

Angle sensors are needed whenever space is too tight for fork sensors and you can no longer find a (simple) solution for applications. This is due to the fact that, with nearly identical specifications, the design of the Balluff angle sensors **BWL Standard** can be used to find a solution for even more applications. The design and beam geometry allow objects to be approached and scanned from almost any direction, while red light and laser variants ensure versatile use.

#### Applications

- Assembly and handling technology
- Robotic systems
- Position and location control

#### Benefits

- High accuracy
- Visible light spot for easy alignment
- Can be installed even in tight mounting conditions



The Balluff angle sensor **BWL Automotive** is a powerful photoelectric sensor designed for harsh industrial use. Its housing is tough and allows for variable mounting options.

Objects are reliably detected, even under extremely difficult conditions.

A strong infrared emitter ensures a large function reserve and various designs allow for flexible use, allowing the creation of elegant solutions for a vast number of applications.

#### Applications

- Robotic systems
- Position and location control



# Photoelectric Sensors

## Angle sensors BWL

### Product overview



Photoelectric Sensors

Photoelectric Sensors

Cylinder Designs

Block Designs

Fork Sensors

BGL

Angle Sensors

BWL

Photoelectric Sensors with Special Properties

Photoelectric Distance Sensors for Analog Distance Measurement

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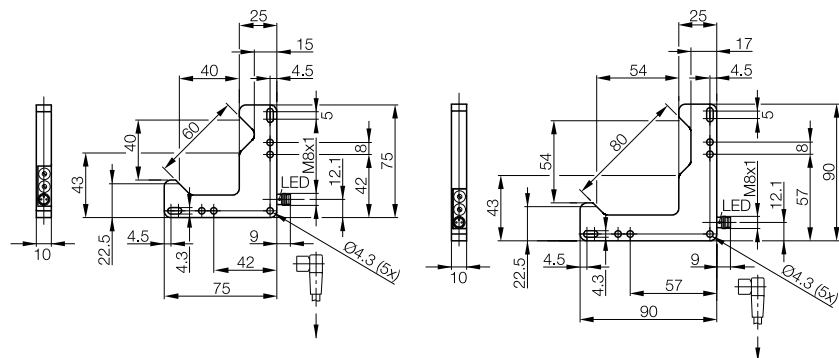
Type	Optical axis	Resolu- tion	Light type				Output	Switching type		Switch- ing fre- quency	U <sub>s</sub>	Connec- tion		Page
			Infrared	Red light	Red light, pin point	Laser		PNP transistor	Light switching			Dark switching	10...30 V DC	
<b>Angle sensors Standard</b>														
<b>BWL000F</b>	BWL 4040D-R011-S49	40/40 mm	0.4 mm	■			■	■	■	1.5 kHz	■	■		262
<b>BWL000J</b>	BWL 4040D-R013-S49	40/40 mm	0.3 mm		■		■	■	■	5 kHz	■	■		264
<b>BWL000C</b>	BWL 4040D-L011-S49	40/40 mm	80 µm			■	■	■	■	5 kHz	■	■		268
<b>BWL0009</b>	BWL 4040D-I011-S49	40/40 mm	1.0 mm	■			■	■	■	2 kHz	■	■		266
<b>BWL000R</b>	BWL 5454D-R011-S49	54/54 mm	0.4 mm	■			■	■	■	1.5 kHz	■	■		262
<b>BWL000U</b>	BWL 5454D-R013-S49	54/54 mm	0.4 mm		■		■	■	■	5 kHz	■	■		264
<b>BWL000N</b>	BWL 5454D-L011-S49	54/54 mm	100 µm			■	■	■	■	5 kHz	■	■		268
<b>BWL000L</b>	BWL 5454D-I011-S49	54/54 mm	1.2 mm	■			■	■	■	2 kHz	■	■		266
<b>BWL0012</b>	BWL 6868D-R011-S49	68/68 mm	0.5 mm	■			■	■	■	1.5 kHz	■	■		263
<b>BWL001N</b>	BWL 6868D-R013-S49	68/68 mm	0.4 mm		■		■	■	■	5 kHz	■	■		265
<b>BWL0010</b>	BWL 6868D-L011-S49	68/68 mm	120 µm			■	■	■	■	5 kHz	■	■		269
<b>BWL000Y</b>	BWL 6868D-I011-S49	68/68 mm	1.5 mm	■			■	■	■	2 kHz	■	■		267
<b>BWL0019</b>	BWL 9090D-R011-S49	90/90 mm	0.6 mm	■			■	■	■	1.5 kHz	■	■		263
<b>BWL001C</b>	BWL 9090D-R013-S49	90/90 mm	0.5 mm		■		■	■	■	5 kHz	■	■		265
<b>BWL0017</b>	BWL 9090D-L011-S49	90/90 mm	150 µm			■	■	■	■	5 kHz	■	■		269
<b>BWL0015</b>	BWL 9090D-I011-S49	90/90 mm	1.5 mm	■			■	■	■	1 kHz	■	■		267
<b>BWL0005</b>	BWL 110110D-R011-S49	110/110 mm	0.6 mm	■			■	■	■	1.5 kHz	■	■		263
<b>BWL0007</b>	BWL 110110D-R013-S49	110/110 mm	0.6 mm		■		■	■	■	5 kHz	■	■		265
<b>BWL0003</b>	BWL 110110D-L011-S49	110/110 mm	0.2 mm			■	■	■	■	5 kHz	■	■		269
<b>BWL0001</b>	BWL 110110D-I011-S49	110/110 mm	1.5 mm	■			■	■	■	2 kHz	■	■		267
<b>Angle sensors Automotive</b>														
<b>BWL001F</b>	BWL 2222B-001-S4	22/22 mm		■			■	■	■	1 kHz	■	■		270
<b>BWL001H</b>	BWL 2222C-001-S4	22/22 mm		■			■	■	■	1 kHz	■	■		270
<b>BWL001J</b>	BWL 4241A-001-S4	43/43 mm		■			■	■	■	1 kHz	■	■		271
<b>BWL001K</b>	BWL 4241A-001-S49	43/43 mm		■			■	■	■	1 kHz	■	■		271
<b>BWL001L</b>	BWL 4260A-001-S4	42/62 mm		■			■	■	■	1 kHz	■	■		271
<b>BWL001M</b>	BWL 4260A-001-S49	42/62 mm		■			■	■	■	1 kHz	■	■		271

NPN on request



Series		<b>BWL</b>	<b>BWL</b>
Optical axis		<b>40/40 mm</b>	<b>54/54</b>
PNP NO/NC	<b>Ordering code</b>	<b>BWL000F</b>	<b>BWL000R</b>
	Part number	BWL 4040D-R011-S49	BWL 5454D-R011-S49
Supply voltage $U_S$		10...30 V DC	10...30 V DC
No-load supply current $I_0$ max.		$\leq 35$ mA	$\leq 35$ mA
Output current		200 mA	200 mA
Switching type		Light/dark switching (selectable)	Light/dark switching (selectable)
Polarity reversal/short-circuit protected		Yes/Yes	Yes/Yes
Settings		Potentiometer, 270°	Potentiometer, 270°
Emitter, light type		LED, red light	LED, red light
Wavelength		640 Nm	640 Nm
Resolution (smallest discernible part)		0.4 mm	0.4 mm
Repeat accuracy		40 $\mu$ m	60 $\mu$ m
Switching hysteresis		$\leq 0.15$ mm	$\leq 0.2$ mm
Output function indicator		Yellow LED	Yellow LED
Response time		0.33 ms	0.33 ms
Switching frequency		1.5 kHz	1.5 kHz
Degree of protection as per IEC 60529		IP 67	IP 67
Ambient temperature $T_a$		-10...+60 °C	-10...+60 °C
Ambient light limit according to		EN 60947-5-2	EN 60947-5-2
Material	Housing	GD-Zn	GD-Zn
	Optical surface	Glass	Glass
Connection		M8 connector, 3-pin	M8 connector, 3-pin

→ Connector orientation



# Photoelectric Sensors

## Angle sensors BWL



Photoelectric Sensors

Photoelectric Sensors  
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Block Designs  
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Angle Sensors  
BWL

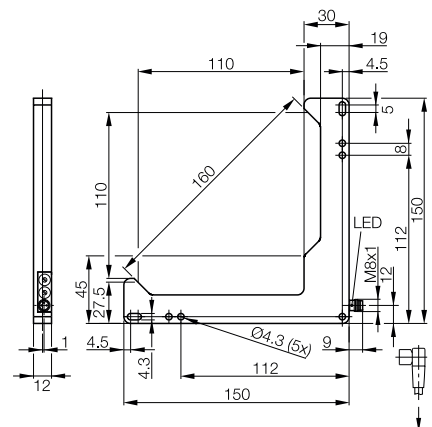
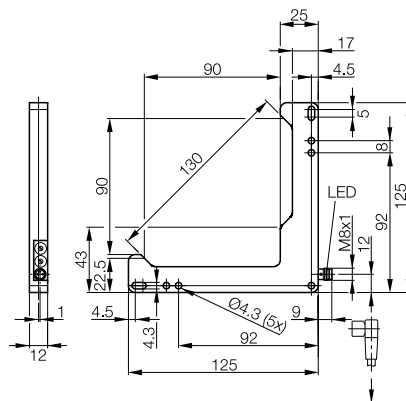
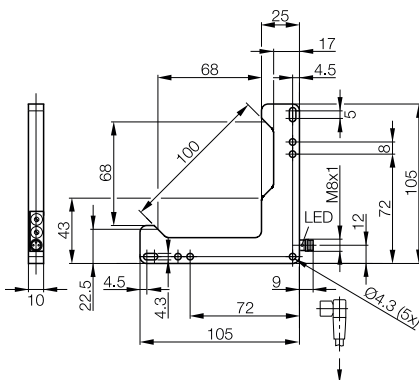
Photoelectric Sensors with Special Properties

Photoelectric Distance Sensors for Analog Distance Measurement

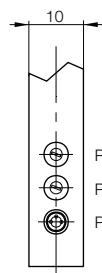
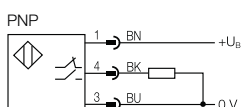
Accessories for Photoelectric Sensors



BWL 68/68 mm BWL0012	BWL 90/90 mm BWL0019	BWL 110/110 mm BWL0005
BWL 6868D-R011-S49	BWL 9090D-R011-S49	BWL 110110D-R011-S49
10...30 V DC	10...30 V DC	10...30 V DC
≤ 35 mA	≤ 35 mA	≤ 35 mA
200 mA	200 mA	200 mA
Light/dark switching (selectable)	Light/dark switching (selectable)	Light/dark switching (selectable)
Yes/Yes	Yes/Yes	Yes/Yes
Potentiometer, 270°	Potentiometer, 270°	Potentiometer, 270°
LED, red light	LED, red light	LED, red light
640 Nm	640 Nm	640 Nm
0.5 mm	0.6 mm	0.6 mm
80 μm	80 μm	80 μm
≤ 0.2 mm	≤ 0.2 mm	≤ 0.2 mm
Yellow LED	Yellow LED	Yellow LED
0.33 ms	0.33 ms	0.33 ms
1.5 kHz	1.5 kHz	1.5 kHz
IP 67	IP 67	IP 67
-10...+60 °C	-10...+60 °C	-10...+60 °C
EN 60947-5-2	EN 60947-5-2	EN 60947-5-2
GD-Zn	GD-Zn	GD-Zn
Glass	Glass	Glass
M8 connector, 3-pin	M8 connector, 3-pin	M8 connector, 3-pin



### Wiring diagram

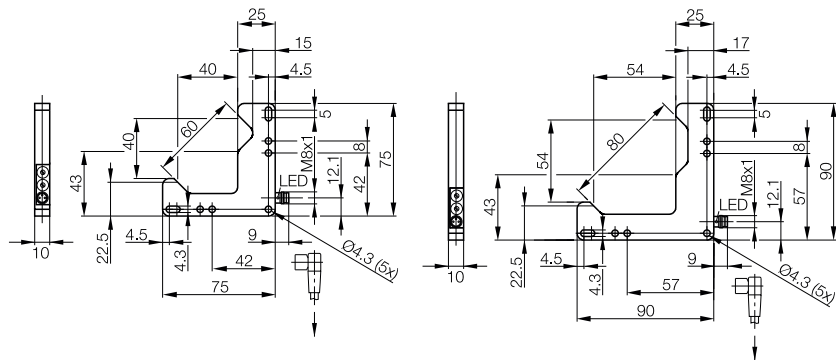


Potentiometer, sensitivity  
Potentiometer light/dark switching  
Plug, LED output function indicator



Series	<b>BWL</b>	<b>BWL</b>
Optical axis	<b>40/40 mm</b>	<b>54/54</b>
PNP NO/NC	<b>BWL000J</b>	<b>BWL000U</b>
<b>Ordering code</b>		
Part number	BWL 4040D-R013-S49	BWL 5454D-R013-S49
Supply voltage $U_S$	10...30 V DC	10...30 V DC
No-load supply current $I_0$ max.	$\leq 35$ mA	$\leq 35$ mA
Output current	200 mA	200 mA
Switching type	Light/dark switching (selectable)	Light/dark switching (selectable)
Polarity reversal/short-circuit protected	Yes/Yes	Yes/Yes
Settings	Potentiometer, 270°	Potentiometer, 270°
Emitter, light type	Red light, pin point	Red light, pin point
Wavelength	640 Nm	640 Nm
Resolution (smallest discernible part)	0.3 mm	0.4 mm
Repeat accuracy	30 $\mu$ m	40 $\mu$ m
Switching hysteresis	$\leq 0.1$ mm	$\leq 0.15$ mm
Output function indicator	Yellow LED	Yellow LED
Response time	0.1 ms	0.1 ms
Switching frequency	5 kHz	5 kHz
Degree of protection as per IEC 60529	IP 67	IP 67
Ambient temperature $T_a$	-10...+60 °C	-10...+60 °C
Ambient light limit according to	EN 60947-5-2	EN 60947-5-2
Material		
Housing	GD-Zn	GD-Zn
Optical surface	Glass	Glass
Connection	M8 connector, 3-pin	M8 connector, 3-pin

 → Connector orientation



# Photoelectric Sensors

## Angle sensors BWL



Photoelectric Sensors

Photoelectric Sensors  
Cylinder Designs  
Block Designs  
Fork Sensors  
BGL

Angle Sensors  
BWL

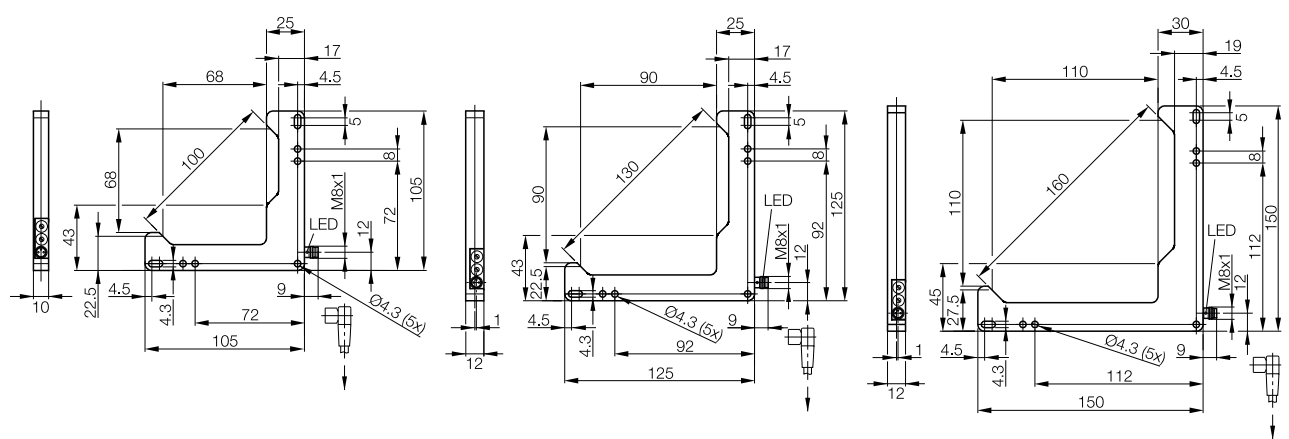
Photoelectric Sensors with Special Properties

Photoelectric Distance Sensors for Analog Distance Measurement

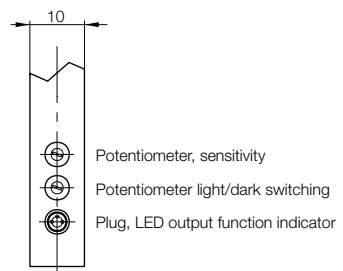
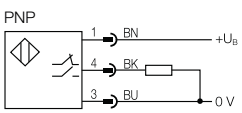
Accessories for Photoelectric Sensors



BWL 68/68 mm BWL001N	BWL 90/90 mm BWL001C	BWL 110/110 mm BWL0007
BWL 6868D-R013-S49	BWL 9090D-R013-S49	BWL 110110D-R013-S49
10...30 V DC	10...30 V DC	10...30 V DC
≤ 35 mA	≤ 35 mA	≤ 35 mA
200 mA	200 mA	200 mA
Light/dark switching (selectable)	Light/dark switching (selectable)	Light/dark switching (selectable)
Yes/Yes	Yes/Yes	Yes/Yes
Potentiometer, 270°	Potentiometer, 270°	Potentiometer, 270°
Red light, pin point	Red light, pin point	Red light, pin point
640 Nm	640 Nm	640 Nm
0.4 mm	0.5 mm	0.6 mm
40 µm	50 µm	60 µm
≤ 0.15 mm	≤ 0.15 mm	≤ 0.2 mm
Yellow LED	Yellow LED	Yellow LED
0.1 ms	0.1 ms	0.1 ms
5 kHz	5 kHz	5 kHz
IP 67	IP 67	IP 67
-10...+60 °C	-10...+60 °C	-10...+60 °C
EN 60947-5-2	EN 60947-5-2	EN 60947-5-2
GD-Zn	GD-Zn	GD-Zn
Glass	Glass	Glass
M8 connector, 3-pin	M8 connector, 3-pin	M8 connector, 3-pin



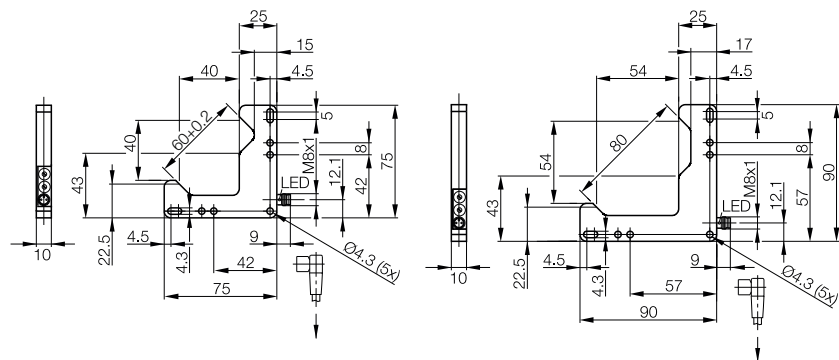
### Wiring diagram





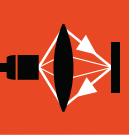
Series	<b>BWL</b>	<b>BWL</b>
Optical axis	<b>40/40 mm</b>	<b>54/54 mm</b>
PNP NO/NC	<b>BWL0009</b>	<b>BWL000L</b>
<b>Ordering code</b>		
Part number	BWL 4040D-I011-S49	BWL 5454D-I011-S49
Supply voltage $U_s$	10...30 V DC	10...30 V DC
No-load supply current $I_0$ max.	$\leq 35$ mA	$\leq 35$ mA
Output current	200 mA	200 mA
Switching type	Light/dark switching (selectable)	Light/dark switching (selectable)
Polarity reversal/short-circuit protected	Yes/Yes	Yes/Yes
Settings	Potentiometer, 270°	Potentiometer, 270°
Emitter, light type	Infrared	Infrared
Wavelength	880 Nm	880 Nm
Resolution (smallest discernible part)	1 mm	1.2 mm
Repeat accuracy	0.12 mm	0.15 mm
Switching hysteresis	$\leq 0.3$ mm	$\leq 0.4$ mm
Operating function indicator	Green LED	Green LED
Output function indicator	Yellow LED	Yellow LED
Response time	0.25 ms	0.25 ms
Switching frequency	2 kHz	2 kHz
Degree of protection as per IEC 60529	IP 67	IP 67
Ambient temperature $T_a$	-10...+60 °C	-10...+60 °C
Ambient light limit according to	EN 60947-5-2	EN 60947-5-2
Material		
Housing	GD-Zn	GD-Zn
Optical surface	Glass	Glass
Connection	M8 connector, 3-pin	M8 connector, 3-pin

 → Connector orientation



# Photoelectric Sensors

## Angle sensors BWL



Photoelectric Sensors

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Angle Sensors  
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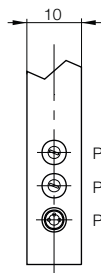
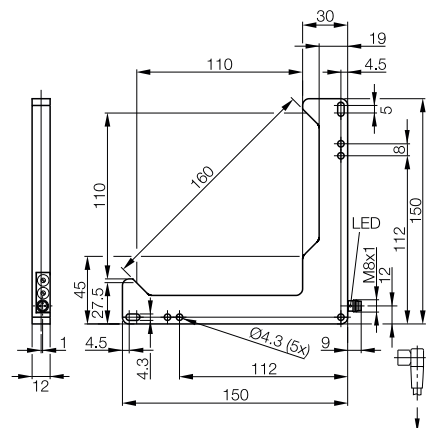
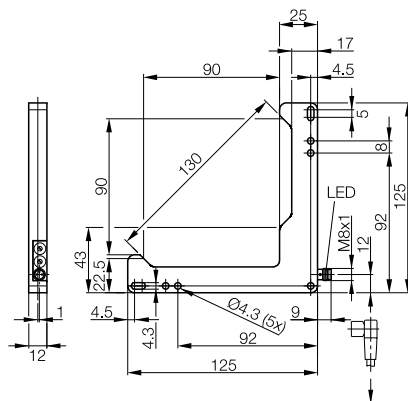
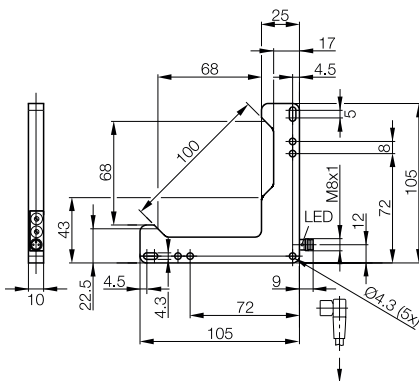
Photoelectric Sensors with Special Properties

Photoelectric Distance Sensors for Analog Distance Measurement

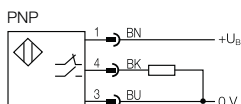
Accessories for Photoelectric Sensors



BWL 68/68 mm BWL000Y	BWL 90/90 mm BWL0015	BWL 110/110 mm BWL0001
BWL 6868D-I011-S49	BWL 9090D-I011-S49	BWL 110110D-I011-S49
10...30 V DC	10...30 V DC	10...30 V DC
≤ 35 mA	≤ 35 mA	≤ 35 mA
200 mA	200 mA	200 mA
Light/dark switching (selectable)	Light/dark switching (selectable)	Light/dark switching (selectable)
Yes/Yes	Yes/Yes	Yes/Yes
Potentiometer, 270°	Potentiometer, 270°	Potentiometer, 270°
Infrared	Infrared	Infrared
880 Nm	880 Nm	880 Nm
1.5 mm	1.5 mm	1.5 mm
0.2 mm	0.2 mm	0.2 mm
≤ 0.5 mm	≤ 0.5 mm	≤ 0.5 mm
Green LED	Green LED	Green LED
Yellow LED	Yellow LED	Yellow LED
0.25 ms	0.33 ms	0.25 ms
2 kHz	1 kHz	2 kHz
IP 67	IP 67	IP 67
-10...+60 °C	-10...+60 °C	-10...+60 °C
EN 60947-5-2	EN 60947-5-2	EN 60947-5-2
GD-Zn	GD-Zn	GD-Zn
Glass	Glass	Glass
M8 connector, 3-pin	M8 connector, 3-pin	M8 connector, 3-pin



### Wiring diagram



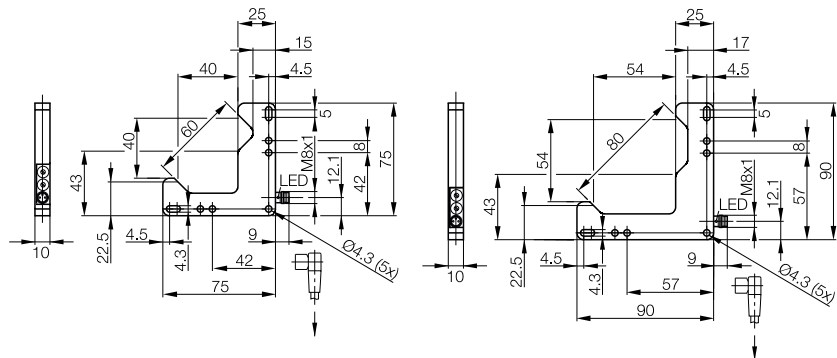
Potentiometer, sensitivity  
Potentiometer light/dark switching  
Plug, LED output function indicator





Series	BWL	BWL
Optical axis	40/40 mm	54/54 mm
PNP NO/NC	<b>Ordering code</b> Part number	<b>BWL000C</b> BWL 4040D-L011-S49
		<b>BWL000N</b> BWL 5454D-L011-S49
Supply voltage $U_S$	10...30 V DC	10...30 V DC
No-load supply current $I_0$ max.	$\leq 20$ mA	$\leq 20$ mA
Output current	200 mA	200 mA
Switching type	Light/dark switching (selectable)	Light/dark switching (selectable)
Polarity reversal/short-circuit protected	Yes/Yes	Yes/Yes
Settings	Potentiometer, 270°	Potentiometer, 270°
Emitter, light type	Laser, red light	Laser
Wavelength	640 Nm	640 Nm
Laser class	1	1
Resolution (smallest discernible part)	80 $\mu$ m	100 $\mu$ m
Repeat accuracy	$\leq 10$ $\mu$ m	10 $\mu$ m
Switching hysteresis	$\leq 25$ $\mu$ m	$\leq 35$ $\mu$ m
Output function indicator	Yellow LED	Yellow LED
Response time	0.1 ms	0.1 ms
Switching frequency	5 kHz	5 kHz
Degree of protection as per IEC 60529	IP 67	IP 67
Ambient temperature $T_a$	-10...+60 °C	-10...+60 °C
Ambient light limit according to	EN 60947-5-2	EN 60947-5-2
Material	Housing: GD-Zn Optical surface: Glass	GD-Zn Glass
Connection	M8 connector, 3-pin	M8 connector, 3-pin

Connector orientation



**Suitable connectors**  
(please order separately)



Size	Design	Cable material	Color	Length	Ordering code
M8, 3-pin	Straight	PUR	Black	2 m	<b>BCC02M8</b>
M8, 3-pin	Straight	PVC	Gray	2 m	<b>BCC02NU</b>
M8, 3-pin	Angled	PUR	Black	2 m	<b>BCC02ML</b>
M8, 3-pin	Angled	PVC	Gray	2 m	<b>BCC02P5</b>

Connectors without LED are suitable for PNP and NPN sensors.

**More electrical accessories:** You can find a large selection of plug connectors and connector cables in a wide variety of cable materials, colors and lengths in our **Industrial Networking and Connectivity catalog**.



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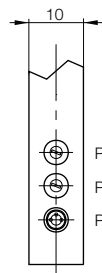
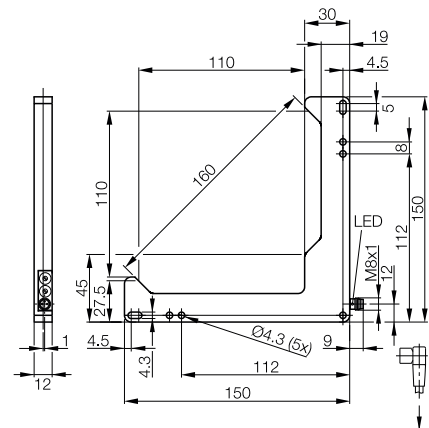
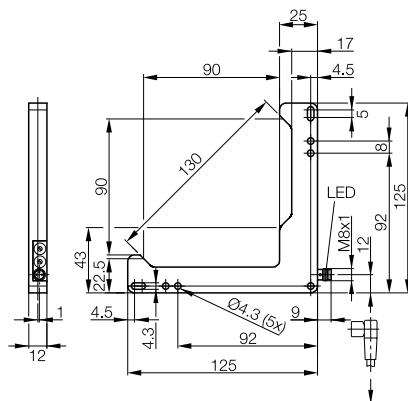
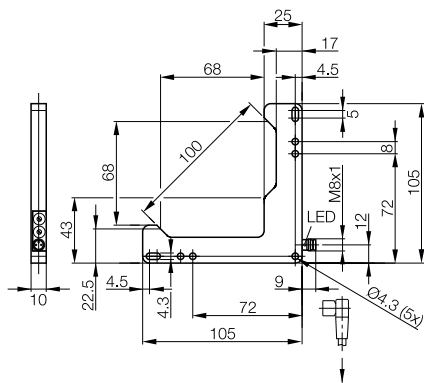
Photoelectric Sensors with Special Properties

Photoelectric Distance Sensors for Analog Distance Measurement

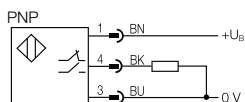
Accessories for Photoelectric Sensors



BWL 68/68 mm BWL0010	BWL 90/90 mm BWL0017	BWL 110/110 mm BWL0003
BWL 6868D-L011-S49	BWL 9090D-L011-S49	BWL 110110D-L011-S49
10...30 V DC	10...30 V DC	10...30 V DC
≤ 20 mA	≤ 20 mA	≤ 20 mA
200 mA	200 mA	200 mA
Light/dark switching (selectable)	Light/dark switching (selectable)	Light/dark switching (selectable)
Yes/Yes	Yes/Yes	Yes/Yes
Potentiometer, 270°	Potentiometer, 270°	Potentiometer, 270°
Laser	Laser	Laser
640 Nm	640 Nm	640 Nm
1	1	1
120 μm	150 μm	0.2 mm
≤ 15 μm	≤ 15 μm	≤ 20 μm
≤ 40 μm	≤ 50 μm	≤ 70 μm
Yellow LED	Yellow LED	Yellow LED
0.1 ms	0.1 ms	0.1 ms
5 kHz	5 kHz	5 kHz
IP 67	IP 67	IP 67
-10...+60 °C	-10...+60 °C	-10...+60 °C
EN 60947-5-2	EN 60947-5-2	EN 60947-5-2
GD-Zn	GD-Zn	GD-Zn
Glass	Glass	Glass
M8 connector, 3-pin	M8 connector, 3-pin	M8 connector, 3-pin

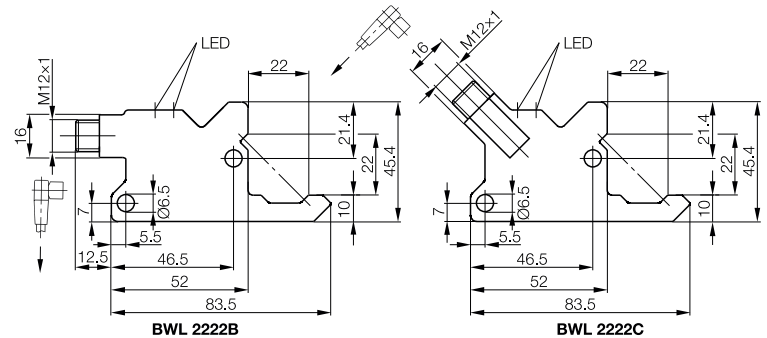


### Wiring diagram





Series		<b>BWL</b>	<b>BWL</b>
Optical axis		<b>22/22 mm</b>	<b>22/22 mm</b>
PNP NO/NC	<b>Ordering code</b>	<b>BWL001F</b>	<b>BWL001H</b>
	Part number	BWL 2222B-001-S4	BWL 2222C-001-S4
Supply voltage $U_S$		10...30 V DC	10...30 V DC
No-load supply current $I_0$ max.		≤ 35 mA	≤ 35 mA
Output current		≤ 200 mA	≤ 200 mA
Switching type		Dark switching	Dark switching
Polarity reversal/short-circuit protected		Yes/Yes	Yes/Yes
Emitter, light type		Infrared	Infrared
Wavelength		880 Nm	880 Nm
Power-on indicator		Green LED	Green LED
Output function indicator		Yellow LED	Yellow LED
Stand-by delay		100 ms	100 ms
Response time		≤ 0.5 ms	≤ 0.5 ms
Switching frequency		1 kHz	1 kHz
Degree of protection as per IEC 60529		IP 67	IP 67
Ambient temperature $T_a$		-10...+60 °C	-10...+60 °C
Ambient light limit according to		EN 60947-5-2	EN 60947-5-2
Material	Housing	Corrosion-resistant steel	Corrosion-resistant steel
	Optical surface	PMMA	PMMA
Connection		M12 connector, 4-pin	M12 connector, 4-pin



**Suitable connectors**  
(please order separately)



Size	Design	Cable material	Color	Length	Ordering code
M8, 3-pin	Straight	PUR	Black	2 m	<b>BCC02M8</b>
M8, 3-pin	Straight	PVC	Gray	2 m	<b>BCC02NU</b>
M8, 3-pin	Angled	PUR	Black	2 m	<b>BCC02ML</b>
M8, 3-pin	Angled	PVC	Gray	2 m	<b>BCC02P5</b>

Connectors without LED are suitable for PNP and NPN sensors.

**Suitable connectors**  
(please order separately)



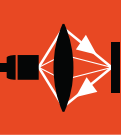
Size	Design	Cable material	Color	Length	Ordering code
M12, 4-pin	Straight	PUR	Black	2 m	<b>BCC032F</b>
M12, 4-pin	Straight	PVC	Gray	2 m	<b>BCC0367</b>
M12, 4-pin	Angled	PUR	Black	2 m	<b>BCC032Y</b>
M12, 4-pin	Angled	PVC	Gray	2 m	<b>BCC036N</b>

Connectors without LED are suitable for PNP and NPN sensors.

**More electrical accessories:** You can find a large selection of plug connectors and connector cables in a wide variety of cable materials, colors and lengths in our **Industrial Networking and Connectivity catalog**.

# Photoelectric Sensors

## Angle sensors BWL



Photoelectric Sensors

Photoelectric Sensors  
Cylinder Designs  
Block Designs  
Fork Sensors  
BGL

Angle Sensors  
BWL

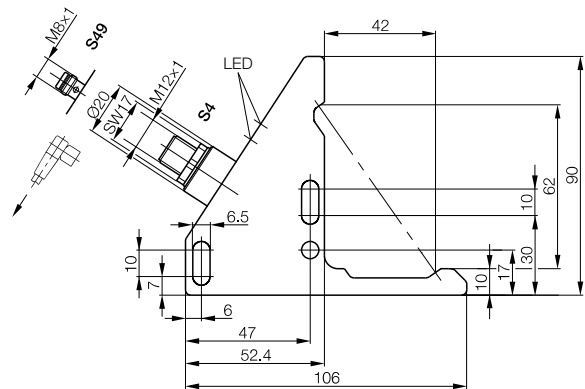
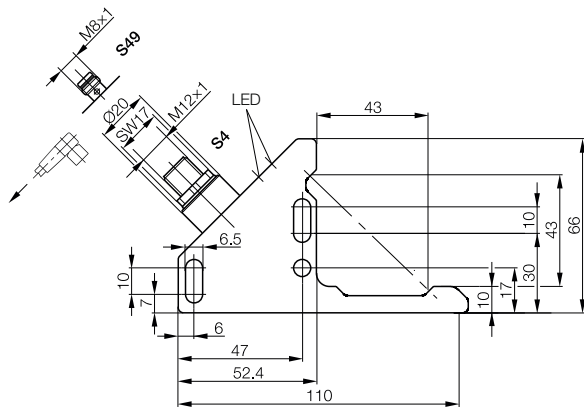
Photoelectric Sensors with Special Properties

Photoelectric Distance Sensors for Analog Distance Measurement

Accessories for Photoelectric Sensors



BWL 43/43 mm BWL001J	BWL 43/43 mm BWL001K	BWL 42/62 mm BWL001L	BWL 42/62 mm BWL001M
BWL 4241A-001-S4	BWL 4241A-001-S49	BWL 4260A-001-S4	BWL 4260A-001-S49
10...30 V DC	10...30 V DC	10...30 V DC	10...30 V DC
≤ 35 mA	≤ 35 mA	≤ 35 mA	≤ 35 mA
≤ 200 mA	≤ 200 mA	≤ 200 mA	≤ 200 mA
Dark switching	Dark switching	Dark switching	Dark switching
Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Infrared	Infrared	Infrared	Infrared
880 Nm	880 Nm	880 Nm	880 Nm
Green LED	Green LED	Green LED	Green LED
Yellow LED	Yellow LED	Yellow LED	Yellow LED
100 ms	100 ms	100 ms	100 ms
≤ 0.5 ms	≤ 0.5 ms	≤ 0.5 ms	≤ 0.5 ms
1 kHz	1 kHz	1 kHz	1 kHz
IP 67	IP 67	IP 67	IP 67
-10...+60 °C	-10...+60 °C	-10...+60 °C	-10...+60 °C
EN 60947-5-2	EN 60947-5-2	EN 60947-5-2	EN 60947-5-2
Corrosion-resistant steel	Corrosion-resistant steel	Corrosion-resistant steel	Corrosion-resistant steel
PMMA	PMMA	PMMA	PMMA
M12 connector, 4-pin	M8 connector, 3-pin	M12 connector, 4-pin	M8 connector, 3-pin



### Wiring diagram

