



DATA SHEET

WTM4FF-1H161120A00

W4
Photoelectric sensors

SICK Sensor Intelligence



Illustration may differ

PHOTOELECTRIC SENSORS

WTM4FF-1H161120A00

ORDERING INFORMATION

Type	part no.
WTM4FF-1H161120A00	1157439

Further device versions and accessories at www.sick.com/W4



DETAILED TECHNICAL DATA

FEATURES

Functional principle	Photoelectric proximity sensor
Functional principle detail	Background suppression, Foreground suppression, MultiMode, distance value
MultiMode	1 Background suppression (factory setting) 2 Foreground suppression 3 Two Value Teach-in 4 Two independent switching points 5 Window Mode 6 ApplicationSelect

¹⁾ 90% remission factor.
²⁾ Equivalent to 3 σ .
³⁾ See repeatability characteristic lines.
⁴⁾ See accuracy curve.

		M manual / measurement
Sensing range	Sensing range min.	4 mm (mode 1, 3, 4, 5) 0 mm (mode 2) 4 mm (Mode 1, 3, 4, 5 combined with 6) 0 mm (Mode 2 and 6 combined)
	Sensing range max.	320 mm (mode 1, 3, 4, 5) 220 mm (mode 2) 500 mm (Mode 1, 3, 4, 5 combined with 6) 300 mm (Mode 2 and 6 combined)
	Adjustable switching threshold for background suppression	15 mm ... 320 mm (mode 1, 3, 4, 5)
	Adjustable switching threshold for foreground suppression	15 mm ... 500 mm (Mode 1, 3, 4, 5 combined with 6) 15 mm ... 220 mm (mode 2) 15 mm ... 300 mm (Mode 2 and 6 combined)
	Reference object	Object with 90% remission factor (complies with standard white according to DIN 5033)
	Minimum distance between set sensing range and background (black 6% / white 90%)	2 mm, at a distance of 120 mm (mode 1, 3, 4, 5) 1 mm, at a distance of 120 mm (Mode 1, 3, 4, 5 combined with 6)
	Minimum object height at set sensing range in front of black background (6% remission factor)	2 mm, at a distance of 120 mm (mode 2) 1 mm, at a distance of 120 mm (Mode 2 and 6 combined)
	Recommended sensing range for the best performance	40 mm ... 150 mm (Mode 1, 2, 3, 4, 5; Mode 1, 2, 3, 4, 5 combined with 6)
Distance value	Measuring range	15 mm ... 320 mm
	Repeatability	0,1 mm ... 2 mm ^{1) 2) 3)}
	Accuracy	4 mm ... 49 mm ^{1) 4)}
	Distance value output	Via IO-Link
	Resolution	0.1 mm
	Update rate of the distance value	8 ms
Emitted beam	Light source	PinPoint Pro LED
	Type of light	Visible red light
	Shape of light spot	Rectangular
	Light spot size (distance)	6 mm x 4.5 mm (150 mm)
	Maximum dispersion of the emitted beam around the standardized transmission axis (squint angle)	< +/- 1.5° (at T _u = +23 °C)
Focus position		150 mm
Key LED figures	Normative reference	EN 62471:2008-09 IEC 62471:2006, modified
	LED risk group marking	Free group
	Wave length	635 nm
	Average service life	100,000 h at T _a = +25 °C
Smallest detectable object (MDO) typ.		0.3 mm, at a distance of 100 mm, mode 1, 3, 4, 5 0.3 mm, at a distance of 100 mm, Mode 1, 3, 4, 5 combined with 6 Object with 90% remission factor (corresponds to standard white according to DIN 5033), without background
Adjustment	Teach-Turn adjustment	BluePilot For adjusting the sensing range with mode selection
	IO-Link	For configuring the sensor parameters and Smart Task functions
Display	LED blue	BluePilot: Display of mode, display of output states Q _U (LED 3 permanently on) and Q _{L2} (LED 5 permanently on)
	LED green	Operating indicator

¹⁾ 90% remission factor.

²⁾ Equivalent to 3 σ.

³⁾ See repeatability characteristic lines.

⁴⁾ See accuracy curve.

LED yellow	Static on: power on Flashing: IO-Link mode Status of received light beam Static on: object present Static off: object not present
Special features	MultiMode

¹⁾ 90% remission factor.
²⁾ Equivalent to 3 σ.
³⁾ See repeatability characteristic lines.
⁴⁾ See accuracy curve.

SAFETY-RELATED PARAMETERS

MTTF _D	642 years
DC _{avg}	0 %
T _M (mission time)	20 years

COMMUNICATION INTERFACE

IO-Link	✓ , IO-Link V1.1
Data transmission rate	COM2 (38,4 kBaud)
Cycle time	2.3 ms
Process data length	16 Bit
Process data structure A	Bit 0 = switching signal Q _{L1} Bit 1 = switching signal Q _{L2} Bit 2 = Uncertainty flag (Quality of run alarm) Bit 3 ... 15 = Current receiver level (live)
Process data structure B	Bit 0 ... 15 = Distance value 0.1 mm (live)
VendorID	26
DeviceID HEX	0x8003DA
DeviceID DEC	8389594
Compatible master port type	A
SIO mode support	Yes

ELECTRONICS

Supply voltage U _B	10 V DC ... 30 V DC ¹⁾
Ripple	≤ 5 V
Usage category	DC-12 (According to EN 60947-5-2) DC-13 (According to EN 60947-5-2)
Current consumption	≤ 25 mA, without load. At U _B = 24 V

¹⁾ Limit values.
²⁾ Signal transit time with resistive load in switching mode.
³⁾ With light/dark ratio 1:1.
⁴⁾ This switching output must not be connected to another output.

Protection class	III																				
Digital output	<table> <tr> <td>Number</td><td>2 (Complementary)</td></tr> <tr> <td>Type</td><td>Push-pull: PNP/NPN</td></tr> <tr> <td>Switching mode</td><td>Light/dark switching</td></tr> <tr> <td>Signal voltage PNP HIGH/LOW</td><td>Approx. U_B -2.5 V / 0 V</td></tr> <tr> <td>Signal voltage NPN HIGH/LOW</td><td>Approx. U_B / < 2.5 V</td></tr> <tr> <td>Output current I_{max}</td><td>≤ 100 mA</td></tr> <tr> <td>Circuit protection outputs</td><td>Reverse polarity protected Overcurrent protected Short-circuit protected</td></tr> <tr> <td>Response time</td><td> $\leq 500 \mu s$ (mode 1, 2, 3)²⁾ $\leq 1,000 \mu s$ (mode 4, 5)²⁾ $\leq 15 ms$ (Mode 1, 2, 3 combined with 6)²⁾ $\leq 30 ms$ (Mode 4, 5 combined with 6)²⁾ </td></tr> <tr> <td>Repeatability (response time)</td><td> $150 \mu s$ (mode 1, 2, 3)²⁾ $350 \mu s$ (mode 4, 5)²⁾ $5 ms$ (Mode 1, 2, 3 combined with 6)²⁾ $10 ms$ (Mode 4, 5 combined with 6)²⁾ </td></tr> <tr> <td>Switching frequency</td><td> $1,000 Hz$ (mode 1, 2, 3)³⁾ $500 Hz$ (mode 4, 5)³⁾ $30 Hz$ (Mode 1, 2, 3 combined with 6)³⁾ $15 Hz$ (Mode 4, 5 combined with 6)³⁾ </td></tr> </table>	Number	2 (Complementary)	Type	Push-pull: PNP/NPN	Switching mode	Light/dark switching	Signal voltage PNP HIGH/LOW	Approx. U_B -2.5 V / 0 V	Signal voltage NPN HIGH/LOW	Approx. U_B / < 2.5 V	Output current I_{max}	≤ 100 mA	Circuit protection outputs	Reverse polarity protected Overcurrent protected Short-circuit protected	Response time	$\leq 500 \mu s$ (mode 1, 2, 3) ²⁾ $\leq 1,000 \mu s$ (mode 4, 5) ²⁾ $\leq 15 ms$ (Mode 1, 2, 3 combined with 6) ²⁾ $\leq 30 ms$ (Mode 4, 5 combined with 6) ²⁾	Repeatability (response time)	$150 \mu s$ (mode 1, 2, 3) ²⁾ $350 \mu s$ (mode 4, 5) ²⁾ $5 ms$ (Mode 1, 2, 3 combined with 6) ²⁾ $10 ms$ (Mode 4, 5 combined with 6) ²⁾	Switching frequency	$1,000 Hz$ (mode 1, 2, 3) ³⁾ $500 Hz$ (mode 4, 5) ³⁾ $30 Hz$ (Mode 1, 2, 3 combined with 6) ³⁾ $15 Hz$ (Mode 4, 5 combined with 6) ³⁾
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¹⁾ Limit values.²⁾ Signal transit time with resistive load in switching mode.³⁾ With light/dark ratio 1:1.⁴⁾ This switching output must not be connected to another output.

MECHANICS

Housing	Rectangular												
Design detail	Flat												
Dimensions (W x H x D)	16 mm x 40.1 mm x 12.1 mm												
Connection	Cable, 4-wire, 2 m												
Connection detail	<table> <tr> <td>Deep-freeze property</td><td>Do not bend below 0 °C</td></tr> <tr> <td>Conductor size</td><td>0.14 mm²</td></tr> <tr> <td>Cable diameter</td><td>Ø 3.4 mm</td></tr> <tr> <td>Length of cable (L)</td><td>2 m</td></tr> <tr> <td>Bending radius</td><td>For flexible use > 12 x cable diameter</td></tr> <tr> <td>Bending cycles</td><td>1,000,000</td></tr> </table>	Deep-freeze property	Do not bend below 0 °C	Conductor size	0.14 mm ²	Cable diameter	Ø 3.4 mm	Length of cable (L)	2 m	Bending radius	For flexible use > 12 x cable diameter	Bending cycles	1,000,000
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Material	<table> <tr> <td>Housing</td><td>Plastic, VISTAL®</td></tr> <tr> <td>Front screen</td><td>Plastic, PMMA</td></tr> <tr> <td>Cable</td><td>Plastic, PVC</td></tr> </table>	Housing	Plastic, VISTAL®	Front screen	Plastic, PMMA	Cable	Plastic, PVC						
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PHOTOELECTRIC SENSORS - WTM4FF-1H161120A00

Weight	Approx. 84 g
Maximum tightening torque of the fixing screws	0.4 Nm

AMBIENT DATA

Enclosure rating	IP66 (EN 60529) IP67 (EN 60529)
Ambient operating temperature	−40 °C ... +60 °C
Ambient temperature, storage	−40 °C ... +75 °C
Typ. Ambient light immunity	Artificial light: ≤ 50,000 lx Sunlight: ≤ 50,000 lx
Shock resistance	30 g, 11 ms (3 positive and 3 negative shocks along X, Y, Z axes, 18 total shocks (EN60068-2-27))
Vibration resistance	10 Hz ... 1,000 Hz (Amplitude 1 mm, 3 x 30 min (EN60068-2-6))
Air humidity	35 % ... 95 %, relative humidity (no condensation)
Electromagnetic compatibility (EMC)	EN 60947-5-2
Resistance to cleaning agent	ECOLAB
UL File No.	NRKH.E181493 & NRKH7.E181493

SMART TASK

Smart Task name	Base logics
Logic function	Direct AND OR
Timer function	Deactivated Switch-on delay Off delay ON and OFF delay Impulse (one shot)
Inverter	Yes
Switching frequency	SIO Logic: 900 Hz (mode 1, 2, 3) ¹⁾ SIO Logic: 450 Hz (mode 4, 5) ¹⁾ SIO Logic: 30 Hz (Mode 1, 2, 3 combined with 6) ¹⁾ SIO Logic: 15 Hz (Mode 4, 5 combined with 6) ¹⁾ IOL: 800 Hz (mode 1, 2, 3) ²⁾ IOL: 450 Hz (mode 4, 5) ²⁾ IOL: 30 Hz (Mode 1, 2, 3 combined with 6) ²⁾ IOL: 15 Hz (Mode 4, 5 combined with 6) ²⁾
Response time	SIO logic: 550 µs (mode 1, 2, 3) ¹⁾ SIO Logic: 1100 µs (mode 4, 5) ¹⁾ SIO Logic: 15 ms (Mode 1, 2, 3 combined with 6) ¹⁾ SIO Logic: 30 ms (Mode 4, 5 combined with 6) ¹⁾ IOL: 600 µs (mode 1, 2, 3) ²⁾ IOL: 1100 µs (mode 4, 5) ²⁾ IOL: 15 ms (Mode 1, 2, 3 combined with 6) ²⁾ IOL: 30 ms (Mode 4, 5 combined with 6) ²⁾
Repeatability	SIO Logic: 200 µs (mode 1, 2, 3) ¹⁾ SIO Logic: 400 µs (mode 4, 5) ¹⁾ SIO Logic: 5 ms (Mode 1, 2, 3 combined with 6) ¹⁾ SIO Logic: 10 ms (Mode 4, 5 combined with 6) ¹⁾ IOL: 250 µs (mode 1, 2, 3) ²⁾ IOL: 450 µs (mode 4, 5) ²⁾ IOL: 5 ms (Mode 1, 2, 3 combined with 6) ²⁾

¹⁾ Use of Smart Task functions without IO-Link communication (SIO mode).

²⁾ Use of Smart Task functions with IO-Link communication function.

		IOL: 10 ms (Mode 4, 5 combined with 6) ²⁾
Switching signal	Switching signal Q _{LI}	Switching output
	Switching signal Q̄ _{LI}	Switching output

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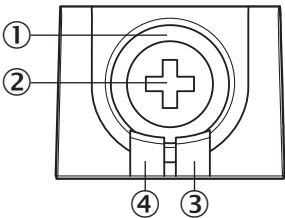
DIAGNOSIS

Device temperature	Measuring range	Very cold, cold, moderate, warm, hot
Device status		Yes
Detailed device status		Yes
Operating hour counter		Yes
Operating hours counter with reset function		Yes
Quality of teach		Yes
Quality of run		Yes, Contamination display

CERTIFICATES

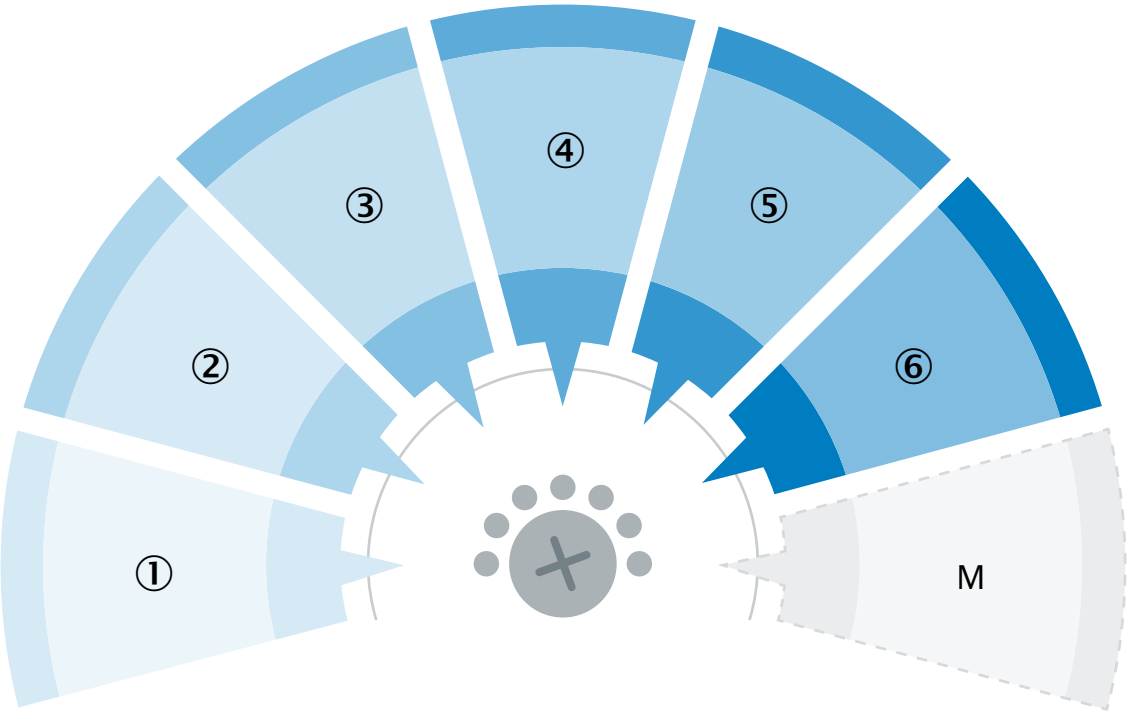
EU declaration of conformity	✓
UK declaration of conformity	✓
ACMA declaration of conformity	✓
Moroccan declaration of conformity	✓
China RoHS	✓
ECOLAB certificate	✓
cULus certificate	✓
IO-Link certificate	✓
Photobiological safety (DIN EN 62471) certificate	✓
Information according to Art. 3 of Data Act (Regulation EU 2023/2854)	✓

DISPLAY AND ADJUSTMENT ELEMENTS



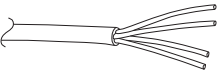
- ① LED blue
- ② Teach-Turn adjustment
- ③ LED yellow
- ④ LED green

DISPLAY AND SETTING DETAIL

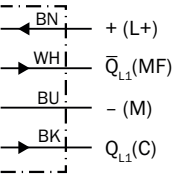


MultiMode settings		
1		Background suppression
2		Foreground suppression
3		Two Value Teach-in
4		Two independent switching points
5		Window Mode
6		ApplicationSelect
M		Manual / measurement

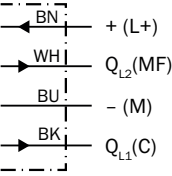
CONNECTION TYPE CABLE, 4-WIRE



CONNECTION DIAGRAM CD-600 (MODE 1, 2, 3, 5, 6)



CONNECTION DIAGRAM CD-599 (MODE 4)



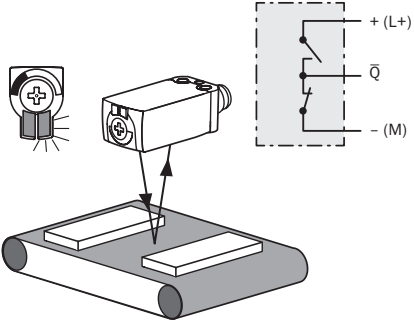
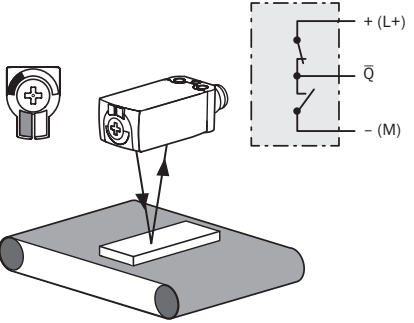
TRUTH TABLE PUSH-PULL: PNP/NPN - DARK SWITCHING $\bar{Q}_{L2}$ (MULTIMODE 4)

	Dark switching $\bar{Q}_{L2}$ (normally closed (upper switch), normally open (lower switch))	
	Object not present → Output HIGH	Object present → Output LOW
Light receive	✗	✓
Light receive indicator	✗	☀
Load resistance to L+	✗	⚡
Load resistance to M	⚡	✗

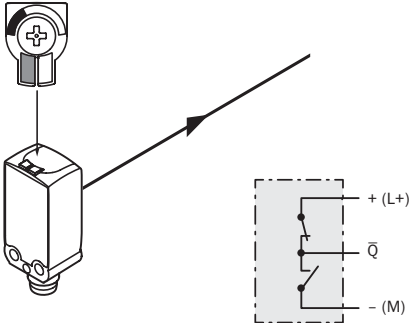
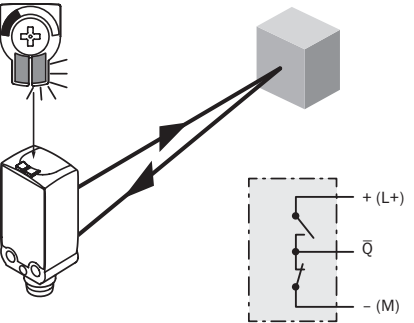
TRUTH TABLE PUSH-PULL: PNP/NPN - DARK SWITCHING $\bar{Q}_{L1}$ (MULTIMODE 4)

	Dark switching $\bar{Q}_{L1}$ (normally closed (upper switch), normally open (lower switch))	
	Object not present → Output HIGH	Object present → Output LOW
Light receive	✗	✓
Light receive indicator	✗	☀
Load resistance to L+	✗	⚡
Load resistance to M	⚡	✗

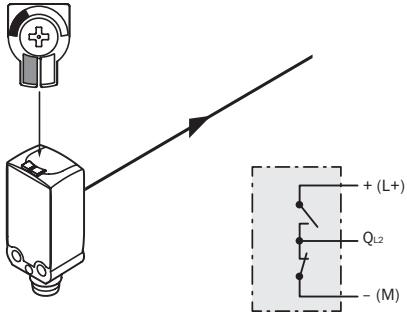
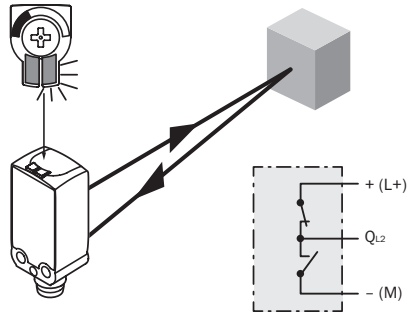
TRUTH TABLE PUSH-PULL: PNP/NPN - DARK SWITCHING $\bar{Q}$ (MULTIMODE 2)

	Dark switching $\bar{Q}$ (normally open (upper switch), normally closed (lower switch))	
	Object not present → Output LOW	Object present → Output HIGH
Light receive	✓	✗
Light receive indicator	☀	✗
Load resistance to L+	⚡	✗
Load resistance to M	✗	⚡
		

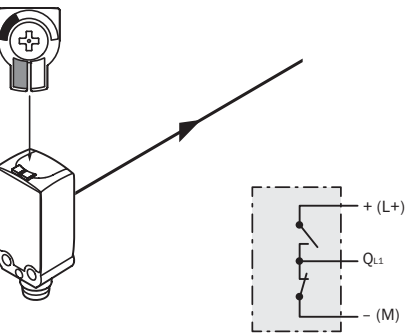
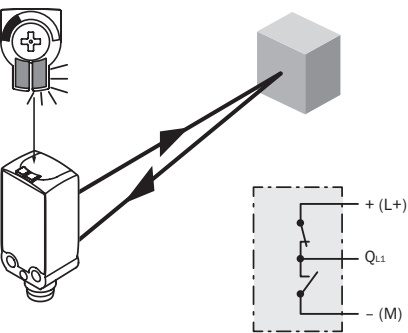
TRUTH TABLE PUSH-PULL: PNP/NPN - DARK SWITCHING $\bar{Q}$ (MULTIMODE 1, 3, 5, 6)

	Dark switching $\bar{Q}$ (normally closed (upper switch), normally open (lower switch))	
	Object not present → Output HIGH	Object present → Output LOW
Light receive	✗	✓
Light receive indicator	✗	☀
Load resistance to L+	✗	⚡
Load resistance to M	⚡	✗
		

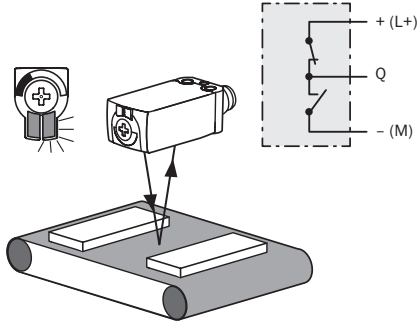
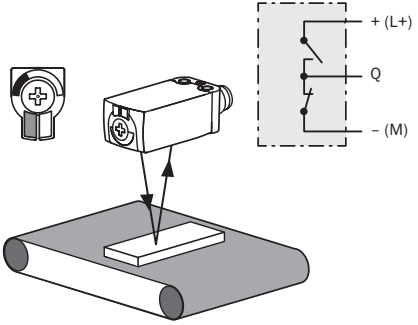
TRUTH TABLE PUSH-PULL: PNP/NPN - LIGHT SWITCHING QL2 (MULTIMODE 4)

	Light switching Q _{L2} (normally open (upper switch), normally closed (lower switch))	
	Object not present → Output LOW	Object present → Output HIGH
Light receive	✗	✓
Light receive indicator	✗	☀
Load resistance to L+	⚡	✗
Load resistance to M	✗	⚡
		

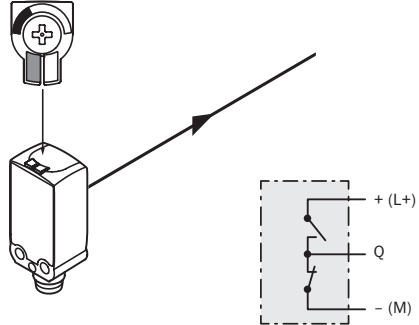
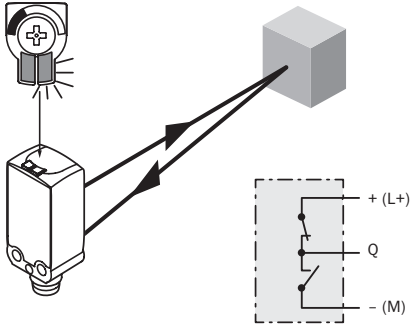
TRUTH TABLE PUSH-PULL: PNP/NPN - LIGHT SWITCHING QL1 (MULTIMODE 4)

	Light switching Q _{L1} (normally open (upper switch), normally closed (lower switch))	
	Object not present → Output LOW	Object present → Output HIGH
Light receive	✗	✓
Light receive indicator	✗	☀
Load resistance to L+	⚡	✗
Load resistance to M	✗	⚡
		

TRUTH TABLE PUSH-PULL: PNP/NPN - LIGHT SWITCHING Q (MULTIMODE 2)

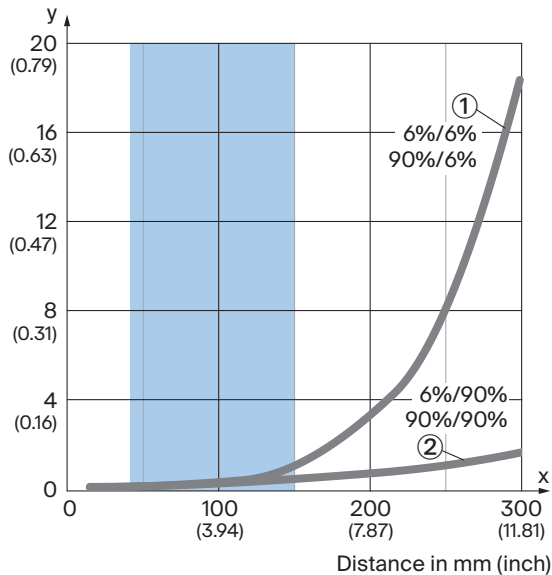
	Light switching Q (normally closed (upper switch), normally open (lower switch))	
	Object not present → Output HIGH	Object present → Output LOW
Light receive	✓	✗
Light receive indicator	☀	✗
Load resistance to L+	✗	⚡
Load resistance to M	⚡	✗
		

TRUTH TABLE PUSH-PULL: PNP/NPN - LIGHT SWITCHING Q (MULTIMODE 1, 3, 5, 6)

	Light switching Q (normally open (upper switch), normally closed (lower switch))	
	Object not present → Output LOW	Object present → Output HIGH
Light receive	✗	✓
Light receive indicator	✗	☀
Load resistance to L+	⚡	✗
Load resistance to M	✗	⚡
		

CHARACTERISTIC CURVE MODE 2 AND 6 COMBINED (HIGHPRECISION/LONGRANGE MODE)

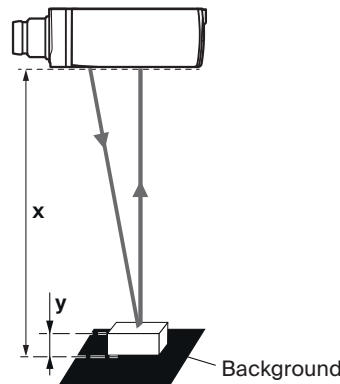
Minimum object height in mm (inch)



Recommended sensing range for the best performance

- ① Black background, 6% remission factor
- ② White background, 90% remission factor

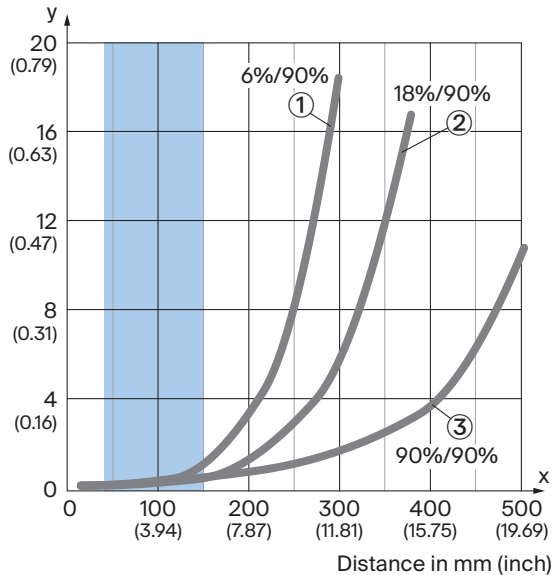
Example:
Reliable detection of the object



Black background (6 % remission factor)
Distance of sensor to background $x = 120$ mm
Required minimum object height $y = 1$ mm
For all objects regardless of their colors

CHARACTERISTIC CURVE MODE 1, 3, 4, 5 COMBINED WITH 6 (HIGHPRECISION/LONGRANGE MODE)

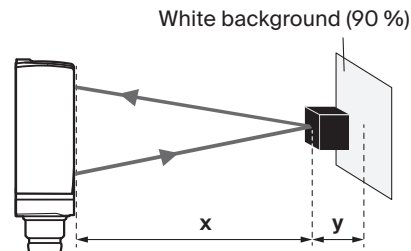
Minimum distance in mm (y) between the set sensing range and white background (90 % remission)



Recommended sensing range for the best performance

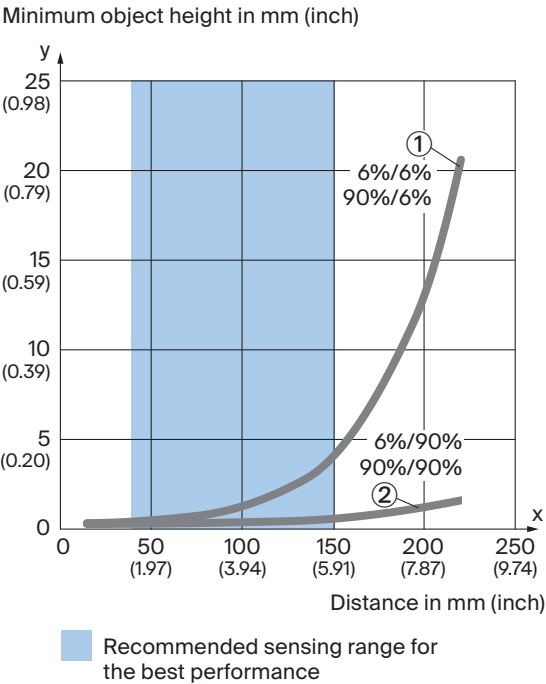
- ① Black object, 6% remission factor
- ② Gray object, 18% remission factor
- ③ White object, 90% remission factor

Example:
Safe suppression of the background



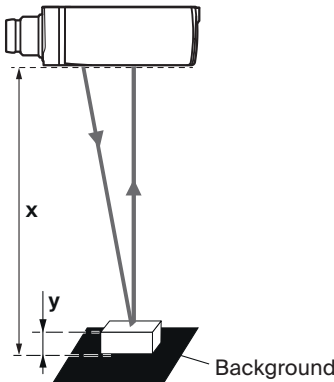
Black object (6 % remission)
Set sensing range $x = 120$ mm
Needed minimum distance to white background $y = 1$ mm

CHARACTERISTIC CURVE MODE 2 (SPEED MODE)



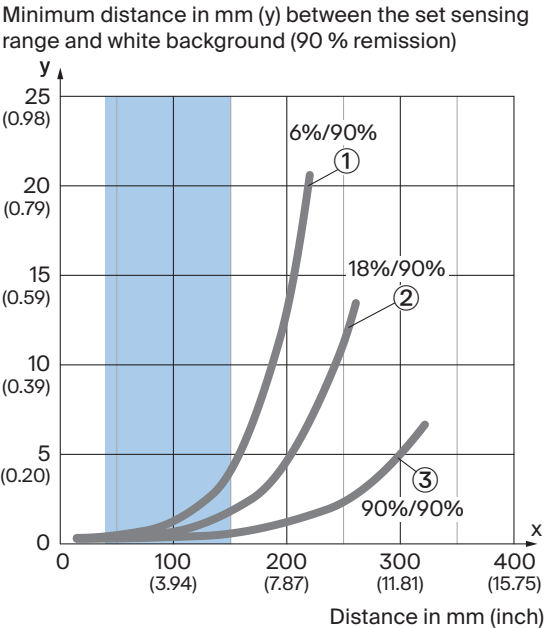
- ① Black background, 6% remission factor
- ② White background, 90% remission factor

Example:
Reliable detection of the object



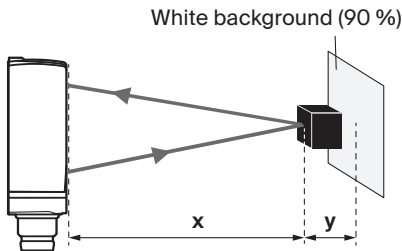
Black background (6 % remission factor)
Distance of sensor to background $x = 120$ mm
Required minimum object height $y = 2$ mm
For all objects regardless of their colors

CHARACTERISTIC CURVE MODE 1, 3, 4, 5 (SPEED MODE)



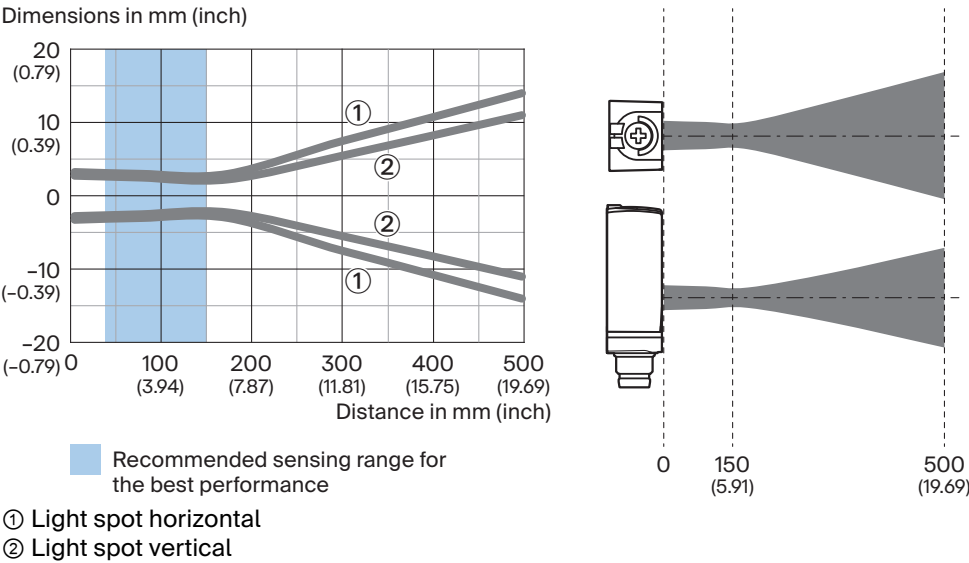
- ① Black background, 6% remission factor
- ② Gray object, 18% remission factor
- ③ White background, 90% remission factor

Example:
Safe suppression of the background

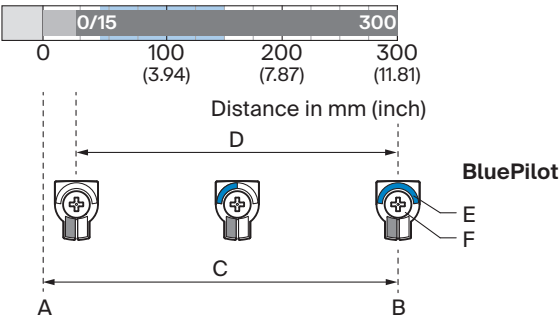


Black object (6 % remission)
Set sensing range $x = 120$ mm
Needed minimum distance to white background $y = 2$ mm

LIGHT SPOT SIZE



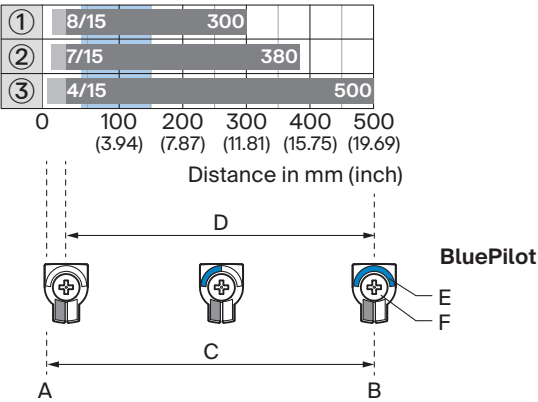
SENSING RANGE DIAGRAM MODE 2 AND 6 COMBINED (HIGHPRECISION/LONGRANGE MODE)



Recommended sensing range for the best performance

A	Sensing range min. in mm
B	Sensing range max. in mm
C	Field of view
D	Adjustable switching threshold for foreground suppression
E	Sensing range indicator
F	Teach-Turn adjustment

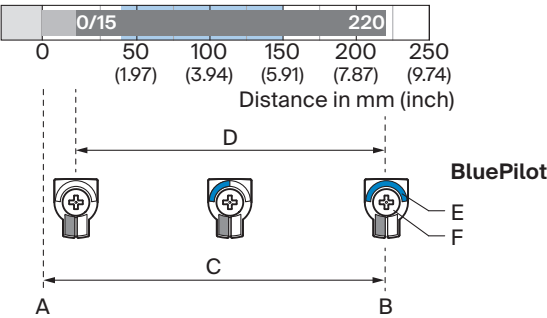
SENSING RANGE DIAGRAM MODE 1, 3, 4, 5 COMBINED WITH 6 (HIGHPRECISION/LONGRANGE MODE)



Recommended sensing range for the best performance

1	Black object, 6% remission factor
2	Gray object, 18% remission factor
3	White object, 90% remission factor
A	Sensing range min. in mm
B	Sensing range max. in mm
C	Field of view
D	Adjustable switching threshold for background suppression
E	Sensing range indicator
F	Teach-Turn adjustment

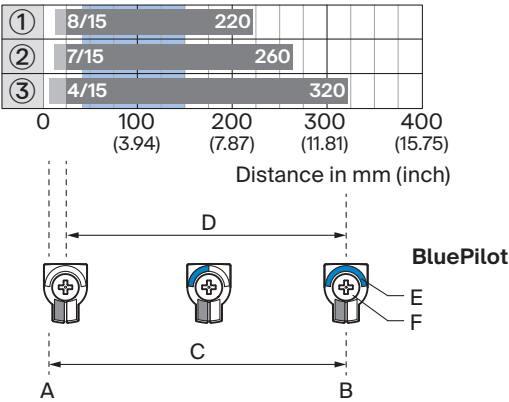
SENSING RANGE DIAGRAM MODE 2 (SPEED MODE)



Recommended sensing range for the best performance

A	Sensing range min. in mm
B	Sensing range max. in mm
C	Field of view
D	Adjustable switching threshold for foreground suppression
E	Sensing range indicator
F	Teach-Turn adjustment

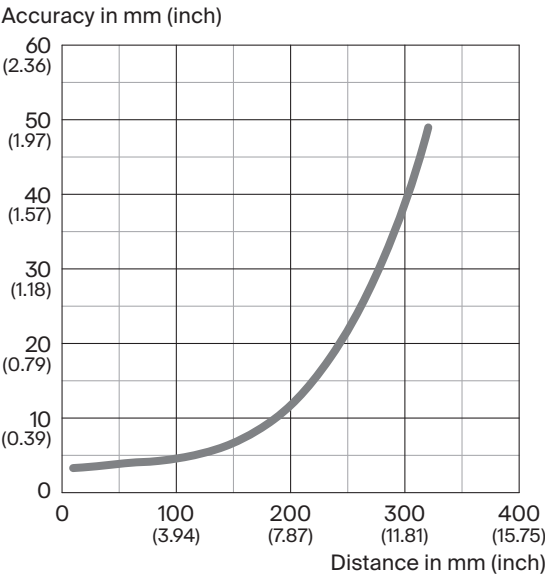
SENSING RANGE DIAGRAM MODE 1, 3, 4, 5 (SPEED MODE)



Recommended sensing range for the best performance

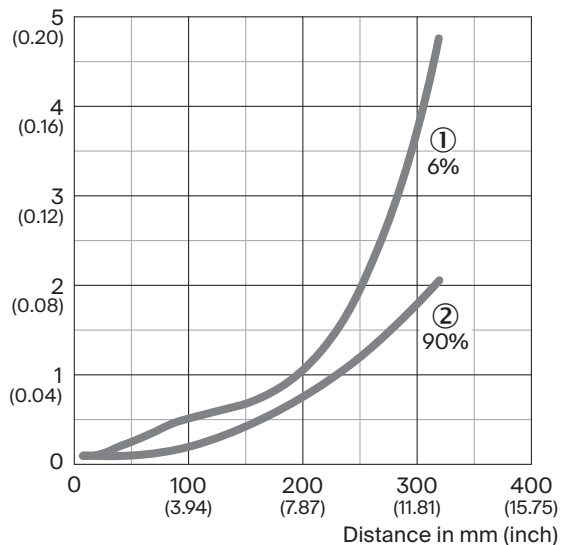
1	Black object, 6% remission factor
2	Gray object, 18% remission factor
3	White object, 90% remission factor
A	Sensing range min. in mm
B	Sensing range max. in mm
C	Field of view
D	Adjustable switching threshold for background suppression
E	Sensing range indicator
F	Teach-Turn adjustment

ACCURACY (MODE M MANUAL / MEASUREMENT)



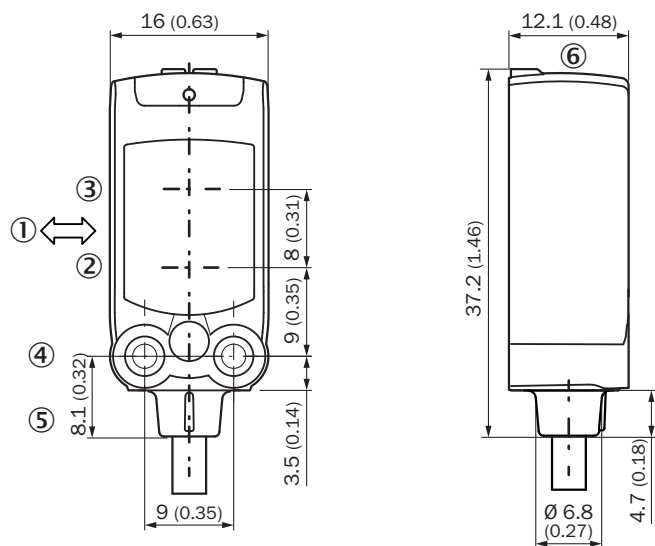
REPEATABILITY (MODE M MANUAL / MEASUREMENT)

Repeatability in mm (inch)



- ① 6% remission factor, on black
- ② 90% remission factor, on white

DIMENSIONAL DRAWING



Dimensions in mm (inch)

- ① Standard direction of the material being detected
- ② Center of optical axis, sender
- ③ Center of optical axis, receiver
- ④ M3 mounting hole
- ⑤ Connection
- ⑥ display and adjustment elements

Further information as well as suitable accessories, example applications and downloads such as CAD dimensional models, operating instructions and software can be found at www.sick.com/1157439



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SICK AT A GLANCE

SICK is a leading global technology company for intelligent sensors and integrated solutions in industrial automation. Our technologies set benchmarks, making your industrial processes more efficient, safer and more sustainable – both in logistics and manufacturing operations.

SICK combines sensor intelligence with industry expertise and certified consulting services. We provide the ideal foundation for scalable as well as tailor-made automation solutions and create added value along the entire value chain. Our close partnerships with our customers are more than just a promise: Together, we optimize productivity, improve quality, protect health and safety, and help build a sustainable future. All with empathy and trust.

Since 1946, we have been developing innovative technologies with passion and a pioneering spirit. With a global network in around 40 countries, SICK has a global presence and is always close by. The company's headquarters are located in Waldkirch near Freiburg, Germany. Our customers benefit from our understanding of both local and global requirements, which enables us to deliver tailor-made solutions

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