

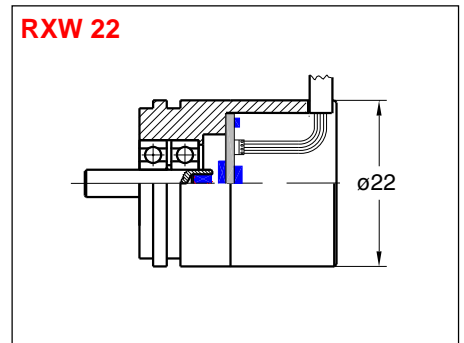
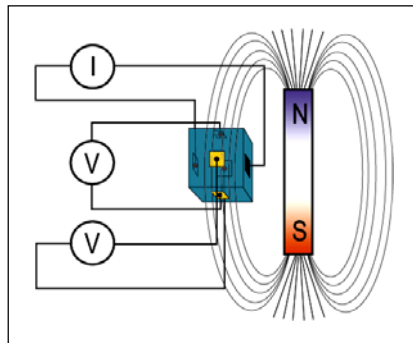
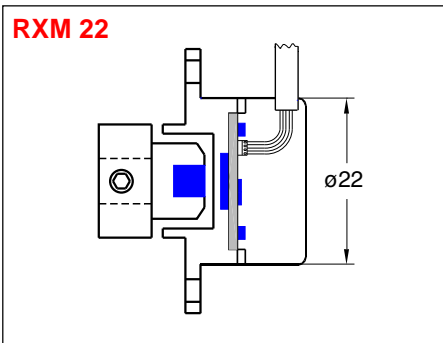
- Contactless sensor technology, free of wear
- Compact, low cost design for mechanical engineering and instrumentation
- Digital and analogue output interfaces
- Nominal operating voltage 5 VDC nominal
- Resolutions 9 Bits per 360°
- **RXM 22 with external magnetic actuator**
- **RXW 22 with shaft and ball bearings**
- Additional potting for protection grades up to IP 68 and for high resistance against shock and vibration



### Construction and function

The sensor system consists of an ASIC with integral Hall elements to convert the rotary motion of an external permanent magnet into a proportional sine-cosine output signal for the range of 360°.

Integral electronic circuits of different layouts transform this signal into digital or analogue data for transmission to displays or control units.



Two different mechanical versions are available: RXM 22 series has no moving parts within its case. The system is activated by an external stainless steel actuator incorporating a small permanent magnet. The actuator must be fixed to the driving shaft of a rotating device. This layout has no friction. It requires no individual torque.

RXW 22 series is a conventional construction with shaft and ball bearings. It must be coupled to a driving shaft. The cases are in aluminium. Standard items have a 1 meter cable lead with a D-subminiature plug. For positive protection against shock, vibration and humidity the cases can be potted before delivery.

### Electrical interfaces

- **Model RBX 22:** Absolute / nat. binary
  - Variants P: Parallel, page 3
  - Variant E: SSI (synchronous serial), page 4
- **Model RIX 22:** Incremental, page 5
- **Model RSX 22:** sine-cosine, page 3
- **Model RAX 22:** Analogue, page 6
- **KITs RXK 22:** Page 8
- **Mechanical and environmental data:** page 2
- **Dimensions and accessories:** page 7

## Mechanical data

Series	<b>RXM 22</b>	<b>RXW 22</b>
Diameter of shaft	n.a.	4 mm (4 <sup>h6</sup> )
Magnetic actuator for shaft diameters	6 mm (4, 8 or 10) <sup>1)</sup>	n.a.
Operating speed	10.000 rpm max.	
Driving torque at 1000 rpm	n.a.	A: 15 cNcm B & C: 40 cNcm <sup>2)</sup>
Starting torque	n.a.	A: 30 cNcm B & C: 60 cNcm <sup>2)</sup>
Permissible angular acceleration	n.a.	10 <sup>5</sup> rad/s <sup>2</sup> max.
Inertia (rotor)	n.a.	0.111 gcm <sup>2</sup>
Permissible shaft load	n.a.	20 N radially 10 N axially
Bearing life (typical)	n.a.	10 <sup>9</sup> revolutions at 20 N radial load
Mass including lead and D-sub plug	40 g approx. + 12 g actuator	A: 70 g approx. B & C: 80 g approx.
Lead exit	radially	A: radially B & C: axially

1) At option, 2) B with PTFE o-ring, C with packing ring, n.a. = not applicable

## Environmental data

Series	<b>RXM 22</b>	<b>RXW 22</b>
Behaviour within magnetic fields	Up to 0,1 Tesla without influence (all 3 axis)	
Operating temperature range	- 40°C to + 85°C (+ 125° at option)	
Storage temperature range	- 20°C to + 70°C (dependant on packing material)	
Resistance against shock	2000 m/s <sup>2</sup> ; 11 ms   200 m/s <sup>2</sup> ; 11 ms to DIN EN 60068-2-27	
Resistance against vibration	10 Hz to 2000 Hz; 500 m/s <sup>2</sup> to DIN EN 60068-2-6	
Protection grades	Front plate IP 67 Case IP 64 with potting IP 68	A: IP 53 B: IP 64 C: IP 68 with potting

## **RXW 22 series with shaft and ball bearings**

Variants A, B and C are available with different sealings and with different protection grades. Please refer to drawings page 8.

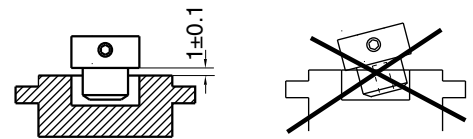
## **RXM 22 series with external magnetic actuator**

Standard magnetic actuators have an internal bore to accept shafts of 6 mm dia. Actuators with 4, 8 or 10 mm dia must be ordered **separately**, e.g. RBM-N08, for quantities up to 24 pieces. For larger quantities such actuators will become part of the standard item as per the order code, e.g. RBM36-08-512RK1 E01.

## Mounting specifications

Position tolerances for the magnet:

- Vertical deviation:  $\leq 1 \pm 0.1$  mm
- Coaxial deviation:  $\leq 0.1$  mm  $\left(\oplus\right)$



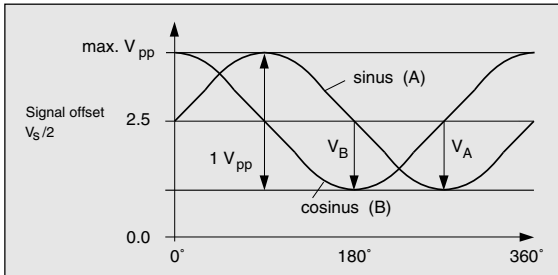
- A sloping position of the actuator will impair the measurement signal
- After removing the actuator the encoder will deliver an arbitrary measurement signal.

## General note

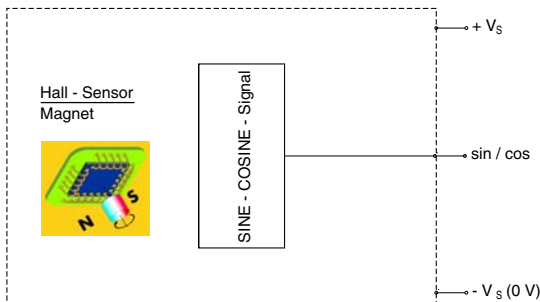
- Remote magnetic fields may have an influence on the behaviour of the sensor system via ferromagnetic pieces close to the encoder.
- Standard items include 1 meter lead and a D-subminiature plug without mating socket. Different lead lengths and different connectors can be made available upon request.
- Connecting diagrams will be supplied with each item.
- EMC standards: EN 50081-2,  
EN 50082-2

## Electrical data

- Signal amplitude:  $2 \pm 0.2 V_{pp}$
- Signal offset :  $V_s/2 \pm 5 \text{ mV}$
- Max. operating current / ea signal: 0.5 mA
- Max. puls rate: 150 kHz
- Operating voltage:  $+5 \pm 0.25 \text{ VDC}$
- Operating current: 30mA typ. / 40mA max.
- Max. output frequency: 500 Hz
- Max. cable length: 3 m



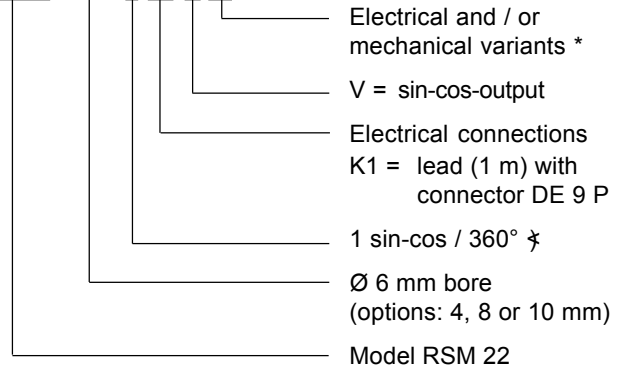
## Block diagram



## Order code format

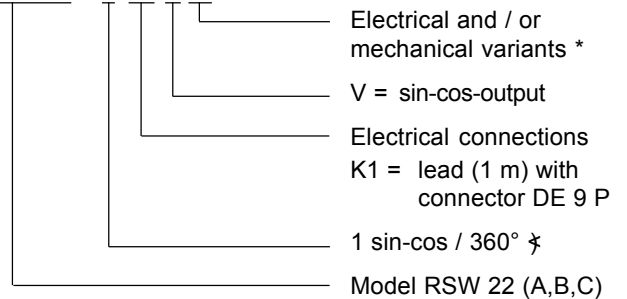
### Model RSM 22 (with external magnetic actuator)

**RSM 22 - 06 - 1 K1 V 01**



### Model RSW 22 (with shaft and ball bearings)

**RSW 22A - 1 K1 V 01**



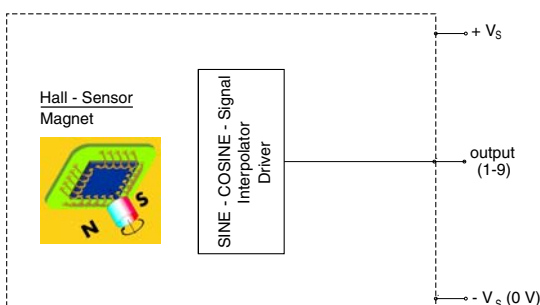
\* The basic versions in accordance with the data sheet bear the code number 01. Variations of the basic version are indicated by a consecutive number and are documented in our works.

# Rotary Encoders **Model RBX 22: natural binary/ parallel**

## Electrical data

- Max. Resolution: 512 positions / 360° (9 Bits)
- Measuring position deviation:  $\pm 1 \text{ LSB}$  (9 Bits)
- Repeatability:  $\leq 0.1 \text{ LSB}$  (9 Bits)
- Parallel output:  $V_H \geq 4 \text{ V}$  at  $-I_H \leq 3 \text{ mA}$   
 $V_L \leq 1 \text{ V}$  at  $I_L \leq 3 \text{ mA}$   
Serial resistor = 300  $\Omega$  typ.
- Latch-Enable: aktiv high:  $V_{LE} \geq 2.4 \text{ VDC}$
- Code sense: CW \*
- Operating voltage:  $+5 \pm 0.25 \text{ VDC}$
- Operating current: 30 mA typ. / 40 mA max.

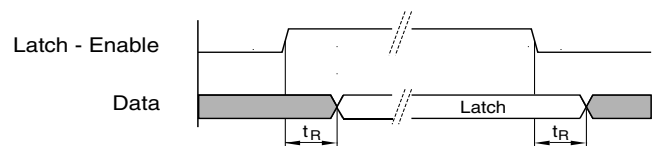
## Block diagram



\* Increasing signal when turning clockwise with view on flange side.

## Timing diagram:

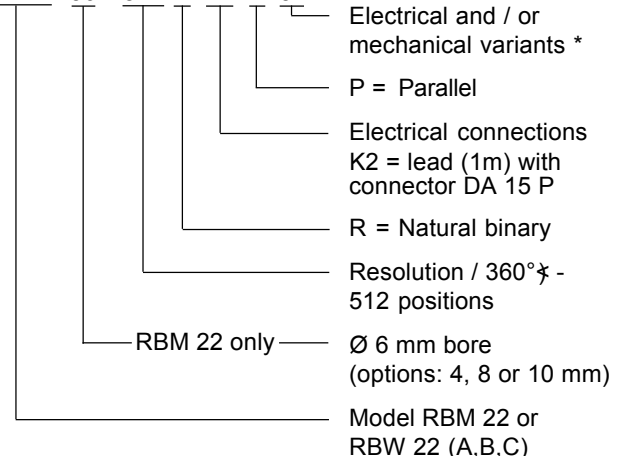
$t_R = \text{Reaction time} \leq 1 \mu\text{s}$



## Order code format

### Model RBM 22 (with external magnetic actuator)

**RBM 22 - 06 - 512 R K2 P 01**



### Model RBW 22 (with shaft and ball bearings)

Example of order code for IP 53 version:

**RBW 22 A - 512 R K2 P 01**



**Model RBX 22: Synchronous Serial Interface - 9 Bits / 360°**

**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.

**Variant: 12 Bits to data sheet RBX 11433.**

**Maximum data transmission rate**

The data rate is 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.  $\leq 300$  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:

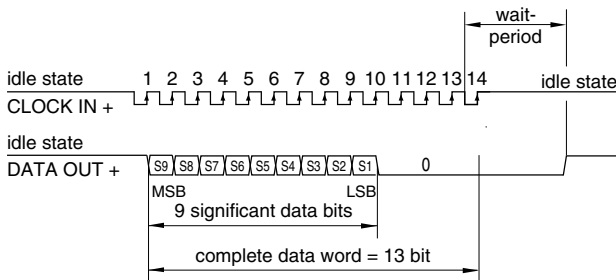
$$t_T = t_{GV} + 50 \text{ ns} = 500 \text{ ns} + 2t_K$$

The maximum clock frequency is defined by the following formula:  $f_{max.} = 1/t_T$

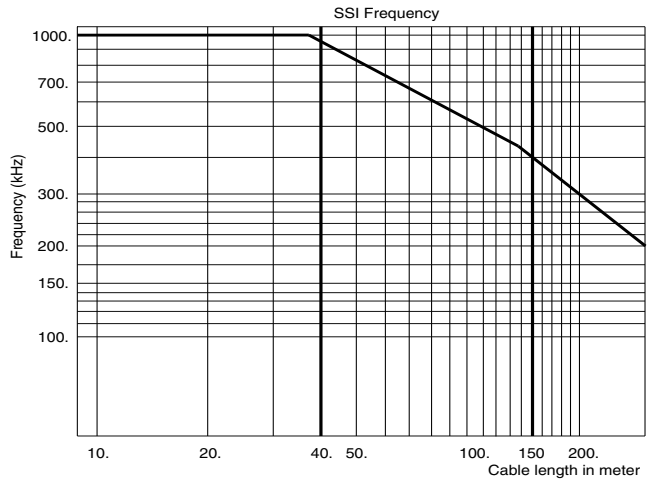
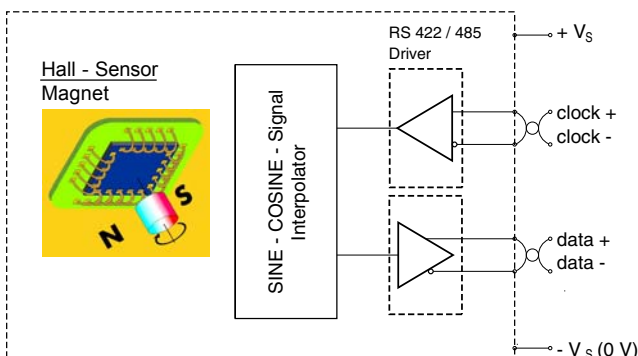
- To RS422 specification starting at 150 m approximately

The opposite diagram is based on the above data.

**Interface profile SSI - 9 Bit / natural binary**



**Block diagram**



**Electrical data**

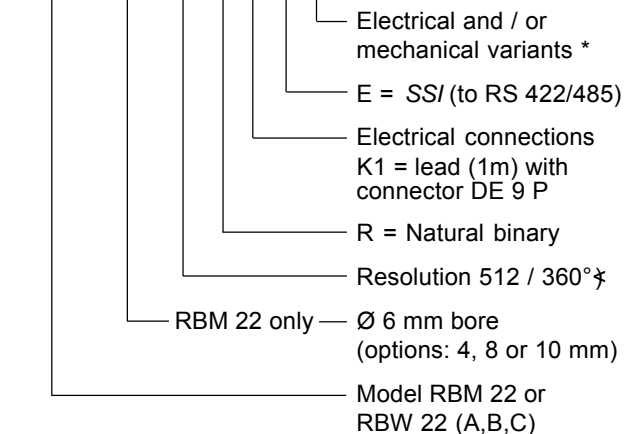
- Output code: Natural binary
- Resolution (standard): 512 positions / 360° (9 Bits)  
(12 Bits to data sheet RBX 11433)
- Code sense: CW \*
- Measuring position deviation:  $\pm 1$  LSB (9 Bits)
- Repeatability:  $\leq 0.1$  LSB (9 Bits)
- Serial output SSI: Differential data output to RS 422/485
- Clock SSI: Differential data input to RS 422/485
- Operating voltage:  $+ 5 \pm 0.25$  VDC
- Operating current: 30 mA typ. / 40 mA max.
- Monoflop time:  $25 \pm 10$   $\mu$ s
- Clock frequency: max. 1 MHz

\* Increasing signal when turning clockwise with view on flangeside.

**Order code format**

**Model RBM 22 (with external magnetic actuator)**

**RBM22 - 06 - 512 R K1 E 01**



**Model RBW 22 (with shaft and ball bearings)**

Example of order code for IP 53 version:

**RBW22 A - 512 R K1 E 01**

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

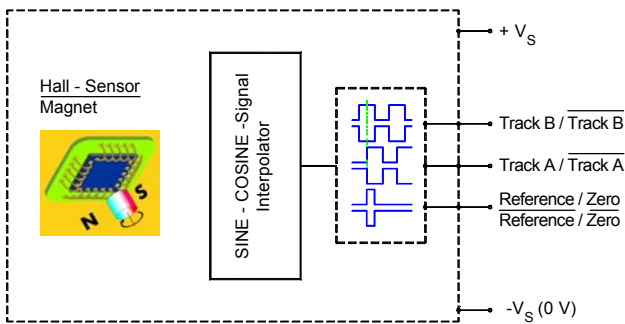


## Electrical data

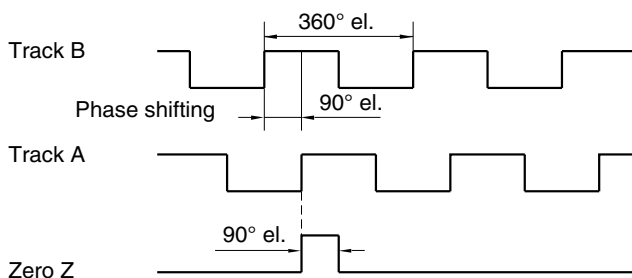
- Counts per turn: 128 (others at request)
- Outputs: Channels A, B, zero and inversions
- Signal shape: square
- Max. output frequency: 200 kHz
- Incremental output: to RS 422/485
- Phase shift A to B:  $90^\circ \pm 25^\circ$
- Pulse rate: 1 : 1  $\pm 15^\circ$
- Signal level:
  - $U_L(I_{\text{sink}} = 20 \text{ mA})$  0.3 V typ./0.5 V max.
  - $U_H(I_{\text{source}} = -20 \text{ mA})$  2.5 Vmin./2.8 V typ.
- Operating voltage: + 5  $\pm$  0.25 VDC
- Operating current: 30 mA typ. / 40 mA max.

**Variant: 1024 counts to data sheet RBX 11433.**

## Block diagram

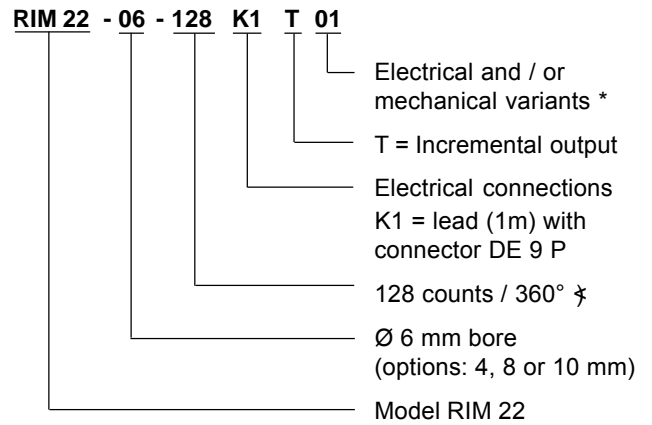


## Signal output when CW turning (view on shaft)



## Order code format

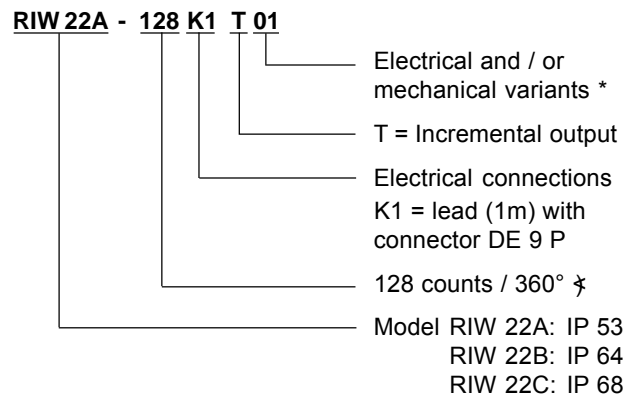
### Model RIM 22 (with external magnetic actuator)



**Please note:** Standard magnetic actuators have an internal bore to accept shafts of 6 mm dia. Actuators with 4, 8 or 10 mm dia must be ordered **separately**, e.g. RBM-N08, for quantities up to 24 pieces. For larger quantities such actuators will become part of the standard item as per the order code, e.g. RAM 22 - 08 - 360 K1 W C01.

## Order code format

### Model RIW 22 (with shaft and ball bearings)



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

**0 ... 5 VDC**

**Construction**

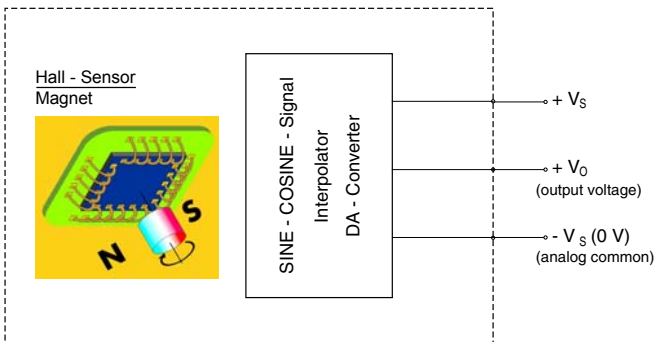
The electro-magnetic sensor system of the encoder is completed by a 9 Bits D/A converter to transform the angular position into an analogue signal of 0 to 5 VDC proportional to 0° to 360° measurement range.

**Electrical data**

- Output signal C: 0 to 5 VDC (dependant on  $V_S$ )
- Linearity:  $< \pm 1.5 \%$
- Temperature drift: 0.02 %/K typ.
- Code sense: CW \*
- Operating voltage :  $+ 5 \pm 0.25$  VDC
- Operating current: 30 mA typ. / 40 mA max.
- Tolerances of output level:
  - Beginning 0 V  $\pm$  50 mV typ./  $\pm$  250 mV max.
  - Ending 5 V  $\pm$  50 mV typ./  $\pm$  250 mV max.
- Output current: max. 2.5 mA at  $> 2$  k $\Omega$  load (not short circuit proof)

\* Increasing signal when turning clockwise with view on flange side.

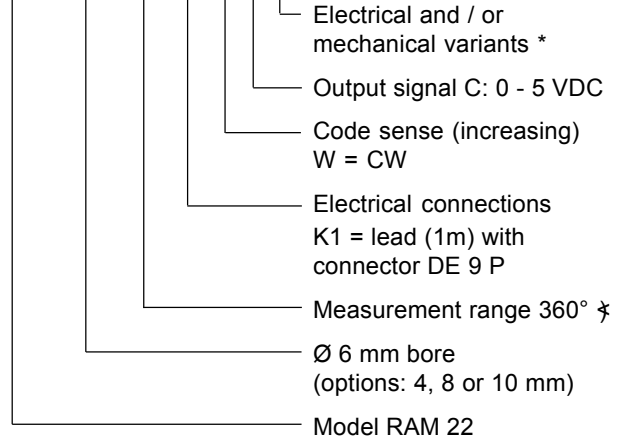
**Block diagram**



**Order code format**

**Model RAM 22 (with external magnetic actuator)**

**RAM 22 - 06 - 360 K1 W C 01**

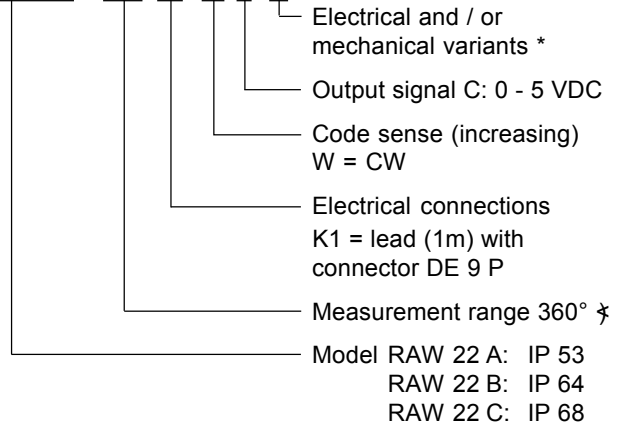


**Please note:** Standard magnetic actuators have an internal bore to accept shafts of 6 mm dia. Actuators with 4, 8 or 10 mm dia must be ordered **separately**, e.g. RBM-N08, for quantities up to 24 pieces. For larger quantities such actuators will become part of the standard item as per the order code, e.g. RAM 22 - **08** - 360 K1 W C01.

**Order code format**

**Model RAW 22 (with shaft and ball bearings)**

**RAW22 A - 360 K1 W C 01**

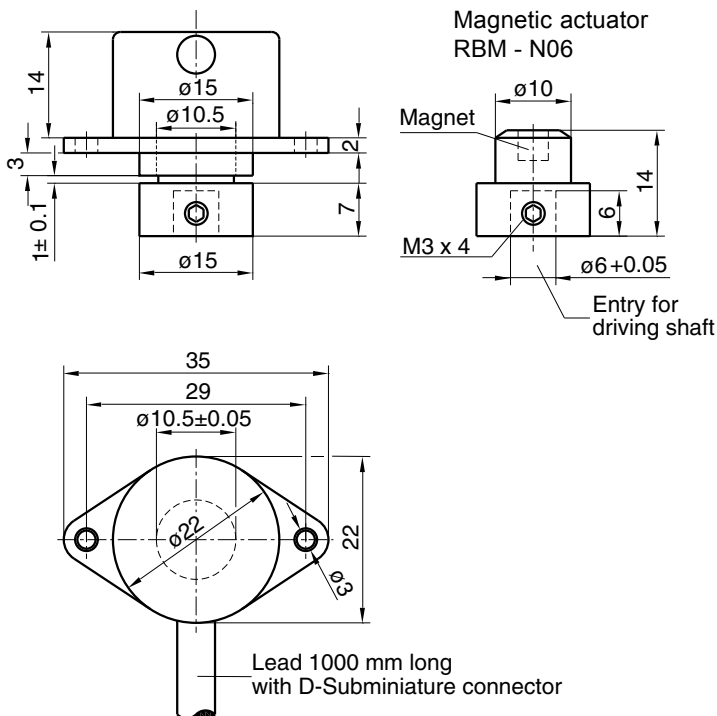


\* The basic versions in accordance with the data sheet bear the code number 01. Variations of the basic version are indicated by a consecutive number and are documented in our works.



**Dimensions in mm**

**Model RXM 22 with external magnetic actuator**



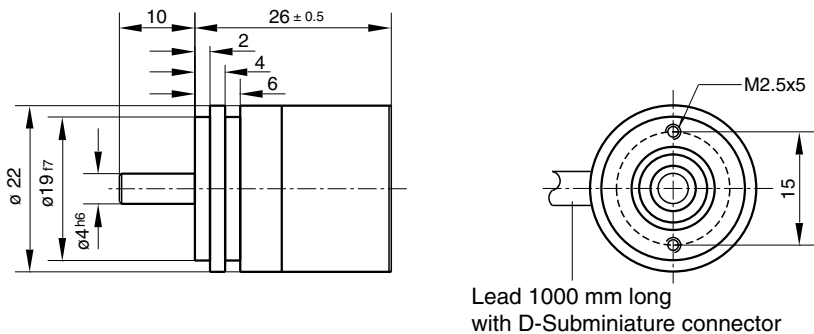
**Electrical connections**

- **Model RSX 22, sine-cosine:**  
K1 = screened lead 1 m long with D-Subminiature-connector DE 9 P, with plastic housing
- **Model RBX 22 with parallel interface:**  
K2 = screened lead 1 m long with D-Subminiature-connector DA 15 P, with plastic housing
- **Model RBX 22 with serial interface SSI:**  
K1 = screened lead 1 m long with D-Subminiature-connector DE 9 P, with plastic housing
- **Model RIX 22, incremental:**  
K1 = screened lead 1 m long with D-Subminiature-connector DE 9 P, with plastic housing
- **Model RAX 22, with analogue signal:**  
K1 = screened lead 1 m long with D-Subminiature-connector DE 9 P, with plastic housing

Counter plugs, clamps and couplings must be ordered separately.

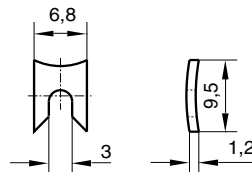
**Please note:** Standard magnetic actuators have an internal bore to accept shafts of 6 mm dia. Actuators with 4, 8 or 10 mm dia must be ordered **separately**, e.g. RBM-N08, for quantities up to 24 pieces. For larger quantities such actuators will become part of the standard item as per the order code, e.g. RBM 22 - 08 -512 R K1 E01.

**Model RXW 22A with shaft and ball bearings: IP 53**

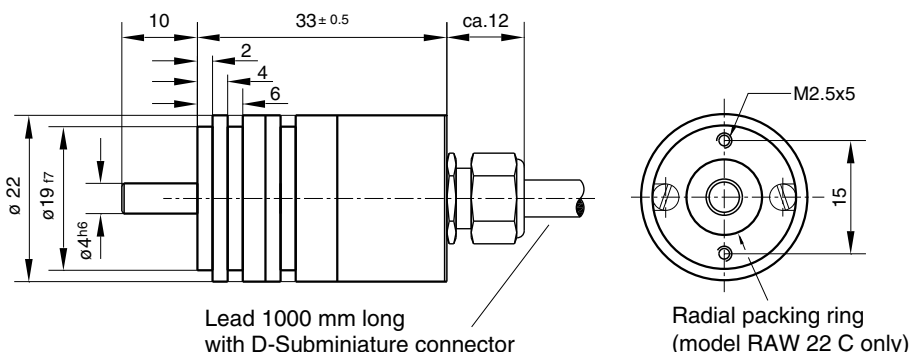


**Mounting clamps GW**

- (3 each RXW 22)
- Reference circle: 28<sup>-0.2</sup> mm
  - Material: 1.4301
  - Screws to be used: M2.5 to DIN 963

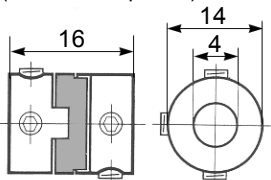


**Models RXW 22B and RXW 22C with shaft and ball bearings: IP 64 and IP 68**

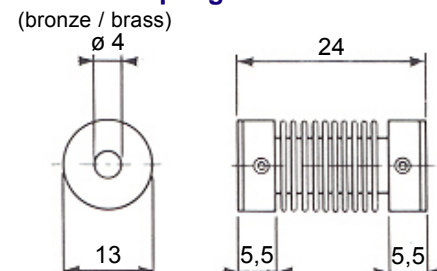


**Oldham-coupling 413/4**

(aluminium / plastic)



**Bellow coupling 420/4**



- Contactless rotary sensor kit
- No wear, for low space and no torque requirements
- PCB with Hall element, ASIC and output circuit and external magnet
- **Model RBK 24-PS: Absolute, 9 Bit natural binary**
- **Model RBK 24-ES: Absolute, 9 Bit, serial SS/**
- **Model RIK 24-TS: Incremental, 128 counts per revolution**
- All models have an additional sine-cosine output interface

**Construction**

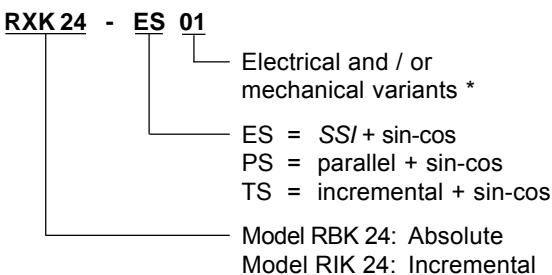
A small PCB contains a Hall element with an integral ASIC and the relevant output circuit. The device is activated either by an external round permanent magnet or by a magnetic stud which can be fitted directly to a shaft. The sensor kit has been designed for use within all kinds of instrumentation and mechanical constructions where minimum space and no environmental protection are required.

**Mechanical and environmental data:** page 2  
(if applicable)

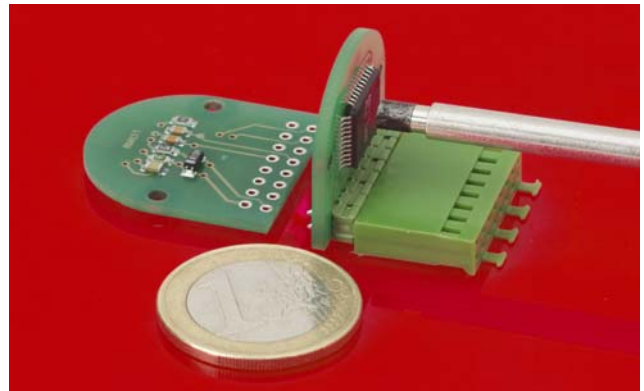
**Electrical data**

- **Model RBK 24-PS:** as per RBX 22 / page 3
- **Model RBK 24-ES:** as per RBX 22 / page 4
- **Model RIK 24-TS:** as per RIX 22 / page 5
- **Sinus-cosinus:** as per RSX 22 / page 3

**Order code format**

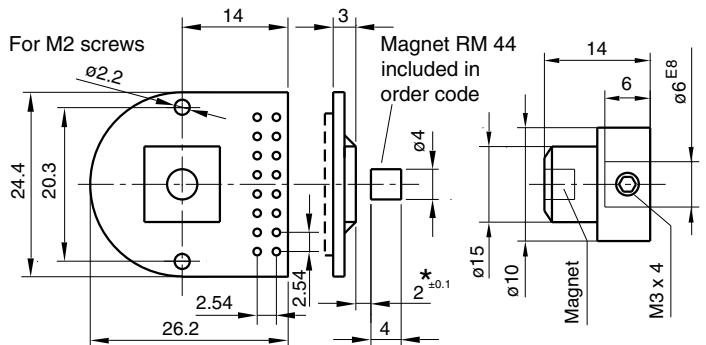


\* The basic versions in accordance with the data sheet bear the code number 01. Variations of the basic version are indicated by a consecutive number and are documented in our works.



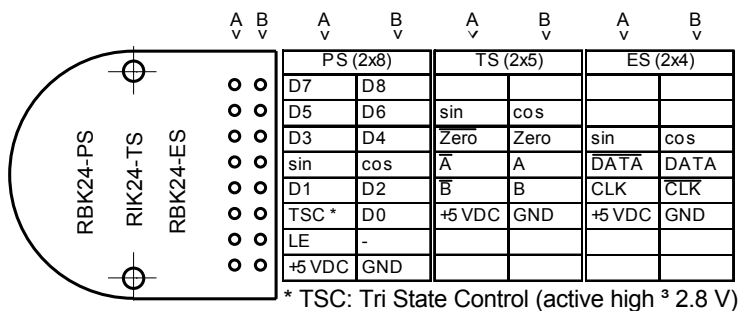
**Dimensions in mm**

The PCB contains 2 x 8 soldering bores within the 2.54 mm grid to accept pin or socket connectors (to be installed by user).



\* Distance between magnetic and sensor chip. Permissible coaxial tolerance  $\pm 0.1$ .  
Magnetic stud RBM-06 to be ordered separately. (at option also for  $\phi 4, 8$  and 10 mm shafts).

**Electrical connections**



**View on compont side**

Permanent magnet RM 44 will be supplied with each item.

**Please note: This data sheet supersedes the following data sheets: 10937, 11177, 11218, 11317.**