FG Series Photoelectric Sensors

Rectangular plastic - AC/DC

- Universal supply voltage: 12-240 VDC or 24-240 VAC
- Diffuse w/background suppression, polarized reflective, and through-beam models
- Plastic housing
- SPDT electrically isolated output
- Adjustable sensitivity
- IP67 rated

FG Series Photoelectric Sensors Selection Chart						
Part Number	Price	Sensing Range	Output	Connection	Dimensions	Characteristic Curves
Diffuse with background suppression						
FGRW-DT-0A	<--->	up to 550mm (21.65in)	SPDT Relay	2m (6.5) axial cable	Figure 1	Chart 1
Polarized reflective*						
FGRN-DT-0A	<--->	up to 9m (29.52ft)	SPDT Relay	2m (6.5) axial cable	Figure 2	Chart 2
Through-beam**						
FGRHD-DT-0A	<--->	up to 20m (65.62ft)	SPDT Relay	2m (6.5) axial cable	Figure 3	Chart 3

*Note: Polarized reflective sensors include one round reflector (84mm dia.) and
 one rectangular reflector (12mm x 54mm). Purchase additional reflectors separately.

**Through-beam model consists of an emitter and receiver pair.

Wiring diagrams

Emitter

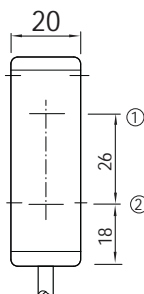All other units
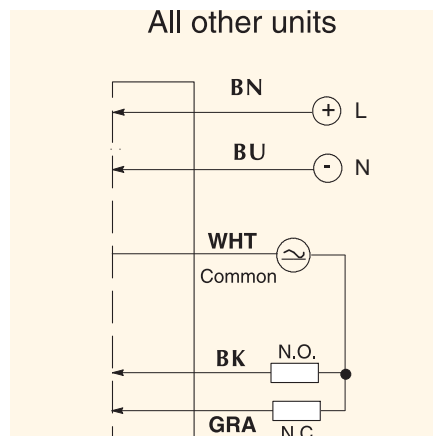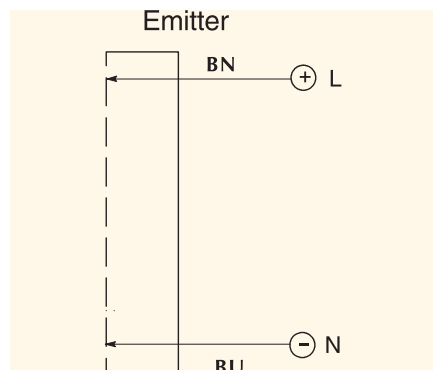
Dimensions (mm)

Figure 1

Figure 2

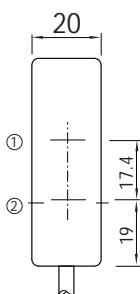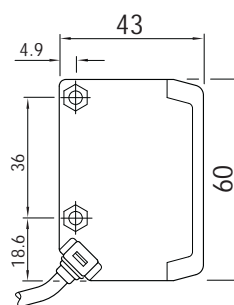### Figure 3
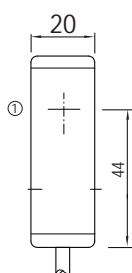
1) Emitter center of optical axis

2) Receiver center of optical axis

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FG Series Photoelectric Sensors

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflection[3]	Through-beam[4]
Sensing Distance	550mm[1]	9m[2]	20m
Emission	Red LED (visable)		
Blind Zone	10-35mm	10mm	-
Sensitivity	Adjustable		
Response Time	≤15ms		
Operating Voltage	12-240VDC or 24-240VAC		
No-load Supply Current	≤2VA		
Load Current	3A @ 240VAC/30VDC		
Output Type	SPDT relay electrically isolated		
Switching Frequency	33Hz		
(tv) Time Delay before Availability	150 ms		
Input Voltage Transients Protection	Yes, as long as the transient peak does not reach 30VDC		
Input Power Polarity Reversal Protection	Yes		
Output Power Short-Circuit Protection	Yes, switch autoresets after load is removed		
Temperature Range	-25/+55°C (-13° to 131° F)		
Temperature Drift	15% Sr		
Interference to External Light	3000 lux (incandescent lamp), 10000 lux (sunlight)		
Protection Degree (DIN 40050)	IP67		
Housing Material	ABS		
Lens Material	PC		
Weight	160g (5.64oz)		Emitter/Receiver pair 290g(10.23oz)

[1] With 100x100mm white matte paper

[2] With standard reflector

[3] Each sensor includes one reflector. Purchase additional reflectors separately.

[4] Each through-beam part number consists of an emitter and receiver pair.

Characteristic curves

Chart 1

Background Suppression
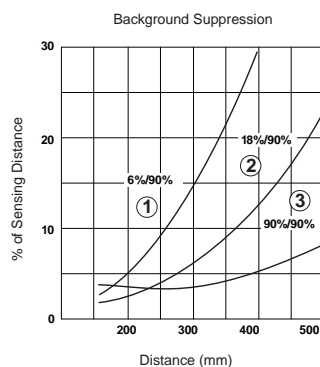
1) Sensing range on black with white background.
2) Sensing range on gray with white background.
3) Sensing range on white with white background.

Chart 2

Excess Gain

Reflector supplied with FGRN models

Chart 3

Excess Gain

Horizontal mounting bracket supplied with each unit

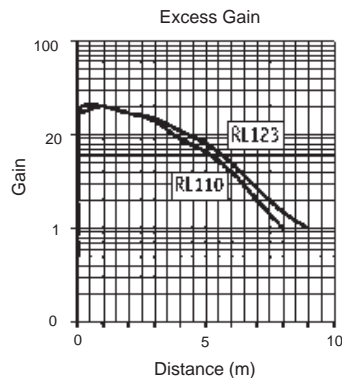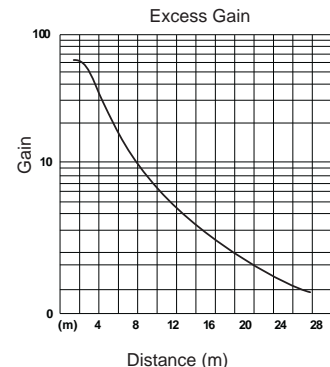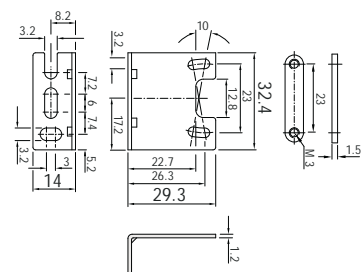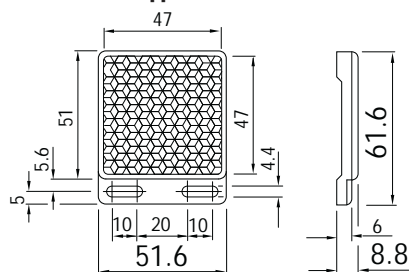**Warning: These products are not safety sensors and are not suitable for use in personal safety applications.**

Sensors Accessories: Cables

Cables with quick-disconnect plugs

- Industry standard axial and right-angle M8/M12 screw-lock connectors with open leads. The cables listed can be used with patch cables
- 2m, 5m, 7m and 10m cable lengths

- PVC (polyvinyl chloride) jacket for typical industrial applications
- PUR (polyurethane) jacket for oily and direct sunlight applications
- IP67 rated

CD08-0A-020-A1 and -C1 shown

CD08-0A-050-A1 and -C1 shown

CD12L-0B-020-A0 and -C0 shown

CD12M-0B-050-C1 and -A1 shown

M8 Quick-Disconnect Cables (Pico, Nano)

Part Number	Price	Length	Poles	Connector	LED	Jacket	Dimensions
M8 Quick-Disconnects							
CD08-0A-020-A1	<--->	2m (6.5ft.)	3	Axial	No	PVC	Figure 1
CD08-0A-020-C1	<--->	2m (6.5ft.)	3	Right-angle	No	PVC	Figure 2
CD08-0A-050-A1	<--->	5m (16.4ft.)	3	Axial	No	PVC	Figure 4
CD08-0C-050-A1	<--->	5m (16.4ft.)	3	Axial	No	PUR	Figure 3
CD08-0A-050-C1	<--->	5m (16.4ft.)	3	Right-angle	No	PVC	Figure 5
CD08-0C-050-C1	<--->	5m (16.4ft.)	3	Right-angle	No	PUR	Figure 5
CD08-0A-070-A1	<--->	7m (23ft.)	3	Axial	No	PVC	Figure 1
CD08-0A-070-C1	<--->	7m (23ft.)	3	Right-angle	No	PVC	Figure 2

M12 Quick-Disconnect Cables (Euro, Micro DC-Single Key)

Part Number	Price	Length	Poles	Connector	LED	Jacket	Dimensions
M12 Quick-Disconnects							
CD12L-0B-020-A0	<--->	2m (6.5ft)	4	Axial	No	PVC	Figure 6
CD12L-0B-020-C0	<--->	2m (6.5ft)	4	Right-angle	No	PVC	Figure 7
CD12M-0B-050-A1*	<--->	5m (16.4ft)	3	Axial	No	PVC	Figure 8
CD12M-0D-050-A1*	<--->	5m (16.4ft)	3	Axial	No	PUR	Figure 9
CD12M-0B-050-C1*	<--->	5m (16.4ft)	3	Right-angle	No	PVC	Figure 10
CD12M-0D-050-C1*	<--->	5m (16.4ft)	3	Right-angle	No	PUR	Figure 11
CD12M-0B-070-A1	<--->	7m (23ft)	4	Axial	No	PVC	Figure 6
CD12M-0B-070-C1	<--->	7m (23ft)	4	Right-angle	No	PVC	Figure 7

*   Note: Do not use with: DM, FA, QX, SS, SSF, SU, TU, VM, VK, MV, MS or MSF series sensors. These sensors require 4-pole cables.

Cables with LED and quick-disconnect plugs

- Industry standard M12 right angle female plug with open leads
- These cables can be used with patch cables
- 2m, 5m and 10m cable lengths

- PUR (polyurethane) jacket for oily and direct sunlight applications
- IP67 /IP68 / IP69K, II rated
- LED indication for 10 -36 VDC PNP sensors only

white wire Pin 2

black wire Pin 4

M12 Quick-Disconnect Cables with LED Indicator (Euro, Micro DC-Single Key)

Part Number	Price	Length	Poles	Connector	LED	Jacket	Dimensions
M12 Quick-Disconnects							
EVC178*	<--->	2m (6.5ft)	4	Right-angle	Yes	PUR	Figure 12
EVC179*	<--->	5m (16.4ft)	4	Right-angle	Yes	PUR	Figure 12
EVC180*	<--->	10m (32.8ft)	4	Right-angle	Yes	PUR	Figure 12

*Note: LED for 10 to 36 VDC PNP only.
Do not use when white wire (Pin 2) is used for selection of a sensor function.

LED Models' Wiring

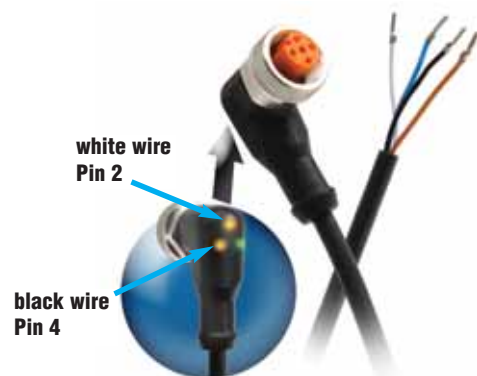
1) (+)BROWN
2) (out)WHITE
4) (out)BLACK
3) (−)BLUE

2-WHITE   3-BLUE
1-BROWN   5-NOT USED   4-BLACK

PNP−NORMALLY OPEN

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Sensors Accessories: Cables

Cable Specifications					
Specification	*M8*		*M12*		*M12 with LED*
Length	2m (6.5ft) / 7m (23ft)	5m (16.4ft)	2m (6.5ft) / 7m (23ft)	5m (16.4ft)	2m (6.5 ft) / 5m (16.4ft) / 10m (32.8ft)
Nominal Voltage	50VAC/75VDC	60VAC/DC	300VAC	250VAC/DC	10 to 36VDC
Max Current	4A		4A		4A
LED Current Loading	N/A	N/A	N/A	N/A	**10V input** Brown wire LED: 1.7mA White and/or Black LED: 0.9mA **36V input** Brown wire LED: 7.3mA White and/or Black LED: 4.7mA
Protection Degree	IP67	IP65 / IP68 / IP69K	IP67	PVC: IP68 PUR: IP68 / IP69K	IP67 / IP68 / IP69K
Material Nut	brass; nickel plated		brass; nickel plated		brass; nickel plated
Jacket Material	PVC	PVC:CD08-0A-xxx. PUR:CD08-0C-xxx	PVC	PVC:CD12M-0B-xxx. PUR:CD12M-0D-xxx	PUR
Housing Material	PUR		PUR		PUR
Contacts Material	Copper-Tin Alloy (CuSn) -gold plated		Copper-Tin Alloy (CuSn) -gold plated		Gold plated brass
Tightening Torque	0.5 Nm	≤ 0.4 Nm	0.5 Nm	≤ 0.4 Nm	0.6 to 1.5 Nm
Conductors Cross Section (AWG)	0.25mm^2 (24 AWG)	0.25mm^2 (24 AWG)	0.25mm^2 (24 AWG)	0.34mm^2 (22 AWG)	4 x 0.34mm^2 (4 x 22 AWG)
Ø Outer Cable	5mm	PVC: 4 mm PUR: 4 mm	5mm	PVC: 4.2 mm PUR: 4.3 mm	5mm
Temperature Range	-25° to +80°C (-13° to 176°F)	-25° to 90°C (-13° to 194°F)	-25° to +80°C (-13° to 176°F)	PVC: -30° to 70°C (-22° to 158°F) PUR: -50° to 90°C (-58° to 194°F)	-25° to +90°C (-13° to 194°F)
Environmental	N/A	Halogen free, Silicone free	N/A	Halogen free, Silicone free	Halogen free, Silicone free
Function Display Power LED	N/A	N/A	N/A	N/A	Green
Switching Status LED	N/A	N/A	N/A	N/A	2 x Yellow
Drag Chain (Roller Cable Tray) Suitability **Bending Radius**	min. 10 x cable diameter				
Bending Cycles	N/A	N/A	N/A	N/A	>5 million
Travel Speed	N/A	N/A	N/A	N/A	Max. 3.3 m/s for a horizontal travel length of 5 meters and max. acceleration of 5 m/s^2
Torsional Strain	N/A	N/A	N/A	N/A	±180°/m
Agency Approvals	RoHS				UL File E191684, RoHS

UL Reference	
Part Number	*Mini-Series Female Cord Connectors Series M12, UL Catalog Number*
EVC178	ADOAH043MSS0002H04
EVC179	ADOAH043MSS0005H04
EVC180	ADOAH043MSS0010H04
Note: Shown in UL file under Mini-series Female Cord Connectors using catalog number	

Sensors Accessories: Cables
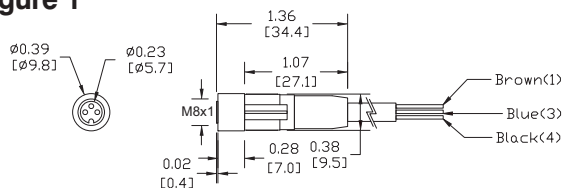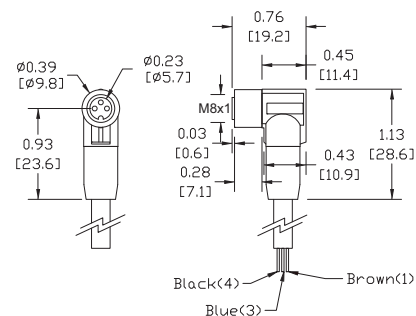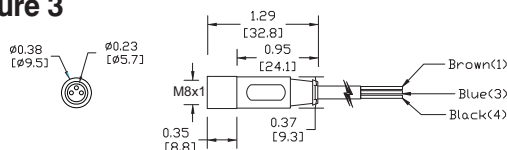
Dimensions (in/mm)

Figure 1

Figure 2
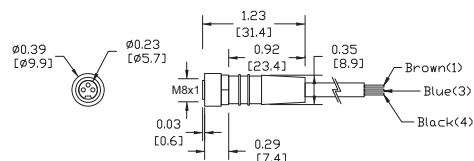
Figure 3
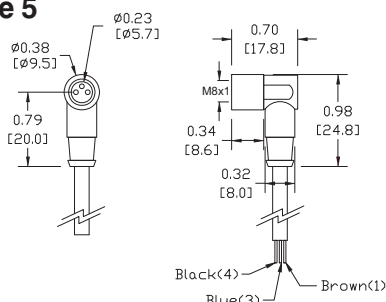
Figure 4
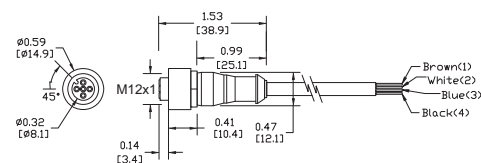
Figure 5

Figure 6

Figure 7
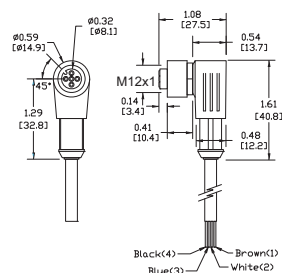
Figure 8
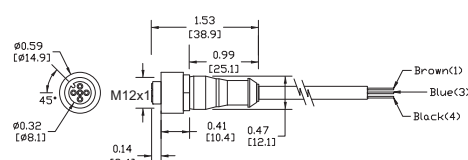
Figure 9
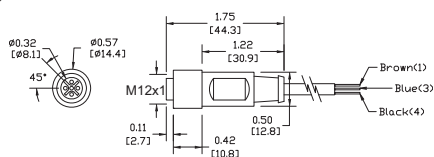
Figure 10

Figure 11

Figure 12

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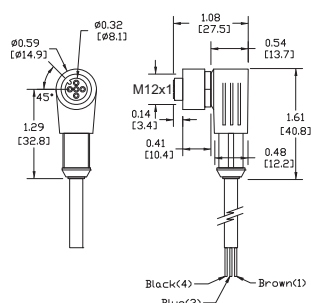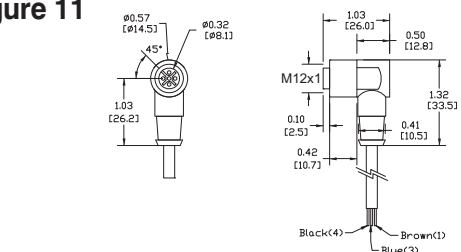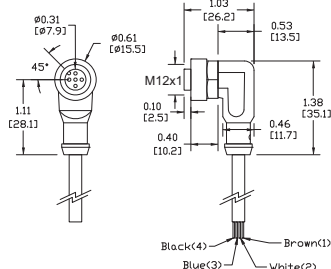Part # Index

Sensors Accessories: Cables

Patch cables with quick-disconnect plugs on each end

Available patch cables include:
- Industry standard M8 and M12 screw-lock connectors

- One male and one female connector
- Axial and right-angle connector models
- 1m and 3m cable lengths
- PVC (polyvinyl chloride)jacket for typical industrial applications
- IP67 rated

| M8 Patch Cables with Quick-Disconnect on Each End (Pico, Nano)						
Part Number	**Price**	**Length**	**Poles**	**Connectors**	**Jacket**	**Dimensions**
M8 Quick-Disconnect Patch Cables						
CDP08-0A-010-AA	<--->	1m (3.28ft)	3	2 Axial. One male and one female connector	PVC	Figure 1
CDP08-0A-010-BB	<--->	1m (3.28ft)	3	2 Right-angle. One male and one female connector	PVC	Figure 3
CDP08-0A-030-AA	<--->	3m (9.84ft)	3	2 Axial. One male and one female connector	PVC	Figure 2
CDP08-0A-030-BB	<--->	3m (9.84ft)	3	2 Right-angle. One male and one female connector	PVC	Figure 3

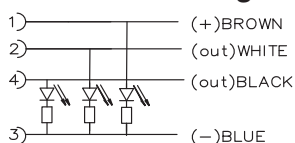| M12 Patch Cables with Quick-Disconnect on Each End (Euro, Micro DC-Single Key)						
Part Number	**Price**	**Length**	**Poles**	**Connectors**	**Jacket**	**Dimensions**
M12 Quick-disconnect Patch Cables						
CDP12-0B-010-AA	<--->	1m (3.28ft.)	4	2 Axial. One male and one female connector	PVC	Figure 4
CDP12-0B-010-BB	<--->	1m (3.28ft.)	4	2 Right-angle. One male and one female connector	PVC	Figure 5
CDP12-0B-030-AA	<--->	3m (9.84ft.)	4	2 Axial. One male and one female connector	PVC	Figure 4
CDP12-0B-030-BB	<--->	3m (9.84ft.)	4	2 Right-angle. One male and one female connector	PVC	Figure 5

Patch Cables with LED

Available patch cables with LED include:
- Right-angle M12 female plug with LED indication on one end and axial male plug on the other end
- 0.3m, 0.6m, 1m, 2m, 5m, and 10m cable lengths

- PUR (polyurethane) jacket for oily and direct sunlight applications
- IP67 /IP68 / IP69K, II rated
- LED indication for 10 -36 VDC PNP sensors only

white wire Pin 2

black wire Pin 4
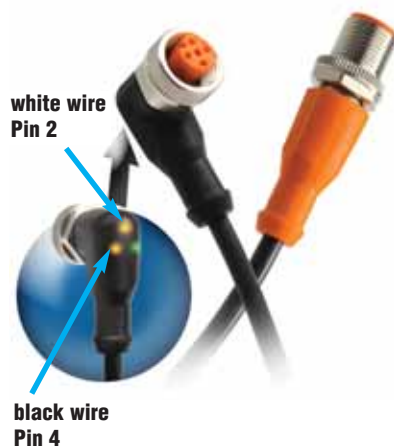
M12 Patch Cables with LED Indicator (Euro, Micro DC-Single Key)							
Part Number	**Price**	**Length**	**Poles**	**Connectors**	**LED**	**Jacket**	**Dimensions**
M12 Patch Cables							
EVC322*	<--->	0.3m (0.98ft)	4	Right-angle female, axial male	Yes	PUR	Figure 6
EVC323*	<--->	0.6m (1.97ft)	4	Right-angle female, axial male	Yes	PUR	Figure 6
EVC324*	<--->	1m (3.28ft)	4	Right-angle female, axial male	Yes	PUR	Figure 6
EVC325*	<--->	2m (6.5ft)	4	Right-angle female, axial male	Yes	PUR	Figure 6
EVC326*	<--->	5m (16.4ft)	4	Right-angle female, axial male	Yes	PUR	Figure 6
EVC327*	<--->	10m (32.8ft)	4	Right-angle female, axial male	Yes	PUR	Figure 6

Note: LED for 10 to 36 VDC PNP only.
Do not use when white wire (Pin 2) is used for selection of a sensor function.

LED Models' Wiring

```
1)---------(+)BROWN          2-WHITE    3-BLUE
2)---------(out)WHITE
4)---------(out)BLACK
3)---------(-)BLUE           1-BROWN    5-NOT USED
                                        4-BLACK
PNP-NORMALLY OPEN
```

Sensors Accessories: Cables

Cable Specifications			
Specification	**M8**	**M12**	**M12 with LED**
Length	1m (3.28ft.) / 3m (9.84ft.)		0.3m (0.98ft) / 0.6m (1.97ft) / 1m (3.28ft) 2m (6.5ft) / 5m (16.4ft) / 10m (32.8ft)
Nominal Voltage	60 VAC/DC	250 VAC/DC	10 to 36VDC
Max Current	4A		4A
LED Current Consumption	N/A		**10V input** Brown wire LED: 1.7mA White and/or Black LED: 0.9mA **36V input** Brown wire LED: 7.3mA White and/or Black LED: 4.7mA
Protection Degree	IEC IP67		IEC IP67/IP68/IP69K
Material Nut	Brass: nickel plated		Brass: nickel plated
Jacket Material	PVC		PUR
Housing Material	PUR		Connector: Orange PUR, Socket: Black PUR
Contacts Material	Copper-tin(CuSn)=Brass		Brass; gold plated
Conductors Cross Section (AWG)	$0.34mm^2$		$0.34mm^2$ (22 AWG)
Tightening Torque	0.5 Nm		**Plug:** 0.6 to 1.5 Nm (take into account the maximum value of the counterpart) **Socket:** 0.6 to 1.5 Nm
Ø Outer Cable	5mm		5mm
Temperature Range	-25° to +70°C (-13° to 158°F)		-25° to +90°C (-13° to 194°F)
Function Display LED	N/A		Green
Switching Status LED	N/A		2 x Yellow
Drag Chain (Roller Cable Tray) Suitability — **Bending Radius**	min. 10 x cable diameter		
Bending Cycles	>5 million		
Travel Speed	N/A		Max. 3.3 m/s for a horizontal travel length of 5 m and max. acceleration of $5 m/s^2$
Torsional Strain	N/A		±180°/m
Agency Approvals	RoHS		UL File E191684, RoHS

UL Reference	
Part Number	**Cable Assemblies Series M12, UL Catalog Number**
EVC322	VDOAH043MSS00.3H04STGH040MSS
EVC323	VDOAH043MSS00.6H04STGH040MSS
EVC324	VDOAH043MSS0001H04STGH040MSS
EVC325	VDOAH043MSS0002H04STGH040MSS
EVC326	VDOAH043MSS0005H04STGH040MSS
EVC327	VDOAH043MSS0010H04STGH040MSS

Note: Shown in UL file under Cable Assemblies using catalog number

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Figure 1

Figure 2
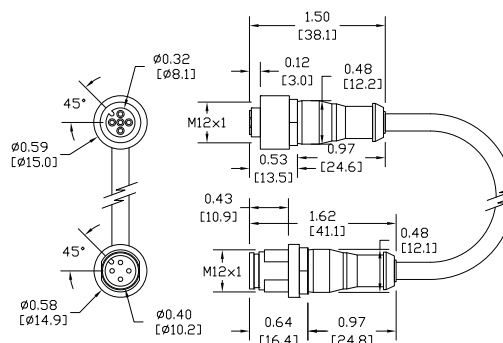

Figure 3

Figure 4
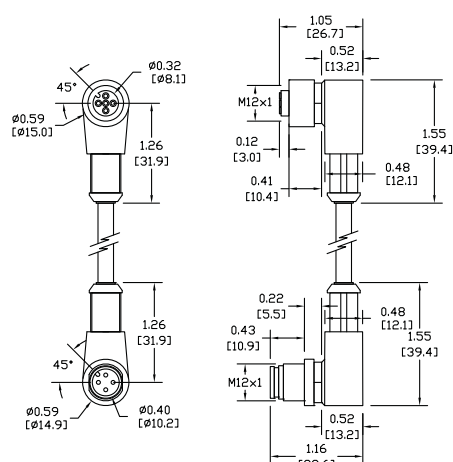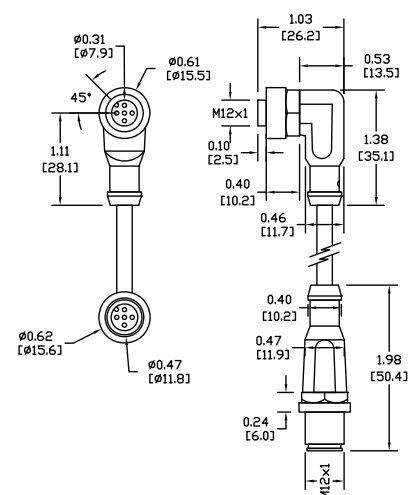

Figure 5

Figure 6

Accessories: Reflectors and Shutters

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 stud mounting types available
- 10 reflectors per package
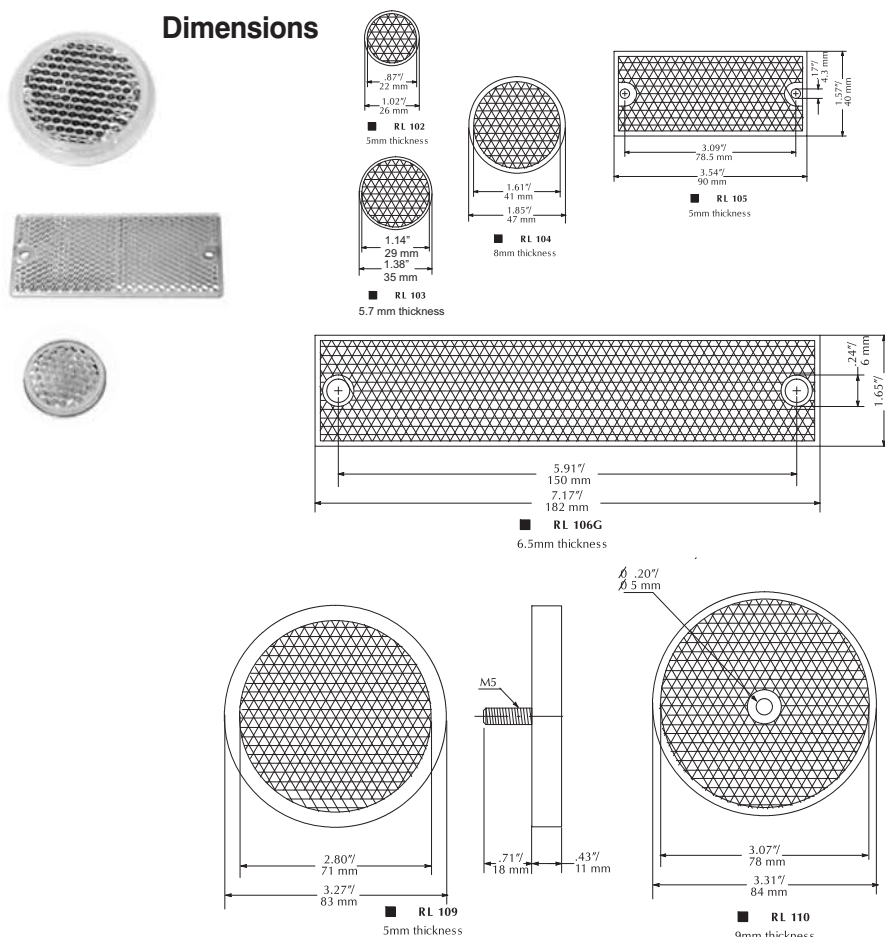
Installation notes

- 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°.

Dimensions

RL 102 — 5mm thickness — .87″/22 mm, 1.02″/26 mm

RL 103 — 5.7 mm thickness — 1.14″/29 mm, 1.38″/35 mm

RL 104 — 8mm thickness — 1.61″/41 mm, 1.85″/47 mm

RL 105 — 5mm thickness — 3.09″/78.5 mm, 3.54″/90 mm, .13″/3.3 mm, 1.57″/40 mm

RL 106G — 6.5mm thickness — 5.91″/150 mm, 7.17″/182 mm, .24″/6 mm, 1.65″/42 mm

RL 109 — 5mm thickness — 2.80″/71 mm, 3.27″/83 mm, .71″/18 mm, M5

RL 110 — 9mm thickness — 3.07″/78 mm, 3.31″/84 mm, .43″/11 mm, Ø.20″/Ø 5 mm

Specifications

Model	RL102	RL103	RL104	RL105	RL106G	RL109	RL110 [3]
Price (10 per pack)	<--->	<--->	<--->	<--->	<--->	<--->	<--->
% Sensing Range Using SSP [1]	50%	40%	50%	50%	50%	50%	100%
% Sensing Range Using QXP [1]	--	35%	60%	50%	45%	30%	100%
Dimensions	Ø26mm	Ø36mm	Ø47mm	90x40mm	182x42mm	Ø83mm	Ø84mm
Degree of Protection [2]	IEC IP67						
Mounting	Customer-supplied adhesive or other mounting method required			two Ø4.3mm holes	two Ø6mm holes	one M5 stud	one Ø5mm hole
Materials	Reflective face: PMMA Polymethylmethacrylate (acrylic); base material: ABS (Acrylonitrile-butadiene-styren)						

1 Refer to individual catalog pages for detailed explanations of these photoelectric sensors.
2 Not recommended for applications involving moist air environments or water immersion.
3 All reflective sensors are shipped with an RL110 reflector.

ST0S1 through ST0S8 shutters for M18 (18 mm) through-beam sensors (SSE / SSR)

- Reduces the emitted beam, allowing the detection of small targets
- Shutter consists of a threaded ring-nut, a protective lens, an O-ring and an aperture, which can screw onto the optical head of either the emitter or receiver. The table above shows the sensing distance and minimal detectable object.

Sensing Distance (when used with SSE / SSR Model Photoelectric switches)

Model	ST0S1	ST0S2	ST0S3	ST0S4	ST0S6	ST0S8
Pieces Per Pack	1	1	1	1	1	1
Price	<--->	<--->	Discontinued	<--->	<--->	<--->
Ø x shutter (mm)	1	2	3	4	6	8
Distance (m) object (mm)	N/A N/A	N/A N/A	1 1.5	1.5 2	3.5 3	6.5 4

Automation Direct

Company Information
Systems Overview
Programmable Controllers
Field I/O
Software
C-more & other HMI
Drives
Soft Starters
Motors & Gearbox
Steppers/ Servos
Motor Controls
Proximity Sensors
Photo Sensors
Limit Switches
Encoders
Current Sensors
Pressure Sensors
Temperature Sensors
Pushbuttons/ Lights
Process
Relays/ Timers
Comm.
Terminal Blocks & Wiring
Power
Circuit Protection
Enclosures
Tools
Pneumatics
Appendix
Product Index
Part # Index

Accessories: Reflectors, Adapters & Mounting Brackets

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
- 5 reflectors per package

Specifications			
Model	RL201	RL203	RL204
Sensing Range Using FALN [1]	30m	7m	7m
Dimensions	60mm x 82mm	19mm x 60mm	20mm x 32mm
Mounting	two Ø4mm holes	two Ø5mm holes	two Ø3mm holes
Degree of Protection [2]	IEC IP67		
Materials	Acrylic/polycarbonate		

1 Refer to individual catalog pages for detailed explanations of these photoelectric sensors.
2 Not recommended for applications involving moist air environments or water immersion.
Note: All reflective sensors are shipped with an RL110 reflector. Purchase additional reflectors separately.

RL201

<--->
(5 per pack)

RL203

<--->
(5 per pack)

RL204
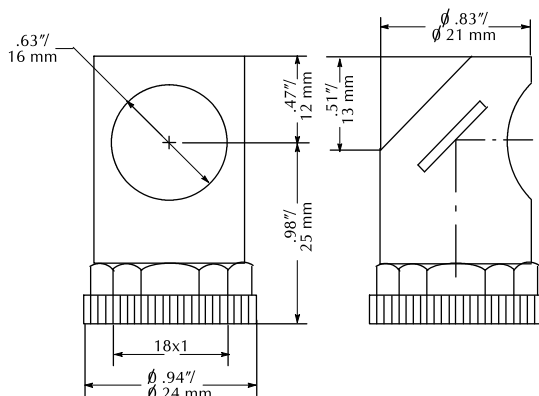
<--->
(5 per pack)
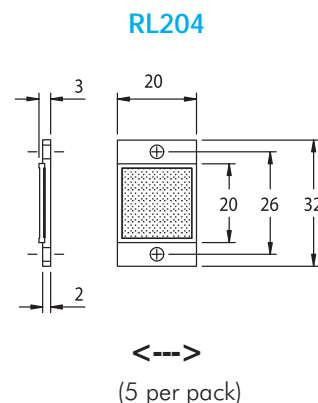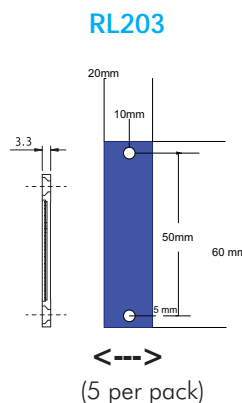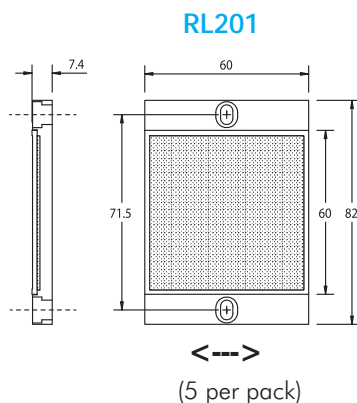
ST03 right-angle M18 (18 mm) beam adapter

For use with M18 retroreflective and through-beam photoelectric switches (not for use with diffuse reflection sensors). Allows 90° light detection using an internal mirror set at 45° to the optical axis. Sensitivity loss is about 20-30%.
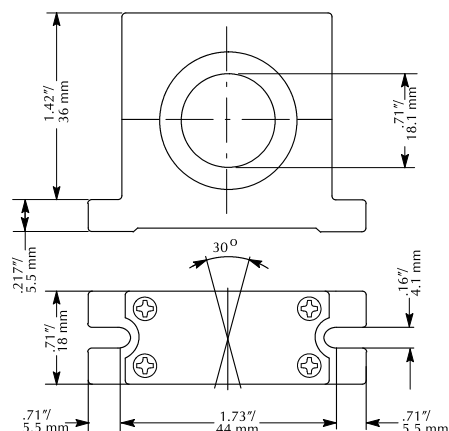
<--->

ST02 plastic swivel bracket M18 (18 mm)

Plastic mounting bracket for use with M18 photoelectric switches. Has a ball-joint and set screws to adjust sensor orientation. Allows orientation in all directions for retroreflective and through-beam sensors. (Will not work with C18 series).
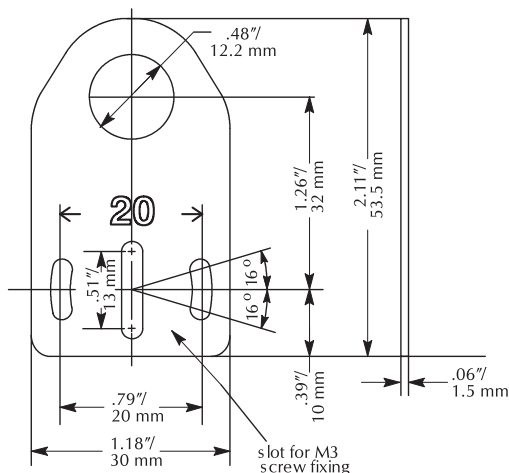
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Accessories: Mounting Brackets

ST12A axial bracket

For mounting M12 (12 mm) sensors. Has two mounting holes (use 3 mm screws) and allows the rotation of an optical axis for right-beam angle adapter sensors.

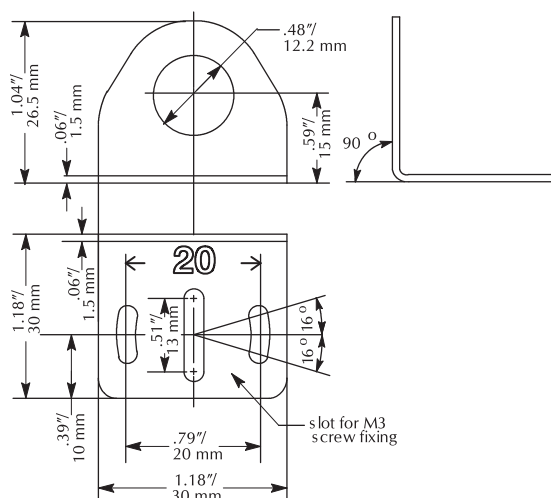| Brackets		
Part Number	**Price**	**Description**
ST12A	<--->	Metal axial bracket for 12 mm sensors, 1/pk
ST12A7W	<--->	316L stainless steel axial bracket for 12 mm sensors, 1/pk

ST12C right-angle bracket

Angular mounting bracket for use with M12 (12 mm) sensors. Has two mounting holes (use 3 mm screws) and allows the rotation of an optical axis for axial sensors.

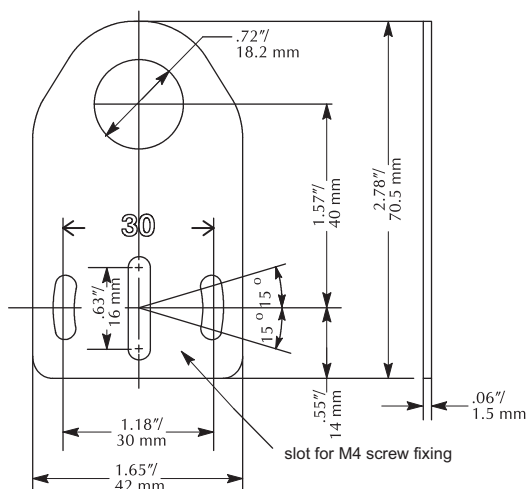| Brackets		
Part Number	**Price**	**Description**
ST12C	<--->	Metal right angle bracket for 12 mm sensors, 1/pk
ST12C7W	<--->	316L stainless steel right angle bracket for 12 mm sensors, 1/pk

ST18A axial bracket

Mounting bracket for M18 (18mm) sensors. Has two mounting holes (use 4 mm screws) and allows the rotation of an optical axis for right-beam angle adapter sensors.

Brackets		
Part Number	**Price**	**Description**
ST18A	<--->	Metal axial bracket for 18 mm sensors, 1/pk
ST18A7W	<--->	316L stainless steel axial bracket for 18 mm sensors, 1/pk

ST18C right-angle bracket

Angular mounting bracket for M18 (18 mm) sensors. Has two mounting holes (use 4 mm screws) and allows the rotation of an optical axis for axial sensors.

Brackets		
Part Number	**Price**	**Description**
ST18C	<--->	Metal right angle bracket for 18 mm sensors, 1/pk
ST18C7W	<--->	316L stainless steel right angle bracket for 18 mm sensors, 1/pk