 5, 10 m, see datasheet **KBL17521**
- KABEL-x-257** Industrial Ethernet data cable with M8 connector D-coded to M12 connector D-coded
 x = length in meters, standard lengths: 1, 2, 5, 10 m, see datasheet **KBL17615**

CONNECTION CABLE - POWER SUPPLY

- KABEL-x-245** Power supply cable with M8 connector A-coded, 2. side open
 x = length in meters, standard lengths: 1, 5, 3, 5, 10 m, see datasheet **KBL17549**

SHAFT COUPLINGS

- BKK** Bellows coupling, large, see datasheet **BKK11840**
- BKM** Bellows coupling, small, see datasheet **BKM11995**
- KK14** Clamp coupling, see datasheet **KK12301**

TOOTHED GEARS

- ZRS** Play-compensating toothed gear, see datasheet **ZRS11877**
- ZRM** Standard toothed gear, see datasheet **ZRM13229**

STATOR COUPLING / TORQUE SUPPORT

- ZVS** See datasheet **ZVS16796**

GENERAL MECHANICAL ACCESSORIES

- Syn. clamps etc.** See datasheet **MZ10111**

DOCUMENTATION

DOCUMENTATION

The following documents can be found in the Internet under www.encoder.com in the documentation area, model TRT42.

Data sheet	TRT16468
Manual	TRT12846
Certificate PROFINET.....	ZE17394
Certificate PROFIsafe.....	ZE17395
Certificate SIL2/PLd	ZE17421
GSD files	GSDML-V2.45-EPC-TRT42S3-20250611.xml
Installation instructions	AN16169
Software etc.....	Software PsCrc
	Program examples
Safety Library	EPC_Safety_Sensors_20251009.xml
Declaration of Conformity.....	CE: ZE12467, UKCA: ZE16569
Reach compliant	QS15286
RoHS compliant	QS13284

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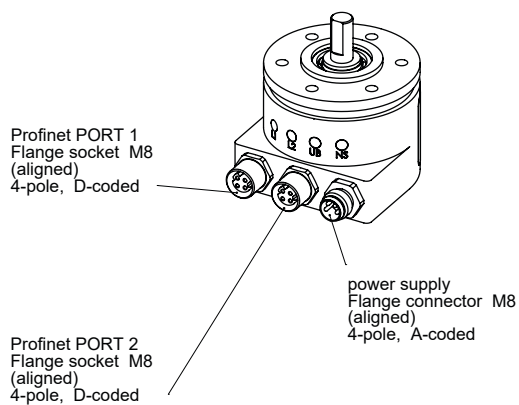
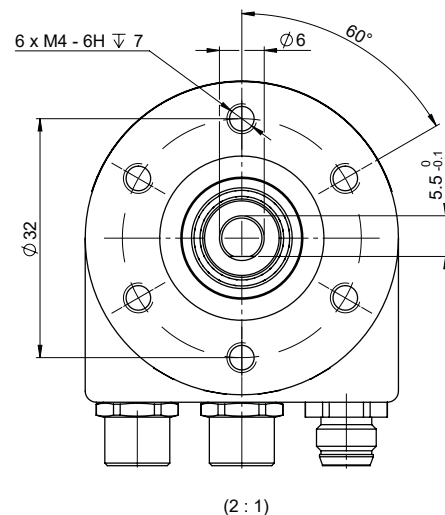
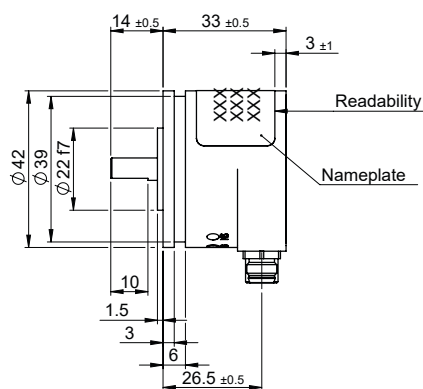
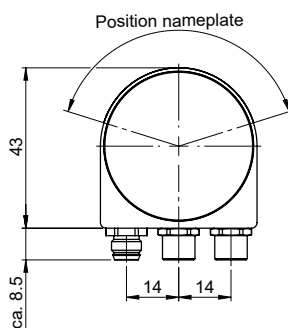
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INSTALLATION DRAWINGS

MODEL TRT42-SA65536DS3MT01 - SINGLETURN - STANDARD VERSION

Shaft $\varnothing$ 6 mm with flattened area

Dimensions in mm



TRT42/S3 - ABSOLUTE ROTARY ENCODER

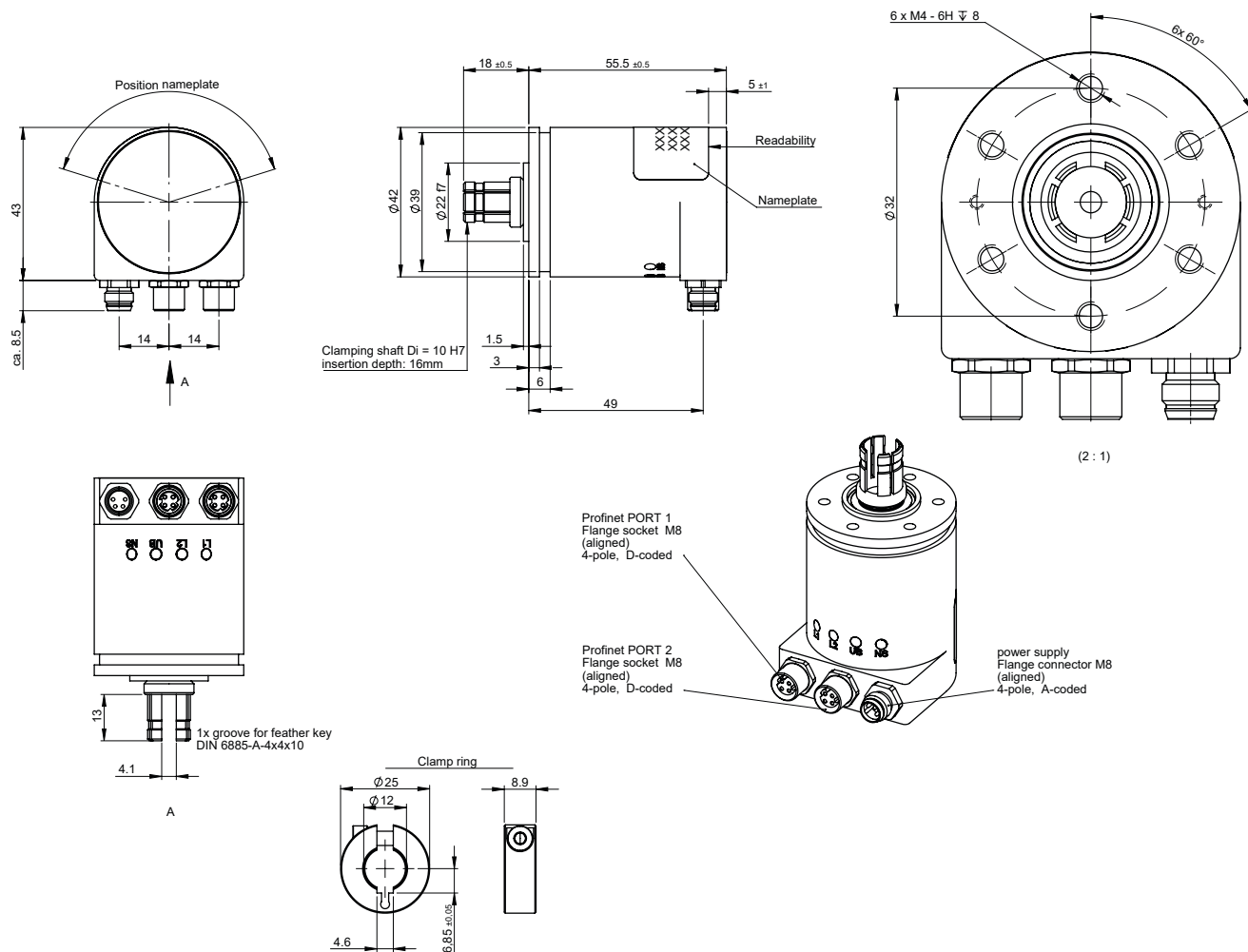
INTERFACE:
PROFISAFE OVER PROFINET

INSTALLATION DRAWINGS

MODEL TRT42-SNA65536D4096S3MT01 - MULTITURN

Clamping shaft 10 mm with groove for parallel key (other shaft diameters on request)

Dimensions in mm



NOTE

The singleturn version is about 22.5 mm shorter.

TRT42/S3 - ABSOLUTE ROTARY ENCODER

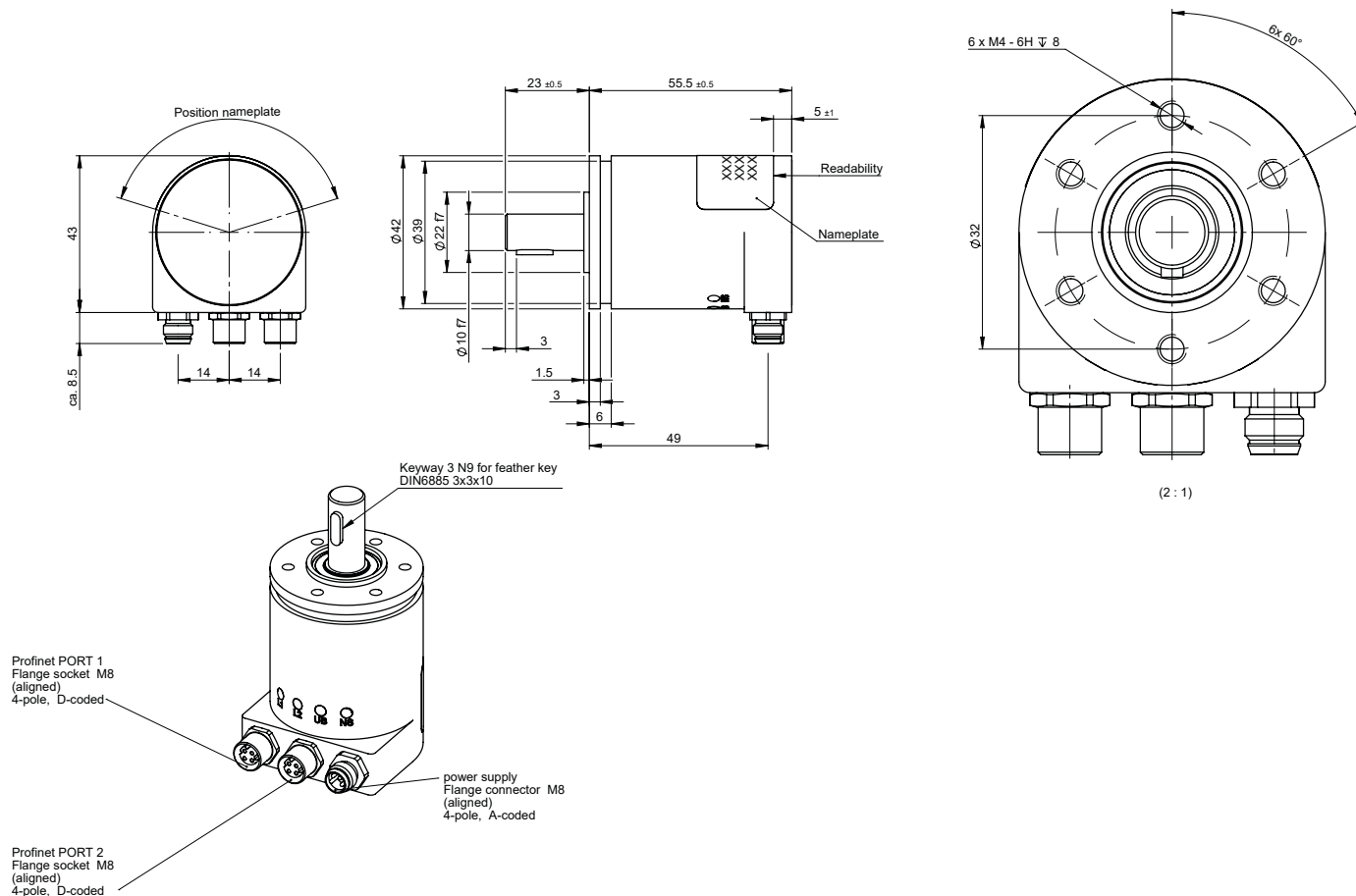
INTERFACE:
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INSTALLATION DRAWINGS

MODEL TRT42-SPA65536D4096S3MT01 - MULTITURN

Shaft 10 mm with parallel key

Dimensions in mm



NOTE

The singleturn version is about 22.5 mm shorter.

TRT42/S3 - ABSOLUTE ROTARY ENCODER

INTERFACE:
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INSTALLATION DRAWINGS

MODEL TRT42-EA65536DS3MT01 - SINGLE TURN, BEARING LESS

Dimensions in mm

Other magnets on request

