FF Series IP69K-rated Photoelectric Sensors

M18 (18mm) stainless steel - DC

- Diffuse, polarized reflective, retro-reflective and through-beam
- 20m maximum reading distance
- M12 quick-disconnect (purchase cable separately)
- 316L stainless steel housing
- Supply voltage: 10 - 30 VDC

- LED light status indicators: yellow (output), green (teach-in function for some diffuse and reflective models)
- IP69K rated for food and beverage applications
- Complete protection against electrical damage
- M18 mounting hex nuts included

NEED CABLES?

FFR3-BN-1E

FF Series Photoelectric Sensor Selection Chart							
Part Number	**Price**	**Sensing Range**	**Output State**	**Logic**	**Connection**	**Wiring**	**Characteristic Curves**
Diffuse							
FFR3-BN-1E	$78.00	100mm [3.9 in]	N.O./N.C. complementary	NPN	M12 [12mm] connector (purchase cable separately)	Diagram 1	Chart Set 1
FFR3-BP-1E	$78.00			PNP		Diagram 2	Chart Set 1
FFR3-0N-1E	$78.00		N.O./N.C. selectable	NPN		Diagram 3	Chart Set 1
FFR3-0P-1E	$78.00			PNP		Diagram 4	Chart Set 1
FFI7-BN-1E	$78.00	400mm [15.7 in]	N.O./N.C. complementary	NPN		Diagram 1	Chart Set 2
FFI7-BP-1E	$78.00			PNP		Diagram 2	Chart Set 2
FFI7-0N-1E	$78.00		N.O./N.C. selectable	NPN		Diagram 3	Chart Set 2
FFI7-0P-1E	$78.00			PNP		Diagram 4	Chart Set 2
FFI8-BN-1E	$80.00	800mm [31.5 in]	N.O./N.C. complementary	NPN		Diagram 1	Chart Set 3
FFI8-BP-1E	$80.00			PNP		Diagram 2	Chart Set 3
FFI8-0N-1E	$80.00		N.O./N.C. selectable	NPN		Diagram 3	Chart Set 3
FFI8-0P-1E	$80.00			PNP		Diagram 4	Chart Set 3
Polarized retro-reflective*							
FFRP-BN-1E •	$80.00	4m [13.1 ft]	N.O./N.C. complementary	NPN	M12 [12mm] connector (purchase cable separately	Diagram 1	Chart Set 4
FFRP-BP-1E •	$80.00			PNP		Diagram 2	Chart Set 4
FFRP-0N-1E •	$80.00		N.O./N.C. selectable	NPN		Diagram 3	Chart Set 4
FFRP-0P-1E •	$80.00			PNP		Diagram 4	Chart Set 4
FFRN-BN-1E	$82.00		N.O./N.C. complementary	NPN		Diagram 1	Chart Set 4
FFRN-BP-1E	$82.00			PNP		Diagram 2	Chart Set 4
FFRN-0N-1E	$82.00		N.O./N.C. selectable	NPN		Diagram 3	Chart Set 4
FFRN-0P-1E	$82.00			PNP		Diagram 4	Chart Set 4
Retro-reflective for transparent objects*							
FFRL-BN-1E	$82.00	1m [3.3 ft]	N.O./N.C. complementary	NPN	M12 [12mm] connector (purchase cable separately	Diagram 1	Chart Set 5
FFRL-BP-1E	$82.00			PNP		Diagram 2	Chart Set 5
FFRL-0N-1E	$82.00		N.O./N.C. selectable	NPN		Diagram 3	Chart Set 5
FFRL-0P-1E	$82.00			PNP		Diagram 4	Chart Set 5
Through-beam**							
FFIZ-BN-1E •	Receiver	$58.00	N.O./N.C. complementary	NPN	M12 [12mm] connector (purchase cable separately	Diagram 1	Chart Set 6
FFIZ-BP-1E •	Receiver	$58.00		PNP		Diagram 2	Chart Set 6
FFIZ-0N-1E •	Receiver	$58.00	N.O./N.C. selectable	NPN		Diagram 3	Chart Set 6
FFIZ-0P-1E •	Receiver	$58.00		PNP		Diagram 4	Chart Set 6
FFIH-00-1E	Emitter	$55.00	Receiver dependent	Receiver dependent		Diagram 5	Chart Set 6
FFIH-X0-1E†	Emitter	$56.00				Diagram 6	Chart Set 6

Note: For Through-beam rows, Sensing Range is 20m [62.6 ft].

NOTES:
† Check function
*Purchase reflectors separately.
**Purchase one receiver and one emitter for a complete set.
• Sensors without sensitivity adjustment
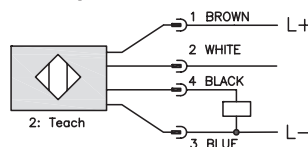
Switching Element Function		
	Through-beam and Reflective Models	**Diffuse Reflective Models**
Light-on	N.C.	N.O.
Dark-on	N.O.	N.C.

FF Series IP69K-rated Photoelectric Sensors

Wiring Diagrams

Diagram 1
NPN Output

1 BROWN	L+
4 BLACK	
2 WHITE	
3 BLUE	L−

4:
2:

Diagram 2
PNP Output

1 BROWN	L+
4 BLACK	
2 WHITE	
3 BLUE	L−

4:
2:
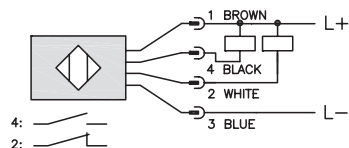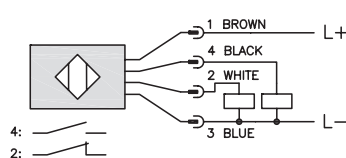
Diagram 3
NPN Output

1 BROWN	L+
4 BLACK	
2 WHITE	
3 BLUE	L−

2: Teach
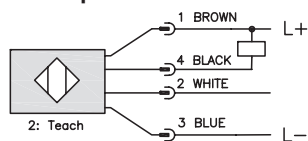
Open (+) Light-on
WH/2 —┘—(−) Dark-on

Diagram 4
PNP Output

1 BROWN	L+
2 WHITE	
4 BLACK	
3 BLUE	L−

2: Teach

(+) Light-on
WH/2 — Open (−) Dark-on
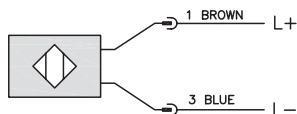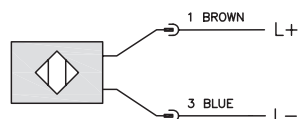
Connector
M12 Connector

2 1
3 4

Diagram 5

1 BROWN	L+
3 BLUE	L−

Diagram 6

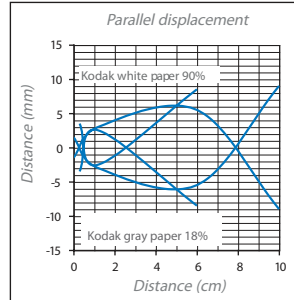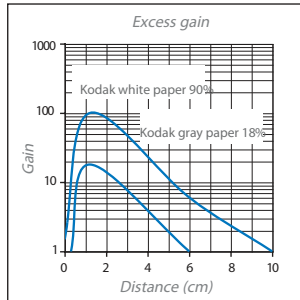|	
1 BROWN	L+
3 BLUE	L−
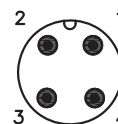
2-meter Axial Cable version: check is black
M12 Connector: check is Pin 2 (white)
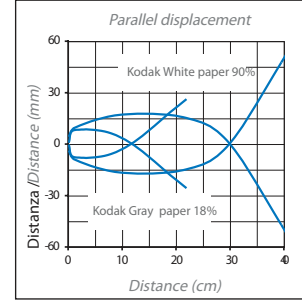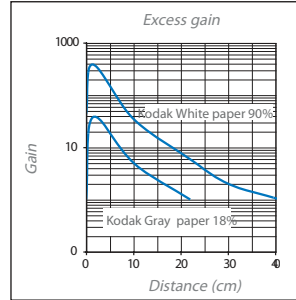
FF Series IP69K-rated Photoelectric Sensors

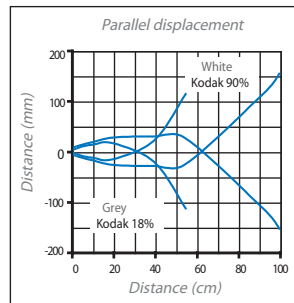## Characteristic curves
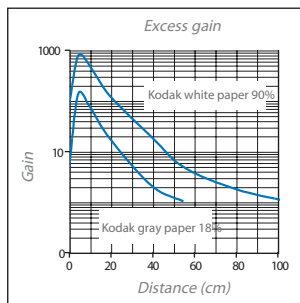
Chart Set 1 (Diffuse FFR3)

FFR3/**-1E

Excess gain

Kodak white paper 90%

Kodak gray paper 18%

Parallel displacement

Kodak white paper 90%

Kodak gray paper 18%

Chart Set 2 (Diffuse FF17)

FFI7/**-1E

Excess gain

Kodak White paper 90%

Kodak Gray paper 18%

Parallel displacement

Kodak White paper 90%

Kodak Gray paper 18%

Chart Set 3 (Diffuse FF18)

FFI8/**-1E

Excess gain

Kodak white paper 90%

Kodak gray paper 18%

Parallel displacement

White Kodak 90%

Grey Kodak 18%

Chart Set 4 (Polarized retro-reflective)

FFRN/**-1E - FFRP/**-1E

Excess gain

RL110-P80

RL 100-D

Parallel displacement
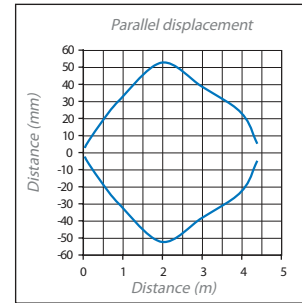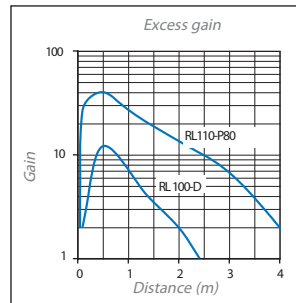
Chart Set 5 (Retro-reflective for transparent objects)

FFRL/**-1E

Excess gain

Parallel displacement
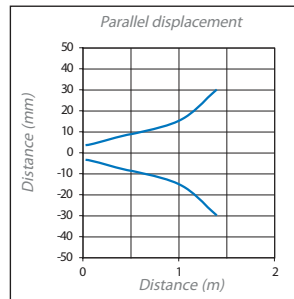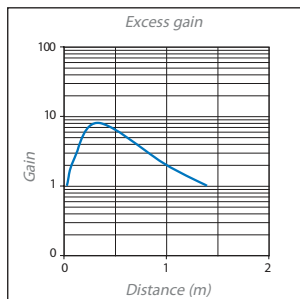
Chart Set 6 (Through-beam)

FFIH/**-1E + FFIZ/**-1E

Excess gain

Parallel displacement
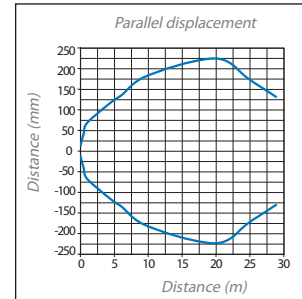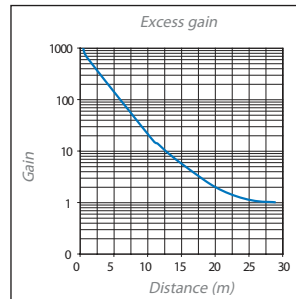
FF Series IP69K-rated Photoelectric Sensors

| FF Series Photoelectric Sensors Specifications								
Type	*Diffuse Reflective*			*Polarized Reflective*			*Through-beam* [5]	
Model Series	FFR3	FFI7	FFI8	FFRL	FFRN	FFRP	FFIZ	FFIH
Sensing Distance	100mm[1]	400mm[2]	800mm[3]	1m	4m[4]		20m	
Light Spot Diameter	10mm @ 100mm	50mm @ 400mm	180mm @ 800mm	80mm @ 1m	200mm @ 4m		600mm @ 20m	
Emission	Red (660nm)	Infrared (660nm)	Infrared (880nm)	Red (660nm)			–	Infrared (880nm)
Sensitivity	Teach						None	
Output Type	See individual parts on Selection Chart							
Operating Voltage	10-30VDC							
No-load Supply Current	≤ 30mA						≤ 25mA	40mA
Operating (Load) Current	≤ 100mA							
Off-state (Leakage) Current	≤ 10µA at 30 VDC							
Voltage Drop	2V max at 100mA							
Switching Frequency	500Hz						250Hz	–
Ripple	≤10%							
Time Delay Before Availability (tv)	200ms							
Short-Circuit Protection	Yes, switch auto-resets after load is removed							
Operating Temperature	-13 to 176°F [-25 to 80°C]							
Protection Degree (DIN 40050)	IEC IP68, IP69K							
LED Indicators- Switching Status	Green ON: teach function available Green OFF: teach function blocked Green Fast flashing: fine teach active Green Slow Flashing: teach in progress Yellow ON: Output state - Excess gain O models*; Light state - Excess gain B models*					Yellow: Output state - O models Light state - B models	Yellow: Supply on	
Housing Material	316L stainless steel							
Lens Material	Polymethyl methacrylate (PMMA), FDA certified							
Exit Connector	Grilamid							
Shock/Vibration	See terminology section							
Tightening Torque	50 N•m [36.88 lb-ft]							
Weight	120g [4.23 oz]							
Connection	M12 plug							
Agency Approvals	CE, cULus file E187310, ECOLAB, RoHS, Johnson Diversey							

[1] **With 100x100mm white matte paper**
[2] **With 200x200mm white matte paper**
[3] **With 400x400mm white matte paper**
[4] **With standard diameter 84mm RL110 reflector**
[5] **An emitter and receiver pair must be ordered for a complete sensor set.**
***Note: Yellow LED Fixed On: Excess Gain m2. Yellow LED flashing: Excess Gain l2**
To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.

Dimensions

mm [inches]

1. M12 PLUG CABLE EXIT
2. LED STATUS INDICATOR
   (N.O. OUTPUT ENERGIZED)
3. SHIELDED VERSION
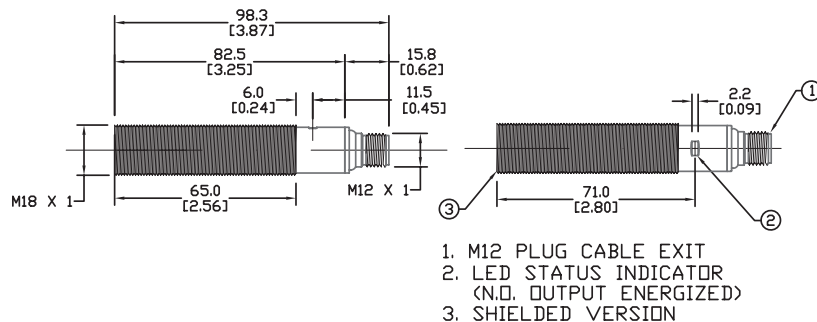
Warning: These products are not safety sensors and are not suitable for use in personal safety applications.

Accessories for 18mm Sensors

Axial Mounting Bracket

Axial mounting bracket available in zinc plated steel or 316L stainless steel. Has two mounting holes (use 4mm screws) and allows for rotation of an optical axis for right-beam-angle-adapter sensors. Hexagonal nuts not included. For use with 18mm sensors.
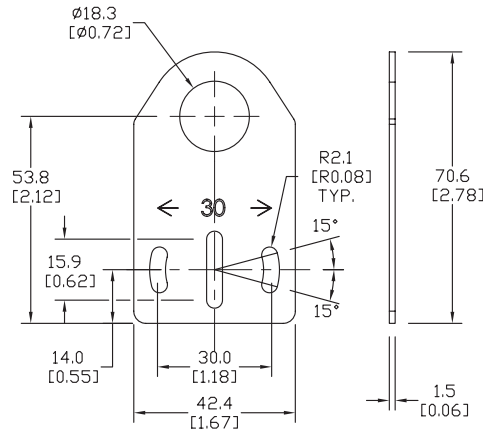
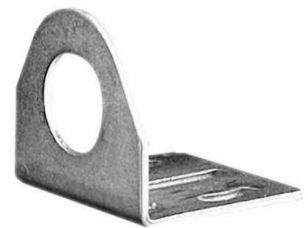| Accessories for 18mm Sensors			
Part Number	**Price**	**Description**	**Weight lb [g]**
ST18A	$2.00	Micro Detectors mounting bracket, axial, zinc plated steel. For use with 18mm sensors.	0.06 [27.2]
ST18A7W	$7.25	Micro Detectors mounting bracket, axial, 316L stainless steel. For use with 18mm sensors.	0.06 [27.2]

ST18A

Dimensions

mm [inches]

Right-angle Mounting Bracket

Right-angle mounting bracket for use with 18mm sensors. Has two mounting holes (use 4mm screws) and allows the rotation of an optical axis for axial sensors. Hexagonal nuts not included.

Accessories for 18mm Sensors			
Part Number	**Price**	**Description**	**Weight lb [g]**
ST18C	$2.00	Micro Detectors mounting bracket, right-angle, zinc plated steel. For use with 18mm sensors.	0.06 [27.2]
ST18C7W	$7.25	Micro Detectors mounting bracket, right-angle, 316L stainless steel. For use with 18mm sensors.	0.06 [27.2]

ST18C

Dimensions

mm [inches]

Sensor Accessories tSEN-481
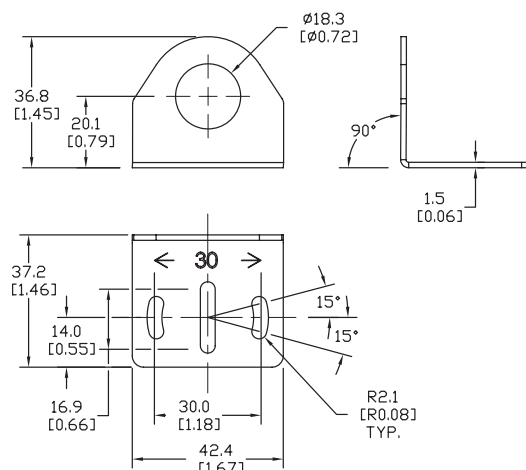
Accessories for 18mm Sensors

Right-angle Fine Tune Mounting Bracket

Mounting bracket, right-angle, fine tune vertical and horizontal adjustment, nickel-plated steel. For use with 18mm sensors. Allows for fine tuning vertical and horizontal placement.

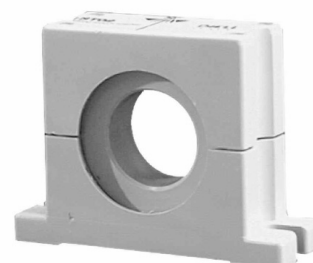| Accessories for 18mm Sensors				
Part Number	Price	Description	Drawing Link	Weight [lb]
OPT2036	$38.50	Wenglor mounting bracket, right-angle, fine tune vertical and horizontal adjustment, nickel plated steel. For use with 18mm sensors.	PDF	0.02
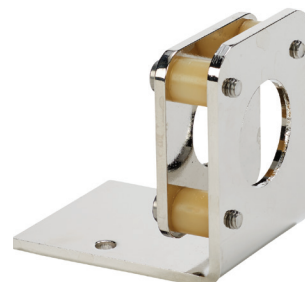
OPT2036

Swivel Mounting Bracket

Mounting bracket, ball swivel, plastic. For use with 18mm sensors. Has a ball-joint and set screws to adjust sensor orientation. Allows angular orientation up to 15 degrees (from center) in all directions for photoelectric sensors (Will not work with C18 series).

Accessories for 18mm Sensors			
Part Number	Price	Description	Weight [lb]
ST02	$9.50	Micro Detectors mounting bracket, ball swivel, plastic. For use with 18mm sensors.	0.06

Dimensions

mm [inches]

```
      1.73
     [44.0]
        30°
0.71              0.16
[18.0]            [4.0]

      2.17
     [55.0]
```

```
      1.61
     [41.0]
                  ⌀0.71
                 [⌀18.0]
1.42
[36.0]

0.22
[5.5]
```

ST02
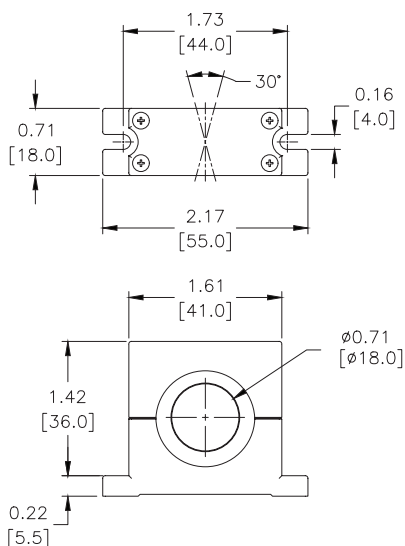
Accessories for 18mm Sensors

Right-angle Mounting Brackets

Mounting bracket, right-angle, fixed insertion stop adjustment, plastic. For use with 18mm sensors. Available with or without fixed insertion stop.

Accessories for 18mm Sensors				
Part Number	Price	Description	Drawing Link	Weight lb [g]
OPT2104	$10.50	Wenglor mounting bracket, right-angle, fixed insertion stop adjustment, plastic. For use with 18mm sensors.	PDF	0.06 [27.2]
OPT2105	$10.50	Wenglor mounting bracket, right-angle, plastic. For use with 18mm sensors.	PDF	0.06 [27.2]

OPT2104, OPT2105

Right-angle Swivel Mounting Systems

Mounting bracket, right-angle swivel, 360 degree vertical and horizontal adjustment, 12mm rod mount. For use with 18mm sensors. Available in all 304 stainless steel or with an aluminum head and a stainless steel mounting plate.

Accessories for 18mm Sensors						
Part Number	Price	Description	Mounting Head	Mounting Plate	Drawing Link	Weight lb [g]
OPT2116	$11.50	Wenglor mounting bracket, right-angle swivel, 360 degree vertical and horizontal adjustment, aluminum, 12mm rod mount. For use with 18mm sensors.	Aluminum	304 Stainless steel	PDF	0.15 [68.0]
OPT2117	$21.00	Wenglor mounting bracket, right-angle swivel, 360 degree vertical and horizontal adjustment, 304 stainless steel, 12mm rod mount. For use with 18mm sensors.	304 Stainless steel	304 Stainless steel	PDF	0.28 [127.0]

Note: 304 Stainless steel mounting rods sold separately: OPT2109 (200mm [7.87 in] length), OPT2110 (300mm [11.81 in] length), and OPT2111 (500mm [19.69 in] length).

OPT2116, OPT2117

Mounting Rods and Brackets

Mounting Rods

304 Stainless steel rods for mounting swivel brackets OPT2112 - OPT2127
Available in three lengths: 200mm, 300mm, and 500mm. 12mm diameter.

| Mounting Rods for OPT2112-2127 Swivel Mounting Brackets				
Part Number	*Price*	*Description*	*Drawing Link*	*Weight lb (g)*
OPT2109	$13.00	Wenglor mounting rod, 12mm diameter, 200mm length, 304 stainless steel.	PDF	0.41 [185.97]
OPT2110	$16.00	Wenglor mounting rod, 12mm diameter, 300mm length, 304 stainless steel.	PDF	0.60 [272.16]
OPT2111	$21.00	Wenglor mounting rod, 12mm diameter, 500mm length, 304 stainless steel.	PDF	0.98 [444.52]

Right-angle Mounting Bracket

Mounting bracket, right-angle, nickel-plated brass. For use with 12mm mounting rods OPT2109, OPT2110 & OPT2111.

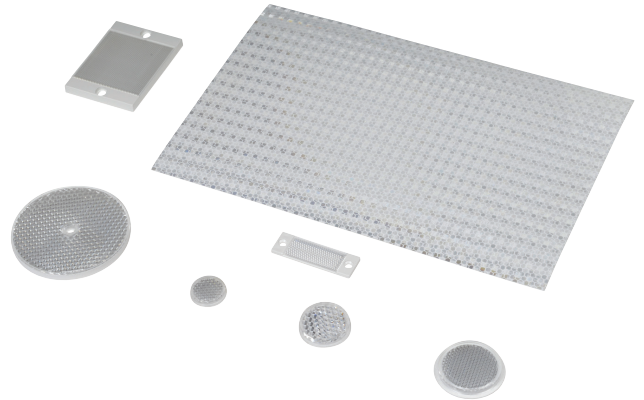| Right-angle Mounting Brackets for 12mm Sensors				
Part Number	*Price*	*Description*	*Drawing Link*	*Weight lb [g]*
OPT2108	$16.00	Wenglor mounting bracket, right-angle, nickel-plated brass. For use with 12mm mounting rods OPT2109, OPT2110 & OPT2111.	PDF	0.07 [31.8]
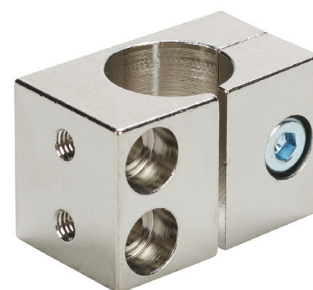
Reflectors

RL Series Reflectors for Polarized Reflective Photoelectric Sensors (All Models)

- Suitable for use with polarized light photoelectric sensors
- Shapes and sizes for most applications
- Miniature types for close mounting in multiple sensor installations
- Single hole, dual hole and self-adhesive mounting types available
- Single and 10-packs available

Installation Notes

- Keep the reflector surface clean to ensure peak detection performance. This is especially true when the maximum sensing range is being used. Clean using a damp cloth.
- When selecting a reflector, it is important to consider the ambient conditions it will be exposed to. Dusty or high humidity conditions may reduce the sensing range as much as 90%.
- Reflectors should be positioned at a 90° angle to the optical axis with a tolerance of ±15°.

Reflector Specifications							
Part number	Price	Drawing Link	Quantity	Dimensions mm [in]	Degree of Protection	Mounting	Materials
RL102	$38.00	PDF	10	25 [0.98]	IEC IP67	Customer-supplied adhesive or other mounting method required	Reflective face: PMMA Polymethylmethacrylate (acrylic) Base material: ABS (Acrylonitrile-butadiene-styren)
RL102-1	$4.25		1				
RL103	$42.50	PDF	10	34.5 [1.36]			
RL103-1	$4.75		1				
RL104	$42.50	PDF	10	46 [1.81]			
RL104-1	$4.75		1				
RL105G	$38.00	PDF	10	95 x 38 [3.74 x 1.50]		Two 4.3 mm holes	
RL105G-1	$4.25		1				
RL106G	$42.50	PDF	10	182 x 42 [7.17 x 1.65]		Two 6mm holes	
RL106G-1	$4.75		1				
RL110	$19.00	PDF	10	84 [3.31]		One 5mm hole	
RL110-1	$2.00		1				
RL116	$19.00	PDF	10	41 x 60 [3.54 x 2.36]		Two 3mm holes	
RL116-1	$2.00		1				
RL100DA4	$38.50	NA	1	200 x 300 [7.87 x 11.81]		Self-adhesive	Paper (Acrylic tape with micro prism)
RL100DC4	$12.00	NA	1	50 x 300 [1.97 x 11.81]			
RL100DQ1	$8.75	NA	1	100 x 100 [3.94 x 3.94]			
RL111G	$60.00	PDF	10	22.5 x 47 [0.89 x 1.85]		Two 3mm slots	Reflective face: PMMA Polymethylmethacrylate (acrylic) Base material: ABS (Acrylonitrile-butadiene-styren)
RL111G-1	$7.25		1				
RL112G	$44.00	PDF	10	19 x 73 [0.75 x 2.87]			
RL112G-1	$4.75		1				
RL113G	$53.00	PDF	10	51.4 x 60.3 [2.02 x 2.37]		Two 4mm slots	
RL113G-1	$6.00		1				

Not recommended for applications involving moist air environments or water immersion.

Sensor Accessories

Reflectors

RL Series Reflectors for Polarized Reflective Laser Photoelectric Sensors (FALN series)

- Suitable for use with polarized light laser photoelectric sensors
- Sizes for most applications
- Miniature types for close mounting in multiple sensor installations
- Single and 5-packs available

Specifications						
Part Number	**RL201**	**RL201-1**	**RL203**	**RL203-1**	**RL204**	**RL204-1**
Price	$38.00	$8.25	$35.50	$7.75	$30.00	$6.75
Quantity	5	1	5	1	5	1
Drawing Link	PDF		PDF		PDF	
Dimensions	60 x 82 mm 2.36 x 3.23 in		19 x 6mm 0.75 x 2.36 in		20mm x 32mm 0.80 in x 1.26 in	
Degree of Protection [1]	IEC IP67					
Mounting	Two 0.4 mm holes		Two 0.4 mm holes		Two 0.3 mm holes	
Materials	Acrylic/polycarbonate					

[1] **Not recommended for applications involving moist air environments or water immersion.**