



perfect in sensors.

posimag[®] lin

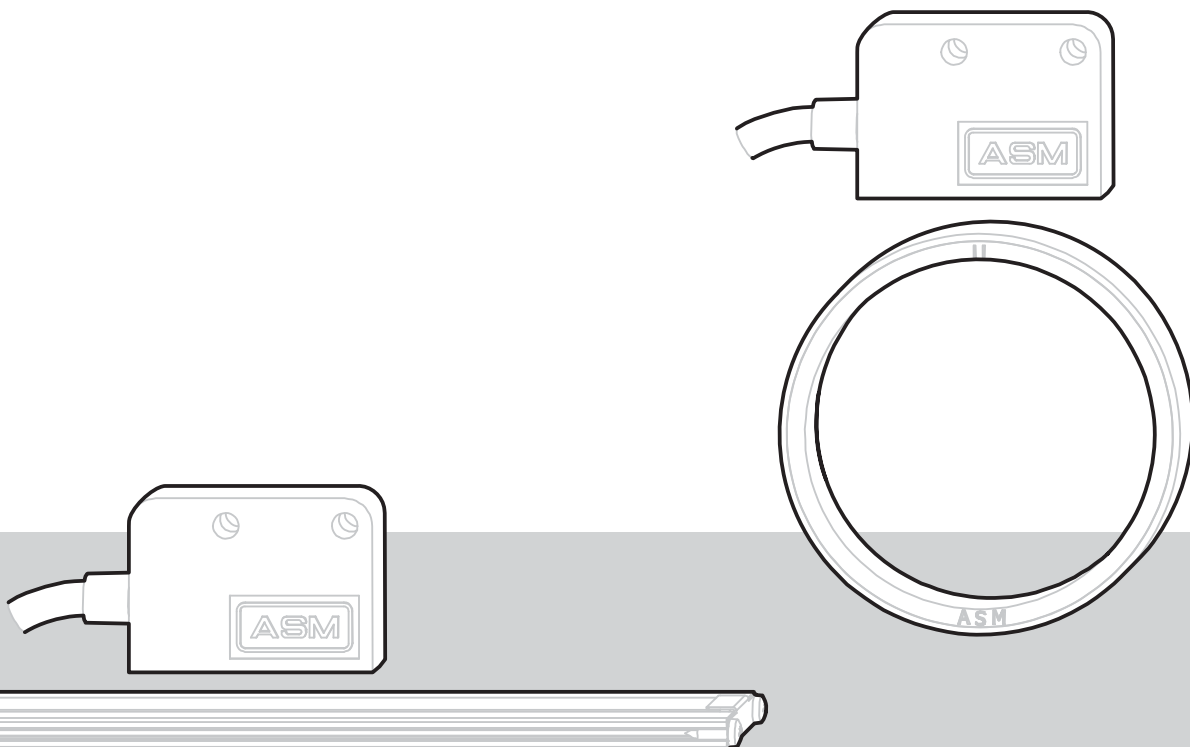
Magnetic Scale Position Sensors

posimag[®] rot

Magnetic Incremental Encoders

Installation and operation manual

EN



Please read carefully before installation and operation!

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1 Safety instructions	4
1.1 Signal words and symbols	4
1.2 General safety instructions.....	4
1.3 Intended use.....	5
2 Transport and storage.....	5
3 Installation and initial operation.....	6
3.1 Overview	6
3.2 Mechanical installation	8
3.3 Electrical installation.....	18
3.4 Operating temperature	20
4 Maintenance and disposal	20
4.1 Maintenance and repair	20
4.2 Disposal.....	20
5 Output specification.....	21
5.1 Specifications	21
5.2 Output signals	22
5.3 Status indicator.....	24
5.4 Option TTL/S.....	24

1 Safety instructions

1.1 Signal words and symbols



WARNING, Risk of Injury:

Indicates a potentially hazardous situation, which, if not avoided, can result in serious injury or property damage.

▲ DANGER

WARNING, Risk of Personal Injury or Death:

Indicates a situation that can result in serious personal injury or death if not properly avoided.

▲ WARNING

WARNING, Risk of Personal Injury or Death:

Indicates a situation that can result in moderate personal injury or death if not properly avoided.

▲ CAUTION

WARNING, Risk of Personal Injury:

Indicates a situation that can result in minor personal injury if not properly avoided.

NOTICE

WARNING, Risk of Property Damage:

Indicates a situation that can result in minor to major property damage if not properly avoided.

Product liability

- Disregarding the following instructions may result in malfunction, damage to property and personal injury and releases the manufacturer from product liability.

Safety regulations

- National safety regulations must be observed!

1.2 General safety instructions

▲ WARNING

Danger of injury to the operator or damage to the property

- Do not use posimag® lin Magnetic Scale Position Sensors and posimag® rot Magnetic Incremental Encoders in safety critical applications where malfunction or total failure of the sensor may cause danger for man or machine.
- Any alteration, reconstruction or extension of the sensor is not allowed!
- The sensor must be operated only within values specified in the datasheet.
- In safety-relevant applications, additional facilities must be provided for maintaining safety and preventing damage.
- Check whether the protection class of the sensor is suitable for the application.

1.3 Intended use

posimag® **lin** magnetic scale position sensors are intended for a non-contact, high-resolution magnetic length measurement up to 30 meters. posimag® **rot** magnetic incremental encoders are intended for a non-contact, high-resolution magnetic angle measurement. For determining measuring range, environmental compatibility and connection data of the sensor, please note the data sheet. Use the sensor as intended by operating within its specified technical data and ambient conditions.

The installation and operating instructions supplied with the unit must be respected. All maintenance and service work must be carried out. The data sheet of the respective sensor is part of this instruction manual. If not yet available, it may be requested by stating the respective model number.

The sensor must not be improperly mounted, operated or serviced. In addition, operation of the sensor in faulty condition is prohibited.

2 Transport and storage

Observe storage and transport temperatures according to the temperatures specified in the data sheet.

Max. rel. humidity 60%, dew condensation must be prevented at all times.

The device must be secured against slipping and tipping during transport.

NOTICE

Magnetic strip or magnetic ring will be damaged when exposed to strong magnetic fields

- Keep a safe distance from ferromagnetic materials (e.g. holding magnets) and other strong magnetic fields.
- Magnetic fields higher than approx. 30mT can permanently destroy the sensor.

The accuracy of magnetic strips and rings will be reduced by low magnetic fields

- Do not remove the transport protection or intermediate layers of the magnetic strips until immediately before assembly.
- Do not store magnetic strips in contact (at least 1 mm distance between several magnetic strips or layers of the same magnetic strip when stored on a roll).

Shipment damage

Check sensor immediately for shipment damage. In case of any damage or equipment not operating appropriately, please contact your supplier.

Shipment content

- Sensor head
- Magnetic strip or magnetic ring
- Mounting set (optional)
- Installation and operation manual

3 Installation and initial operation

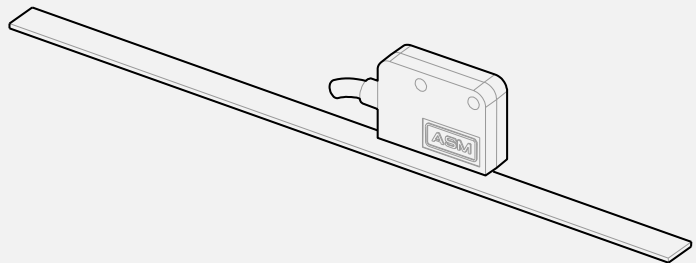
3.1 Overview

A posimag® measuring system consists of the following elements:

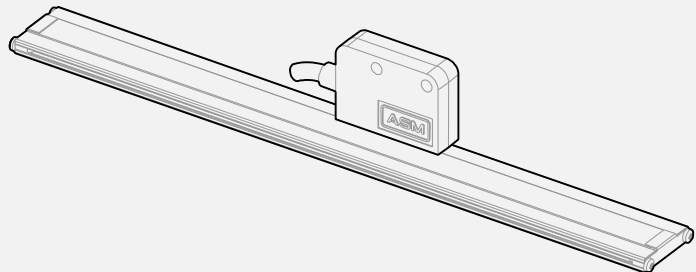
**Sensor head PMIS3 or PMIS4,
Magnetic scale PMIB3, PMFP or PMHP or magnetic ring PMIR4, PMIR5 or PMIR7,
Accessories e.g. slider PMGW3**

- Sensor head and magnetic scale/magnetic ring must have the same magnetic period.
- The subsequent counting device must be able to process the specified maximum pulse frequency of the sensor.

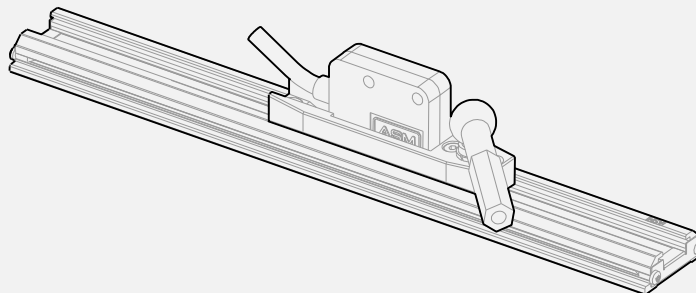
**Unguided sensor head PMIS3
Magnetic measuring scale PMIB3**



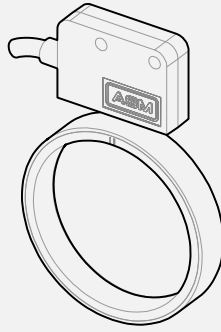
**Unguided sensor head PMIS3
Magnetic measuring scale
in flat profile PMFP**



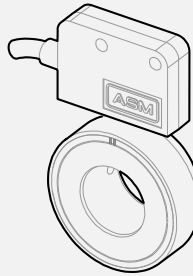
**Guided sensor head PMIS3
and slider PMGW3
Magnetic measuring scale
in high profile PMHP**



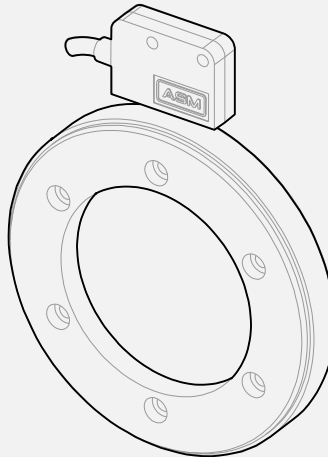
Sensor head PMIS4
Magnetic ring PMIR7 for press mounting



Sensor head PMIS4
Magnetic ring PMIR4 or PMIR7N for screw mounting (with hub)



Sensor head PMIS4
Magnetic ring PMIR5 for screw mounting (without hub)



3.2 Mechanical installation

The sensor head

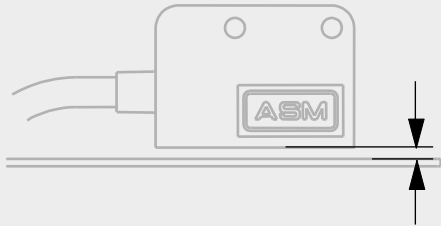
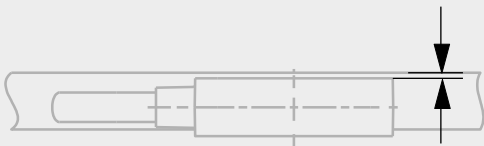
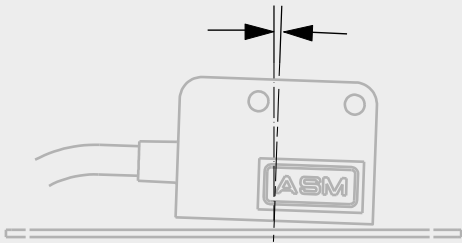
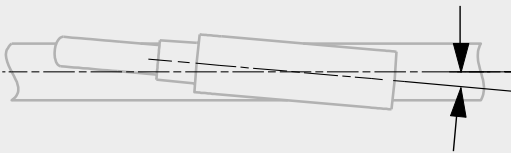
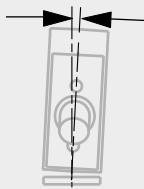
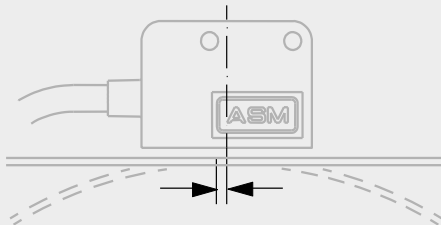
All options of the sensor are indicated on the type label of the sensor head. The first option after the model type is the magnetic period (example: PMIS3 - **50** - 25 - 50KHZ - HTL - Z0 - 2M - S; in that case the magnetic period is 5 mm). The magnetic periods of the sensor head and of the magnetic strip must be the same!

We recommend a quadrature counter (e.g. Agilent HCTL2000) for the exact evaluation of incremental signals.

An edge-sensitive up/down counter is not suitable.

Mounting of the sensor head

- Mount the sensor head with two screws M3 through the mounting holes (Ø 3.5 mm). Torque: 0.5Nm
- Secure the cable so that there is no risk of damage by cable tension or other machine parts.
- Use protecting hose and/or strain relief if necessary.
- Check for the correct orientation of the sensor head (see from page 13) .

Mounting tolerances of the sensor head	
	0.1 ... 0.8 mm (magnetic period 2mm) 0.1 ... 2 mm (magnetic period 5mm) The sensor head must not touch the magnetic strip!
	±1mm
	±2°
	±5°
	±3°
	Position tolerance of the active measurement range ±1 mm

The status output signal (option Z3) and the status indicator are activated if the allowable maximal distance or the maximum velocity have been exceeded.

The velocity tolerance results from the maximal pulse frequency and the resolution, both indicated at the type label.

$$V_{max}[m/s] = (\text{resolution } [\mu\text{m}] \times 4 \times \text{pulse frequency } [\text{kHz}] / 1000) - 20\%$$

Example: resolution 50 μm, pulse frequency 50 kHz

$$V_{max} = (50 \times 4 \times 50 / 1000) - 20\% = 8 \text{ m/s}$$

Mounting of magnetic scale and magnetic rings

NOTICE

Magnetic scale and magnetic rings may possibly be damaged by strong magnetic fields

- Do not use any magnetic tools (e.g. screw driver with magnetic bit holder) or magnetic mounting material.

Magnetic strip and magnetic ring may possibly be damaged by aggressive chemical substances

- Keep the magnetic strip and magnetic ring away from solvents, acids and sea water. (Resistant against mineral oil, vegetable oil and methane alcohol).

The magnetic strip must be mounted evenly on the mounting surface ensuring that it is perfectly level and free of bumps. Any corrugation impairs the accuracy. The following additions must be observed for a customer's pre-cut of the used magnetic strip PMIB and the masking tape PMAB:

Model of magnetic strip	Without reference/end position marks	With reference marks (option R1, R2)	With end position marks (option E1, E2)
Pre-cut length of masking tape /magnetic strip	Measurement length + 40 mm	Measurement length + 40 mm	Measurement length + 50 mm

In order to achieve an optimum adhesion, the mounting surface should first be cleaned of undesirable substances such as oil, grease, dust etc. The surface should also be dry, and contact pressure of the magnetic tape to the surface be as high as possible. The optimum temperature in dry rooms is between 20 and 30 °C.

To fix longer magnetic strips it is advisable to remove the protective plastic for a short length at one end and fix onto the surface. Then align the rest of the magnetic strip and remove the protective film step by step while pressing the strip to the surface simultaneously.

Procedure:

1. Clean the mounting surface carefully.
2. Remove the protective plastic film from the adhesive side of the magnetic strip.
3. Mount the magnetic strip with the magnetically active (dark) side upwards.
4. Clean the surface of the magnetic strip carefully.
5. Remove the protective plastic film from the masking tape.
6. Mount the masking tape onto the magnetic strip, exactly matching to the magnetic strip at both ends.

Magnetic strip in low profile

Mounting the magnetic strip in the low profile PMFP is recommended if a suitable mounting surface is not available.

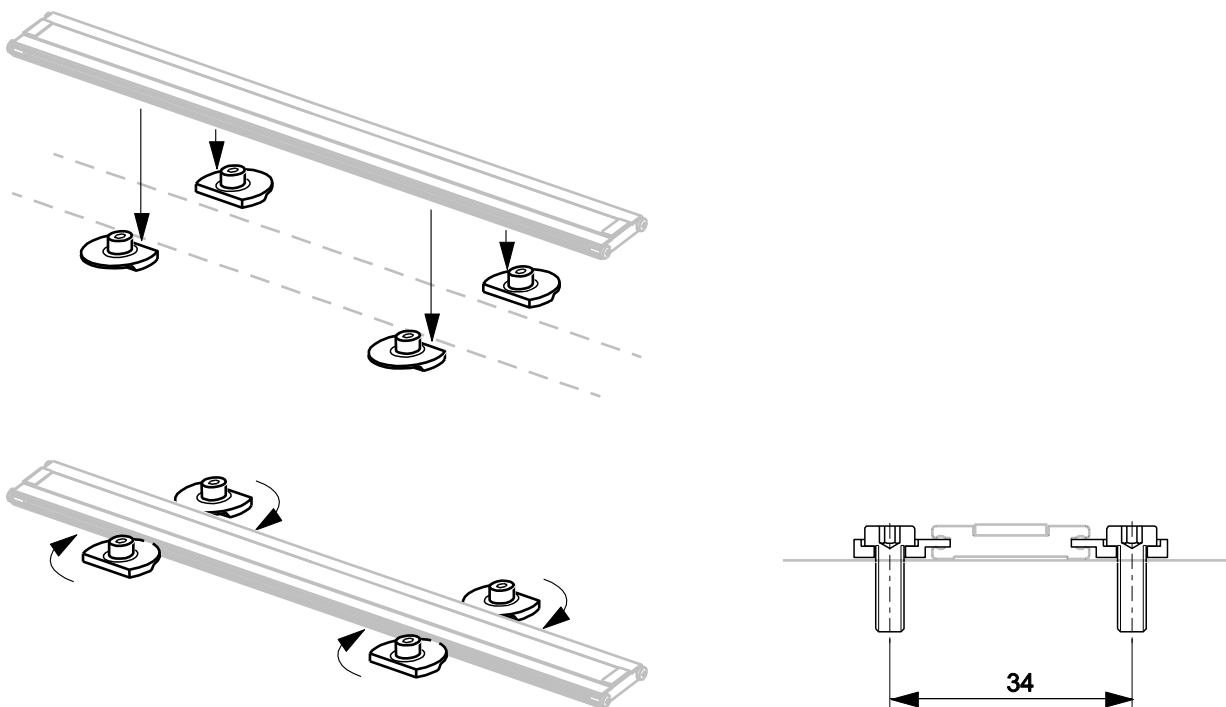
The low profile is sold by the meter (max. length 3 m). Separate profile rails can be connected in any order using the connecting pins PM-VERBINDUNGSSTIFT-SET. The end parts PMFP-END-BFS1 must be mounted on both ends. The following additions must be observed for a customer's pre-cut of the used magnetic strip and the masking tape PMAB:

Model of magnetic strip	Without reference/end position marks	With reference marks (option R1, R2)	With end position marks (option E1, E2)
Pre-cut length of masking tape/profile rail	Measurement length + 40 mm	Measurement length + 40 mm	Measurement length + 50 mm

Procedure:

1. Clean the mounting surface carefully
2. Connect low profile rails with connecting pins (for lengths more than 2850 mm)
3. Remove the protective plastic film from the adhesive side of the magnetic strip (possibly a shorter length first)
4. Mount the magnetic strip with the magnetically active (dark) side upwards (check the position of reference or end position mark(s) if existing)
5. Clean the surface of the magnetic strip carefully
6. Remove the protective plastic film from the masking tape (possibly partly)
7. Mount the masking tape onto the magnetic strip, exactly matching to the magnetic strip at both ends.
8. Mount the end part on both ends of the profile.

Fixing of the low profile using mounting set PMFP-BFS1



Magnetic strip in high profile

The use of the high profile PMHP in combination with the slider PMGW3 is recommended if a precise guiding of the sensor head above the magnetic strip (within the given tolerances) is not possible.

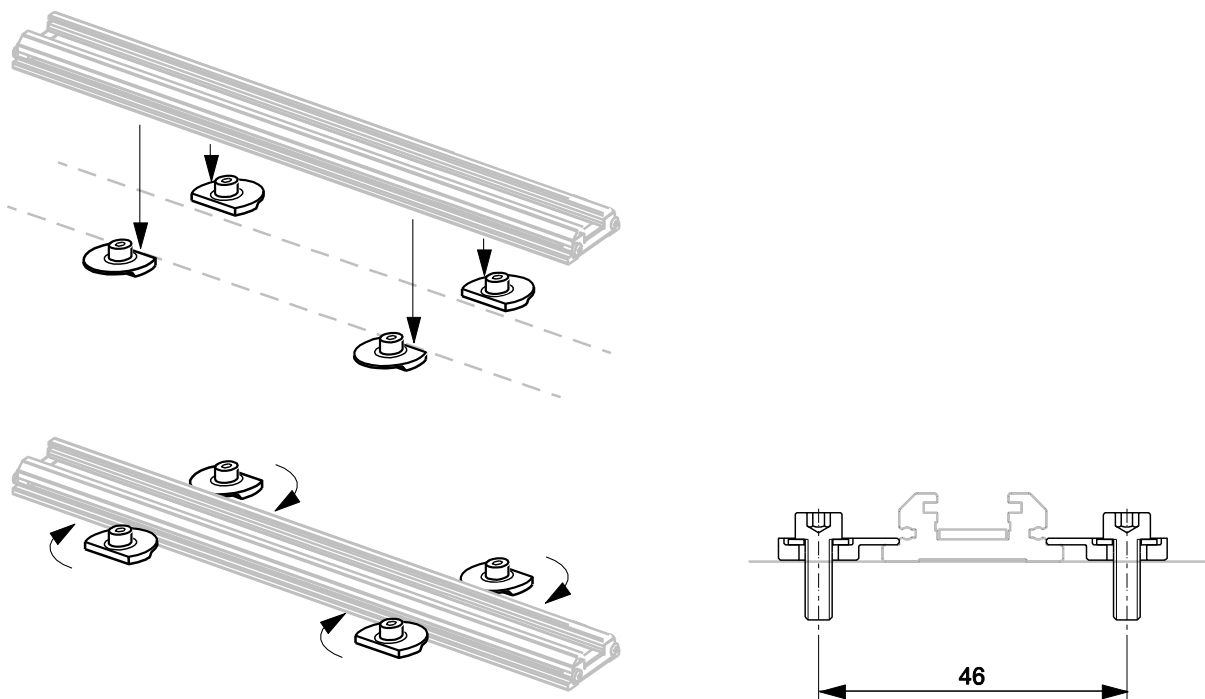
The high profile is sold by the meter (max. length 3 m). Separate profile rails can be connected in any order using the connecting pins PM-VERBINDUNGSSTIFT-SET. The end parts PMHP-END-BFS1 must be mounted on both ends. The following additions must be observed for a customer's pre-cut of the used magnetic strip and the masking tape PMAB:

Model of magnetic strip	Without reference/end position marks	With reference marks (option R1, R2)	With end position marks (option E1, E2)
Pre-cut length of masking tape/profile rail	Measurement length + 120 mm	Measurement length + 120 mm	Measurement length + 130 mm

Procedure:

1. Clean the mounting surface carefully
2. Connect high profile rails with connecting pins (for lengths more than 2850 mm)
3. Remove the protective plastic film from the adhesive side of the magnetic strip (possibly a shorter length first)
4. Mount the magnetic strip with the magnetically active (dark) side upwards (check the position of reference or end position mark(s) if existing)
5. Clean the surface of the magnetic strip carefully
6. Remove the protective plastic film from the masking tape (possibly a shorter length)
7. Mount the masking tape onto the magnetic strip, exactly matching to the magnetic strip at both ends
8. Insert the slider into the high profile
9. Mount the end part on both ends of the profile.

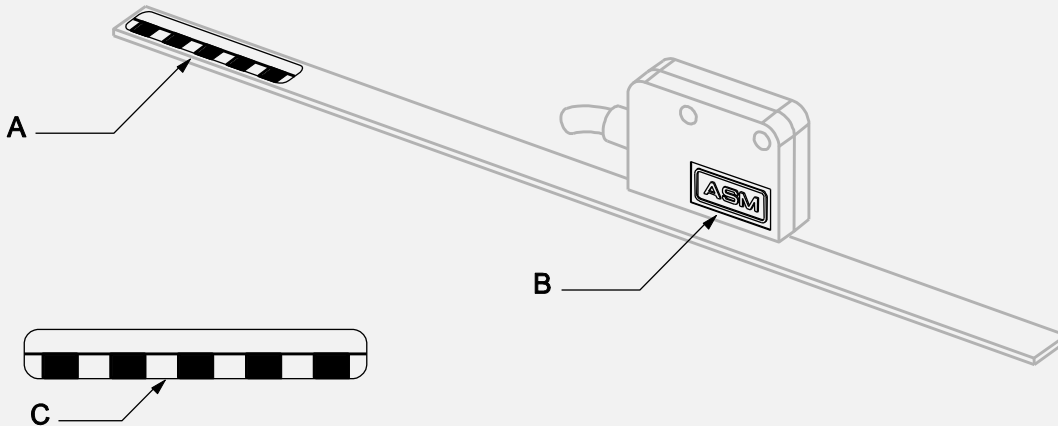
Fixing of the high profile using the mounting set PMHP-BFS1



Orientation of the sensor head and magnetic strip for posimag® lin Magnetic Scale Sensors

To guarantee the correct functioning of the sensor, the orientation of the sensor head related to the magnetic strip must be observed:

PMIS3 and PMIB3

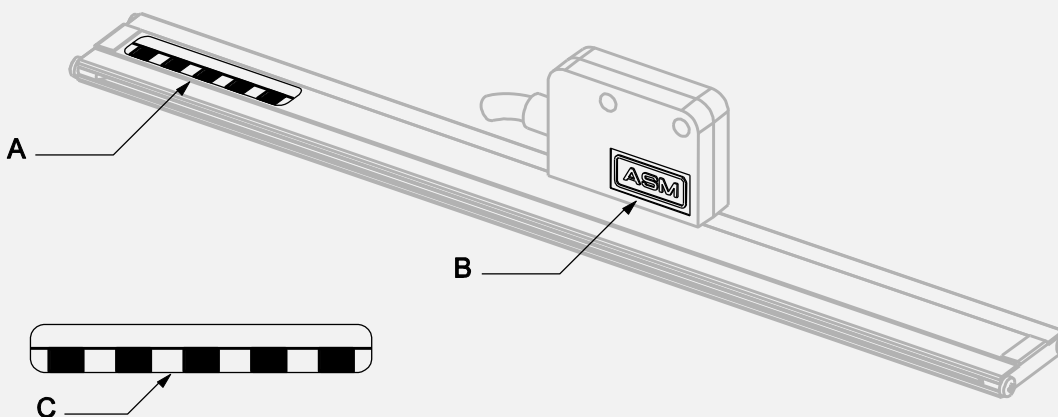


A – Marking on the magnetic strip (adhesive label)
B – Marking on the front side of the sensor head (=ASM logo)

Correct orientation:

- Marking on the sensor head (B) to the front
- dashed side of the magnetic scale marking (C) to the front (=incremental track of the magnetic strip)

PMIS3 und PMFP

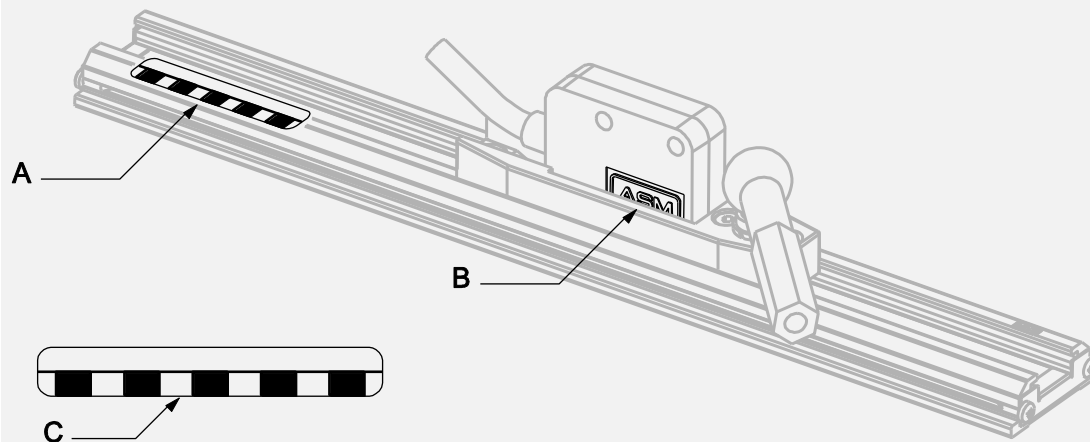


A – Marking on the magnetic strip (adhesive label)
B – Marking on the front side of the sensor head (=ASM logo)

Correct orientation:

- Marking on the sensor head (B) to the front
- dashed side of the magnetic scale marking (C) to the front (=incremental track of the magnetic strip)

PMIS3 and PMHP

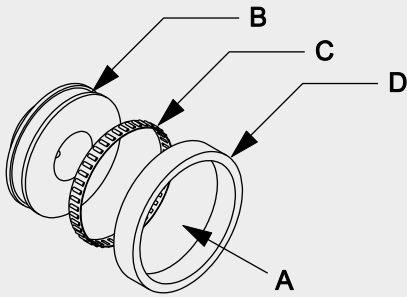


- A – Marking on the magnetic strip (adhesive label)
- B – Marking on the front side of the sensor head (=ASM logo)

Correct orientation:

- **Marking on the sensor head (B) to the front**
- **dashed side of the magnetic scale marking (C) to the front (=incremental track of the magnetic strip)**

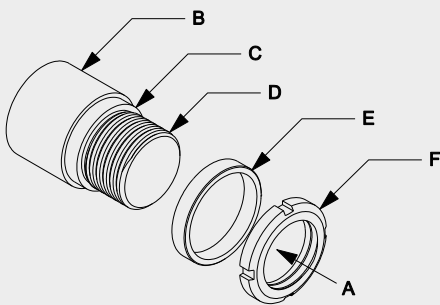
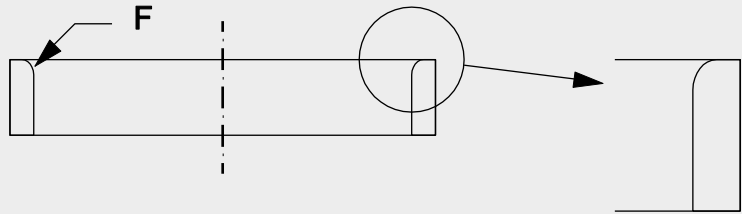
Mounting options for PMIR7 magnetic rings on customer-supplied shaft



Mounting with press ring on hub

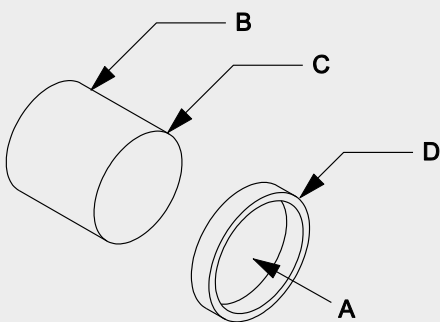
- A – Mounting direction
- B – Hub with groove for press ring
- C – Press ring
- D – Magnetic ring PMIR7

Insert the magnetic ring (F) with the rounded edge facing mounting direction!



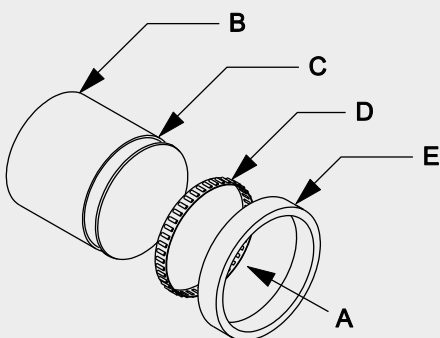
Mounting with shaft nut

- A – Mounting direction
- B – Customer-supplied shaft
- C – Force fit for magnetic ring
- D – Thread for shaft nut
- E – Magnetic ring PMIR7
- F – Shaft nut



Mounting as press fit on shaft

- A – Mounting direction
- B – Customer-supplied shaft
- C – Press fit for magnetic ring
- D – Magnetic ring PMIR7



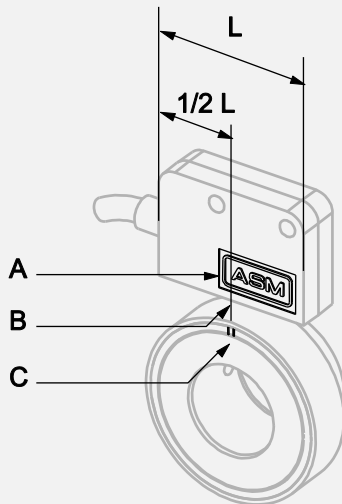
Mounting with press ring on shaft

- A – Mounting direction
- B – Customer-supplied shaft
- C – Groove for press ring
- D – Press ring
- E – Magnetic ring PMIR7

Orientation of the sensor head and magnetic ring for posimag® rot magnetic incremental encoders

To guarantee the correct functioning of the sensor, the orientation of the sensor head related to the magnetic ring must be observed.

PMIS4 and PMIR7N

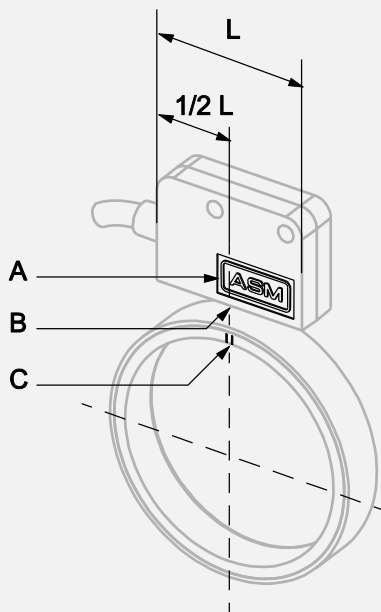


- A – Marking on the front side of the sensor head (=ASM logo)
- B – Active measurement range
- C – Marking on the magnetic ring for the position of the reference mark (laser marking double bar)

Correct orientation:

- Marking on the sensor head to the front
- Flange of the magnetic ring to the rear

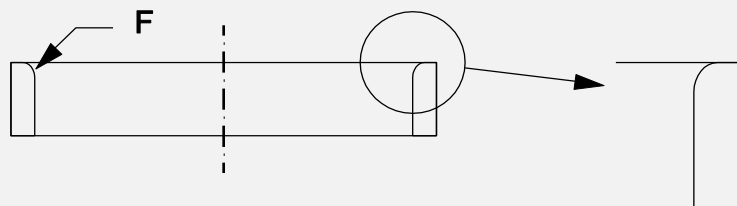
PMIS4 and PMIR7



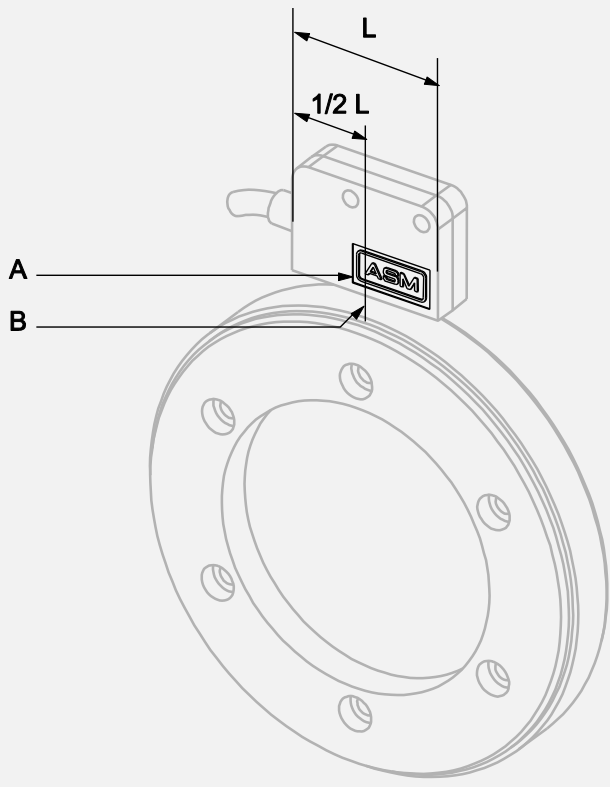
- A – Marking on the front side of the sensor head (=ASM logo)
- B – Active measurement range
- C – Marking on the magnetic ring for the position of the reference mark

Correct orientation:

- Marking on the sensor head to the front
- Rounding (F) inside the magnetic ring to the rear



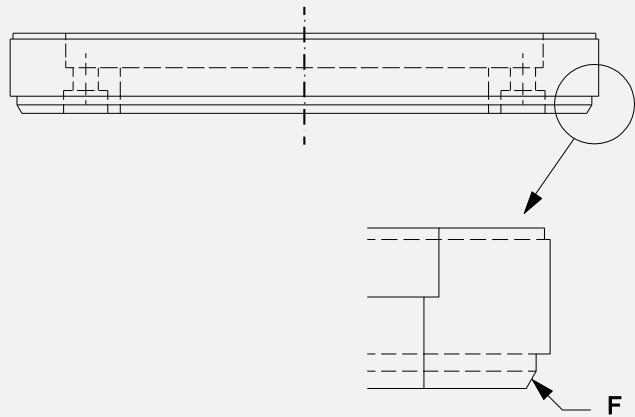
PMIS4 and PMIR5



A – Marking on the front side of the sensor head (=ASM logo)
B – Active measurement range

Correct orientation:

- **Marking on the sensor head to the front**
- **Chamfer (F) on the outside of the magnetic ring to the front**



3.3 Electrical installation

NOTICE**Damage or destruction of the sensor due to excessive operating voltage or mounting error**

- The applied operating voltage must not exceed the value specified in the data sheet.
- Operate the sensor only within the limits specified in the data sheet.
- Connect to the power supply only by qualified personnel and in accordance with the applicable safety regulations for electrical equipment.
- Do not connect or disconnect the sensor under voltage!
- Make a separate voltage supply available for the posimag® sensor head with consumers with high interference levels.
- Use shielded sensor cables.
- When sensor is mounted on moving machine parts connect them to protective ground.

Corrosion in the sensor due to moisture penetration

- Use the sensor only according to protection class.
- Avoid crossing the dew point.
- Cable outputs must be installed in such a way that no moisture can get into the cable.

Damage of the sensor cable due to mechanical stress

- Do not strain the connection cable.
- A separate strain relief is recommended.

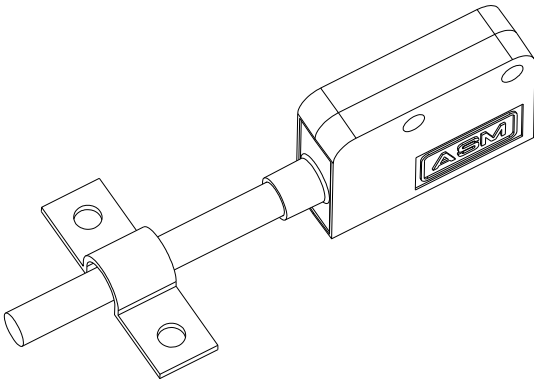
Connection of the cable shield

- The housing of the sensor head is connected to the cable shield. Depending on the facility and the interference environment either an isolated or a conductive mounting is necessary.
- We recommend to connect the cable shield to protective ground at cable inlet of switch cabinet and to mount the sensor head isolated.
- A possible alternative connection is to use a conductive mounting of the sensor head and to connect the cable shield to the protective ground of the switch cabinet.

Cable mounting and bending radius

For all sensors with cable:

Cable diameter	Ø 5.2 mm	
Minimum bending radius	in motion	not in motion
	10 x Ø, 10 million cycles	5 x Ø



Strain relief

The supply cable of the sensor head must be fastened with a suitable strain relief (e.g. clamp).

Electromagnetic Compatibility (EMC)

Electromagnetic compatibility of posimag® lin Magnetic Scale Position Sensors and posimag® rot Magnetic Incremental Encoders is influenced by the sensor wiring.

NOTICE

Possible malfunction of the sensor when used in systems with highly interference-prone components such as frequency inverters

Recommended wiring:

- Use single shielded sensor cable with twisted pair conductors for power supply and signal output.
- Connect the cable shield to ground on one side of the control cabinet. Connect the shield connection over a large area using cable clamps before or at the cable entry into the control cabinet. When preassembled cables are delivered, the screen is not connected to the housing on the sensor side.
- Do not install sensor cables close to power conductors such as motor or contactor control cables (use separate cable ducts for signal and power cables).
- Install the cables in metal cable ducts connected to ground.
- Install the complete unit to meet the EMC standards. The installation environment can affect the function of the sensor head.
- Make a separate voltage supply available for the posimag® sensor head with consumers with high interference levels.
- When sensor is mounted on moving machine parts connect them to protective ground.

3.4 Operating temperature

Magnetic scales

posimag® lin PMIS3	-40 ... +85°C
posimag® lin PMIB3	-40 ... +100°C
posimag® lin PMIS4	-40 ... +85°C

Magnetic rings

posimag® rot PMIR5	-40 ... +85°C
posimag® rot PMIR7, PMIR7N	-40 ... +85°C

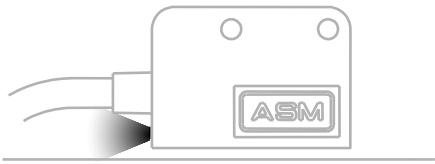
4 Maintenance and disposal

4.1 Maintenance and repair

NOTICE

Opening the sensor will cause damage and void the warranty

- Do not open the sensor.
- Due to possible risk of injury by improper handling, we strongly advise against repair attempts. No warranty or liability will be granted for opened sensors.



If in case of sensor malfunction:

- the status indicator blinks, please check the orientation of the sensor head (see from page 13) and read the chapter 5.3 „Status indicator“(see page 24).
- the status indicator lights continuously, read the chapter 5.3 „Status indicator“ (see page 24) .

4.2 Disposal

Disposal according to applicable government regulations.

5 Output specification

5.1 Specifications

Magnetic period of the sensor	2 mm				5 mm			
Guided spacing between sensor and mag. scale (x_z)	0.1 ... 0.8 mm				0.1 ... 2 mm			
Side tracking tolerance of the sensor	± 1 mm				± 1 mm			
Linearity (sensor with magnetic scale PMIB3)	15 $\mu\text{m} \pm 40 \mu\text{m/m}$				30 $\mu\text{m} \pm 40 \mu\text{m/m}$			
Resolution with ext. times 4 counting mode [μm]	5	10	20	50	10	25	50	125
Max. velocity with $f_p=50$ kHz [m/s]	0.8	1.6	3.2	8	1.6	4	8	20
Repeatability	± 1 digit							
Excitation voltage	10 ... 30 VDC or 5 VDC ± 5 %							
Excitation current	50 mA to 300 mA, depending on pulse frequency, cable length and load							
Max. pulse frequency f_p	50 kHz, 20 kHz, 10 kHz (standard 50 kHz) <small>(The subsequent counting device must be able to process the specified maximum pulse frequency of the sensor)</small>							
Output	Incremental encoder output A/B with differential push-pull output HTL output with excitation 24 VDC, output 24 V TTL output with excitation 5 VDC, output TTL/RS422 TTL output with excitation 24 VDC, output TTL/10 mA							
Reference pulse / end position signal / status signal	Z0 = A/B without reference pulse Z1 = A/B with reference pulse Z Z2 = A/B with end position signal Z3 = A/B with reference pulse and status signal <small>(Option Z3 only for non-diferential output, single ended)</small>							
Output signals	A, \bar{A} , B, \bar{B} , reference pulse Z, \bar{Z} , end position signal E, \bar{E} status signal (\bar{ERR}) (only for HTL output, single ended)							

5.2 Output signals

NOTICE

The subsequent counting device must be able to process the specified maximum pulse frequency.

Saturation voltage	UH, UL = 0,2 V	$I_{out} = \pm 10 \text{ mA}$ (UH = UB - U _{out})
	UH, UL = 0,4 V	$I_{out} = \pm 30 \text{ mA}$
	C _{last} < 10 nF	
Short circuit current	ISL, ISH < 800 mA	(UH, UL = 0 V)
	ISL, ISH < 90 mA	(UH, UL = 1,5 V)
Rise time	tr, tf < 200 ns	with cable length 1 m, 10 % ... 90 %

Pulse frequency in dependence on the cable length

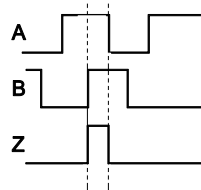
Load / cable length	Load / pulse frequency fp		
	HTL single ended UB = 24 V	TTL/RS422 differential UB = 5 V *	TTL/24 V UB = 24 V
Max. output current	50 mA	50 mA	10 mA
R _{last} min.	500 Ω	100 Ω	500 Ω
C _{last} max.	10 nF	10 nF	1 nF
200 m	15 kHz	—	—
100 m	25 kHz	100 kHz	—
50 m	50 kHz	200 kHz	50 kHz
10 m	100 kHz	300 kHz	100 kHz

* = consider the voltage drop within the cable; the excitation voltage 5 V ± 5% of the sensor must be guaranteed.

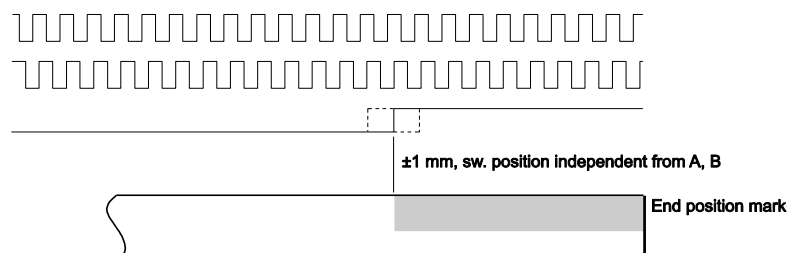
Note: For longer distances (see specification above) you must use min. 0.5 mm² wire for „Excitation+“ and „Excitation GND“ (see signal wiring), all signal wires must be min. 0.14 mm²!

Output signals

**Option Z1
(Reference pulse)**



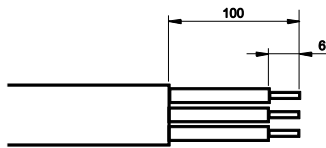
**Option Z2
(End position signal)**



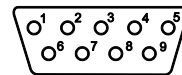
Signal wiring

Signal		Open cable end cable color				Connector Sub-D, Pin no.	
Option	Z0	Z1	Z2	Z3*	9 pin	15 pin	
	Excitation +				white	1	1
	Excitation GND (0V)				brown	5	2
	B	B	B	B	green	2	6
	A	A	A	A	yellow	3	4
	\bar{B}	\bar{B}	\bar{B}	\bar{ERR}	grey	7	7
	\bar{A}	\bar{A}	\bar{A}	–	pink	6	5
	–	Z	\bar{E}	Z	blue	4	8
	–	\bar{Z}	E	–	red	8	9
	Shield				black	9	housing

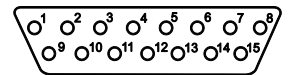
- Z = reference pulse
- E = end position signal
- \bar{ERR} = status signal, periodical approx. 16 Hz, for side tracking and velocity errors
- * = status signal ERR available only with HTL (single ended) output



Dimensions open cable end



Connector SUB-D
(9 pin)



Connector SUB-D
(15 pin)

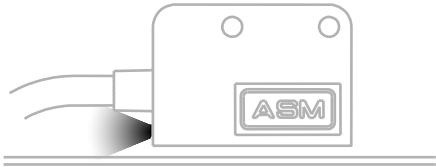
View to the connector pins

NOTICE

- Unused wires are connected inside the sensor head. Do not connect unused wires to each other or to supply U_B or ground potential GND. Isolate and secure unused wires at switch cabinet terminal.

5.3 Status indicator

In case of sensor malfunction, the status indicator lights up:



The following errors will be displayed:

- Allowable maximum distance too large, or incorrect orientation of the sensor head (LED blinking)
Check sensor mounting (see page 9).
- Maximum velocity too high (LED blinking).
- Internal error, sensor defective (LED lights continuously).

The velocity tolerance results from the maximum pulse frequency and the resolution, both indicated on the sensor label:

$$V_{\max}[\text{m/s}] = (\text{resolution} [\mu\text{m}] \times 4 \times \text{pulse frequency} [\text{kHz}] / 1000) - 20\%$$

Example: resolution 50 μm , pulse frequency 50 kHz

$$V_{\max} = (50 \times 4 \times 50 / 1000) - 20\% = 8 \text{ m/s}$$

5.4 Option TTL/S

Connection diagram for sensors having excitation sense line.

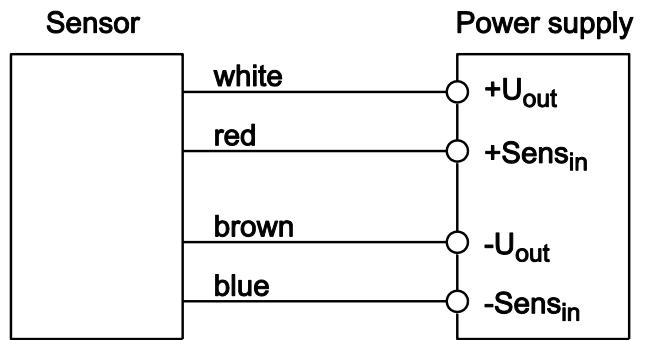
Signal wiring	Signal	Cable color
	Excitation +	white
	Excitation GND	brown
	Excitation +_sense	red
	GND_sense	blue
	B	green
	\bar{B}	grey
	A	yellow
	\bar{A}	pink

The signals EXCITATION + and EXCITATION +_SENSE as well as the signals GND and GND_SENSE are connected in the sensor.

If cable length exceeds 3 m excitation care has to be given for a supply voltage tolerance $5V \pm 5\%$ at the sensor head.

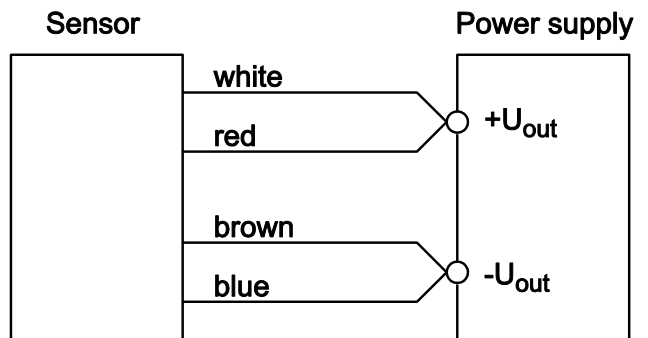
Wiring option 1:

Sense lines EXCITATION+SENSE and GND_SENSE are wired as feedback for power supply having sense input.

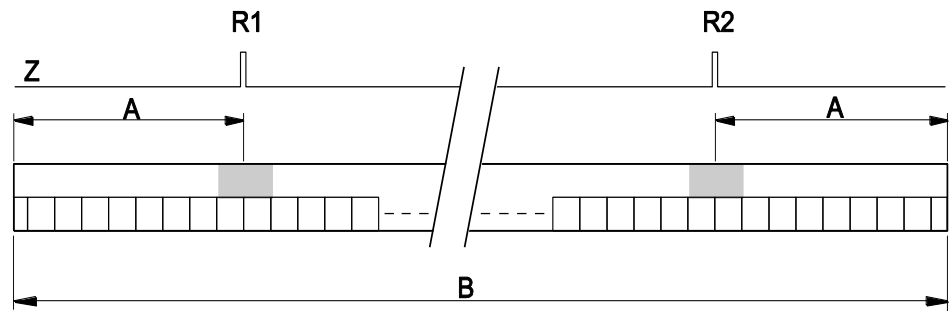


Wiring option 2:

Sense lines EXCITATION+SENSE and GND_SENSE are wired parallel to reduce supply line resistance.



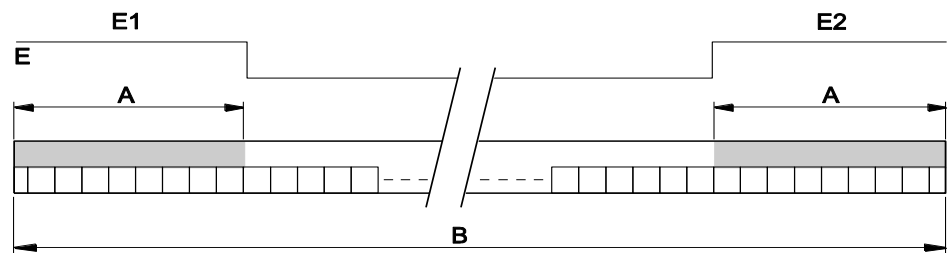
Position of the default reference marks



Reference mark dimensions

Magnetic period	Switching position A	Total length B
2 mm	20.0 ±1 mm	measurement range + 40 mm
5 mm		
2 mm with high profile	60.0 ±1 mm	measurement range + 120 mm
5 mm with high profile		

Position of the end position marks



End position mark dimensions

Magnetic period	Switching position A	Total length B
2 mm	21.0 ±1 mm	measurement range + 50 mm
5 mm	22.5 ±1 mm	measurement range + 50 mm
2 mm with high profile	61.0 ±1 mm	measurement range + 130 mm
5 mm with high profile	62.5 ±1 mm	measurement range + 130 mm

Reliability Characteristics

Characteristics		
PMIS3/PMIS4	Failure rate (λ_F)	298 Fit [$1 \times 10^{-9}/h$]
	MTBF ($1/\lambda_F$)	380 years
	Service life	20 years
	Mechanical life time B_{10}	$5 \cdot 10^6$ cycles (draft)
PMIR7/PMIR7N	Service life	15 years
PMIB3	Service life	15 years

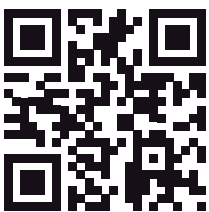
Life time calculation according to MIL-HDBK-217 FN2

Environment: T = 40 °C, ground equipment

Cable specification	Halogen free flexible cable 12FCF11Y, 8 x 0.14sqmm TPE, stranded, shielded Outer jacket polyurethan (PUR), diameter 5.2+/-0.2mm according to UL 20233, CSA, drag chain compatible bending radius 10 x diameter, 10 million cycles, bending radius fixed installation 5 x diameter
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