

Datasheet



**Absolute magnetic sensor
 with high-speed SSI-BiSS C serial interface**



General Characteristics

- Linear magnetic sensor, with direct reading of the absolute position.
- High-speed SSI - BiSS C (unidirectional) serial interface.
- Resolutions up to 0.5 μm and measuring length up to 16.000 mm.
- Contactless reading.
- Status indication through LED RGBW.
- Flexible cable allows axial or radial connection of the sensor.
- Extremely easy and fast mounting of the sensor and application of the magnetic scale, with wide alignment tolerances.
- Small size, to allow installation in narrow spaces.
- Cable suitable for continuous movements.
- To be used with absolute coded magnetic scale MBA2-S composed by a magnetized plastroferrite, with pole pitch 2+2 mm. The magnetized plastroferrite is supported by a stainless steel tape, already provided with an adhesive tape, for an easy application on the machine.

Technical characteristics

| | |
|-------------------------------------|--|
| Pole pitch | 2+2 mm |
| Incremental signal | Sinus/Cosinus 1 Vpp (optional) |
| Resolution 1 Vpp | up to 0.5 μm ¹⁾ |
| Signal period | 2 mm |
| Serial interface | SSI - BiSS C (unidirectional) |
| Resolution absolute position | 500 – 100 – 50 – 10 – 5 – 1 – 0.5 μm |
| Accuracy grade | $\pm 8 \mu\text{m}$ ²⁾ |
| Interpolation error (SDE) | $\pm 1 \mu\text{m}$ ³⁾ |
| Unidirectional repeatability | $\pm 0.5 \mu\text{m}$ ³⁾ |
| Hysteresis | $\pm 1.5 \mu\text{m}$ ³⁾ |
| Measuring length ML | up to 16.000 mm |
| Max. traversing speed | 600 m/min |
| Vibration resistance (EN 60068-2-6) | 200 m/s ² [55 ... 2.000 Hz] |
| Protection class (EN 60529) | IP67 |
| Operating temperature | -20 °C ... 75 °C (serial), 0 °C ... 60 °C (serial + 1 Vpp) |
| Storage temperature | -40 °C ... 80 °C |

Datasheet

Technical characteristics (continuation)

| | |
|---------------------------------|---|
| Relative humidity | 100% |
| Power supply | 5 ... 28 VDC $\pm 5\%$ |
| Current consumption with 24 VDC | 200 mA _{MAX} (with R = 120 Ω) 5 VDC 80 mA _{MAX} (with R = 1200 Ω) 24 VDC |
| Max. cable length | 20 m ⁴⁾ |
| Electrical connections | see related table |
| Electrical protections | inversion of polarity and short circuits |
| Weight | 50 g |

- 1) Depending on CNC division factor.
- 2) The declared accuracy grade of $\pm X \mu\text{m}$ is referred to a measuring length of 1 m.
- 3) The error declared is subject to the respect of the alignment tolerances.
- 4) Ensuring a minimum power supply of 5 V to the sensor, the maximum cable length can be extended to 50 m.

Mechanical characteristics

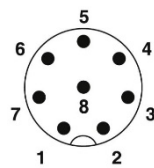
- Magnetic sensor housing made of die-cast metallic material.
- Possibility to fix the magnetic sensor with M4 screws or with through M3 screws.
- Wide alignment tolerances.

Electrical characteristics

- Reading through positioning sensor based on magneto resistance, with AMR effect (Magnetic Anisotropy).
- Electrical protection against inversion of power supply polarity and short circuits on output ports.
- Option: 1 Vpp A and B output signals, with phase displacement of 90° (electrical).
- Serial protocol SSI - BiSS C (unidirectional).

Connector M12 plug straight, 8-pin, type CI9

| PIN | Signal | Colour |
|-----|--------|--------|
| 1 | CK/ | yellow |
| 2 | CK | green |
| 3 | +V | brown |
| 4 | -- | -- |
| 5 | Data/ | grey |
| 6 | Data | pink |
| 7 | -- | -- |
| 8 | 0V | white |
| 9 | -- | -- |
| 10 | -- | -- |
| 11 | -- | -- |
| 12 | Shield | |



Connector type **CI9**:
M12 plug straight, 8-pin,
view on plug side.

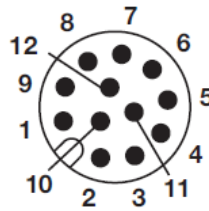
Shield = connected to plug housing

Wiring and Pin Assignment: M12 plug straight, 8-pin (according to DIN 47100)

Datasheet

Connector M23 plug straight, 8-pin type CG4

| PIN | Signal | Colour |
|-----|--------|--------|
| 1 | Data | pink |
| 2 | Data/ | grey |
| 3 | -- | -- |
| 4 | -- | -- |
| 5 | -- | -- |
| 6 | -- | -- |
| 7 | CK | green |
| 8 | CK/ | yellow |
| 9 | -- | -- |
| 10 | GND | white |
| 11 | +V | brown |
| 12 | Shield | |



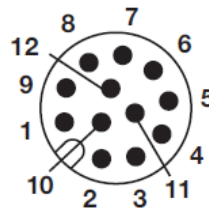
Connector type **CG4**:
 M23 plug straight, 8-pin,
 view on plug side.

Shield = connected to plug housing

Wiring and Pin Assignment: M23 plug straight, 8-pin (according to DIN 47100)

Connector M23 plug straight, 12-pin type CG4

| PIN | Signal | Colour |
|-----|--------|-------------|
| 1 | Data | pink |
| 2 | Data/ | grey |
| 3 | A | green |
| 4 | A/ | orange |
| 5 | B | white |
| 6 | B/ | bright blue |
| 7 | CK | brown |
| 8 | CK/ | yellow |
| 9 | -- | -- |
| 10 | GND | blue |
| 11 | +V | red |
| 12 | Shield | |



Connector type **CG4**:
 M23 plug straight, 12-pin,
 view on plug side.

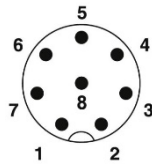
Shield = connected to plug housing

Wiring and Pin Assignment: M23 plug straight, 8-pin (according to DIN 47100)

Datasheet

Connector M12 plug straight, 8-pin, type C08

| PIN | Signal | Colour |
|-----|--------|--------|
| 1 | -- | -- |
| 2 | -- | -- |
| 3 | CK | green |
| 4 | CK/ | yellow |
| 5 | Data/ | grey |
| 6 | Data | pink |
| 7 | 0V | white |
| 8 | +V | brown |

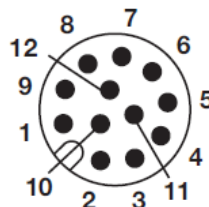


Connector type **C08**:
 M12 plug straight, 8-pin,
 view on plug side.

Wiring and Pin Assignment: M12 plug straight, 8-pin (according to DIN 47100)

Connector M12 plug straight, 12-pin, type C12

| PIN | Signal | Colour |
|-----|--------|-------------|
| 1 | B | white |
| 2 | B/ | bright blue |
| 3 | CK | brown |
| 4 | CK/ | yellow |
| 5 | Data/ | grey |
| 6 | Data | rosa |
| 7 | 0V | blue |
| 8 | +V | red |
| 9 | A/ | orange |
| 10 | A | green |
| 11 | -- | -- |
| 12 | -- | -- |



Connector type **C12**:
 M12 plug straight, 12-pin,
 view on plug side.

Wiring and Pin Assignment: M12 plug straight, 12-pin (according to DIN 47100)

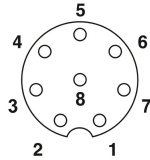
Datasheet

Extension cables

Extension cable type **VLK-8** with M12 **socket**, 8-pin, straight, opposite open cable end.

- Conductors section: 8 x 0.25 mm² for power supply and signals, PUR/PVC external sheath

| PIN | Signal | Colour |
|-----|--------|--------|
| 1 | -- | white |
| 2 | -- | brown |
| 3 | CK | green |
| 4 | CK/ | yellow |
| 5 | Data/ | grey |
| 6 | Data | pink |
| 7 | 0V | blue |
| 8 | +V | red |



Connector type **C08**:
 M12 socket straight, 8-pin,
 view on socket side.

Wiring and Pin Assignment: M12 socket straight, 8-pin (according to DIN 47100)

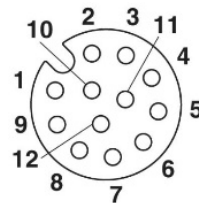


Connection extension cable type VLK-8 only in combination with M12 plug, 8-pin type C08 (standard).

Extension cable type **VLK-12** with M12 **socket**, 12-pin, straight, opposite open cable end.

- Conductors section: 12 x 0.14 mm² for power supply and signals, PUR/PVC external sheath

| PIN | Signal | Colour |
|-----|--------|-----------|
| 1 | B | brown |
| 2 | B/ | blue |
| 3 | CK | white |
| 4 | CK/ | green |
| 5 | Data/ | pink |
| 6 | Data | yellow |
| 7 | 0V | black |
| 8 | +V | grey |
| 9 | A/ | red |
| 10 | A | violet |
| 11 | -- | grey/pink |
| 12 | -- | red/blue |



Connector type **C12**:
 M12 socket straight, 12-pin,
 view on socket side.

Wiring and Pin Assignment: M12 socket straight, 12-pin (according to DIN 47100)



Connection extension cable type VLK-12 only in combination with M12 plug, 12-pin type C12 (standard).

Datasheet

Cable types

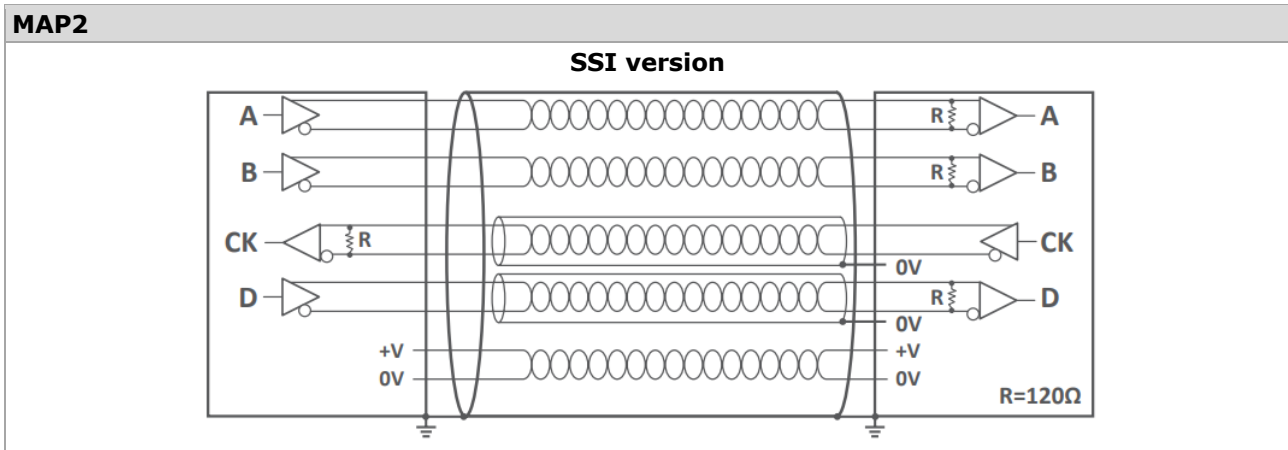
- Shielded twisted pair for digital signals (SSI - BiSS).
- PUR external sheath with low friction coefficient, resistant to oil and suitable for continuous movements.

Serial + Analog output version

- 10-wire shielded cable $\varnothing = 4.8$ mm, PUR external sheath.
- Conductors section:
 - power supply 0.14 mm²
 - signals 0.08 mm²



The cable's bending radius should not be lower than 70 mm.

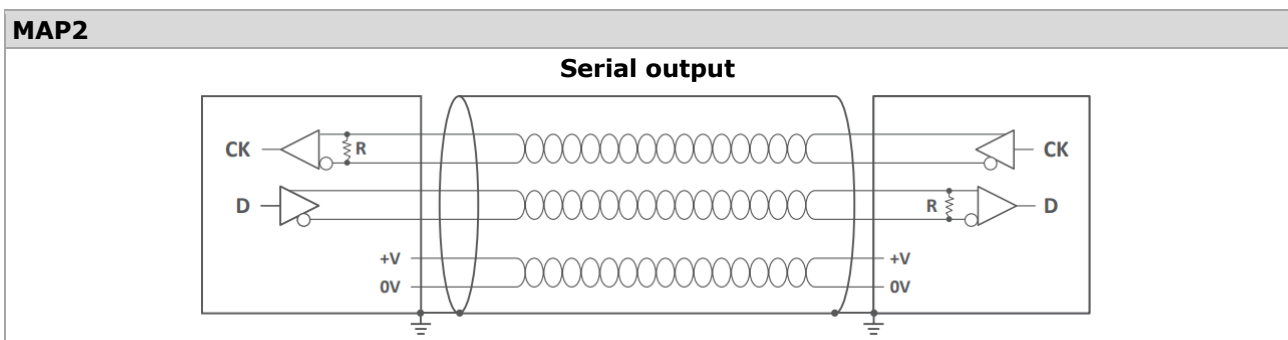


Serial output version

- 6-wire shielded cable $\varnothing = 4.8$ mm, PUR external sheath.
- Conductors section:
 - power supply 0.25 mm²
 - signals 0.14 mm²



The cable's bending radius should not be lower than 70 mm.



In case of cable extension, it is necessary to guarantee:

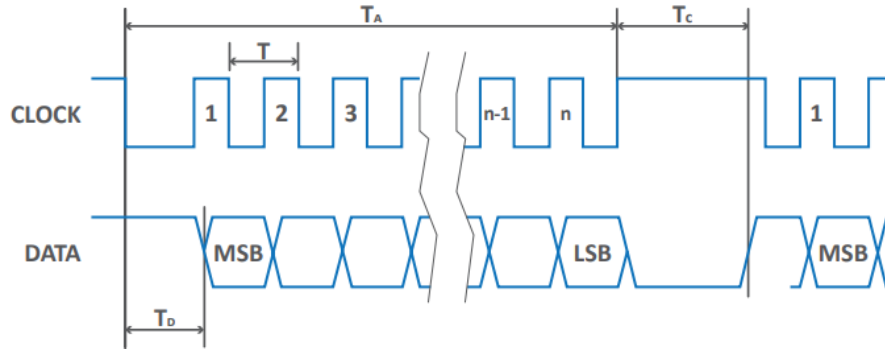
- the electrical connection between the body of the connectors and the cables shield
- a minimum power supply voltage of 5 V to the sensor

Datasheet

Output signals

MAP2

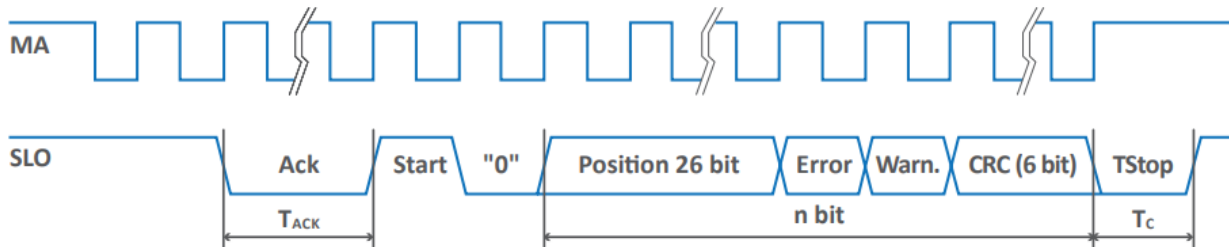
SSI version



| | |
|------------------------------|---|
| Interface | SSI binary - Gray |
| Signal level | EIA RS422 |
| Clock frequency [MHz] | 0.1 ... 1.2 MHz ¹⁾ Duty cycle 50% ±10% |
| n | position bit |
| T_C | max. 25 µs |
| T_D | max. 7 µs |

MAP2

BiSS C (unidirectional) version

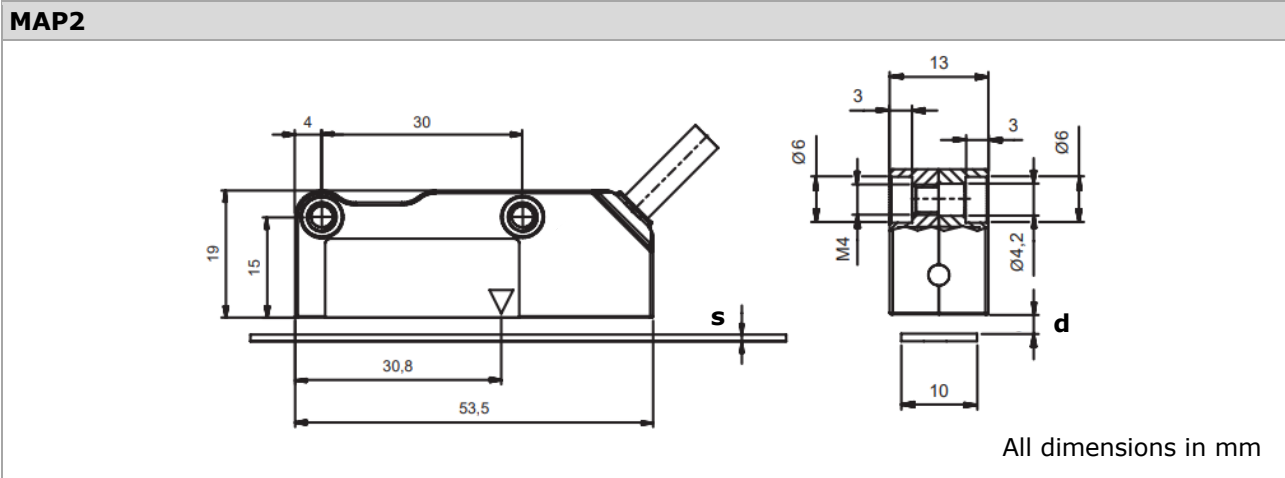


| | |
|------------------------------|---|
| Interface | BiSS C unidirectional |
| Signal level | EIA RS485 / RS422 |
| Clock frequency [MHz] | 0.1 ... 8 MHz ¹⁾ Duty cycle 50% ±10% |
| n | 26 + 2 + 6 Bit |
| T_C | max. 25 µs |
| T_{ACK} | 3 Clock |

¹⁾ The maximum frequency is guaranteed with a cable length up to 4 m.

Datasheet

Dimensions and alignment tolerances



s (mm) = thickness magnetic scale

| | | |
|---|---|-----|
| MBA2-S¹⁾ | thickness without double-sided adhesive tape | 1.3 |
| | thickness with double-sided adhesive tape | 1.4 |
| MBA2-S¹ + DB01²⁾ | thickness with double-sided adhesive tape and cover tape DB01 | 1.7 |

d (mm) = distance to be maintained between sensor and surface

| | | |
|---|---|-------------|
| MBA2-S¹⁾ | distance to be maintained between sensor and surface of the magnetic scale (without cover tape) | 0.1 ... 0.8 |
| MBA2-S¹ + DB01²⁾ | distance to be maintained between sensor and surface of the cover tape | max. 0.5 |

- 1) Absolute magnetic scale MBA2-S, composed by a magnetized plastroferrite tape, with pole pitch 2+2 mm. The plastroferrite is supported by a stainless steel tape, already provided with an adhesive tape.
- 2) Non-magnetic stainless steel cover tape DB01 on which a double-sided adhesive tape is pre-mounted for a quick sticking and an easy fixing on the magnetic scale.

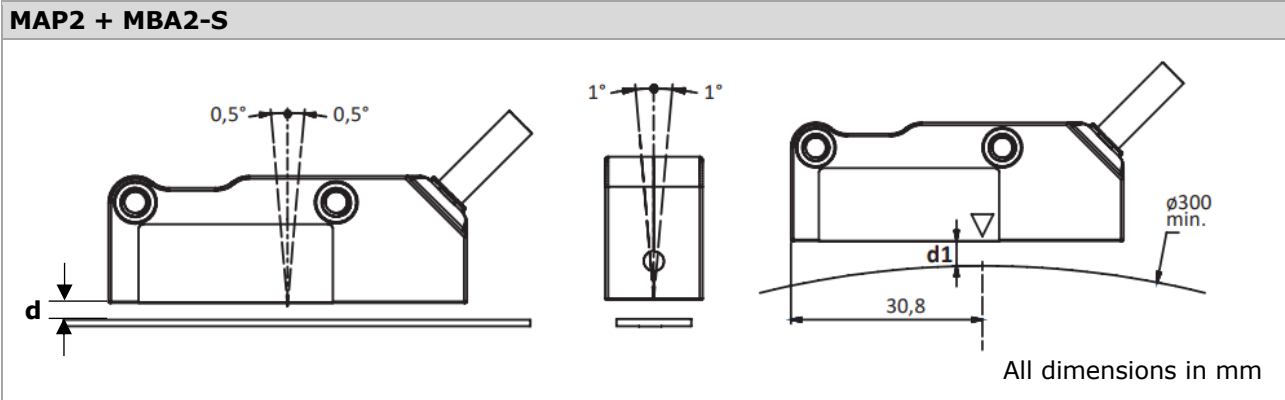
Datasheet



Alignment tolerances

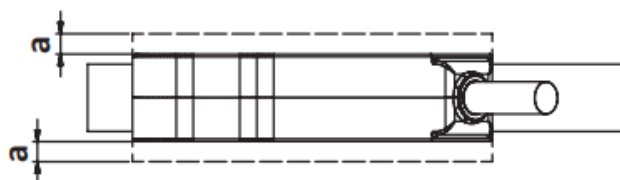
If the magnetic scale is applied on a linear surface, the distance (**d**) to be respected between the magnetic sensor to the magnetic scale must be between 0.1 and 0.8 mm.

The magnetic sensor MAP2 can work on an angular surface having a minimum diameter of 300 mm. In this case the distance (**d1**) between the magnetic sensor to the magnetic scale must be between 0.1 and 0.5 mm.



d1 (mm) = distance to be maintained between sensor and surface

| | | |
|-----------------------------------|---|-------------|
| MBA2-S ¹⁾ | distance to be maintained between sensor and surface of the magnetic scale (without cover tape) | 0.1 ... 0.5 |
| MBA2-S + DB01²⁾ | distance to be maintained between sensor and surface of the cover tape | max. 0.2 |

| | |
|---|-------------------------------------|
| MAP2 + MBA2-S | a (mm) = alignment tolerance |
|  | a = 0.5_{MAX} |

NOTICE

- Respect the maximum distance between the sensor and the magnetic band.

NOTICE

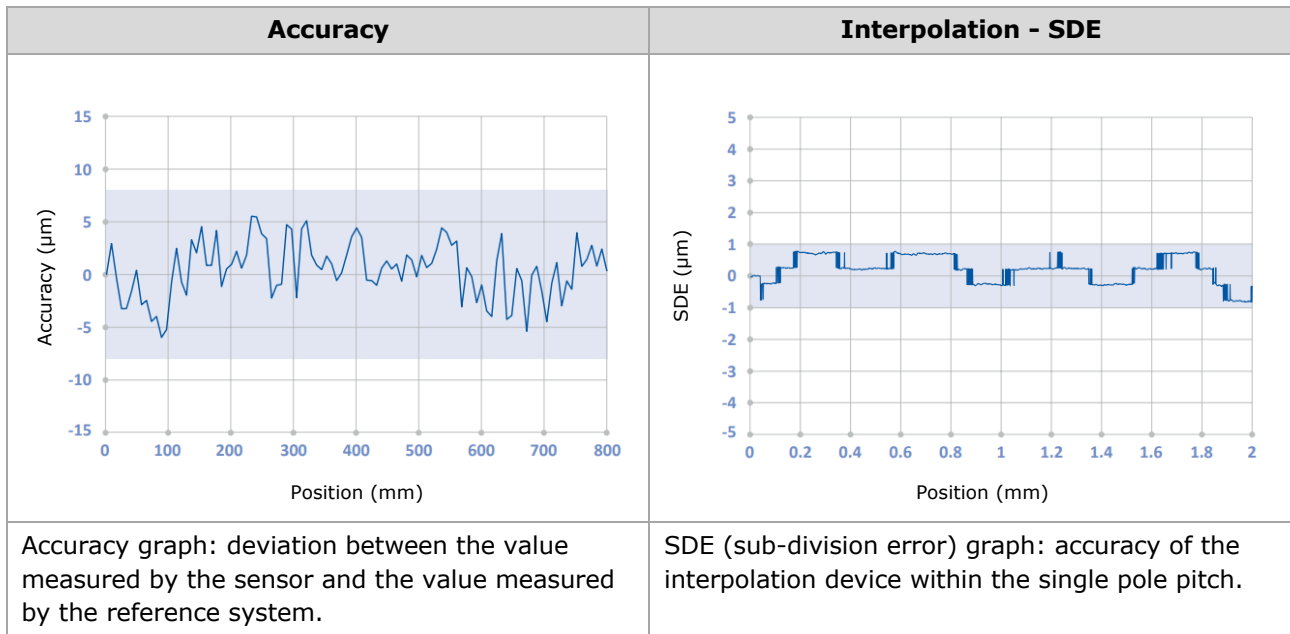
- Avoid the direct contact with magnetized objects or tools that could damage the surface.
- **Do not touch** the contacts of the cable's connector to avoid electrostatic discharges (ESD) on the device.

Datasheet

The following graphs show tests carried out in a metrological room under controlled climatic conditions:
 T= 20 °C ± 0.1 °C and R.H.= 45% ... 55%.

The reference system for the comparison of position measurements is interferometric with 1 nm resolution and equipped with an environmental compensation device. The sensor is installed according to the recommended mechanical configuration at a distance of 0.5 mm from the magnetic scale.

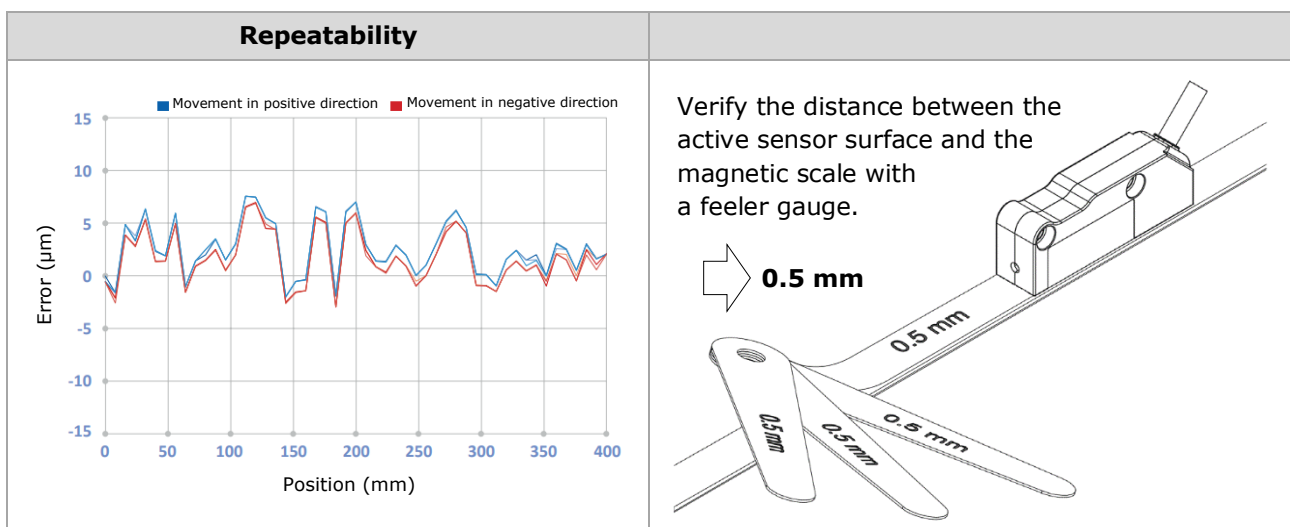
Accuracy and Interpolation



Repeatability

Repeatability graph obtained by carrying out the measurements several times in both directions of advancement.

- Unidirectional repeatability: measurement error detected without inverting the movement direction of the sensor.
- Hysteresis: difference in the measure due to the inversion of the sensor movement direction.



Datasheet

Ordering example Magnetic sensor

Type **MAP2** - **10** - **528V** - **S0** - **V** - **M02/S** - **SC**

Pole pitch

2 = 2+2 mm

Resolution [μm]

500; 100; 50; **10**; 5; 1; 05

Power supply

528V = 5 ... 28 VDC

Output signals

- S0** = SSI programmable ¹⁾
- S1** = SSI binary
- S2** = SSI binary+even parity
- S3** = SSI binary+odd parity
- S4** = SSI binary+error
- S5** = SSI binary+even parity+error
- S6** = SSI binary+odd parity+error
- S7** = SSI Gray
- B1** = BiSS binary

Incremental signal

- V** = +1 Vpp (10-wire cable)
- = without incremental signal (6-wire cable)

Cable length/type

- M0.3** = 0,3 m (only in combination with connector M12 plug)
- M02** = 2 m (standard)
- M20** = 20 m
- S** = Pure-Cable
- 10-wire cable (serial + analog) / 6-wire cable (only serial)

Connector/wiring

- SC** = without connector, open cable end
- CI9** = connector M12 plug straight, 8-pin
- CG4** = connector M23 plug straight, 8-pin or 12-pin
- CO8** = connector M12 plug straight, 8-pin (only in combination with extension cable VLK-8)
- C12** = connector M12 plug straight, 12-pin (only in combination with extension cable VLK-12)

¹⁾ Programming device available separately.



Accessories

Please order the magnetic scale, and extension cable for connectors type CO8 and type C12 separately. For ordering information, please refer to the corresponding data sheet. You can configure the enclosure according to your requirements from the technical information and enter it into the ordering code. Variants that cannot be configured from the ordering code are available on request as a special version.

Without prior notice, the products may be subject to modifications that the Manufacturer reserves to introduce as deemed necessary for their improvement.