



DATA SHEET

WTM12F-24161120A00ZDZZZZZZZZZZ1

W12
Photoelectric sensors

SICK Sensor Intelligence



Illustration may differ

PHOTOELECTRIC SENSORS

WTM12F-
24161120A00ZDZZZZZZZZ1

ORDERING INFORMATION

Type	part no.
WTM12F-24161120A00ZDZZZZZZZZ1	1152325

Further device versions and accessories at www.sick.com/W12



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.	10 mm (mode 1, 3, 4, 5) 0 mm (mode 2) 10 mm (Mode 1, 3, 4, 5 combined with 6) 0 mm (Mode 2 and 6 combined)
	Sensing range max.	1,100 mm (mode 1, 3, 4, 5) 650 mm (mode 2) 1,400 mm (Mode 1, 3, 4, 5 combined with 6) 1,000 mm (Mode 2 and 6 combined)
	Adjustable switching threshold for background suppression	40 mm ... 1,100 mm (mode 1, 3, 4, 5) 40 mm ... 1,400 mm (Mode 1, 3, 4, 5 combined with 6)
	Adjustable switching threshold for foreground suppression	40 mm ... 650 mm (mode 2) 40 mm ... 1,000 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%)	9 mm, at a distance of 400 mm (mode 1, 3, 4, 5) 3 mm, at a distance of 400 mm (Mode 1, 3, 4, 5 combined with 6)
	Minimum object height at set sensing range in front of black background (6% remission factor)	9 mm, at a distance of 400 mm (mode 2) 3 mm, at a distance of 400 mm (Mode 2 and 6 combined)
	Recommended sensing range for the best performance	50 mm ... 550 mm
	Distance value	
	Measuring range	40 mm ... 1,000 mm
Emitted beam	Repeatability	0,2 mm ... 9 mm ^{1) 2) 3)}
	Accuracy	3 mm ... 125 mm ^{1) 4)}
	Distance value output	Via IO-Link
	Resolution	0.1 mm
	Update rate of the distance value	8 ms
Focus position	Light source	PinPoint Pro LED
	Type of light	Visible red light
	Shape of light spot	Rectangular
	Light spot size (distance)	14 mm x 11 mm (400 mm)
	Maximum dispersion of the emitted beam around the standardized transmission axis (squint angle)	< +/- 1.0° (at T _u = +23 °C)
Key LED figures		
Smallest detectable object (MDO) typ.	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
Adjustment		0.3 mm, at a distance of 200 mm, mode 1, 3, 4, 5 0.3 mm, at a distance of 200 mm, mode 2 0.3 mm, at a distance of 200 mm, Mode 1, 3, 4, 5 combined with 6 0.3 mm, at a distance of 200 mm, Mode 2 and 6 combined Object with 90% remission factor (complies with standard white according to DIN 5033)
	Teach-Turn adjustment	BluePilot For adjusting the sensing range with mode selection

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

	IO-Link	For configuring the sensor parameters and Smart Task functions
Display	LED blue	BluePilot: Display of mode, display of output states Q _{L1} (LED 3 permanently on) and Q _{L2} (LED 5 permanently on)
	LED green	Operating indicator Static on: power on Flashing: IO-Link mode
	LED yellow	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	1,208 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 ... 15 = Current receiver level (live)
Process data structure B	Bit 0 ... 15 = Distance value 0.1 mm (live)
VendorID	26
DeviceID HEX	0x8003A4
DeviceID DEC	8389540
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	≤ 40 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	
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	≤ 330 μs (mode 1, 2, 3) ²⁾ ≤ 1,000 μs (mode 4, 5) ²⁾ ≤ 15 ms (Mode 1, 2, 3 combined with 6) ²⁾ ≤ 30 ms (Mode 4, 5 combined with 6) ²⁾
Repeatability (response time)	100 μs (mode 1, 2, 3) ²⁾ 350 μs (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	1,500 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⁾
Pin/Wire assignment	
Function of pin 4/black (BK)	Digital output, light switching, object present → output QL1 HIGH (Mode 1, 3, 4, 5, 6) ⁴⁾ Digital output, dark switching, object present → output $\bar{Q}$ L1 HIGH (Mode 2) ⁴⁾ IO-Link communication C
Function of pin 4/black (BK) – detail	The pin 4 function of the sensor can be configured Additional possible settings via IO-Link
Function of pin 2/white (WH)	Digital output, dark switching, object present → output $\bar{Q}$ L1 LOW (Mode 1, 3, 5, 6) ⁴⁾ Digital output, light switching, object present → output QL1 LOW (Mode 2) ⁴⁾ Digital output, light switching, object present → output QL2 HIGH (Mode 4) ⁴⁾
Function of pin 2/white (WH) – detail	The pin 2 function of the sensor can be configured Additional possible settings via IO-Link

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
Dimensions (W x H x D)	15.6 mm x 49.5 mm x 43.1 mm
Connection	Male connector M12, 4-pin
Material	
Housing	Metal, zinc diecast
Front screen	Plastic, PMMA
Male connector	Plastic, VISTAL®
Weight	Approx. 77 g
Maximum tightening torque of the fixing screws	1.4 Nm

AMBIENT DATA

Enclosure rating	IP66 (EN 60529) IP67 (EN 60529)
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	IP69 (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	50 g, 11 ms (25 positive and 25 negative shocks along X, Y, Z axes, 150 total shocks (EN60068-2-27))
Vibration resistance	10 Hz ... 2,000 Hz (Amplitude 0.5 mm / 10 g, 20 sweeps per axis, for X, Y, Z axes, 1 octave/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: 1300 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: 1200 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: 390 µs (mode 1, 2, 3) ¹⁾ SIO Logic: 1000 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: 420 µs (mode 1, 2, 3) ²⁾ IOL: 1000 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: 140 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: 170 µs (mode 1, 2, 3) ²⁾ IOL: 450 µs (mode 4, 5) ²⁾ IOL: 5 ms (Mode 1, 2, 3 combined with 6) ²⁾ IOL: 10 ms (Mode 4, 5 combined with 6) ²⁾
Switching signal	Switching signal Q _L Switching output Switching signal Q̄ _L Switching output

¹⁾ Use of Smart Task functions without IO-Link communication (SIO mode).
²⁾ Use of Smart Task functions with IO-Link communication function.

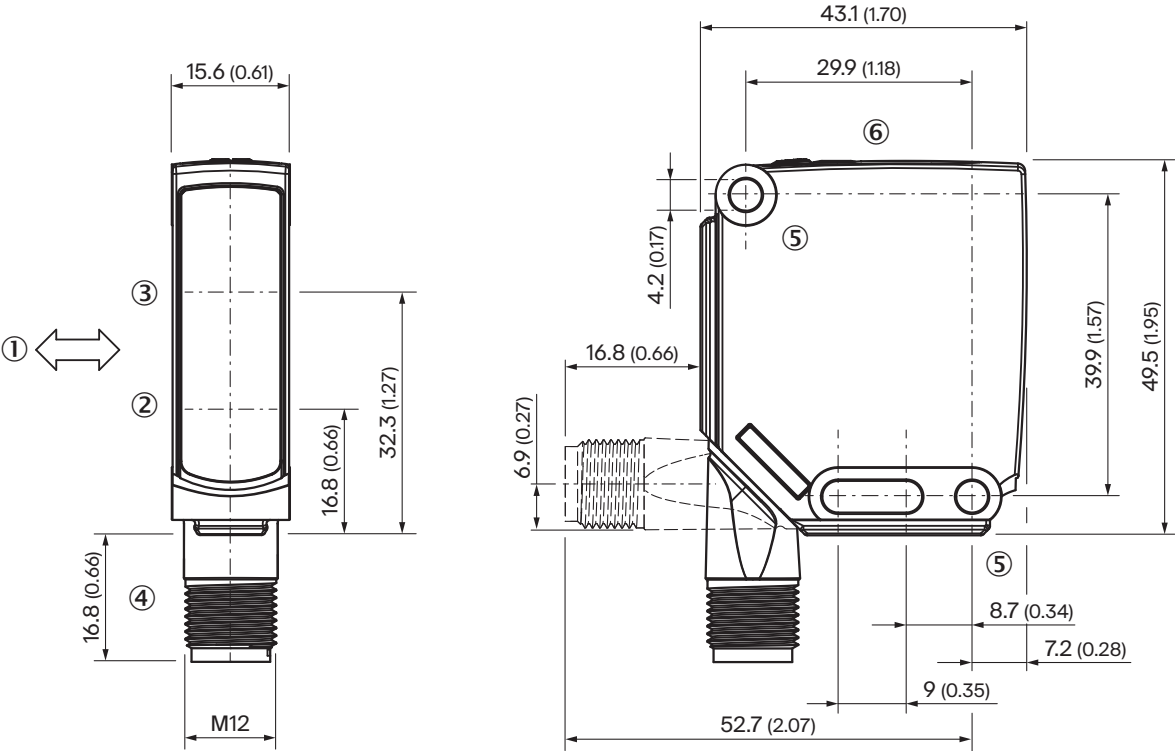
DIAGNOSIS

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

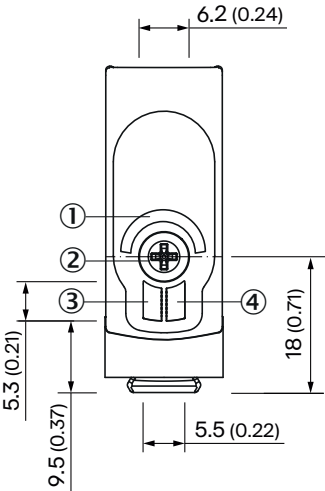
EU declaration of conformity	✓
UK declaration of conformity	✓
ACMA declaration of conformity	✓
Moroccan declaration of conformity	✓
China RoHS	✓
China Compulsory Product Certification (CCC) exempt	✓
ECOLAB certificate	✓
cULus certificate	✓
IO-Link certificate	✓
Photobiological safety (IEC EN 62471)	✓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

DIMENSIONAL DRAWING, SENSOR



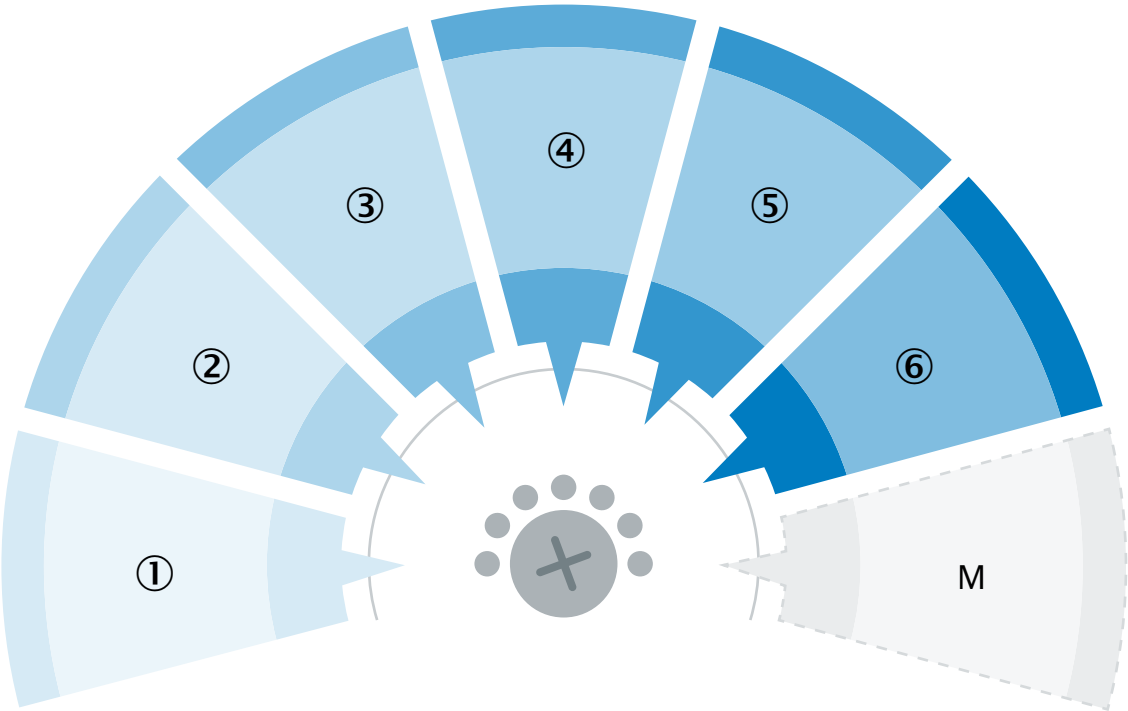
- Dimensions in mm (inch)
- ① Standard direction of the material being detected
 - ② Center of optical axis, sender
 - ③ Center of optical axis, receiver
 - ④ Connection
 - ⑤ Mounting hole, Ø 4.2 mm
 - ⑥ display and adjustment elements

DISPLAY AND ADJUSTMENT ELEMENTS



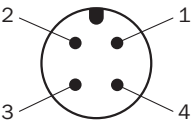
- ① LED blue
- ② Teach-Turn adjustment
- ③ LED green
- ④ LED yellow

DISPLAY AND SETTING DETAIL

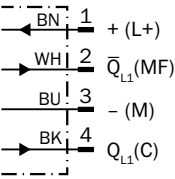


MultiMode settings	
1	Background suppression
2	Foreground suppression
3	Two Value Teach-in
4	Two independent switching points
5	Window Mode
6	ApplicationSelect
M	Manual / measurement

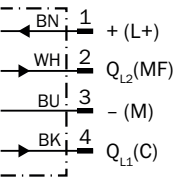
CONNECTION TYPE M12 MALE CONNECTOR, 4-PIN



CONNECTION DIAGRAM CD-598 (MODE 1, 2, 3, 5, 6)



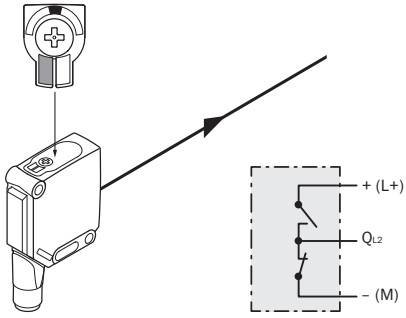
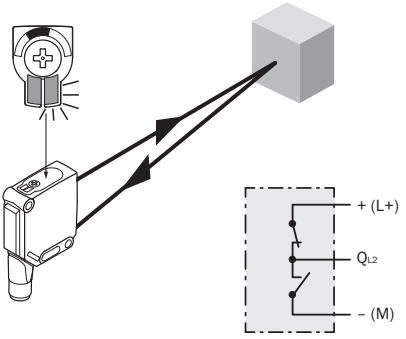
CONNECTION DIAGRAM CD-597 (MODE 4)



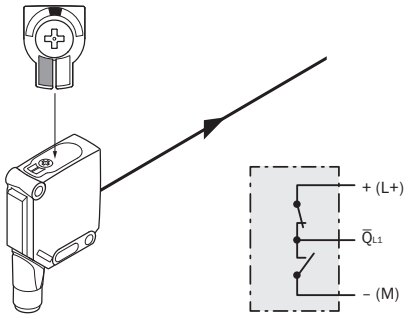
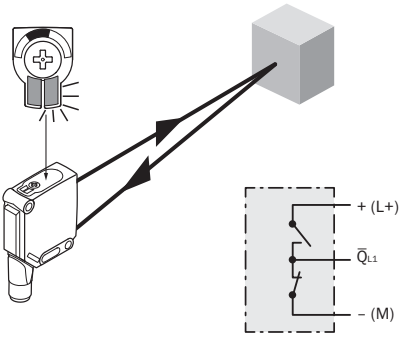
TRUTH TABLE PUSH-PULL: PNP/NPN – DARK SWITCHING $\bar{Q}_{L2}$ (MULTIMODE 4)

	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	⚡	✗

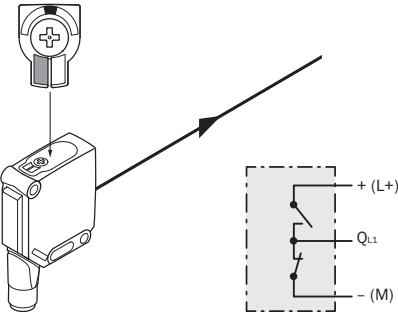
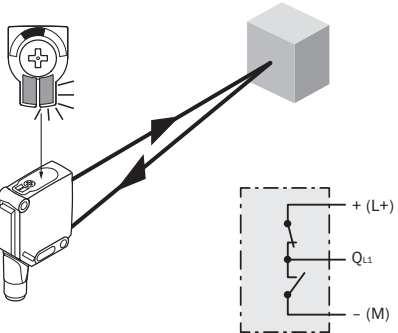
TRUTH TABLE PUSH-PULL: PNP/NPN - LIGHT SWITCHING Q_{L2} (MULTIMODE 4)

	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	✗	⚡
		

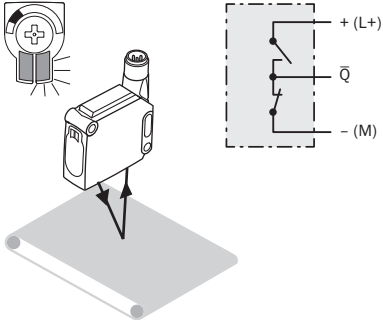
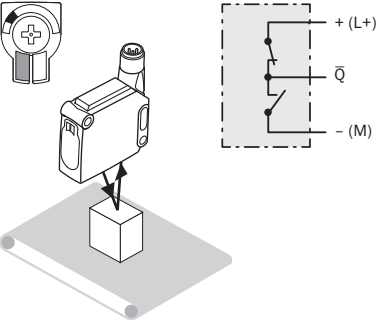
TRUTH TABLE PUSH-PULL: PNP/NPN - DARK SWITCHING Q̄_{L1} (MULTIMODE 4)

	Dark switching Q̄ _{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	⚡	✗
		

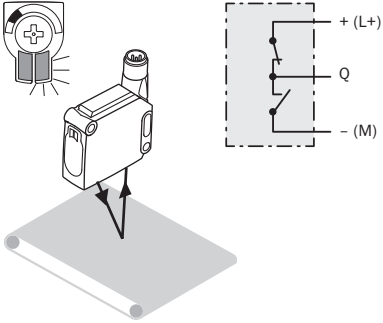
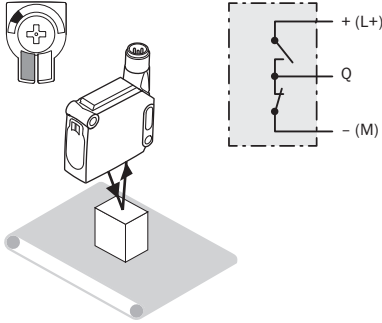
TRUTH TABLE PUSH-PULL: PNP/NPN – LIGHT SWITCHING Q_{L1} (MULTIMODE 4)

	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	✕	⚡
		

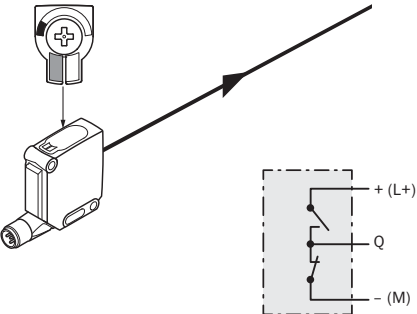
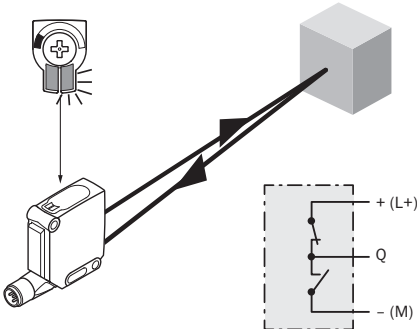
TRUTH TABLE PUSH-PULL: PNP/NPN – DARK SWITCHING Q̄ (MULTIMODE 2)

	Dark switching Q̄ (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	✕	⚡
		

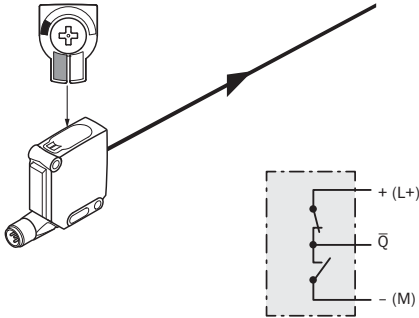
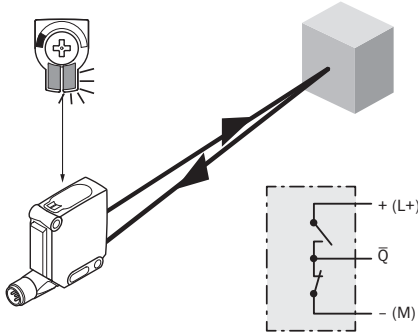
TRUTH TABLE PUSH-PULL: PNP/NPN - LIGHT SWITCHING Q (MULTIMODE 2)

	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	⚡	✗
		

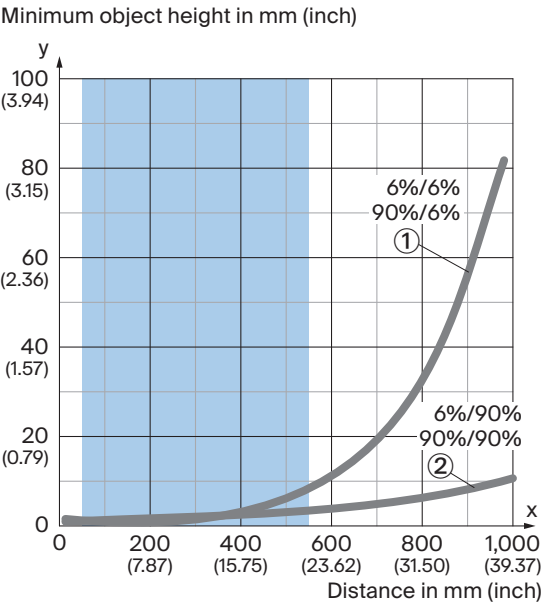
TRUTH TABLE PUSH-PULL: PNP/NPN - LIGHT SWITCHING Q (MULTIMODE 1, 3, 5, 6)

	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	✗	⚡
		

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

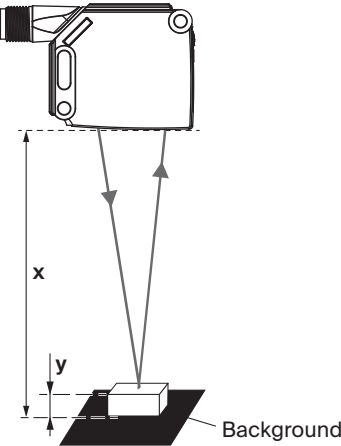
	Dark switching $\bar{Q}$ (normally closed (upper switch), normally open (lower switch))	
	Object not present → Output HIGH	Object present → Output LOW
Light receive	⊗	✓
Light receive indicator	⊗	☀
Load resistance to L+	⊗	⚡
Load resistance to M	⚡	⊗
		

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



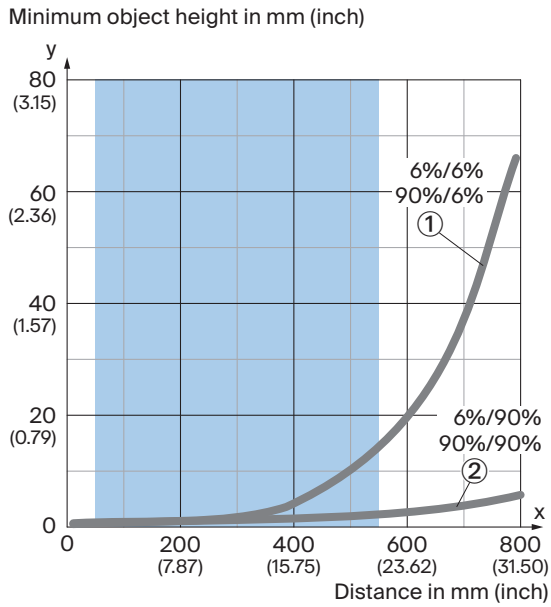
- Recommended sensing range for the best performance
- ① Black background, 6% remission factor
 - ② White background, 90% remission factor

Example:
Reliable detection of the object



Black background (6 % remission factor)
Distance of sensor to background $x = 400$ mm
Required minimum object height $y = 3$ mm
For all objects regardless of their colors

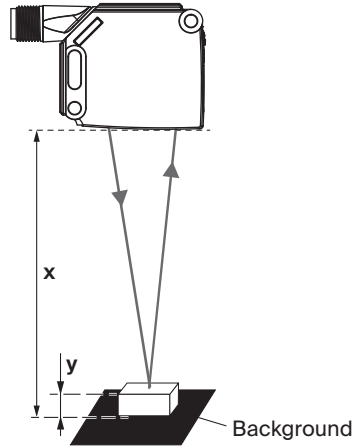
CHARACTERISTIC CURVE MODE 2 AND 6 COMBINED (BALANCED MODE)



Recommended sensing range for the best performance

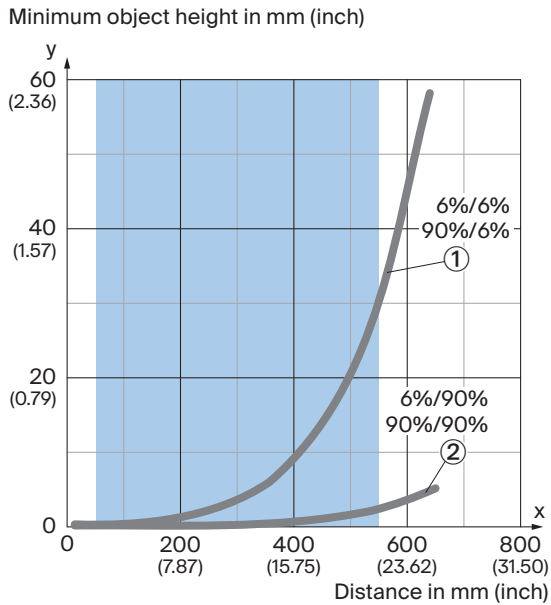
- ① Black background, 6% remission factor
- ② White background, 90% remission factor

Example:
Reliable detection of the object



Black background (6 % remission factor)
Distance of sensor to background $x = 400$ mm
Required minimum object height $y = 4$ mm
For all objects regardless of their colors

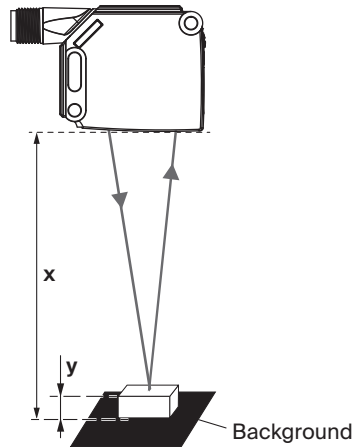
CHARACTERISTIC CURVE MODE 2



Recommended sensing range for the best performance

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

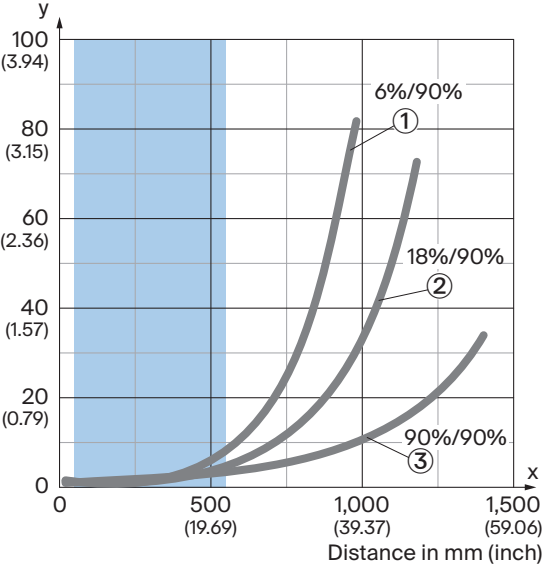
Example:
Reliable detection of the object



Black background (6 % remission factor)
Distance of sensor to background $x = 400$ mm
Required minimum object height $y = 9$ mm
For all objects regardless of their colors

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

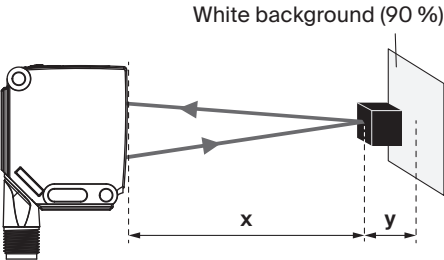
Minimum distance in mm (y) between the set sensing range and white background (90 % remission)



Recommended sensing range for the best performance

- ① Sensing range on black, 6% remission factor
- ② Sensing range on gray, 18% remission factor
- ③ Sensing range on white, 90% remission factor

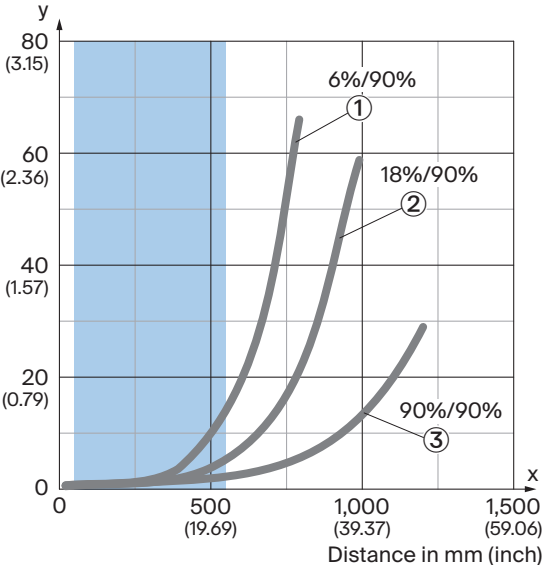
Example:
Safe suppression of the background



Black object (6 % remission)
Set sensing range x = 400 mm
Needed minimum distance to white background y = 3 mm

CHARACTERISTIC CURVE MODE 1, 3, 4, 5 COMBINED WITH 6 (BALANCED MODE)

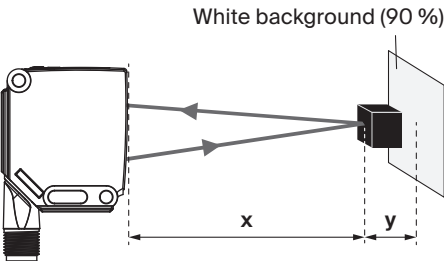
Minimum distance in mm (y) between the set sensing range and white background (90 % remission)



Recommended sensing range for the best performance

- ① Sensing range on black, 6% remission factor
- ② Sensing range on gray, 18% remission factor
- ③ Sensing range on white, 90% remission factor

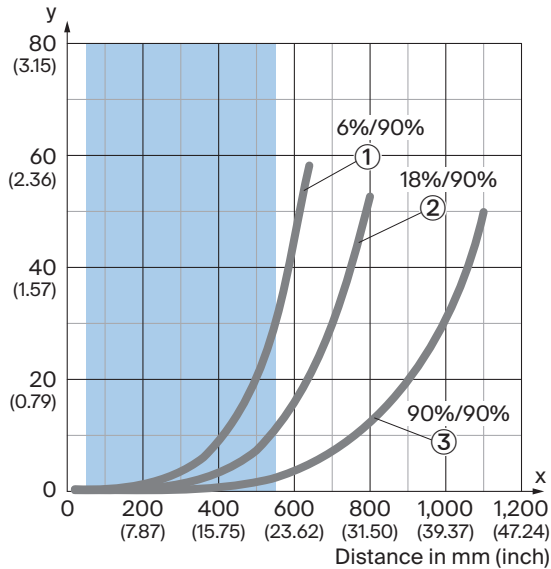
Example:
Safe suppression of the background



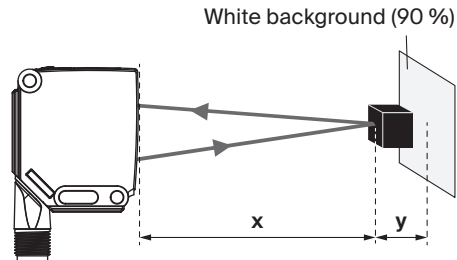
Black object (6 % remission)
Set sensing range x = 400 mm
Needed minimum distance to white background y = 4 mm

CHARACTERISTIC CURVE MODE 1, 3, 4, 5

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



Example:
Safe suppression of the background



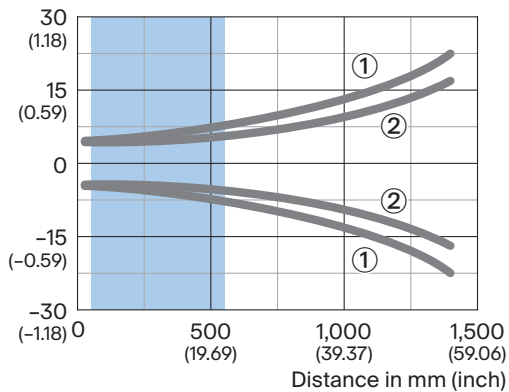
Black object (6 % remission)
Set sensing range $x = 400$ mm
Needed minimum distance to white background $y = 9$ mm

Recommended sensing range for the best performance

- ① Sensing range on black, 6% remission factor
- ② Sensing range on gray, 18% remission factor
- ③ Sensing range on white, 90% remission factor

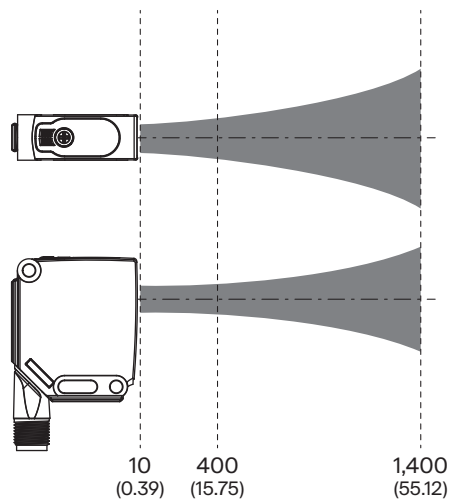
LIGHT SPOT SIZE

Dimensions in mm (inch)

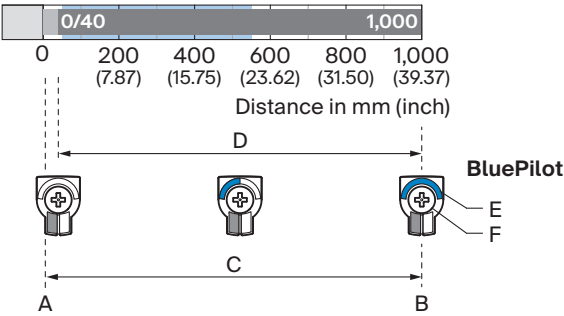


Recommended sensing range for the best performance

- ① Light spot horizontal
- ② Light spot vertical



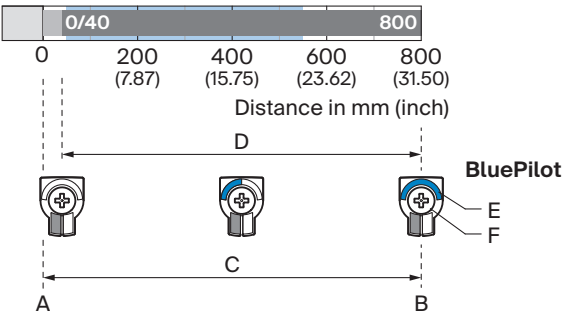
SENSING RANGE DIAGRAM MODE 2 AND 6 COMBINED (HIGHPRECISION/LONGRANGE MODE)



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

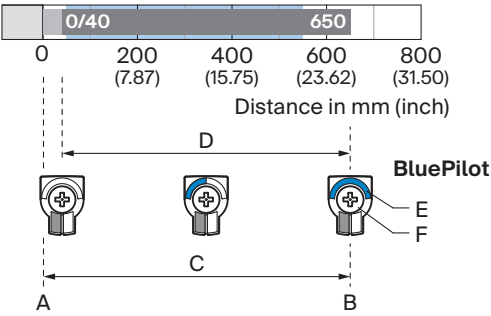
SENSING RANGE DIAGRAM MODE 2 AND 6 COMBINED (BALANCED MODE)



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

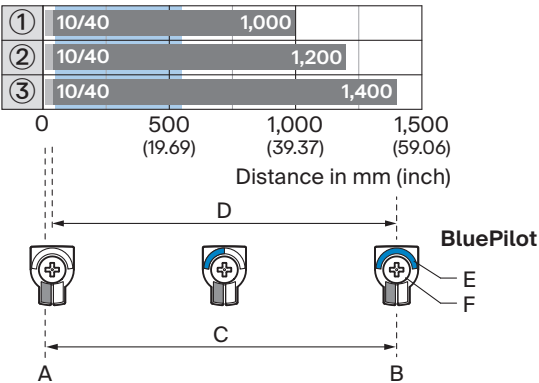
SENSING RANGE DIAGRAM MODE 2



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

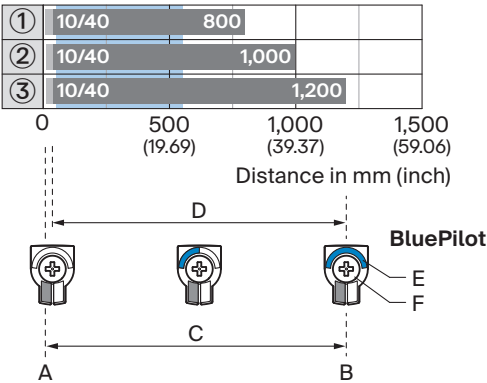
SENSING RANGE DIAGRAM MODE 1, 3, 4, 5 COMBINED WITH 6 (HIGHPRECISION/LONGRANGE MODE)



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

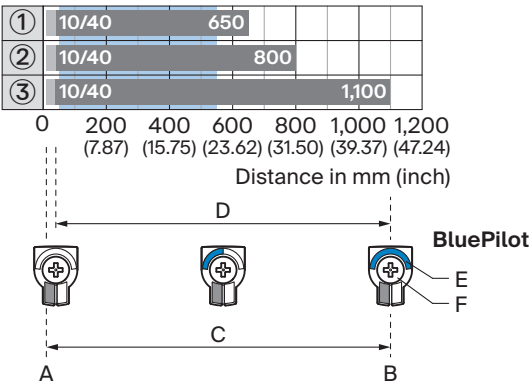
SENSING RANGE DIAGRAM MODE 1, 3, 4, 5 COMBINED WITH 6 (BALANCED MODE)



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 1, 3, 4, 5



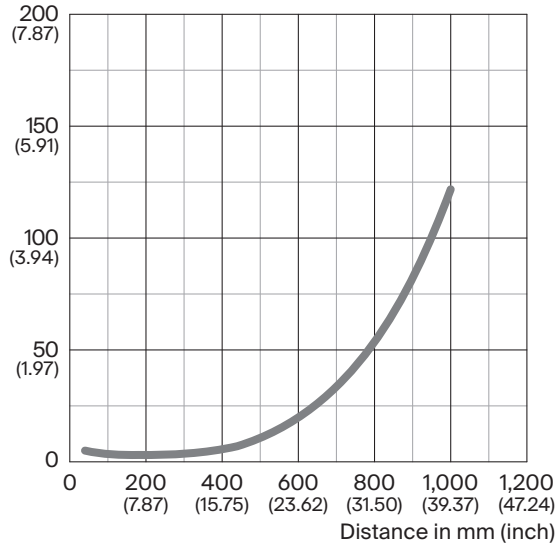
Recommended sensing range for the best performance

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

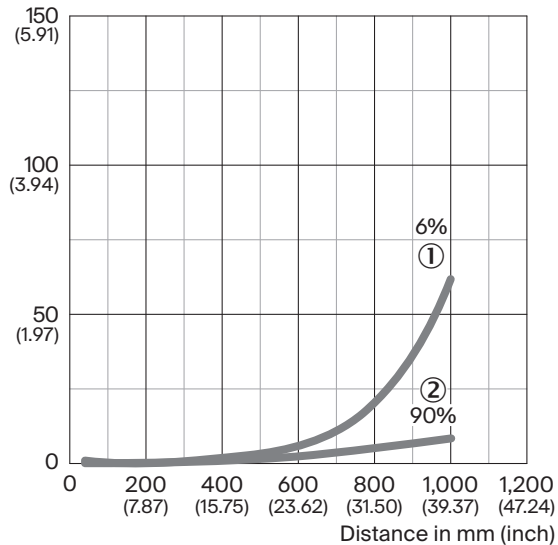
F Teach-Turn adjustment

ACCURACY

Accuracy in mm (inch)

**REPEATABILITY**

Repeatability in mm (inch)



① 6% remission factor, on black

② 90% remission factor, on white

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/1152325



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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

SICK
Sensor Intelligence