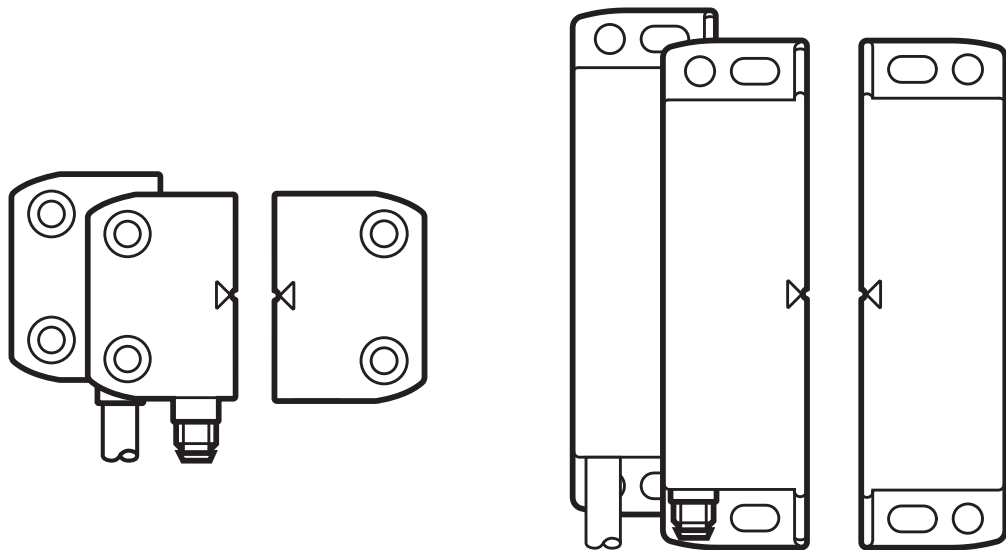


Original operating instructions
Magnet-coded sensor
(for use in safety-related applications)

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MN2xxS / MN5xxS

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1 Preliminary note

The instructions are part of the unit. They are intended for authorised persons according to the EMC, Low Voltage and Machinery Directive and safety regulations. The instructions contain information about the correct handling of the product.

Read the instructions before use to familiarise yourself with operating conditions, installation and operation.

Follow the safety instructions.

1.1 Symbols used

▶ Instructions

> Reaction, result

→ Cross-reference



Important note

Non-compliance may result in malfunction or interference.



Information

Supplementary note.

1.2 Warning signs used

WARNING

Warning of serious personal injury.

Death or serious irreversible injuries may result.

2 Safety instructions

- Follow the operating instructions.
- Improper use may result in malfunctions of the unit. This can lead to personal injury and/or damage to property during operation of the machine. For this reason note all remarks on installation and handling given in this document. Also adhere to the safety instructions for the operation of the whole installation.
- In case of non-observance of notes or standards, especially when tampering with and/or modifying the unit, any liability and warranty is excluded.
- If the sensor is damaged, the function cannot be guaranteed.
- Errors caused by damage cannot be detected by the sensor.
- The unit must be installed, connected and put into operation by a qualified electrician trained in safety technology.
- The applicable technical standards for the corresponding application must be complied with.
- For installation the requirements according to EN 60204 must be observed.
- The sensor and the actuator must be in perfect condition and regularly tested by qualified personnel (person trained in safety matters).
- In case of malfunction of the unit please contact the manufacturer. Tampering with the unit is not allowed.
- Disconnect the unit externally before handling it. Also disconnect any independently supplied relay load circuits.
- After installation, maintenance or repair of the device, perform a complete function check. (→ 10 Maintenance, repair and disposal).
- Only use the unit under the specified operating conditions (→ 9 Technical data). In case of special operating conditions please contact the manufacturer.
- Use only as described below (→ 4).

2.1 Safety-related requirements regarding the application

It must be ensured that the safety requirements of the respective application correspond to the requirements stated in these instructions.

⚠ WARNING

Failure of the safety function

When used outside of the defined environmental conditions, the safety-related function of the sensor cannot be guaranteed.

- ▶ Use only in accordance with the defined environmental conditions (→ 9 Technical data).

Use of the sensor in the vicinity of chemical and biological media (solid, liquid, gaseous) as well as ionising radiation is not permitted.

The sensor must not be installed or operated in the environment of strong magnetic fields.

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Observe the following requirements:

- ▶ Only operate the sensors with the corresponding permissible actuators and safety relays. Only using components that are adapted to each other guarantees correct safety-related functioning.
- ▶ Protect the sensor and the actuator from foreign bodies (e.g. metal swarf).
- ▶ When the device is mounted directly to ferromagnetic materials, using a spacer is mandatory (→ 6 Installation).
- ▶ Take measures to avoid ferromagnetic objects (e.g. structural steel) being placed intentionally or unintentionally on the sensing face.
- ▶ Adhere to EN ISO 14119 for interlocking devices associated with guards.
- ▶ The protective equipment must be dimensioned and mounted in a way to prevent persons can walk or touch behind it.
- ▶ The sensor and the actuator may neither be manipulated nor may their correct position be changed.
- ▶ The additional signal contact is for status indication. It is not permitted to use it as a safety-related contact.
- ▶ Do not use any different magnets and do not bridge any contacts.
- ▶ Do not use the device as an end stop.
- ▶ Only use cable glands, insulation material and connecting wires that have an appropriate protection rating.
- ▶ Adhere to the principle of normally closed operation for all external safety circuits connected to the system.

- ▶ Sensors and actuators must be protected from strong shocks and vibrations. Observe the permissible environmental conditions (→ 9 Technical data)
- ▶ Replace damaged units.

3 Items supplied

1 sensor, 1 actuator, 1 x original operating instructions.

If one of the above-mentioned components is missing or damaged, please contact one of the ifm branch offices.

4 Functions and features

The magnetically-coded sensor (with safety relay) is designed for use in protective door monitoring according to EN ISO 14119 (type 4).

These devices are designed for safety-related monitoring of movable safety guards.

The sensor and the actuator may only be used if they were mounted, connected, put into operation and tested according to the applicable operating instructions, the relevant rules, standards and regulations concerning occupational health and safety and by a qualified person (qualified electrician trained in safety matters).

In connection with a G150xS type evaluation unit or an AC4x2S safety monitor, it is possible to reach up to SIL_{cl} 3 according to IEC 62061 and PL e according to EN ISO 13849-1.



The standard EN ISO 14119 and the technical report ISO/TR 24119 defined, among other things, the requirements regarding logical series connection.

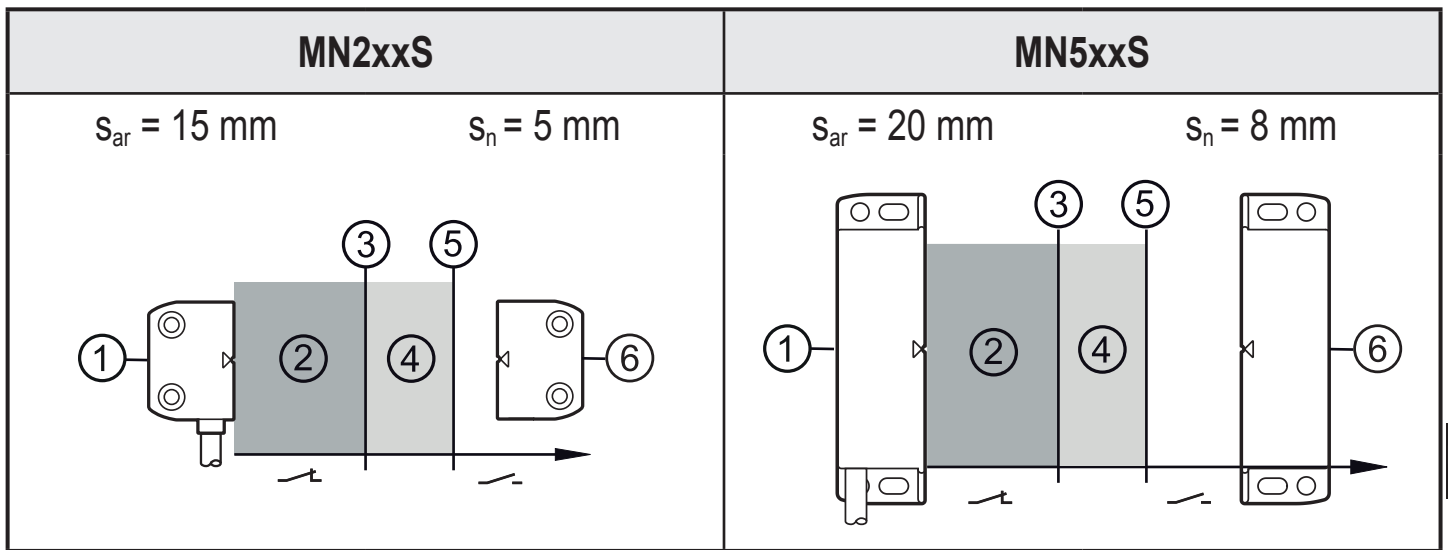
The danger of potential fault masking in series connection of the sensors' potential-free contacts limits the attainable performance level (PL).

Components that are not safety-related must not be connected into the safety circuit.

Combination with non-approved sensor or actuator parts is not permitted. When connecting other controllers, corresponding verification by the plant operator is required.

The sensors have been certified by TÜVNord in conjunction with G150xS type evaluation units and AC4x2S type safety monitors.

5 Function



① Sensor

② Operating area

③ Sensing range s_n

④ Limit range

⑤ Safe switch-off distance s_{ar}

⑥ Actuator

The unit consists of a sensor and an actuator. The sensor features reed contacts that are activated without contact through the coded magnetic field of the actuator. If e.g. a hatch or a door is opened, the magnetically coded actuator moves away from the sensor which is positioned on the stationary part of the guard.

If the changed position of the actuator reaches the safe switch-off distance s_{ar} , the switching status can be communicated to a connected safety relay (G150xS, AC4x2S).



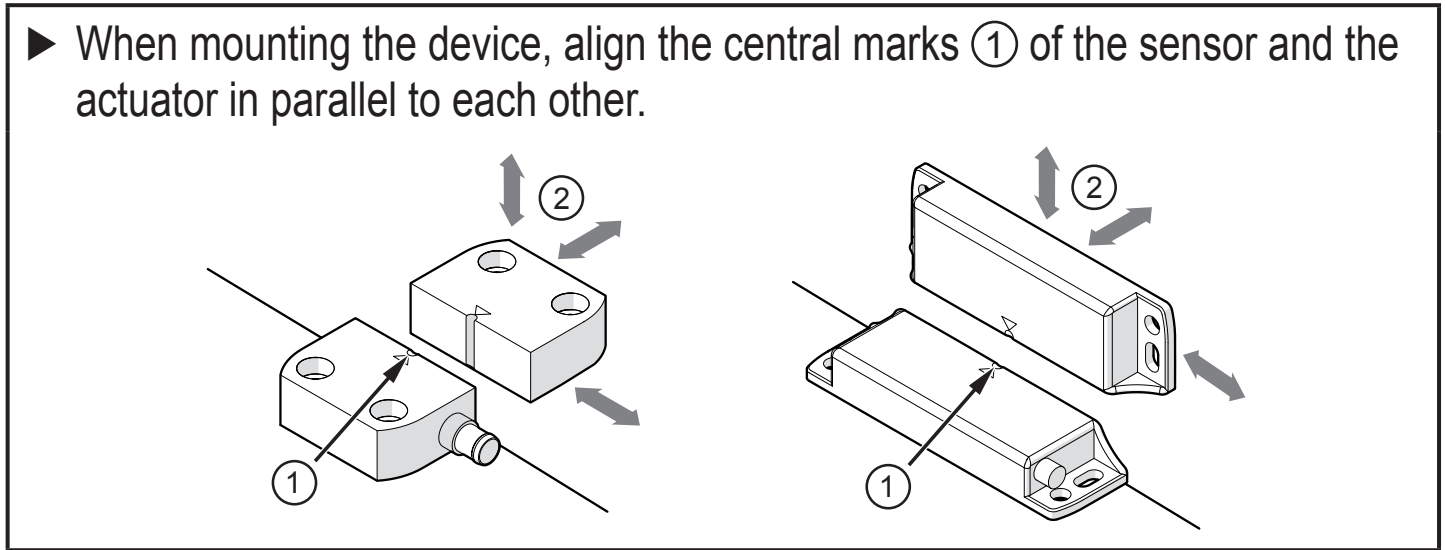
Approach curves of the sensors at www.ifm.com:

→ General information about mounting and operation

6 Installation

6.1 Actuating directions

The sensor recognises the actuator from three different directions ②.



① Reference marks (central mark)

② Actuating direction

! When using several sensors, a minimum distance of 50 mm in each direction must be maintained.

- Only mount on a flat surface to avoid damage or changes of the sensing range.
- The protective equipment must be dimensioned and mounted in a way to prevent persons can walk or touch behind it.

If installed on ferromagnetic materials, a spacer that is not ferromagnetic must be used (available as accessories).

► Fasten the sensor and the actuator with two screws each (M4, > 18 mm).

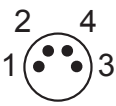
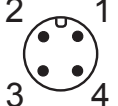
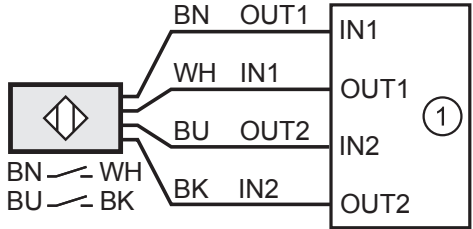
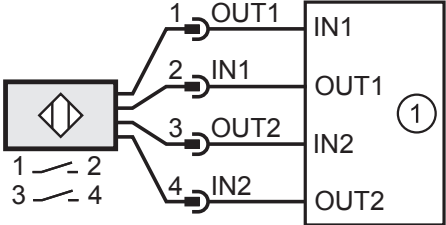
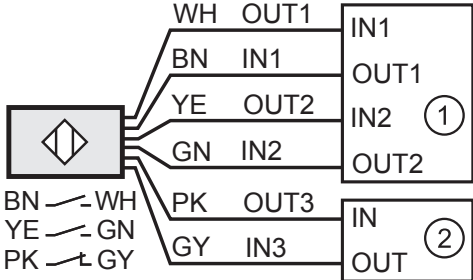
! Using fewer than two screws for each component is not permissible. According to EN ISO 14119, the actuator must be fixed immovably.

Safety screws with one-way heads, rivets or the like are to be used. Using non-detachable safety screws can increase the protection against tampering (available as accessories).

i For sensors with an additional signal contact, the signals for the safety functions and the signal contact may be delayed depending on the direction from which the target approaches.


7 Electrical connection

- ▶ Disconnect power. Also disconnect any independently supplied relay load circuits.

Cable		Connector	
BK: Black BN: Brown BU: Blue GN: Green	GY: Grey PK: Pink WH: White YE: Yellow	 <p>M8 connector</p>	 <p>M12 connector</p>
 <p>PVC cable, 4 x 0.25 mm², Ø 50 mm</p>			
 <p>PVC cable, 6 x 0.25 mm², Ø 50 mm</p>			

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- ① Safety-related logic unit
- ② Programmable Logic Controller (PLC)

 You will find more information about connections to safety relays and monitors from ifm at www.ifm.com: → General information about mounting and operation

If other safety relays are used, a full assessment of the attainable safety-related reliability (e.g. according to EN ISO 13849-1, IEC 62061) is to be carried out by the user (e.g. with SISTEMA) and systematic errors (e.g. cross faults, short circuits in the connection cables) are to be considered. A complete risk analysis (FMEA) may be necessary.

8 Operation

8.1 Interface classification

The interface complies with interface type A according to the ZVEI position paper CB24I Ed. 2.0.

8.1.1 Identification key

	Interface type		Suitable interface type
Source:	A	Receiver:	A

9 Technical data

Electrical data		
Operating voltage U_i	24 V DC	
Rated insulation voltage	60 V	
Protection class	III	
Reverse polarity protection	no	
Internal resistance R_i	10 Ω (1 W)	
Outputs		
Output function (MNx04S, MNx05S)	2 x NC 2 x NC / 1 x NO	
Output characteristics	Interface type A	
Voltage drop	1 V	
Current rating	50 mA	
Short circuit proof	no	
Switching frequency	150 Hz	
Switching power (max.)	6 W	
Max. capacitive load CL_{max}	20 nF	
Detection zone	MN2xxS	MN5xxS
Sensing range s_n (with coded actuator)	5 mm	8 mm
Safe switch-off distance s_{ar}	15 mm	20 mm
Response times		
Response time to safety request (response time of the contacts after the actuator is moved away $> s_{ar}$)	10 ms	
Response time when approaching the enable zone (enable time)	7...12 ms	

Fall time	0.1 ms
Switching time incl. bouncing	0.6 ms
Environmental conditions	
Application (according to EN 60654-1)	Class C
Ambient temperature for service life ≤ 87600 h for service life ≤ 175200 h	-25...80 °C 10...40 °C
Max. perm. relative humidity short time permanent	5...95 % 5...70 %
Air pressure	80...106 kPa
Height above sea level	< 2000 m
Ionising radiation	not permissible
Salt spray	no
Protection rating (protected cable laying)	IP 67 / IP 69K
Approvals / tests	
EMC	IEC 60947-5-2
Shock resistance (EN 60068-2-27)	30 g (11 ms)
Vibration resistance (IEC 60068-2-6)	10 g (10...55 Hz)
Safety classification	
Mission time T_M	≤ 175200 h (20 years)
B10 _D (without load) at max. load DC 12, 24 V, 50 mA	20,000,000 400,000
Mechanical data	
Installation	non flush mountable
Housing materials	PA
Tightening torque	0.8...2 Nm
Potential-free	yes
Coding level according to EN ISO 14119	low

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10 Maintenance, repair and disposal

The function of the sensor must be tested

- at least once a month (automatically or manually) in case of applications up to PL e (EN ISO 13849-1) or SIL_{cl} 3 (IEC 62061)
- once a year in case of applications up to PL d (EN ISO 13849-1) or SIL_{cl} 2 (IEC 62061).

The function can be tested by removing the actuator $> s_{ar}$.

In this case, a subsequent safe evaluation unit must pass into the state defined as safe. The regular functional checks are to be documented and archived in an appropriate manner.

Dispose of the device in accordance with the national environmental regulations when it is no longer used.

The operating time of the device is restricted to T_{10D} .

After that period, the device must be replaced!

$T_{10D} = B_{10D} / n_{op}$ (see EN ISO 13849-1).

11 Terms and abbreviations

B_{10D}		Number of cycles until 10 % of the components were found to be critical (for electromechanical components).
n_{op}		Mean number of annual activations
PL	Performance level	PL to EN ISO 13849-1
SIL	Safety Integrity Level	Safety integrity level SIL 1-4 according to IEC 61508. The higher the SIL, the lower the probability that a safety function will fail.
SIL _{cl}	Safety Integrity Level _{claim limit}	Safety integrity level _{claim limit} (according to IEC 62061)
s_{ar}	Safe switch-off distance	Distance to the sensing face outside which the absence of the magnet deactivates (safe state) a subsequent evaluation unit.
T_M	Mission time	Service life according to EN ISO 13849-1 (= max. service life)

More information at www.ifm.com