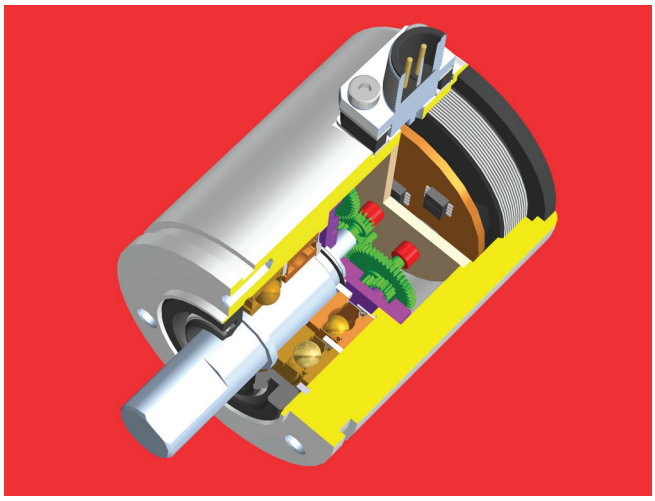
- **Compact, robust design for mechanical engineering especially for building machinery, underwater devices and food conditioning equipment**
- **With absolute multiturn gearbox**
- **With digital or analogue interfaces**
- **Resolution: 4096 positions / 360° (12 Bits) / 13 Bits (optional)**
- **Measuring range: 4096 revolutions max.**
- **Case in aluminium or stainless steel**
- **Two - chamber construction to separate rotating components from electronic circuit**
- **Protection grades: IP 66 or IP 69K (option)**
- **Working temperature range: - 40 °C to + 85 °C**
- **Option:** □ **TRN/S with CANopen Safety Protocol (CiA DS 304, Vers. 1.01)**
  □ **Redundant System (TRE. TRA)**
  □ **SIL2 (IEC61508)**



Construction

Robust case with wall thickness of 5 mm either in seawater resistant aluminum or in stainless steel - shaft in stainless steel - rotating components with permanent magnet in front chamber - electronic circuit with ASiC and Hall elements and interface components fitted within main chamber, separated from rotating components by a metallic wall - integrated absolute multiturn gearbox for the acquisition of revolutions - optional potting against water jets (IP 69K) - electrical connections via round plug M12x1 or lead exit.

Electronic interfaces

- **TRE 50: Synchronous serial interface-*SSI*** (page 2)
- **TRN 50: CANopen** (page 3)
- **TRN/S : CANopen Safety, Datasheet TRN12664**
- **TRA 50: Analogue** (page 4)

The connection data are supplied with each item.

Mechanical data of all models

Operating speed:	1,000 rpm max. (10,000 rpm / optional)
Angular acceleration:	10^5 rad/s² max.
Inertial mass (rotor):	20 gcm²
Operating torque:	≤ 8 Ncm at 500 rpm
Wind-up torque:	≤ 4 Ncm
Permissible shaft loads:	250 N (axial and radial)
Bearing life expectancy:	10^9 revolutions
Mass:	0.5 kg approx.

Dimensions, materials and accessories: Page 7

Electrical data of all models

Sensor system:	ASIC with Hall elements
Accuracy:	± 0.2 % (relative to 360°) applies to analog models ± 0.25 %
Reproducibility:	± 0.02 % (relative to 360°)
Temperature drifting:	± 0.1 % (relative to 360° over the entire temperature range) applies to analog models < 0.01 %/°K
EMC - Standards:	DIN EN 61000-6-2 Immission (Burst/ESD/etc.) DIN EN 61000-6-4 Emission

Environmental data of all models

Operating temperature:	- 40 °C to + 85 °C
Storage temperature:	- 20 °C to + 60 °C (dependant on packing materials)
Resistance to shock:	500 m/s² ; 11 ms (DIN EN 60068-2-27)
Resistance to vibration:	10 Hz ... 2000 Hz ; 500 m/s² (DIN EN 60068-2-6)
Protection grades:	IP 66 IP 69K (with optional potting of main chamber) (DIN EN 60529)

Model TRE 50: Synchronous Serial Interface - 12 Bits / 360° and max. 4096 rev.

Function

The absolute angle information derived by the encoder is converted into serial information by an internal parallel-serial converter and then transmitted to a receiving electronic circuit in synchronism with a clock. Important advantages are : Low number of data lines and high reliability. (A detailed description can be found in the document SSI10630)

Maximum data transmission rate

The date rate ist defined by the following factors:

- Clock frequency 1 MHz max up to 40 meters connection line
- Delay time of the overall electronics (between 40 and 150 meters)

$$t_{GV} = t_C + 2t_K + t_E$$

t_{GV}: Total delay time

t_C: Delay time of the encoder electronics, e. g. ≤ 300 ns

t_K: Delay time of lead, depending on type and length, e. g. speed 6.5 ns/m

t_E: Delay time of receiving electronics, e. g. 150 ns

Admitting a security gap of 50 ns between the periods of clock t_T and the delay time of the overall electronics t_{GV} the result is shown as follows:

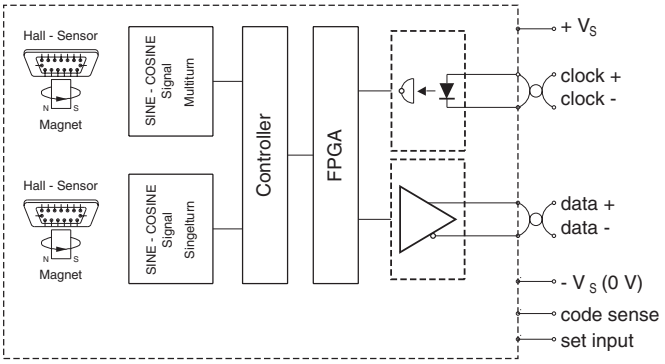
$$t_T = t_{GV} + 50\ ns = 500\ ns + 2t_K$$

When calculating the maximum frequency the following function applies: $f_{max.} = 1/t_T$.

- To RS422 specification starting at 150 m approximately

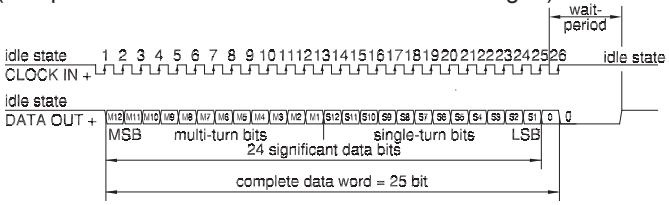
The opposite diagram is based on the above dat

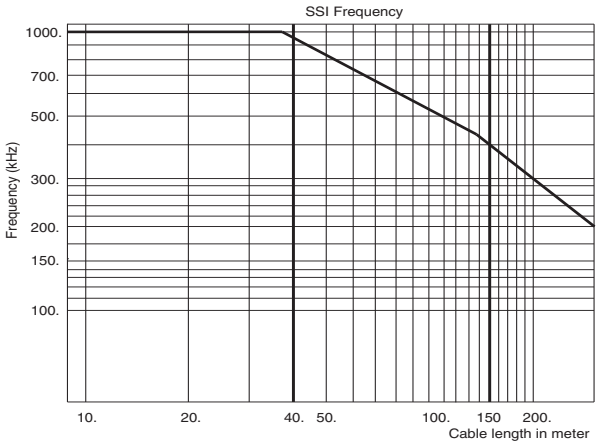
Block diagram



Interface profile *SSI* - 25 Bits nat. binary

(Beispiel: 4096 Schritte / 360° - 4096 Umdrehungen)





Electrical data

■ Supply voltage range:	+ 11 VDC to + 28 VDC
■ Supply current:	30 mA typ. / 90 mA max.
■ Resolution (standard):	4096 positions / 360° (12 Bits) (13 Bits optional)
■ Measuring range:	max. 4096 rev.
■ Output code:	Nat. binary (Gray optional)
■ Preset value:	Set Zero or other values (optio nal), via input circuit E1, page 6
■ Code sense:	CW or CCW adjustable via input circuit E1, page 6
■ Serial output:	Differential data output to RS 422
■ Clock input:	Differential data input to RS 422
■ Monoflop time:	16 ± 10 µs (standard)
■ Clock rate:	1 MHz max.

Order code format

TRE 50 - S A 4096 R 4096 S E 01

- Electrical and mechanical variants*
  - E = *SSI*
- Electrical connections
  - S = Connector M12x1**
  - K = 1m lead**
- Range (revolutions)
- R = Nat. binary
  - G = Gray (optional)
- Resolution
  - 4096 positions / 360°
- Case material
  - S = Stainless steel**
  - A = Aluminium**
- S = Synchro flange
- Diameter ø 50 mm
- TRE series with ***SSI*-interface**

* The basic versions in accordance with the data sheet bear the code number 01. Variations from the basic version are indicated with a consecutive number and are documented in our works.

** Case in aluminium with M12x1 (8 pins) connector, case in stainless steel with lead (1m) and D-Sub plug without hood (for test purposes only).

Model TRN 50: CANopen - 12 Bits / 360°, up to 4096 revolutions

Electrical data

To CANopen Application Layer and Communication Profile, CiA Draft Standard 301, Version 4.1 and to "Device Profile for Encoders CiA Draft Standard Proposal 406 Version 3.0" and CANopen Layer setting Services and Protocol (LSS), CiA DSP 305.

- Supply voltage range: + 11 VDC to + 28 VDC
- Power consumption: < 1 W
- Inrush current: < 200 mA
- Resolution: 4096 positions / 360° (12Bits) (13 Bits optional)
- Measuring range: 4096 revolutions max. (12 Bit)
- Output code: Nat. binary
- Code sense: CW / CCW
- Reference value: 0 - (total capacity less 1)
- CAN-interface: to ISO/DIS 11898
- Addressing: via SDO / LSS
- Termination resistance: by separate implementation
- Max. transmission length: 200 m*

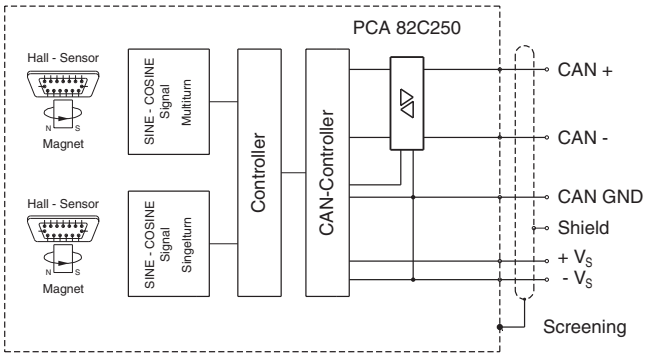
* No galvanic isolation between power supply and bus (see CiA DS301)

CANopen features

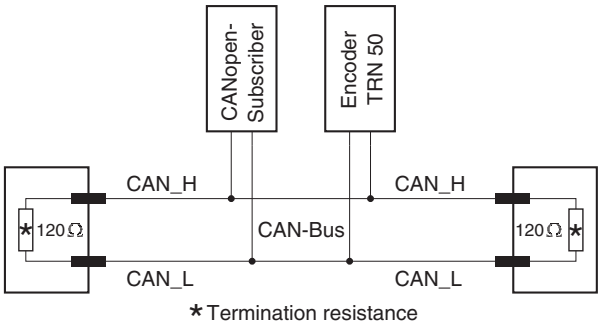
- NMT Master: no
- NMT-Slave: yes
- Maximum Boot up: no
- Minimum Boot up: yes
- COB ID Distribution: Default, SDO
- Node ID Distribution: via Index 2000 or LSS
- No of PDOs: 2 Tx
- PDO-Modes: sync, async, cyclic, acyclic
- Variables PDO-Mapping: no
- Emergency Message: yes
- Heartbeat: yes
- No. of SDOs: 1 Rx / 1 Tx
- Device Profile: CiA DSP 406 Version 3.0

For detailed description of the CANopen profile pl. refer to application manual TXN 11551

Block diagram



Bus configuration to ISO / DIS 11898



* Termination resistance

Order code format

TRN 50 - S A 4096 R 4096 C2 S N 01

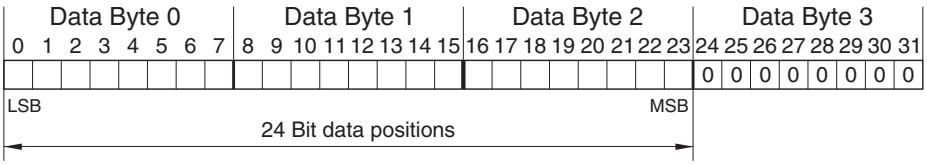
- Electrical and mechanical variants*
- N = CANopen
- Electrical connections S = Connector M12x1** K = 1m lead**
- Profile: C2 = CANopen to CiA DS 406 rev 3.0
- Range (revolutions)
- R = Nat. binary
- Resolution 4096 positions / 360°
- Case material A = Aluminium** S = Stainless steel**
- S = Synchro flange
- Diameter ø 50 mm
- TRN series with **CANopen-Interface**

* The basic versions in accordance with the data sheet bear the code number 01. Variations from the basic version are indicated with a consecutive number and are documented in our works.

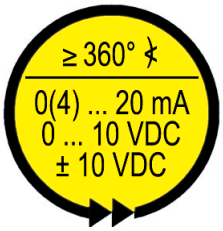
** Case in aluminium with M12x1 (8 pins) connector, case in stainless steel with lead (1m) and D-Sub plug without hood (for test purposes only).

Data profile CANopen

PDO 1 / PDO 2



Model TRA 50: Analogue outputs 0-20 mA, 4-20 mA, 0-10 VDC or ±10 VDC, max. 4096 revolutions



Function

The electro-magnetic sensor system of the encoder is completed by a 12 Bit D/A converter to transform the angular position into an analogue signal of either 0(4) to 20 mA, 0 to 10 VDC or ±10 VDC.

Electrical data

- Supply voltage range: + 18 VDC to + 28 VDC (Output: A, B, C) ± 13 to ± 16 VDC (Output: D)
- Supply current: 80 mA typ. / 100 mA max.
- Resolution: 4096 steps/ 360°⦜ - 12 Bit
- Measuring range: to 4096 x 360°⦜ (see table) (Default adjustment: 3600°⦜)
- D/A-Converter: 12 Bit
- Signal sense: CW or CCW adjustable
- Preset value: Centre of the measuring range, other values optional

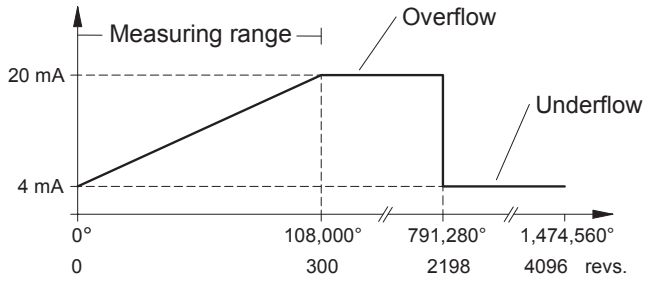
Electrical output data

- **Current output A:** 0 to 20 mA
  B: 4 to 20 mA
  Accuracy: ≤ ± 50 µA for the total temperature range
  Load resistance: to 500 Ω at Vs = 18 to 28 VDC
- **Voltage output C:** 0 - 10 VDC
  Accuracy: at 0 V: + 100 mV
  at 10 V: ± 25 mV
  Output current: 5 mA max. when load resistance > 2 kΩ (short circuit proof)
- **Voltage output D:** ± 10 VDC
  Accuracy: at 0 V: ± 25 mV
  at 10 V: ± 50 mV
  Output current: 5 mA max. when load resistance > 2kΩ (short circuit proof)

Measuring range setting

The rotary encoder has a maximum measuring range of 1,474,560° (4096 revolutions). As standard, the measuring range is set to 3600°, i.e. 10 revolutions. Pre-set measuring ranges which deviate from the standard can be ordered. To do this, the desired measuring range has to be specified in the order designation. The MFPs (see below) can be used by the customer to adapt the pre-set measuring ranges. Outside of the measuring range, the characteristic curve contains a symmetrically subdivided overflow and underflow up to the 4096th revolution (see characteristic curve). Solutions e.g. without overflow and underflow or any special characteristic curves are possible on request.

Characteristic curve: measuring range 108,000° or 300 revolutions as an example (output B



Note: If the measuring range cannot be found directly due to sensor shaft rotation (as the sensor system is in the overflow or underflow range), the rotary encoder can be pre-set with the aid of the MFPs. As a result, the rotary encoder jumps to the centre of the measuring range.

Order code format

TRA 50 - S A 3600 W S A 01

- 01 — Electrical and mechanical variants*
- A — Output signals : A = 0 - 20 mA B = 4 - 20 mA C = 0 - 10 VDC D = ± 10 VDC
- S — Electrical connections S = Connector M12x1** K = 1m lead**
- W — Signal sense W = CW C = CCW
- 3600 — Measuring range 3600°
- A — Case material A = Aluminium** S = Stainless steel**
- S — S = Synchro flange
- 50 — Diameter ø 50 mm
- TRA — TRA series with **Analogue output**

* The basic versions in accordance with the data sheet bear the code number 01. Variations from the basic version are indicated with a consecutive number and are documented in our works.

** Case in aluminium with M12x1 (8 pins) connector, case in stainless steel with lead (1m) and D-Sub plug without hood (for test purposes only).

Functional description and adjustment modes

The following parameters can be adjusted by the user in situ: Code sense, zero point, end point, preset value and default values, via the multi-functional entries MFP 0 and 1 (entry circuit E1).

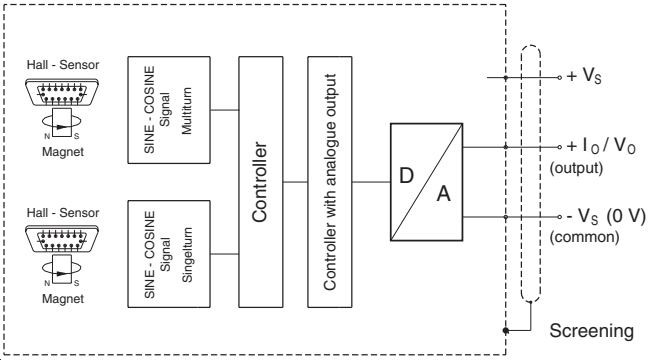
Before delivery the measuring range will be set at 0 to 3600 degree and the code sense increasing CW with view to the shaft end. The default value for the Preset value is the centre of the measuring range. Other values can be realized ex-work. The encoder will be supplied ex work with the default values.

Note: Because there are 6 functions for only 2 MFPs the functions "Change of code sense" and "Preset value" are processed sequentially. Via the function "Reset to default values" the default situation can be achieved.

Table for multi-functional inputs (mfp)			
Function	**MFP 0**	**MFP 1**	
Preset zero point	1	0	Keep the pin MFP 0 to logical 1 for a period of 1 s.
Preset final value	0	1	Keep the pin MFP 1 to logical 1 for a period of 1 s.
Reset to default values	1	1	At the same time (within 1ms) preset pins MFP 0 and MFP 1 to logical 1 for a period of 1 s. Manufacturer adjustment is restored.
Change of code sense	1 0	0 1	Attention: at the same shaft position Keep the pin MFP 0 to logical 1 for a period of 1,5 s after a delay of a minimal period of 0,5 s Keep the pin MFP 1 to logical 1 for a period of 1,5 s
Preset value (centre of the measuring range)	1 1	0 0	Attention: at the same shaft position Keep the pin MFP 0 to logical 0 for a period of 1,5 s. after a delay of a minimal period of 0,5 s Keep the pin MFP 0 to logical 0 for a period of 1,5 s.
End of adjustment, normal transducer function	0	0	

The Analogue Hand Programming device Model PMA-05 (see datasheet PMA 11443) is used for simple teach in adjustment of transducer TRA.

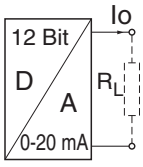
Block diagram



Output circuits

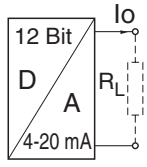
Output A

Io = 0 - 20 mA
R_L = 0 - 0.5 k



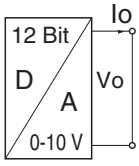
Output B

Io = 4 - 20 mA
R_L = 0 - 0.5 k



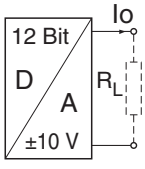
Output C

Vo = 0 ... 10 V
$Io_{max.}$ = 5 mA
R_{min} = 2 k



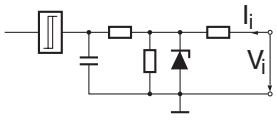
Output D

Vo = -10 ... +10 V
Io_{max} = 5 mA
R_{min} = 2 k



Input circuits of the multifunctional entries (MFP)

Input E1 active "high"

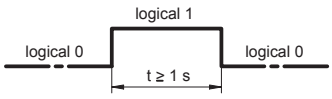


Log 0 < 5 V or not connected
Log 1 = 11 ... Vs
E1 specification

Timing diagram for the MFP- adjustments

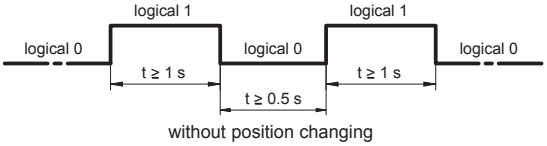
1. MFP 0 or MFP 1 once setting

Preset zero point (MFP 0)
Preset final value (MFP 1)



2. MFP 0 and/ or MFP 1 setting twice at the same shaft position

Preset value (MFP 0)
Code sense (MFP 1)



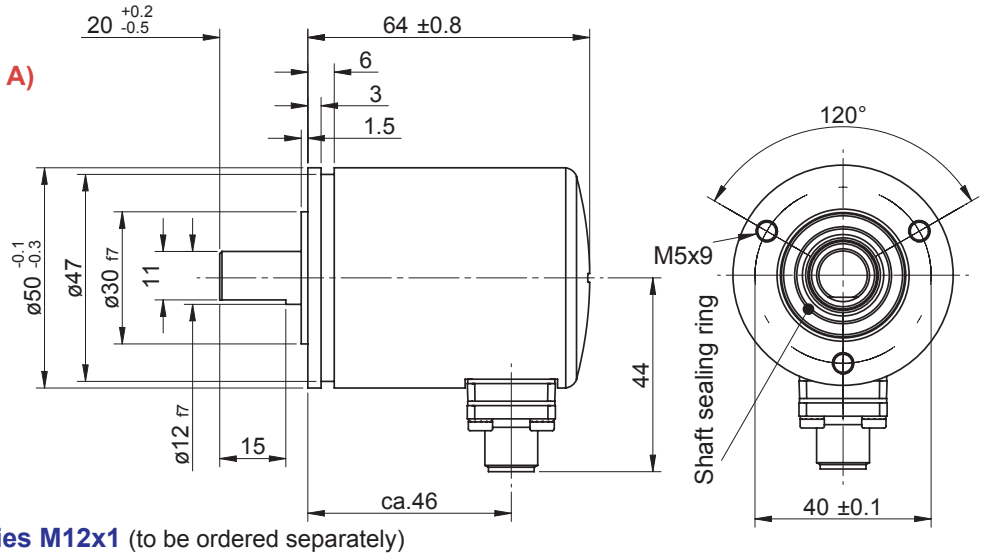
without position changing

3. MFP 0 and MFP 1 setting simultaneously

Time difference between MFP 0 und MFP 1 ≤ 0,25 s.

Dimensions in mm

Case in aluminium with connector M12x1 (Version A)

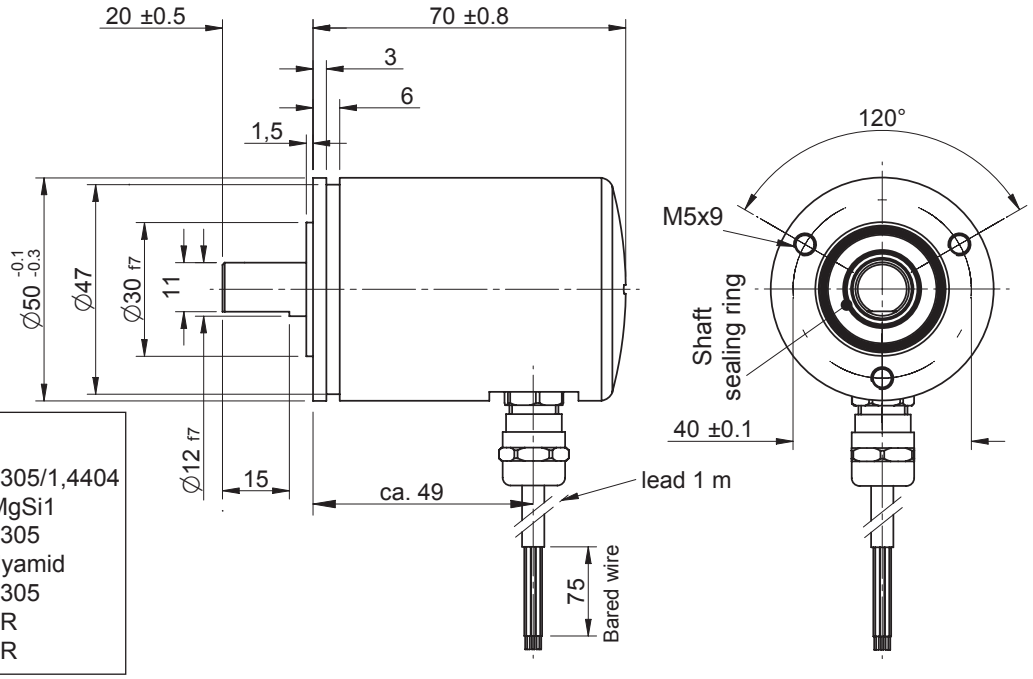


Counter plug, straight, series M12x1 (to be ordered separately)

Model	No. of pins	Material of case		K Ø (mm)
		plastic [1]	metal [2]	
TME 50	8	STK 8GS 53	STK 8GS 54	6 - 8
TMN 50	8	STK 8GS 53	STK 8GS 54	6 - 8
	(5) [3]	(STK 5GS 55)	(STK 5GS 56)	(4 - 6)
TMA 50	8	STK 8GS 53	STK 8GS 54	6 - 8

[1] screen on pin
[2] screen on case
[3] at option

Case in stainless steel with lead exit (Version S)

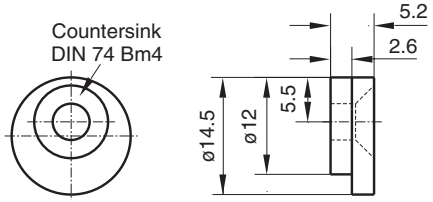


Materials used

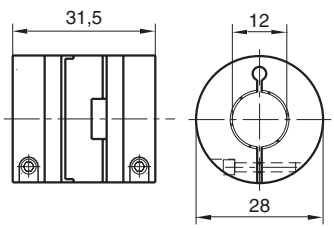
Case in stainless steel:	1,4305/1,4404
Case in aluminium:	AlMgSi1
Shaft in stainless steel:	1,4305
Rear cover:	Polyamid
Lead gland:	1,4305
Shaft sealing ring:	NBR
Taroidal sealing rings:	NBR

Mounting clamps KL 66-2

- Reference circle: 65 +0,5 mm
- Material: brass, nickel plated
- Screws to be used: M 4 to DIN 7991

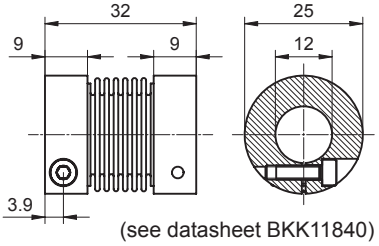


Oldham coupling 416/12



(aluminium / plastic)

Bellow coupling BKK 32/12



(see datasheet BKK11840)

(stainless steel)

Couplings are also available with different bores for driving shafts with diameters other than 12 mm.