

Absolute Monoturn / Multiturn Encoder Models TBE / TRE with SSI-Interface



- For use in construction machines and systems, e.g. industrial plants engineering and for rough operating conditions
- Magnetic sensor system(s)
- Measuring range
 - TBE: max. 65,536 steps / 360°
 - TRE: max. 268,435,456 steps
(65,536 steps per revolution x 4096 revolutions)
- Protection grade IP65 / IP67
(Higher protection classes up to IP 69K are available as an option)
- Redundant design of the SSI-Interface optional, see notes on pages 7 and 17

Design

- Robust housing (wall thickness up to 5 mm) manufactured from seawater-proof aluminium (AlMgSi1 - 3.2315) or stainless steel (material: 1.4305 or 1.4404)
- Available versions in different housing diameters e.g. Ø 42, Ø 50, Ø 58 mm and special designs, optimized for specific applications are feasible
- Magnetic sensor system(s) for detecting the position
- The revolution detection is given by absolute multiturn gear on model TRE
- Electrical connection by connector M12x1, M23 or via cable

Function

A positive and mechanical connection between customer and sensor shaft ensures that the magnet of the sensor shaft the rotation of the customer shaft are exactly reproduced.

The encoder TBE is a single-turn encoder because the absolute position of the motor shaft can only be determined with one revolution.

For the encoder TRE the compact absolute gear counts revolutions up to 4096 turns safely and reliably - without a battery.

Via the inputs 'Set input' and 'Code sense' (in each case input circuit E1) can be set and changed the Reference value '0' and the Code sense (CW or CCW).

Absolute Monoturn / Multiturn Encoder

Models TBE / TRE with SS-Interface

Technical data

Electrical data

- Sensor system: Magnetic Sensor system(s)
- Operating voltage:
 - Ø 58: 9 to 36 VDC, Polarity-safe and short circuit proof
 - Ø 42, Ø 50: 18 to 28 VDC, Polarity-safe and short circuit proof
- Power consumption:
 - TBE: < 1 W
 - TRE: < 1.5 W
- Total of measuring steps:
 - TBE: max. 65,536 steps
 - TRE: 268,435,456 steps (65,536 steps / revolution x 4096 revolutions)
- Code sense (Input circuit E1): CW* oder CCW**, adjustable
- SET input (Input circuit E1): Set zero point (Other values from '1' to 'Total measuring range-1' as factory programmed)
- Absolute accuracy TBE: $\pm 0.1 \%$
- Absolute accuracy: TRE: $\pm 0.25 \%$
- Repeatability.: $\pm 0.02 \%$
- Temperature drift: $< 0.02^\circ / K$

SSI

The absolute angle information derived by the encoder is converted into serial information by an internal serial converter and the transmitted to a receiving electronic circuit in synchronism with a clock. Important advantages are: Low number of data lines, high reliability and high interference immunity by differential signal transmission (RS422). A detailed description can be found in the "TWK-SSI 10630" brochure.

- Input data CLOCK IN: Differential-Clock input (Optocoupler) for Data driver acc. RS 422 standard
 - Output data DATA OUT: Differential-data output for Data driver acc. RS 422 standard
 - Max. Clock frequency: 2 MHz (Transmission length ca. 10 m)
Note: Cable specification, use of shielded twisted-pair cable, terminating resistor)
 - Mono flop time: $16 \pm 10 \mu s$
 - SSI-Protocol: 32-Bit-Protocol (standard)
- (other SSI-Protocols on request: e.g. with CRC-Sum, Bit number, Error bit, ...)

Mechanical data

- Operating speed:
 - max. 1000 rpm with sealing ring
 - max. 10,000 rpm with Nilos ring
- Angular acceleration: $10^5 \text{ rad/s}^2 \text{ max.}$
- Moment of inertia (shaft): 20 gcm^2
- Operating torque: $\leq 8 \text{ Ncm}$ (at speed 500 rpm and with sealing ring)
- Starting torque: $\leq 4 \text{ Ncm}$
- Perm. shaft load:
 - 250 N axial
 - 250 N radial
- Bearing service life: $\geq 10^9 \text{ revolutions}^{***}$
- Weight:
 - TBE Ø 58: Aluminium ca. 0.3 kg, stainless steel ca. 0.4 kg
 - TRE Ø 58: Aluminium ca. 0.5 kg, stainless steel ca. 0.7 kg

*) CW = increasing output signal for clockwise sensor shaft rotation, viewed looking towards the shaft

**) CCW = increasing output signal for counter clockwise sensor shaft rotation, viewed looking towards the shaft

***) This value applies at the maximum shaft load

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Models TBE / TRE with SSI-Interface

Technical data

Environmental data

- Operating temperature range: - 40 °C to + 85 °C
- Storage temperature range: - 20 °C to + 60 °C (packaging-related)
- Resistance:
 - To shock: 250 m/s², 6 ms, 100 x each in 3 axes
DIN EN 60068-2-27
 - To vibration: 100 m/s², 5 Hz ... 2000 Hz, 1 hour each in 3 axes, (larger values optionally)
DIN EN 60068-2-6
- EMC standards: DIN EN 61 000 - 6 - 2 Immersion (Burst/ ESD/ etc.)
DIN EN 61 000 - 6 - 4 Emission
- Protection grade (DIN EN 60529):
 - shaft-side: IP 67 - Shaft sealing ring,
IP 65 - Nilos ring
 - housing-side: IP67
Option IP 69K (Potting)
 (For higher protection grades to IP69K please contact us if you require any further information.)

Reliability values TRN

Calculation basis: HRD 5- Handbook of Reliability Data for Electronic Components used in Telecommunication Systems

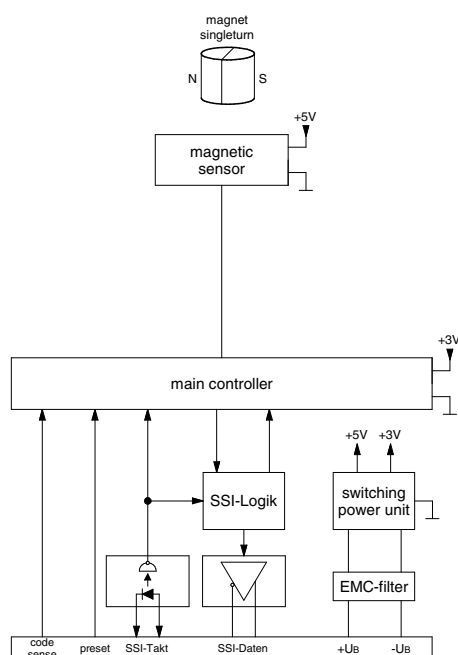
MTTF _d - value	Environmental temperature
354,8 years	+25°C
194,6 years	+55°C
127,9 years	+70°C

(Quality factor: 2)

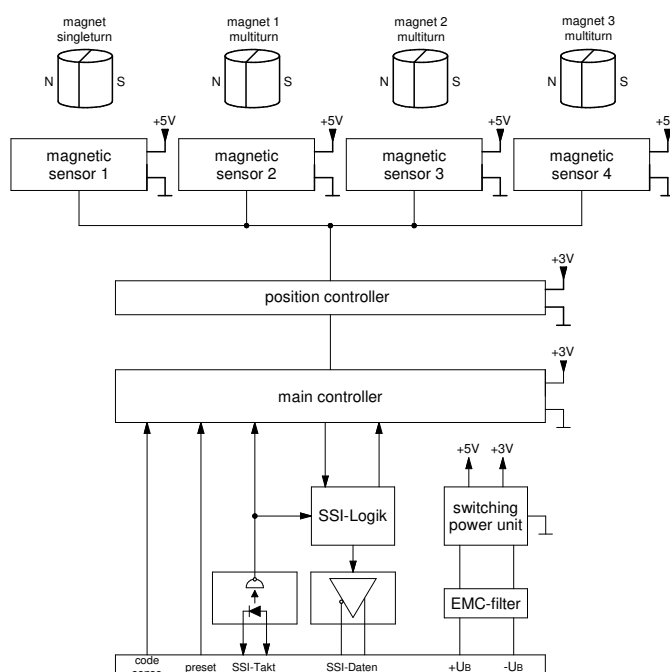
Principle circuit diagram

Principle circuit diagram TBE and TRE (Model Ø 58)

Model: TBE



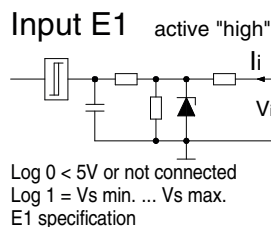
Model: TRE



Absolute Monoturn / Multiturn Encoder Models TBE / TRE with SS/-Interface

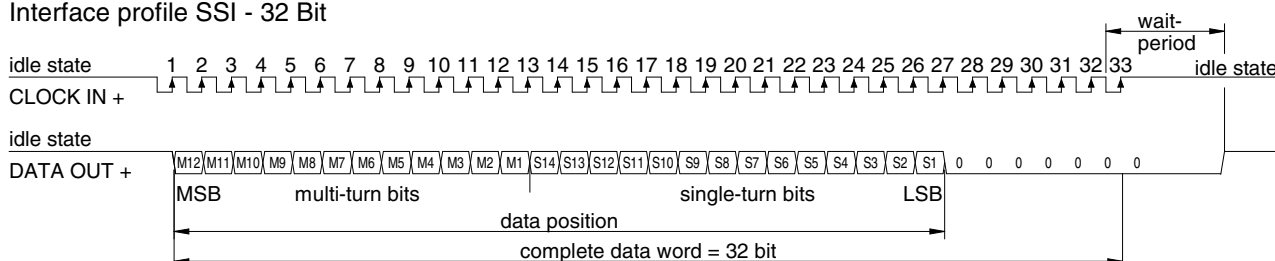
Input circuit for Set input and Code sense, Interface profile SS/ - 32 Bit / Binary

Input circuit for Set input und Code sense



Interface-Profile SS/ - 32 Bit / Binary

Interface profile SSI - 32 Bit



Standard assignment SS/-Protocols

Standard assignment SS/-Protocols

The following table contains the default assignments for the number of bits in the SS/-protocol. For further requirements e.g. with modified SS/-protocol, or with additional error bit, additional CRC-calculation and others must then be defined in a special variant.

Type	Bit number	SSI-Protocol
TBE	≤ 13 Bit	13 Bit Protocol
	> 13 Bit	25 Bit Protocol
TRE	≤ 25 Bit	25 Bit Protocol
	> 25 Bit	32 Bit Protocol

Absolute Monoturn / Multiturn Encoder

Models TBE / TRE with SS-Interface

Connector assignment, Mating connector, Pole figure M12x1

Connector assignment (standard version)

- TBE Ø 58 / TRE Ø 58: With connector M12x1, Pin, 8-pole, A-coded
With connector M23 Pin assignment counterclockwise
With cable radial, twisted pair, 8-wire (4x2), shielded
- The connection diagram is included in the scope of delivery and is enclosed with every device.

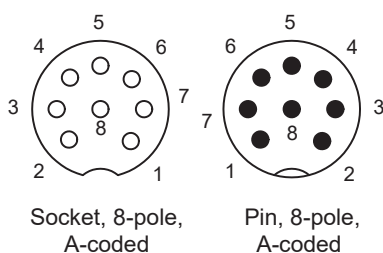
Mating connector (must be ordered separately)

Order code number	STK 8GS54	STK 8WS86	STK 8GS105	STK12GS93	STR12GS11
Type	M12x1	M12x1	M12x1	M12x1	M23
Pole number	8	8	8	12	12
Type of contact	socket, A-coded	socket, A-coded	socket, A-coded	socket, A-coded	socket
Connector model	straight	angled	straight	straight	straight
Housing material	brass nickel-plated	brass nickel-plated	Stainless steel 1.4404	brass nickel-plated	brass nickel-plated
Cable ø (mm)	6 - 8	6 - 8	5,5 - 8,6	6-8	6 - 10
Type of connection	screw	screw	screw	soldering	soldering
Protection grade	IP 67	IP 67	IP 67	IP 68	IP67
Screening	on housing	on housing	on housing	on housing	on housing
Maximum wire size (mm ²)	0.5	0.5	0.5	0.25	1.0

Please note: The position of the coding groove of the angled connector must be defined by the customer and must then be defined in a special variant.

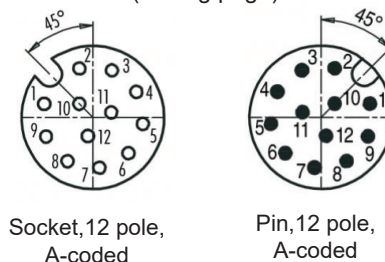
Pole figure M12x1

(Mating page)



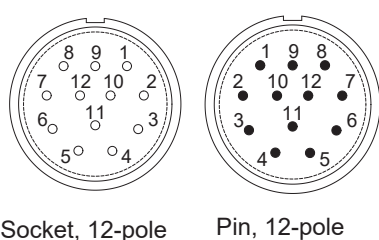
Pole figure M12x1

(Mating page)



Pole figure M23

(Mating page)



Absolute Monoturn / Multiturn Encoder

Models TBE / TRE with SS-Interface

Connection diagram

Connection diagramm

M12x1, 8-pole	Assignment
1	+V _S = 9 to 36 VDC, TBE: P _D < 1 W TRE: P _D < 1,5 W
2	- V _S = 0 VDC
3	CLOCK IN +
4	CLOCK IN -
5	DATA OUT +
6	DATA OUT -
7	SET input (input circuit E1) Set zero point SET inactivated at Vi = 'Log 0' or not connected SET activated at Vi = 'Log 1'
8	Code sense (input circuit E1) CW at Vi = 'Log 0' or not connected CCW at Vi = 'Log 1'

Absolute Monoturn / Multiturn Encoder**Models TBE / TRE with SSI-Interface****Notes and additional technical data for TBE/ TRE redundant****Hinweise und zusätzliche Technische Daten für TBE/ TRE redundant**

With the TBE/ TRE series, the SSI interface can optionally be designed redundantly. In general, the technical data in this data sheet apply with some additional information.

These include the following points:

- The SSI interfaces are designed twice in the redundant version, where Sensor1: SSI-1 and Sensor2: SSI-2 are each autonomous (see article description below)
- There are two options for the power supply
 - Common power supply for sensor1,2 (electrical connection via M12 plug, 12-pin)
 - Separate power supply for sensor1 and sensor2 (electrical connection via cable LiYCY 8x2x0,14mm²)
- Extension of the parameterization for sensor1 and sensor2
- Code sense CW/ CCW (optional)
- Reference value $\neq 0$ for sensor 1, 2 via factory programming or via PMU (Data sheet: PMU12005) by customer
- Extensive protocol options such as:
 - Bit length (>32 bit) of the SSI protocol
 - Error bit related to the respective sensor system
 - 8-bit CRC sum according to generator polynomial: $x^8 + x^5 + x^4 + 1$
 - ... customer-specific requirements
- Accuracy data for the 2 sensors:
 - Synchronisation of the systems:
 - static $\leq 1 \%$
 - dynamic $\leq 5 \%$ (at 3,000 revolutions min⁻¹)
- Page 17 of data sheet TBE/TRE14270 shows an installation drawing for a redundant encoder TRN Ø 58
- Example of an article designation: TRE58-KA 8192 R 4096 W R2 S E51
R2: redundant version for sensor 1 and sensor 2

Absolute Monoturn / Multiturn Encoder

Models TBE / TRE with SS-Interface

Order code number

TRE	58	-	K	A	65536	R	4096	W	S	E	01
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01 **Electrical and mechanical variants:***

Output signal:

E SS-Interface

Electrical connections:

K1 Cable, 1 m
S Device connector M12
M Device connector M23

Code sense:

W CW
C CCW

Measuring range in revolutions (only for TRE):

4096 Revolutions

Output code:

R Binary
G Gray (optional)

Resolution in steps / 360°:

4096	Steps / revolution	12 Bit
8192	Steps / revolution	13 Bit
16,384	Steps / revolution	14 Bit
32,768	Steps / revolution	15 Bit
65,536	Steps / revolution	16 Bit

Housing material:

A Aluminium 3.2315
S Stainless steel 1.4305
V Stainless steel 1.4404

Flange:

58 K Clamp flange, shaft Ø 10 mm with flat
KF Clamp flange, shaft Ø 10 mm with Woodruff key
KP Clamp flange, shaft Ø 10 mm with feather key
KZ Clamp flange, shaft Ø 12 mm for play-compensating toothed gear ZRS ([ZRS 11877](#))
S Syncro flange, shaft Ø 6 mm
SR Syncro flange, clamping shaft for Ø 12 mm (Torque support, [ZMS 12939](#))
SP Syncro flange, shaft Ø 12 mm with Woodruff key

Design:

Model:

TBE Singleturn encoder with SS-Interface (Design Ø 58 mm)
TRE Multiturn encoder with SS-Interface (Design Ø 58 mm)

* 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.

Absolute Monoturn / Multiturn Encoder

Models TBE / TRE with SS/-Interface

Allocation to flange type, bearing seal, rpm and Protection grade

Allocation to flange type, bearing seal, rpm and Protection grade (Design Ø 58)

Flange type	Design	rpm	Protection grade
Clamping flange K, KF, KP	Shaft sealing ring	max. 1000 min-1	IP67
			IP69K - on housing (optional)
Clamping flange KZ	Shaft sealing ring	max. 1000 min-1	IP67
			IP69K - on housing (optional)
Syncro flange S, SP	Shaft sealing ring	max. 1000 min-1	IP67
	Nilos ring	max. 10,000 min-1	IP65

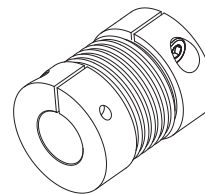
Absolute Monoturn / Multiturn Encoder Models TBE / TRE with SS-Interface

Accessories

Play free bellows coupling BKK 32 / x - y

x and y: bore diameter for shaft mounting

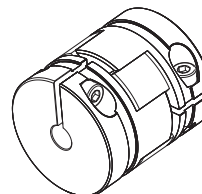
See data sheet [BKK 11840](#)



Play free clamp coupling KK14S / x - y (without notch)

x and y: bore diameter for shaft mounting

See data sheet [KK 12301](#)

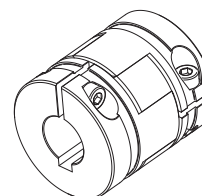


Play free clamp coupling KK14N / x - y (with notch)

x and y: bore diameter for shaft mounting

With groove for keyway according to DIN 6885 Bl. 1 – JS9.

See data sheet [KK 12301](#)



KL 66-2-S and others

Mounting brackets for mounting encoders.

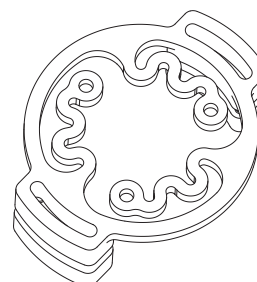
See data sheet [MZ 10111](#) for the appropriate model.



ZMS58

Torque arm / stator. Can be used as encoder shaft holder for version 'clamp shaft' to compensate for radial and axial play of the drive shaft (Design Ø 58 mm).

See data sheet [ZMS 12939](#)

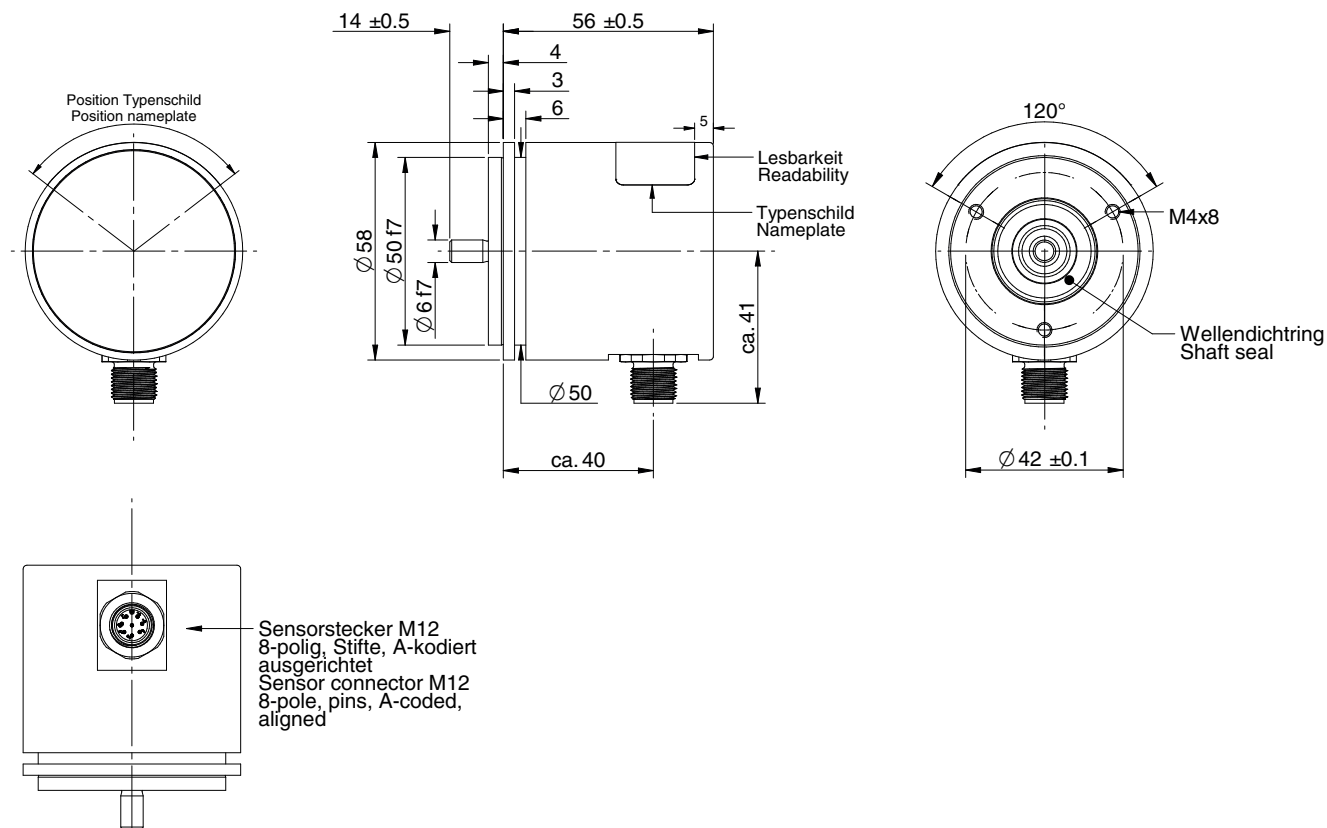


Absolute Monoturn / Multiturn Encoder

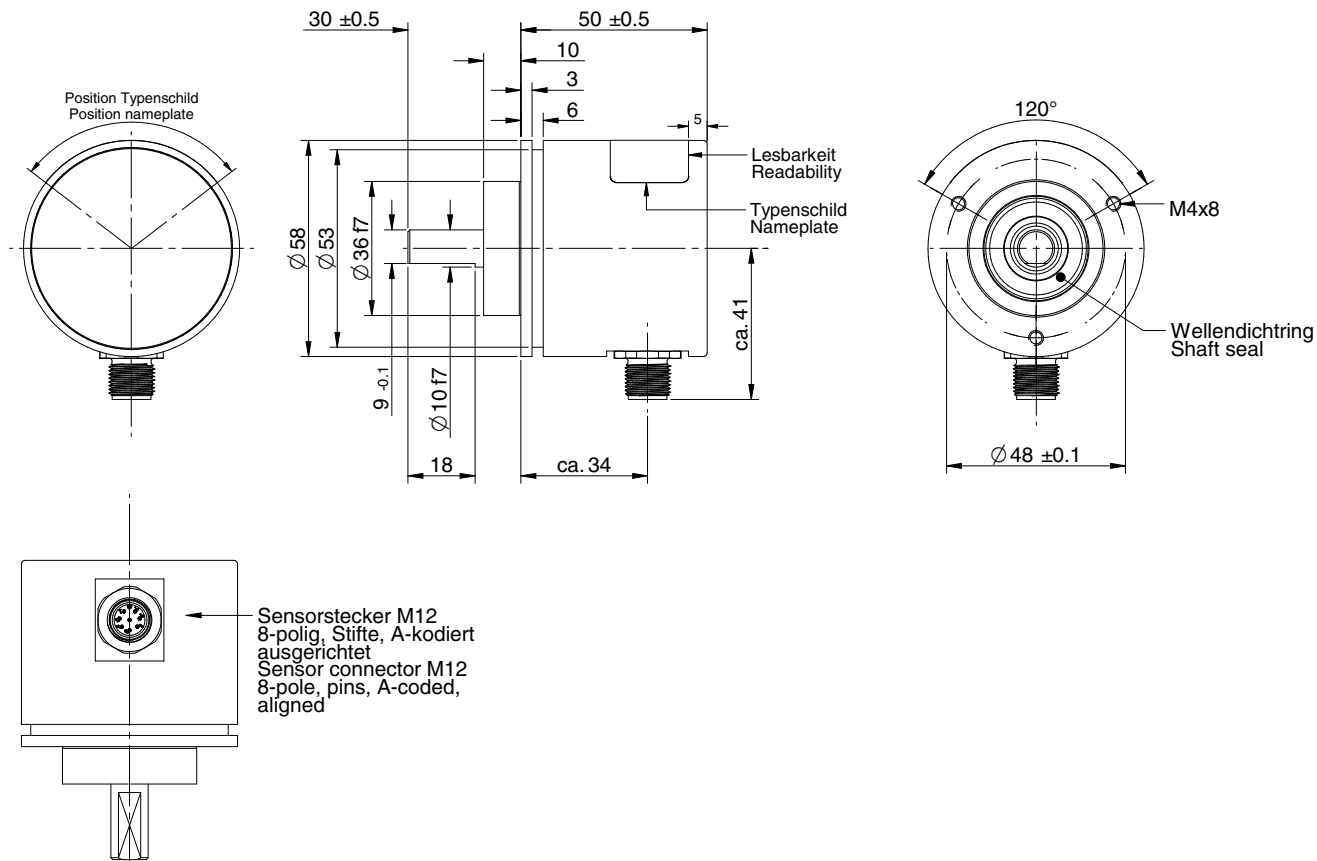
Models TBE / TRE with SS-Interface

Technical drawing (Data in mm)

Order code: **TBE58 - SA 16384 R W S E01**



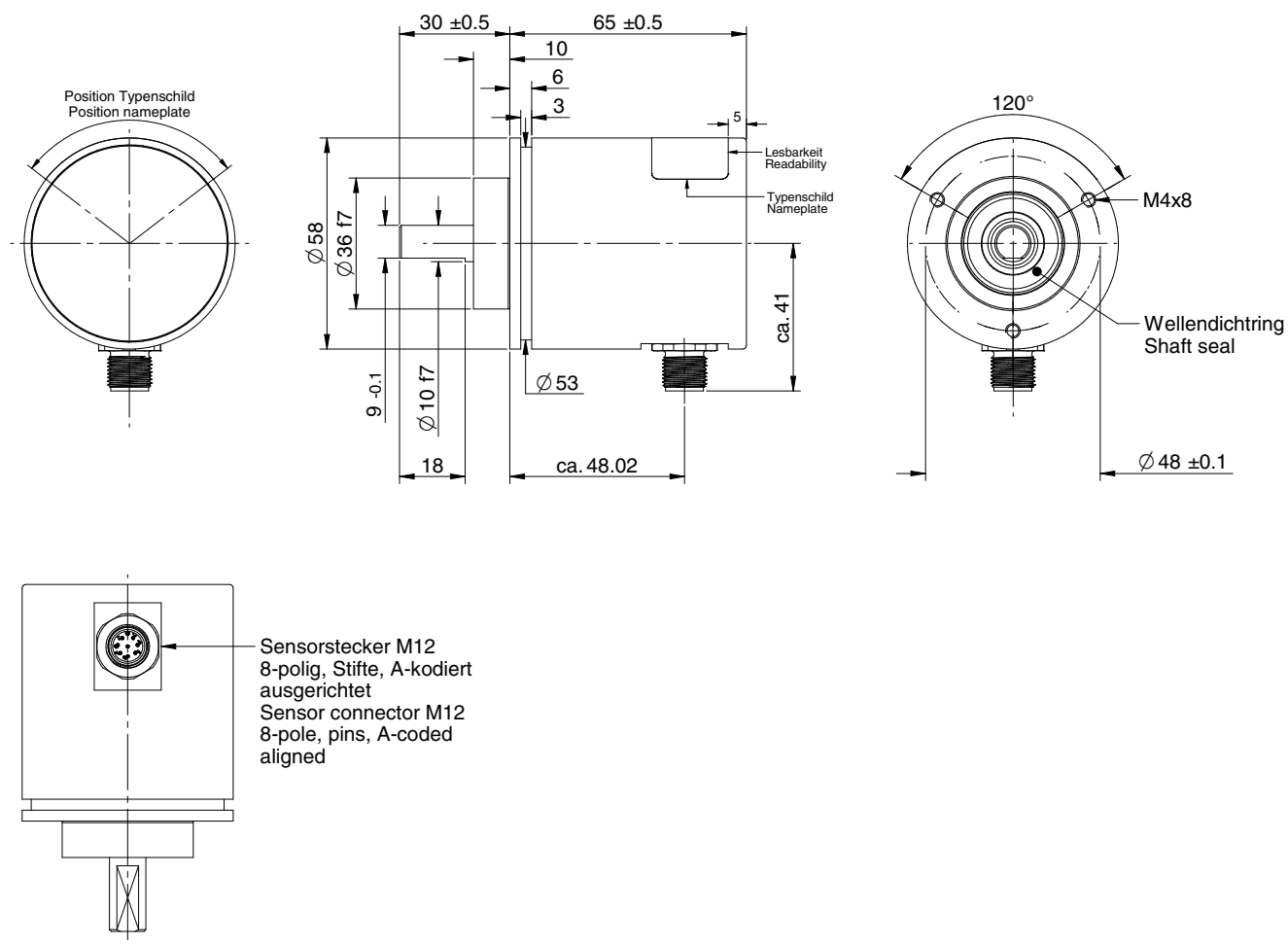
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Absolute Monoturn / Multiturn Encoder Models TBE / TRE with SS-Interface

Technical drawing (Data in mm)

Order code: **TRE58 - KA 16384 R 4096 W S E01**

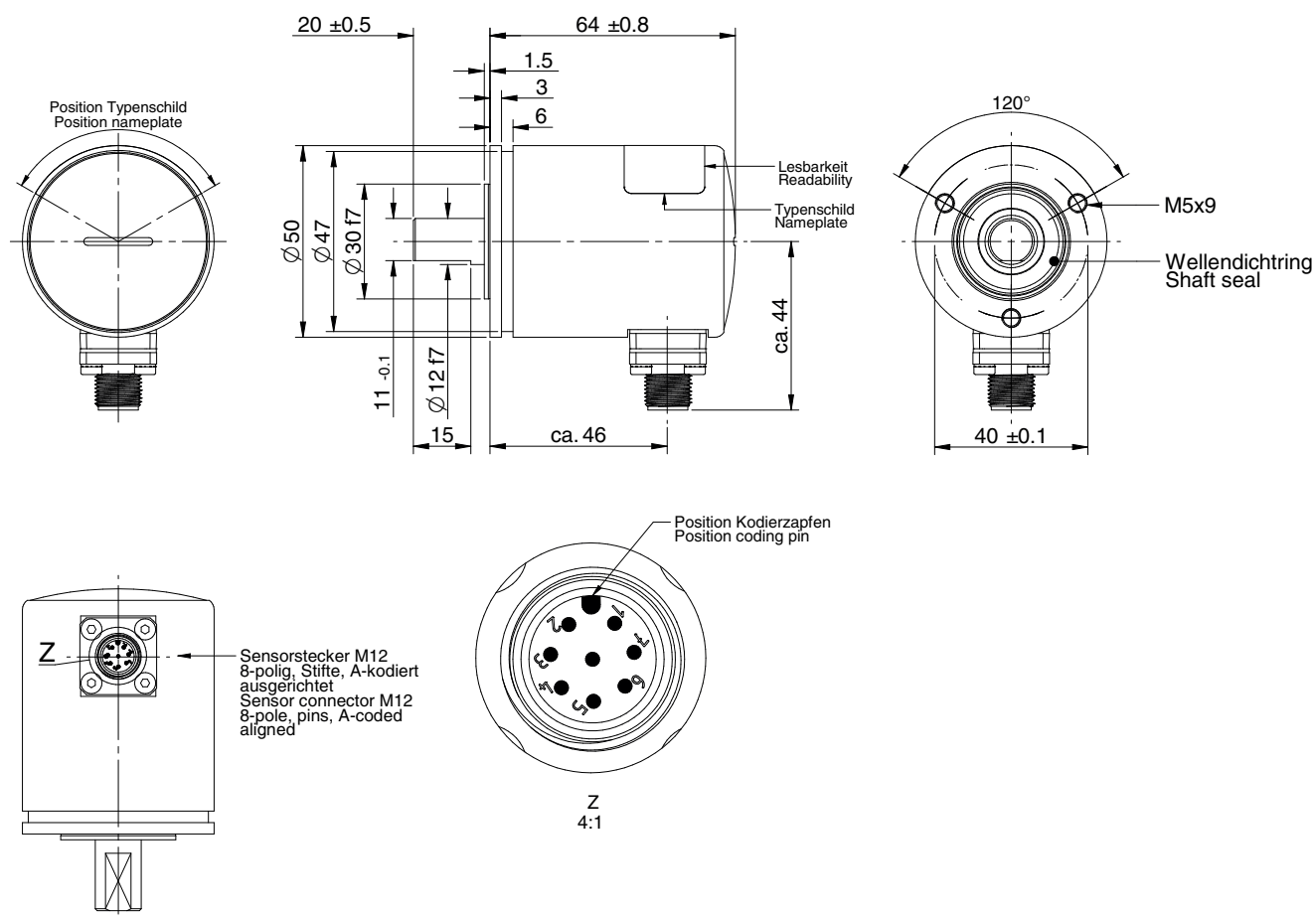


Absolute Monoturn / Multiturn Encoder

Models TBE / TRE with SS-Interface

Technical drawing (Data in mm)

Order code: **TRE50 - SA 16384 R 4096 W S E01**

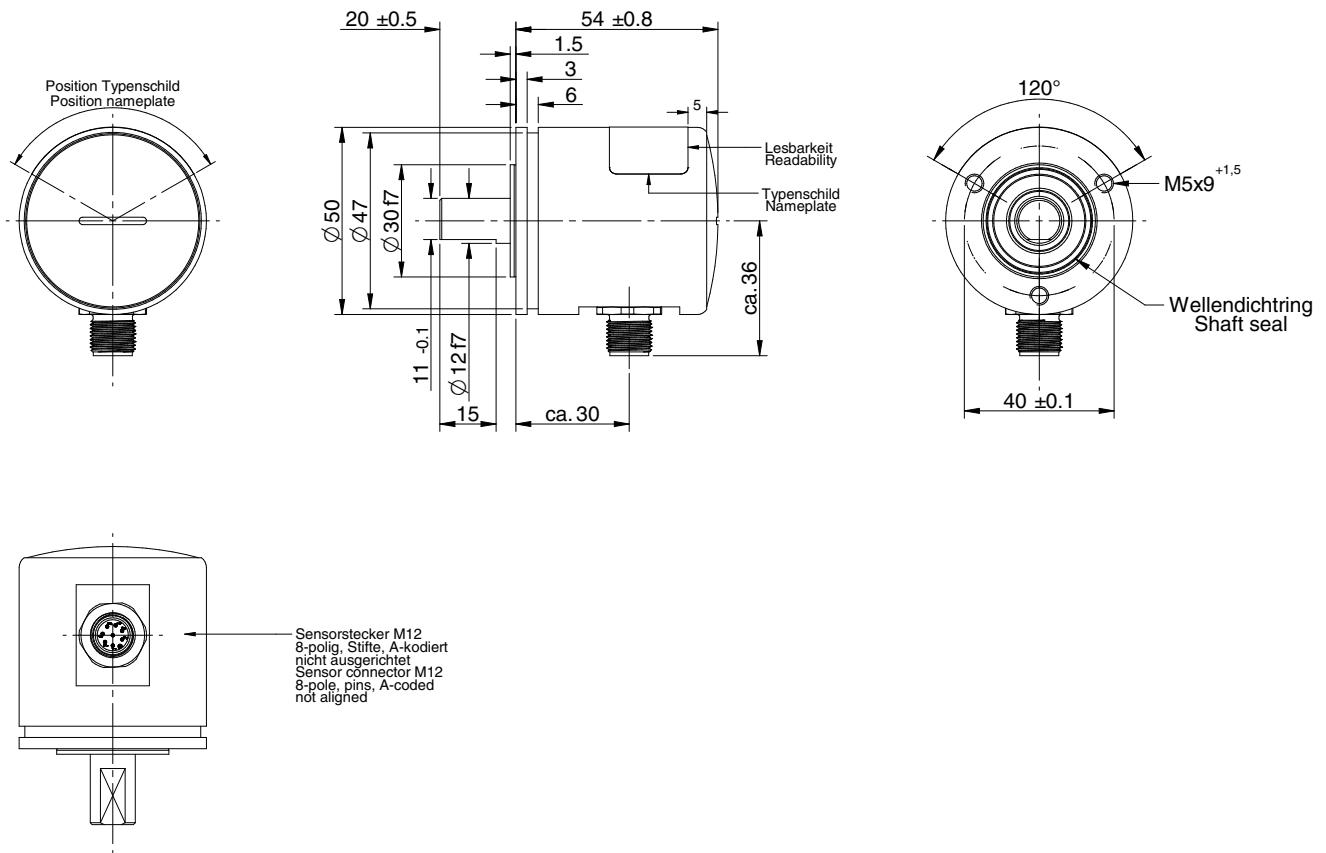


Absolute Monoturn / Multiturn Encoder

Models TBE / TRE with SS-Interface

Technical drawing (Data in mm)

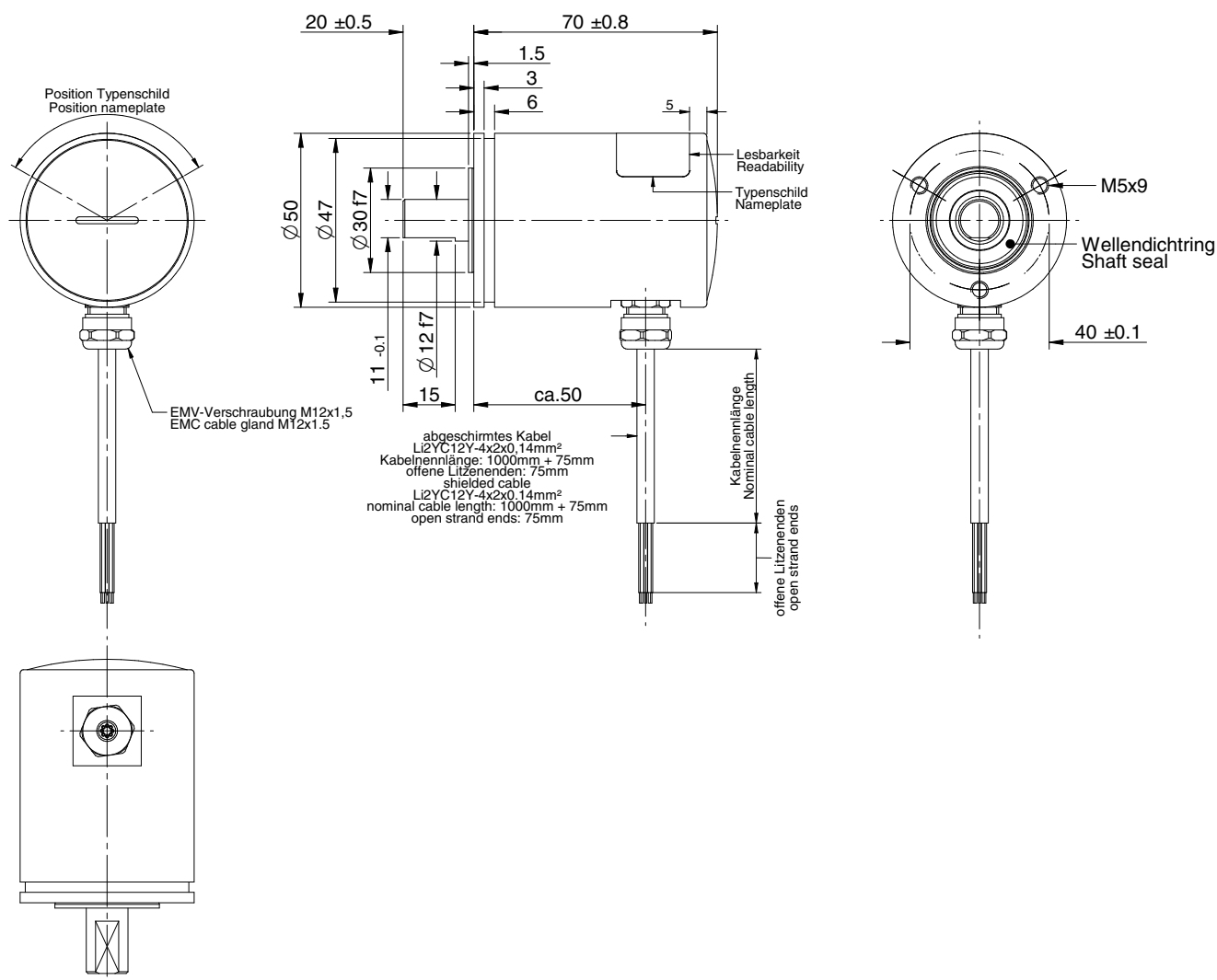
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Absolute Monoturn / Multiturn Encoder Models TBE / TRE with SS-Interface

Technical drawing (Data in mm)

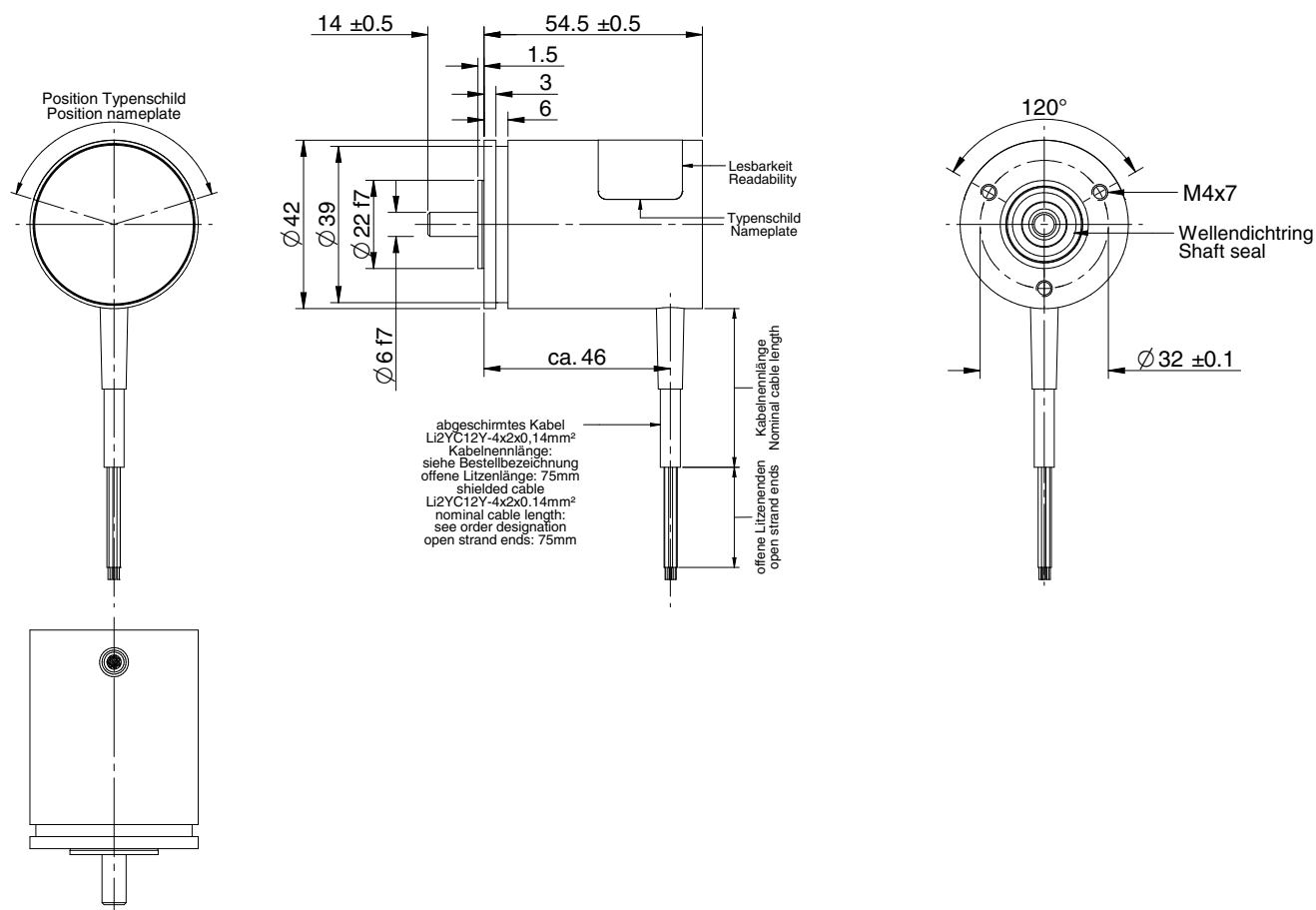
Order code: **TRE50 - SA 16384 R 4096 W K E01**



Absolute Monoturn / Multiturn Encoder Models TBE / TRE with SS-Interface

Technical drawing (Data in mm)

Order code: **TRE42 - SA 16384 R 4096 W K E01**



Absolute Monoturn / Multiturn Encoder

Models TBE / TRE with SS-Interface

Technical drawing (Data in mm)

Order code: **TRE58-KA 8192 R 4096 W R2 S E51, redundant version**

