DT2/DT10/DT20/DT60: Analogue distance sensors to satisfy all customer requirements

With the four distance sensors DT2, DT10, DT20 and DT60, there are several sensors for applications in very different industrial areas. The sensors feature various measurement ranges:
DT2: 300 mm max.
DT10: 500 mm max.
DT20: 1000 mm max. and
DT60/DL: 5300 mm max.

An analogue output plus an additional switching output can communicate information about a continuous object movement, to the controller.

Depending on the application and requirements, the sensor configurations can be used for level control, loop control and even object measurements. These products are very robust and suited to harsh industrial environmental conditions, featuring insensitivity to ambient light. Particular importance has been placed on fast and intuitive commissioning: all sensors are Plug&Play sensors, an added value immediately reflected in shorter machine downtimes.

Innovative technologies such as OES3 and time-of-flight measurement enable resolutions to 1 mm, as well as high-precision and reproducible measurements.
A particular highlight is the type-oriented ordering procedure for the DT20 and DT60 sensors, with any measurement range capable of being supplied preset ex works.

► High accuracies are required when determining the diameter of paper rolls

▼ Analogue distance sensors – essential for measuring and classifying objects

◄ ▲ Analogue distance sensors checking levels

Measurement range
50 ... 300 mm

Photoelectric proximity switch

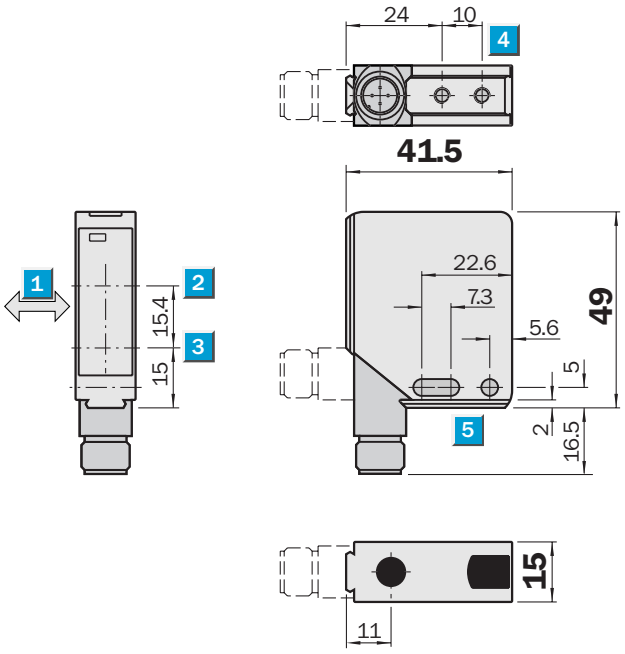
- Analogue output
- 90° rotatable M12 plug
- Infrared light
- 1 mm resolution

See chapter Accessories

Cables and connectors

Mounting systems

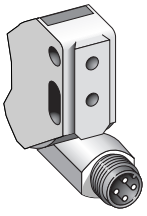
Dimensional drawing



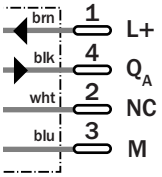
1 Standard direction of the material being scanned
2 Optical axis, receiver
3 Optical axis, sender
4 M4 threaded mounting hole – 4 mm deep
5 Through borehole Ø 4.2 mm

Connection type

DT2-410



4-pin, M12



Technical data	DT2-	410
Measurement range [1]	90 % remission: 50 ... 300 mm	
	6 % remission: 50 ... 250 mm	
Accuracy		
Object with 90 % remission	±8 % to current value	
Reproducibility		
Object with 90 % remission	3 % to 200 mm	
	5 % to 300 mm to current value	
Light source [2], **light type**	Infrared, 880 nm	
Light spot diameter	80 mm at 300 mm	
Supply voltage V_S	18 ... 30 V DC [3]	
Residual ripple [4]	< 5 V_{PP}	
Current consumption [5]	< 100 mA	
Analogue output	4–20 mA	
Response time	200 ms	
Resolution	1 mm	
Connection type	Plug, M12, 4-pin	
VDE protection class [6]	III	
Enclosure rating	IP 67	
Ambient temperature T_A	Operation –10 °C ... +45 °C	
	Storage –25 °C ... +75 °C	

1) Falling below of the measurement range results in ambiguous values
Exceeding the measurement range results in values = 20.3 mA

2) Average service life 100,000 h at T_A = + 25 °C

3) Limit values, reverse-polarity protected

4) May not exceed or fall short of V_S tolerances

5) Without load

6) Reference voltage DC 30 V

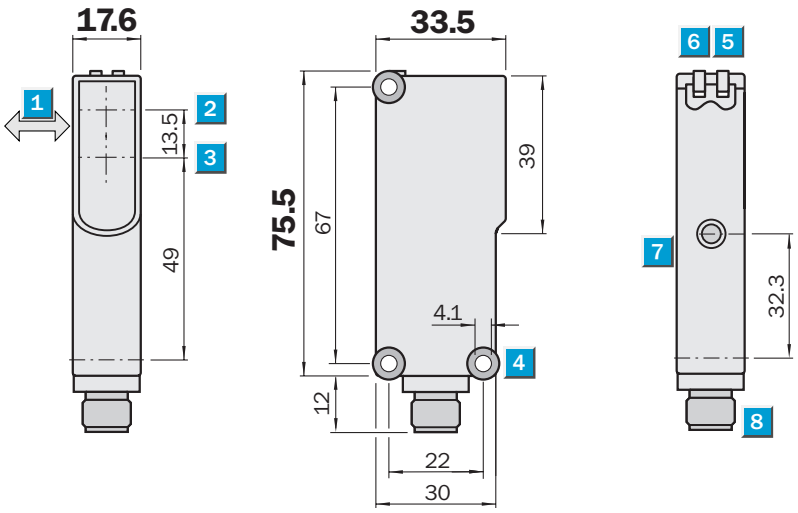
Order information	
Type	**Order no.**
DT2-410	1 024 093

Measurement range
50 ... 500 mm

Distance Sensor

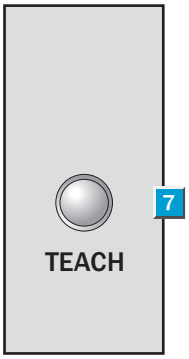
- Analogue output 4 ... 20 mA
- High measuring accuracy
- Visible red light
- Power-On LED
- Insensitive to external light sources (HF lamps)

Dimensional drawing



Adjustments possible

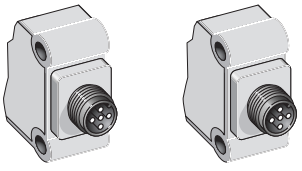
All types



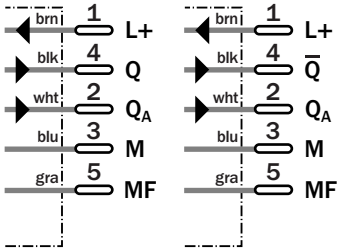
1 Standard direction of the material being detected
2 Optical axis, sender
3 Optical axis, receiver
4 Mounting hole Ø 4.1 mm
5 LED indicator, yellow; switching output status active
6 LED indicator, green; power on
7 Teach button
8 M12 plug, 5-pin

Connection type

DT10-P10B5	DT10-P10D5
DT10-N10B5	DT10-N10D5



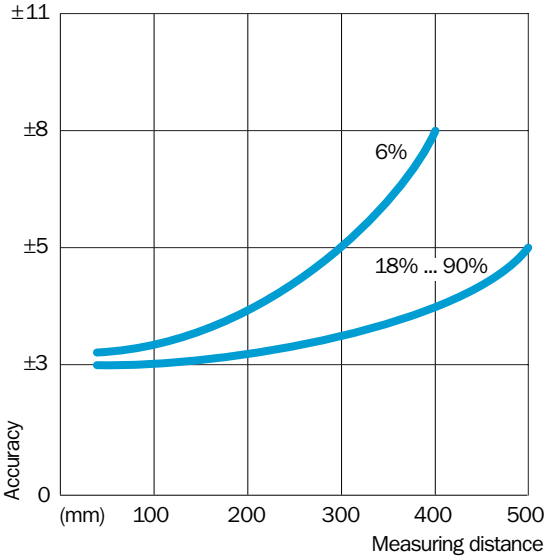
5-pin, M12	5-pin, M12



See chapter Accessories
Cables and connectors
Mounting systems

Technical data	DT10-	P10B5	P10D5	N10B5	N10D5
Measuring range					
Object with 6% remission	50 mm ... 400 mm	■	■	■	■
Object with 18 % ... 90 % remission	50 mm ... 500 mm	■	■	■	■
Light source [1]	LED, red light	■	■	■	■
Light spot diameter	20 mm at 400 mm	■	■	■	■
Supply voltage V_S [2]	10 ... 30 V DC	■	■	■	■
Current consumption [3]	< 1.2 W	■	■	■	■
Residual ripple [4]	≤ 5 V_{PP}	■	■	■	■
Analogue output [5]	4 ... 20 mA	■	■	■	■
Accuracy [6]	± 3 ... 8 mm	■	■	■	■
Reproducibility [7]	3 mm	■	■	■	■
Resolution	< 1.5 mm	■	■	■	■
Response time [8]	20 ms	■	■	■	■
Output rate [9]	1 ms	■	■	■	■
Temperature drift	1.0 mm/K	■	■	■	■
Switching outputs	Q	■		■	
	$\overline{Q}$		■		■
DT10-P: PNP	HIGH = V_S – (< 1 V)/LOW ≤ 1 V	■	■		
DT10-N: NPN	HIGH = V_S – (< 1 V)/LOW ≤ 1 V			■	■
Multifunction MF	External Teach	■	■	■	■
Output current I_A [10]	100 mA	■	■	■	■
Connection type	M12 plug, 5-pin	■	■	■	■
VDE protection class [11]	⧈	■	■	■	■
Enclosure rating	IP 67	■	■	■	■
Ambient temperature T_A	Operation –25 ... +50 °C	■	■	■	■
	Storage –40 ... +75 °C	■	■	■	■
Warm-up time	30 min.	■	■	■	■
Initialisation period	650 ms	■	■	■	■
Weight	Approx. 40 g	■	■	■	■

1) Average service life 100,000 h at T_A = +25 °C
2) Limit values, reverse-polarity protected Operation in short-circuit protected network max. 8 A
3) Without load
4) May not exceed or fall short of V_S tolerances
5) R_L < 200 Ω, V_P ≥ 10 V
R_L < 500 Ω, V_P ≥ 16 V
6) At room temperature
7) Same ambient conditions
8) Lateral introduction of object into the measurement range
9) Object in measurement range
10) Output Q short-circuit protected
11) Reference voltage 50 V DC



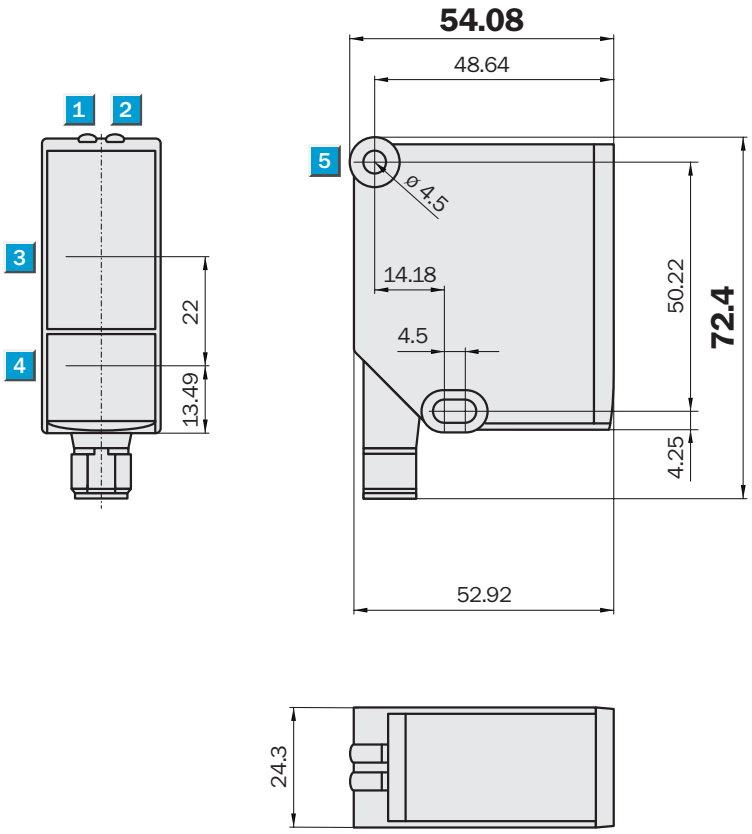
Order information	
Type	**Order no.**
DT10-P10B5	1 027 325
DT10-P10D5	1 027 326
DT10-N10B5	1 027 327
DT10-N10D5	1 027 328

Measurement range
90 ... 600 mm
100 ... 1000 mm

Distance Sensor, Proximity mode

- Analogue output 4 ... 20 mA
- High measurement accuracy
- Power-On LED
- Plug & Play Sensor
- Insensitive to external light sources

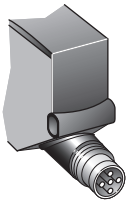
Dimensional drawing



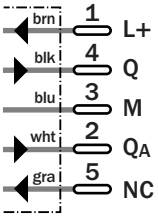
1 Power
2 Function indicator
3 Optical axis, receiver
4 Optical axis, sender
5 Mounting hole
6 Plug, M12, 5-pin

Connection type

DT20



5-pin, M12



See chapter Accessories
Cables and connectors
Mounting systems

Technical data	DT20										
Measurement range [1]		■									
Object with 6% remission	90 ... 600 mm	■									
	100 ... 820 mm		■								
Object with 18% remission	90 ... 600 mm	■									
	100 ... 1,000 mm		■								
Object with 90% remission	90 ... 600 mm	■									
	100 ... 1,000 mm		■								
Light source [2]	LED, infrared light	■	■								
Light spot diameter	35 mm at 1 m	■	■								
Supply voltage V_S [3]	10 ... 30 V DC	■	■								
Current consumption [4]	1.5 W	■	■								
Residual ripple [5]	≤ 5 V_{PP}	■	■								
Analogue output	4 ... 20 mA	■	■								
Reproducibility	± 1.5 mm	■									
	± 3 mm		■								
Resolution	1 mm	■									
	2 mm		■								
Response time	10 ms	■									
	15 ms		■								
Output rate	1 ms	■	■								
Temperature drift	0.25 mm/K	■	■								
Switching outputs	PNP o. NPN, Q	■	■								
Signal voltage PNP	HIGH = U_V – (< 2 V)/LOW = 0 V	■	■								
Signal voltage NPN	HIGH = U_V/LOW ≤ 2 V	■	■								
Connection type	M12 plug, 5-pin	■	■								
VDE protection class	□	■	■								
Enclosure rating	IP 66/IP 67	■	■								
Ambient temperature T_A	Operation –25 ... +55 °C	■	■								
	Storage –40 ... +75 °C	■	■								
Weight	135 g	■	■								
Housing material	Metal	■	■								

1) For types with max. measurement range:
> 600 mm for min. measurement range = 100 mm
≤ 600 mm for min. measurement range = 90 mm

Various measurement ranges are possible (see type-based order information below)

2) Average service life 100,000 h at T_A = +25 °C

3) Limit values, reverse-polarity protected

4) Without load

5) May not exceed or fall short of V_S tolerances

Plug & Play: measurement range freely selectable, measurement range bb to ee ; 4 mA ... 20 mA	
DT20-P/N130Bbbee	
bb: min. measurement range [6]	ee: max. measurement range [6]
09 [7]	00 [7]

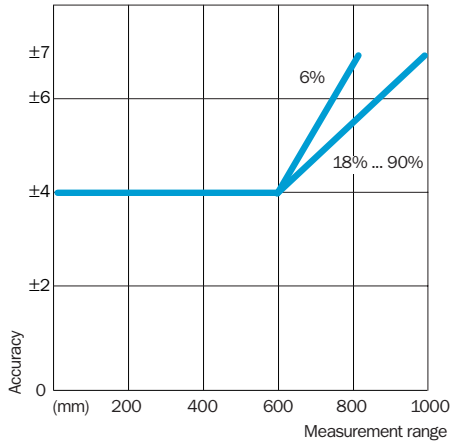
6) Minimum range between bb and ee must be 10 units (05 ≙ 5 cm; 10 ≙ 10 cm)

7) 09 ≙ 9 cm; 00 ≙ 100 cm

1th example: measurement range 100 mm ... 1000 mm	
DT20-P130B1000	
4 mA ≙ 10 cm	20 mA ≙ 100 cm

2nd example: measurement range 600 mm ... 90 mm (Inverse diagram)	
DT20-P130B6009	
4 mA ≙ 60 cm	20 mA ≙ 9 cm

Accuracy



Basic types:
Order information

Type	Order no.	Measurement range
DT20-P130B0960	1029273	90 ... 600 mm
DT20-P130B1000	1028800	100 ... 1000 mm
DT20-P130B1050	1027831	100 ... 500 mm
DT20-P130B1080	1028720	100 ... 800 mm
DT20-P130B2535	1028721	250 ... 350 mm
DT20-P130B2545	1028724	250 ... 450 mm
DT20-P130B2560	1028723	250 ... 600 mm
DT20-P130B4000	1028722	400 ... 1000 mm
DT20-N130B0960	1029274	90 ... 600 mm
DT20-N130B1000	1029275	100 ... 1000 mm

Measurement range
200 ... 5300 mm

Distance sensor

- Analogue output 4 ... 20 mA
- Teach-in and Plug & Play version
- High measuring accuracy
- Visible red light laser
- Power-On LED
- Acknowledgement after Teach-in

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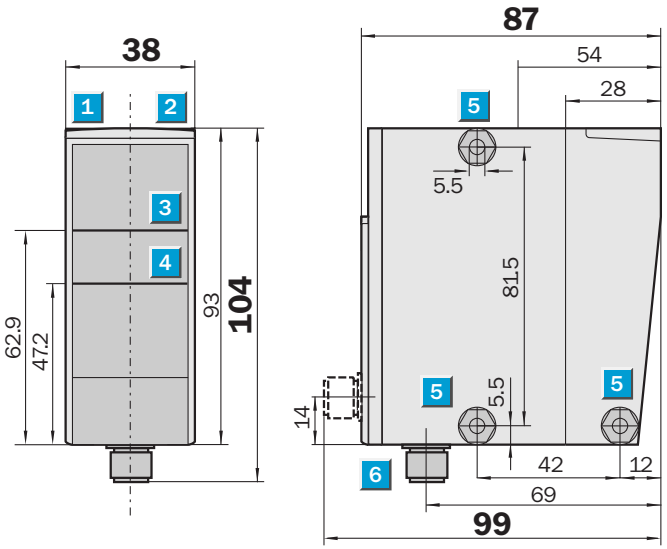
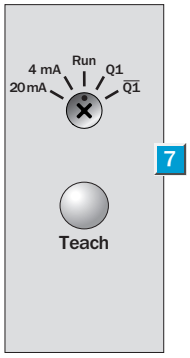
Dimensional drawing



Adjustments possible

DT60-P111B

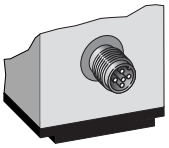
DT60-N111B



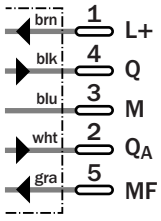
1 Power
2 Function indicator
3 Optical axis, sender
4 Optical axis, receiver
5 Mounting hole
6 M12 plug, 5-pin
7 Operating panel Teach-in version

Connection type

All types



5-pin, M12



See chapter Accessories

Cables and connectors

Mounting systems

Technical data	DT60-	P111B	N111B	P111B bbee	N111B bbee						
Teach-in version		■	■								
Plug & Play version	Measuring range freely selectable			■	■						
Measuring range											
(min. ... max. measuring distance)	200 mm ... 5300 mm	■	■	■	■						
Object with 3% remission	200 mm ... 2000 mm	■	■	■	■						
Object with 6% remission	200 mm ... 2800 mm	■	■	■	■						
Object with 18% remission	200 mm ... 5000 mm	■	■	■	■						
Object with 90% remission	200 mm ... 5300 mm	■	■	■	■						
Light source [1]	Laser diode, red light	■	■	■	■						
Light spot at 2 m distance	Ø 10 mm	■	■	■	■						
Supply voltage V_S [2]	11 ... 30 V DC	■	■	■	■						
Power consumption [3]	< 3 W	■	■	■	■						
Ripple [4]	≤ 5 V_{SS}	■	■	■	■						
Analogue output (invertable)	4 ... 20 mA	■	■	■	■						
Accuracy [5]	± 10 mm	■	■	■	■						
Reproducibility	± 8 mm typ.	■	■	■	■						
Resolution	1.5 mm	■	■	■	■						
Response time	50 ms ... 250 ms [6]	■	■	■	■						
Cycle time	< 55 ms	■	■	■	■						
Output rate	< 15 ms	■	■	■	■						
Temperature drift	0.5 mm/K (0.4 mm/K typ.)	■	■	■	■						
Switching outputs (invertable)	Q	■	■	■	■						
	$\overline{Q}$	■	■								
DL60-P: PNP	HIGH = U_V – (< 2 V)/LOW = 0 V	■		■							
DL60-N: NPN	HIGH = U_V/LOW ≤ 2 V		■		■						
Output current I_A [7]	100 mA	■	■	■	■						
Multifunction MF	Laser off	■	■	■	■						
Connection type	M12 plug, 5-pin	■	■	■	■						
VDE protection class [8]	II	■	■	■	■						
Laser protection class	2 (EN 60 825-1)	■	■	■	■						
Enclosure rating	IP 67	■	■	■	■						
Ambient temperature	Operation –25 ... +55 °C	■	■	■	■						
	Storage –25 ... +75 °C	■	■	■	■						
Weight	202 g	■	■	■	■						

1) Average service life 50,000 h at T_A = +25 °C
2) Limit values, reverse-polarity protected
3) Without load
4) May not exceed or fall short of V_S tolerances
5) After 30 minutes on-time
6) Adaptive, depending on degree of reflectance
7) Output Q short-circuit protected
8) Reference voltage 50 V DC

Plug & Play version: measuring range freely selectable, measuring range bb to ee ≙ 4 mA ... 20 mA	
DT60-P/N111Bbbee	
bb: min. measuring distance [9]	ee: max. measuring distance [9]
02 [10]	53 [11]

9) Minimum distance between bb and ee must be 03 units (03 ≙ 300 mm)
10) 02 ≙ 200 mm; 53 ≙ 5300 mm
11) 90% remission

1st example: measuring range 1200 mm ... 3400 mm	
DT60-P/N111B1234	
4 mA ≙ 1200 mm	20 mA ≙ 3400 mm

2nd example: measuring range 4200 mm ... 3800 mm (Inverted characteristic curve)	
DT60-P/N111B4238	
4 mA ≙ 4200 mm	20 mA ≙ 3800 mm

Order information	
Type	**Order no.**
DT60-P111B	1 025 843
DT60-N111B	1 025 844
DT60-P111B0520	1 025 847
DT60-P111B0253	1 026 063
DT60-N111B0253	1 026 160
DT60-P111Bbbee*)	X XXX XXX

*) Measuring range freely selectable

Measurement range
200 ... 5300 mm

Distance sensor

- Analogue output 4 ... 20 mA
- Teach-in and Plug & Play version
- High measuring accuracy
- Visible red light laser
- Power-On LED
- Acknowledgement after Teach-in

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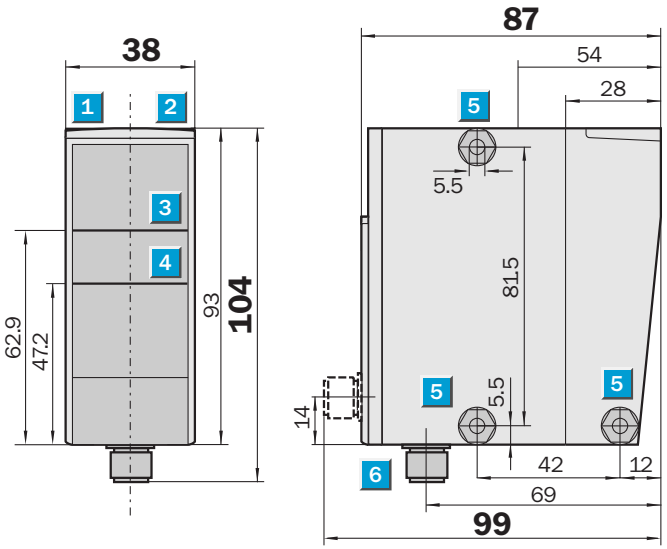
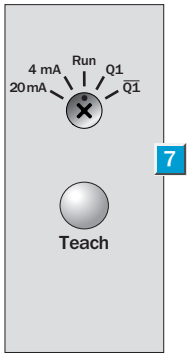
See chapter Accessories
Cables and connectors
Mounting systems

Dimensional drawing



Adjustments possible

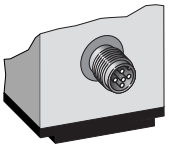
DT60-P211B
DT60-N211B



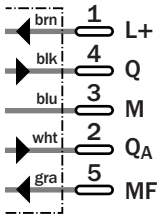
1 Power
2 Function indicator
3 Optical axis, sender
4 Optical axis, receiver
5 Mounting hole
6 M12 plug, 5-pin
7 Operating panel Teach-in version

Connection type

All types



5-pin, M12



Technical data	DT60-	P211B	N211B	P211B bbee	N211B bbee						
Teach-in version		■	■								
Plug & Play version	Measuring range freely selectable			■	■						
Measuring range											
(min. ... max. measuring distance)	200 mm ... 5300 mm	■	■	■	■						
Object with 3% remission	200 mm ... 1000 mm (A)/1400 mm (B)	■	■	■	■						
Object with 6% remission	200 mm ... 1400 mm (A)/2000 mm (B)	■	■	■	■						
Object with 18% remission	200 mm ... 2400 mm (A)/3600 mm (B)	■	■	■	■						
Object with 90% remission	200 mm ... 5000 mm (A)/5300 mm (B)	■	■	■	■						
Light source [1]	Laser diode, red light	■	■	■	■						
Light spot at 2 m distance	Ø 10 mm	■	■	■	■						
Supply voltage V_S [2]	11 ... 30 V DC	■	■	■	■						
Power consumption [3]	< 3 W	■	■	■	■						
Ripple [4]	≤ 5 V_{SS}	■	■	■	■						
Analogue output (invertable)	4 ... 20 mA	■	■	■	■						
Accuracy [5]	± 13 mm	■	■	■	■						
Reproducibility	± 10 mm	■	■	■	■						
Resolution	1.5 mm	■	■	■	■						
Response time	A = 30 ms/B = 50 ms	■	■	■	■						
Output rate	1.2 ms (A)/3.6 ms (B)	■	■	■	■						
Temperature drift	0.5 mm/K (0.4 mm/K typ.)	■	■	■	■						
Switching outputs (invertable)	Q	■	■	■	■						
	$\overline{Q}$	■	■								
DT60-P: PNP	HIGH = U_V – (< 2 V)/LOW = 0 V	■		■							
DT60-N: NPN	HIGH = U_V/LOW ≤ 2 V		■		■						
Output current I_A [6]	100 mA	■	■	■	■						
Multifunction MF	Laser off	■	■	■	■						
Connection type	M12 plug, 5-pin	■	■	■	■						
VDE protection class [7]	II	■	■	■	■						
Laser protection class	2 (EN 60 825-1)	■	■	■	■						
Enclosure rating	IP 67	■	■	■	■						
Ambient temperature	Operation –25 ... +55 °C	■	■	■	■						
	Storage –25 ... +75 °C	■	■	■	■						
Weight	202 g	■	■	■	■						

1) Average service life 50,000 h at T_A = +25 °C
2) Limit values, reverse-polarity protected
3) Without load
4) May not exceed or fall short of V_S tolerances
5) After 30 minutes on-time
6) Output Q short-circuit protected
7) Reference voltage 50 V DC

Plug & Play version: measuring range freely selectable, measuring range bb to ee ≙ 4 mA ... 20 mA	
DT60-P/N111Bbbee	
bb: min. measuring distance [8]	ee: max. measuring distance [8]
02 [11]	53 [12]

8) Minimum distance between bb and ee must be 03 units (03 ≙ 300 mm)
9) 02 ≙ 200 mm; 53 ≙ 5300 mm
10) 90% remission

1st example: measuring range 1200 mm ... 3400 mm	
DT60-P/N111B1234	
4 mA ≙ 1200 mm	20 mA ≙ 3400 mm

2nd example: measuring range 4200 mm ... 3800 mm (Inverted characteristic curve)	
DT60-P/N111B4238	
4 mA ≙ 4200 mm	20 mA ≙ 3800 mm

Order information	
Type	**Order no.**
DT60-P211B	1 025 845
DT60-N211B	1 025 846
DT60-P211B0520	1 026 444
DT60-P211B0253	1 026 445
DT60-N211B0253	1 026 446
DT60-P211Bbbee*)	X XXX XXX
DT60-N211Bbbee*)	X XXX XXX

*) Measuring range freely selectable

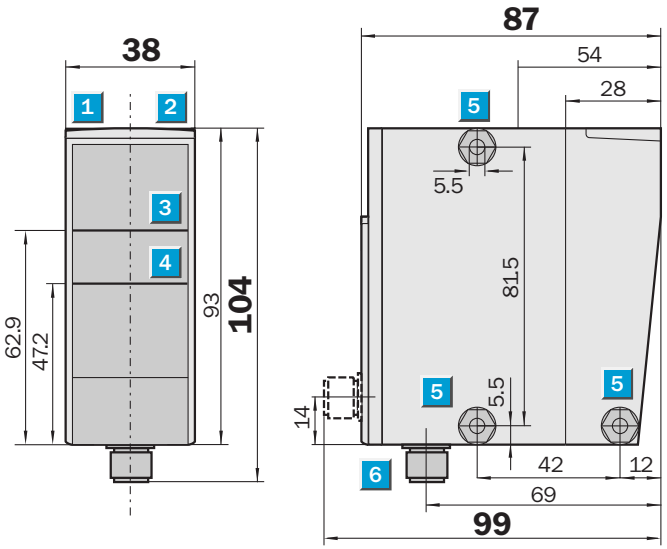
Measurement range
300 mm ... 24 m

Distance sensor

- Analogue output 4 ... 20 mA
- Teach-in and Plug & Play version
- High measuring accuracy
- Visible red light laser
- Power-On LED
- Acknowledgement after Teach-in

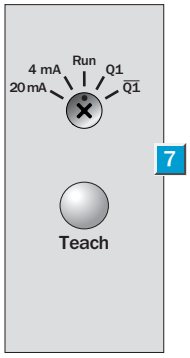
c UL us

Dimensional drawing



Adjustments possible

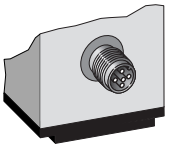
DL60-P111B
DL60-N111B



1 Power
2 Function indicator
3 Optical axis, sender
4 Optical axis, receiver
5 Mounting hole
6 M12 plug, 5-pin
7 Operating panel Teach-in version

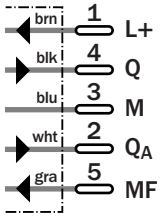
Connection type

DL60-P111B	DL60-P111Bbbee
DL60-N111B	DL60-N111Bbbee



See chapter Accessories
Cables and connectors
Mounting systems

5-pin, M12



Technical data	DL60-	P111B	N111B	P111B bbee	N111B bbee						
Teach-in version		■	■								
Plug & Play version	Measuring range freely selectable			■	■						
Measuring range											
(min. ... max. measuring distance)											
Reflective Tape: REF-5870-K2	300 mm... 24000 mm [1]	■	■	■	■						
Light source [2]	Laser diode, red light	■	■	■	■						
Light spot at 2 m distance	Ø 20 mm	■	■	■	■						
Supply voltage V_S [3]	11 ... 30 V DC	■	■	■	■						
Power consumption [4]	< 3 W	■	■	■	■						
Residual ripple [5]	≤ 5 V_{PP}	■	■	■	■						
Analogue output (invertable)	4 ... 20 mA	■	■	■	■						
Accuracy [6]	± 15 mm	■	■	■	■						
Reproducibility	± 7 mm	■	■	■	■						
Resolution	12 Bit [7]	■	■	■	■						
Response time	130 ms	■	■	■	■						
Output rate	< 8 ms	■	■	■	■						
Temperature drift	0.4 mm/K typ.	■	■	■	■						
Switching outputs (invertable)	Q	■	■	■	■						
	$\overline{Q}$	■	■								
DL60-P: PNP	HIGH = U_V – (< 2 V)/LOW = 0 V	■		■							
DL60-N: NPN	HIGH = U_V/LOW ≤ 2 V		■		■						
Output current I_A [8]	100 mA	■	■	■	■						
Multifunction MF	Laser off	■	■	■	■						
Connection type	M12 plug, 5-pin	■	■	■	■						
VDE protection class [9]	II	■	■	■	■						
Laser protection class	2 (EN 60 825-1)	■	■	■	■						
Enclosure rating	IP 67	■	■	■	■						
Ambient temperature	Operation –25 ... +55 °C	■	■	■	■						
	Storage –25 ... +75 °C	■	■	■	■						
Initialisation time	550 ms	■	■	■	■						
Weight	202 g	■	■	■	■						

1) 40 m on request
2) Average service life 50,000 h at T_A = +25 °C
3) Limit values, reverse-polarity protected
4) Without load
5) May not exceed or fall short of V_S tolerances
6) After 30 minutes on-time
7) At 24 m measuring distance = 7 mm
8) Output Q short-circuit protected
9) Reference voltage 50 V DC

Plug & Play version: measuring range freely selectable, measuring range bb to ee ≙ 4 mA ... 20 mA	
DL60-P/N111Bbbee	
bb: min. measuring distance [10]	ee: max. measuring distance [10]
00 [11]	24 [11]

10) Minimum distance between bb and ee must be 01 units (01 ≙ 1 m)
11) 00 ≙ 300 mm; 24 ≙ 24 m

1st example: measuring range 300 mm ... 24 m	
DL60-P/N111B0024	
4 mA ≙ 300 mm	20 mA ≙ 24 m

2nd example: measuring range 2 m ... 10 m	
DL60-P/N111B0210	
4 mA ≙ 2 m	20 mA ≙ 10 m

Order information	
Type	**Order no.**
DL60-P111B	1 025 848
DL60-N111B	1 026 360
DL60-P111B0024	1 026 361
DL60-P111B0210	1 026 362
DL60-N111B0024	1 026 363
DL60-P111Bbbee*)	X XXX XXX
DL60-N111Bbbee*)	X XXX XXX

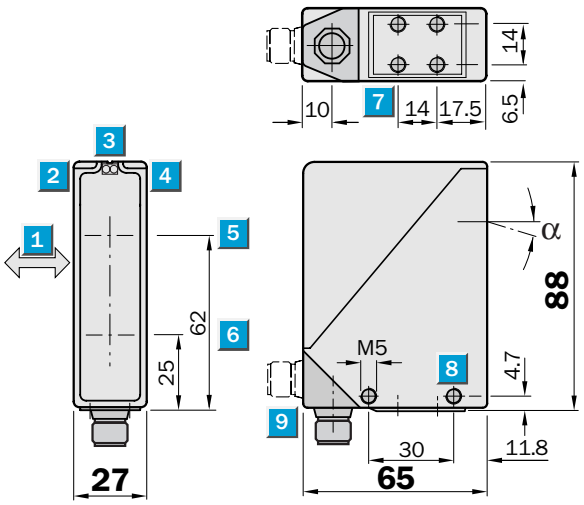
*) Measuring range freely selectable

Scanning distance
100 ... 3000 mm

Photoelectric proximity switches

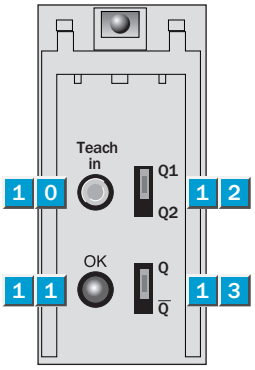
- Analogue + digital output
- High resolution
- Switching outputs adjustable using simple teach-in
- Compact housing
- Insensitive to ambient light

Dimensional drawing



Adjustments possible

All types



1	Standard direction of object being scanned
2	Output Q_2 function indicator
3	Alignment sight
4	Output Q_1 function indicator
5	Centre of transmitter's optical axis
6	Centre of receiver's optical axis
7	M5 threaded mounting hole, 6 mm deep
8	M5 threaded mounting hole
9	Rotatable plug
10	"Teach-in" programming switch
11	"Teach-in" function indicator
12	"Q_1/Q_2" program switch
13	"Q/Q" program switch

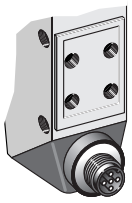
Adjustment instructions

Programming the switching outputs:

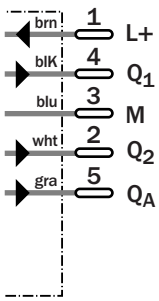
1. Move "Q_1/Q_2" switch to the switching output to be programmed. Move "$Q/\overline{Q}$" switch to the desired switching mode.
2. Place object at the required switching distance.
3. Press "Teach-in" key. "OK" indicator illuminates when the switching limit has been saved to the memory.
4. Repeat steps 1/2/3 for the second switching output.
5. The device is ready for operation.

Connection type

All types



5-pin, M12



See chapter Accessories

Cables and connectors

Mounting systems

Special accessories

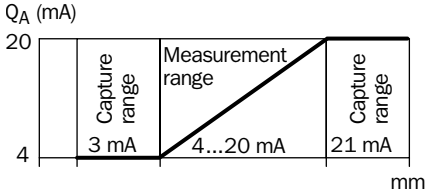
Technical data	WTA24-P	5201	5401	5501	5201 S 04
Light source[1], light type	LED, infrared light	■	■	■	■
Supply voltage V_S	12…30 V DC[2]	■	■	■	■
Residual ripple	< 5 V_{PP}[3]	■	■	■	■
Current consumption	< 100 mA[4]	■	■	■	■
Switching outputs					
Q_1, Q_2	PNP, reversible	■	■	■	■
Output voltage	HIGH = V_S – < 2 V/LOW = < 2 V	■	■	■	■
Output current I_A max.	100 mA	■	■	■	■
Response time[5]	5 ms	■	■		
Max. switching frequency[6]	100 Hz	■	■		
Response time[5]	50 ms			■	
Max. switching frequency[6]	10 Hz			■	
Response time[5]	100 ms				■
Max. switching frequency[6]	5 Hz				■
Analogue output[7] [8]	4…20 mA	■	■	■	■
Connection type	Plug	■	■	■	■
VDE protection class[9]	⧈	■	■	■	■
Circuit protection[10]	A, B, C	■	■	■	■
Enclosure rating	IP 67	■	■	■	■
Ambient temperature T_A	Operation – 10 °C…+ 55 °C	■	■	■	■
	Storage – 25 °C…+ 75 °C	■	■	■	■
Shock load	To IEC 68	■	■	■	■
Temperature drift	0.2 %/K	■	■	■	■
(relative to measured value)					

1) Average service life 100,000 h at T_A = + 25 °C
2) Limit values
3) May not exceed or fall short of V_S tolerances
4) Without load
5) Signal transit time with resistive load
6) Object 50:50
7) In capture range 3 or 21 mA
8) R = 0…500 Ω
9) Reference voltage 50 V DC
10) A = V_S connections reverse-polarity protected
B = Inputs Q_1 and Q_2 short-circuit protected
C = Interference pulse suppression

Measurement range, reproducibility and accuracy

WTA24-	P 5201		P 5401		P 5501		P 5201 S04	
Measurement range	250…350 mm		600…1200 mm		1000…3000 mm		100…500 mm	
Capture range	200…250 mm		400…600 mm		500…1000 mm		80…100 mm	
Light spot diameter (90 % core light)	4…8 mm		15…30 mm		20…50 mm		8…12 mm	
Angle of dispersion α	7°		2°		0.5°		7°	
Reproducibility	White (90 %)	1.0 %	White (90 %)	1.5 %	White (90 %)	4.0 %	White (90 %)	1.0 %
(relative to measured value,	Grey (18 %)	1.0 %	Grey (18 %)	2.5 %	Grey (18 %)	8.0 %	Black (6 %)	2.0 %
object 100 x 100 mm,	Black (6 %)	1.5 %	Black (6 %)[1]	4.0 %	Black (6 %)[2]	10.0 %		
ambient surroundings remain constant)								
Accuracy	blanc (90 %)	1.5 %	blanc (90 %)	3.0 %	blanc (90 %)	5.5 %	White (90 %)	6.5 %
(relative to measured value,	Grey (18 %)	2.0 %	Grey (18 %)	5.0 %	Grey (18 %)	10.0 %	Grey (18 %)	10.5 %
object 100 x 100 mm,	Black (6 %)	4.0 %	Black (6 %)[1]	8.0 %	Black (6 %)[2]	13.0 %	Black (6 %)	11.5 %
ambient surroundings remain constant)								

1) up to 1000 mm
2) up to 2000 mm

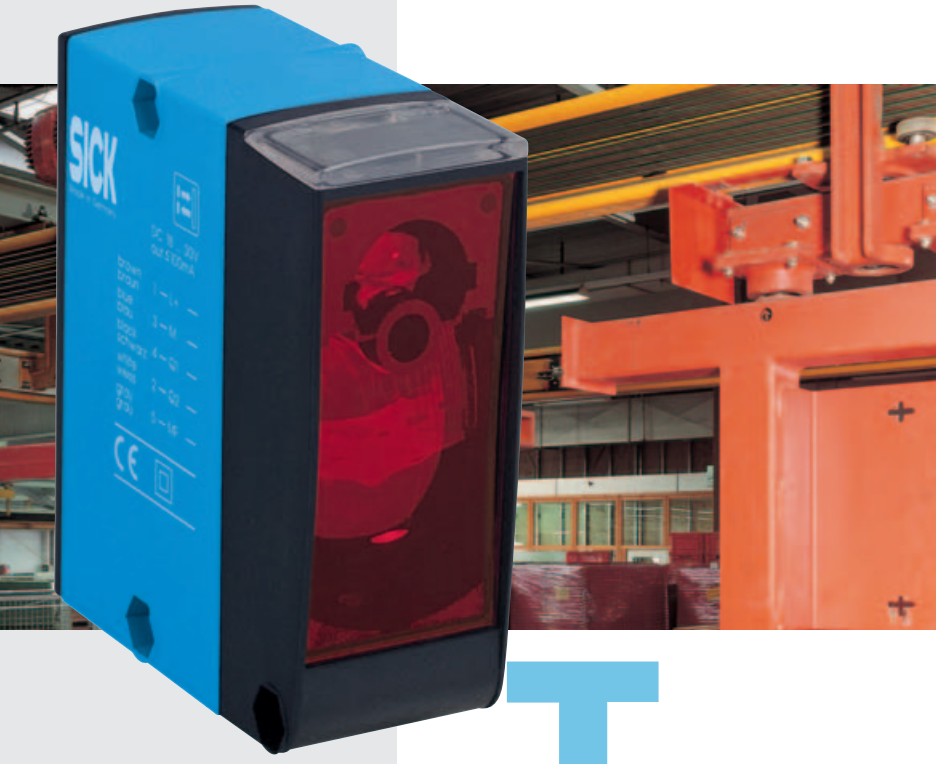


Order information	
Type	**Order no.**
WTA24-P 5201	1 011 504
WTA24-P 5401	1 011 505
WTA24-P 5501	1 011 515
WTA24-P 5201 S04	1 015 804

Distance sensors
Proximity mode

Distance sensors
Reflector mode

DS60: The solution for large scanning distances

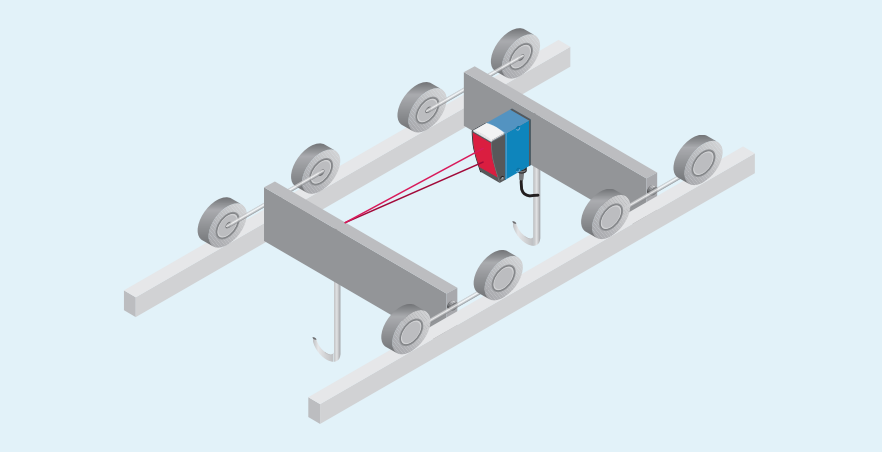


The prevention of collisions for cranes and vehicles or checking whether storage bays in warehousing systems are occupied are typical examples of applications in which compact triangulation scanners reach their technological limits and laser distance measuring systems become too expensive. The DS60 fills this gap. Even under difficult ambient conditions and with a variety of target objects, the compact, optoelectronic distance sensor can detect them reliably and consistently at distances between 100 mm and 6,000 mm.

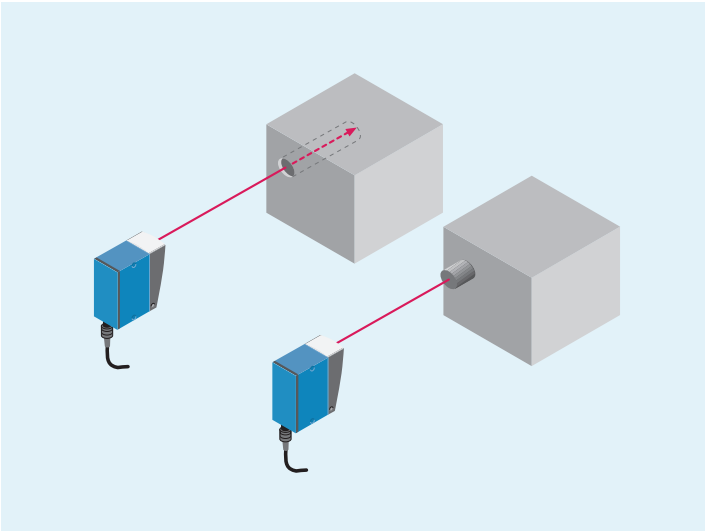
During development of the DS60, emphasis was placed on satisfying user requirements such as, compact design, two invertable switching outputs, simple operation and adjustment as well as low maintenance requirements with a long service life.

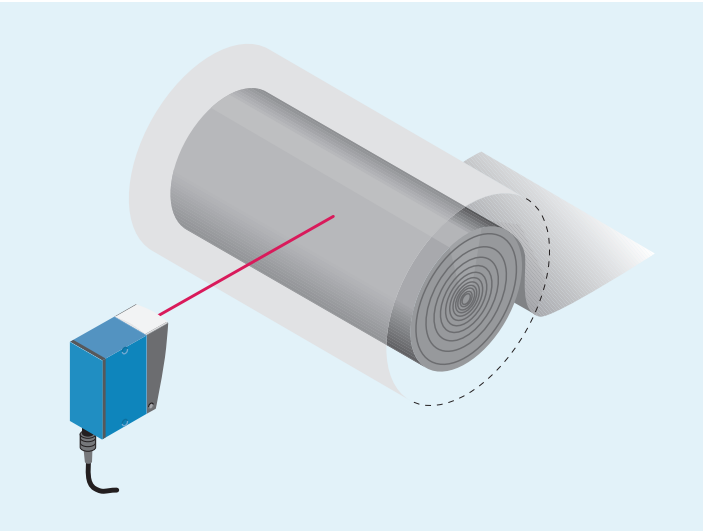
The DS60 is able to do much more than prevent collisions and check whether storage bays are full. By linking the two binary outputs, min./max. control operations in level gauging systems (bulk materials) can be implemented as combined protection against dry-running and overfilling. Another typical application would be two-point sag regulation in the paper and plastics industries. Further possible applications for distance measurement using two binary outputs are, for example, high/low speed regulation for overhead conveyors or assisting ground conveyors in docking manoeuvres.

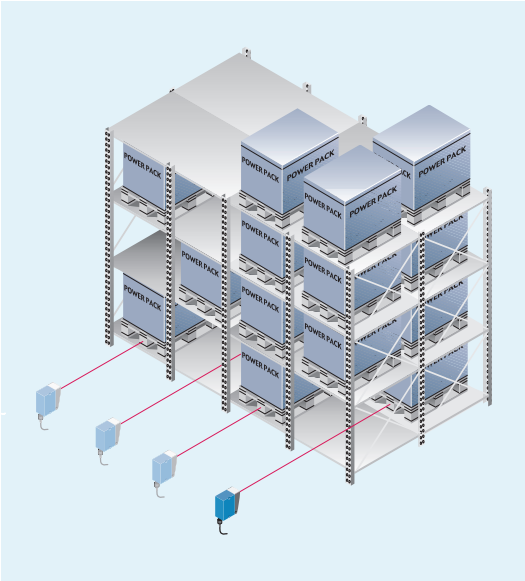
▶ Ensuring everything runs smoothly in warehousing/handling systems: The DS60 distance sensor is used to make sure that a safe distance is maintained between overhead conveyors.



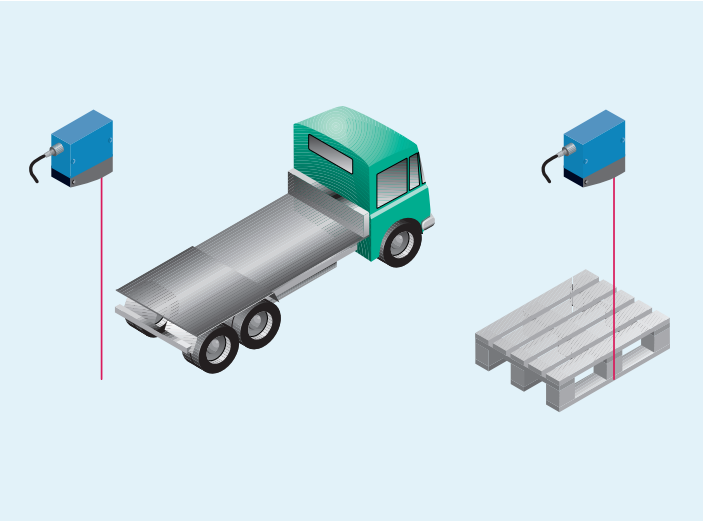
▼ Detection of bolts or recesses in work-pieces – another speciality of the DS60.







▲ Two storage bays can be monitored with just one sensor.



▲ A variant of the sensor, used to detect objects between the sensor and a fixed background.

▲ Positioning and checking the diameters of rolled materials. The object can move closer to the DS60 during positioning. The switching output is activated as soon as the taught-in distance is undershot.

Application Field

The DS60 distance sensors operate according to the principle of time of flight measurement. The compact sensor makes large and adjustable scanning distances possible with very precise distance detection.

Almost any objects, including tilted ones, are detected dependably in front of a shiny background (e.g., zinc-coated steel sheets or window panes) within the scanning range.

A connectable pilot light simplifies precise alignment on the scanning object.

One sensor model with a red light laser and a small light spot makes the detection of even the smallest objects at large distances possible. Precise alignment is made using a visible, red laser beam.

Another sensor model operates using Diamond Grade reflective tape. This switches when the reflective tape falls short of the previously set distance (not comparable to a photoelectric switch during light path interruption).

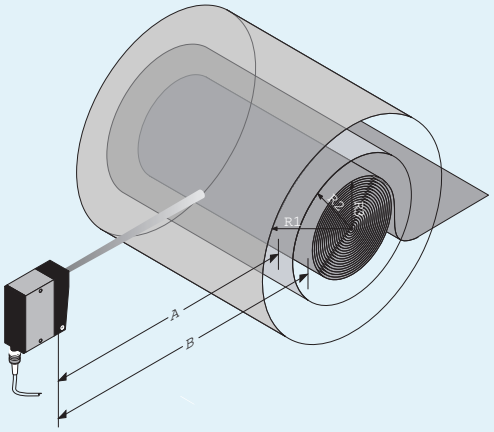
Two switching outputs signal whether the set distances are reached.

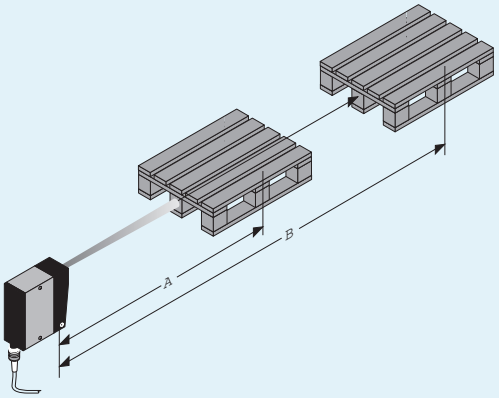
DS60 DtO IR Distance to Object, Infrared Light

Variant DtO IR – Application field

Detecting the distance between sensor and object.
The object can move toward the sensor during positioning.
Falling short of the previously set distance triggers the switching outputs.

▶ Task:
Determining the diameter of a (shining) aluminum or (dark) steel coil.
The distances A (switching output Q_1) and B (switching output Q_2) are taught in.
Radius R1 = switching distance A: switching output Q_1 is actuated,
Radius R2 = switching distance B: switching output Q_2 is actuated.





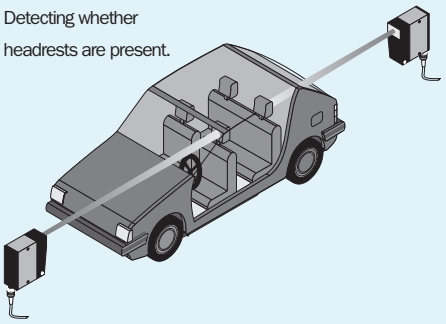
◀ Task:
Detecting whether a compartment is vacant or contains one or two Euro-pallets.
The sensor model with a 12 mm light spot measurement is especially suitable for precise detection of a pallet foot at a great distance. Problem-free alignment of the sensor using the pilot light.

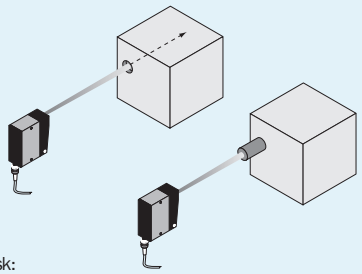
DS60 DtO R Distance to Object, Red Light

Variant DtO R – Application field

Detecting smaller objects and cavities or holes.
The object can move toward the sensor during positioning. Falling short of the previously set distance triggers the switching output.

▼ Task:
Detecting whether headrests are present.



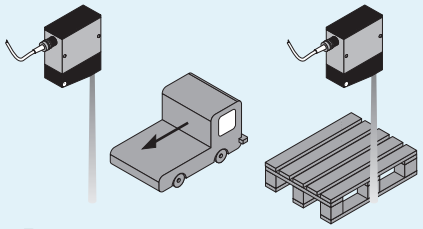


▲ Task:
Detecting whether bolts or cavities/holes are present.

DS60 ObSB IR Object between Sensor and Background, Infrared Light

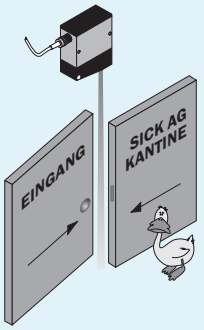
Variant ObSB IR – Application field

Similar to a photoelectric reflex switch only that no reflector is required, but instead a stationary background (e.g., a floor).
The distance to the background is set, not the distance to the object. The switching output is triggered when an object is between the background and the sensor.



▲ Task:
Detecting and/or counting vehicles.
Detecting whether pallets are present.

▶ Task:
Monitoring closing edges of doors.

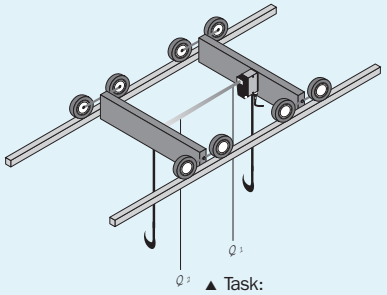


DS60 DtR IR Distance to Diamond Grade Reflective Tape, Infrared Light

Variant DtR IR – Application field

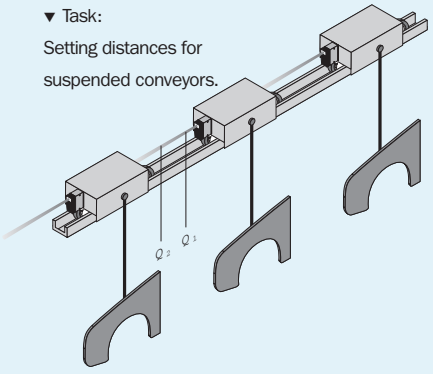
Setting distances from cranes, suspended conveyors and conveyors on the ground. The sensor function can be checked via a test input. A distance of up to 20 m can be separated into three sectors on the Diamond Grade reflective tape:

- Distance to tape greater than the taught-in distances Q_1 and Q_2
- Distance to tape between Q_1 and Q_2
- Distance to tape shorter than Q_1



▲ Task:
Setting distances to gantry cranes.

▼ Task:
Setting distances for suspended conveyors.

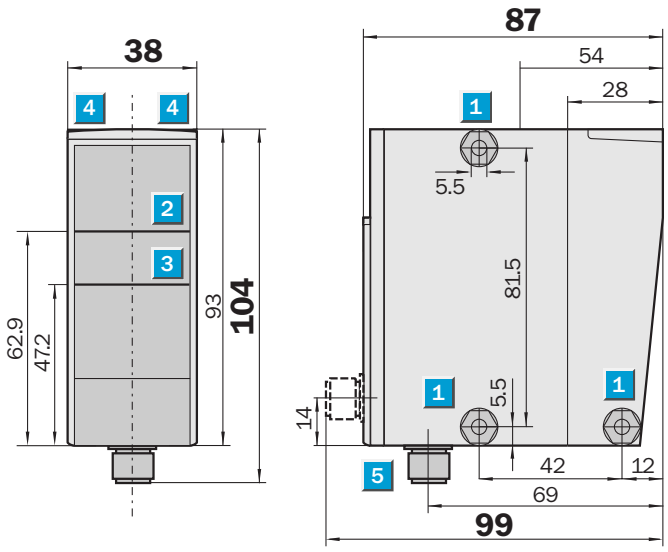


Scanning distance
200 ... 6000 mm

Distance Sensor

- Background suppression up to 100 m
- High target dynamic: black … extremely shiny
- Two function LED
- Red Pilot Light
- Teach-in

Dimensional drawing



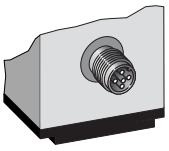
Adjustments possible

- DS60-P/-N21111
- DS60-P/-N21311
- DS60-P/-N41111
- DS60-P/-N41311
- DS60-P41111-S03

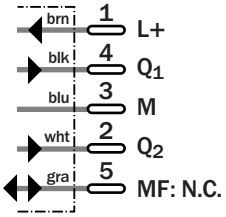
1 Mounting hole Ø 5.2 mm
2 Optical axis – sender
3 Optical axis – receiver
4 Status indicator
5 M12 plug, 5-pin
6 Control panel

Connection type

DS60-P/-N21111 | DS60-P/-N41111 | DS60-P41111-S03
DS60-P/-N21311 | DS60-P/-N41311



5-pin, M12



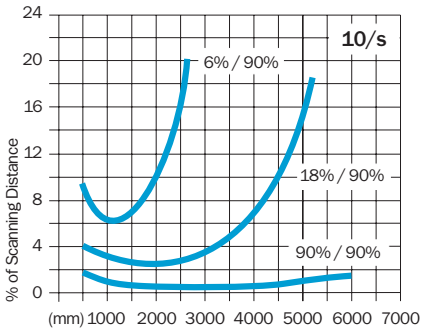
See chapter Accessories

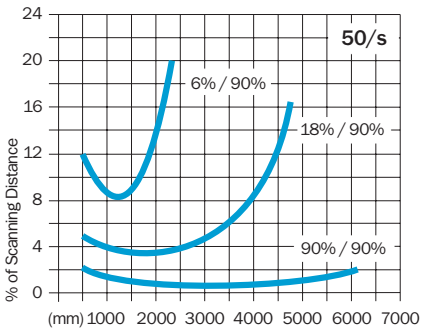
- Cables and connectors
- Mounting systems
- Special accessories

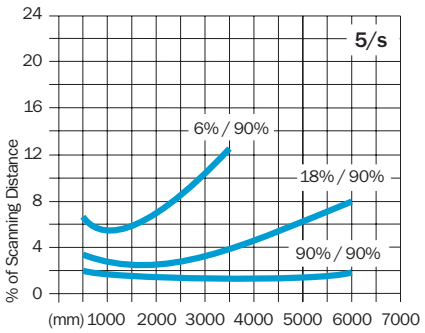
Technical data	DS60	-P 21111	-N 21111	-P 21311	-N 21311	-P 41111	-N 41111	-P 41311	-N 41311	-P 41111-S03
Type of connection	M12 plug, 5-pin	■	■	■	■	■	■	■	■	■
Scanning distance, adjustable	200 mm to 6000 mm	■	■	■	■	■	■	■	■	■
Object with 3 % remission	80 mm to 1400 mm	■	■	■	■					
	80 mm to 1600 mm					■	■	■	■	
	80 mm to 1750 mm									■
Object with 6 % remission	80 mm to 2400 mm	■	■	■	■					
	80 mm to 2600 mm					■	■	■	■	
	80 mm to 3000 mm									■
Object with 18 % remission	80 mm to 4600 mm	■	■	■	■					
	80 mm to 5000 mm					■	■	■	■	
	80 mm to 5650 mm									■
Object with 90 % remission [1]	80 mm to 6000 mm	■	■	■	■	■	■	■	■	■
Light source [2]	Laser diode, infrared	■	■	■	■	■	■	■	■	■
Light spot at 6 m distance	Ø 60 mm	■	■			■	■			
	Ø 12 mm			■	■			■	■	■
Supply voltage V_S [3]	18 to 30 V DC	■	■	■	■	■	■	■	■	■
Power consumption [4]	< 3 W	■	■	■	■	■	■	■	■	■
Ripple [5]	≤ 5 V_{PP}	■	■	■	■	■	■	■	■	■
Switching outputs (invertable)	Q_1, Q_2	■	■	■	■	■	■	■	■	■
DS60-P: PNP	HIGH = V_S – (< 2 V)/LOW = 0 V	■		■		■		■		■
DS60-N: NPN	HIGH = V_S/LOW ≤ 2 V		■		■		■		■	
Output current [6]	100 mA	■	■	■	■	■	■	■	■	■
Switching frequency	50/s	■	■	■	■					
	10/s					■	■	■	■	
	5/s									■
Switching limit Q_1/Q_2	adjustable (Teach-in)	■	■	■	■	■	■	■	■	■
Time delay	on request	■	■	■	■	■	■	■	■	■
Multifunction MF	N.C./External Teach on request	■	■	■	■	■	■	■	■	■
VDE protection class [7]	II	■	■	■	■	■	■	■	■	■
Laser protection class	1 (EN 60 825-1)	■	■	■	■	■	■	■	■	■
Enclosure rating	IP 67	■	■	■	■	■	■	■	■	■
Ambient temperature[8]	Operation – 25 to + 50 °C	■	■	■	■	■	■	■	■	■
	Storage – 25 to + 75 °C	■	■	■	■	■	■	■	■	■
Weight	202 g	■	■	■	■	■	■	■	■	■

1) Also shiny
2) Average service life 100 000 h, at room temperature = + 25 °C
3) Limit values, reverse polarity protected
4) Without load
5) Must be within V_S tolerances
6) Outputs Q_1 and Q_2 short-circuit protected
7) Withstand voltage 50 V DC
8) Do not distort cable below 0 °C

Scanning distance







Order information

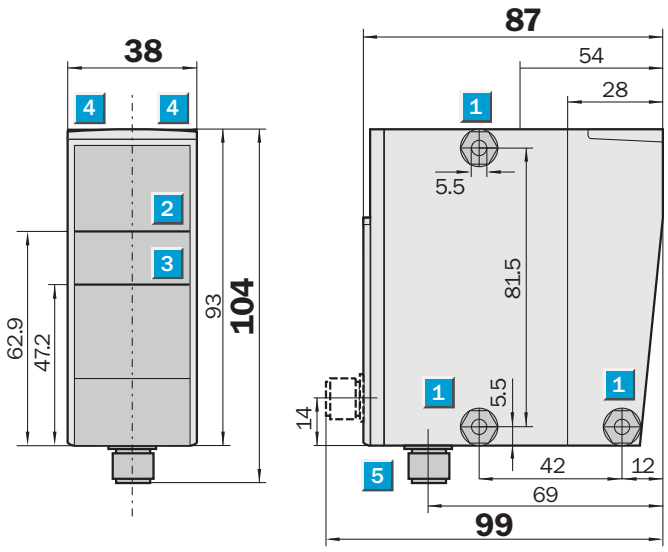
Type	Order no.
DS60-P21111	1 016 361
DS60-P21311	1 016 393
DS60-P41111	1 016 687
DS60-P41311	1 016 689
DS60-N21111	1 016 394
DS60-N21311	1 016 686
DS60-N41111	1 016 688
DS60-N41311	1 016 690
DS60-P41111-S03	1 023 745

Scanning distance
200 ... 6000 mm

Distance Sensor

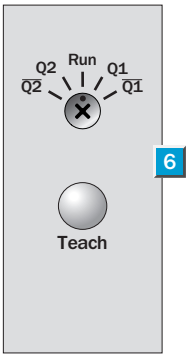
- Background suppression up to 100 m
- High target dynamic: black … extremely shiny
- Two function LED
- Precise alignment by red laser light
- Teach-in

Dimensional drawing



Adjustments possible

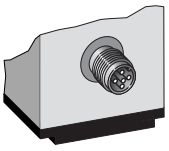
DS60-P/-N21211
DS60-P/-N41211



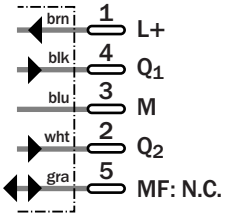
1 Mounting hole Ø 5.2 mm
2 Optical axis – sender
3 Optical axis – receiver
4 Status indicator
5 M12 plug, 5-pin
6 Control panel

Connection type

DS60-P/-N21211
DS60-P/-N41211



5-pin, M12

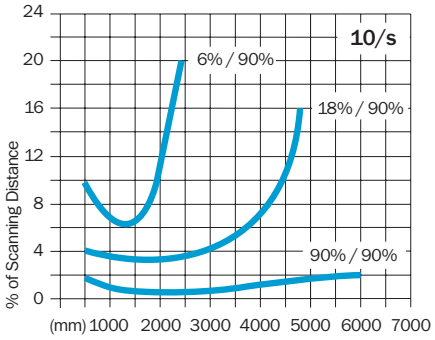


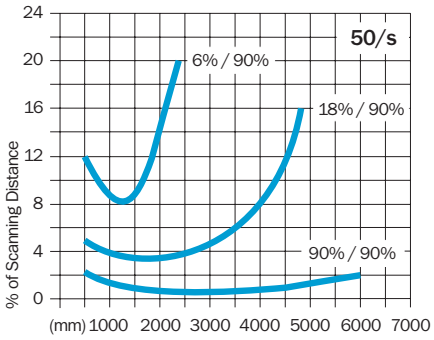
See chapter Accessories
Cables and connectors
Mounting systems
Special accessories

Technical data	DS60	-P 21211	-N 21211	-P 41211	-N 41211
Type of connection	M12 plug, 5-pin	■	■	■	■
Scanning distance, adjustable	200 mm to 6000 mm	■	■	■	■
Object with 3 % remission	80 mm to 1400 mm	■	■		
	80 mm to 1600 mm			■	■
Object with 6 % remission	80 mm to 2400 mm	■	■		
	80 mm to 2600 mm			■	■
Object with 18 % remission	80 mm to 4600 mm	■	■		
	80 mm to 5000 mm			■	■
Object with 90 % remission [1]	80 mm to 6000 mm	■	■	■	■
Light source [2]	Laser diode, red	■	■	■	■
Light spot at 4.5 m distance	Ø 9 mm	■	■	■	■
Supply voltage V_S [3]	18 to 30 V DC	■	■	■	■
Power consumption [4]	< 3 W	■	■	■	■
Ripple [5]	≤ 5 V_{PP}	■	■	■	■
Switching outputs (invertable)	Q_1, Q_2	■	■	■	■
DS60-P: PNP	HIGH = V_S – (< 2 V)/LOW = 0 V	■		■	
DS60-N: NPN	HIGH = V_S/LOW ≤ 2 V		■		■
Output current [6]	100 mA	■	■	■	■
Switching frequency	50/s	■	■		
	10/s			■	■
Switching limit Q_1/Q_2	adjustable (Teach-in)	■	■	■	■
Time delay	on request	■	■	■	■
Multifunction MF	N.C./External Teach on request	■	■	■	■
VDE protection class [7]	II	■	■	■	■
Laser protection class	2 (EN 60 825-1)	■	■	■	■
Enclosure rating	IP 67	■	■	■	■
Ambient temperature[8]	Operation – 25 to + 50 °C	■	■	■	■
	Storage – 25 to + 75 °C	■	■	■	■
Weight	202 g	■	■	■	■

1) Also shiny
2) Average service life 50 000 h, at room temperature = + 25 °C
3) Limit values, reverse polarity protected
4) Without load
5) Must be within V_S tolerances
6) Outputs Q_1 and Q_2 short-circuit protected
7) Withstand voltage 50 V DC
8) Do not distort cable below 0 °C

Scanning distance





Order information

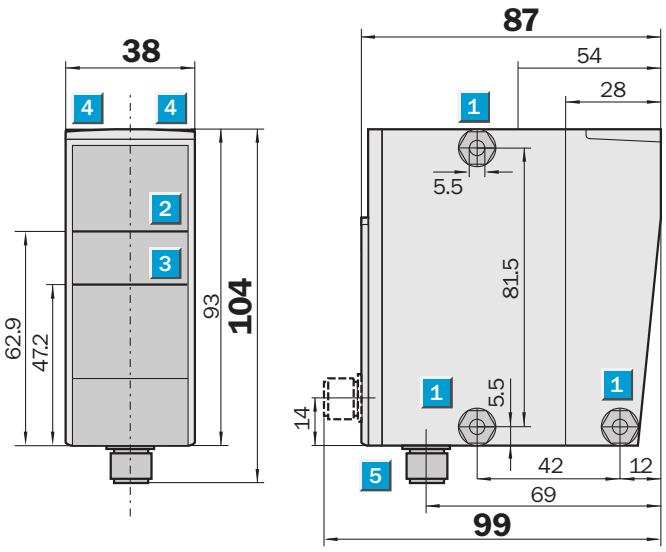
Type	Order no.
DS60-P21211	1 016 396
DS60-N21211	1 016 491
DS60-P41211	1 016 691
DS60-N41211	1 016 692

Scanning distance
200 ... 6000 mm

Distance Sensor

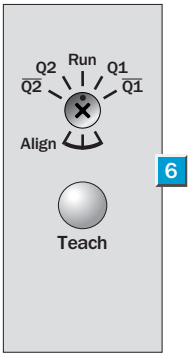
- Detection of extremely dark and shiny objects against a background
- High target dynamic: black … extremely shiny
- Two function LED
- Red Pilot Light
- Teach-in

Dimensional drawing



Adjustments possible

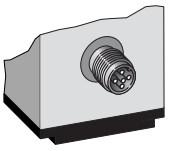
DS60-P/-N31111
DS60-P/-N31311
DS60-P/-N51111
DS60-P/-N51311



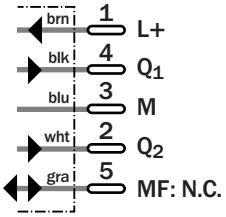
1 Mounting hole Ø 5.2 mm
2 Optical axis – sender
3 Optical axis – receiver
4 Status indicator
5 M12 plug, 5-pin
6 Control panel

Connection type

DS60-P/-N31111	DS60-P/-N51111
DS60-P/-N31311	DS60-P/-N51311



5-pin, M12



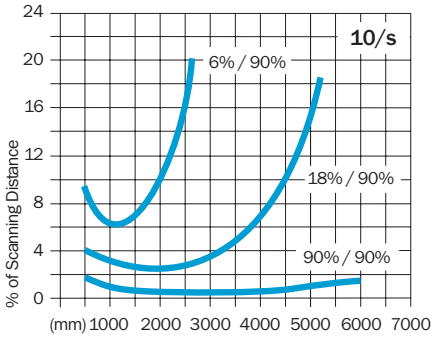
See chapter Accessories

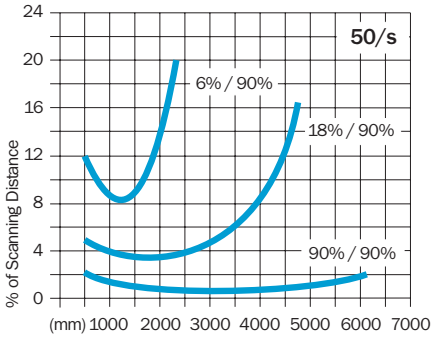
- Cables and connectors
- Mounting systems
- Special accessories

Technical data	DS60	-P 31111	-N 31111	-P 31311	-N 31311	-P 51111	-N 51111	-P 51311	-N 51311
Type of connection	M12 plug, 5-pin	■	■	■	■	■	■	■	■
Scanning distance, adjustable	200 mm to 6000 mm	■	■	■	■	■	■	■	■
Object with 3 % remission	80 mm to 1400 mm	■	■	■	■				
	80 mm to 1600 mm					■	■	■	■
Object with 6 % remission	80 mm to 2400 mm	■	■	■	■				
	80 mm to 2600 mm					■	■	■	■
Object with 18 % remission	80 mm to 4600 mm	■	■	■	■				
	80 mm to 5000 mm					■	■	■	■
Object with 90 % remission [1]	80 mm to 6000 mm	■	■	■	■	■	■	■	■
Light source [2]	Laser diode, infrared/	■	■	■	■	■	■	■	■
	Laser diode, red light on request	■	■	■	■	■	■	■	■
Light spot at 6 m distance	Ø 60 mm	■	■			■	■		
	Ø 12 mm			■	■			■	■
Supply voltage V_S [3]	18 to 30 V DC	■	■	■	■	■	■	■	■
Power consumption [4]	< 3 W	■	■	■	■	■	■	■	■
Ripple [5]	≤ 5 V_{PP}	■	■	■	■	■	■	■	■
Switching outputs (invertable)	Q_1, Q_2	■	■	■	■	■	■	■	■
DS60-P: PNP	HIGH = V_S – (< 2 V)/LOW = 0 V	■		■		■		■	
DS60-N: NPN	HIGH = V_S/LOW ≤ 2 V		■		■		■		■
Output current [6]	100 mA	■	■	■	■	■	■	■	■
Switching frequency	50/s	■	■	■	■				
	10/s					■	■	■	■
Switching limit Q_1/Q_2	adjustable (Teach-in)	■	■	■	■	■	■	■	■
Time delay	on request	■	■	■	■	■	■	■	■
Multifunction MF	N.C./External Teach on request	■	■	■	■	■	■	■	■
VDE protection class [7]	II	■	■	■	■	■	■	■	■
Laser protection class	1 (EN 60 825-1)	■	■	■	■	■	■	■	■
Enclosure rating	IP 67	■	■	■	■	■	■	■	■
Ambient temperature [8]	Operation – 25 to + 50 °C	■	■	■	■	■	■	■	■
	Storage – 25 to + 75 °C	■	■	■	■	■	■	■	■
Weight	202 g	■	■	■	■	■	■	■	■

1) Also shiny
2) Average service life 100 000 h, at room temperature = + 25 °C
3) Limit values, reverse polarity protected
4) Without load
5) Must be within V_S tolerances
6) Outputs Q_1 and Q_2 short-circuit protected
7) Withstand voltage 50 V DC
8) Do not distort cable below 0 °C

Scanning distance





Order information

Type	Order no.
DS60-P31111	1 016 493
DS60-P31311	1 016 693
DS60-P51111	1 016 695
DS60-P51311	1 016 697
DS60-N31111	1 016 494
DS60-N31311	1 016 694
DS60-N51111	1 016 696
DS60-N51311	1 016 698

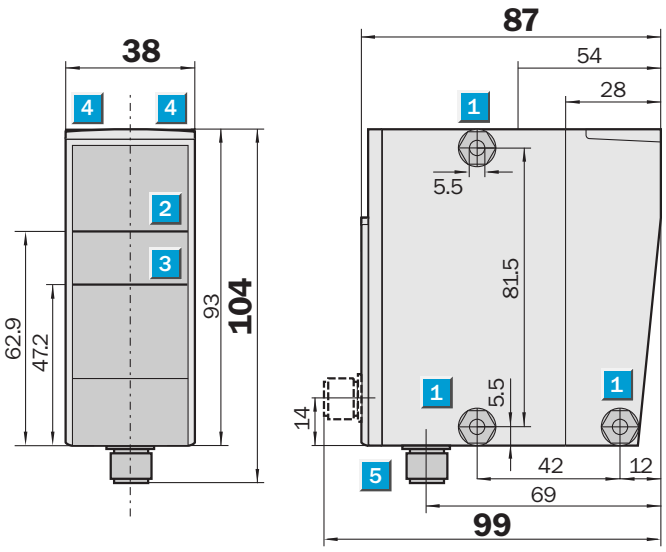
DS60 DtR IR Distance sensor: Time flight measurement distance to reflective tape, infrared light

Scanning range
200 ... 20000 mm

Distance Sensor

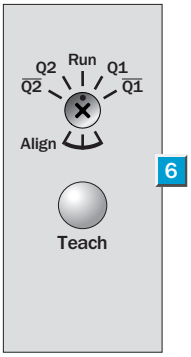
- Distance to reflective tape diamond grade
- Two switching outputs
- Two function LED
- Red Pilot Light
- Teach-in setup of switching outputs according to the distance of reflective tape

Dimensional drawing



Adjustments possible

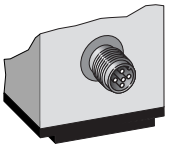
DS60-P/-N11121



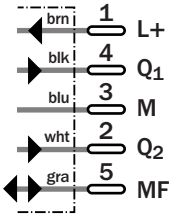
1 Mounting hole Ø 5.2 mm
2 Optical axis – sender
3 Optical axis – receiver
4 Status indicator
5 M12 plug, 5-pin
6 Control panel

Connection type

DS60-P/-N11121



5-pin, M12



See chapter Accessories
Cables and connectors
Mounting systems
Special accessories

Technical data	DS60	-P 11121	-N 11121
Type of connection	M12 plug, 5-pin	■	■
Scanning range, adjustable	200 mm to 20 000 mm	■	■
Reflective tape	Diamond Grade	■	■
Light source [1]	Laser diode, infrared	■	■
Light spot at 20 000 mm distance	Ø 200 mm	■	■
Supply voltage V_S [2]	18 to 30 V DC	■	■
Power consumption [3]	< 3 W	■	■
Ripple [4]	≤ 5 V_{PP}	■	■
Switching outputs (invertable)	Q_1, Q_2	■	■
DS60-P: PNP	HIGH = V_S – (< 2 V)/LOW = 0 V	■	
DS60-N: NPN	HIGH = V_S/LOW ≤ 2 V		■
Output current [5]	100 mA	■	■
Switching frequency	50/s	■	■
Switching limit Q_1/Q_2	adjustable (Teach-in)	■	■
Time delay	on request	■	■
Multifunction MF	Test-input/External Teach on request	■	■
Sender on	< 2 V or open-circuit	■	
	V_S – (< 2 V) or open-circuit		■
Sender off	> 12 V to < V_S	■	
	0 V to V_S – (> 12 V)		■
VDE protection class [6]	II	■	■
Laser protection class	1 (EN 60 825-1)	■	■
Enclosure rating	IP 67	■	■
Ambient temperature [7]	Operation – 25 to + 50 °C	■	■
	Storage – 25 to + 75 °C	■	■
Weight	202 g	■	■

1) Average service life 100 000 h, at room temperature = + 25 °C
2) Limit values, reverse polarity protected
3) Without load
4) Must be within V_S tolerances
5) Outputs Q_1 and Q_2 short-circuit protected
6) Withstand voltage 50 V DC
7) Do not distort cable below 0 °C

Order information	
Type	**Order no.**
DS60-P11121	1 016 397
DS60-N11121	1 016 492