

MPS-G with analog output

Magnetic cylinder sensors

SICK
Sensor Intelligence.



Described product

MPS-G

Manufacturer

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Original document

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1 About this document

1.1 Further information

You can find the product page with further information under the **SICK Product ID** at: pid.sick.com/{P/N}.

P/N corresponds to the part number of the product.

The following information is available depending on the product:

- Data sheets
- These publication in all available languages
- CAD files and dimensional drawings
- Certificates (e.g., declaration of conformity)
- Other publications
- Software
- Accessories

1.2 Symbols and document conventions

Warnings and other notes



DANGER

Indicates a situation presenting imminent danger, which will lead to death or serious injuries if not prevented.



WARNING

Indicates a situation presenting possible danger, which may lead to death or serious injuries if not prevented.



CAUTION

Indicates a situation presenting possible danger, which may lead to moderate or minor injuries if not prevented.



NOTICE

Indicates a situation presenting possible danger, which may lead to property damage if not prevented.



NOTE

Highlights useful tips and recommendations as well as information for efficient and trouble-free operation.

Instructions to action

- ▶ The arrow denotes instructions to action.
- 1. The sequence of instructions is numbered.
- 2. Follow the order in which the numbered instructions are given.
- ✓ The tick denotes the results of an action.

2 Safety information

2.1 Intended use

The sensor from the MPS-G product family is an intelligent, magnetic position sensor. It is used for non-contact detection of the piston stroke of pneumatic drives with axially magnetized permanent magnets.

SICK AG assumes no liability for losses or damage arising from the use of the product, either directly or indirectly. This applies in particular to use of the product that does not conform to its intended purpose and is not described in this documentation.

2.2 Improper use

- The sensor does not constitute a safety-relevant device according to the EC Machinery Directive (2006/42/EC).
- The sensor must not be used in explosion-hazardous areas.
- Any other use that is not described as intended use is prohibited.
- Any use of accessories not specifically approved by SICK AG is at your own risk.
- The sensor is not suitable for outdoor applications.



NOTICE

Danger due to improper use!

Any improper use can result in dangerous situations.

Therefore, take note of the following information:

- ▶ The sensor should be used only in line with intended use specifications.
 - ▶ All information in these operating instructions must be strictly complied with.
-

2.3 Limitation of liability

Applicable standards and regulations, the latest state of technological development, and our many years of knowledge and experience have all been taken into account when assembling the data and information contained in these operating instructions. The manufacturer accepts no liability for damage caused by:

- Failing to observe the operating instructions
- Improper use
- Use by untrained personnel
- Unauthorized conversions
- Technical modifications
- Use of unauthorized spare parts, consumables, and accessories

With special variants, where optional extras have been ordered, or owing to the latest technical changes, the actual scope of delivery may vary from the features and illustrations shown here.

2.4 Requirements for skilled persons and operating personnel



WARNING

Risk of injury due to insufficient training.

Improper handling of the sensor may result in considerable personal injury and material damage.

- All work must only ever be carried out by the stipulated persons.
-

The operating instructions state the following qualification requirements for the various areas of work:

- **Instructed personnel** have been briefed by the operating entity about the tasks assigned to them and about potential dangers arising from improper action.
- **Skilled personnel** have the specialist training, skills, and experience, as well as knowledge of the relevant regulations, to be able to perform tasks assigned to them and to detect and avoid any potential dangers independently.
- **Electricians** have the specialist training, skills, and experience, as well as knowledge of the relevant standards and provisions to be able to carry out work on electrical systems and to detect and avoid any potential dangers independently. In Germany, electricians must meet the specifications of the BGV A3 Work Safety Regulations (e.g., Master Electrician). Other relevant regulations applicable in other countries must be observed.

The following qualifications are required for various activities:

Activities	Qualification
Mounting, maintenance	<ul style="list-style-type: none"> ■ Basic practical technical training ■ Knowledge of the current safety regulations in the workplace
Electrical installation, device replacement	<ul style="list-style-type: none"> ■ Practical electrical training ■ Knowledge of current electrical safety regulations ■ Knowledge of the operation and control of the devices in their particular application
Commissioning, configuration	<ul style="list-style-type: none"> ■ Basic knowledge of the design and setup of the described connections and interfaces ■ Basic knowledge of data transmission ■ Knowledge of the operation and control of the devices in their particular application
Operation of the devices in their particular application	<ul style="list-style-type: none"> ■ Knowledge of the operation and control of the devices in their particular application ■ Knowledge of the software and hardware environment in the application

2.5 Hazard warnings and operational safety

Please observe the safety notes and the warnings listed here and in other chapters of these operating instructions to reduce the possibility of risks to health and avoid dangerous situations.

2.6 Notes on UL approval

The device must be supplied by a Class 2 source of supply.

UL Environmental Rating: Enclosure type 1

3 Product description

3.1 Product ID

3.1.1 Device view

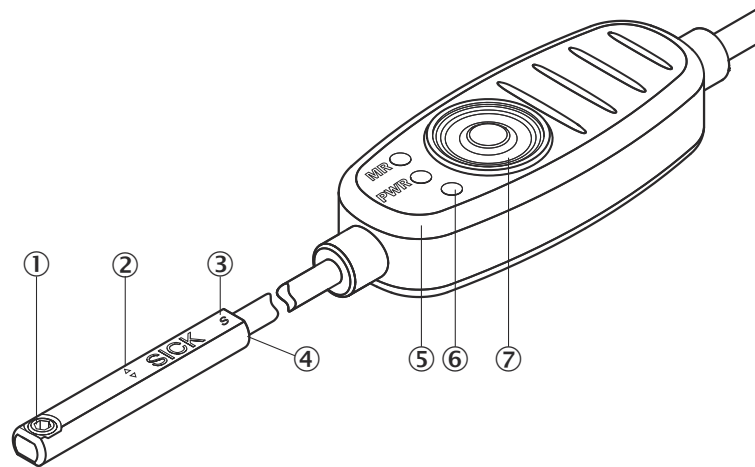


Figure 1: Operating elements and status indicators

- ① Fixing screw, size 1.3 (Tightening torque $M_A = 0.1 \text{ Nm}$)
- ② Physical zero position
- ③ Cylinder type marking
(S = SMC/BIMBA/Schunk/PHD; F = FESTO/ZIMMER)
- ④ Sensor head
- ⑤ Operating element
- ⑥ 3 x LED indicators
- ⑦ Teach-in button

3.2 Product characteristics

3.2.1 Product features

The MPS-G position sensor with analog output is used for non-contact linear position measurement mainly on pneumatic cylinders, grippers, and slides.

Target application

Analog position measurement for short stroke in systems without IO-Link.

Mechanical standard variants

The mechanical standard variants differ in the geometry of the sensor head, the length of the connection cable between the head and control panel, the length of the connecting cable between the control panel and connection and in the connection.



Figure 2: MPS-G structure

- ① Sensor head:

- Festo slot (F)
- SMC slot (S)
- ② Head / Control panel connection cable
- ③ Sensor connecting cable
- ④ Sensor connection

Table 1: Mechanical variants

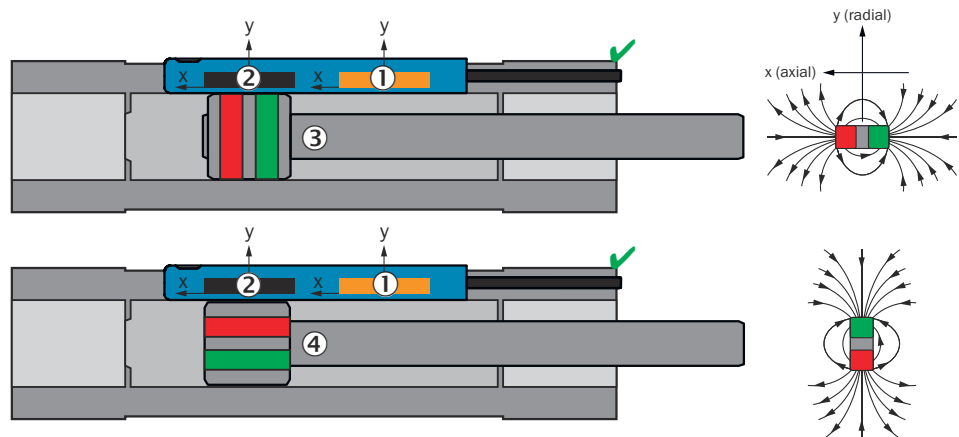
Part number	Type designation	Sensor head	Connection cable	Functional scope (output)	Connecting cable
1108672	MPS-G50 ...	F	0.1 m	Analog	0.5 m, M8 knurled screw
1108673	MPS-G50 ...	S	0.1 m	Analog	0.5 m, M8 knurled screw
1108674	MPS-G50 ...	S	0.5 m	Analog	0.5 m, M8 knurled screw

3.3 Operating principle

3.3.1 Principle of operation

The MPS-G determines the position of an encoder magnet via a row of 2 sensor elements located in the sensor head.

Axially and diametrically magnetized magnets can be detected since the two sensor elements measure the field strength in both the X- and Y-direction.



- ① Sensor element 1
- ② Sensor element 2
- ③ Axially magnetized magnet
- ④ Diametrically magnetized magnet

3.3.2 Detection range

The sensor is designed for a detection range of 50 mm. The zero point / physical zero position is marked with arrows on the sensor head and is located roughly at the center point of the sensor. From the zero point, -25 mm are measured to the cable and +25 mm to the fixing screw.



NOTE

The maximum detection range is 60 mm. The actual detection range can vary and depends on the drive.

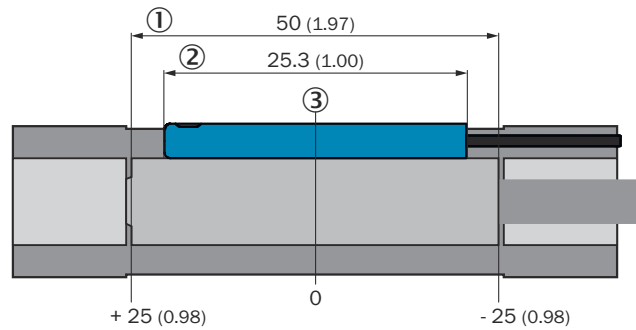


Figure 3: Detection range

- ① Detection range
- ② Housing length
- ③ Zero point / Physical zero position

3.3.3 Position output

The sensor can output a linearized position in a detection range of approx. 50 mm (depends on the drive). Only when the **Out-of-Range** display is activated are 11 V or 10.5 V displayed when the magnet leaves the measuring range. The **Out-of-Range** display is only activated with Manual Teach.



NOTE

The **Out-of-Range** display is always activated with Manual Teach. Manual activation/deactivation is not possible.

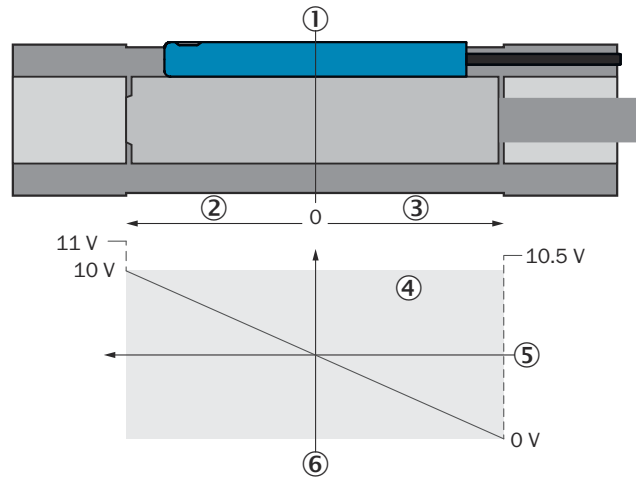


Figure 4: Zero point / Physical zero position

- ① Zero point / Physical zero position
- ② Positive positions
- ③ Negative positions
- ④ Sensor detection range: 0 ... 10 V
- ⑤ Piston position
- ⑥ Sensor position output

4 Transport and storage

4.1 Transport

For your own safety, please read and observe the following notes:



NOTE

Damage to the sensor due to improper transport.

- The device must be packaged for transport with protection against shock and damp.
- Transport should be performed by specialist staff only.
- The utmost care and attention is required at all times during unloading and transportation on company premises.
- Note the symbols on the packaging.
- Do not remove packaging until immediately before you start mounting.

4.2 Transport inspection

Immediately upon receipt at the receiving work station, check the delivery for completeness and for any damage that may have occurred in transit. In the case of transit damage that is visible externally, proceed as follows:

- Do not accept the delivery or only do so conditionally.
- Note the scope of damage on the transport documents or on the transport company's delivery note.
- File a complaint.



NOTE

Complaints regarding defects should be filed as soon as these are detected. Damage claims are only valid before the applicable complaint deadlines.

4.3 Storage

Store the device under the following conditions:

- Recommendation: Use the original packaging.
- Do not store outdoors.
- Store in a dry area that is protected from dust.
- To allow any residual dampness to evaporate, do not package in airtight containers.
- Do not expose to any aggressive substances.
- Protect from sunlight.
- Avoid mechanical shocks.
- Storage temperature: see "Technical data", page 27.
- Relative humidity: see "Technical data", page 27.

5 Mounting

5.1 Mounting requirements

- Comply with technical data such as the permitted ambient conditions for operation of the sensor (e.g., temperature range, EM interference), see ["technical data", page 27](#).
- Protect the sensor from direct sunlight.
- Only mount sensor with the intended accessories.

Mounting location

When selecting the mounting location, the following factors must be considered:

- The mounting location must be as free from (electro)magnetic disturbance fields as possible

5.2 Optional accessories

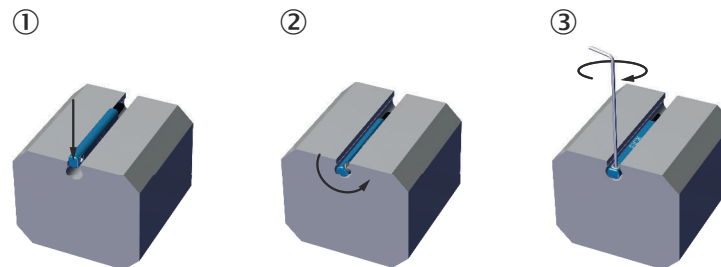
Table 2: Optional accessories

Part number	Designation
2117133	Control panel mounting
2117770	T-slot adapter

5.3 Mounting

Insert sensor into the slot from above. The **PWR LED**¹⁾ lights up green and the **MR LED**²⁾ lights up yellow when the magnet is located in the measuring range.

If the user does not teach in the measuring range, the standard measuring range of +/-25 mm is used.



- ① Insert sensor
- ② Turn sensor
- ③ Tighten screws (tightening torque max. 0.1 Nm)

1) PWR LED = Power LED

2) MR LED = Measuring Range LED

6 Electrical installation

6.1 Safety

6.1.1 Notes on electrical installation



CAUTION

Danger due to incorrect supply voltage!

An incorrect supply voltage may result in injuries from electric shocks and/or damage to the device.

- Only operate the sensor with safety/protective extra-low voltage (SELV/PELV).



NOTICE

Sensor damage or unpredictable operation due to working with live parts.

Working with live parts may result in unpredictable operation.

- Only carry out wiring work when the power is off.
- Only connect and disconnect electrical connections when the power is off.

- **The electrical installation must only be performed by electrically qualified personnel.**
- **Standard safety requirements must be observed when working on electrical systems!**
- Only switch on the supply voltage for the device when the connection tasks have been completed and the wiring has been thoroughly checked.
- When using extension cables with open ends, ensure that bare wire ends do not come into contact with each other (risk of short-circuit when supply voltage is switched on!). Wires must be appropriately insulated from each other.
- Wire cross-sections in the supply cable from the user's power system must be designed in accordance with the applicable standards. When this is being done in Germany, observe the following standards: DIN VDE 0100 (Part 430) and DIN VDE 0298 (Part 4) and/or DIN VDE 0891 (Part 1).
- Circuits connected to the device must be designed as SELV circuits (SELV = Safety Extra Low Voltage).
- Protect the device with a separate fuse at the start of the supply circuit.

The IP enclosure rating for the sensor is only achieved if the connected cable is completely screwed in.

6.1.2 Wiring instructions



NOTE

Pre-assembled cables can be found online at:

- ▶ www.sick.com/mps-g

Please observe the following wiring instructions:

- During installation, pay attention to the different cable groups. The cables are grouped into the following four groups according to their sensitivity to interference or radiated emissions:
 - Group 1: Cables very sensitive to interference, such as analog measuring cables
 - Group 2: Cables sensitive to interference, such as sensor cables, communication signals, bus signals

- Group 3: Cables which are a source of interference, such as control cables for inductive loads, motor brakes
- Group 4: Cables which are powerful sources of interference, such as output cables from frequency inverters, welding system power supplies, power cables
- ▶ Cables in groups 1, 2 and 3, 4 must be crossed at right angles, [see figure 5](#).
- ▶ Cables in groups 1, 2 and 3, 4 must be routed in different cable channels or metallic separators must be used, [see figure 6](#) and [see figure 7](#). This applies particularly where cables of devices with a high level of radiated emission, such as frequency converters, are laid parallel to sensor cables.

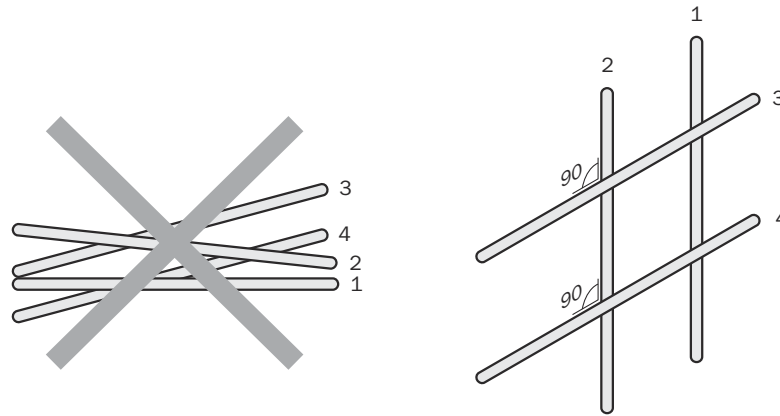


Figure 5: Cross cables at right angles

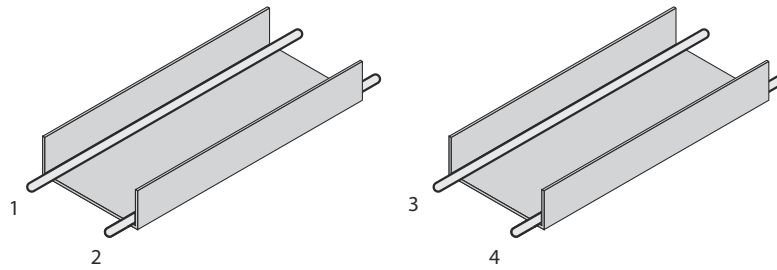


Figure 6: Ideal laying - Place cables in different cable channels

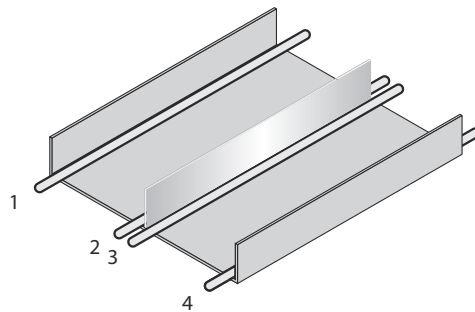


Figure 7: Alternative laying - Separate cables with metallic separators



NOTE


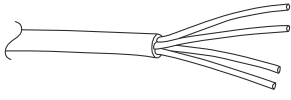
Prevent equipotential bonding currents via the cable shield with a suitable earthing method, [see "Safety", page 13](#).

6.2 Connections

6.2.1 Pin assignment/Connection diagram + wire colors


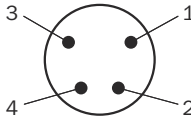
MPS-GxxxxxxxAXxxxxxxxxxxxxxxxxx: Open cable end

Table 3: Pin assignment for male connector, M8, A-coded, 4-pin

PIN	Connection	Pin assignment
1	BN	+ (L+)
2	WH	U _{OUT}
3	BU	- (M)
4	BK	-
 		


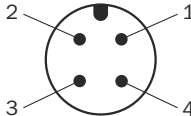
MPS-GxxxxxxxCXxxxxxxxxxxxxxxxxx / MPS-GxxxxxxxDXxxxxxxxxxxxxxxxxx: M8 connection

Table 4: Pin assignment for male connector, M8, A-coded, 4-pin

PIN	Connection	Pin assignment
1	BN	+ (L+)
2	WH	U _{OUT}
3	BU	- (M)
4	BK	-
 		

MPS-GxxxxxxxEXxxxxxxxxxxxxxxxxx: M12 connection

Table 5: Pin assignment for male connector, M12, A-coded, 4-pin

PIN	Connection	Pin assignment
1	BN	+ (L+)
2	WH	U _{OUT}
3	BU	- (M)
4	BK	-
 		

6.3 Connecting the supply voltage

The sensor must be connected to a voltage supply with the following properties:

- Supply voltage DC 12 V ... 30 V, with switched-on **Out-of-Range** display 13 V ... 30 V (SELV/PELV as per currently valid standards)
- Electricity source with at least 5 W power

Protecting the supply cables

To ensure protection against short-circuits/overload in the customer's supply cables, the wire cross-sections used must be appropriately selected and protected.

The following standards must be observed in Germany:

- DIN VDE 0100 (part 430)
- DIN VDE 0298 (part 4) and/or DIN VDE 0891 (part 1)

7 Commissioning

7.1 Overview of commissioning steps

- Connect the voltage supply.
- Commission the sensor using the factory settings.
- Configure the sensor.

7.2 Positioning on drive

To achieve the best possible performance, the sensor should be positioned centrally to the travel range of the magnet.

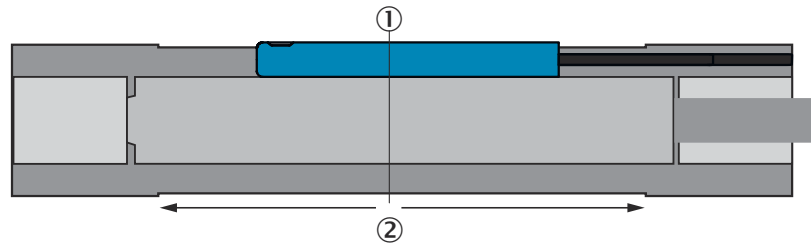


Figure 8: Positioning on drive

- ① Zero point
- ② Same distance in both directions

7.3 Commissioning the sensor for the first time

For optimal sensor performance, move the drive through the entire range of movement of the drive roughly 5x. Not until teach-in is complete is the complete accuracy (minimal linearity error, correct display of measuring range) achieved.

8 Operation

8.1 General notes on operation

Teach possible using teach-in button.



NOTE

The user is responsible for the correct teach process.

8.2 Operating and status indicators

8.2.1 Control element



The beginning and end of the measuring range can be set via the teach-in button.

8.2.2 Status indicators

3 LEDs are arranged on the control panel. The two outer LEDs light up yellow and the center LED in green.



The table below describes the individual function displays. The actual behavior of the LEDs during operation represents a combination of these function displays.

Table 6: Function of the LEDs

Sensor condition	LED 1 (unmarked)		LED 2 (PWR)		LED 3 (MR)	
	Display	Meaning	Display	Meaning	Display	Meaning
SIO	○ Does not light up	No function during operation	● Flashing	Power ok	● Lights up	Magnet inside the measuring range
					○ Does not light up	Magnet outside the measuring range
Error	No error display via LEDs					
Teach	This table only lists the LED behavior during operation. The LED behavior during teach-in can be found in section 8.3 .					

8.3 Teach-in mode

The MPS-G features two teach options: **Dynamic Teach** and **Manual Teach**.

Both teach options can be executed via the teach-in button.

8.3.1 Dynamic Teach

Dynamic Teach is used to have the sensor automatically set the end points of the desired measuring range.

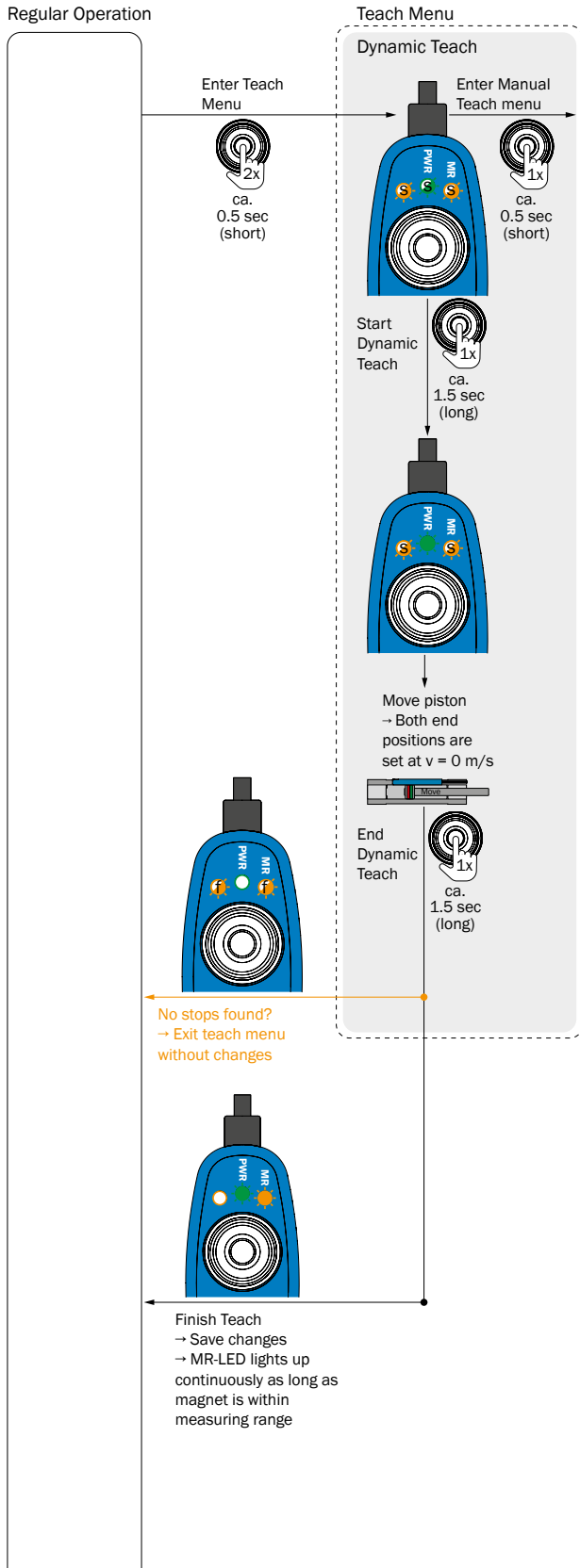
The sensor detects the movement stops and then assigns the respective end points to the found positions: 0 V on the cable side and 10 V on the side of the sensor fixing screw. (The positions must be at least 1 mm apart to be detected as two different positions).

The initial position of the piston when **Dynamic Teach** starts is NOT seen as the first stop! The **Out-Of-Range** display is hereby deactivated.



NOTE

The magnet must be moved at a speed greater than 0.025 m/s so the **Dynamic Teach** works correctly.



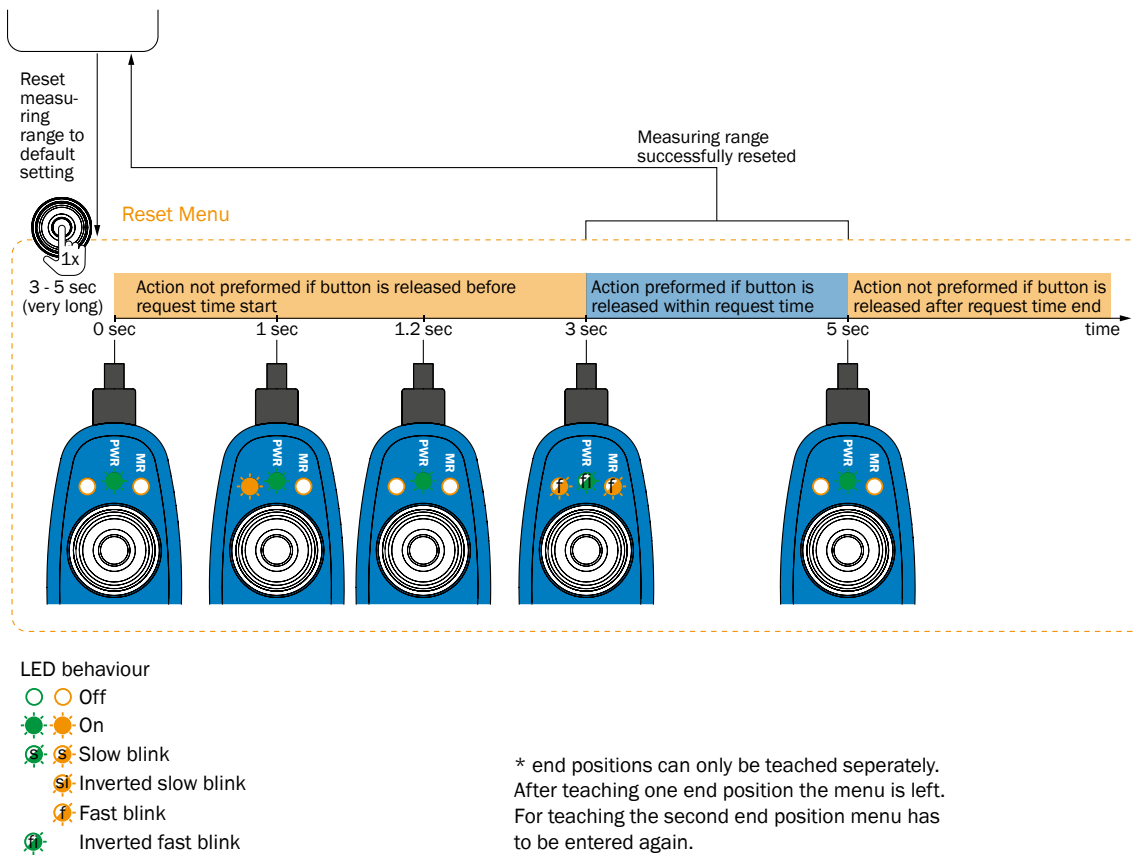


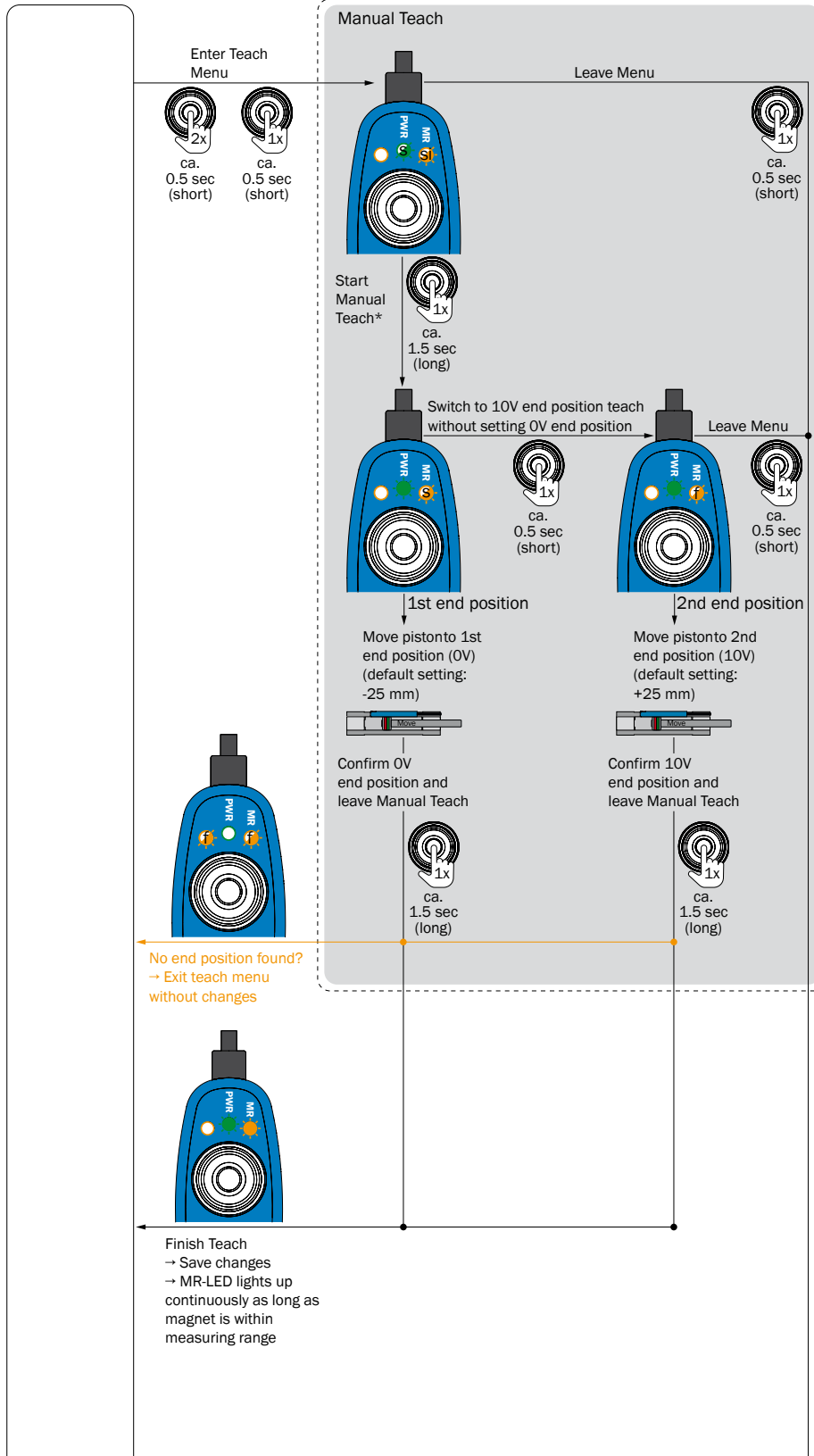
Figure 9: Dynamic Teach teach routine

8.3.2 Manual Teach

Manual Teach is used to manually teach in the two end points of the measuring range using the teach-in button. Both end points are taught in separately. The **Out-Of-Range** display is activated here.

Regular Operation

Teach Menu



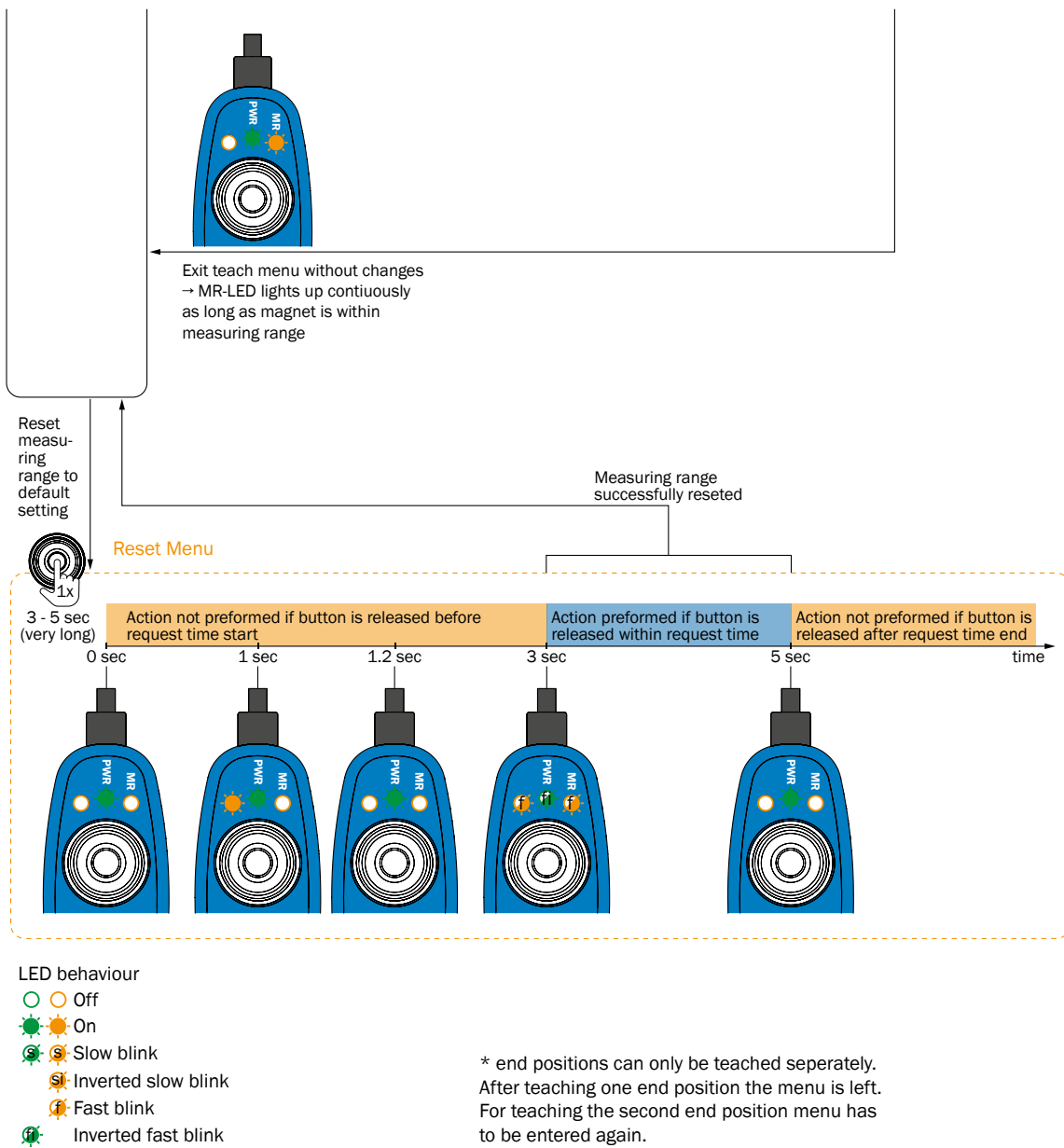


Figure 10: Manual Teach teach routine

9 Troubleshooting

Table 7: Possible error displays via the LEDs

LED/fault pattern / Fault pattern	Cause	Measures
Green LED does not light up	No voltage or voltage below the limit values	Check the power supply, check all electrical connections (cables and plug connections)
LED 1 + LED 3: Quick flashing	During a teach attempt outside the detection range, no end point is applied	Bring pistons into the detection range of the sensor
	If no or only one end point is found during Dynamic Teach , no end points are applied	Adjust the position so that two end points are found
Sensor position is imprecise	Mounting position unfavorable	Position sensor head as recommended in the operating instructions and run voltage reset
End positions are lost	Sensor was not yet completely taught in to drive	Perform several strokes (> 5) and reset end positions

10 Maintenance

SICK sensors are maintenance-free.

We do, however, recommend that the following activities are undertaken regularly:

- Clean the sensor surfaces
- Check the fittings and plug connectors

No modifications may be made to devices.

Subject to change without notice. Specified product properties and technical data are not written guarantees.

11 Decommissioning

11.1 Replace device

The **IO-Link Data Storage** function can be used to save previous parameters and transmit them to the exchange device. This prevents complete re-parameterization of the exchange device.

11.2 Disassembly and disposal

Disassembling the device

1. Switch off the supply voltage to the device.
2. Detach all connecting cables from the device.
3. If the device is being replaced, mark its position and alignment on the bracket or surroundings.
4. Detach the device from the bracket.

Disposing of the device

Any device which can no longer be used must be disposed of in an environmentally friendly manner in accordance with the applicable country-specific waste disposal regulations.




NOTE

Disposal of batteries, electric and electronic devices

- According to international directives, batteries, accumulators and electrical or electronic devices must not be disposed of in general waste.
- The owner is obliged by law to return this devices at the end of their life to the respective public collection points.



 This symbol on the product, its package or in this document, indicates that a product is subject to these regulations.

11.3 Returning devices

- ▶ Do not dispatch devices to the SICK Service department without consultation.



NOTE

To enable efficient processing and allow us to determine the cause quickly, please include the following when making a return:

- Details of the contact person
 - Description of the application
 - Description of the fault that occurred
-

12 Technical data

Table 8: Technical data

Cylinder type	C-slot
Detection zone	0 ... 50 mm ¹⁾
Supply voltage U _B	12 ... 30 V DC ²⁾
Power consumption	≤ 550 mW
Required magnetic field strength, typ.	≥ 2 mT
Time delay before availability	0.15 s
Resolution typ.	0.01 mm ³⁾
Linearity typ.	0.3 mm ⁴⁾
Repeatability (response time) typ.	0.05 mm ⁵⁾
Sampling rate min.	2 kHz
Enclosure rating	IP67
Protection class	III
Circuit protection	A, B, D ⁶⁾
Ambient temperature, operation	-20 °C ... +70 °C

- 1) Deviations are possible depending on the drive.
- 2) When the Out-of-Range display is active, then 13 ... 30 V
- 3) For measuring range > 37 mm, the following applies for the resolution: Measuring range / 3,723.
- 4) At 25 °C, the linearity error (maximum deviation) depends on response curve and minimum deviation function.
- 5) At 25 °C, repeatability with magnet movement from one direction.
- 6) A = UB connections reverse polarity protected
 B = Inputs and outputs reverse polarity protected
 C = Interference suppression
 D = Outputs overcurrent and short-circuit protected

12.1 Dimensional drawing

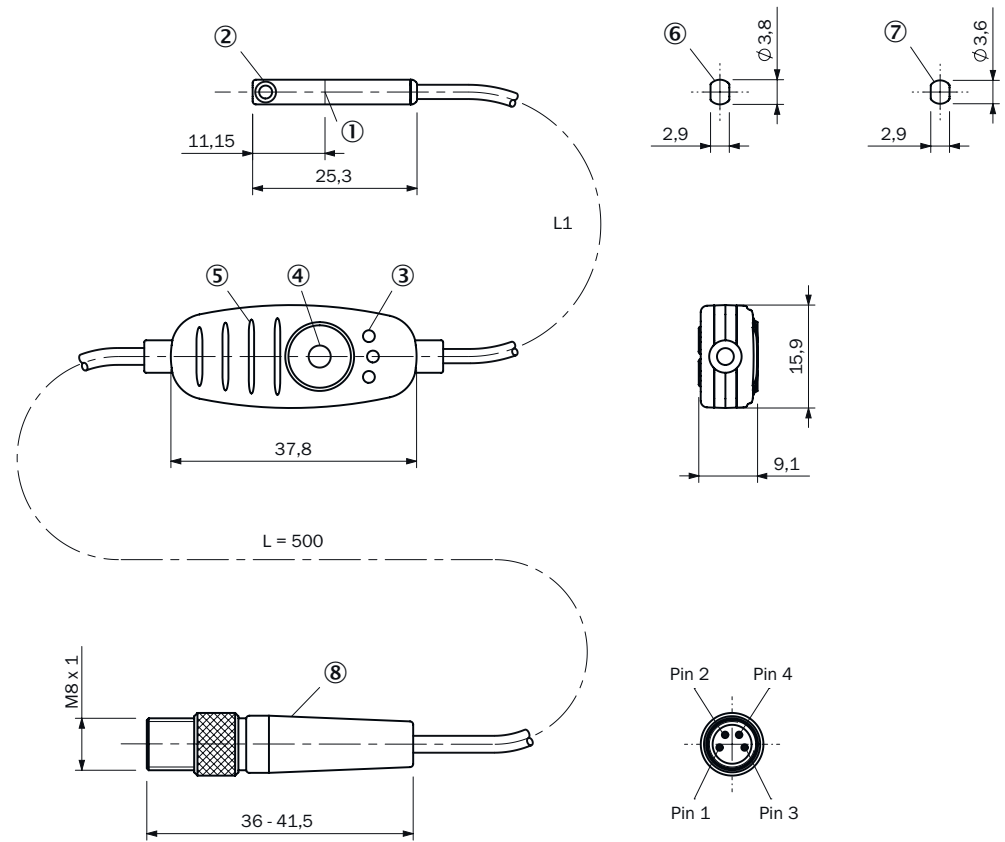


Figure 11: Dimensional drawing with male connector, M8 knurled

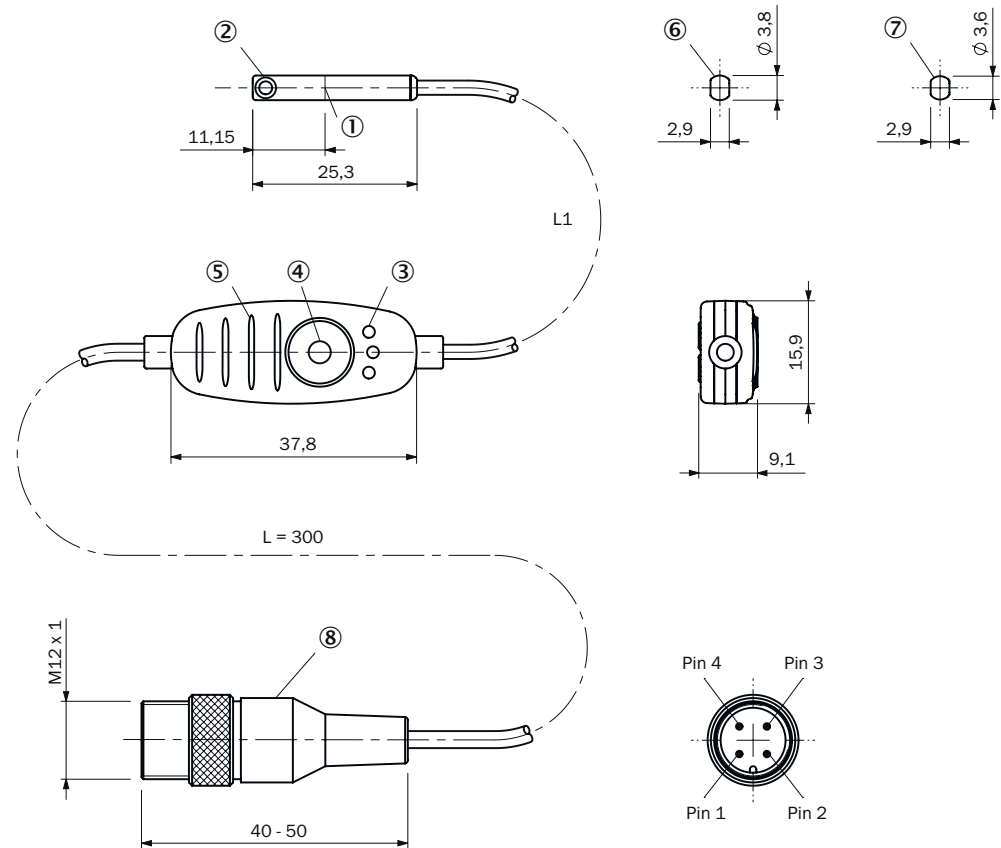


Figure 12: Dimensional drawing with male connector, M12 knurled

- ① Center sensor element
- ② Fixing screw, size 1.3
- ③ LED
- ④ Teach-in button
- ⑤ Ribs for cable tie
- ⑥ For SMC, Schunk, PHD, Bimba slot (MPS-G50CS...)
- ⑦ For Festo-, Zimmer slot (MPS-G50CF...)
- ⑧ Connection

Table 9: L1 length of sensor head / control panel connection cable

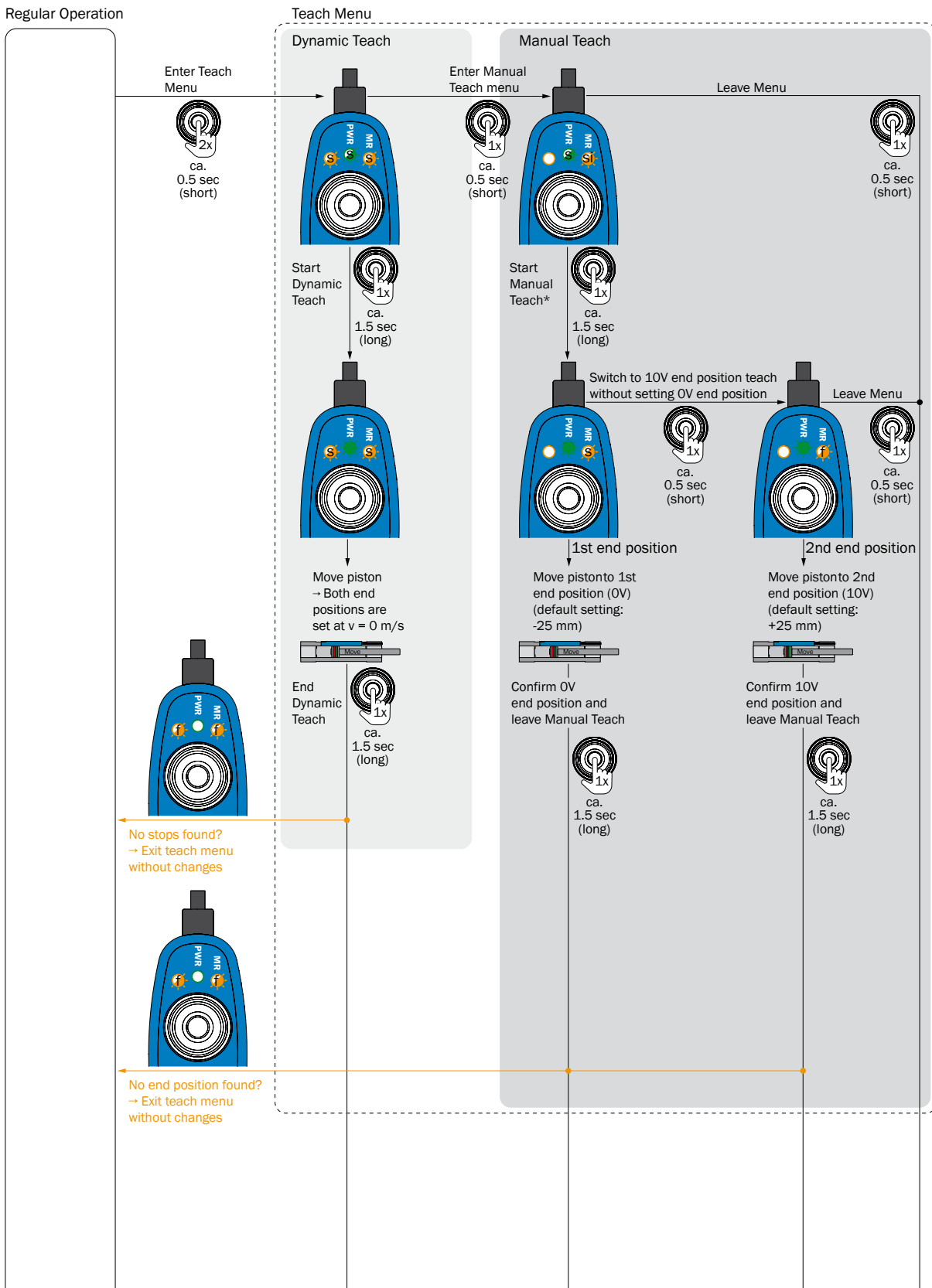
Type code	Connection cable length
MPS-Gxxxxx1xxxxxxxxxxxxxxxxxxxx	0.1 m
MPS-Gxxxxx5xxxxxxxxxxxxxxxxxxxx	0.5 m

13 Glossary

Detection range	The detection range describes the maximum physical range in which the sensor can determine a position. The detection range is max. +30 mm and - 30 mm around the physical zero position.
Dynamic Teach and Manual Teach	<p>Dynamic Teach and Manual Teach are two different teach options. The teach-in button can be used to execute both Dynamic Teach and Manual Teach.</p> <ul style="list-style-type: none"> • Dynamic Teach: Dynamic Teach can be used to have the sensor automatically set the end points of the desired measuring range. • Manual Teach: Manual Teach is used to manually teach in the two end points of the measuring range using the teach-in button. Both end points are taught in separately. <p>The teach-in processes are described in detail in section 8.3.</p>
Linearity error	<p>The linearity error describes the maximum deviation of the output signal from an ideal straight line. It is measured in millimeters.</p> <p>MPS-G with analog output: The linearity error depends on the drive on which the sensor is mounted and is typically 0.3 mm.</p>
Measuring range	The measuring range can be anywhere inside the detection range. The measuring range must always be completely inside the detection range.
Out-of-Range display	The Out-of-Range display is used to display the analog position output when the magnet has left the measuring range. If 11 V is output, the magnet has left the measuring range in the positive direction (on the side of the sensor fixing screw). If 10.5 V is output, the magnet has left the measuring range in the negative direction (on the cable side of the sensor).
Range of movement	The range of movement describes the actual path traveled by the piston.
Repeatability	<p>Repeatability is defined as any move to a preset position from the same direction in every case.</p> <p>MPS-G with analog output: The repeatability depends on the drive on which the sensor is mounted and is typically 0.05 mm.</p>
Resolution	<p>The sensor resolution describes the minimum, specifiable magnet route change as output by the sensor.</p> <p>MPS-G with analog output: The resolution depends on the drive on which the sensor is mounted and is typically ≥ 0.01 mm.</p>
Sampling rate	<p>The sampling rate indicates the time interval in which the signal is updated at the outputs.</p> <p>MPS-G with analog output: The sampling rate is min. 2 kHz.</p>

14 Annex

14.1 Teach routine at a glance



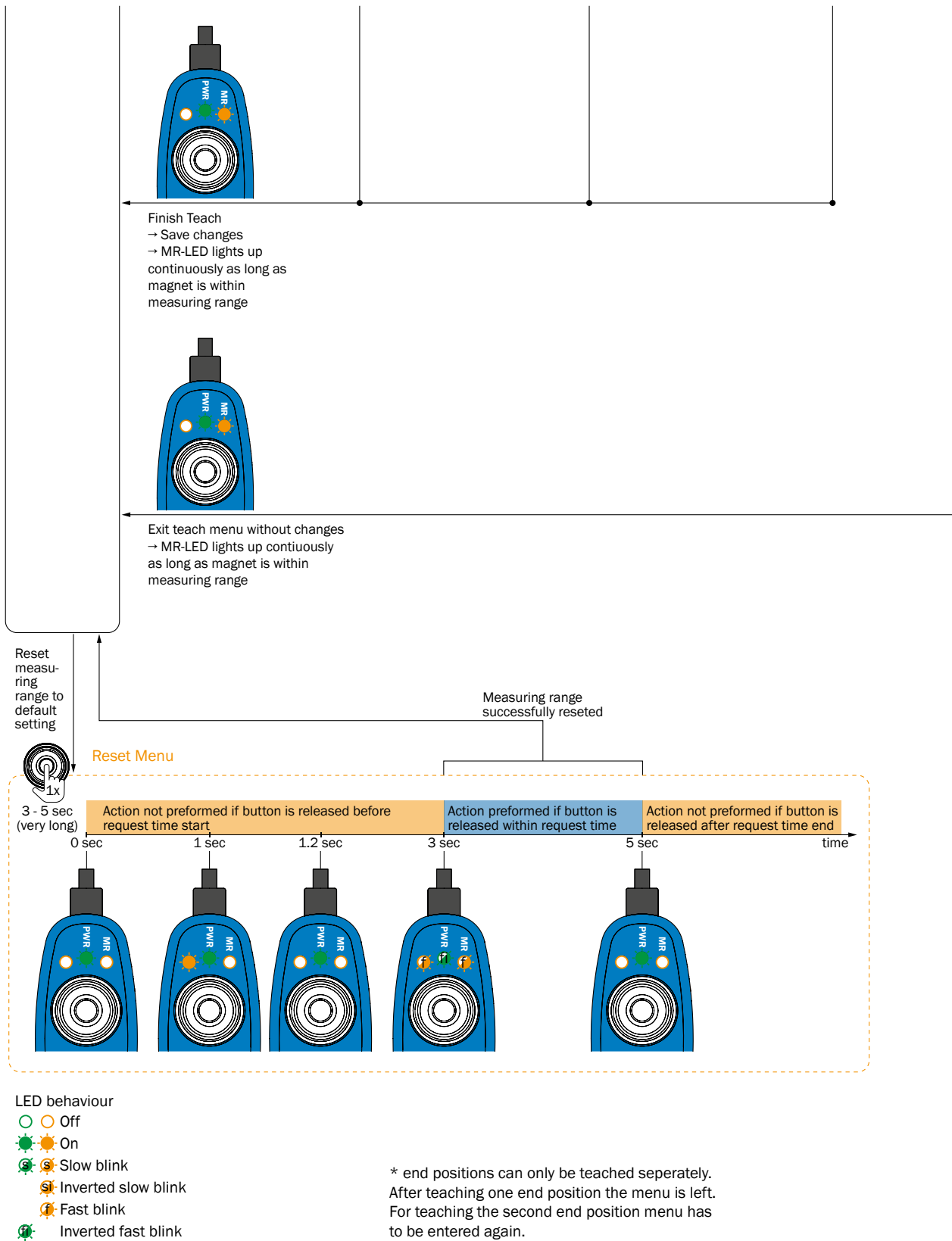


Figure 13: MPS-G analog teach routine

14.2 Conformities and certificates

You can obtain declarations of conformity, certificates and the current documentation for the product at www.sick.com. To do so, enter the product part number in the search field (part number: see the entry in the “P/N” or “Ident. no.” field on the type label).

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