Info card

Photoelectric sensors

> This info card serves as a supplement to the main position sensors catalogue and to the individual data sheets. For further information and contact addresses please visit our homepage at www.ifm.com.

Operating principle of a photoelectric sensor		
Through-beam sensor	The transmitter (1) and the receiver (2) are in separate housings. The objects are detected by interruption of the light beam.	
Retro-reflective sensor	The transmitter and receiver are integrated in one housing (3). The light beam is reflected by a reflector (4). The objects are detected by interruption of the light beam.	
Diffuse reflection sensor	The transmitter and receiver are integrated in one housing (3). The light beam is reflected by an object (5). The objects are detected by reflection of the light beam according to the energetic or triangulation principle. **Energetic principle:** The range depends on the energy of the reflected light. Depending on the object surface the light is reflected more or less well: ● good reflection: smooth / light object. ● poor reflection: rough / dark object. **Triangulation:**	
Diffuse reflection sensor with background suppression (BGS)	Evaluates the position where reflected light falls as the distance to an object changes. The range is largely independent of the energy of the reflected light.	1: Transmitter 2: Receiver 3: Transmitter and receiver 4: Reflector 5: Object

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Important terms

Output function	Light-on mode:	The receiver "sees" light and the output is switched. Through-beam and reflective = NC Diffuse = NO
	Dark-on mode:	The receiver "sees" dark and the output is switched. Through-beam and reflective = NO Diffuse = NC
	Programmable:	Choice between light-on mode or dark-on mode.
	Positive switching:	Positive output signal (to L-).
	Negative switching:	Negative output signal (to L+).
Rated insulation voltage	AC units depending on UB: 140 V AC / 250 V AC DC units with protection class II: 250 V AC DC units with protection class III: 60 V DC	
Rated short-circuit current	For short-circuit-proof units: 100 A	
Rated impulse withstand voltage	AC units depending on UB: 140 V AC = 2.5 kV or 250 V AC = 4 kV (≙ overvoltage category III) DC units with protection class II: 4 kV (≙ overvoltage category III) DC units with protection class III: 60 V DC: 0.8 kV (≙ overvoltage category II)	
Power-on delay time	The time the sensor needs to be ready for operation after application of the operating voltage (typically < 300 ms).	
Operating voltage	Voltage range in which the sensor operates reliably. 【!】Use stabilised and smoothed direct current. Take into account the residual ripple.	
EMC	Photoelectric sensors meet the requirements of EN 60947-5-2 so that ● there are no noise levels that affect other equipment in their intended operation. ● they are insensitive to electromagnetic interference to be expected during intended operation.	
Excess gain	Relationship between the received amount of light and the light amount required for switching.	
Utilisation category	AC units: AC-140 (control of small electromagnetic loads with holding currents < 200 mA) DC units: DC-13 (control of solenoids)	
Accuracy graph	Minimum distance between object and background depending on the range.	
Background suppression	Optical process of the diffuse reflection sensor to distinguish the object from a reflective surface behind.	

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Important terms	
Hysteresis	Difference between the switch-on and the switch-off point.
Short-circuit protection	⚠ Photoelectric sensors with pulsed short-circuit protection can react sensitively to incandescent lamps, electronic relays and other low-resistance loads.
Minimum load current	Smallest operating current to maintain the conductivity of the switching element.
Polarisation filter	A very fine filter which only allows light waves on a specific plane to pass (for example: horizontal waves).
Product standard	EN 60947-5-2
Range	The maximum usable distance between transmitter and receiver (through beam) or sensor and reflector (reflective).
Leakage current	Current for the internal supply of 2-wire units; also flows through the load when the output is blocked.
Switching frequency	Maximum number of signal changes at the switching output per second (in Hz).
Protection rating	Describes the protection of electric equipment by means of housings, covers, enclosures and is indicated by the IP code.
Voltage drop	Voltage across the output switching element in the conductive state.
Current consumption	No-load current for internal supply of 3 or 4-wire DC units.
Transport and storage conditions	Unless otherwise indicated in the data sheet, the following applies: Transport and storage temperature: Min. = - 40 °C. Max. = 70 °C. The relative air humidity (RH) must not exceed 50 % at +70 °C. At lower temperatures, a higher air humidity is permissible. Shelf life: 5 years. Transport and storage height: no restrictions.
Range	The mechanically usable distance between photoelectric sensor and object referred to white paper 200mm x 200mm, 90% remission.
Degree of soiling	Photoelectric proximity sensors are designed for degree of soiling 3.
Repeat accuracy	< 10% of the set range.
Radiation power	Classification of the radiation power: laser classed according to EN60825-1:2014-05 LED units according to DIN EN62471:2009, risk group 0
Shaft lengths	According to the data sheet

UK

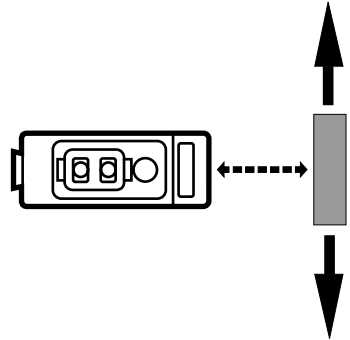# Info card

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Important terms

Response time	< 1/f (typical 1/2 f) unless stated otherwise (f = switching frequency)

Preferred direction

Note:
The objects to be detected
are to move transversely to
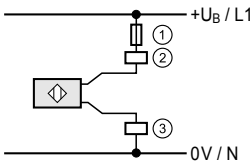the lens of the sensor.
▶ In case of other
 directions of movement
 it should be tested
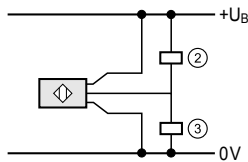 before whether safe
 switching is guaranteed.

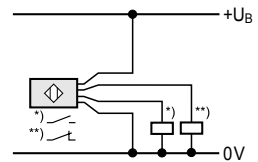|	
Reflective objects	With reflective objects it may make sense to align the sensor at an angle of approx. 5° - 10° to the object.

Connection systems

Two-wire technology
(negative **or** positive switching)
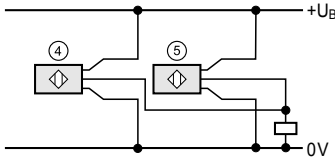
3-wire technology
(negative **or** positive switching)

4-wire technology
(positive switching, normally closed
and normally open)

+U$_B$ / L1

0V / N

+U$_B$

0V

+U$_B$

0V

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Parallel connection (OR)

Parallel connection of 3-wire units
The current consumption of all non-switched units adds up. The units can be used in combination with mechanical switches.

Parallel connection of 2-wire units
Not possible.

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① Use a miniature fuse according to the technical data sheet, if specified.
  Recommendation: Check the safe functioning of the unit after a short circuit.

② Negative switching ④ Sensor 1

③ Positive switching ⑤ Sensor n

⚠ Series connection (AND) is not recommended since the power-on delay times, voltage drops and current consumption add up. $U_{B\,min}$ (sensor) and $U_{HIGH\,min}$ (load) must remain unchanged.
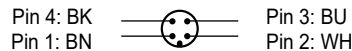

Configuration of cables and connectors

Colours: BK: black, BN: brown, BU: blue, WH: white

Standard configuration for 3-wire DC:

	Cable	Terminal chamber	US-100 plug
L+	BN	1 / 3	Pin 1 / BN
L−	BU	2 / 4	Pin 3 / BU
Output	BK	X	Pin 2 / WH Pin 4 / BK

Pin configuration of the US-100 connections (view on the plug on the unit)

Pin 4: BK ———⊙——— Pin 3: BU
Pin 1: BN Pin 2: WH

For the cable and the pin configuration as well as the unit data of special versions please refer to the wiring diagrams in our main catalogue for position sensors.
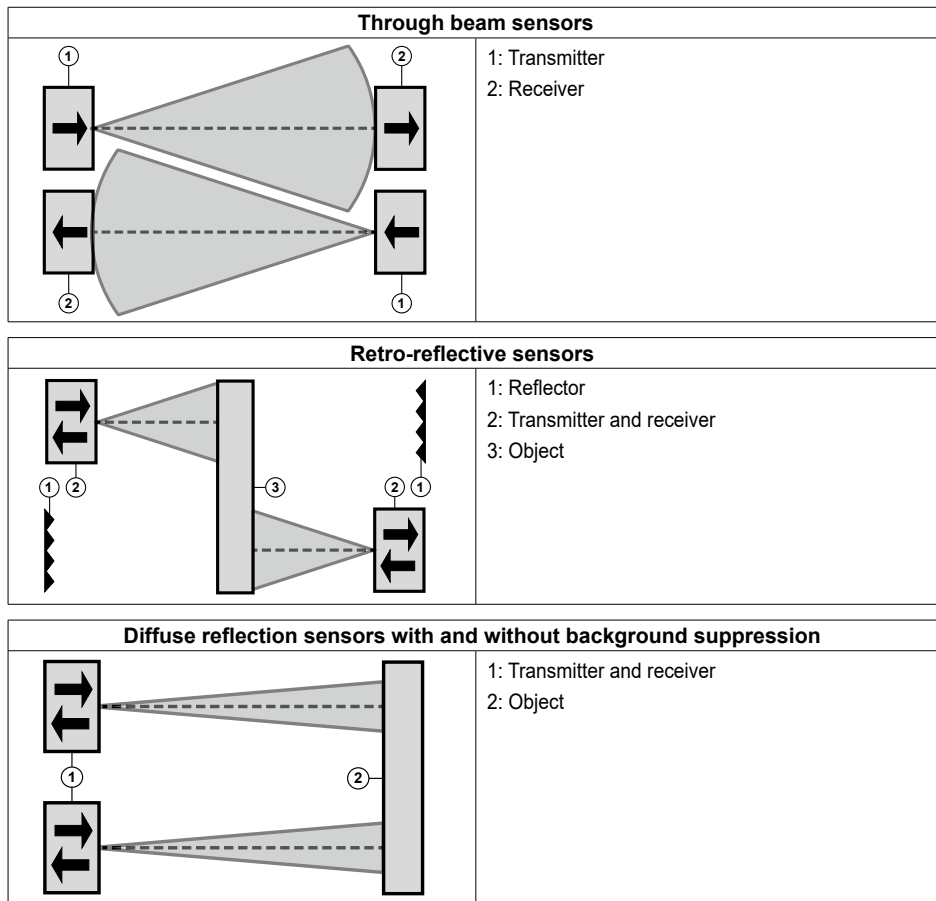
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![ifm logo]

Minimum clearance for installing sensors of the same type

⚠️ Incorrect function of the sensors possible!

Sensors of the same kind can influence each other when they are mounted side by side.

► Observe the following notes on installation.

Through beam sensors	
	1: Transmitter 2: Receiver

Retro-reflective sensors	
	1: Reflector 2: Transmitter and receiver 3: Object

Diffuse reflection sensors with and without background suppression	
	1: Transmitter and receiver 2: Object

ℹ️ Photoelectric sensors with red or infrared light emit a cone-shaped light beam.

ℹ️ Depending on the application there are other possible solutions.