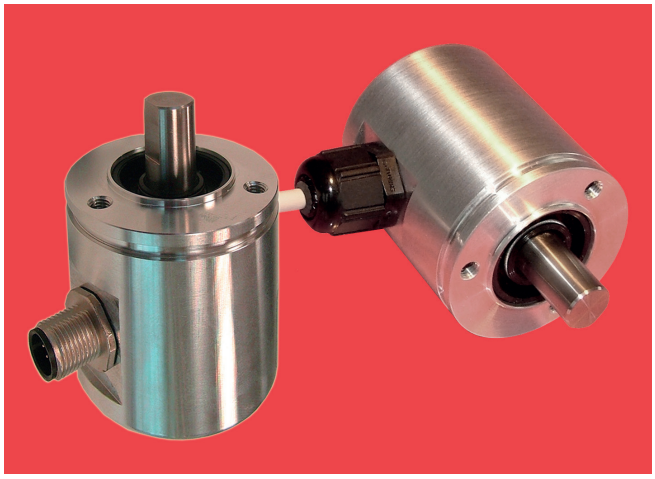
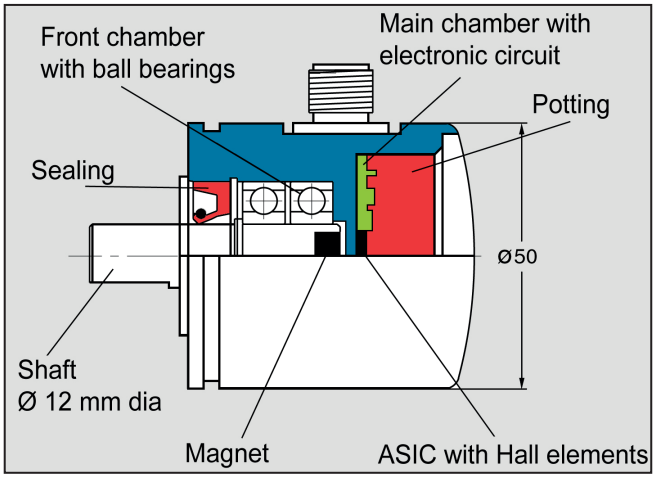
- **Contactless rotary sensor system, free of wear, with Hall technology**
- **Compact, robust design for mechanical engineering especially for building machinery, underwater devices and food conditioning equipment**
- **Resolution: 4096 positions / 360° (12 Bits) 13 Bits (optional)**
- **Measuring ranges up to 32,768 revolutions**
- **With digital or analogue interfaces**
- **Case in aluminium or stainless steel**
- **Optional potting for positive shock and vibration protection**
- **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**





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 - integral counter for the acquisition of revolutions, with non - volatile storage - optional potting against water jets (IP 69K) - electrical connections via round plug or lead exit.

Note (TMA, TMN)**:** The device restores the position value in case the supply voltage is cut off, provided that the shaft is not deflected by more than ±90° during the interruption of the supply voltage.

Electronic interfaces

- **TME 50: Synchronous serial interface-*SSI*** (page 2)
- **TMN 50: CANopen** (page 3)
- **TMA 50: Analogue** (page 4)

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:	0.350 kg approx.

Dimensions, materials and accessories: Page 6

Electrical data of all models

Sensor system:	ASIC with Hall elements
Measuring position deviation:	± 0.5 LSB
EMC-standards:	EN 50081-2, EN 50082-2

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: (DIN EN 60068-2-27)	500 m/s² ; 11 ms
Resistance to vibration: (DIN EN 60068-2-6)	10 Hz ... 2000 Hz ; 500 m/s²
Protection grades: (DIN EN 60529)	IP 66 IP 69K (with optional potting of main chamber)

The connection data are supplied with each item.

Model TME 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.

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:

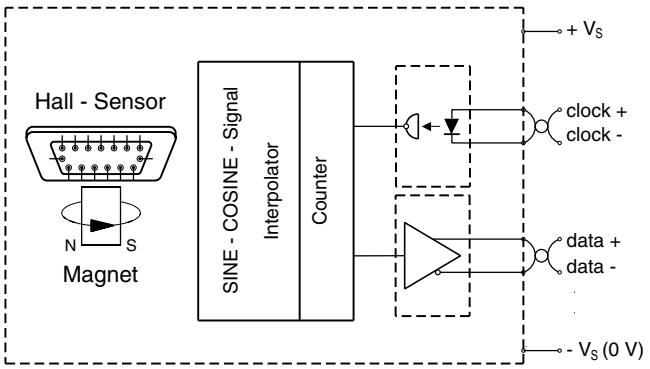
$$t_T = t_{GV} + 50\ ns = 500\ ns + 2t_K$$

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

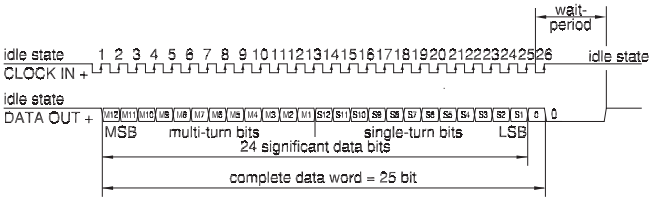
- To RS422 specification starting at 150 m approximately

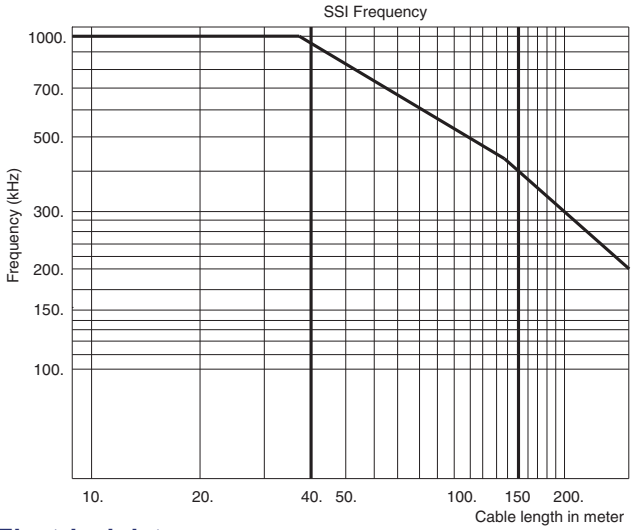
The opposite diagram is based on the above data.

Block diagram



Interface profile *SSI* - 25 Bits nat. binary





Electrical data

■ Supply voltage range:	+ 11 VDC to + 28 VDC
■ Supply current:	50 mA typ. / 80 mA max.
■ Resolution (standard):	4096 positions / 360° (12 Bits) (13 Bits optional)
■ Measuring range:	*SSI* 13 Bit protocol: max. 256 rev. *SSI* 25 Bit protocol: max. 4096 rev.
■ Output code:	Nat. binary (Gray optional)
■ Code sense:	CW (CCW optional)
■ 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

TME 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
  - A = Aluminium**
  - S = Stainless steel**
- S = Synchro flange
- Diameter ø 50 mm
- TME 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 TMN 50: CANopen - 12 Bits / 360°, up to 32768 revolutions

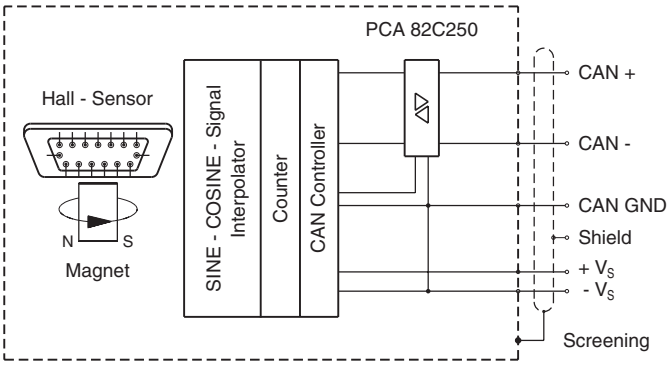
Electrical data

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.

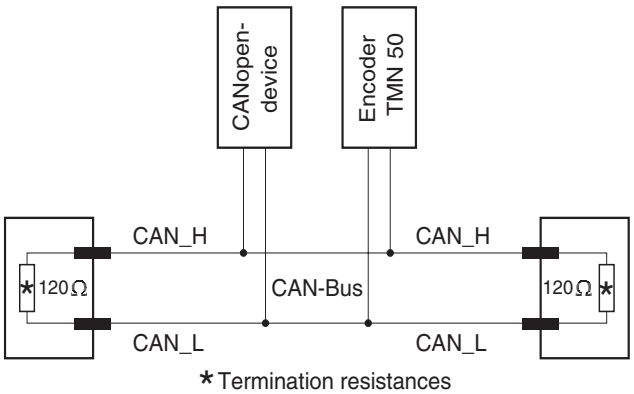
- Supply voltage range: + 13 VDC to + 26 VDC
- Supply current: 50 mA typ. / 80 mA max.
- Resolution: 4096 positions / 360° (12Bits) (13 Bits optional)
- Measuring range: 32768 revolutions max. (15 Bit)
- Output code: Nat. binary
- Code sense: CW / CCW
- Reference value: 0 - (total capacity less 1)
- CAN-interface: to ISO/DIS 11898
- Adressing: via SDO / LSS
- Termination resistance: by separate implementation
- Max. transmission length: 200 m*

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

Block diagram



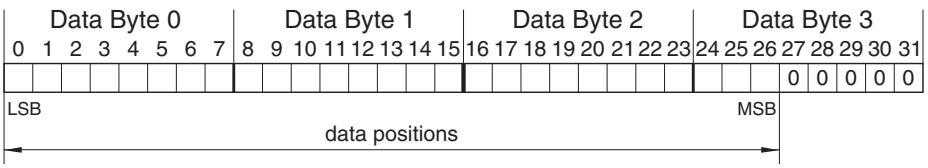
Bus configuration to ISO / DIS 11898



* Termination resistances

Data profile CANopen

PDO 1 / PDO 2



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

Order code format

TMN 50 - S A 4096 R 32768 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
- TMN 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, optional 5 pins) connector, case in stainless steel with lead (1m) and D-Sub plug without hood (for test purposes only).

Model TMA 50: Analogue outputs 0-20 mA, 4-20 mA, 0-10 VDC or ±10 VDC

≥ 360° ⊁
0(4) ... 20 mA
0 ... 10 VDC
± 10 VDC

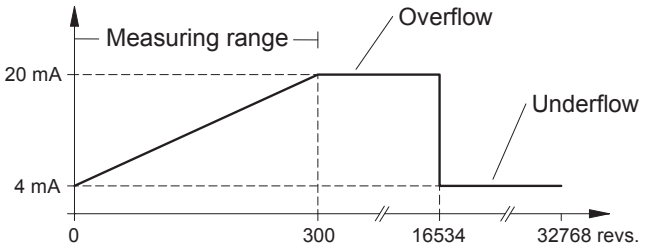
Function

The contactless electromagnetic sensor system is extended with a 12-bit D/A converter so that the measured variable is available as an analogue signal from 0 (4) to 20 mA, 0 to 10 V or ± 10 VDC.

Measuring range setting

The rotary encoder is equipped with a maximum measuring range of 15 bits, i.e. 32,768 revolutions. As standard, the measuring range is therefore set to 3600°, i.e. 10 revolutions and CW (increasing values clockwise viewed looking towards the sensor shaft) as the code direction. 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 32,768th 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 set to the zero point with the MFPs.

Electrical data

- Resolution: 12 Bits
- Measuring range: 3600°⊁ (other ranges upon request)
- Programmable parameter: Preset zero point, Preset final value, Code sense (see table mfp)
- Output signals: A: 0 to 20 mA, B: 4 to 20 mA, C: 0 to 10 VDC, D: ± 10 VDC
- Signal sense: CW (CCW at option)
- Zero shift: At option
- Supply voltage range: 20 to 28 VDC (output A,B,C), ± 13 to ± 16 VDC (output D)
- Supply current: 50 mA typ. / 60 mA max.
- Linearity: ± 0.25 % option ± 0.1 %
- Repeatability: ± 0.02 %
- Temperature drift: < 0.01 % / ° K / typ.

Current output accuracy

- ☐ at starting point 0 mA: 0 mA ± 50 µA
  4 mA: 4 mA ± 50 µA
- ☐ at end point 20 mA: 20 mA ± 50 µA
- Load resistance: to 500 Ω at Vs = 20 to 28 VDC

Voltage output accuracy

- ☐ at starting point 0 V: 0 V + 0.1 V (output 0 - 10 V), 0 V ± 25 mV (output ± 10 V)
- ☐ at end point 10 V: 10 V ± 25 mV
  ± 10 V: ± 10 V ± 50 mV
- Output current: 5 mA max. When load resistance > 2kΩ (short circuit proof)

Order code format

TMA 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 K = 1m lead**, S = Connector M12x1**
- W: Signal sense W = CW, C = CCW (optional)
- 3600: Measuring range ⊁ °
- A: Case material A = Aluminium**, S = Stainless steel**
- S: S = Synchro flange
- 50: Diameter ø 50 mm
- TMA: TBA 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 (4 pins) connector, case in stainless steel with lead (1m) and D-Sub plug without hood (for test purposes only).

Functional description and adjustement modes

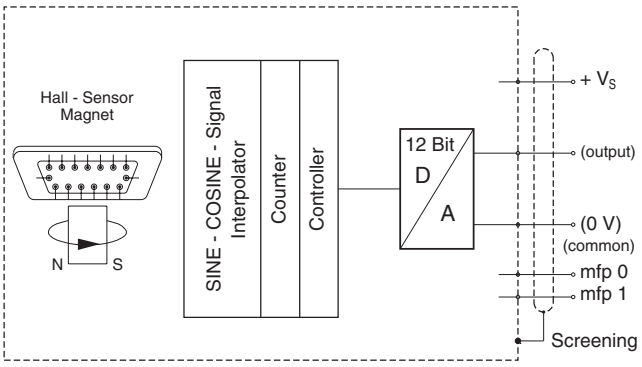
The following parameters can be adjusted by the user in situ: Code sense, zero point, end point and default values, via the multi-functional entries MFP 0 and 1 (entry circuit E8 respectively E9). Before delivery the measuring range will be set at 0 to 3600 degree and the code sense increasing CW with view to the shaft end.

If the user chooses a smaller measuring range, e.g. 2700°⊀, there will be an overflow when leaving the specified range. In this event the output signal keeps its maximum level, i.e. 20 mA up to 3600°⊀.

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

The Analogue Hand Programming device Model PMA-01 (see datasheet PMA 11443) is used for simple teach in adjustement of transducer TMA.

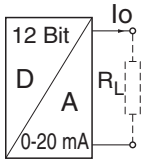
Block diagram



Output circuits

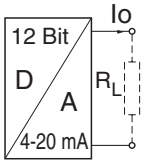
Output A

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



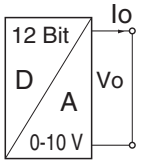
Output B

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



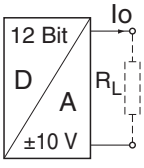
Output C

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



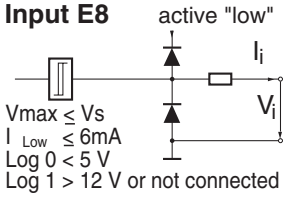
Output D

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



Input circuits of the multifunctional entries (MFP)

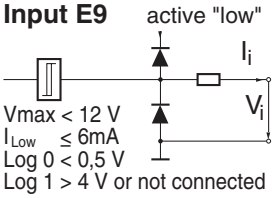
Input E8 active "low"



Vmax ≤ Vs
I_{Low} ≤ 6mA
Log 0 < 5 V
Log 1 > 12 V or not connected

with the output circuits
A = 0-20 mA and B = 4-20 mA

Input E9 active "low"

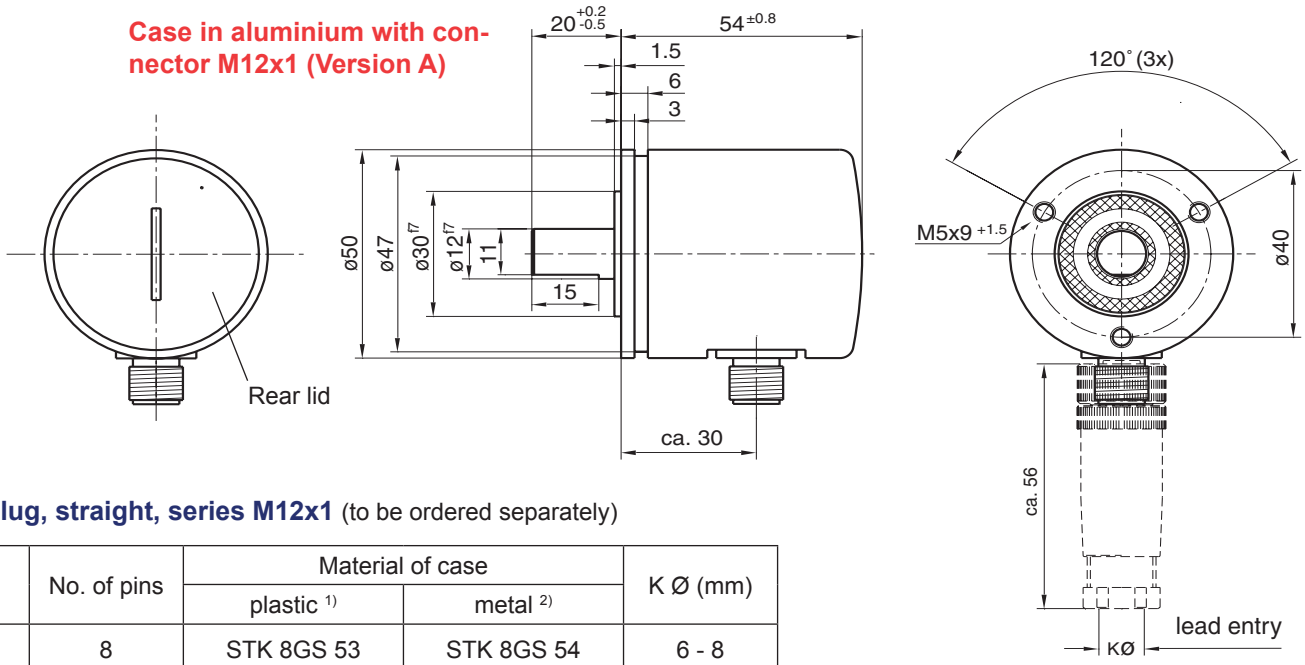


Vmax < 12 V
I_{Low} ≤ 6mA
Log 0 < 0,5 V
Log 1 > 4 V or not connected

with the output circuits
C = 0-10 VDC and D = ± 10 VDC

Dimensions in mm

Case in aluminium with connector M12x1 (Version A)

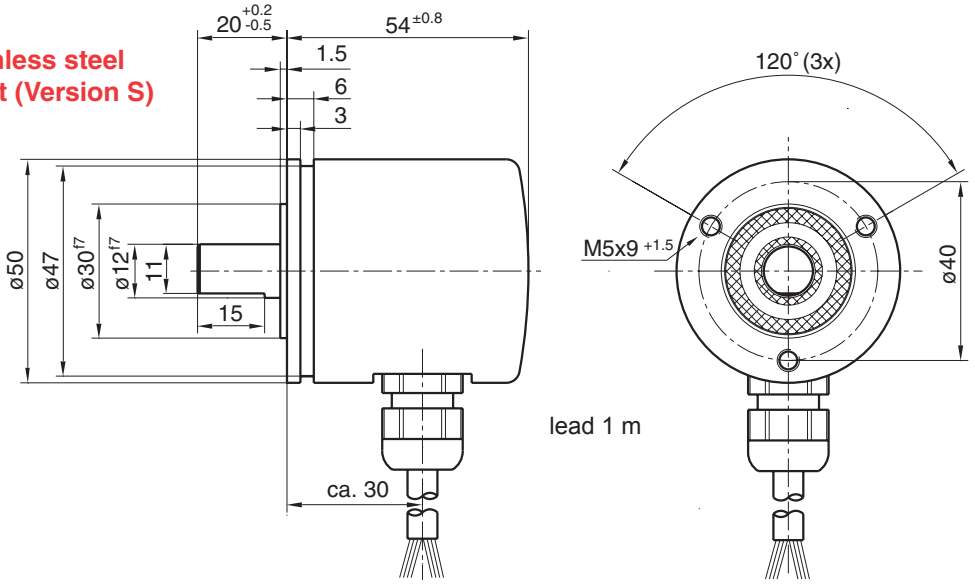


Counter plug, straight, series M12x1 (to be ordered separately)

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)

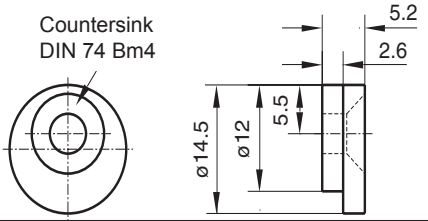


Materials used

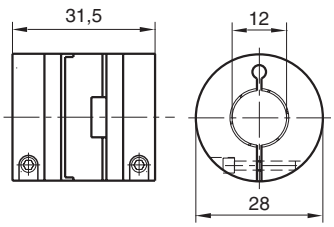
Case in stainless steel:	1.4305
Case in aluminium:	AlMgSi1
Shaft in stainless steel:	1.4305
Rear cover:	polyamid
Lead gland:	polyamid
Shaft packing seal:	NBR
Taroidal sealing rings:	NBR

Mounting clamps KL 66-2

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

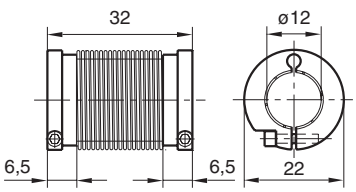


Oldham coupling 416/12



(aluminium / plastic)

Bellow coupling 493/12



(stainless steel)

Coupling no. 416 is also available with different bores for driving shafts with diameters other than 12 mm.