Manual

Bearingless encoder
RMA-5
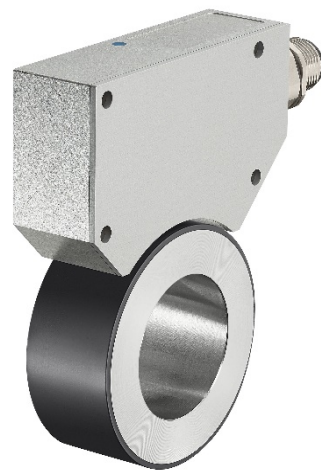
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1 Symbol explanation

Special information is marked by symbols in these operating instructions.

This information is introduced by signal words describing the severity of the danger.

Imperatively comply with these instructions and act cautiously in order to avoid accidents, personal injuries and damage to property.

Warnings:

⚠ **DANGER**	This symbol, in combination with the signal word "Danger" represents a direct imminent threat to life and health.
	Ignoring these instructions will result in serious injury to health, including life-threatening injuries.
⚠ **WARNING**	This symbol in connection with the signal word "warning" means a potentially imminent danger to the life and health of persons.
	Ignoring these instructions can result in serious injury to health, including life-threatening injuries.
⚠ **CAUTION**	This symbol in connection with the signal word "Caution" means a potentially dangerous situation.
	Ignoring these instructions can result in minor injuries or damage to property.
NOTICE	Tips and recommendations as well as information for an efficient and trouble-free operation.
SAFETY INSTRUCTION	A safety note indicates any specific or potential hazards. This serves to prevent accidents. Read and follow safety instructions carefully.

Table 1

2 Technical details and product characteristics

The angle measuring system RMA-5 is a combination of a sensor and a magnetic ring. The magnetic ring is mounted directly on the motor shaft (see mounting suggestions ☞ 2.3), allowing for simple and fast installation (the RMA-5 suits particularly for rotary angle measurement).
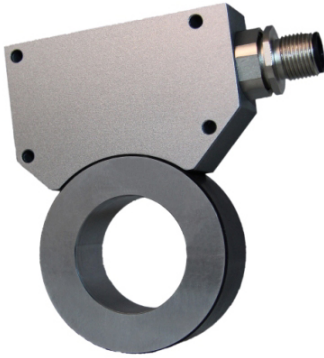
Figure 1

Thanks to its high protection level, the sensor head withstands any kind of dust and dirt and is absolutely wear-free. The RMA-5 rotary measuring system moreover offers the advantage of absolute value measurement and therefore belongs to the category of the singleturn encoders.

Important features:
- Rotary angle measuring system
- Resolution 16,000 measuring steps over 360° (other resolutions on request)
- Absolute value measurement
- Various interfaces available

Absolute:
- Standard: SSI or CANopen (DS406)
- On request: RS422, addressable RS422, RS232, BISS-C

Incremental:
- 90° phase-shifted quadrature signals TTL or HTL
- Sine/Cosine signal 1Vss
- Direct measurement on the motor shaft or axis possible

2.1 The operating principle

A Hall sensors line and a magnetoresistive resistance measuring bridge element are running above a magnetic ring bearing two tracks, a fine interpolation track and an absolute track. The absolute track provides, with the sensors line, an absolute value, and the fine interpolation track ensures, with the interpolation electronics, the high resolution of the measuring system. The illustration shows the two magnetic tracks of the magnetic ring, with north and south pole magnetization. The fine interpolation track has north and south poles alternating at a distance of 5 mm, which are scanned by means of resistance measuring bridges and provide a resolution reaching 16,000 measuring steps per revolution. The absolute value is provided by the sensors line with 16 individual Hall sensors, which scan the code sequence of the north and south poles. The absolute value on the magnetic ring repeats itself once per revolution.

To simplify the representation, the tracks of the magnetic ring are represented as a tape

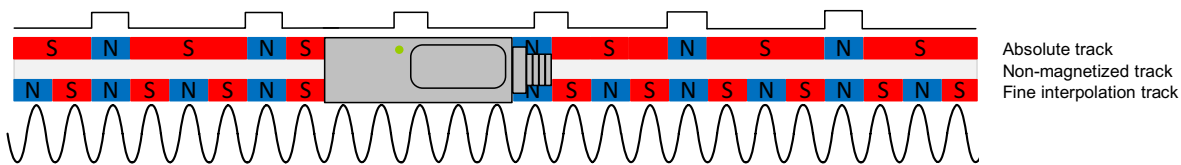Absolute track
Non-magnetized track
Fine interpolation track

Figure 2

2.2 Identification

The name plate allows the exact identification of the unit. It is located on the sensor housing and indicates the exact type designation.

The name plate also includes a unique traceable device number.

In case of contacts with Turck, always use and indicate this information.

2.3 Dimensions Sensor

Dimensions

Dimensions in mm [inch]
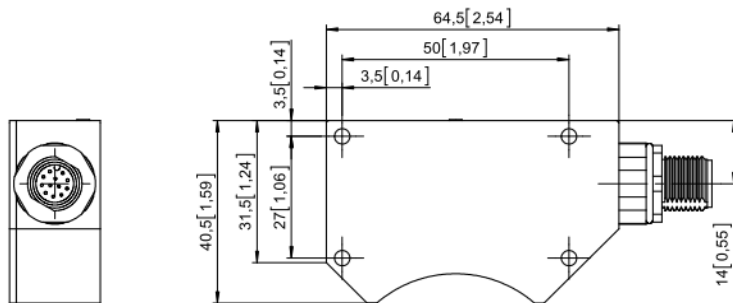
Sensor head   **Magnetic ring**
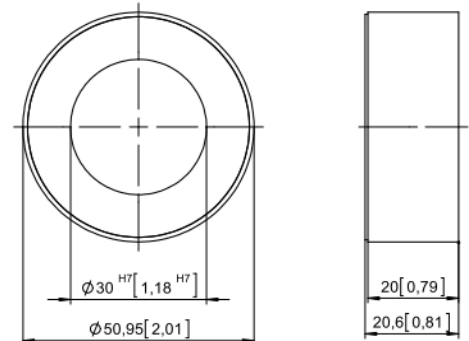
Figure 3

Mounting position and permissible mounting tolerances
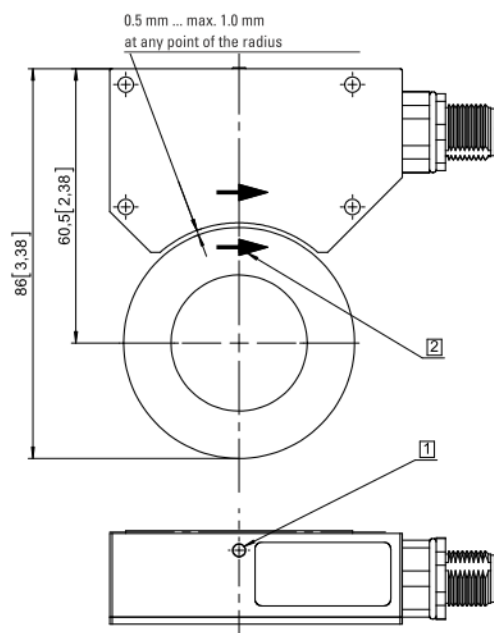
Sensor distance   **Offset**   **Tilting**
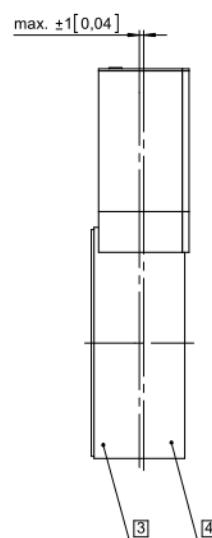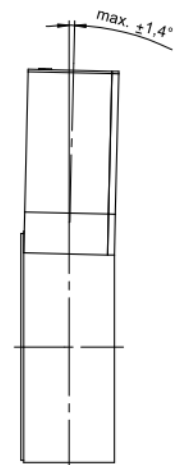
1 LED for distance monitoring

2 Direction arrows for the assembly

3 Fine interpolation track

4 Absolute track

Caution: imperatively comply with the mounting position of the sensor head with respect to the magnetic ring!

Figure 4

7

2.4 Dimensions Magnetic ring

2.4.1 Dimensions Magnetic ring without protective aluminum ring

Ø 30^{H7}

Ø 50,95

20,00

20,60
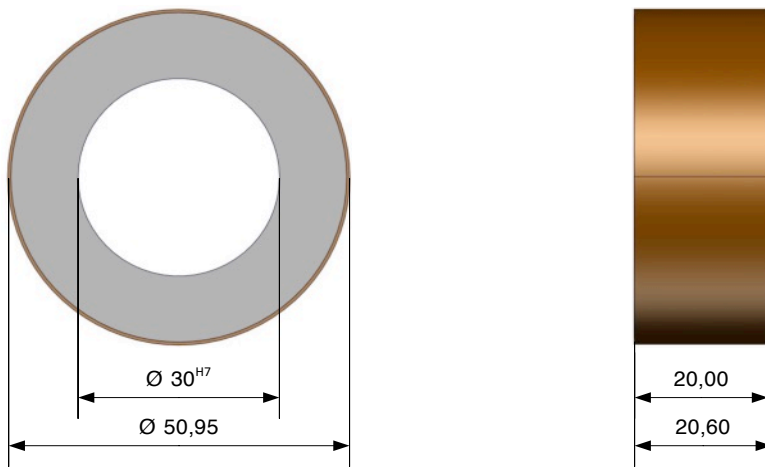
Required shaft / Tolerance Ø 30$_{h6}$

Figure 5

Use up to max. 1,000 RPM

2.4.2 Dimensions Magnetic ring with protective aluminum ring

Ø 30^{H7}

Ø 51,50

20,00

20,60

Required shaft / Tolerance Ø 30$_{h6}$

Figure 6

Use up to max. 20,000 RPM

2.5 Technical data Sensor

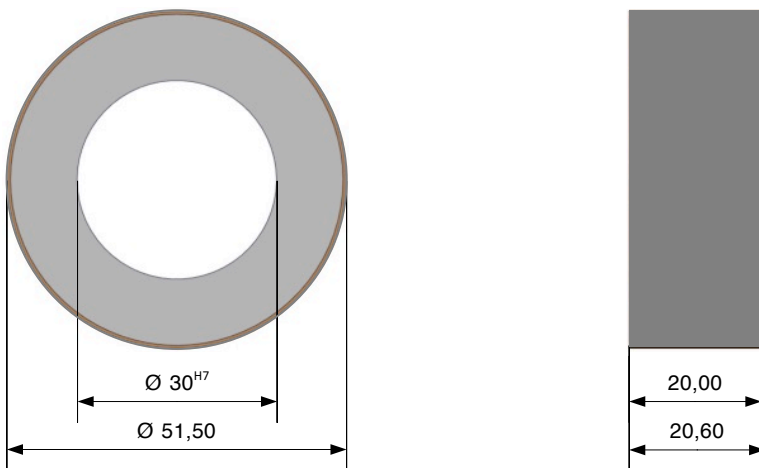| RMA-5 (Standard version)	
Mechanical data	
Measuring principle	absolute
Repeatability	± 1 increment
System accuracy in µm / °at 20°C	± (150 + 20 x L) / ± 0,35° L = Length in meters
Sensor distance to the magnetic ring	max.1.0 mm without protective ring, max. 0.45 with protective ring
Basic pole pitch	5 mm
Sensor housing material	Aluminum
Sensor housing dimensions	L x W x H = 64.50 x 40.50 x 20 mm
Max. measuring range:	360°
Type of connection	12-pin M12 Eurofast
Weight	approx. 0.19 lbs. [0.09 kg]
Electrical data	
Supply voltage	10 - 30 VDC
Residual ripple	<5 %
Current consumption	max. 150 mA
Interfaces	standard: SSI or CANopen (DS406) / on request RS422, addressable RS422, RS232, BISS-C
Resolution	16,000 measuring steps / revolution
Max. rotary speed	20,000 RPM (depending on the interface) ▪ 0 to 1,000 RPM without protective aluminum ring ▪ 1,000 to 20,000 RPM with protective aluminum ring
Cable length	max. 30 m (depending on the interface)

Environmental conditions	
Storage temperature	-13 °F to +185 °F [-25 to +85 °C]
Operating temperature	+14 °F to +157 °F [-10 to +70 °C]
Air humidity	max. 95 %, non-condensing
Protection level	IP50

Table 2

2.6 Technical data Magnetic ring

Mechanical data	
External Ø	50.95 mm without protective aluminum ring 51.50 mm with protective aluminum ring
Internal Ø	30^{H7} (required shaft: 30_{h6})
Width	20.6 mm
Number of poles / P	32
Basic pole length	5 mm
Ring material	Martensitic stainless steel, (magnetic, hardenable), material 1.4021(ASTM: 420)
Weight	approx. 0.41 lbs [0.19 kg]

Table 3

3 Connections and interfaces

3.1 Terminal assignment
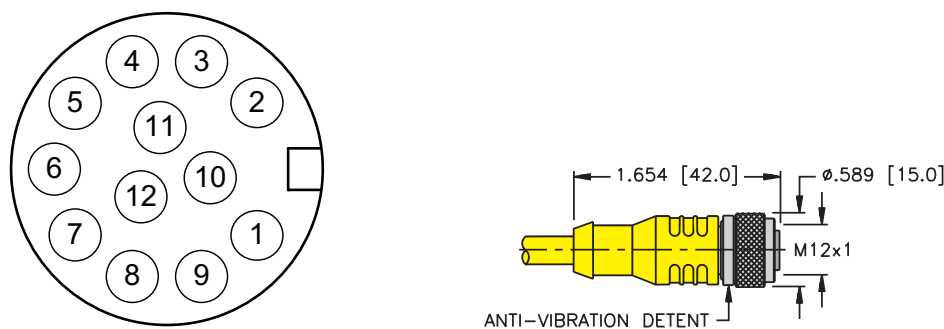
Standard Wiring

Output Circuit JC25B

Connection Type	Common (0V)	+V	+Clock	-Clock	+Data	-Data	-	-	-	-	-	-
M12 Eurofast	1	2	3	4	5	6	7	8	9	10	11	12

Output Circuit 9D38B

Connection Type	Common (0V)	+V	CAN_Low	CAN_High	-	-	-	-	-	-	-	-
M12 Eurofast	1	2	3	4	5	6	7	8	9	10	11	12

Figure 7

3.2 Interfaces

The following sections provide detailed information about connections and interfaces.

3.2.1 SSI interface

If the cycle is not interrupted for a duration of **Tm-T/2**, (output of 25 further periods), the shift register transmits again the same data value (error detection in the evaluation).

Some encoders have a **Power Failure Bit (PFB):**

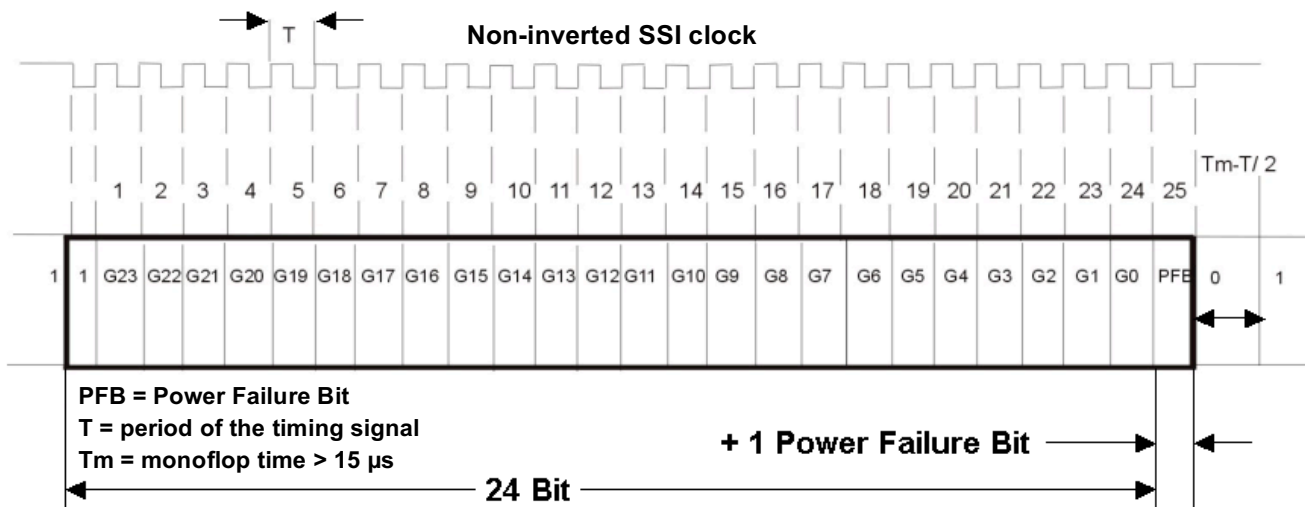With the RMA-5, the PFB is always "LOW".

Non-inverted SSI clock

PFB = Power Failure Bit
T = period of the timing signal
Tm = monoflop time > 15 µs

+ 1 Power Failure Bit

24 Bit

Figure 8

3.2.2 CANopen interface (9D32B, the RMA-5)

When ordering the option 9D32B, the RMA-5 measuring system is equipped with a CAN interface according to CANopen standard DS406.

The following identifiers are prescribed:

CAN identifier

(6-byte telegram)
181 h (16)   = Identifier for device address 1
First 4 bytes   = Position
Baud rate   = 250 KB/s

MSB			LSB
xxh	xxh	xxh	xxh
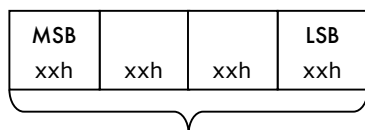
ABS position

Figure 9

3.2.3 Incremental signals TTL / HTL

As an option, two 90° phase-shifted rectangular signals (rotary pulse encoder-compatible) with HTL or TTL output level (push/pull) are available.

HTL (10 … 30 V)
TTL (5 V)

90°
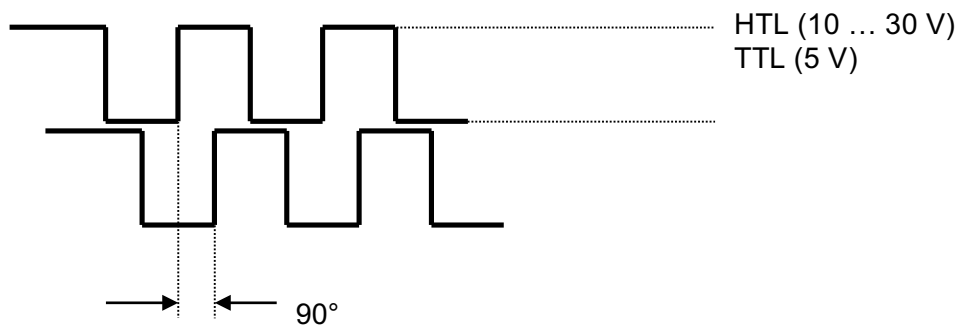
Figure 10

3.2.4 Sine-Cosine incremental signals

As an option, Sine-Cosine signals with 1 Vss are available (push/pull final stage, short-circuit protection)
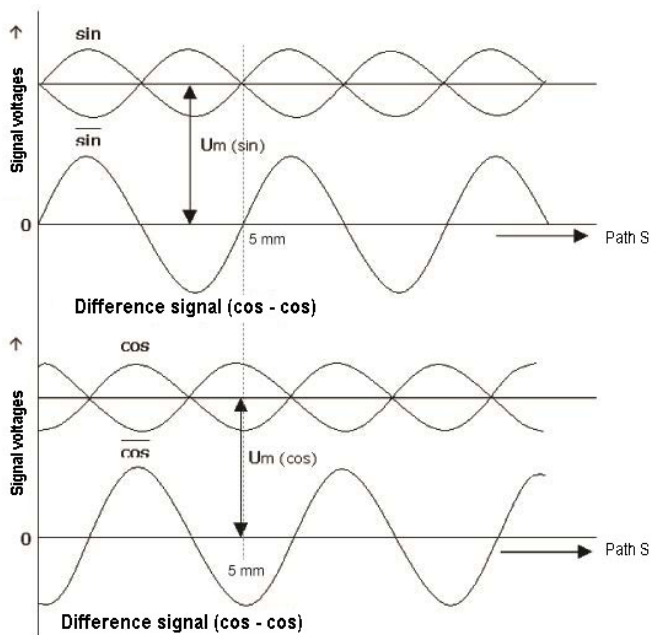
Figure 11

Parameter	Designation	min.	typ.	max.	Unit
Median voltage	um (sin), um (cos)	2,4	2,5	2,6	V
Amplitude	sin $-$ sin cos - cos	400	500	600	mV
Ratio	(sin $-$ sin) / (cos $-$ cos)	0,9	1,0	1,1	-
Phase shift	φ	89	90	91	° degrees
Distortion factor	K	-	-	2	%

Table 4

4 Quick Start Guide

⚠ WARNING	Do not operate the device in explosive or corrosive atmospheres! The device shall not be installed close to interfering sources with high inductive or capacitive interferences or strong electrostatic fields!
⚠ WARNING	**Influence of external magnets** External magnetic fields shall not exceed 64 mT (640 Oe; 52 kA/m) on the surface of the magnetic ring, as this might damage or destroy the encoding of the magnetic tape.
⚠ CAUTION	Electrical connections must be carried out by suitably qualified personnel, in compliance with the local provisions. If necessary, the device is intended for mounting in a control panel. If there is a risk of touching live elements while working at the control panel, all components must be de-energized. (Protection against contact) Wiring work may only be carried out in de-energized condition! Thin-wire cable strands are to be equipped with ferrules! Check all connections and plugs before switching on! Mount the device so that is it protected against harmful environmental influences such as splash water, solvents; vibrations, shocks and heavy contamination, and so that the operating temperature is complied with.
NOTICE	Before commissioning the device please read thoroughly the operating instructions! The installation instructions are to be complied with imperatively! The guarantee voids in case of damages due to non-compliance with these operating instructions. Turck shall not be liable for any consequential damage. We likewise accept no liability for personal injury, damage to property or financial damage! The operator is obliged to take and implement suitable safety-relevant measures. Commissioning shall only be carried out by qualified personal, authorized and trained by the operator.

5 CANopen objects

Object	Sub Index	Access	Name	Default Value	Low Limit	High Limit
Communication profile						
0x1000		read	Device Type	0x00080196		
0x1001		read	Error Register	0	0	0
0x1003	1	read	Standard Error Field	0	0	0
0x1005		readWrite	COB-ID SYNC	0x80	80	8000080
0x1010	1	readWrite	Save all Parameters	0		
0x1014		readWrite	COB-ID EMCY	$NODEID+0x80	1	0xffffffff
0x1017		readWrite	Producer Heartbeat Time	0	0	0xffff
0x1018	1	read	Vendor Id	0x13		
0x1018	2	read	Product Code	0x0200		
0x1018	3	read	Revision number	0x0002		
0x1018	4	read	Serial number	0x0001		
0x1200	1	read	COB ID Client to Server	$NODEID+0x600		
0x1200	2	read	COB ID Server to Client	$NODEID+0x580		
0x1800	1	readWrite	COB-ID	$NODEID+0x180		
0x1800	2	readWrite	Transmission Type	0xfe	0	0xff
0x1800	3	readWrite	Inhibit Time	0	0	0xffff
0x1800	4	read	Compatibility Entry	0	0	0xff
0x1800	5	readWrite	Event Timer	5	0	0xffff
0x1801	1	readWrite	COB-ID	$NODEID+0x280		
0x1801	2	readWrite	Transmission Type	0xfe	0	0xff
0x1801	3	readWrite	Inhibit Time	0	0	0xffff
0x1801	4	readWrite	Compatibility Entry	0	0	0xff
0x1801	5	readWrite	Event Timer	0	0	0xffff
0x1a00	1	readWrite	PDO Mapping Entry	0x60040020	0	0xffffffff
0x1a01	1	readWrite	PDO Mapping Entry	0x60300110	0	0xffffffff
Manufacturing profile						
0x2000		write	Clear EEPROM	0	0	0
0x2001		readWrite	NMT bootup status	0	0	1
0x2002		write	Function call (internal testing purposes)			

Device profile						
0x6004		read	Position Value	0	0	0xffffffff
0x6005	1	readWrite	Position Measuring Step in 0.001 um	1000	0	0xffffffff
0x6005	2	readWrite	Speed Measuring Step in 0.01 mm/sec	100	0	0xffffffff
0x6030	1	read	Speed Value1	0	0x8000	0x7fff
0x6500		read	Operating Status	0	0	0

Table 5

TURCK