Photoelectric Sensor Technologies Expand Applications

What type of photoelectric sensor is best for me?

There are many different styles of photoelectric sensors, but really only four basic technologies: through-beam, reflective, diffuse, and background suppression. The chart describes some advantages and disadvantages of each technology.

Type	Advantages	Disadvantages
Through-beam	· Most accurate · Longest sensing range · Very reliable	· Must install at two points on system: emitter and receiver · Costly - must purchase both emitter and receiver
Reflective	· Cost less than through-beam · Only slightly less accurate than through-beam · Sensing range better than diffuse · Very reliable	· Must install at two points on system: sensor and reflector · Slightly more costly than diffuse · Sensing range less than through-beam
Diffuse	· Only install at one point · Cost less than through-beam or reflective	· Less accurate than through-beam or reflective · More setup time involved
Background Suppression	· Effective with reflective backgrounds	· Cost more than diffuse, reflective or through-beam · Most setup time required

How do these sensors benefit me?

Everybody wants to know how a particular product will help them. With AUTOMATIONDIRECT photoelectric sensors, you benefit from:

- Approximately 2-to-1 list pricingcompared to the competition. Thisallows OEM-like pricing on single item purchases.
- Rectangular formats that provide mounting holes directly into the sensor. This eliminates the need for mounting plates and allows for easier installation.
- Quick-disconnect cable versions available for all sensors. The Q/D sensors make for fast and easy replacement. Troubleshooting is also much faster with Q/D devices as the user need only unscrew the connector and change out the sensor. This eliminates the need for disconnecting wires and cutting wire ties, thus speeding up the replacement process with much less room for error.
- Electrical protection against short circuit, reverse polarity, and transient noise. Even if the sensor is initially wired wrong, or wired into a noisy environment, the sensor will still operate properly.
- 30-day, money-back guarantee. Nothing else needs to be said. If you are not satisfied with the performance of your sensor, just send it back.

The Most Popular Photoelectric Sensor Styles

The most popular and widely-accepted photoelectric sensor mounting shape in the U.S. market is the 18 mm round format. From a standard through-beam (plastic) sensor to a unique right-angle, background suppression diffuse sensor, AUTOMATIONDIRECT has a model to fit your needs.

- Metal or plastic housing
- Diffuse, polarized retroreflective, through-beam, and background suppression models
- Straight or unique right-angle optics
- 3-wire and 4-wire outputs
- NPN and PNP models
- Normally open and normally closed (light or dark operation) models

Also available are 5, 8 and 12 mm diameter models in various styles.

A photoelectric sensor must suit your application, and must also be easy to install, simple to set up, and operate flawlessly. AUTOMATIONDIRECT understands these needs and offers products that solve your application problems:

- **Unique right-angle mounting sensors.** Have you ever tried to install a right-angle sensor? Have you tried getting the mounting nut over the right-angle head of the sensor? It's not easy! We offer a right-angle sensor that a nut will fit directly over. Our competitors don't offer a product that's so easy to use. This technology will save you time and headaches during installation.
- **IP67 (washdown) rating**. All of our sensors are watertight and built to last. Since you won't have to swap sensors out constantly, you will ultimately save money.
- **Metal or plastic sensors.** Plastic sensors are great for corrosion resistance, while metal sensors are rugged and can absorb more punishment. We offer both.
- **Alignment LEDs.** With onboard indicators, our sensors simplify installation to save you time and money.

We are so confident of our sensors' quality, we offer a 30-day money-back guarantee if you don't like them.

Rectangular styles for unique mounting needs

Rectangular sensors are available as AC or DC-powered models, in varying sizes and sensing styles, including diffuse, retroreflective, and through-beam.

GX Series DC photoelectric sensors

- Power: 10 - 30 VDC
- 18 mm diameter threaded lens with rectangular base
- 12 models available
- Fixed sensing ranges
- NPN or PNP, Light-on, Dark-on output models
- M12 quick-disconnect

Quick-disconnect cables and accessories

Quick-disconnect cables, reflectors, mounting brackets and other accessories available include:

- Micro (12 mm) and pico (8 mm) Q/D sizes in 2 m, 5 m, and 7 m lengths
- Extension cables for quick-disconnect sensors
- LED sensor cables for signal confirmation
- Round and rectangular reflectors in many sizes
- Photoelectric shutters that focus your photoelectric sensor on small targets
- Right-angle adapters for special mounting applications

Photoelectric Sensors Selection Guide




Specification	FA Series LED DC	FA Series Laser DC	FB Series DC	SS Series DC
Description	18mm plastic, DC	18mm plastic, DC	18mm plastic, DC	18mm plastic, DC
Sensing Distances	Diffuse models: 1m Reflective models: 3m Through-beam: 20m	Diffuse models: 300mm Reflective models: 20m Through-beam: 50m	Diffuse models: 400mm Reflective models: 2.5m Through-beam models: 8m	Diffuse models: 100mm, 200mm, 400mm Reflective models: 2m Through-beam models: 8m
Output State	Complementary N.O. / N.C.	Complementary N.O. / N.C.	Light-on, Dark-on	N.O. / N.C. selectable
Logic Output	NPN / PNP	NPN / PNP	NPN / PNP	NPN / PNP
Connection Type	Axial cable / M12 connector	Axial cable / M12 connector	M12 connector	Axial cable / M12 connector
Supply Voltage	10 to 30 VDC	10 to 30 VDC	10 to 30 VDC	10 to 30 VDC
Switching Frequency	250Hz	Diffuse and reflective models: 800Hz Through-beam models: 1kHz	1kHz	Diffuse and reflective models: 250Hz Though-beam models 25Hz
Rating	IEC IP67	IEC IP67	Diffuse: IEC IP65 Retro-reflective and Thru-beam: IEC IP67	IEC IP67




Specification	MS Series DC	FARS Series DC	FF Series	FFRS Series	
Description	18mm plastic with background suppression, DC	18mm diffuse with background suppression	IP69K sensors, 18 mm stainless steel, DC	IP69K sensors, 18mm stainless steel diffuse with background suppression, DC	
Sensing Distances	Diffuse Reflection Standard distance models: . . 50mm Extended distance models: . . 100mm	30 to 130 mm	Diffuse: 100m, 400m, 800mm Polarized reflective: 4m Through-beam: 20m Retro-reflective: 1m	Standard: 30 to 130mm Shiny object: 60 to 100mm	
Output State	N.O. / N.C. selectable	N.O. / N.C. background suppression Light-on/Dark-on selectable Q/Qnot	N.O. / N.C. Complementary; Light-on/Dark-on selectable	N.O. / N.C. Complementary; Light-on/Dark-on selectable	
Logic Output	NPN / PNP selectable	NPN/PNP	NPN / PNP	NPN / PNP	
Connection Type	Axial cable M12 connector	Axial cable M12 connector	M12 connector	M12 connector	
Supply Voltage	10 to 30 VDC	10 to 30 VDC	10 to 30 VDC	10 to 30 VDC	
Switching Frequency	80Hz	1kHz	Diffuse, Polarized reflective and Retro-reflective: 500Hz, Through-beam: 250Hz	Standard: 1kHz	Shiny: 400Hz
Rating	IEC IP67	IEC IP67	IEC IP68, IP69K	IEC IP68, IP69K	

Photoelectric Sensors Selection Guide

Specification	MQ Series AC	MV Series AC	C5 Series DC	HE/HER Series DC	DM Series DC
Description	18mm diffuse with background suppression, 90° radial optic	18mm plastic, AC	5mm stainless steel, DC	8mm Thru-Beam	12mm nickel-plated brass with Teach operating distance function, DC
Sensing Distances	Standard distance models: 50mm Extended distance models: 100mm	Diffuse: 100mm, 200mm, 400mm Reflective: 3m Through-beam: 16m	Diffuse models: 50mm Through-beam models: 250mm	1000 mm / Ex. gain = 2	Diffuse models: 100mm, 300mm Reflective models: 2m Through-beam: 4m
Output State	N.O./ N.C. background suppression	N.O./ receiver dependent	N.O. / receiver dependent	N.O./ N.C.	Diffuse: N.O./ N.C. selectable Polarized reflective: N.O./ N.C. selectable Through-beam: N.O / N.C./ receiver dependent
Logic Output	Triac	Triac	NPN / PNP/ N.O. only	NPN / PNP	NPN / PNP
Connection Type	M12 quick disconnect	Axial cable M12 connector	Axial cable M8 connector	Axial cable M8 quick disconnect	Axial cable / M12 connector
Supply Voltage	20 to 253 VAC	20 to 253 VAC	10 to 30 VDC	10 to 30 VDC	10 to 30 VDC
Switching Frequency	25Hz	25Hz	250Hz	10kHz	Diffuse and reflective models: 400Hz Though-beam models: 250Hz
Rating	IEC IP67	IEC IP67	IEC IP67	IEC IP67	IEC IP67

Specification	C18 Series DC	GX Series DC	FE Series DC	CX Series DC
Description	18mm nickel-plated brass, DC	18mm rectangular plastic, DC	Mini-rectangular plastic, DC	Mini-rectangular plastic, DC
Sensing Distances	Diffuse models: up to 600mm Diffuse models w/ background suppression: 10 to 120mm Reflective models: Up to 2m Through-beam models: Up to 6m	Diffuse models w/ background suppression: Up to 150mm Reflective models: Up to 4m Through-beam models: Up to 20m	Diffuse models: 800mm Reflective models: 4m Through-beam: 12m	Diffuse models: up to 600mm Diffuse models w/ background suppression: 15 to 150mm Reflective models: Up to 2m Through-beam models: Up to 6m
Output State	Diffuse: Light-on / Dark-on selectable Diffuse models with background suppression: Light-on Polarized reflective: Dark-on Through-beam: Light-on / Dark-on / receiver dependent	Diffuse models w/ background suppression: Light-on Polarized reflective: Light-on / Dark-on Through-beam: Light-on / Dark-on / receiver dependent	Light-on/Dark-on selectable	N.O.
Logic Output	NPN / PNP/ receiver dependent	NPN / PNP/ receiver dependent	NPN / PNP	NPN / PNP
Connection Type	Axial cable / M12 connector	M12 connector	Axial cable / M8 connector	Axial cable / M8 connector
Supply Voltage	10 to 36 VDC	10 to 30 VDC	10 to 30 VDC	10 to 36 VDC
Switching Frequency	Diffuse models: 1kHz Diffuse models w/ background suppression: 500Hz Reflective models:1kHz Through-beam models: 1kHz	1kHz	1kHz	Diffuse models: 1kHz Diffuse models w/ background suppression: 500Hz Reflective models: 1kHz Through-beam models: 1kHz
Rating	IEC IP67	IEC IP67	IEC IP67	IEC IP65

Photoelectric Sensors Selection Guide

Specification	OPT Short Range (CMOS) Series	OPT Long Range (Transit Time) Series
Description	Photoelectric reflex laser distance measuring sensors. 50 x 50 mm rectangular housing.	Photoelectric transit time laser distance measuring sensors. 50 x 50 mm or 81 x 55 mm rectangular housing.
Sensing Distances	Diffuse models: 80 mm, 160 mm, 350 mm, 660 mm	Diffuse models: 3000 mm, 3050 mm, 6.2m, 10.1m Retro-reflective models: 100.2m
Output State	Diffuse models: Analog N.O. / N.C. selectable (OPT2001-OPT2006) N.O. / N.C. selectable	Diffuse models: Analog N.O. / N.C. selectable N.O. / N.C. selectable Two selectable N.O. / N.C. Retro-reflective models: 2 N.O. / N.C. selectable
Logic Output	PNP, NPN or Push-Pull	PNP or PNP/NPN
Connection Type	5-Pin M12 connector 8-pin M12 connector	4-pin M12 connector 5-Pin M12 connector 8-pin M12 connector
Supply Voltage	18-30 VDC, 10-30 VDC	18-30 VDC, 10-30 VDC
Switching Frequency	100 Hz	50 Hz, 250 Hz, 1 kHz
Rating	IEC IP67	IEC IP68

Specification	FG Series AC/DC	FW Series DC	CH Enhanced 50 Series
Description	Rectangular plastic, AC/DC	30 mm mount, metal, DC	Fiberglass-reinforced plastic
Sensing Distances	Diffuse models: 550mm Reflective models: 9m Through-beam: 20m	Diffuse w/background suppression models: Adjustable 50 to 800 mm; Fixed to 600 mm Polarized retro-reflective models: 0.1 to 15m	Through-beam: 500 ft (152m) Diffuse models: 10 ft. (3m) Polarized reflex: 16 ft (4.9m) Clear /object detector: 45 in (1.2m)
Output State	N.O./N.C.	Diffuse models w/background suppression: Light-on Polarized retro-reflective models: Light-on or Dark-on	Light-on/Dark-on selectable
Logic Output	SPDT 3A relay	PNP/NPN	Through-beam: NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3A @ 120 VAC Diffuse: NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3A @ 120 VAC Polarized reflex: NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3A @ 120 VAC Clear object detector: NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3A @ 120 VAC
Connection Type	Axial cable	M12 (12 mm) connector	Cable or mini/micro connection
Supply Voltage	12 to 240 VDC, 24 to 240 VAC	10 to 30 VDC	10 to 40 VDC, 12 to 240 VDC, 24 to 240 VAC
Switching Frequency	33 Hz	Diffuse models w/background suppression: 300 Hz Polarized retro-reflective models: 1000 Hz	various
Rating	IEC IP67	IEC IP67	IEC IP67

Photoelectric Sensors Selection Guide



Specification	DFT Series Fiber Amp	DFP Series Fiber Amp	SSF Series Fiber Amp
Description	Compact rectangular plastic fiber optic amplifier with Teach operating distance function, DC	Compact rectangular plastic fiber optic amplifier, DC	18mm plastic fiber optic amplifier, DC
Sensing Distances	See Optical Fiber Tables following the amplifier's specifications	See Optical Fiber Tables following the amplifier's specifications	See Optical Fiber Tables following the amplifier's specifications
Output State	Light-on / Dark-on selectable	Light-on / Dark-on selectable	Light-on / Dark-on selectable
Logic Output	NPN / PNP	NPN / PNP	NPN / PNP
Connection Type	Axial cable / M8 connector	Axial cable / M8 connector	Axial cable / M12 connector
Supply Voltage	10 to 30 VDC	10 to 30 VDC	10 to 30 VDC
Switching Frequency	1.5kHz	1.5kHz	800Hz
Rating	IEC IP64	IEC IP64	IEC IP67


Specification	CF Series Optical Fibers	BX Series Light Screen
Description	Cuttable diffuse reflection and through-beam fiber optic cables (2.2mm diameter)	Rectangular plastic high resolution area sensor, DC
Sensing Distances	Amplifier dependent. Refer to fiber optic tables for sensing distances.	Through-beam: 2m with 70mm height area
Output State	N/A	Selectable N.O / N.C.
Logic Output	N/A	NPN / PNP
Connection Type	N/A	M12 connector
Supply Voltage	N/A	12 to 24 VDC
Switching Frequency	N/A	N/A
Rating	IEC IP67	IEC IP67

FA Series LED Photoelectric Sensors

M18 (18 mm) plastic - DC

- 14 models available
- Diffuse, polarized reflective, and through-beam models with long sensing distances
- Plastic housing
- Axial cable or M12 quick-disconnect models
- NPN or PNP; Complementary N.O./N.C. outputs
- IP67 rated

FA Series Photoelectric Sensors Selection Chart									
Part Number		**Price**	**Sensing Range**	**Output State**	**Logic**	**Connection**	**Wiring**	**Dimensions**	**Characteristic Curves**
Diffuse									
FAI8-BN-0A		<--->	1m (39.37in)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Diagram 1	Figure 1	Chart 1
FAI8-BP-0A		<--->			PNP	2m (6.5) axial cable	Diagram 2	Figure 1	Chart 1
FAI8-BN-0E		<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 1
FAI8-BP-0E		<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart 1
Polarized reflective*									
FARN-BN-0A		<--->	3m (118.11in)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Diagram 1	Figure 1	Chart 2
FARN-BP-0A		<--->			PNP	2m (6.5) axial cable	Diagram 2	Figure 1	Chart 2
FARN-BN-0E		<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 2
FARN-BP-0E		<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart 2
Through-beam									
FAID-BN-0A	Receiver	<--->	20m (65.62ft)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Diagram 1	Figure 1	Chart 3
FAID-BP-0A	Receiver	<--->			PNP	2m (6.5) axial cable	Diagram 2	Figure 1	Chart 3
FAID-BN-0E	Receiver	<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 3
FAID-BP-0E	Receiver	<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart 3
FAIH-00-0A	Emitter	<--->			Receiver dependent	2m (6.5) axial cable	Diagram 3	Figure 1	Chart 3
FAIH-00-0E	Emitter	<--->				M12 (12mm) connector	Diagram 3	Figure 2	Chart 3

Receivers include one round (84mm dia.) RL110 reflector. Purchase additional reflectors separately.

****Purchase one receiver and one emitter for a complete set.***

Wiring diagrams

Diagram 1

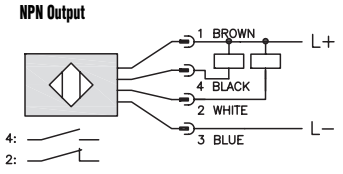


Diagram 2

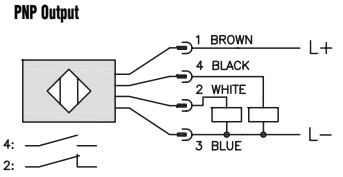
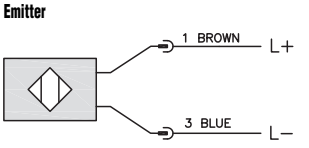


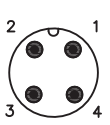
Diagram 3



Note: N.O. = Signal ON when emmitter is NOT sensing receiver.

N.C. = Signal ON when emmitter is sensing receiver.

Connector



Switching Element Function		
	Thru-Beam and Reflective Models	***Diffuse Models***
Light-on	N.C.	N.O.
Dark-on	N.O.	N.C.

FA Series LED Photoelectric Sensors

FA LED Series Specifications			
Mounting Type	***Diffuse Models***	***Reflective Models***	***Through-Beam Models***
	Diffuse reflection	Polarized reflection[3]	Through-beam[4]
Sensing Distance	1m[1]	3m[2]	20m
Light Spot Diameter	180 mm @ 800 mm	200 mm @ 4 m	600 mm @ 20 m
Emission	Infrared (880 nm)	Red (660 nm)	Infrared (880 nm)
Sensitivity	Adjustable		
Output Type	NPN or PNP - Complementary NO/NC		
Operating Voltage	10-30 VDC		
No-load Supply Current	≤30mA		≤25mA
Operating (Load) Current	≤100mA		
Off-state (Leakage) Current	≤10µA		
Voltage Drop	2V max at 100mA		
Switching Frequency	250Hz		
Ripple	≤10%		
Time Delay Before Availability (tv)	200ms		
Short-Circuit Protection	Yes, switch autoresets after load is removed		
Operating Temperature	-25 to 70°C (-13° to 158°F); Drift: 10% Sr		
Protection Degree (DIN 40050)	IEC IP67		
LED Indicators/Switching Status	Yellow (output energized)		Receiver: Yellow (output energized) Emitter: Green (power ON)
Housing Material	Polybutylene Terephthalate (PBT)		
Lens Material	Polycarbonate (PC)	PMMA	Polycarbonate (PC)
Shock/Vibration	See terminology section		
Tightening Torque	1 Nm (0.737 lb-ft)		
Weight *(cable/M12 connector)*	100g (3.53 oz)		Emitter + Receiver 200g (7.05 oz)
Connection	2m (6.5') axial cable; M12 (12mm) connector. Two lock nuts included		
Agency Approvals	UL file E187310, CE		

[1] With 100x100mm white matte paper

[2] With standard diameter 84mm RL110 reflector.

[3] Each sensor includes one 84mm round reflector (RL110). Purchase additional reflectors separately.

[4] An emitter (FAIH) and receiver (FAID) pair must be ordered for a complete sensor set.

Dimensions

mm

Figure 1

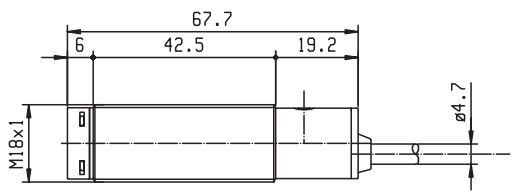
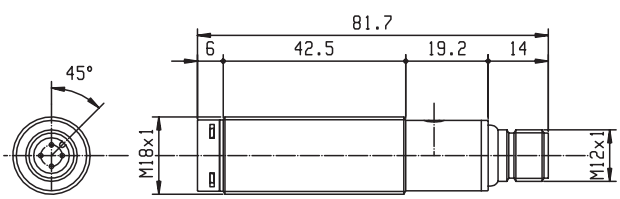


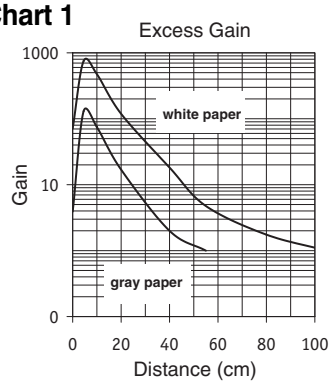
Figure 2



FA Series LED Photoelectric Sensors

Characteristic curves

Chart 1



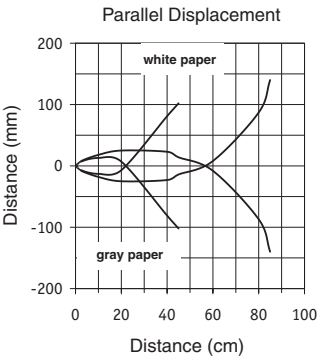
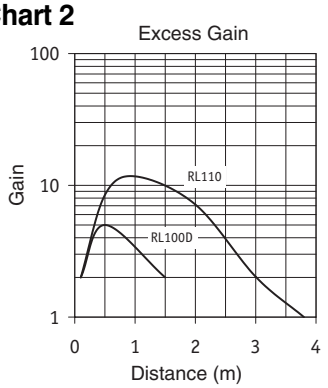


Chart 2



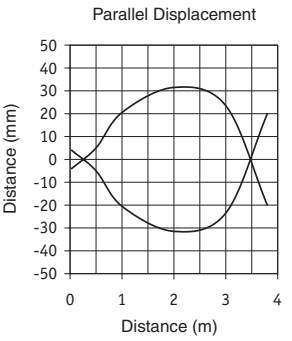
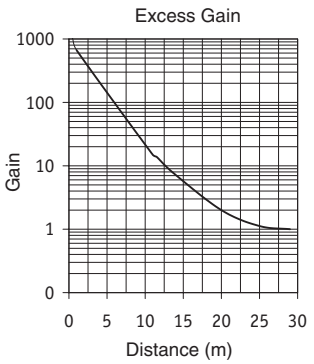
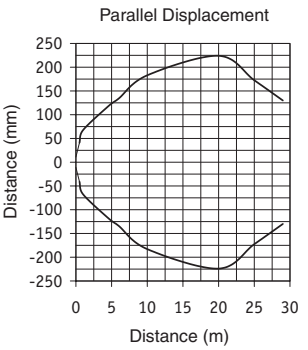


Chart 3





FA Series Laser Photoelectric Sensors

M18 (18 mm) plastic - DC

- 14 models available
- Diffuse, polarized reflective, and through-beam models with long sensing distances
- Plastic housing
- Axial cable or M12 quick-disconnect models
- NPN or PNP, complementary N.O./N.C. outputs
- IP67 rated

FA Series Photoelectric Sensors Selection Chart									
Part Number		**Price**	**Sensing Range**	**Output State**	**Logic**	**Connection**	**Wiring**	**Dimensions**	**Characteristic Curves**
Diffuse									
FAL4-BN-0A		<--->	300mm (11.81in)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Diagram 1	Figure 1	Chart 1
FAL4-BP-0A		<--->			PNP	2m (6.5) axial cable	Diagram 2	Figure 1	Chart 1
FAL4-BN-0E		<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 1
FAL4-BP-0E		<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart 1
Polarized reflective*									
FALN-BN-0A		<--->	20m (65.61ft) with RL110 30m (98.43ft) with RL201	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Diagram 1	Figure 1	Chart 2
FALN-BP-0A		<--->			PNP	2m (6.5) axial cable	Diagram 2	Figure 1	Chart 2
FALN-BN-0E		<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 2
FALN-BP-0E		<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart 2
Through-beam*									
FALD-BN-0A	Receiver	<--->	50m (164.04ft)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Diagram 1	Figure 1	Chart 3
FALD-BP-0A	Receiver	<--->			PNP	2m (6.5) axial cable	Diagram 2	Figure 1	Chart 3
FALD-BN-0E	Receiver	<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 3
FALD-BP-0E	Receiver	<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart 3
FALH-X0-0A	Emitter	<--->			Receiver dependent	2m (6.5) axial cable	Diagram 3	Figure 1	Chart 3
FALH-X0-0E	Emitter	<--->				M12 (12mm) connector	Diagram 3	Figure 2	Chart 3

Receivers include one round (84mm dia.) RL110 reflector. Purchase additional reflectors separately.

****Purchase one receiver and one emitter for a complete set.***

Wiring diagrams

Diagram 1

NPN Output

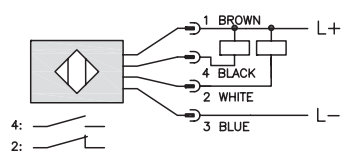


Diagram 2

PNP Output

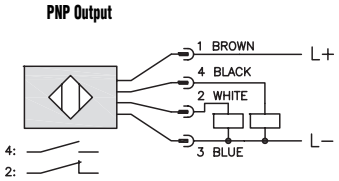
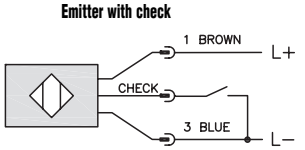


Diagram 3

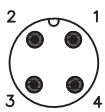
Emitter with check



2-meter Axial Cable version: check is black
M12 Connector: check is Pin 2 (white)

Connector

M12 connector



Switching Element Function		
	Thru-Beam and Reflective Models	***Diffuse Models***
Light-on	N.C.	N.O.
Dark-on	N.O.	N.C.

Note: N.O. = Signal ON when emitter is NOT sensing receiver.
N.C. = Signal ON when emitter is sensing receiver.

FA Series Laser Photoelectric Sensors

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflection[3]	Through-beam[4]
Sensing Distance	300mm[1]	20m with RL110 reflector[2] 30m with RL201 reflector	50m
Light Spot Diameter	1 mm @100 mm	15 mm @ 800 mm	22x5 mm @ 20 m
Emission	Visible red Class 1 Laser (650nm); see note below		
Sensitivity	Adjustable		
Output Type	NPN or PNP - Complementary NO/NC		
Operating Voltage	10-30 VDC		
No-load Supply Current	≤30mA	≤20mA	≤25mA
Operating (Load) Current	≤100mA		
Off-state (Leakage) Current	≤10µA		
Voltage Drop	2V max at 100mA		
Switching Frequency	800Hz		1kHz
Ripple	≤10%		
Time Delay Before Availability (tv)	200ms		
Short-Circuit Protection	Yes, switch autoresets after load is removed		
Operating Temperature	-15 to 55°C (5° to 131°F)		
Protection Degree (DIN 40050)	IEC IP67		
LED Indicators/Switch Status	Yellow (output energized) Green (power ON)		Receiver: Yellow (output energized) Emitter: Green (power ON)
Housing Material	Polybutylene Terephthalate (PBT)		
Lens Material	Polycarbonate (PC)		
Shock/Vibration	See terminology section		
Tightening Torque	1 Nm (0.737 lb-ft)		
Weight	200g (7.05 oz)		
Connectors	2m (6.5') axial cable; M12 (12mm) connector. Two lock nuts included.		
Agency Approvals	UL E187310, CE		

[1] With 100x100mm white matte paper
[2] With standard Ø84mm RL110 reflector
[3] Each sensor includes one reflector (RL110). Purchase additional reflectors separately.
[4] An emitter (FALH) and receiver (FALD) pair must be ordered for a complete sensor set.

IMPORTANT NOTE

Class 1 Laser Product
Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice Number 50, dated July 26, 2001.

Note: FA-L sensors are equipped with a visible red light laser diode and are classified as CLASS 1 LASER DEVICES. According to the CEIEN60825-1 norms, the class 1 laser devices are safe in operating conditions that can be reasonably foreseen. The FA-L sensors emit visible laser light impulses with a maximum peak power of 0.4 milliwatt. The laser output maximum power level is checked through a circuit that is always working, so it can detect any single failure. The FA-L Class 1 laser always emits a beam of intense and very concentrated light. The intentional and prolonged observation of this light can cause eye problems. As a result, it is advisable, where possible, to install the laser sensors so the beam cannot exceed the operating area. Avoid laser beam contact with eyes.

FA Series Laser Photoelectric Sensors

Dimensions

mm

Figure 1

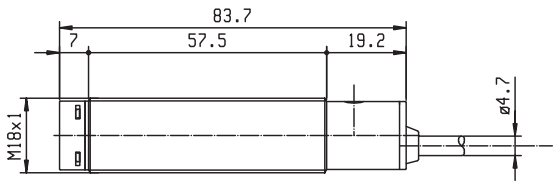
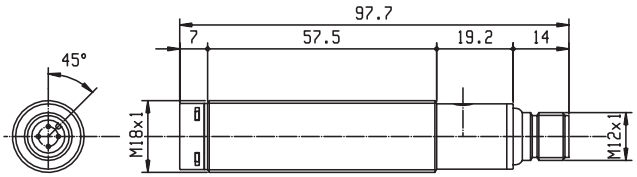
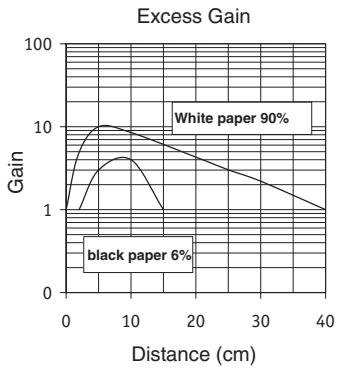


Figure 2



Characteristic curves

Chart 1



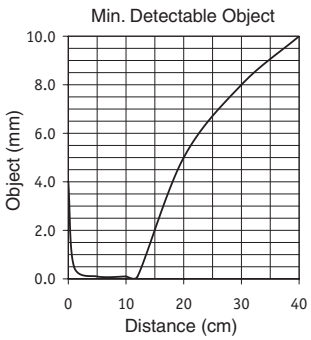
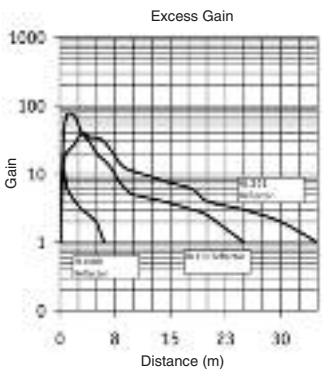
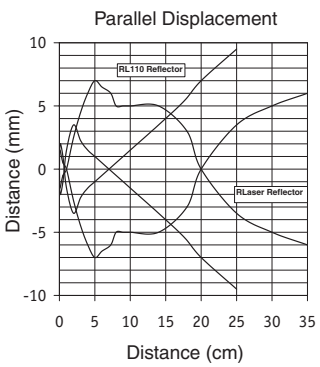


Chart 2





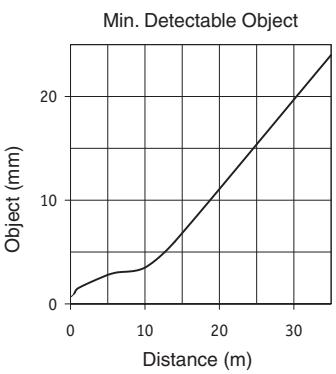
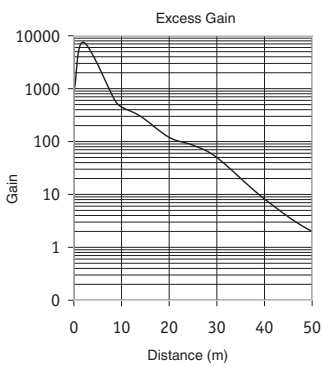
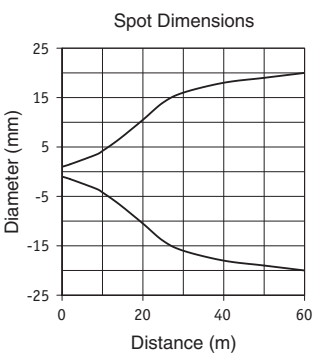


Chart 3





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2006 Design News magazine Readers' Choice Awards

2005 Control Design magazine Readers' Choice Awards

FB Series Photoelectric Sensors

M18 (18 mm) plastic - DC

- Low cost/ high performance
- 13 models available
- Diffuse, polarized reflective, and through-beam models
- Compact plastic housing
- M12 quick-disconnect; order cable separately
- Potentiometer range adjustment on diffuse models

FB Series Photoelectric Sensors Selection Chart								
Part Number		**Price**	**Sensing Range**	**Output State**	**Logic**	**Connection**	**Wiring**	**Dimensions**
Diffuse								
FB6-LN-0E		<--->	70 to 400 mm (2.76 to 15.75 in)	N.O.	NPN	M12 (12mm) connector	Diagram 1	Figure 1
FB6-LP-0E		<--->			PNP	M12 (12mm) connector	Diagram 2	
FB6-DN-0E		<--->		N.C.	NPN	M12 (12mm) connector	Diagram 1	
FB6-DP-0E		<--->			PNP	M12 (12mm) connector	Diagram 2	
Polarized reflective*								
FBP-LN-0E		<--->	2.5 m (8.2 ft)	N.C.	NPN	M12 (12mm) connector	Diagram 1	Figure 1
FBP-LP-0E		<--->			PNP	M12 (12mm) connector	Diagram 2	
FBP-DN-0E		<--->		N.O.	NPN	M12 (12mm) connector	Diagram 1	
FBP-DP-0E		<--->			PNP	M12 (12mm) connector	Diagram 2	
Through-beam								
FBR-LN-0E	Receiver	<--->	8 m (26.25 ft)	N.C.	NPN	M12 (12mm) connector	Diagram 1	Figure 1
FBR-LP-0E	Receiver	<--->			PNP	M12 (12mm) connector	Diagram 2	
FBR-DN-0E	Receiver	<--->		N.O.	NPN	M12 (12mm) connector	Diagram 1	
FBR-DP-0E	Receiver	<--->			PNP	M12 (12mm) connector	Diagram 2	
FBE-00-0E	Emitter	<--->		–	Receiver dependent	M12 (12mm) connector	Diagram 3	–

Receivers include one round (84mm dia.) RL110-reflector. Purchase additional reflectors separately.

****Purchase one receiver and one emitter for a complete set.***

Wiring Diagrams

Diagram 1

NPN Output

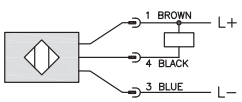


Diagram 2

PNPN Output

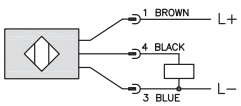
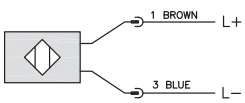


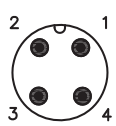
Diagram 3



Switching Element Function		
	Thru-Beam and Reflective Models	***Diffuse Models***
Light-on	N.C.	N.O.
Dark-on	N.O.	N.C.

Connector

M12 Connector

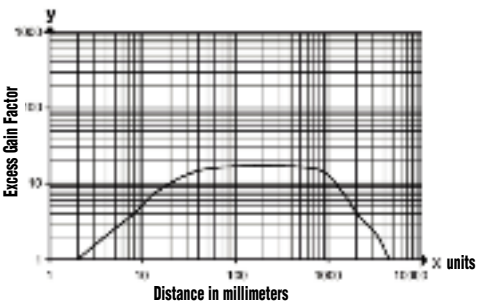


FB Series Photoelectric Sensors

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflection[1]	Through-beam[2]
Sensing Distance	400mm	2.5m	8m
Light Spot Diameter	25mm at maximum range	200mm at maximum range	600mm at maximum range
Emission	Red LED (visible), 645 nm		
Sensitivity	Adjustable 70 to 400 mm	Fixed	Fixed
Output Type	NPN or PNP - Light-on or Dark-on		
Operating Voltage	10-30 VDC		
No Load Supply Current	≤20 mA	≤20 mA	≤8 mA
Operating (Load) Current	≤200 mA		
Off-state (Leakage) Current	N/A		
Voltage Drop	<2.5V		
Switching Frequency	1kHz		
Ripple	N/A		
Time Delay Before Availability (tv)	N/A		
Short-Circuit Protection	Yes		
Operating Temperature Range	-25 to 60°C (-13° to 140°F)		
Protection Degree (DIN 40050)	IEC IP65	IEC IP67	
LED Indicators - Switching Status	Yellow (output energized)		
Housing Material	Acrylonitrile-butadienestyrene (ABS), black		
Lens Material	Polymethyl metacrylate (PMMA)		
Shock /Vibration	EN 60947-5-2 part 7, 4, 1/EN 60947-5-2 part 7, 4, 2		
Tightening Torque	2.25 Nm (1.66 lb-ft)		
Weight	8.50 g (0.3 oz)		
Connection	M12 connector. Two mounting hex nuts included		
Agency Approvals	cULus listed, UL file E328811, CE, RoHs		

Notes: [1] ***With standard diameter 84mm RL110 reflector included with sensor. Purchase additional reflectors separately.***
[2] ***An emitter and receiver pair must be ordered for a complete sensor set.***

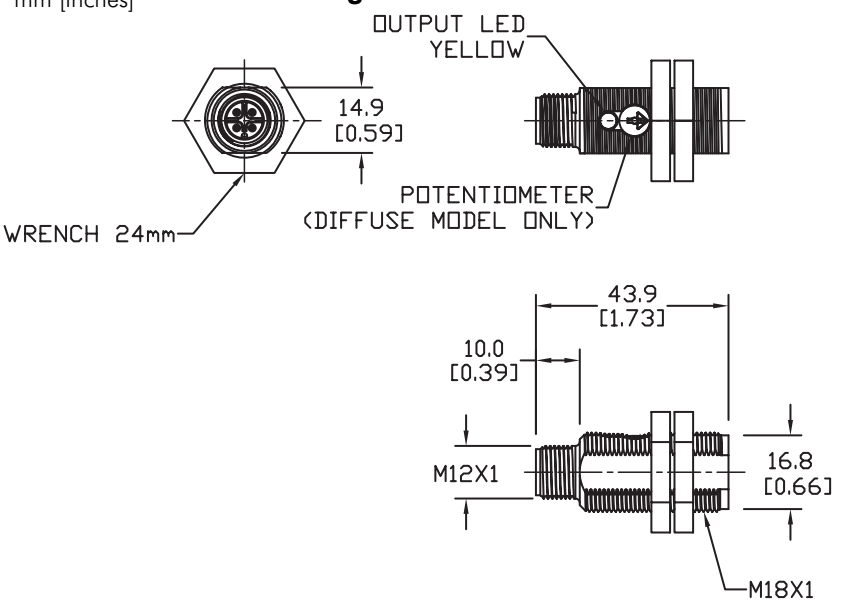
Curves FBP series



Dimensions

mm [inches]

Figure 1



SS Series Photoelectric Sensors

M18 (18 mm) plastic- DC

- 22 models available
- Diffuse, polarized reflective, and through-beam models
- Plastic housing
- Axial cable or M12 quick-disconnect models
- N.O./N.C. selectable output
- IP67 rated

SS Series Photoelectric Sensor Selection Chart

Part Number		Price	Sensing Range	Output State*	Logic	Connection	Wiring	Dimensions	Characteristic Curves
Diffuse									
SS2-0N-4A		<--->	100mm (3.9 in.)	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart Set 1
SS2-0P-4A		<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart Set 1
SS2-0N-4E		<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart Set 1
SS2-0P-4E		<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart Set 1
SS5-0N-4A		<--->	200mm (7.9 in.)	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart Set 2
SS5-0P-4A		<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart Set 2
SS5-0N-4E		<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart Set 2
SS5-0P-4E		<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart Set 2
SS6-0N-4A		<--->	400mm (15.7 in.)	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart Set 3
SS6-0P-4A		<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart Set 3
SS6-0N-4E		<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart Set 3
SS6-0P-4E		<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart Set 3
Polarized reflective*									
SSP-0N-4A		<--->	3m (9.84 ft)	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart Set 4
SSP-0P-4A		<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart Set 4
SSP-0N-4E		<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart Set 4
SSP-0P-4E		<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart Set 4
Through-beam									
SSR-0N-4A	Receiver	<--->	8m (26.2 ft)	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart Set 5
SSR-0P-4A	Receiver	<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart Set 5
SSR-0N-4E	Receiver	<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart Set 5
SSR-0P-4E	Receiver	<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart Set 5
SSE-00-4A	Emitter	<--->		Receiver- dependent	Receiver dependent	2m (6.5') axial cable	Diagram 3	Figure 1	Chart Set 5
SSE-00-4E †	Emitter	<--->				M12 (12mm) connector	Diagram 3	Figure 2	Chart Set 5

† Check function

***Receivers include one round (84mm dia.) RL110 reflector. Purchase additional reflectors separately.**

****Purchase one receiver and one emitter for a complete set.**

Switching Element Function		
	Thru-Beam and Reflective Models	***Diffuse Models***
Light-on	N.C.	N.O.
Dark-on	N.O.	N.C.

Wiring Diagrams

Diagram 1

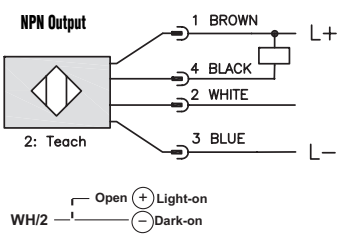


Diagram 2

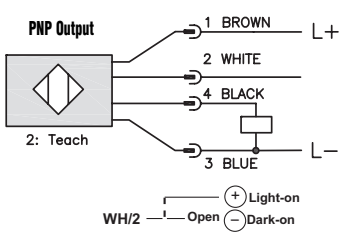
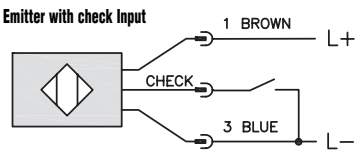
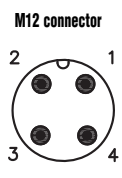


Diagram 3



2-meter Axial Cable version: check is black
M12 Connector: check is Pin 2 (white)

Connector



SS Series Photoelectric Sensors

Specifications	Diffuse Models			Reflective Models	Through-Beam Models
Type	Diffuse reflection			Polarized reflection[4]	Through-beam[5]
Sensing Distance	100mm[1]	200mm[1]	400mm[2]	2m[3]	8M
Light Spot Diameter	50 mm @ 100 mm	90 mm @ 200 mm	240 mm @ 400 mm	80 mm @ 3 m	900 mm @ 10 m
Emission	Infrared (880nm)			Red (660nm)	Infrared (880nm)
Sensitivity	Fixed				
Output Type	NPN or PNP/N.O./N.C. selectable				
Operating Voltage	10-30VDC				
Ripple	≤10%				
No-load Supply Current	30mA				15mA (SSE), 20mA (SSR)
Operating (Load) Current	≤100mA				
Off-state (Leakage) Current	≤10µA				
Voltage Drop	≤1.2volt maximum at 100mA				
Switching Frequency	250Hz				25Hz
Ripple	N/A				
Time Delay Before Availability (tv)	200ms				
Short-Circuit Protection	Yes (switch autoresets after overload is removed)				
Operating Temperature	-25° to + 70° C (-13° to 158° F)				
Protection Degree (DIN 40050)	IEC IP67				
LED Indicators Switching Status	Yellow (output energized)				Red (output energized)
Housing Material	Polybutylene Terephthalate (PBT) plastic housing, polycarbonate (PC) cable exit				
Lens Material	Polymethyl metacrylate (PMMA)				
Shock/Vibration	See terminology section				
Tightening Torque	1 Nm (0.74 lb-ft)				
Weight	100g (3.53 oz)				200g (7.05oz)
Connectors	2m (6.5') axial cable; M12 (12mm) connector				
Agency Approvals	CE				

[1] With 100x100mm white matte paper
[2] With 200x200mm white matte paper
[3] With standard Ø84mm RL110 reflector
[4] Each sensor includes one 84mm round reflector (RL110). Purchase additional reflectors separately.

[5] An emitter (SSE) and receiver (SSR) pair must be ordered for a complete sensor set.

Dimensions

in/mm

Figure 1

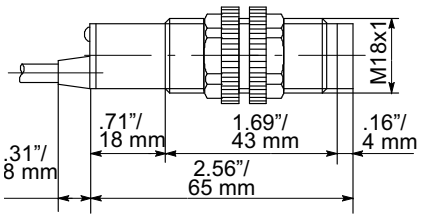
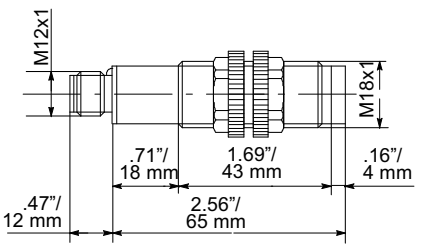


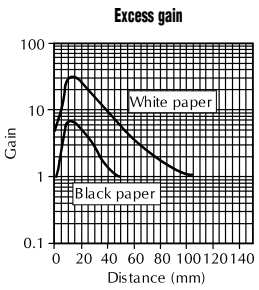
Figure 2

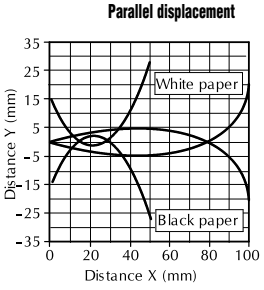


SS Series Photoelectric Sensors

Characteristic curves

Chart Set 1





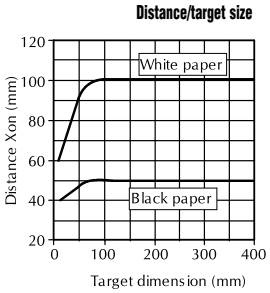
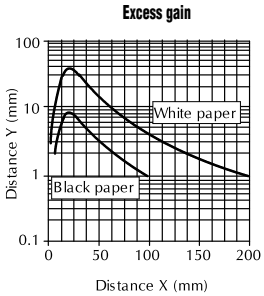
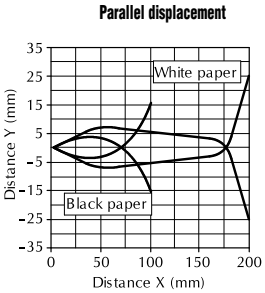


Chart Set 2





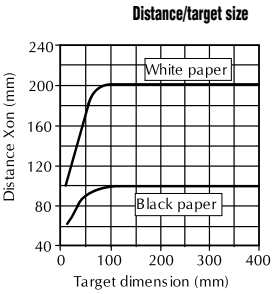
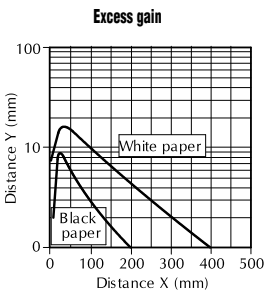
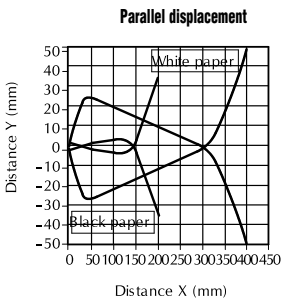


Chart Set 3





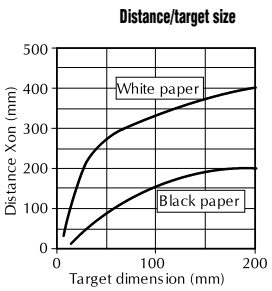
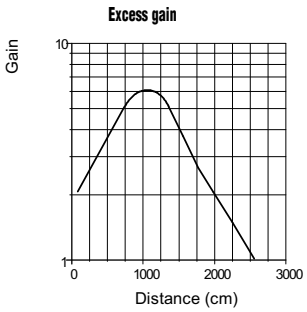


Chart Set 4



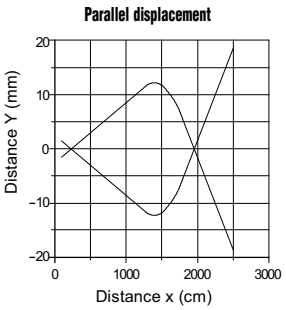
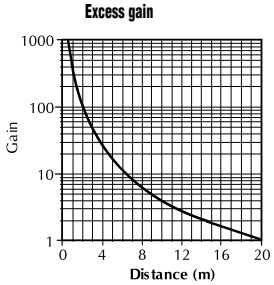
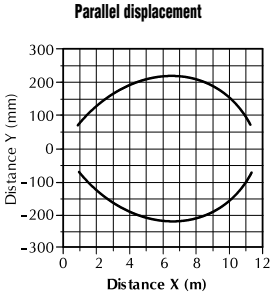
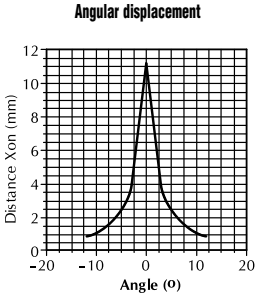
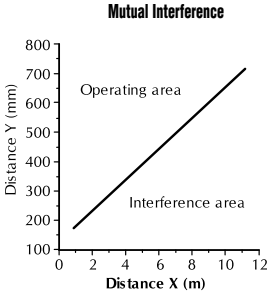


Chart Set 5









MS Series Photoelectric Sensors

M18 (18 mm) plastic with background suppression - DC

- 4 models available
- Diffuse reflection with background suppression
- Plastic housing
- Axial cable or M12 quick-disconnect models
- NPN, PNP, N.O./N.C. selectable output
- IP67 rated

MS Series Photoelectric Selection Chart								
Part Number	*Price*	*Sensing Range*	*Output State*	*Logic*	*Connection*	*Wiring*	*Dimensions*	*Characteristic Curves*
MS0-00-0A	<--->	50mm (1.97in)	N.O./N.C. selectable	NPN/PNP selectable	2m (6.5') axial cable	Diagram 1 or Diagram 2	Figure 1	Chart 1
MS0-00-0E	<--->				M12 (12mm) connector		Figure 2	Chart 1
MS1-00-0A	<--->	100mm (3.94in)	N.O./N.C. selectable	NPN/PNP selectable	2m (6.5') axial cable		Figure 1	Chart 2
MS1-00-0E	<--->				M12 (12mm) connector		Figure 2	Chart 2

Wiring diagrams

Diagram 1

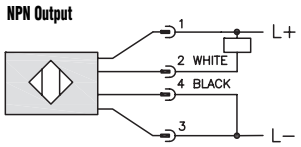
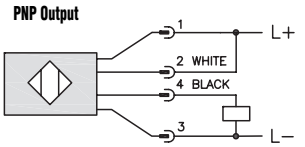


Diagram 2



Connector

Note For Diagram 1 and Diagram 2: For N.O. – Brown 1 to L+ and Blue 3 to L-
For N.C. – Blue 3 to L+ and Brown 1 to L-

Switching Element Function		
	Thru-beam and Reflective Models	*Diffuse Reflective Models*
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

Dimensions

in/mm)

Figure 1

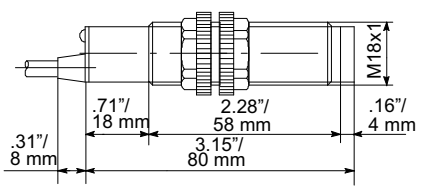
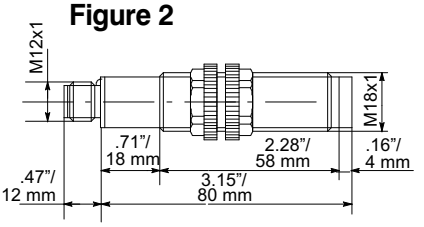


Figure 2



Characteristic curves

Chart 1

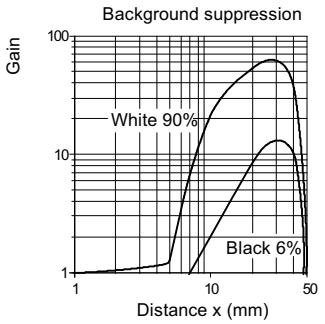
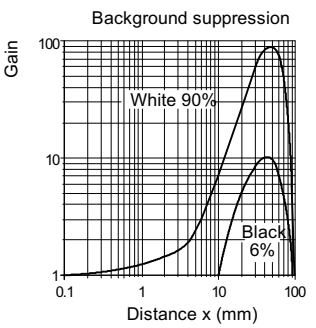


Chart 2



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

MS Series Photoelectric Sensors

MS Series Specifications	Standard Distance	Extended Distance
Type	Diffuse reflection with background suppression	
Sensing Distance	50mm[1]	100mm[1]
Light Spot Diameter	0.6 mm @50 mm	0.9 mm @ 100 mm
Emission	Infrared (880nm)	
Sensitivity	NPN/PNP selectable; N.O./N.C. selectable	
Output Type	5%	
Operating Voltage	10-30VDC	
No-load Supply Current	40mA	
Operating (Load) Current	≤100mA	
Off-state (Leakage) Current	≤10µA	
Voltage Drop	≤1.2volt maximum at 100mA	
Switching Frequency	80Hz	
Ripple	≤10%	
Time Delay Before Availability (tv)	200ms	
Short-Circuit Protection	Yes (switch autoresets after overload is removed)	
Operating Temperature	-25° to + 70° C (-13° to 158° F)	
Protection Degree (DIN 40050)	IEC IP67	
LED Indicators - Switching Status	Red (output energized)	
Housing Material	Polybutylene Terephthalate (PBT) plastic housing, polycarbonate (PC) cable exit	
Lens Material	Plexiglass 7N	
Shock/Vibration	See terminology section	
Tightening Torque	1 Nm (0.74 lb-ft)	
Weight	150g (5.29 oz)	
Connectors	2m (6.5') axial cable; M12 (12mm) connector	
Agency Approvals	CE	

[1] With 100x100mm white matte paper

FARS Series Photoelectric Sensors

FARS-BN-0E

FARS-BN-0A

M18 (18 mm) plastic - DC

The FARS series is a direct reflection diffuse sensor with adjustable background suppression. By using an embedded linear position sensor and a microprocessor, the FARS sensor has excellent capabilities in sensing targets of all shades of color, from a 90% reflective white target, all the way to a 6% reflective black target. The sensing distance can be adjusted between 30 mm and 130 mm using the lateral trimmer.

Features

- 8 models, diffuse with background suppression
- 30/130 mm adjustable maximum reading distance
- Cable or M12 quick disconnect
- Plastic or metal housing
- Supply voltage: 10 - 30 VDC, output current: 100 mA
- LED light status indicator
- IP67 housing protection
- Complete protection against electrical damage

18mm diameter Diffuse Sensors Selection Chart

Part Number	Price	Voltage Range	Sensing Range	Switching Frequency	Sensing Beam	Thru-Beam Component	Output Type	Connection Type	Wiring
FARS-BN-0A	<--->	10 to 30 VDC	30 -130 mm adjustable	1 kHz	Red light (660 nm)	NO/NC background suppression	NPN NO + NC complementary	2 meter axial cable	Diagram 1
FARS-BN-0E	<--->						NPN NO + NC complementary	M12 quick disconnect (purchase cable separately)	
FARS-BP-0A	<--->						PNP NO + NC complementary	2 meter axial cable	Diagram 2
FARS-BP-0E	<--->						PNP NO + NC complementary	M12 quick disconnect (purchase cable separately)	
FARS-0N-0A	<--->					NO/NC background suppression	NPN NO/NC selectable	2 meter axial cable	Diagram 3
FARS-0N-0E	<--->						NPN NO/NC selectable	M12 quick disconnect (purchase cable separately)	
FARS-0P-0A	<--->						PNP NO/NC selectable	2 meter axial cable	Diagram 4
FARS-0P-0E	<--->						PNP NO/NC selectable	M12 quick disconnect (purchase cable separately)	

Wiring Diagrams

Diagram 1

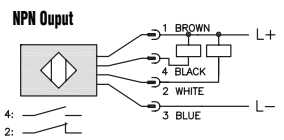
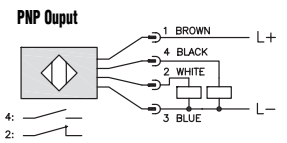


Diagram 2



Connector

M12 Connector

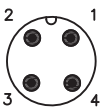


Diagram 3

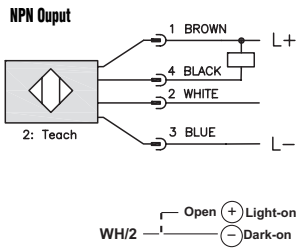
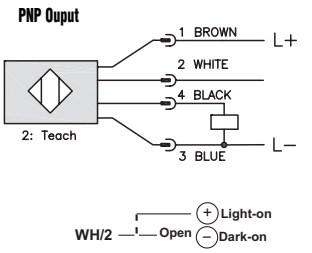


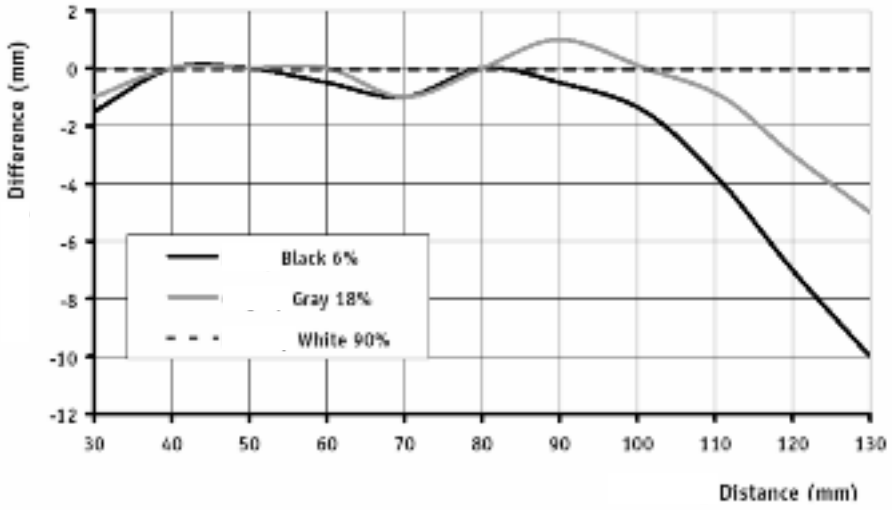
Diagram 4



NO	Light ON
NC	Dark ON

FARS Series Photoelectric Sensors

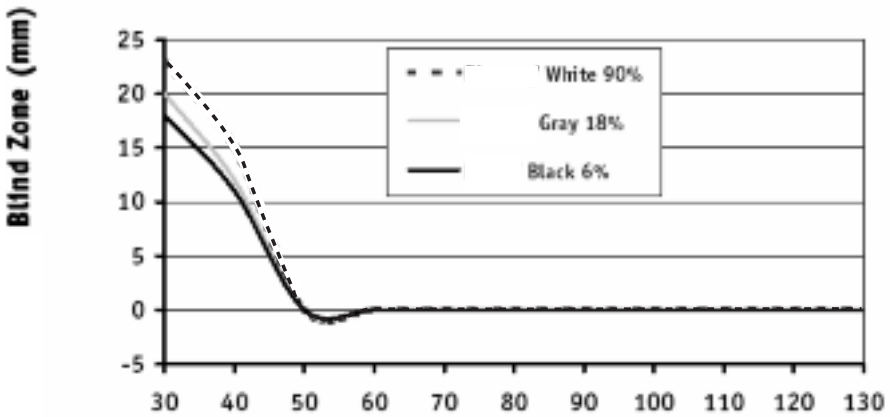
Black-White Differential Chart



Black-White Differential Graph

This graph shows the difference in distance between where the FARS series sensors detect a 90% reflective white card, versus a 6% reflective black test card under the same conditions. As the adjoining graph illustrates, the FARS series sensors provide practically a zero millimeter difference between the white and black target at a setup distance of 80 mm, 3 mm difference at a setup distance of 100 mm and 10 mm for a setup distance of 130 mm.

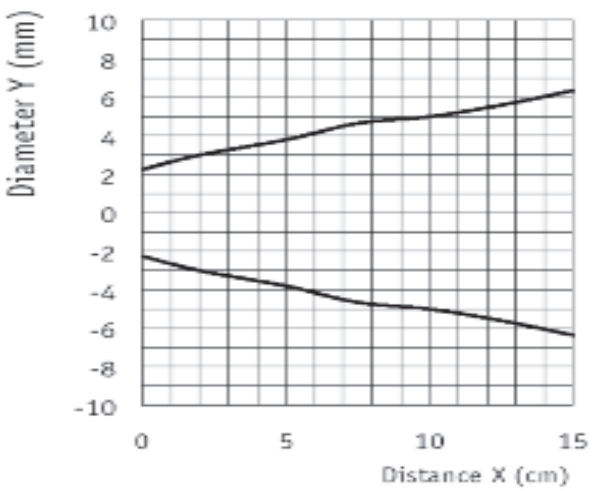
Blind zone chart



Blind Zone Graph

This graph shows the blind zone, which is where the FARS series sensors will not detect, depending on the setup distance. For setup sensing distance of 30 mm the FARS sensor will have a blind zone of 25 mm, so the effective sensing envelope is from 25 mm to 30 mm; but, as the setup sensing distance is increased, the blind zone decreases.The graph shows that from a setup sensing distance of 60 mm to 130 mm, the blind zone is zero millimeters.

Spot dimension chart



Switching Element Function		
	Thru-beam and Reflective Models	***Diffuse Reflective Models***
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

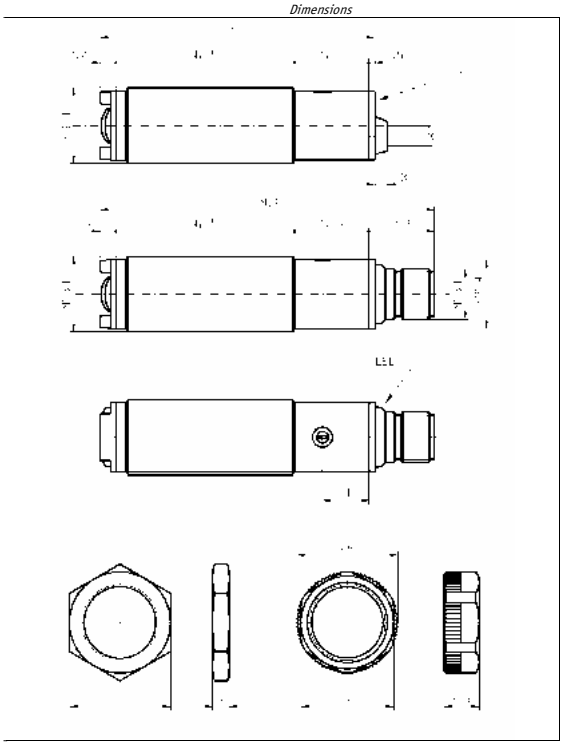
FARS Series Photoelectric Sensors

FARS Series Photoelectric Sensors Specifications	
Type	***18 mm Diffuse with Background Suppression***
Sensing Distance	30 - 130 mm
Light Spot Diameter	13 mm @ 100 mm
Emission	Red Light (660 nm)
Sensitivity	Adjustable
Output Types	NPN / PNP Q/Qnot L-on/D-on, switch-selectable
Operating Voltage	10 to 30 VDC
No Load Supply Current	25 mA
Operating (Load) Current	100 mA
Off-state (Leakage) Current	≤ 10 µA @ 30 VDC
Voltage Drop	2V max @ 100 mA
Switching Frequency	1 kHz
Ripple	≤ 10%
Time Delay Before Availability (tv)	200 ms
Short-circuit Protection	Yes
Operating Temperature	13°F to 158°F (-25°C to +70°C)
Protection Degree(DIN 40050)	IP67
LED Indicators- Switching Status	Yellow Output/Short Crcuit Status
Housing Material	Polybutylene Terephthalate (PBT)
Lens Material	Poly methyl methacrylate (PMMA),
Shock/Vibration	per IEC EN 60947-5-2
Tightening Torque	1 Nm (0.74 lb-ft)
Weight	28.576 g (1.008 oz)
Connectors	2m (6.5') axial cable; M12 (12mm) connector
Agency Approvals	UL, CE

Dimensions

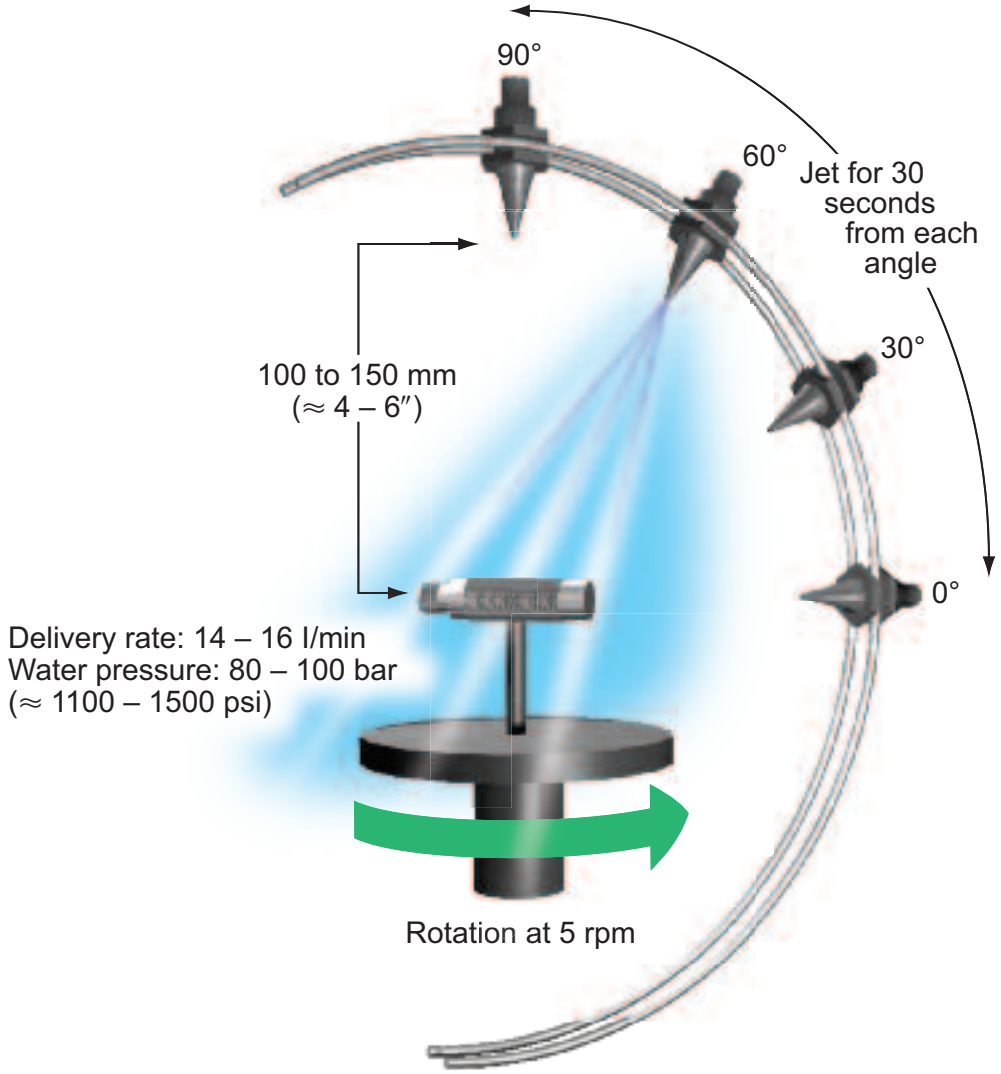
(mm)

Dimensions



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

IP69K-rated Photoelectric Sensors



Overview

IP69K high-pressure cleaning test

The ADC Food and Beverage products were tested in accordance with the IP69K standard, according to DIN 40050 part 9. The goal of this test was to duplicate pressure cleaning conditions on a plant floor. In the test fixture, the sensors were exposed to a 1500 psi spray of water at a temperature of 176 °F. The duration of each cleaning cycle was 30 seconds. The test was performed at specified angles using a spray nozzle located at a distance of 4″ from the switch.The sensors withstood test conditions and were still operable, providing 100% of sensing range.

Thermal endurance

In pressure cleaning environments, proximity and photo sensors can be exposed to extreme temperature conditions. A thermal shock test was performed on the proximity sensors by cycling the temperature to ensure their consistent high reliability. All proximity and FFRS photoeyes can withstandtemperatures up to 100°C (212°F).

FDA certified Materials

The ADC Food & Beverage sensors are manufactured from materials capable of withstanding solutions used during equipment cleaning. These materials are all approved by the FDA for use in food production environments:

- 316L (V4A) stainless steel
- PMMA (acrylic)
- PEEK (Polyether Ether Ketone)
- PPS (Techtron)

Third Party chemical testing companies such as ECOLAB and Johnson Diversey have tested these products with common cleaning agents, such as P3-clint KF and P3-topax 52, to assure continued operation.

FF Series IP69K-rated Photoelectric Sensors

FFR3-BN-1E

M18 (18 mm) stainless steel - DC

- 30 models - diffuse, polarized reflective, retro-reflective and through-beam
- 20 m 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

FF Series Photoelectric Sensor Selection Chart

Part Number		Price	Sensing Range	Output State	Logic	Connection	Wiring	Characteristic Curves
Diffuse								
FFR3-BN-1E		<--->	100mm (3.9 in.)	N.O./N.C. complementary	NPN	M12 (12mm) connector (purchase cable separately)	Diagram 3	Chart Set 1
FFR3-BP-1E		<--->			PNP		Diagram 4	Chart Set 1
FFR3-0N-1E		<--->		N.O./N.C. selectable	NPN		Diagram 1	Chart Set 1
FFR3-0P-1E		<--->			PNP		Diagram 2	Chart Set 1
FFI7-BN-1E		<--->	400mm (15.7 in.)	N.O./N.C. complementary	NPN		Diagram 3	Chart Set 2
FFI7-BP-1E		<--->			PNP		Diagram 4	Chart Set 2
FFI7-0N-1E		<--->		N.O./N.C. selectable	NPN		Diagram 1	Chart Set 2
FFI7-0P-1E		<--->			PNP		Diagram 2	Chart Set 2
FFI8-BN-1E		<--->	800mm (31.5 in.)	N.O./N.C. complementary	NPN		Diagram 3	Chart Set 3
FFI8-BP-1E		<--->			PNP		Diagram 4	Chart Set 3
FFI8-0N-1E		<--->		N.O./N.C. selectable	NPN		Diagram 1	Chart Set 3
FFI8-0P-1E		<--->			PNP		Diagram 2	Chart Set 3
Polarized reflective*								
FFRP-BN-1E •		<--->	4m (13.1 ft)	N.O./N.C. complementary	NPN	M12 (12mm) connector (purchase cable separately)	Diagram 3	Chart Set 4
FFRP-BP-1E •		<--->			PNP		Diagram 4	Chart Set 4
FFRP-0N-1E •		<--->		N.O./N.C. selectable	NPN		Diagram 1	Chart Set 4
FFRP-0P-1E •		<--->			PNP		Diagram 2	Chart Set 4
FFRN-BN-1E		<--->		N.O./N.C. complementary	NPN		Diagram 3	Chart Set 4
FFRN-BP-1E		<--->			PNP		Diagram 4	Chart Set 4
FFRN-0N-1E		<--->		N.O./N.C. selectable	NPN		Diagram 1	Chart Set 4
FFRN-0P-1E		<--->			PNP		Diagram 2	Chart Set 4
Retro-reflective for transparent objects*								
FFRL-BN-1E		<--->	1m (3.3 ft)	N.O./N.C. complementary	NPN	M12 (12mm) connector (purchase cable separately)	Diagram 3	Chart Set 5
FFRL-BP-1E		<--->			PNP		Diagram 4	Chart Set 5
FFRL-0N-1E		<--->		N.O./N.C. selectable	NPN		Diagram 1	Chart Set 5
FFRL-0P-1E		<--->			PNP		Diagram 2	Chart Set 5
Through-beam **								
FFIZ-BN-1E •	Receiver	<--->	20m (62.6 ft)	N.O./N.C. complementary	NPN	M12 (12mm) connector (purchase cable separately)	Diagram 3	Chart Set 6
FFIZ-BP-1E •	Receiver	<--->			PNP		Diagram 4	Chart Set 6
FFIZ-0N-1E •	Receiver	<--->		N.O./N.C. selectable	NPN		Diagram 1	Chart Set 6
FFIZ-0P-1E •	Receiver	<--->			PNP		Diagram 2	Chart Set 6
FFIH-00-1E	Emitter	<--->		Receiver dependent	Receiver dependent		Diagram 5	Chart Set 6
FFIH-X0-1E†	Emitter	<--->					Diagram 6	Chart Set 6

NOTES:

† Check function

****Receivers include one round (84mm dia.) RL110 reflector. Purchase additional reflectors separately.***

*****Purchase one receiver and one emitter for a complete set.***

• Sensors without sensitivity adjustment

Switching Element Function

	Thru-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

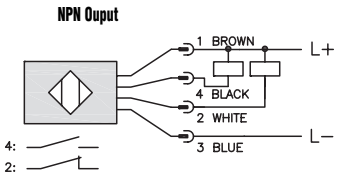


Diagram 2

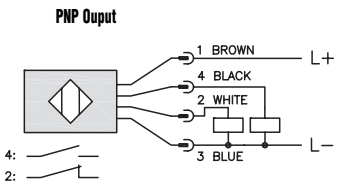


Diagram 3

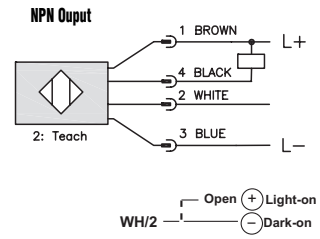
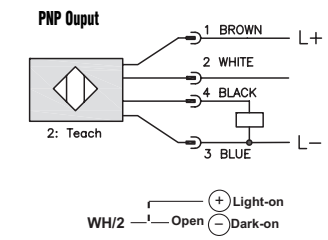


Diagram 4



Connector

M12 Connector

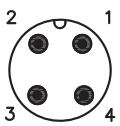


Diagram 5

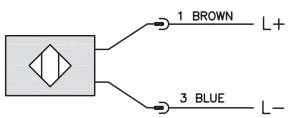
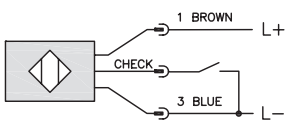


Diagram 6



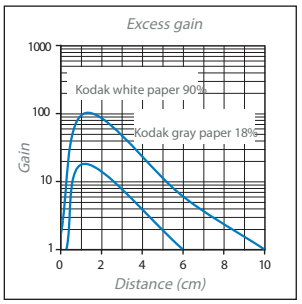
2-meter Axial Cable version: check is black
M12 Connector: check is Pin 2 (white)

FF Series IP69K-rated Photoelectric Sensors

Characteristic curves

Chart Set 1

FFR3/**-1E



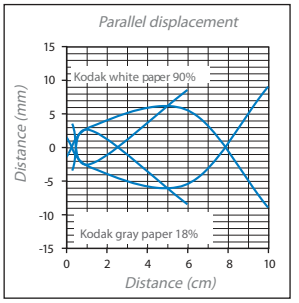
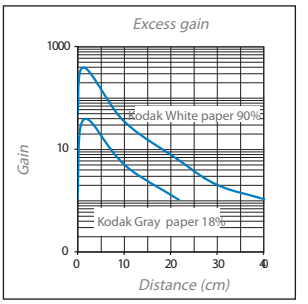


Chart Set 2

FFI7/**-1E



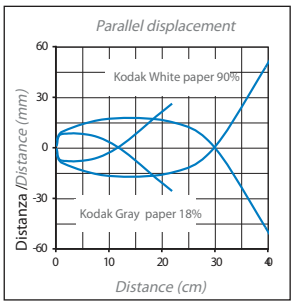
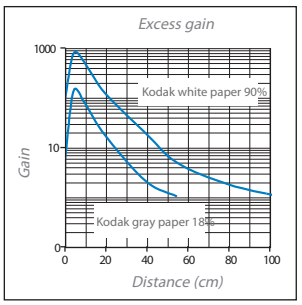


Chart Set 3

FFI8/**-1E



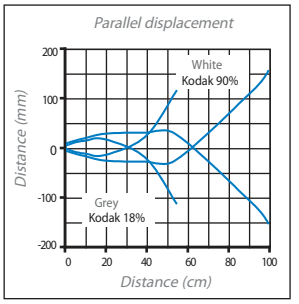
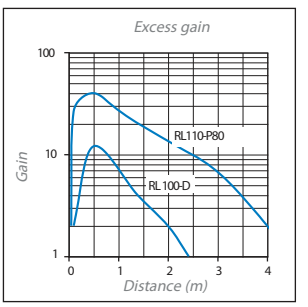


Chart Set 4

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



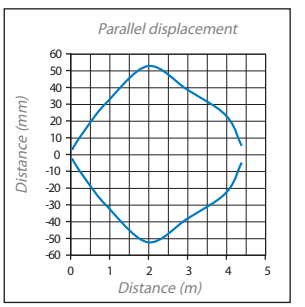
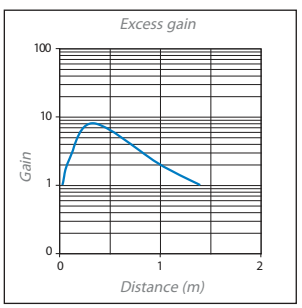


Chart Set 5

FFRL/**-1E



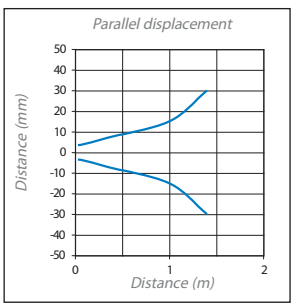
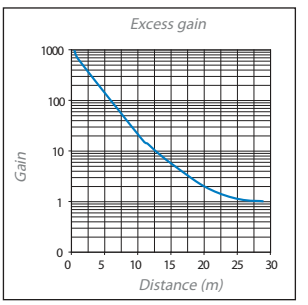
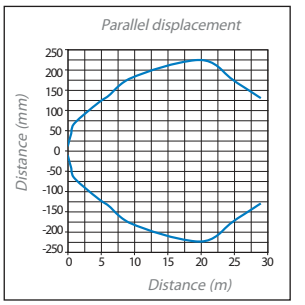


Chart Set 6

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





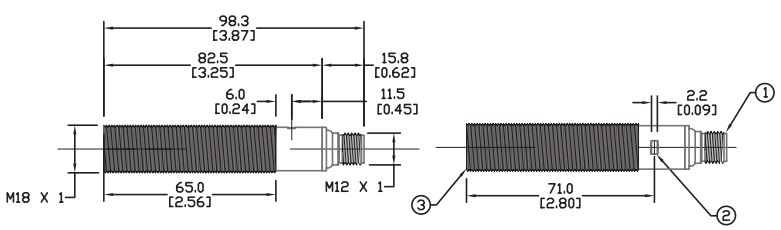
FF Series IP69K-rated Photoelectric Sensors

FF Series 18 mm Photoelectric Sensors Specifications								
Type	***Diffuse Reflective***			***Polarized Reflective***			***Through-beam [5]***	
Model Series	***FFR3***	***FFI7***	***FFI8***	***FFRL***	***FFRN***	***FFRP***	***FFIZ***	***FFIH***
Sensing Distance	100 mm[1]	400 mm[2]	800 mm[3]	1 m	4 m[4]		20 m	
Light Spot Diameter	10 mm @ 100 mm	50 mm @ 400 mm	180 mm @ 800 mm	80 mm @ 1 m	200 mm @ 4 m		600 mm @ 20 m	
Emission	Red (660 nm)	Infrared (660 nm)	Infrared (880 nm)	Red (660 nm)			–	Infrared (880 nm)
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	500 Hz						250 Hz	–
Ripple	≤10%							
Time Delay Before Availability (tv)	200ms							
Short-Circuit Protection	Yes, switch auto-resets after load is removed							
Operating Temperature	-13°F to 176°F (-25°C 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	Poly methyl methacrylate (PMMA), FDA certified							
Exit Connector	Grilamid							
Shock/Vibration	See terminology section							
Tightening Torque	50 Nm (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, included with sensor
[5] An emitter and receiver pair must be ordered for a complete sensor set.
*Note: Yellow LED Fixed On: Excess Gain ≤2. Yellow LED flashing: Excess Gain<2

Dimensions

mm(in)



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

FFRS Series IP69K-rated Photoelectric Sensors

FFRS-BN-1E

M18 (18 mm) stainless steel - DC

- 8 models, diffuse with background suppression
- Choose from 30/130 mm adjustable maximum reading distance, or 60/100 mm adjustable maximum reading distance for shiny objects
- M12 quick disconnect (purchase cable separately)
- 316L stainless steel housing
- Supply voltage: 10 - 30 VDC
- LED light status indicators: yellow (output), green (teach function)
- IP69K rated for food and beverage applications
- Complete protection against electrical damage
- M18 mounting hex nuts included

18mm FFRS Series Photoelectric Sensors Selection								
Part Number	***Price***	***Voltage Range***	***Sensing Range***	***Switching Frequency***	***Sensing Beam***	***Output Type***	***Connection Type***	***Wiring***
FFRS-BN-1E	<--->	10 to 30 VDC	30 to130 mm adjustable	1 kHz	Red (660 mm)	NPN NO + NC complementary	M12 quick disconnect (purchase cable separately)	Diagram 3
FFRS-BP-1E	<--->					PNP NO + NC complementary		Diagram 4
FFRS-0N-1E	<--->					NPN NO + NC selectable		Diagram 1
FFRS-0P-1E	<--->					PNP NO + NC selectable		Diagram 2
FFRS-BN-1E77	<--->		For shiny objects 60 to 100 mm adjustable	400 Hz		NPN NO + NC complementary		Diagram 3
FFRS-BP-1E77	<--->					PNP NO + NC complementary		Diagram 4
FFRS-0N-1E77	<--->					NPN NO + NC selectable		Diagram 1
FFRS-0P-1E77	<--->					PNP NO + NC selectable		Diagram 2

N.O.	Light ON
N.C.	Dark ON

Wiring Diagrams

Diagram 1

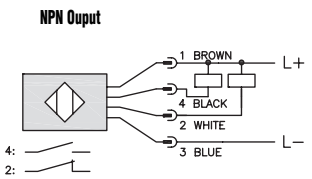
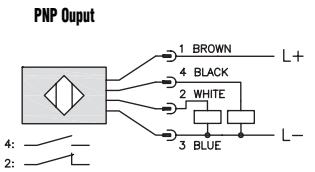


Diagram 2



Connector

Diagram 3

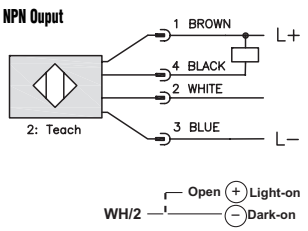
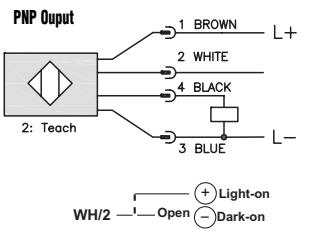


Diagram 4



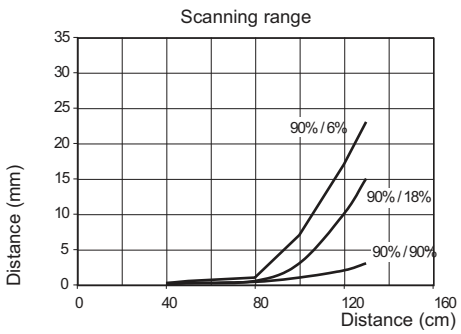
Note: In case of combined load, resistive and capacitive, the maximum admissible capacity (C) is 0.1 µF for maximum output voltage and current.

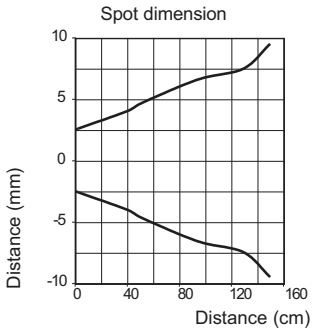
NOTE: CLASS 2 POWER SUPPLY REQUIRED

FFRS Series IP69K-rated Photoelectric Sensors

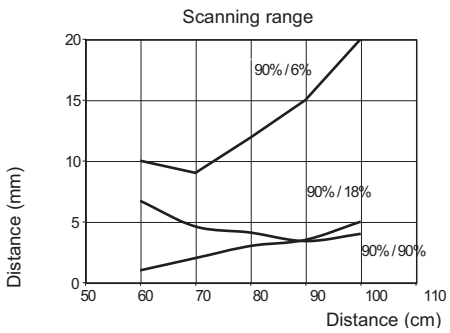
Characteristic curves

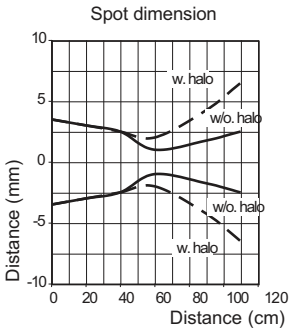
FFRS-**-** Standard Version





FFRS-**-**77 Special model for shiny object



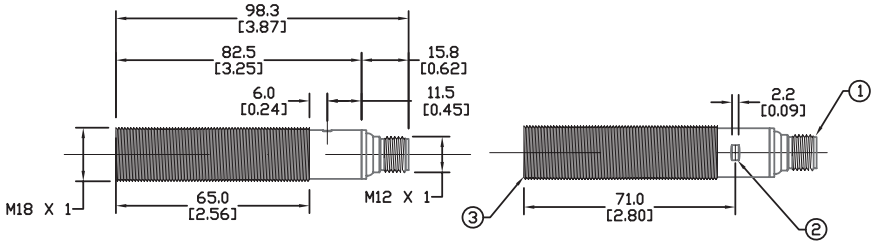


FFRS Series IP69K-rated Photoelectric Sensors

FFRS Series 18 mm Photoelectric Sensors Specifications		
Type	***Background Suppression***	
	Standard	***For Shiny Objects***
Model Series	***FFRS***	***FFRS**77***
Sensing Distance	30 to 130 mm	60 to 100 mm
Light Spot Diameter	13 mm @ 100 mm	
Emission	Red 660 nm	
Sensitivity	Teach	
Output Type	See individual parts in Selection Guide	
Operating Voltage	10-30VDC	
No-load Supply Current	≤50mA	
Operating (Load) Current	≤100mA	
Off-state (Leakage) Current	≤10mA at 30 VDC	
Voltage Drop	2V max at 100mA	
Switching Frequency	1 KHz	400 Hz
Ripple	≤10%	
Time Delay Before Availability (tv)	200ms	
Short-Circuit Protection	Yes, switch autoresets after load is removed	
Operating Temperature	-13°F to 176°F (-25°C to 80°C); short exposure 15 minutes, to 212°F (100°C)	
Protection Degree (DIN 40050)	IEC IP68, IP69K	
LED Indicators - Switching Status	Green ON: teach function available Green OFF: teach function blocked Green Slow Flashing: teach in progress Yellow ON: Output state - O models*; Yellow ON: Light state - B models*	
Housing Material	316L stainless steel	
Lens Material	Poly methyl methacrylate (PMMA), , FDA certified	
Exit Connector Material	Grilamid	
Shock/Vibration	See terminology section	
Tightening Torque	50 Nm (36.88 lb-ft)	
Weight	200g (7.05 oz)	
Connectors	M12 plug	
Approvals	CE, cULus file E187310, ECOLAB, RoHS, Johnson Diversey	

Dimensions

mm(in)



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.

MQ Series Photoelectric Sensors

M18 (18 mm) plastic - AC

The MQ series is an AC diffuse photoelectric with a unique 90° optic package for mounting in space-limited applications. This series fits in a standard 18 mm mounting bracket or mounting hole, and is available in a choice of 20-250 VAC outputs in NO or NC configurations with an M12 disconnect. All MQ models include background suppression with maximum available sensing distances of 50 mm or 100 mm.

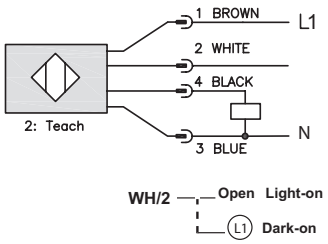
Features

- Diffuse with background suppression
- Models with 50 mm or 100 mm maximum reading distance
- M12 plug connection
- Plastic housing
- Supply voltage 20 - 253 VAC
- LED output status indicator
- Light - ON, Dark - ON selectable
- IP67 housing protection

18mm AC Photoelectric Reflection Sensors with Background Suppression Selection Chart

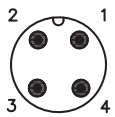
Part Number	Price	Voltage Range	Sensing Range	Switching Frequency	Sensing Beam	Thru-Beam Component	Output Type	Connection Type
MQ0-00-0E	<--->	20 to 253 VAC	50 mm	25 Hz	Infrared	NO/NC background suppression	TRIAC LO/DO selectable	M12 quick disconnect (purchase cable separately)
MQ1-00-0E	<--->		100 mm				TRIAC LO/DO selectable	M12 quick disconnect (purchase cable separately)

Wiring Diagram



Connector

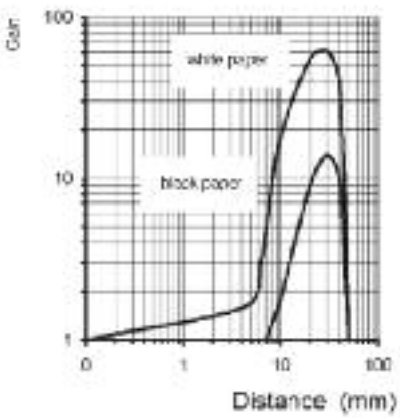
M12 Connector

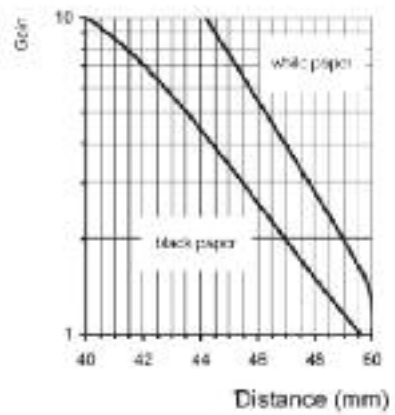


NO	Light ON
NC	Dark ON

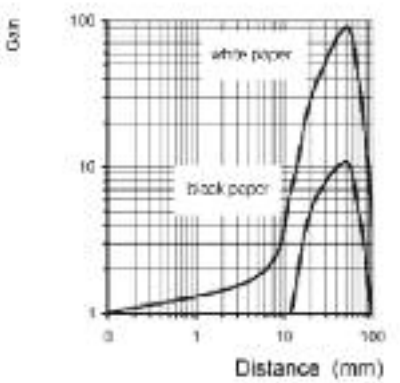
Characteristic Curves

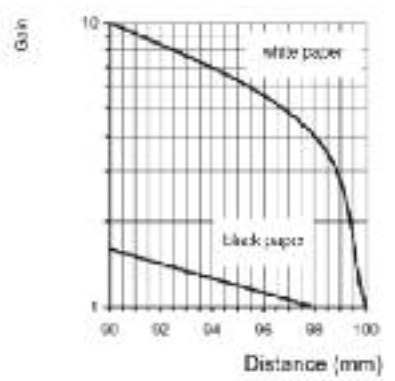
MQ0-00-0E





MQ1-00-0E



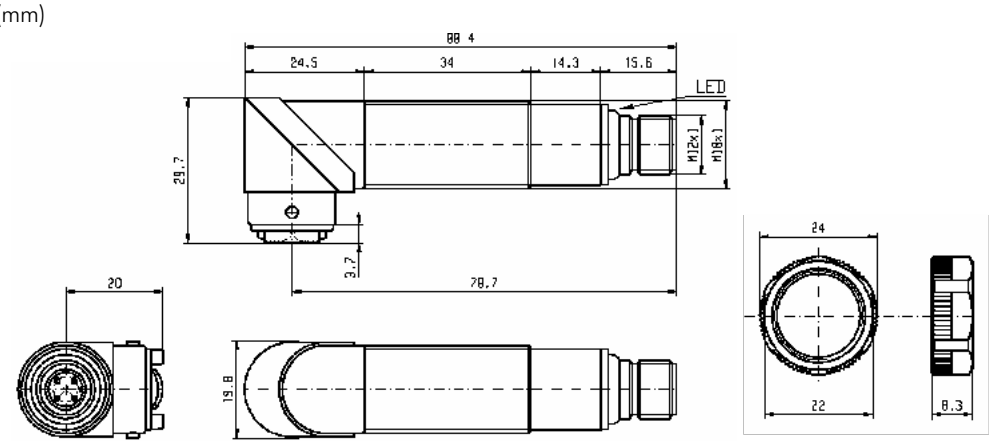


MQ Series Photoelectric Sensors

MQ Series Photoelectric Sensors Specifications	
Type	***18 mm Diffuse with Background Suppression, 90° Radial Optic***
Model Series	MQ0/MQ1
Sensing Distance	50 mm / 100 mm
LightSpot Diameter	0.6 mm @ 50 mm/0.9 mm @ 100 mm
Emission	Infrared (C880nm)
Sensitivity	Fixed
Output Types	TRIAC
Operating Voltage	20 - 253 VAC
No Load Supply Current	40 mA
Operating (Load) Current	<300 mA
Off-state (Leakage) Current (max)	≤ 1.5 mA @ 250 VAC
Voltage Drop	3V @ 300 mA
Switching Frequency	25 Hz
Ripple	≤10%
Time Delay Before Availability (tv)	200 ms
Short-circuit Protection	Yes
Operating Temperature	13°F to 158°F (-25°C to +70°C)
Protection Degree (DIN 40050)	IP67
LED Indicators - Switching Status	Yellow Output State
Housing Material	Polybutylene Terephthalate (PBT)
Lens Material	Poly methyl methacrylate (PMMA)
Shock/Vibration	See terminology section
Tightening Torque	1 Nm (0.74 lb-ft)
Weight	34.473 g (1.216 oz)
Connectors	M12 quick disconnect
Agency Approvals	UL Recognized E130644, CE

Dimensions

(mm)



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

MV Series AC Powered Photoelectric Sensors

M18 (18 mm) plastic- AC

- 12 models available
- Diffuse, polarized reflective, and through-beam models
- Plastic housing
- Axial cable or M12 quick-disconnect models
- Operates on 20 to 253 VAC
- IP67 rated

MV Series Photoelectric Selection Chart

Part Number		Price	Sensing Range	Output State	Connection	Wiring	Dimensions	Characteristic Curves
Diffuse								
MV2-A0-0A		<--->	100mm (3.9 in.)	N.O.	2m (6.5 ft) axial cable	Diagram1	Figure 1	Chart 1
MV2-A0-0E		<--->			M12 (12mm) connector	Diagram1	Figure 2	
MV4-A0-0A		<--->	200mm (7.9 in.)		2m (6.5 ft) axial cable	Diagram1	Figure 1	Chart 2
MV4-A0-0E		<--->			M12 (12mm) connector	Diagram1	Figure 2	
MV6-A0-0A		<--->	400mm (15.7 in.)		2m (6.5 ft) axial cable	Diagram1	Figure 1	Chart 3
MV6-A0-0E		<--->			M12 (12mm) connector	Diagram1	Figure 2	
Polarized reflective*								
MVP-A0-0A		<--->	3m (9.8 ft)	N.O	2m (6.5 ft) axial cable	Diagram1	Figure 1	Chart 4
MVP-A0-0E		<--->			M12 (12mm) connector	Diagram1	Figure 2	
Through-beam **								
MVE-00-0A	Emitter	<--->	16m (52.5 ft)	Receiver dependent	2m (6.5 ft) axial cable	Diagram 2	Figure 1	Chart 5
MVE-00-0E	Emitter	<--->			M12 (12mm) connector	Diagram 2	Figure 2	
MVR-A0-0A	Receiver	<--->		N.O.	2m (6.5 ft) axial cable	Diagram1	Figure 1	Chart 5
MVR-A0-0E	Receiver	<--->		N.O.	M12 (12mm) connector	Diagram1	Figure 2	

Receivers include one round (84mm dia.) reflector. Purchase additional reflectors separately. **Purchase one receiver and one emitter for a complete set.

Wiring diagrams

Diagram 1 Receiver

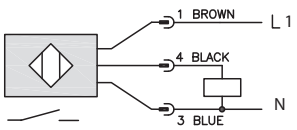
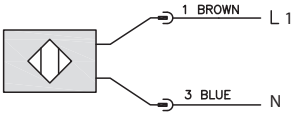
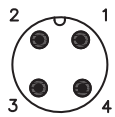


Diagram 2 Emitter



Connector

M12 Connector



Dimensions

(mm)

Figure 1

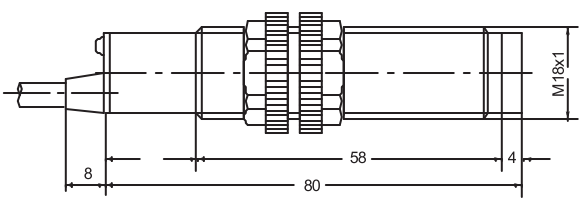
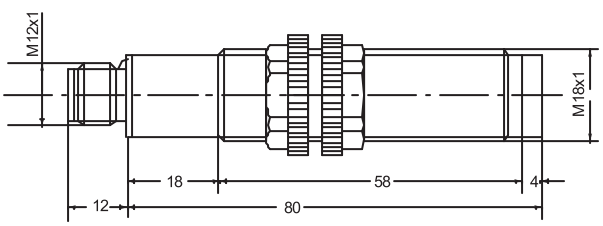


Figure 2



MV Series AC Powered Photoelectric Sensors

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflective[4]	Through-beam[5]
Sensing Distance	MV2 models: 100mm[1] MV4 models: 200mm[1] MV6 models: 400mm[2]	3m[3]	16m
Light Spot Diameter	MV2 models: 50 mm @ 100 mm MV4 models 900 mm @ 200 mm MV6 models: 240mm @ 400 mm	80 mm @ 3 m	1200 mm @ 20 m
Emission	Infrared (880nm)	Red (660nm)	Infrared (880nm)
Tolerance	+15/ -5% Sn		N/A
Sensitivity	Fixed		
Output Type	TRIAC		
Operating Voltage	20-253VAC, 50/60Hz		
No-load Supply Current	30mA (rms)		Emitter: 30mA (rms) Receiver: 15mA (rms)
Operating (Load) Current	5-300mA (rms) (Ta=50°C)		
Off-state (Leakage) Current	1.5mA (rms) max. at 250VAC		
Voltage Drop	3V max. I_L=300mA		
Switching Frequency	25Hz		
Ripple	≤10%		
Time Delay Before Availability (tv)	200 ms		
Short-Circuit Protection	Yes		
Operating Temperature	-25° to +70°C (-13° to +158°F)		
Protection Degree (DIN 40050)	IEC IP67		
LED Indicators - Switching Status	red (output energized)		
Housing Material	Polybutylene Terephthalate (PBT) plastic housing, polycarbonate (PC) cable exit		
Lens Material	Plexiglas 7N		
Shock/Vibration	See terminology section		
Tightening Torque	1 Nm (0.737 lb-ft)		
Weight	35-100g		70-200g
Connectors	2m (6.5') axial cable; M12 (12mm) connector		
Agency Approvals	UL Recognized E130644, CE		

[1] With 100x100mm white matte paper
[2] With 200x200mm white matte paper
[3] With standard Ø84mm RL110 reflector
[4] Each sensor includes one 84mm round reflector (RL110). Purchase additional reflectors separately.
[5] An emitter (SSE) and receiver (SSR) pair must be ordered for a complete sensor set.

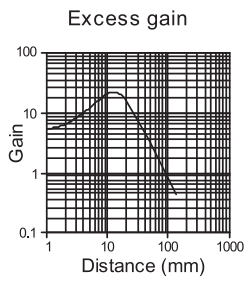
Switching Element Function		
	Thru-beam and Reflective Models	***Diffuse Reflective Models***
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

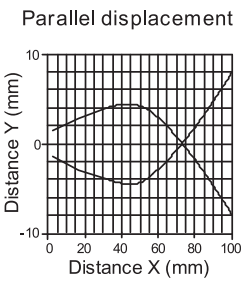
Warning: These products are not safety sensors and are not suitable for use in personal safety applications.

MV Series AC Powered Photoelectric Sensors

Characteristic curves

Chart 1





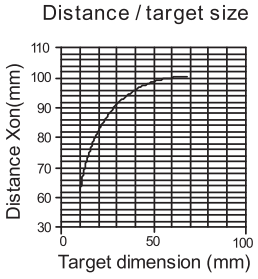
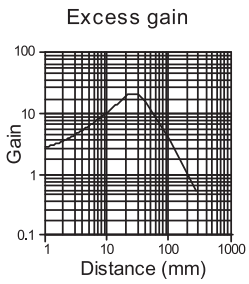
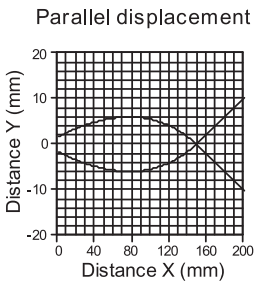


Chart 2





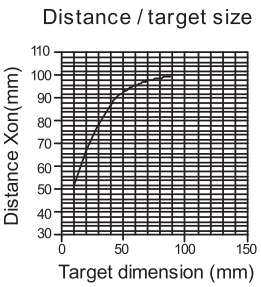
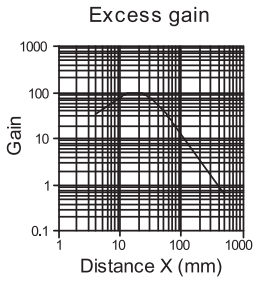
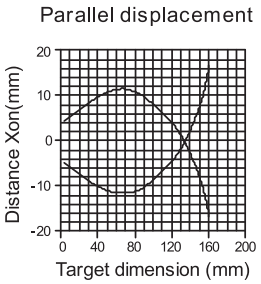


Chart 3





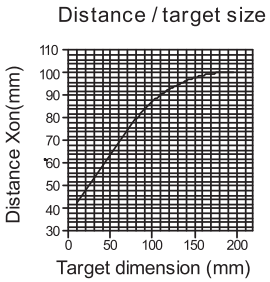
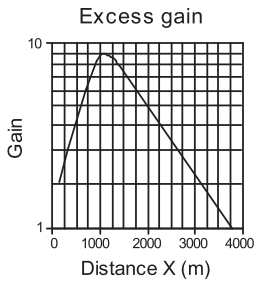


Chart 4



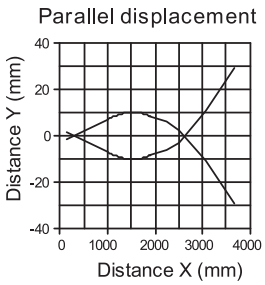
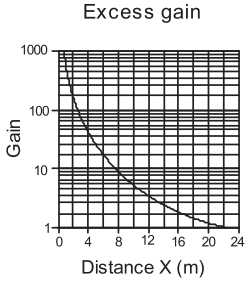
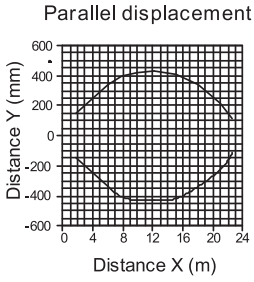
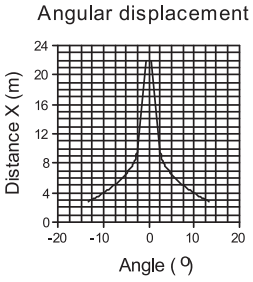
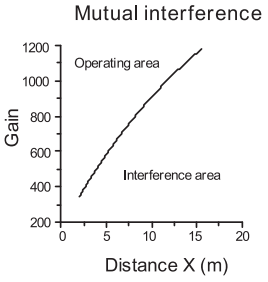


Chart 5









C5 Series Stainless Steel Photoelectric Sensors

M5 (5 mm) stainless steel - DC

- 14 models available
- Diffuse and through-beam styles
- Long operating distances
- Compact stainless steel housing
- Scratch resistant and easy to clean glass lens
- Axial cable or M8 quick-disconnect models
- Complete overload protection
- IP67 rated

C5 Series M5 Photoelectric Sensors Selection Chart

Part Number		Price	Sensing Range	Output State	Logic	Connection	Wiring	Dimensions	Characteristic Curves
Diffuse									
C5D-AN-1A		<--->	50mm (1.97in)[1]	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 1
C5D-AP-1A		<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 1
C5D-AN-1F		<--->			NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 1
C5D-AP-1F		<--->			PNP	M8 (8mm) connector	Diagram 2	Figure 2	Chart 1
C5D-AN-2A		<--->	10mm (0.40in)		NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3
C5D-AP-2A		<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 3
C5D-AN-3A		<--->	20mm (0.79in)[1]		NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 4
C5D-AP-3A		<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 4
Through-beam*									
C5R-AN-1A	Receiver	<--->	250mm (9.84in)	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 2
C5R-AP-1A	Receiver	<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 2
C5R-AN-1F	Receiver	<--->			NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 2
C5R-AP-1F	Receiver	<--->			PNP	M8 (8mm) connector	Diagram 2	Figure 2	Chart 2
C5E-0N-1A	Emitter	<--->		Receiver dependent	Receiver dependent	2m (6.5') axial cable	Diagram 3	Figure 1	Chart 2
C5E-0N-1F	Emitter	<--->				M8 (8mm) connector	Diagram 3	Figure 2	Chart 2

[1] With 100x100mm white matte paper

Purchase one receiver and one emitter for a complete set.

Wiring diagrams

Diagram 1

NPN output

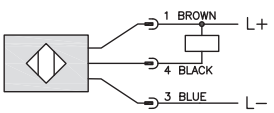


Diagram 2

PNP output

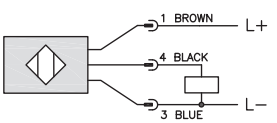
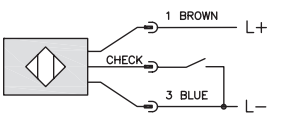


Diagram 3

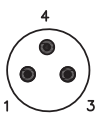
Emitter



Emitter test input (<4V: OFF/ >8V or open: ON) 0.5mA

Connector

M8 Connector



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

Switching Element Function		
	Thru-beam and Reflective Models	***Diffuse Reflective Models***
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

C5 Series Stainless Steel Photoelectric Sensors

Specifications	Diffuse and Through-beam Models	
Type	Diffuse	Through-beam
Sensing Distance	10 to 50 mm (0.39 to 1.97 in)	250 mm (9.84 in)
Light Spot Diameter	See charts	
Emission	Infrared (880nm)	
Sensitivity	Fixed	
Output Type	NPN or PNP; N.O. only	
Operating Voltage	10-30VDC	
No-load Supply Current	Emitter: 10mA Reciever: 5mA	
Operating (Load) Current	≤100mA	
Off-state (Leakage) Current	≤10µA	
Voltage Drop	≤2.0V	
Switching Frequency	250Hz	
Ripple	≤20%	
Time Delay Before Availability (tv)	20ms	
Short-Circuit Protection	Yes (switch autoresets after overload is removed)	
OperatingTemperature	0° to + 55° C (32° to 131° F)	
Protection Degree (DIN 400050)	IEC IP67	
LED Indicators - Switching Status	Yellow (output energized), yellow flashing (excess light indication)	
Housing Material	Stainless steel	
Lens Material	Glass	
Shock/Vibration	See terminology section	
Tightening Torque	1.5 Nm (13.3 lb-in)	
Weight (cable/connector)	76g (2.68 oz)/18g (0.63 oz)	
Connectors	2m (6.5') axial cable; M12 (12mm) connector	
Agency Approvals	UL file E328811	

Dimensions

(mm)

Figure 1

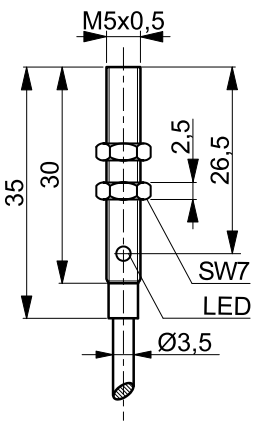
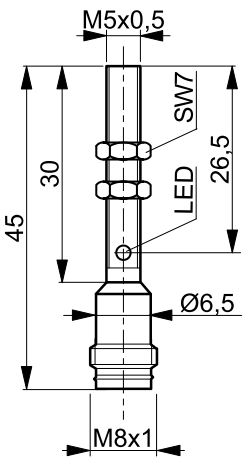


Figure 2



Characteristic curves

Chart 1

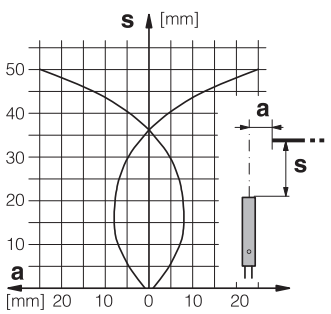


Chart 2

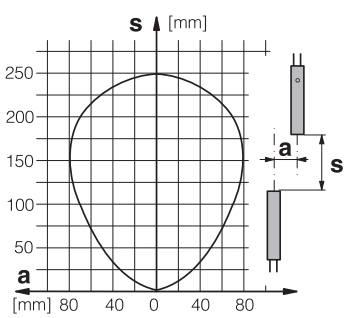


Chart 3

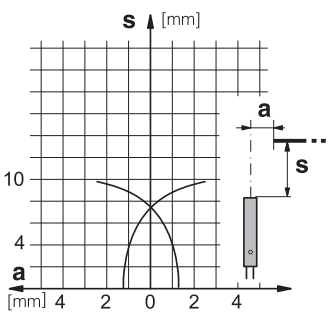
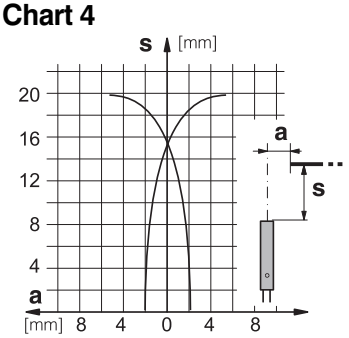


Chart 4



HE Series Photoelectric Sensors

M8 (8 mm) thru-beam series

M8 miniaturized HEE and HER series thru-beam sensors are available with NPN or PNP, and NO or NC outputs.

In the PNP models, the load is connected between the output (black wire) and the negative (blue wire).

In the NPN models, the load is connected between the output (black wire) and the positive (brown wire).

In the Normally Open models, the output is ON when the target is present (beam interrupted); in the Normally Closed models, the output is On when the target is absent (beam free).

Features

- M8 small dimension housing
- LED status indicator for all models
- Complete protection against electrical damage
- IP67 protection
- Strong stainless steel housing
- Fast switching frequency 10 kHz
- Sensing distance: 1 meter
- Supply voltage: 10 - 30 VDC
- NPN or PNP, NO or NC models

8mm diameter Thru-beam Photoelectric Sensors Selection Chart									
Part Number	***Price***	***Voltage Range***	***Sensing Range***	***Switching Frequency***	***Sensing Beam***	***Thru-Beam Component***	***Output Type***	***Connection Type***	***Wiring***
HEE-00-3A	<--->	10 to 30 VDC	3.28 ft. (1 m)	10 kHz	Infrared	Emitter		1 meter cable	Diagram 3
HER-AP-3A	<--->					Receiver	PNP NO		Diagram 2
HER-CP-3A	<--->					Receiver	PNP NC		Diagram 2
HER-AN-3A	<--->					Receiver	NPN NO		Diagram 1
HER-CN-3A	<--->					Receiver	NPN NC		Diagram 1
HEE-00-3F	<--->					Emitter		M8 quick disconnect (purchase separately)	Diagram 3
HER-AP-3F	<--->					Receiver	PNP NO		Diagram 2
HER-CP-3F	<--->					Receiver	PNP NC		Diagram 2
HER-AN-3F	<--->					Receiver	NPN NO		Diagram 1
HER-CN-3F	<--->					Receiver	NPN NC		Diagram 1

Wiring diagram

Diagram 1
NPN output

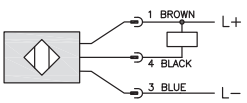


Diagram 2
PNP output

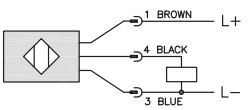
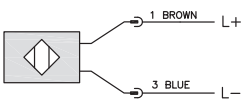
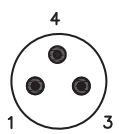


Diagram 3
Emitter



Connector
M8 Connector



Switching Element Function		
	Thru-beam and Reflective Models	***Diffuse Reflective Models***
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

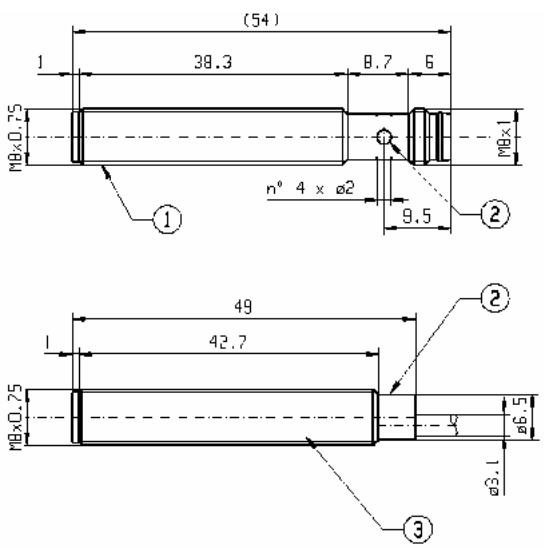
Warning: These products are not safety sensors and are not suitable for use in personal safety applications.

HE Series Photoelectric Sensors

HEE/HER Series Photoelectric Sensors Specifications	
Type	***Through-Beam***
Sensing Distance	1 m (3.28 ft) /Ex. Gain = 2
Light Spot Diameter	See chart
Emission	Infrared
Sensitivity	Fixed
Output Types	PNP/NPN NO/ NC
Operating Voltage	10 - 30 VDC
No Load Supply Current	25 mA
Operating (Load) Current	100 mA
Off-state (Leakage) Current (max)	<10 µA @ 30 VDC
Voltage Drop	1 Volt
Switching Frequency	10 kHz
Ripple	≤10%
Time Delay Before Availability (tv)	100 ms
Short-circuit Protection	Yes
Operating Temperature	13°F to 122°F (-25°C to +50°C)
Protection Degree	IP67
LED Indicators - Switching Status	Yellow Output State
Housing Material	Stainless Steel
Lens Material	Poly methyl methacrylate (PMMA)
Shock/Vibration	See terminology section
Tightening Torque	5 Nm (3.69 lb-ft)
Weight	30.9 g (1.09 oz)
Connectors	1 meter cable; 8 mm quick disconnect
Agency Approvals	CE

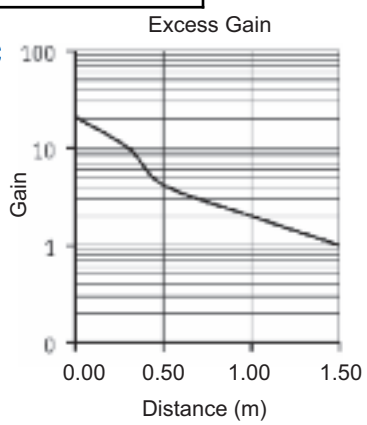
Dimensions

(mm)

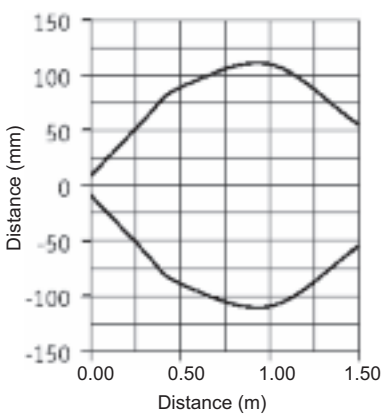


① M8 x 0.75 threaded cylindrical housing M8 connector exit
② Yellow LED (output state indicator HER - Supply Indicator HEE)
③ M8 x 0.75 threaded cylindrical housing cable exit

Characteristic curve chart



Spot dimension chart



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

DM Series Photoelectric Sensors

M12 (12 mm) metal with Teach function - DC

- 18 models available
- Metal housing
- Teach function available on diffuse and polarized reflective models
- Adjustable sensitivity on through-beam models
- Axial cable or M12 quick-disconnect models
- Multifunction LED status indicator
- Operates on 10-30 VDC
- IP67 rated

DM Series Photoelectric Sensors Selection Chart

Part Number		Price	Sensing Range	Output State	Logic	Connection	Wiring	Dimensions	Characteristic Curves
Diffuse									
DM3-0N-1A		<--->	Up to 100mm (3.9 in.)	NO + NC Selectable	NPN	2m (6.5) axial cable	Diagram 1	Figure 1	Chart 1
DM3-0P-1A		<--->			PNP	2m (6.5) axial cable	Diagram 2	Figure 1	Chart 1
DM3-0N-1H		<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 1
DM3-0P-1H		<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart 1
DM7-0N-1A		<--->	Up to 300mm (11.8 in.)	NO + NC Selectable	NPN	2m (6.5) axial cable	Diagram 1	Figure 1	Chart 2
DM7-0P-1A		<--->			PNP	2m (6.5) axial cable	Diagram 2	Figure 1	Chart 2
DM7-0N-1H		<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 2
DM7-0P-1H		<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart 2
Polarized reflective*									
DMP-0N-1A		<--->	Up to 2m (6.6 ft)	NO + NC Selectable	NPN	2m (6.5) axial cable	Diagram 1	Figure 1	Chart 3
DMP-0P-1A		<--->			PNP	2m (6.5) axial cable	Diagram 2	Figure 1	Chart 3
DMP-0N-1H		<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 3
DMP-0P-1H		<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart 3
Through-beam									
DMR-0N-1A	Receiver	<--->	Up to 4m (13.1 ft)	NO + NC Selectable	NPN	2m (6.5) axial cable	Diagram 1	Figure 1	Chart 4
DMR-0P-1A	Receiver	<--->			PNP	2m (6.5) axial cable	Diagram 2	Figure 1	Chart 4
DMR-0N-1H	Receiver	<--->			NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 4
DMR-0P-1H	Receiver	<--->			PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart 4
DME-00-1A	Emitter	<--->			Receiver dependent	2m (6.5) axial cable	Diagram 3	Figure 1	Chart 4
DME-00-1H	Emitter	<--->				M12 (12mm) connector	Diagram 3	Figure 2	Chart 4

***Receivers include one round (84mm dia.) reflector. Purchase additional reflectors separately.** ***Purchase one receiver and one emitter for a complete set.**

Wiring diagrams

Diagram 1

NPN Output

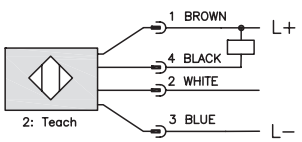


Diagram 2

PNP Output

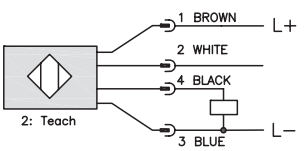
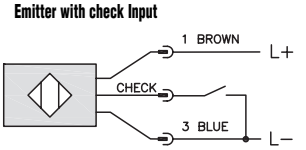


Diagram 3

Emitter with check Input



2-meter Axial Cable version: check is black
M12 Connector: check is Pin 2 (white)

Diagram 4

Diffuse models

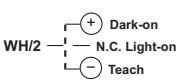


Diagram 5

Polarized reflective models

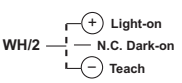
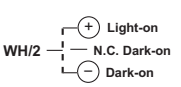


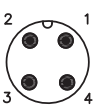
Diagram 6

Through-beam models



Connector

M12 connector



DM Series Photoelectric Sensors

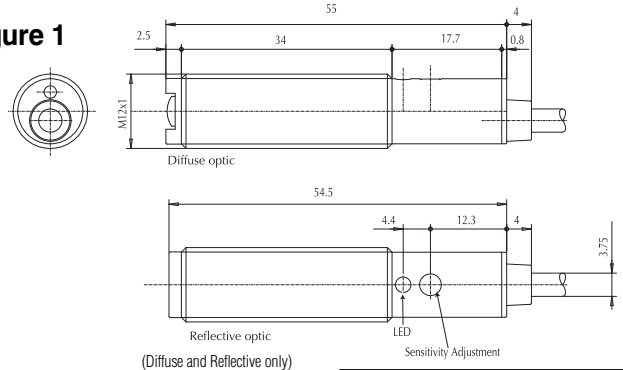
Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflection[4]	Through-beam[5]
Sensing Distance	DM3:100mm[1] DM7: 300mm[2]	2m[3]	4m
Light Spot Diameter	DM3: 80 mm @ 100 mm DM7: 200 mm @ 300 mm	100 mm @ 2.5 m	350 mm @ 4 m
Emission	100mm: Infrared (880nm) 300mm: Red (660nm)	Infrared (880nm)	
Sensitivity	Teach function (see product data sheet for details)		Fixed
Output Type	NPN or PNP - Light on / Dark on selectable		
Operating Voltage	10-30VDC		
No-load Supply Current	≤20mA		
Operating (Load) Current	≤100mA		
Off-state Leakage Current	≤10µA		
Voltage Drop	2V max at 100mA		
Switching Frequency	400Hz		250Hz
Ripple	≤10%		
Time Delay Before Availability (tv)	150ms		
Short-Circuit Protection	Yes, switch autoresets after load is removed		
Operating Temperature	-25 to +70°C (-13° to 158°F)		
Protection Degree (DIN 40050)	IEC IP67		
LED Indicators - Switching Status	Yellow		
Housing Material	Nickel-plated brass		
Lens Material	Poly methyl methacrylate (PMMA)		
Shock/Vibration	See terminology section		
Tightening Torque	10 Nm (7.37 lb-ft)		
Weight	Axial cable models: 54g (1.9 oz) M12 connector models: 18g (0.63 oz)		
Connectors	2m (6.5') axial cable; M12 (12mm) connector		
Agency Approvals	cULus F187310, CE		

[1] With 100x100mm white matte paper
[2] With 200x200mm white matte paper
[3] With standard Ø84mm RL110 reflector
[4] Each sensor includes one 84mm round reflector (RL110). Purchase additional reflectors separately.
[5] An emitter (DME) and receiver (DMR) pair must be ordered for a complete sensor set.

Dimensions

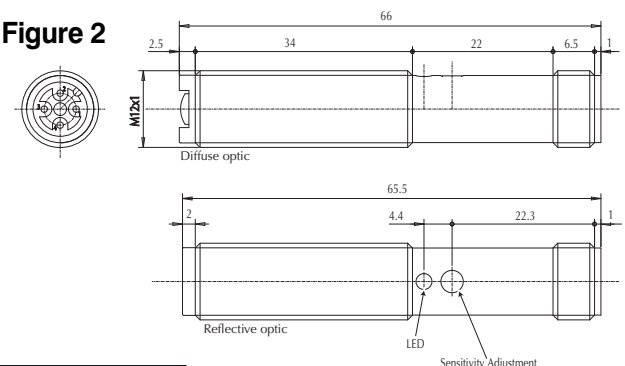
mm)

Figure 1



(Diffuse and Reflective only)

Figure 2



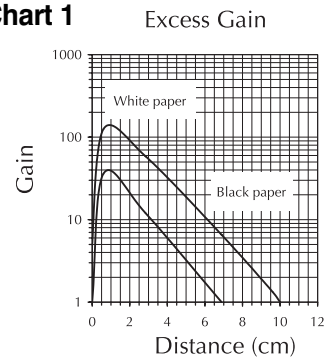
(Diffuse and Reflective only)

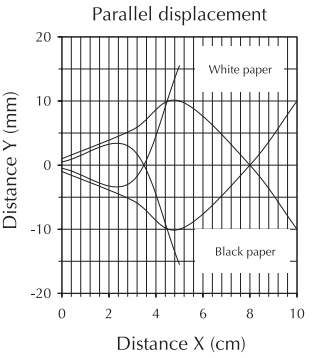
Switching Element Function		
	Thru-beam and Reflective Models	***Diffuse Reflective Models***
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

DM Series Photoelectric Sensors

Characteristic curves

Chart 1





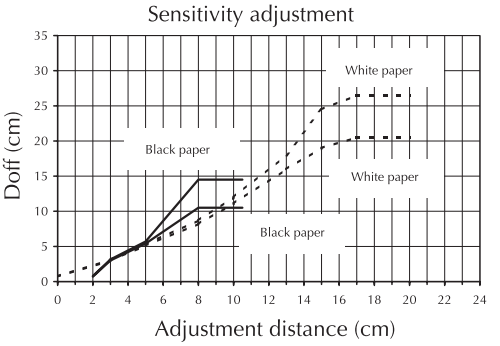
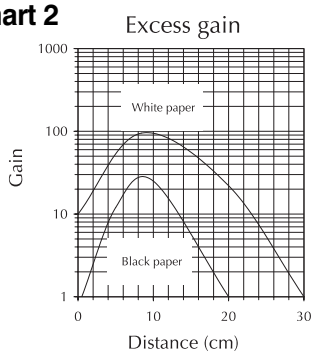
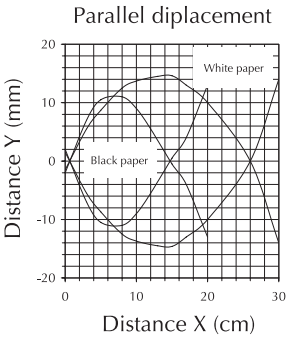


Chart 2





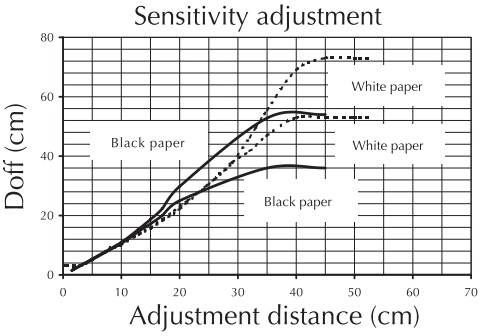
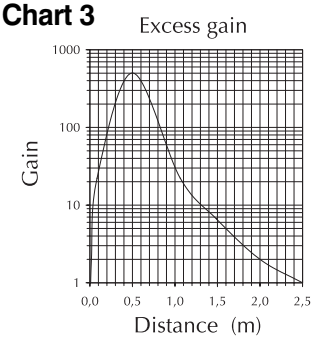
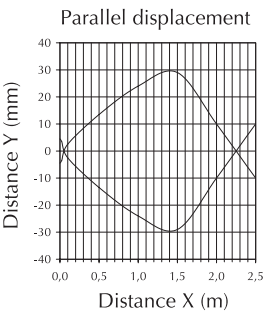


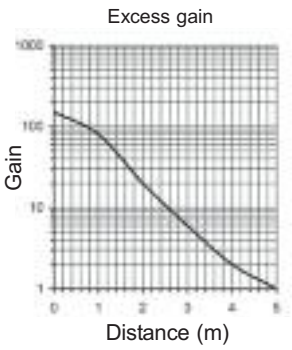
Chart 3

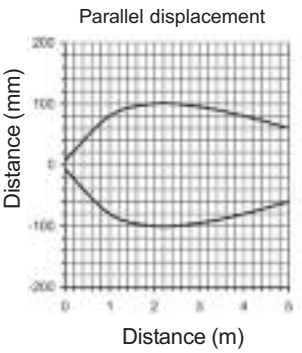


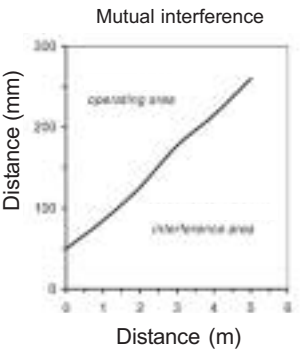


Warning: These products are not safety sensors and are not suitable for use in personal safety applications.

Chart 4







C18 Series Photoelectric Sensors

M18 (18 mm) metal – DC

- 36 models available
- Diffuse, Polarized reflective, Through-beam, and Diffuse with background suppression models
- Long operating distances
- Scratch resistant and easy-to-clean glass lens
- Adustable sensitivity (diffuse models only)
- Axial cable or 12 mm quick-disconnect models
- Complete overload protection
- IP67 rated

C18 Series Photoelectric Sensor Selection Chart

Part Number	Price	Sensing Range	Output State	Optics	Logic	Connection	Wiring	Dimensions	Characteristic Curves
Diffuse									
C18D-0N-1A	<--->	Up to 600mm (23.62 in)	1 N.O. and 1 N.C.	Axial	NPN	2m (6.5') axial cable	Diagram 3	Figure 1	Chart 5
C18D-0P-1A	<--->		1 N.O. and 1 N.C..	Axial	PNP	2m (6.5') axial cable	Diagram 4	Figure 1	Chart 5
C18D-0N-1E	<--->		1 N.O. and 1 N.C.	Axial	NPN	M12 (12mm) connector	Diagram 3	Figure 2	Chart 5
C18D-0P-1E	<--->		1 N.O. and 1 N.C.	Axial	PNP	M12 (12mm) connector	Diagram 4	Figure 2	Chart 5
C18D-0N-2A	<--->		1 N.O. and 1 N.C..	Right-angle	NPN	2m (6.5') axial cable	Diagram 3	Figure 3	Chart 6
C18D-0P-2A	<--->		1 N.O. and 1 N.C.	Right-angle	PNP	2m (6.5') axial cable	Diagram 4	Figure 3	Chart 6
C18D-0N-2E	<--->		1 N.O. and 1 N.C.	Right-angle	NPN	M12 (12mm) connector	Diagram 3	Figure 4	Chart 6
C18D-0P-2E	<--->		1 N.O. and 1 N.C..	Right-angle	PNP	M12 (12mm) connector	Diagram 4	Figure 4	Chart 6
Diffuse with background suppression									
C18B-AN-1A	<--->	10-120mm (0.39 to 4.72 in)	N..O.	Axial	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 1
C18B-AP-1A	<--->			Axial	PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 1
C18B-AN-1E	<--->			Axial	NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 1
C18B-AP-1E	<--->			Axial	PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart 1
C18B-AN-2A	<--->	10-120mm (0.39 to 4.72 in)	N.O.	Right-angle	NPN	2m (6.5') axial cable	Diagram 1	Figure 3	Chart 2
C18B-AP-2A	<--->			Right-angle	PNP	2m (6.5') axial cable	Diagram 2	Figure 3	Chart 2
C18B-AN-2E	<--->			Right-angle	NPN	M12 (12mm) connector	Diagram 1	Figure 4	Chart 2
C18B-AP-2E	<--->			Right-angle	PNP	M12 (12mm) connector	Diagram 2	Figure 4	Chart 2
Polarized reflective *Receivers include one round (84mm dia.) reflector. Purchase additional reflectors separately.									
C18P-AN-1A	<--->	Up to 2m (6.6 ft)	N.O.	Axial	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3
C18P-AP-1A	<--->			Axial	PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 3
C18P-AN-1E	<--->			Axial	NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 3
C18P-AP-1E	<--->			Axial	PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart 3
C18P-AN-2A	<--->	Up to 2m (6.6 ft)	N.O.	Right-angle	NPN	2m (6.5') axial cable	Diagram 1	Figure 3	Chart 4
C18P-AP-2A	<--->			Right-angle	PNP	2m (6.5') axial cable	Diagram 2	Figure 3	Chart 4
C18P-AN-2E	<--->			Right-angle	NPN	M12 (12mm) connector	Diagram 1	Figure 4	Chart 4
C18P-AP-2E	<--->			Right-angle	PNP	M12 (12mm) connector	Diagram 2	Figure 4	Chart 4
Through-beam **Purchase one receiver and one emitter for a complete set.									
C18R-0N-1A	<--->	Up to 6m (19.7 ft)	1 N.O. and 1 N.C.	Axial	NPN	2m (6.5') axial cable	Diagram 3	Figure 1	Chart 7
C18R-0P-1A	<--->			Axial	PNP	2m (6.5') axial cable	Diagram 4	Figure 1	Chart 7
C18R-0N-1E	<--->			Axial	NPN	M12 (12mm) connector	Diagram 3	Figure 2	Chart 7
C18R-0P-1E	<--->			Axial	PNP	M12 (12mm) connector	Diagram 4	Figure 2	Chart 7
C18E-00-1A	<--->	Receiver dependent	Receiver dependent	Axial	Receiver dependent	2m (6.5') axial cable	Diagram 5	Figure 5	Chart 7
C18E-00-1E	<--->			Axial		M12 (12mm) connector	Diagram 5	Figure 6	Chart 7
C18R-0N-2A	<--->	Up to 6m (19.7 ft.)	1 N.O. and 1 N.C.	Right-angle	NPN	2m (6.5') axial cable	Diagram 3	Figure 3	Chart 8
C18R-0P-2A	<--->			Right-angle	PNP	2m (6.5') axial cable	Diagram 4	Figure 3	Chart 8
C18R-0N-2E	<--->			Right-angle	NPN	M12 (12mm) connector	Diagram 3	Figure 4	Chart 8
C18R-0P-2E	<--->			Right-angle	PNP	M12 (12mm) connector	Diagram 4	Figure 4	Chart 8
C18E-00-2A	<--->	Receiver dependent	Receiver dependent	Right-angle	Receiver dependent	2m (6.5') axial cable	Diagram 5	Figure 7	Chart 8
C18E-00-2E	<--->			Right-angle		M12 (12mm) connector	Diagram 5	Figure 8	Chart 8

C18 Series Photoelectric Sensors

Specifications	Diffuse Models	Diffuse Models with Background Suppression	Reflective Models	Through-beam Models
Type	Diffuse	Diffuse with background suppression	Polarized reflection	Through-beam[1]
Sensing Distance	600 mm (23.62in)[2]	10 to 120 mm (0.39 to 4.72 in)[3]	2 m (6.6 ft)	6 m (19.7 ft)
Emission	LED red (660nm)	LED red (660nm)	LED red polarized (660 nm)	LED red (660nm)
Light Spot Diameter	See charts			
Sensitivity	Adjustable one-turn pot.		—	
Output Type	NPN or PNP; 1 L.O. and 1 D.O.	NPN or PNP; L.O. only	NPN or PNP; D.O. only	NPN or PNP; 1 L.O. and 1 D.O.
Operating Voltage	10-36 VDC			
No Load Supply Current	20 mA	25 mA	15 mA	Receiver: 10 mA Emitter:15 mA
Operating (Load) Current	≤200 mA			
Off-state (Leakage) Current	≤10µ A			
Voltage Drop	≤2.0 V			
Switching Frequency	1kHz	500Hz	1kHz	1kHz
Ripple	≤20%			
Time Delay Before Availability (tv)	60ms	20ms	20ms	20ms
Short-Circuit Protection	Yes (switch autoresets after overload is removed)			
Operating Temperature Range	-25° to + 55°C (-13° to 131°F)			
Protection Degree (DIN 40050)	IEC IP67			
LED Indicators - Switching Status	Yellow (output state, output energized), green (excess light indication). Emitter has no LED			
Housing Material	Chrome-plated brass			
Lens Material	Glass			
Shock/Vibration	See terminology section			
Tightening Torque	50 Nm (36.88 lb-ft)			
Weight	65.22 g (2.3 oz).			
Connectors	2m (6.5') axial cable; M12 (12mm) connector			
Agency Approvals	UL file E328811			

Notes: [1] Through-beam sensors must be used in pairs consisting of one receiver and one emitter. [2] With 200x200mm white matte paper. [3] With 100x100mm white matte paper.

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

Wiring diagrams

Diagram 1

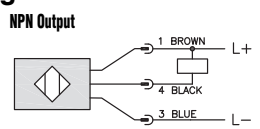
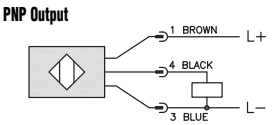


Diagram 2



Connector

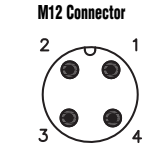


Diagram 3

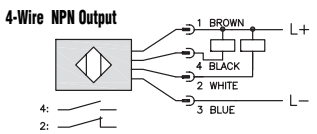


Diagram 4

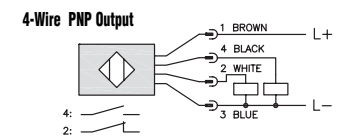
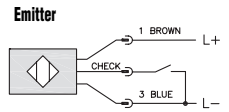


Diagram 5



Emitter test input (<4V: OFF / >8V or open: ON) 0.5mA

Switching Element Function		
	Thru-beam and Reflective Models	***Diffuse Models***
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

C18 Series Photoelectric Sensors

Dimensions

(mm)

Figure 1

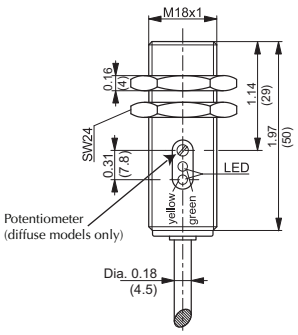


Figure 2

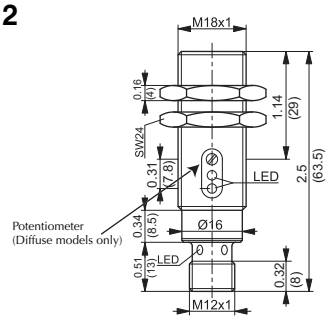


Figure 3

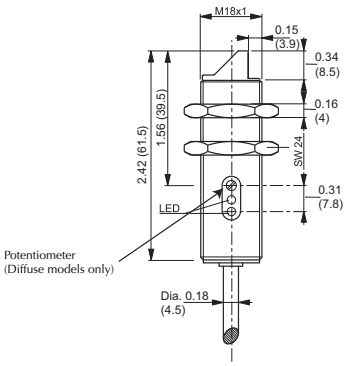


Figure 4

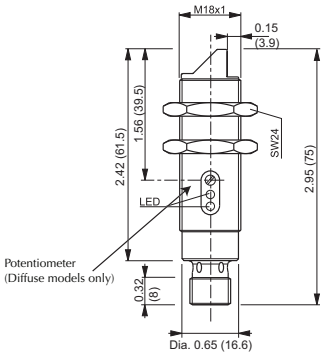


Figure 5

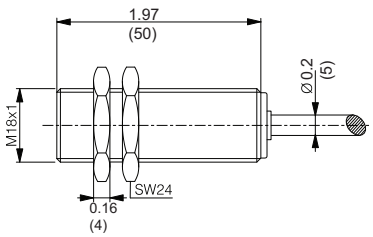


Figure 6

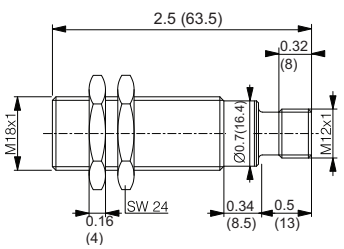


Figure 7

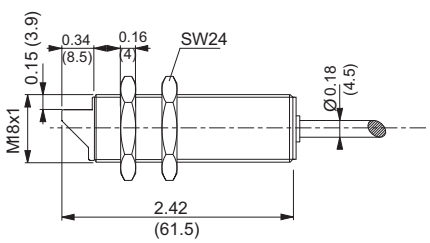
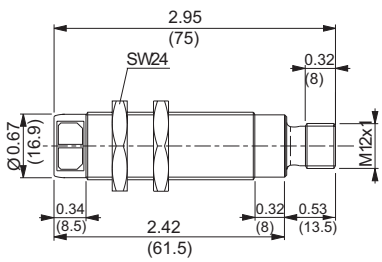


Figure 8



Note: Dimensions are in inches (millimeters).

C18 Series Photoelectric Sensors

Characteristic Curves

Chart 1

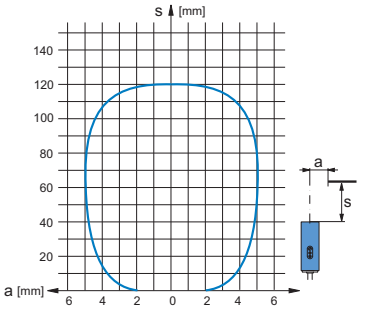


Chart 2

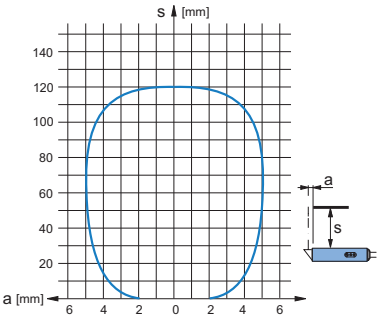


Chart 3

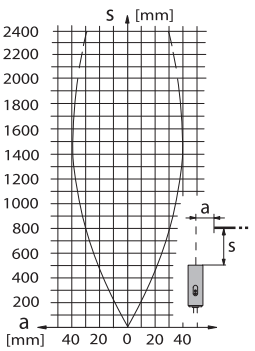


Chart 4

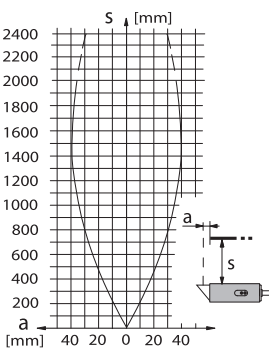


Chart 5

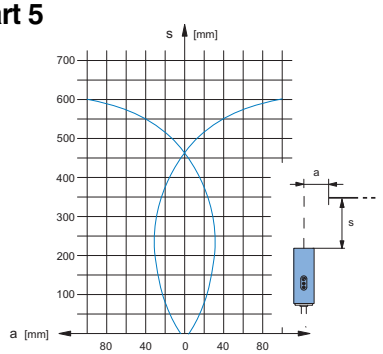


Chart 6

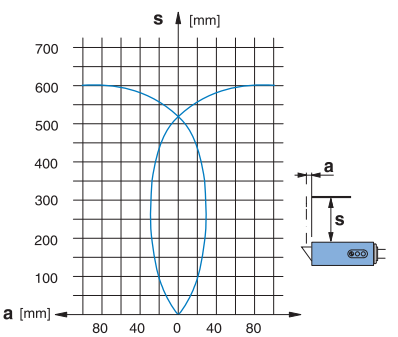


Chart 7

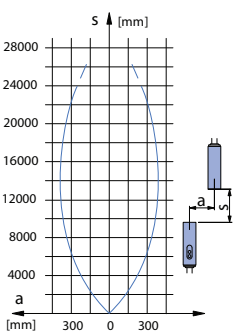
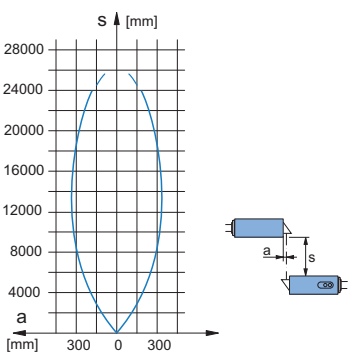


Chart 8



GX Series Photoelectric Sensors

GX3-AP-2E

M18 (18 mm) rectangular plastic - DC

- 12 models available
- Diffuse with background suppression, polarized reflective, and through-beam models
- Fixed sensing ranges, no adjustment required
- 18 mm diameter threaded lens with mounting hex nut included
- NPN or PNP, Light-on, Dark-on output models
- Visible red LED emission
- M12 quick-disconnect; order cable separately
- IP67 rated

GX Series Photoelectric Sensors Selection Chart

Part Number		Price	Sensing Range	Output State	Logic	Connection	Wiring	Characteristic Curves
Diffuse with background suppression								
GX3-AN-1E		<--->	Up to 100 mm (3.93 in)	N.O.	NPN	M12 (12 mm) connector	Diagram 1	N/A
GX3-AP-1E		<--->			PNP	M12 (12 mm) connector	Diagram 2	
GX3-AN-2E		<--->	Up to 150 mm (5.90 in)		NPN	M12 (12 mm) connector	Diagram 1	
GX3-AP-2E		<--->			PNP	M12 (12 mm) connector	Diagram 2	
Polarized reflective								
GXP-AN-1E		<--->	Up to 4 m (13.12 ft) with RL110 reflector	N.C.	NPN	M12 (12 mm) connector	Diagram 1	Chart 1
GXP-AP-1E		<--->			PNP	M12 (12 mm) connector	Diagram 2	
GXP-CN-1E		<--->		N.O.	NPN	M12 (12 mm) connector	Diagram 1	
GXP-CP-1E		<--->			PNP	M12 (12 mm) connector	Diagram 2	
Through-beam								
GXR-AP-1E	Receiver - must be used with Emitter	<--->	Up to 20 m (65.62 ft)	N.C.	PNP	M12 (12 mm) connector	Diagram 2	Chart 2
GXR-CN-1E		<--->		N.O.	NPN	M12 (12 mm) connector	Diagram 1	
GXR-CP-1E		<--->			PNP	M12 (12 mm) connector	Diagram 2	
GXE-00-1E	Emitter	<--->		Receiver dependent	Receiver dependent	M12 (12 mm) connector	Diagram 3	

Note: Polarized reflective sensors include one round reflector (84mm dia.). Purchase additional reflectors separately.

Wiring Diagrams

Diagram 1

NPN Output

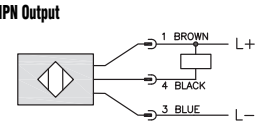


Diagram 2

PNP Output

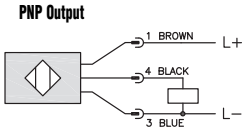
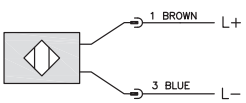


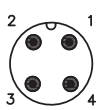
Diagram 3

Emitter



Connector

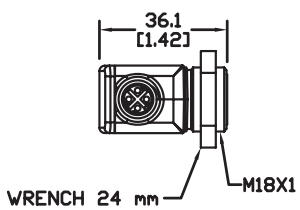
M12 connector

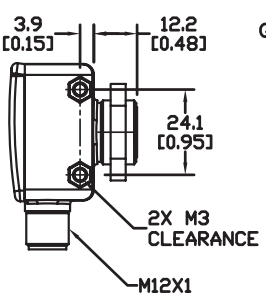


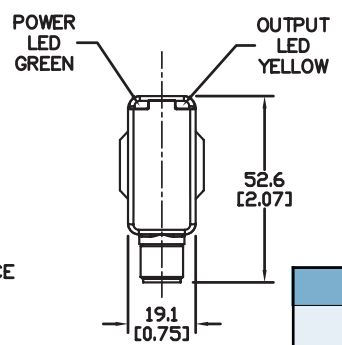
NOTE: CLASS 2 POWER SOURCE REQUIRED

Dimensions

mm [inches]







Switching Element Function		
	Thru-Beam and Reflective Models	***Diffuse Models***
Light-on	N.C.	N.O.
Dark-on	N.O.	N.C.

GX Series Photoelectric Sensors

Specifications	Diffuse Models with Background Suppression	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflection	Through-beam[3]
Sensing Distance	GX3-AN-1E, GX3-AP-1E: up to 100 mm[1] GX3-AN-2E, GX3-AP-2E: up to 150 mm[1]	4m with RL110[2]	20m
Light Spot Diameter	GX3-AN-1E, GX3-AP-1E: 7mm at maximum range GX3-AN-2E, GX3-AP-2E: 11mm at maximum range	160mm at maximum range	GXE-00-1E: 800mm at maximum range
Emission	Red LED (visible)		
Sensitivity	Fixed		
Output Type	NPN or PNP - Light-on or Dark-on		
Operating Voltage	10 to 30 VDC		
No Load Supply Current	30 mA	25 mA	20 mA
Operating (Load) Current	<200 mA		
Off-state (Leakage) Current	N/A		
Voltage Drop	<2.5 V		
Switching Frequency	1kHz		
Ripple	–		
Time Delay Before Availability (tv)	Minimal		
Short-Circuit Protection	Yes (non-latching)		
Operating Temperature	-25 to 60°C (-13° to 140°F)		
Protection Degree (DIN 40050)	IEC IP67		
LED Indicators - Switching Status	Yellow (output energized)		
LED Indicators - Power	Green		
Housing Material	LCP (Liquid Crystal Polymer); PEI (Polyether imide)		
Lens Material	(Polymethyl methacrylate PMMA)		
Shock/Vibration	See terminology section		
Tightening Torque	2.25 Nm (1.66 lb-ft)		
Weight (cable/connector)	45.36 g (1.6 oz)		
Connectors	M12 connector		
Accessories	1 mounting hex nut included		
Agency Approvals	cULus listed UL file E328811, CE		

[1] *With 200x200mm white matte paper, 90% remission*

[2] *With standard diameter 84mm RL110 reflector included with sensor*

[3] *An emitter and receiver pair must be ordered for a complete sensor set.*

Characteristic Curves

Chart 1 - GXP

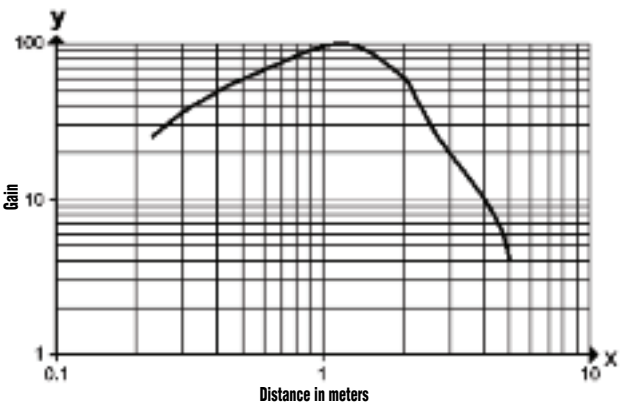
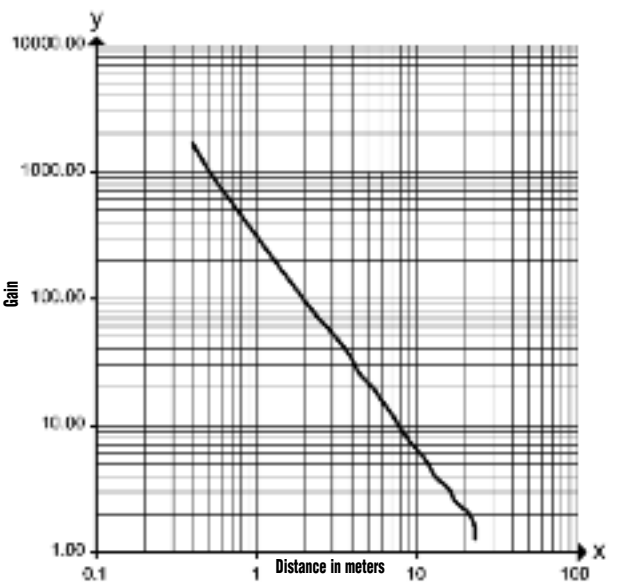


Chart 2 - GXE, GXR



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

FE Series Photoelectric Sensors

Mini-rectangular plastic - DC

- 12 models available
- Diffuse, polarized reflective, and through-beam models
- Adjustable sensitivity
- Axial cable or M8 quick-disconnect models
- NPN or PNP, Light-on/Dark-on selectable output
- IP67 rated

FE Series Photoelectric Sensors Selection Chart

Part Number	Price	Sensing Range	Output State	Logic	Connection	Wiring	Dimensions	Characteristic Curves
Diffuse								
FER8-0N-0A	<--->	up to 800mm (31.49in)	N.O./N.C. selectable	NPN	2m (6.5) axial cable	Diagram 1	Figure 1	Chart 1
FER8-0P-0A	<--->			PNP	2m (6.5) axial cable	Diagram 2	Figure 2	Chart 1
FER8-0N-0F	<--->			NPN	M8 (8mm) connector	Diagram 1	Figure 1	Chart 1
FER8-0P-0F	<--->			PNP	M8 (8mm) connector	Diagram 2	Figure 2	Chart 1
Polarized reflective*								
FERN-0N-0A	<--->	up to 4m (13.12ft) with RL110 up to 1m (39.37in) with RL122	N.C./N.O. selectable	NPN	2m (6.5) axial cable	Diagram 1	Figure 1	Chart 2
FERN-0P-0A	<--->			PNP	2m (6.5) axial cable	Diagram 2	Figure 2	Chart 2
FERN-0N-0F	<--->			NPN	M8 (8mm) connector	Diagram 1	Figure 1	Chart 2
FERN-0P-0F	<--->			PNP	M8 (8mm) connector	Diagram 2	Figure 2	Chart 2
Through-beam								
FERHD-0N-0A	Each part number consists of an emitter and receiver pair	<--->	up to 12m (39.37ft)	N.C./N.O. selectable	NPN	2m (6.5) axial cable	Diagram	Figure 1	Chart 3
FERHD-0P-0A		<--->			PNP	2m (6.5) axial cable	Diagram	Figure 2	Chart 3
FERHD-0N-0F		<--->			NPN	M8 (8mm) connector	Diagram	Figure 1	Chart 3
FERHD-0P-0F		<--->			PNP	M8 (8mm) connector	Diagram	Figure 2	Chart 3

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

Switching Element Function

	Thru-beam and Reflective Models	*Diffuse Reflective Models*
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

Wiring Diagrams

Diagram 1

NPN Output

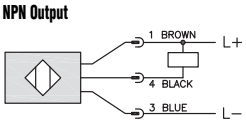


Diagram 2

PNP Output

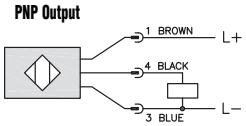
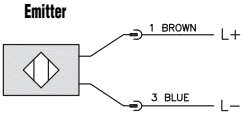


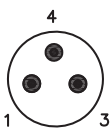
Diagram 3

Emitter



Connector

M8 connector



Dimensions

mm

Figure 1

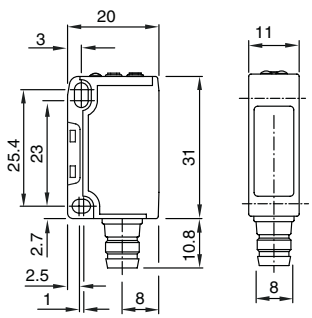
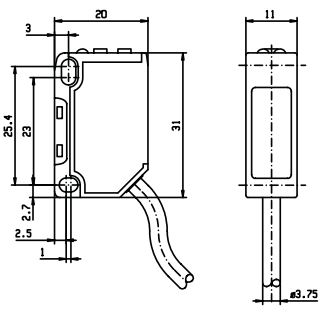
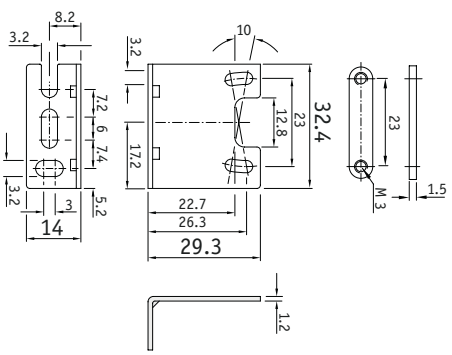


Figure 2





Horizontal mounting bracket supplied with each unit

FE Series Photoelectric Sensors

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflection[3]	Through-beam[4]
Sensing Distance	800mm[1]	4m with RL110 1m with RL122[2]	20m
Light Spot Diameter	25 mm @ 300 mm	150 mm @2.5 mm	650 mm @ 12 m
Emission	Red LED (visible)		
Sensitivity	Adjustable		
Output Type	NPN or PNP - Light-on/Dark-on Rotary Switch		
Operating Voltage	10-30VDC		
No-load Supply Current	≤30mA		Emitter: ≤15mA; Receiver: ≤20mA
Operating (Load) Current	≤100mA		
Off-state (Leakage) Current	N/A		
Voltage Drop	1.8V max at 100mA		
Switching Frequency	1kHz		
Ripple	≤10%		
Time Delay Before Availability (tv)	100ms		
Short-Circuit Protection	Yes, switch autoresets after load is removed		
Operating Temperature	-25 to 55°C (-13° to 131° F)		
Protection Degree (DIN 40050)	IEC IP67		
LED Indicators -Switching Status	Yellow (output energized)		
Housing Material	Polybutylene Terephthalate (PBT)		
Lens Material	Polycarbonate (PC)		
Shock/Vibration	See terminology section		
Tightening Torque	40 Nm (29 lb-ft)		
Weight (cable/connector)	53 g (1.87 oz) / 9 g (0.32 oz)		
Connectors	2m (6.5') axial cable; M8 (8 mm) connector		
Agency Approvals	UL Recognized E224302, CE		

[1] With 100x100mm white matte paper
[2] With Ø84mm RL110 reflector or 12 x 54mm RL122 reflector.
[3] Each sensor includes one 84mm round reflector (RL110) and one 12 x 54mm rectangular reflector. Purchase additional reflectors separately.
[4] Each through-beam part number consists of an emitter and receiver pair.

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

Characteristic curves

Chart 1

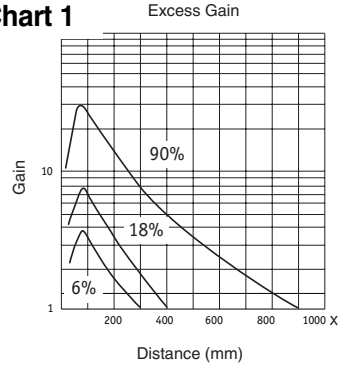


Chart 2

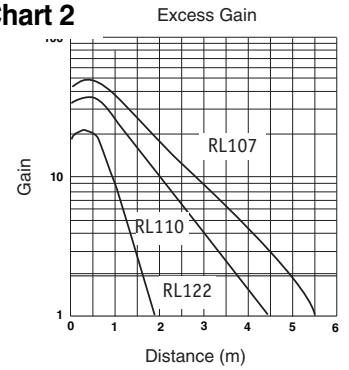
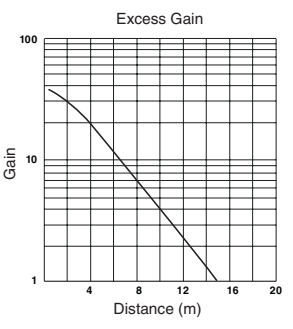


Chart 3



CX Series Photoelectric Sensors

Mini-rectangular plastic - DC

- 18 models available
- Long operating distances
- Adjustable sensitivity
- Scratch-resistant and easy to clean glass lens
- Axial cable or M8 quick-disconnect models
- Complete overload protection
- Mounting brackets are not needed
- IP65 rated

CX Series Mini-Rectangular Photoelectric Sensors Selection Chart

Part Number		Price	Sensing Range	Output State	Logic	Connection	Wiring	Dimensions	Characteristic Curves
Diffuse									
CX3-AN-1A		<--->	Up to 600mm (23.62in)	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 1
CX3-AP-1A		<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 1
CX3-AN-1F		<--->			NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 1
CX3-AP-1F		<--->			PNP	M8 (8mm) connector	Diagram 2	Figure 2	Chart 1
Diffuse with background suppression									
CX5-AN-1A		<--->	15-150mm (0.59 to 5.91in)	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 2
CX5-AP-1A		<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 2
CX5-AN-1F		<--->			NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 2
CX5-AP-1F		<--->			PNP	M8 (8mm) connector	Diagram 2	Figure 2	Chart 2
Polarized reflective*									
CXP-AN-1A		<--->	Up to 2m (6.6 ft)	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3
CXP-AP-1A		<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 3
CXP-AN-1F		<--->			NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 3
CXP-AP-1F		<--->			PNP	M8 (8mm) connector	Diagram 2	Figure 2	Chart 3
Through-beam**									
CXR-AN-1A	Receiver	<--->	Up to 6m (19.7 ft)	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 4
CXR-AP-1A	Receiver	<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 4
CXR-AN-1F	Receiver	<--->			NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 4
CXR-AP-1F	Receiver	<--->			PNP	M8 (8mm) connector	Diagram 2	Figure 2	Chart 4
CXE-0N-1A	Emitter	<--->		Receiver dependent	Receiver dependent	2m (6.5') axial cable	Diagram 3	Figure 1	Chart 4
CXE-0N-1F	Emitter	<--->				M8 (8mm) connector	Diagram 3	Figure 2	Chart 4

Receivers include one round (84mm dia.) RL110 reflector.Purchase additional reflectors separately.

****Purchase one receiver and one emitter for a complete set.***

Switching Element Function

	Thru-beam and Reflective Models	*Diffuse Reflective Models*
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

Wiring Diagrams

Diagram 1

NPN Output

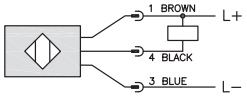


Diagram 2

PNP Output

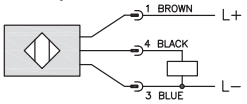
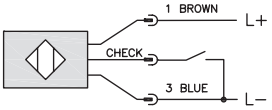


Diagram 3

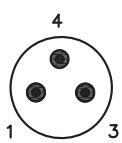
Emitter



Emitter test input (<4V: OFF / >8V or open: ON) 0.5mA

Connector

M8 connector



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

CX Series Photoelectric Sensors

Specifications	Diffuse Models	Diffuse Models with Background Suppression	Reflective Models	Through-beam Models[1]
Type	Diffuse reflection	Diffuse reflection with background suppression	Polarized reflection	Through-beam
Sensing Distance	600mm[2]	15 to 150mm[3]	2m	6m
Light Spot Diameter	See charts			
Emission	IR-LED (880nm)	LED red (660nm)	LED red polarized(660nm)	IR-LED (880nm)
Sensitivity	Adjustable 12-turn pot.			
Output Type	NPN or PNP; N.O. only			
Operating Voltage	10-36VDC			
No Load Supply Current	15mA	25mA	15mA	15mA (R) / 10mA (E)
Operating (Load) Current	≤200mA			
Off-state (Leakage) Current	≤10µA			
Voltage Drop	≤2.0V			
Switching Frequency	1kHz	500Hz	1kHz	1kHz
Ripple	≤20%			
Time Delay Before Availability (tv)	100ms			
Short-Circuit Protection	Yes (switch autoresets after overload is removed)			
Operating Temperature	-25° to + 55°C (-13° to 131°F)			
Protection Degree (DIN 40050)	IEC IP65			
LED Indicators - Switching Status	Yellow (output state, output energized), green (excess light indication)			
Housing Material	PBTP (Crastin)			
Lens Material	Glass			
Shock/Vibration	See terminology section			
Tightening Torque	N/A			
Weight (cable/connector)	84g (2.96 oz)/49g (1.73 oz)			232g (8.40oz)/98g (3.46oz)
Connectors	2m (6.5') axial cable; M8 (8 mm) connector			
Agency Approvals	cULus E32881			

[1] Through-beam sensors must be used in pairs consisting of one receiver and one emitter [2] With 200x200mm white matte paper, [3] With 100x100mm white matte paper

Dimensions

(mm)

Figure 1

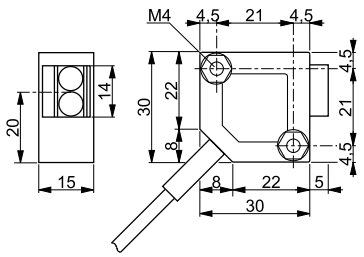
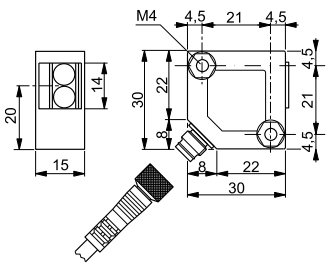


Figure 2



Characteristic curves

Chart 1

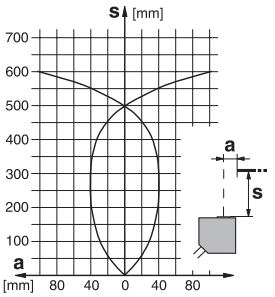


Chart 2

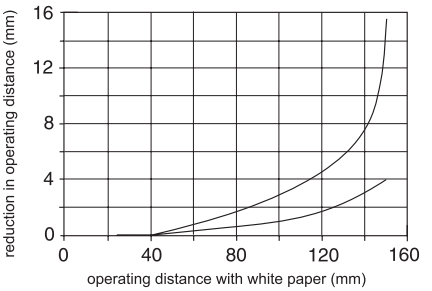


Chart 3

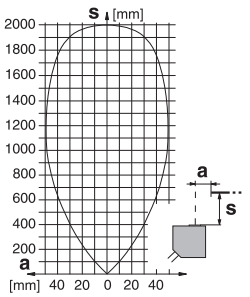
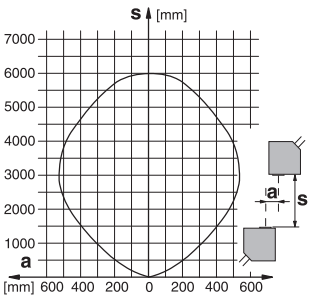


Chart 4



OPT Short Range (CMOS) Series Photoelectric Sensors

OPT2001

50 x 50 mm rectangular plastic - DC

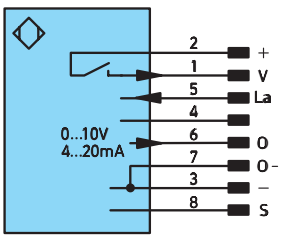
- Diffuse (Reflex) laser distance measurement sensors with CMOS technology
- Analog and switching outputs available
- Measured value independent of material, color, and brightness
- Class 1 and 2 lasers available (safety label included with Class 2 lasers)
- High resolution down to 8 µm - (analog scalable down to 5 mm range)
- High speed response times down to 660 µs
- M12 quick-disconnect; order cable separately
- Mounting hardware included

OPT Series Photoelectric Sensors Selection Chart

Part Number	Price	Sensing Range	Laser Class	Measurement Rate	Resolution	Output State	Logic	Connection	Wiring	Characteristic Curves
Diffuse (Reflex)										
OPT2001	<--->	30-80 mm [1.18 - 3.15 in]	2	1500/s (660 µs)	<8 µm	Analog 4-20 mA or 0-10V	—	8-pin M12 quick-disconnect	Diagram 1	See Characteristic Curve
OPT2002	<--->		1	1000/s (1000 µs)			—			
OPT2003	<--->	40-160 mm [1.57 - 6.30 in]	2	1500/s (660 µs)	<20 µm		—			
OPT2004	<--->		1	1000/s (1000 µs)			—			
OPT2005	<--->	50-350 mm [1.97 - 13.80 in]	2	800/s (1250 µs)	<50 µm		—			
OPT2006	<--->		1	500/s (2000 µs)			—			
OPT2007	<--->	0 - 660 mm [0 - 25.98 in] working range 60-660 mm [2.36 - 25.98 in] adjustable range	1	100 Hz switching	Hysteresis <1 % of range	Selectable (N.O., N.C.)	5-wire, configurable as PNP, NPN, or Push-Pull	5-pin M12 quick-disconnect	Diagram 2	—

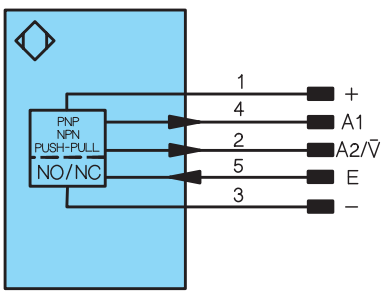
Wiring Diagrams

Diagram 1



+	Supply Voltage "+"
V	Contamination/Error output (NO)
O	Analog output
O–	Ground for the analog output
–	Supply Voltage "0 V"
S	Shielding
La	Emitted Light disengageable

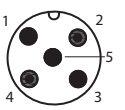
Diagram 2



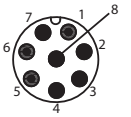
+	Supply Voltage "+"
–	Supply Voltage "0 V"
A1/A2	Switching output (NO)
V̄	Contamination Warning/ Error Output (NC)
E	Input (Teach Input, Emitted light can be switched off)

Connectors

5-Pin M12 connector



8-Pin M12 connector



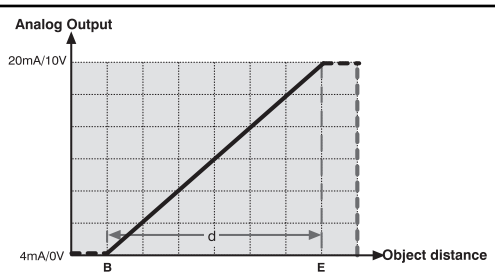
NOTE: CLASS 2 POWER SOURCE REQUIRED

PRODUCT MANUAL AVAILABLE VIA DOWNLOAD AT WWW.AUTOMATIONDIRECT.COM

OPT Short Range (CMOS) Series Photoelectric Sensors

Specifications	OPT 2001	OPT 2002	OPT 2003	OPT 2004	OPT 2005	OPT 2006	OPT 2007
Type	Diffuse Reflex						
Sensing Distance	30-80 mm [1.18-3.15 in]	30-80 mm [1.18-3.15 in]	40-160 mm [1.57- 6.30 in]	40-160 mm [1.57- 6.30 in]	50-350 mm [1.97-13.78 in]	50-350 mm [1.97-13.78 in]	60-660 mm [2.36-25.98 in]]
Light Spot Diameter (at maximum range)	1 x 2 mm [0.04 x 0.08 in]	0.7 x 1.4 mm [0.03 x 0.06 in]	1 x 2.5 mm [0.04 x 0.10 in]	0.9 x 1.8 mm [0.04 x 0.07 in]	1.5 x 4 mm [0.06 x 0.16 in]	1.4 x 3.1 mm [0.06 x 0.12 in]	2.0 x 5.5 mm [0.08 x 0.22 in]
Emission	Class 2 Red laser 660 Nm	Class 1 Red laser 660 Nm	Class 2 Red laser 660 Nm	Class 1 Red laser 660 Nm	Class 2 Red laser 660 Nm	Class 1 Red laser 660 Nm	Class 1 Red laser 655 Nm
Sensitivity	Adjustable via Teach						
Output Type	0-10 VDC or 4-20 mA: PNP error output						Complementary N.O./N.C. (Light-on, Dark-on) PNP or NPN
Current Output Max Load	500Ω						NA
Voltage Output Min Load	10 KΩ						NA
Operating Voltage	18-30 VDC						10-30 VDC
No Load Supply Current	<80 mA @ 24 VDC						<50 mA @24 VDC
Operating (Load) Current	max 200 mA						
Off-state (Leakage) Current	negligible						
Voltage Drop	<2.5V						<1.5V
Measurement Rate/Resolution	1500/s (660 µs) @ 12µm 600/s(1660 µs) @ 8µm	1000/s (1000 µs) @ 12 µm 500/s (2000 µs) @ 8 µm	1500/s (660 µs) @ 30 µm 600/s (1660 µs) @ 20 µm	1000/s (1000 µs) @ 30 µm 500/s (2000 µs) @ 20 µm	800/s (1250 µs) @ 80 µm 400/s (2500 µs) @ 50 µm	500/s (2000 µs) @ 80 µm 250/s (4000 µs) @ 50 µm	NA
Switching Frequency	1.5 kHz	1.0 kHz	1.5 kHz	1.0 kHz	800 Hz	500 Hz	100 Hz
Linearity	0.1%				0.15%		NA
Time Delay Before Availability (tv)	NA						
Short-Circuit Protection	Yes						
Operating Temperature	-25°C to 50°C [13°F to 122°F]						-25°C to 60°C [13°F to 140°F]
Protection Degree (DIN 40050)	IEC IP67						IEC IP68
LED Indicators - Switching Status	Yellow						
LED Indicators - Power	Green						
Housing Material	Polycarbonate						
Lens Material	Poly(methyl methacrylate) (PMMA)						
Shock/Vibration	See *Terminology* section.						
Tightening Torque	0.5 Nm (mounting screws)						
Weight (lbs) (cable/connector)	0.2						
Connectors	M12 Quick Disconnect						
Agency Approvals	CE, cULUS, E189727, RoHs						

Characteristic Curves

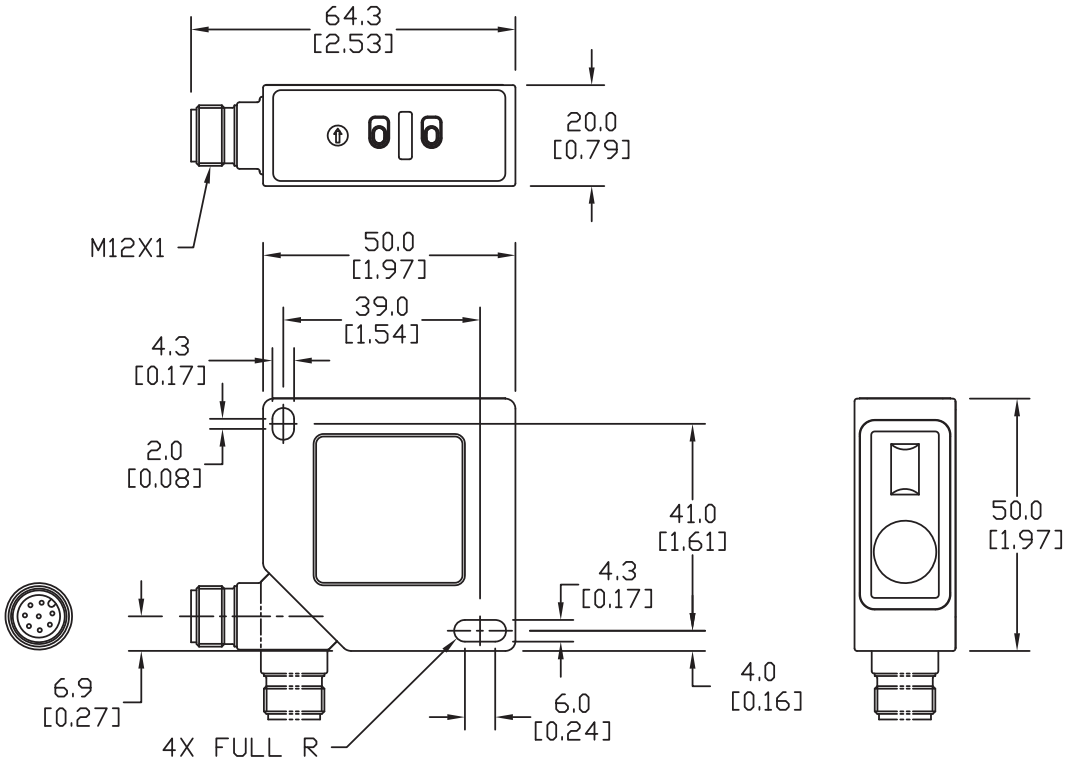


d = working range
B =begin working range
E = end working range

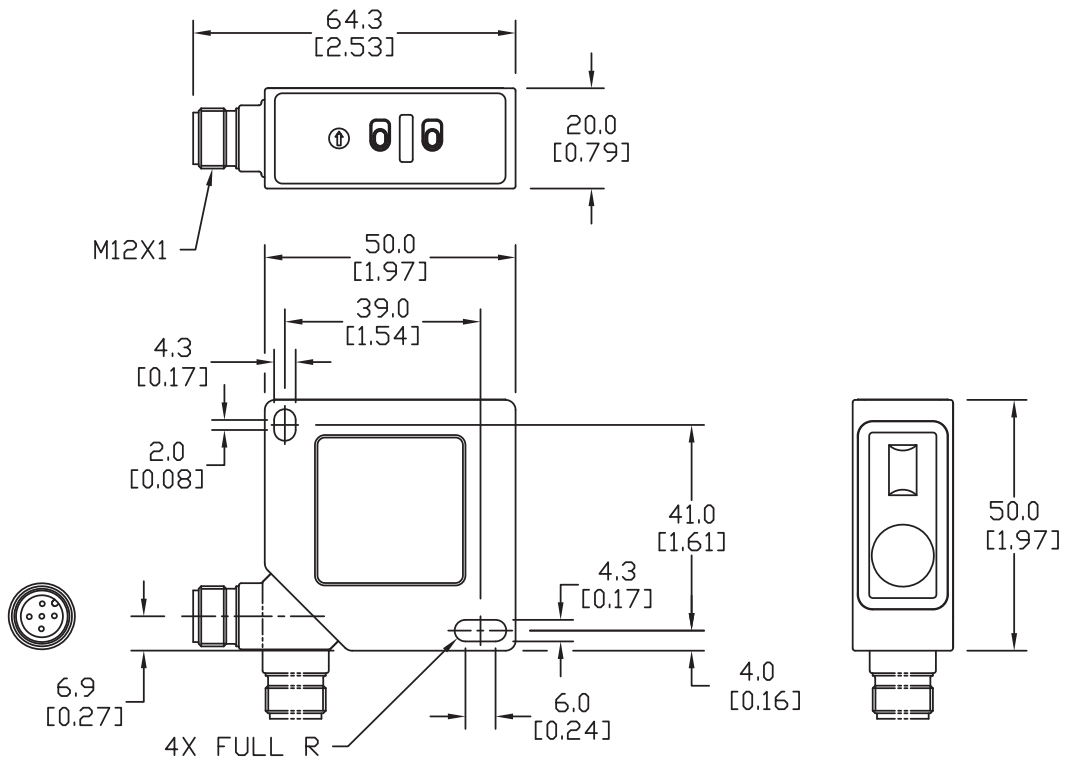
OPT Short Range (CMOS) Series Photoelectric Sensors

Dimensions mm [inches]

OPT2001
OPT2002
OPT2003
OPT2004
OPT2005
OPT2006



OPT2007



OPT Long Range (Transit Time) Series Photoelectric Sensors

OPT2010
OPT2015

50 x 50 and 81 x 55 mm rectangular plastic DC

- Diffuse and Retro-reflective (Transit time) laser distance measurement sensors
- Analog and switching outputs available
- Measured value independent of material, color, and brightness
- Class 1 and 2 lasers available (safety label included with Class 2 lasers)
- M12 quick-disconnect; order cable separately
- Mounting hardware included

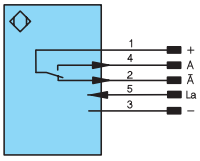
OPT Series Photoelectric Sensors Selection Chart

Part Number	Price	Sensing Range	Laser Class	Measurement Rate	Resolution	Output State	Connection	Wiring	Dimensions
Diffuse (Transit Time)									
OPT2010	<--->	0 - 3000 mm [0 - 118.11 in] working range 200 - 3000 mm [7.87 - 118.11 in] adjustable range	1	1 kHz switching	Hysteresis <15 mm	Complementary (N.O. and N.C.). PNP	5-pin M12 quick-disconnect	Diagram 1	50 x 50 mm
OPT2011	<--->	0 - 3050 mm [0 - 120.08 in] working range 50 - 3050 mm [1.97 - 120.08 in] adjustable range		1-500/s [2 ms]	1 mm [0.04 in]	Analog 4-20 mA or 0-10 VDC Switching PNP/NPN, N.O. or N.C.	4-pin M12 quick-disconnect	Diagram 2	50 x 50 mm
OPT2012	<--->	0 - 6.2m [0 - 244.09 in] working range 0.2 - 6.2m [7.87 - 244.09 in] adjustable range		1-100/s [10 ms]	1-12 mm [0.04 - 0.47 in]			Diagram 3	81 x 55 mm
OPT2013	<--->	0 - 10.1m [0 - 397.64 in] working range 0.1 - 10.1m [3.94 - 397.64 in] adjustable range	2				8-pin M12 quick-disconnect	Diagram 4	81 x 55 mm
OPT2014	<--->	0 - 10.1m [0 - 397.64 in] working range 0.1 - 10.1m [3.94 - 397.64 in] adjustable range					4-pin M12 quick-disconnect	Diagram 3	81 x 55 mm
Retro-Reflective (Transit Time)									
OPT2015*	<--->	0 - 100.2m [0 ft - 328.74 ft] working range 0.2 - 100.2m [0.66 ft - 328.74 ft] adjustable range	1	1-100/s [10 ms]	4-20 mm [0.16 - 0.79 in]	Analog 4-20 mA or 0-10 VDC Switching PNP/NPN, N.O. or N.C.	8-pin M12 quick-disconnect	Diagram 4	81 x 55 mm

Requires purchase of OPT2030 reflector (see Accessories). <50m sensing distance requires 1 reflector. 50-100m sensing distance requires 4 reflectors.

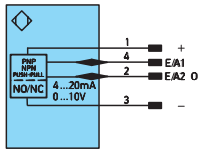
Wiring Diagrams

Diagram 1



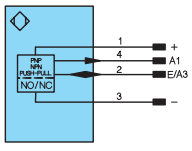
+ Supply Voltage "+"
– Supply Voltage "0 V"
A Switching output (NO)
Ā Switching output (NC)
La Emitted light can be switched off

Diagram 2



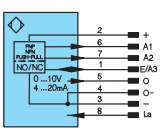
+ Supply Voltage "+"
– Supply Voltage "0 V"
O Analog output
EA1/ EA2 Output/Input programmable

Diagram 3



+ Supply Voltage "+"
– Supply Voltage "0 V"
E/A3 Input/Output programmable
A1 Switching Output (NO)

Diagram 4

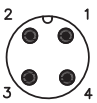


+ Supply Voltage "+"
– Supply Voltage "0 V"
La Emitted light can be switched off
O Analog output
O- Ground for the Analog output
E/A3 Input/Output programmable
A1/A2 Switching Output (NO)

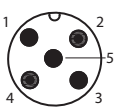
Switching Element Function		
	Thru-Beam and Reflective Models	***Diffuse Models***
Light-on	N.C.	N.O.
Dark-on	N.O.	N.C.

Connectors

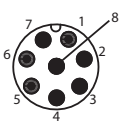
4-Pin M12 connector



5-Pin M12 connector



8-Pin M12 connector



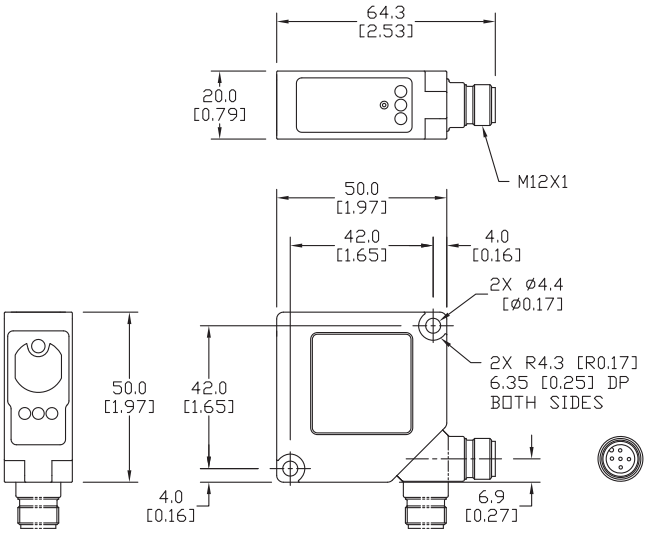
NOTE: CLASS 2 POWER SOURCE REQUIRED

OPT Long Range (Transit Time) Series Photoelectric Sensors

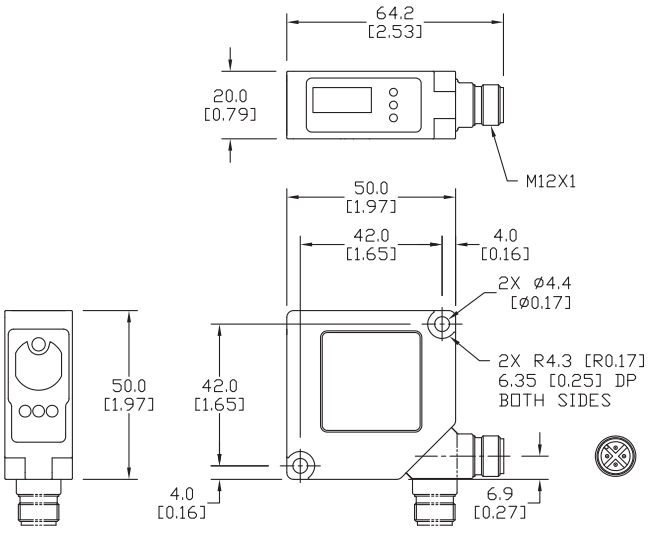
Dimensions

mm [inches]

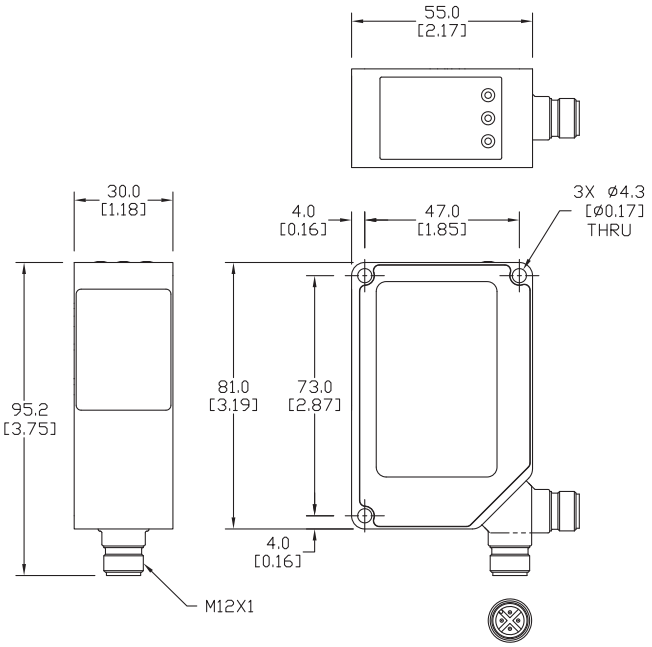
OPT2010



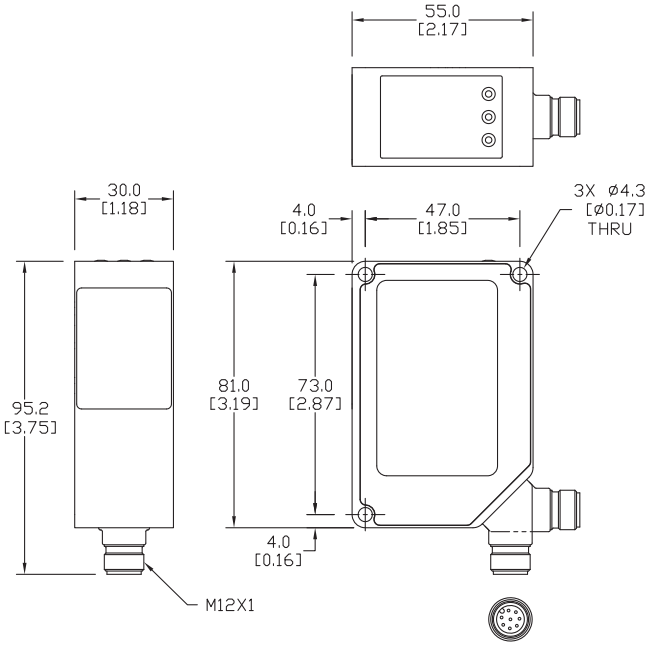
OPT2011



OPT2012
OPT2014



OPT2013
OPT2015



OPT Long Range (Transit Time) Series Photoelectric Sensors

Specifications	OPT2010	OPT2011	OPT2012	OPT2013	OPT2014	OPT2015
Type	***Diffuse (Transit time)***					****Retro-Reflective***
Sensing Distance	3m [118.11 in]	3.05m [120.08 in]	6.2m [244.09 in]	10.1m [397.64 in]	10.1m [397.64 in]	100.2m [3944.90 in]
Light Spot Diameter (at maximum range)	9 mm		<12 mm	<20 mm		80 mm @ 40m <200 mm @ 100m
Emission	Class 1 Red laser 660 Nm	Class 1 Red laser 660 Nm	Class 1 Red laser 660 Nm	Class 2 Red laser 660 Nm	Class 2 Red laser 660 Nm	Class 1 Red laser 660 Nm
Sensitivity	Adjustable via Teach					
Output Type	N.O./N.C. PNP	Programmable: Analog 4-20 mA/0-10 VDC, N.O./N.C. PNP/NPN				
Current Output Max Load	NA	500 Ω				
Operating Voltage	10-30 VDC	18-30 VDC				
No Load Supply Current	<50 mA	<70 mA	<100 mA			
Operating (Load) Current	200 mA	100 mA	200 mA			
Off-state (Leakage) Current	negligible					
Voltage Drop	<2.5V (switching outputs)					
Measurement Rate	NA	1-500/s	1-100/s			
Switching Frequency	1000 Hz	250 HZ	50 Hz			
Linearity	NA		0.2%			.05%
Time Delay Before Availability (tv)	NA					
Short-Circuit Protection	Yes					
Operating Temperature	-40 °C to 60 °C [-40 °F t to 140°F]	-40°C to 50°C [-40°F to 122°F]	-25 °C to 60 °C [13°F t to 140°F]			
Protection Degree (DIN 40050)	IEC IP 68					
LED Indicators - Switching Status	Yellow	Screen Display				
LED Indicators - Power	Green	Screen Display				
Housing Material	Polycarbonate					
Lens Material	Poly(methyl methacrylate) (PMMA)					
Shock/Vibration	See *Terminology* section					
Tightening Torque	0.5 Nm (mounting screws)					
Weight (cable/connector)	0.2		0.3			
Connectors	M12 Connector					
Agency Approvals	CE, cULUS, E189727, RoHs					

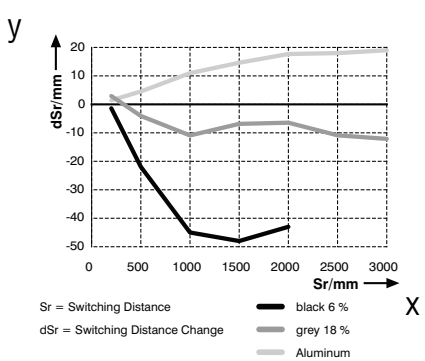
****Requires purchase of OPT2030 reflector (see Accessories). <50m sensing distance requires 1 reflector. 50-100m sensing distance requires 4 reflectors.***

Characteristic Curves

(OPT2010)

Switching Distance Deviation

Typical characteristic curve based on Kodak white, 90 %



X	Distance to target [mm]
Y	Minimum distance between object and background [mm]

OPT Series Photoelectric Sensors Accessories

OPT Series Photoelectric Sensors Accessories			
Part Number	**Price**	**Description**	**Weight (Lbs)**
OPT2030*	<--->	Reflector, for photoelectric laser sensors, square, 100 x 100 mm.	0.2
OPT2031	<--->	Mounting bracket, nickel-plated brass, for 50 x 50 mm sensors, right angle	0.2
OPT2032	<--->	Mounting bracket, nickel-plated brass, for 81 x 55 mm sensors, right angle	0.3

**** OPT2015 requires purchase of OPT2030 reflector. <50m sensing distance requires 1 reflector. 50-100m sensing distance requires 4 reflectors.***

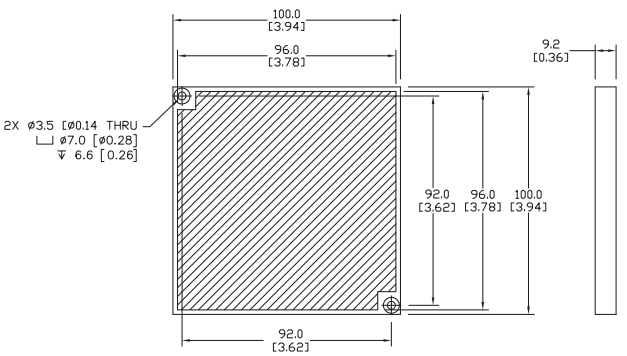
OPT2030

OPT2031

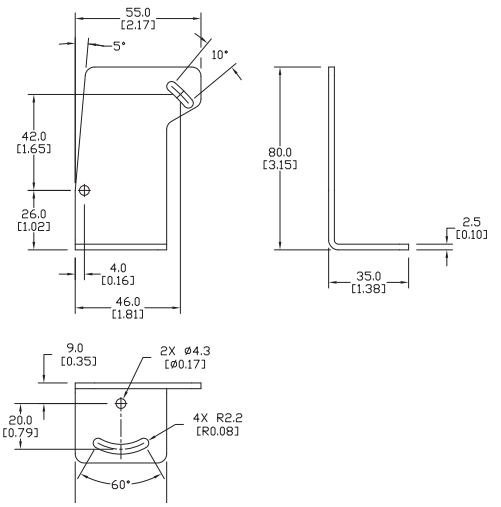
OPT2032

Dimensions mm [inches]

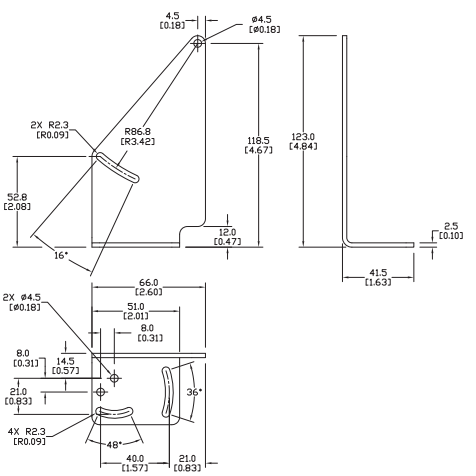
OPT2030



OPT2031



OPT2032



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**	**Wiring**	**Dimensions**	**Characteristic Curves**
Diffuse with background suppression							
FGRW-DT-0A	<--->	up to 550mm (21.65in)	SPDT Relay	2m (6.5) axial cable	Diagram 1	Figure 1	Chart 1
Polarized reflective*							
FGRN-DT-0A	<--->	up to 9m (29.52ft)	SPDT Relay	2m (6.5) axial cable	Diagram 1	Figure 2	Chart 2
Through-beam **							
FGRHD-DT-0A	<--->	up to 20m (65.62ft)	SPDT Relay	2m (6.5) axial cable	Diagram 1 and 2	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.**

Switching Element Function		
	Thru-beam and Reflective Models	***Diffuse Reflective Models***
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

Wiring diagrams

Diagram 1

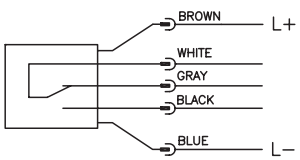
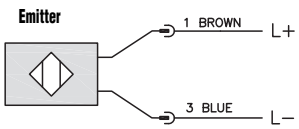


Diagram 2



Dimensions

(mm)

Figure 1

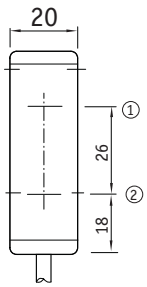


Figure 2

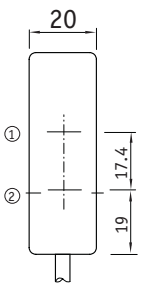
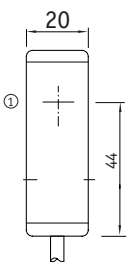
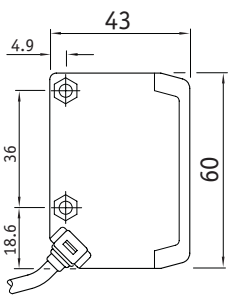


Figure 3





1) Emitter center of optical axis

2) Receiver center of optical axis

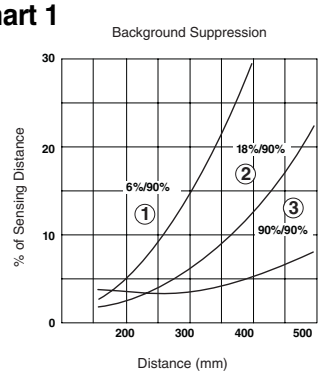
FG Series Photoelectric Sensors

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflection[3]	Through-beam[4]
Sensing Distance	550mm[1]	9m[2]	20m
Light Spot Diameter	–	–	1.5m @ 20m
Emission	Red LED (visable)		
Sensitivity	Adjustable		
Output Type	SPDT relay electrically isolated		
Operating Voltage	12-240VDC or 24-240VAC		
No-load Supply Current	≤2VA		
Operating (Load) Current	3A @ 240VAC/30VDC		
Off-state (Leakage) Current	–		
Voltage Drop	–		
Switching Frequency	33Hz		
Ripple	–		
Time Delay before Availability (tv)	150 ms		
Short-Circuit Protection	Yes, switch autoresets after load is removed		
Operating Temperature	-25 to 55°C (-13° to 131° F)		
Protection Degree (DIN 40050)	IEC IP67		
LED Indicators - Switching Status	Red LED - Switching status		
Housing Material	ABS		
Lens Material	Polycarbonate (PC)		
Shock/Vibration	See terminology section		
Tightening Torque	N/A		
Weight	160g (5.64oz)	160g (5.64oz)	Emitter/Receiver pair 290g(10.23oz)
Connectors	2m (6.5') axial cable		
Agency Approvals	UL Recognized E224302, CE		

[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



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

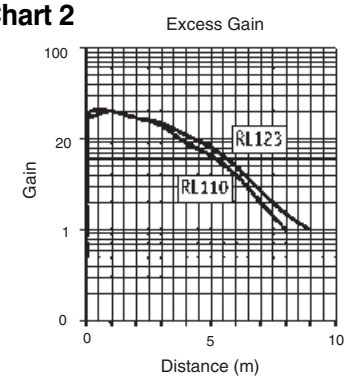
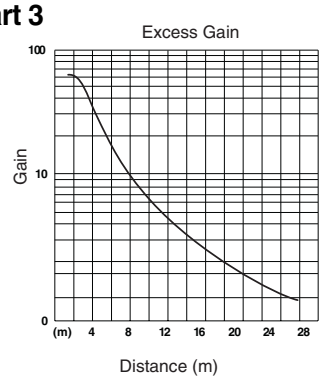
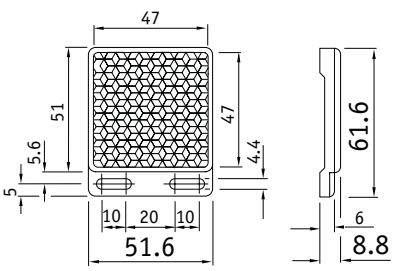


Chart 3

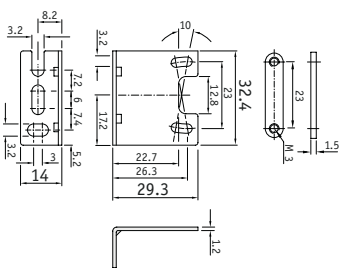


Dimensions

(mm)



Reflector supplied with FGRN models



Horizontal mounting bracket supplied with each unit

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

FW Series Photoelectric Sensors

M30 (30 mm) Compact Metal - DC

- 8 models available
- Zinc alloy nickel-plated housing
- Diffuse with background suppression and polarized retro-reflective models
- 30 mm mounted with 1 mounting hex nut included
- NPN or PNP, Light-on, Dark-on output models
- Easy-to-use multi-turn potentiometer for setting switchpoint distance on select models
- M12 quick-disconnect; order cable separately
- IP67 rated

FW Series Photoelectric Sensors Selection Chart

Part Number	Price	Sensing Distance	Output State	Logic	Connection	Wiring	Characteristic Curves
Diffuse with background suppression							
FW3-LP-1E	<--->	Adjustable 50 to 800 mm (1.97 to 31.5 in)	Light-On	PNP	M12 (12 mm) connector	Diagram 1	Chart 1
FW3-LN-1E	<--->		Light-On	NPN		Diagram 2	Chart 1
FW3-LP-2E	<--->	Fixed 0.0 to 600 mm (0 to 23.62 in)	Light-On	PNP		Diagram 1	NA
FW3-LN-2E	<--->		Light-On	NPN		Diagram 2	NA
Polarized retro-reflective*							
FWP-DP-1E	<--->	0.1 to 15m (0.33 to 49.21 ft)	Dark-On	PNP	M12 (12 mm) connector	Diagram 1	Chart 2
FWP-LP-1E	<--->		Light-On	PNP		Diagram 1	
FWP-DN-1E	<--->		Dark-On	NPN		Diagram 2	
FWP-LN-1E	<--->		Light-On	NPN		Diagram 2	

***Note: Polarized retro-reflective sensors include one round reflector. Purchase additional reflectors separately.**

Switching Element Function

	Reflective Models	Diffuse Models
Light-on	N.C.	N.O.
Dark-on	N.O.	N.C.

Mounting Bracket

FW Series Accessories Selection Chart

Part Number	Price	Description	Weight
ST30C6W	<--->	Mounting bracket, for 30mm FW series photoelectric sensors, 304S15 stainless steel, right angle	0.1 lbs

Wiring Diagrams

Connector

M12 connector

Diagram 1

PNP Output

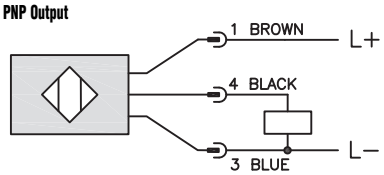
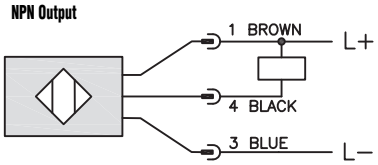


Diagram 2

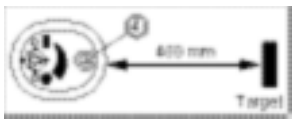
NPN Output



NOTE: CLASS 2 POWER SOURCE REQUIRED

Adjustable Background Suppression Settings

- **Measure the desired range. Example: target distance 400 mm**
- **Set the range:**
  - Turn the setting screw of the potentiometer clockwise until the required range to the target has been reached. Each rotation corresponds to 100 mm.
  - If the setting fails, increase the potentiometer value until the target is detected.



FW Series Photoelectric Sensors

Specifications	Diffuse with Background Suppression Models	Retro-Reflective Models
Type	Diffuse reflection	Polarized Retro-reflective
Sensing Distance	FW3-L*-1E: 50 to 800 mm (1.97 to 31.5 in) FW3-L*-2E: 0.0 to 600 mm (23.62 in)	0.1 to 15m (0.33 to 49.21 ft)
Light Spot Diameter	FW3-LP-1E, FW3-LN-1E: 55 mm (2.17 in) at maximum range FW3-LP-2E, FW3-LN-2E: 30 mm (1.18 in) at maximum range	100 mm x 130 mm (3.94 in x 5.12 in) Sensing range 5m (16.4 ft)
Emission	Red LED (visible) 624-625 nm	
Sensitivity	Adjustable (FW3-LP-1E, FW3-LN-1E)	
Output Type	NPN or PNP, Light-on or Dark-on	
Operating Voltage	10 to 30 VDC	
No Load Supply Current	35 mA	20 mA
Operating (Load) Current	200 mA	
Off-state (Leakage) Current	N/A	
Voltage Drop	<2.5V	
Switching Frequency	300 Hz	1000 Hz
Ripple	N/A	
Time Delay Before Availability (tv)	Minimal	
Short-Circuit Protection	Yes (non-latching)	
Operating Temperature	-25 to 60 °C (-37.7 to 140 °F)	
Protection Degree (DIN 40050)	IP67	
LED Indicators - Switching Status	Yellow	
LED Indicators - Power	Green	
Housing Material	Zinc Alloy Nickel-plated (ZnAl4Cu1)	
Lens Material	Polymethyl methacrylate (PMMA)	
Shock/Vibration	See terminology section	
Tightening Torque	80Nm (59 lb-ft)	
Weight	0.5 lbs	
Connectors	M12 Connector	
Accessories	1 mounting hex nut included	
Agency Approvals	CULus listed UL file E328811, CE	

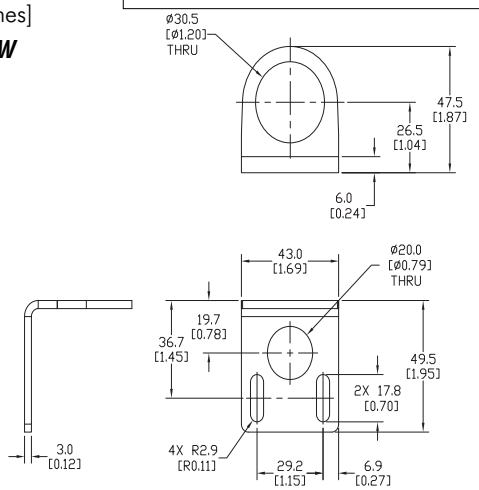
[1]With 200x200mm white matte paper, 90% remission. [2] With standard diameter 80mm reflector included with sensor.

Dimensions

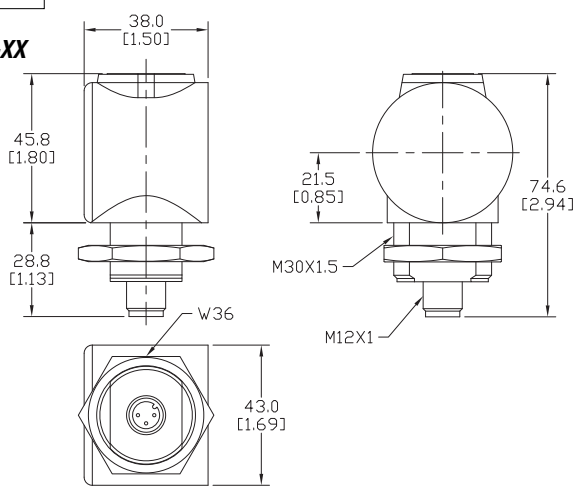
Warning: These products are not safety sensors and are not suitable for use in personal safety applications.

mm [inches]

ST30C6W



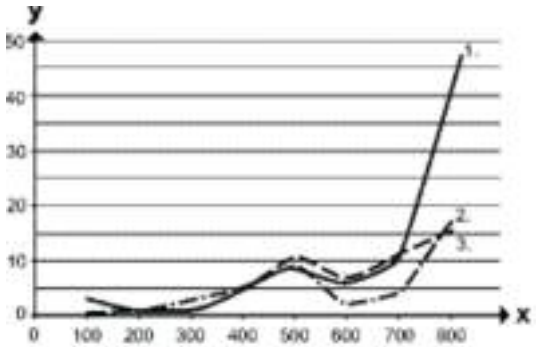
FW3-XX-XX



Characteristic Curves

Background Suppression Curves

Chart 1

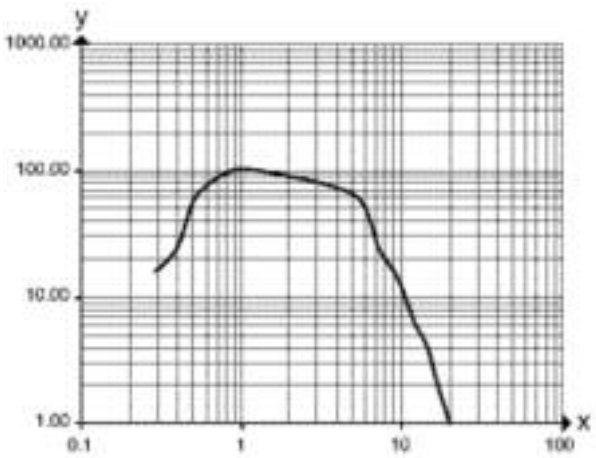


X	Distance to target [mm]
Y	Minimum distance between object and background [mm]

Values in [mm]
1 = object black (6 % remission), background white (90 % remission)
2 = object gray (18 % remission), background white (90 % remission)
3 = object white (90 % remission), background white (90 % remission)

Excess Gain Chart

Chart 2



X	Distance to target [m]
Y	Excess gain factor

EATON
Cutler-Hammer

Enhanced 50 Series Photoelectric Sensors Selection Guide

Overview

The Enhanced 50 family of high performance photoelectric sensors offers outstanding features, flexibility and durability at an incredible price. Choose from a wide selection of Thru-beam, Polarized Reflex, Diffuse and even Clear Object models all designed in a rugged, industry standard, rectangular package. Each model comes with a variety of input options for maximum flexibility across many voltage ratings. Cabling choices include built-in mini-connector, micro-connector, pigtail micro-connector or a 6 ft. integrated cable.

Other convenient features included are Dark-On/Light-On selectability and Gain adjustment, available on all models. Use the Selection Guide below to find the sensor model that best suits your requirements.

Enhanced 50 Photoelectric Sensors Specifications by Model Type				
Specifications	***Thru-Beam***	***Diffuse***	***Polarized Reflex***	***Clear Object Detector***
Voltage Range	10 - 40 VDC 12 - 240 VDC 24 - 240 VAC	10 - 40 VDC 12 - 240 VDC 24 - 240 VAC	10 - 40 VDC 12 - 240 VDC 24 - 240 VAC	10 - 40 VDC 12 - 240 VDC 24 - 240 VAC
Sensing Range	500 ft. (152 m)	10 ft. (3 m)	16 ft. (4.9 m)	45 in. (1.2 m)
Optimum Power	0.1 to 250 ft. (0.03 to 77 m)	1 to 60 in. (25 to 1520 mm)	0.5 to 8 ft. (0.2 to 2.5 m)	1 to 24 in. (25 to 610 mm)
Sensing Beam	Infrared	Infrared	Visible Red	Visible Red
Output Types	NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3 A @ 120 VAC	NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3 A @ 120 VAC	NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3 A @ 120 VAC	NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3 A @ 120 VAC

Enhanced 50 Photoelectric Sensors Specifications by Input Type			
Specifications	***AC/DC EM Relay Models***	***AC/DC Solid-State Relay Models***	***DC Only Models***
Input Voltage	12 – 240 VDC 24 – 240 VAC	12 – 240 VDC 24 – 240 VAC	10 – 40 VDC
Light/Dark Operation	Switch selectable		
Operating Temperature	-13° to 131°F (-25° to 55°C)		
Humidity	95% relative humidity, non-condensing		
Case Material	Fiberglass reinforced plastic		
Lens Material	Acrylic		
Vibration	IEC 60947-5-2 part 7.4.2		
Shock	IEC 60947-5-2 part 7.4.1		
Protection	Output short circuit and overcurrent protection, reverse polarity protection		
Enclosure Ratings	IP67		
Agency Approvals	IEC IP67, cCSAus, UL508 (CSA File 224447)	IEC IP67, cCSAus, UL508 (CSA File 224447)	IEC IP67, cCSAus, UL508 (CSA File 224447)
Output Load	3A @ 120 VAC 3A @ 28 VAC 3A @ 240 VAC	300 mA @ 240 VAC/VDC	250 mA
Response Time	15 ms	2 ms	
No Load Current Draw	<30 mA		
Leakage Current (max.)	—	1 mA @ 240 VAC	<10 µA
Indicator LEDs	Thru-Beam Source ..... All Others: Red: Power ..... Green: Output ..... Yellow: Power ..... Red: Alignment		

Enhanced 50 Series Photoelectric Sensors

Cutler-Hammer

Application Guide

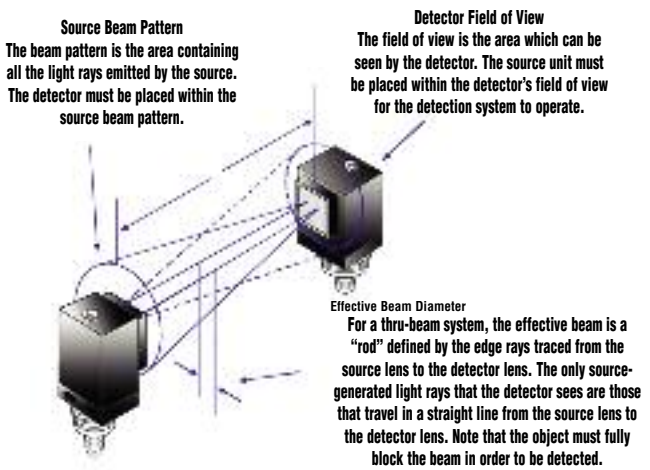
The Enhanced 50 Series Photoelectric Sensors are a great fit for applications such as material handling, packaging, wrapping and sortation.

This family of sensors, with its four basic models (Thru-beam, Polarized Reflex, Diffuse and Clear Object), meets the needs for almost any sensing requirement, including harsh environments with excessive dust or high temperature.

Follow the application guide below to choose the best sensor model for your application.

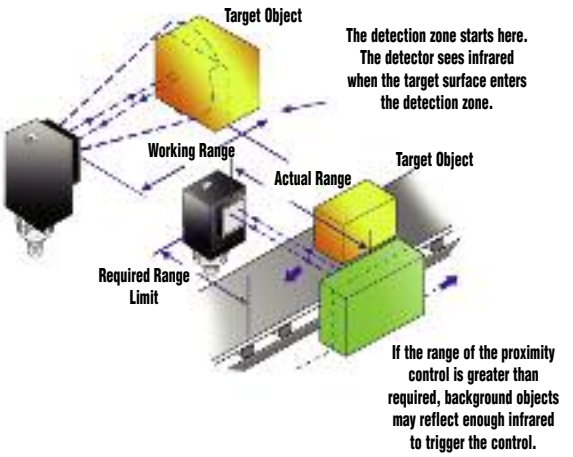
Thru-Beam

- Most accurate
- Longest sensing range
- Most reliable
- Must be installed in two points on system: emitter and receiver
- More costly



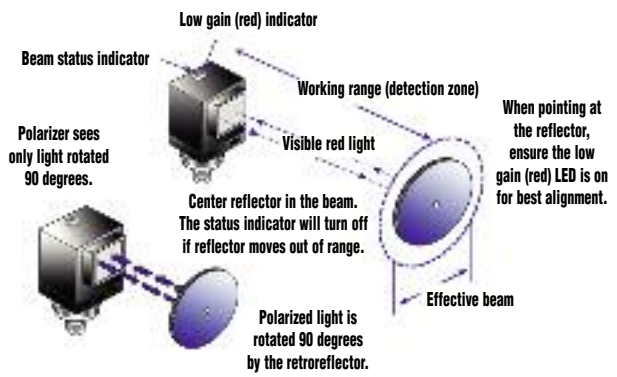
Diffuse

- Lower cost
- Install at one point
- Less accurate than Thru-Beam or Polarized Reflex
- More setup time involved



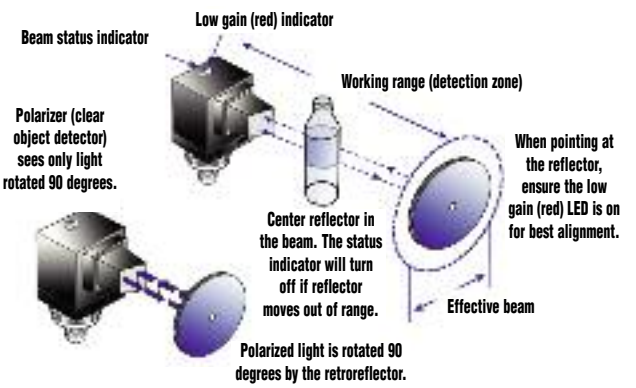
Polarized Reflex

- Lower cost than Thru-Beam
- Longer sensing range than Diffuse
- Very reliable
- Must be installed in two points on system: sensor and reflector



Clear Object Detector

- Most reliable for sensing transparent objects
- Must be installed in two points on system: sensor and reflector.
- Short sensing distance: 45 inches max.



Enhanced 50 Series Thru-beam Photoelectric Sensors

EATON Cutler-Hammer

1151E-6504 1251E-6504

- Long sensing distances
- 13 models available
- Fiberglass-reinforced plastic housing
- Field of view: 2.4°
- Cable wires or mini/micro connector termination
- NPN/PNP, Solid-State Relay, or SPDT EM Relay outputs
- IP67 rated

Note: Cutler-Hammer parts available for sale to North America locations only.

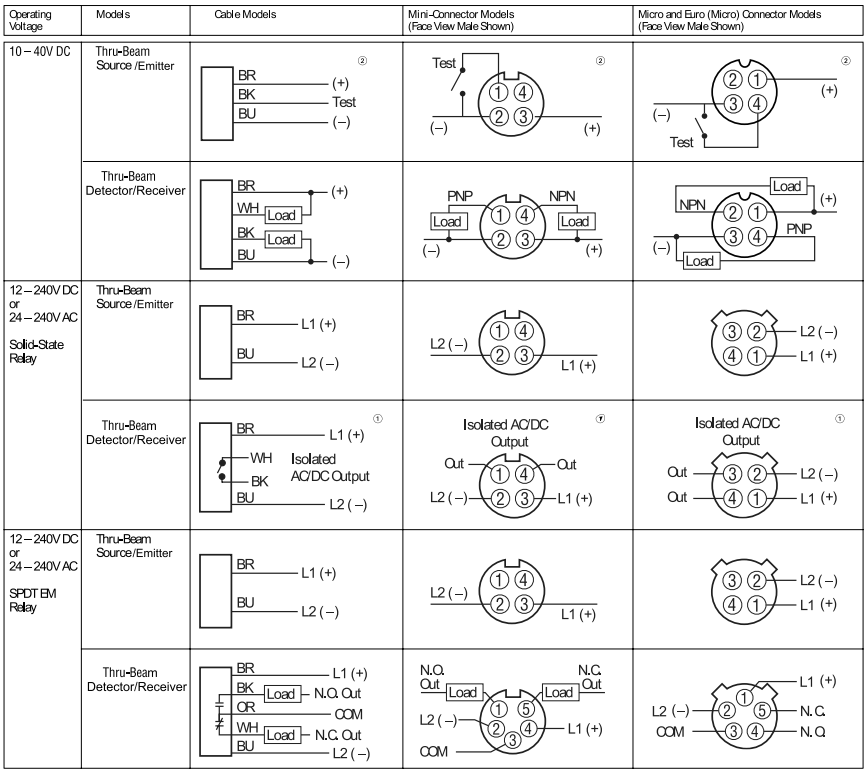
1151E-6517 1251E-6517

Enhanced 50 Series Thru-beam Photoelectric Sensors Selection Chart

Part Number	Price	Voltage Range	Sensing Range	Optimum Range	Sensing Beam	Thru-Beam Component	Output Type	Connection Type	Cable Part Number
1151E-6517	<--->	10 - 40 VDC	500 ft. (152 m)	0.1 to 250 ft. (0.03 to 77 m)	Infrared	Source/Emitter	N/A	6-foot cable (300V)	**pre-wired 6 ft. (1.8 m)**
1251E-6517	<--->					Detector/Receiver	NPN/PNP 250 mA		
1151E-6547	<--->					Source/Emitter	N/A	4-pin Euro (Micro) DC connector	**CSDS4A4CY2202**
1251E-6547	<--->					Detector/Receiver	NPN/PNP 250 mA		**CSDS4A4CY2205**
1151E-6507	<--->					Source/Emitter	N/A	4-pin Mini connector	**CSMS4A4CY1602**
1251E-6507	<--->					Detector/Receiver	NPN/PNP 250 mA		**CSMS4A4CY1606**
1151E-6513	<--->	12 - 240 VDC 24 - 240 VAC				Source/Emitter	N/A	6-foot cable (300V)	**pre-wired 6 ft. (1.8 m)**
1251E-6513	<--->					Detector/Receiver	Solid-state relay 300 mA @ 240 VAC/VDC		
1151E-6543	<--->					Source/Emitter	N/A	4-pin Micro AC connector	**CSAS4F4CY2202**
1251E-6543	<--->					Detector/Receiver	Solid-state relay 300 mA @ 240 VAC/VDC		**CSAS4F4CY2205**
1151E-6504	<--->					Source/Emitter	N/A	4-pin Mini connector	**CSMS4A4CY1602**
1251E-6503	<--->					Detector/Receiver	Solid-state relay 300 mA @ 240 VAC/VDC		**CSMS4A4CY1606**
1251E-6504	<--->					Detector/Receiver	SPDT EM relay 3A @ 120 VAC	5-pin Mini connector	**CSMS5A5CY1602** **CSMS5A5CY1606**

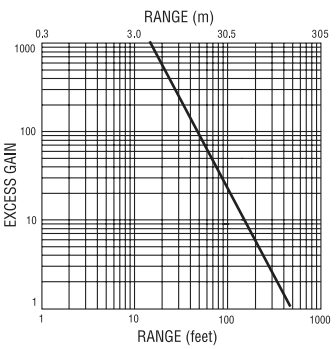
Note: Purchase one source and one detector for a complete set.

WIRING DIAGRAM (Pin numbers are for reference only. Rely on pin location when wiring.)

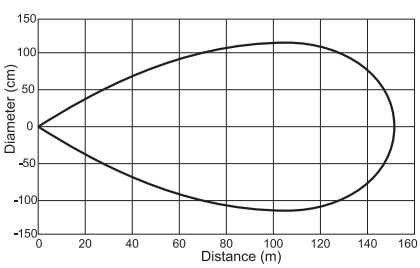


① Connect load to appropriate output for either sinking or sourcing operation.
② Connecting the test input to 0 VDC allows you to switch the light source off for troubleshooting while leaving the sensor under power.

Characteristic curve chart



Spot dimension chart



Enhanced 50 Series Diffuse Photoelectric Sensors

1351E-6547

1351E-6517

- 9 models available
- Fiberglass-reinforced plastic housing
- Field of view: 2.8°
- Cable wires or mini/micro connector termination
- NPN/PNP, Solid-State Relay, or SPDT EM Relay outputs
- IP67 rated

1351E-6534

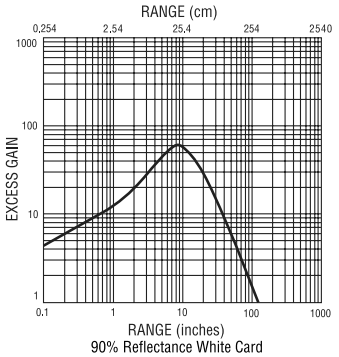
Note: Cutler-Hammer parts available for sale to North Amrica locations only.

Enhanced 50 Series Diffuse Photoelectric Sensors Selection Chart

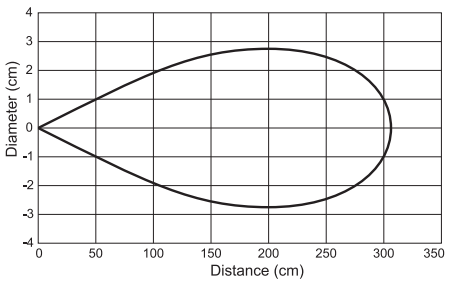
Part Number	Price	Voltage Range	Sensing Range*	Optimum Range*	Sensing Beam	Output Type	Connection Type	Cable Part Number
1351E-6517	<--->	10 - 40 VDC	10 ft. (3 m)	1 to 60 in. (25 to 1520 mm)	Infrared	NPN/PNP 250 mA	6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1351E-6547	<--->						4-pin Euro (Micro) DC connector	CSDS4A4CY2202 CSDS4A4CY2205
1351E-6507	<--->						4-pin Mini connector	CSMS4A4CY1602 CSMS4A4CY1606
1351E-6513	<--->	12 - 240 VDC 24 - 240 VAC				Solid-state relay 300 mA @ 240 VAC/VDC	6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1351E-6543	<--->						4-pin Micro AC connector	CSAS4F4CY2202 CSAS4F4CY2205
1351E-6503	<--->						4-pin Mini connector	CSMS4A4CY1602 CSMS4A4CY1606
1351E-6514	<--->					SPDT EM relay 3 A @ 120 VAC	6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1351E-6534	<--->						5-pin Micro AC connector (7.5" pigtail)	CSAS5A5CY2202 CSAS5A5CY2205
1351E-6504	<--->						5-pin Mini connector	CSMS5A5CY1602 CSMS5A5CY1606

***Note: Ranges based on 90% reflectance white card for diffuse reflective sensors.**

Characteristic curve chart

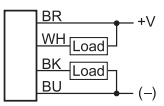
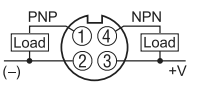
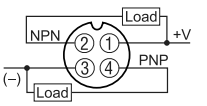
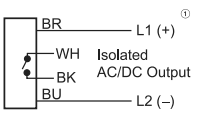
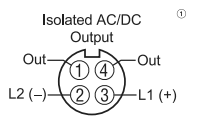
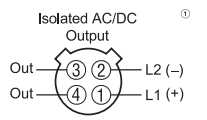
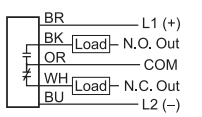
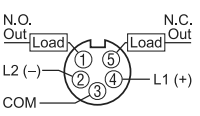
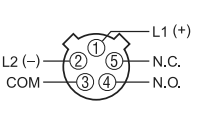


Spot dimension chart



Wiring Diagrams

(Pin numbers are for reference only. Rely on pin location when wiring.)

Operating Voltage	Models	Cable Models	Mini-Connector Models (Face View Male Shown)	Micro and Euro (Micro) Connector Models (Face View Male Shown)
10-40 VDC	Diffuse			
12 – 240 VDC or 24 – 240 VAC Solid-State Relay	Diffuse	 ①	 ①	 ①
12 – 240 VDC or 24 – 240 VAC SPDT EM Relay	Diffuse			

① Connect load to appropriate output for either sinking or sourcing operation.

Enhanced 50 Series Polarized Reflex Photoelectric Sensors

1451E-6503

1451E-6513

- 9 models available
- Fiberglass-reinforced plastic housing
- Field of view: 1.0˚
- Cable wires or mini/micro connection termination
- NPN/PNP, Solid-State Relay, or SPDT EM Relay outputs
- IP67 rated

Note: Cutler-Hammer parts available for sale to North America . locations only.

1451E-6543

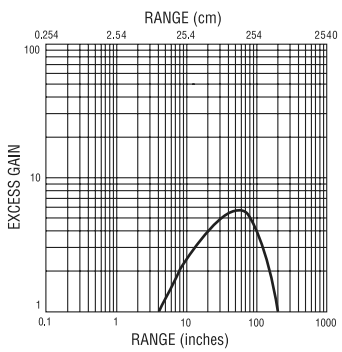
Enhanced 50 Series Polarized Reflex Photoelectric Sensors Selection Chart

Part Number	Price	Voltage Range	Sensing Range*	Optimum Range*	Sensing Beam	Output Type	Connection Type	Cable Part Number
1451E-6517	<--->	10 - 40 VDC	16 ft. (4.9 m)	0.5 to 8 ft. (0.2 to 2.5 m)	Visible Red	NPN/PNP 250 mA	6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1451E-6547	<--->						4-pin Euro (Micro) DC connector	CSDS4A4CY2202 CSDS4A4CY2205
1451E-6507	<--->						4-pin Mini connector	CSMS4A4CY1602 CSMS4A4CY1606
1451E-6513	<--->	12 - 240 VDC 24 - 240 VAC				Solid-state relay 300 mA @ 240 VAC/VDC	6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1451E-6543	<--->						4-pin Micro AC connector	CSAS4F4CY2202 CSAS4F4CY2205
1451E-6503	<--->						4-pin Mini connector	CSMS4A4CY1602 CSMS4A4CY1606
1451E-6514	<--->					SPDT EM relay 3 A @ 120 VAC	6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1451E-6534	<--->						5-pin Micro AC connector (7.5" pigtail)	CSAS5A5CY2202 CSAS5A5CY2205
1451E-6504	<--->						5-pin Mini connector	CSMS5A5CY1602 CSMS5A5CY1606

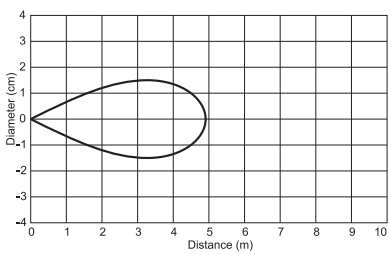
Note: Ranges based on 3-inch retro-reflector for reflex sensors.
Polarized sensors may not operate with reflective tape. Test tape selection before installation.

Note: Polarized Reflex models include one 84 mm RL110 reflector.
Purchase additional reflectors separately.

Characteristic curve chart

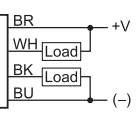
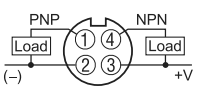
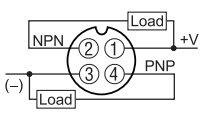
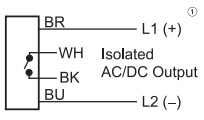
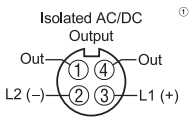
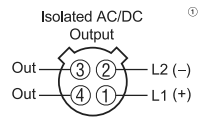
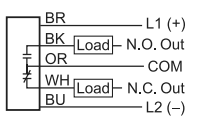
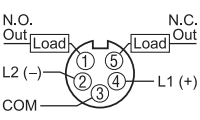
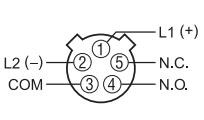


Spot dimension chart



Wiring Diagrams

(Pin numbers are for reference only. Rely on pin location when wiring.)

Operating Voltage	Models	Cable Models	Mini-Connector Models (Face View Male Shown)	Micro and Euro (Micro) Connector Models (Face View Male Shown)
10-40 VDC	Polarized Reflex			
12 – 240 VDC or 24 – 240 VAC Solid-State Relay	Polarized Reflex			
12 – 240 VDC or 24 – 240 VAC SPDT EM Relay	Polarized Reflex			

① Connect load to appropriate output for either sinking or sourcing operation.

Enhanced 50 Series Clear Object Photoelectric Sensors

1452E-6547

1452E-6517

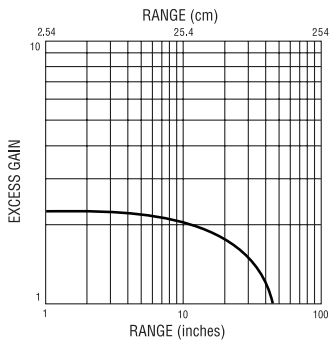
- 7 models available
- Fiberglass-reinforced plastic housing
- Field of view: 0.68°
- Cable wires or mini/micro connector termination
- NPN/PNP, Solid-State Relay, or SPDT EM Relay outputs
- IP67 rated

Note: Cutler-Hammer parts available for sale to North America locations only.

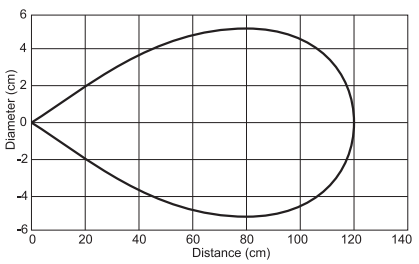
Enhanced 50 Series Clear Object Photoelectric Sensors Selection Chart

Part Number	Price	Voltage Range	Sensing Range	Optimum Range	Sensing Beam	Output Type	Connection Type	Cable Part Number
1452E-6517	<--->	10 - 40 VDC	45 in. (1.2 m)	1 to 24 in. (25 to 610 m m)	Visible Red	NPN/PNP 250 mA	6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1452E-6547	<--->						4-pin Euro (Micro) DC connector	CSDS4A4CY2202 CSDS4A4CY2205
1452E-6507	<--->						4-pin Mini connector	CSMS4A4CY1602 CSMS4A4CY1606
1452E-6513	<--->	12 - 240 VDC 24 - 240 VAC				Solid-state relay 300 mA @ 240 VAC/VDC	6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1452E-6543	<--->						4-pin Micro AC connector	CSAS4F4CY2202 CSAS4F4CY2205
1452E-6503	<--->						4-pin Mini connector	CSMS4A4CY1602 CSMS4A4CY1606
1452E-6504	<--->					SPDT EM relay 3 A @ 120 VAC	5-pin Mini connector	CSMS5A5CY1602 CSMS5A5CY1606

Characteristic curve chart

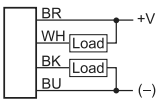
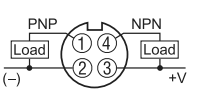
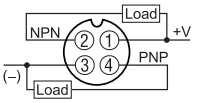
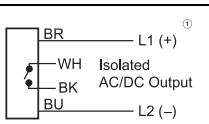
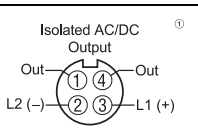
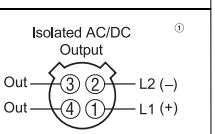
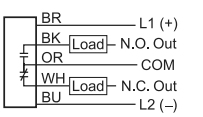
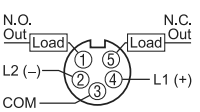
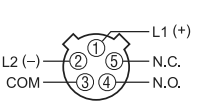


Spot dimension chart



Note: Clear Object models include one 84 mm RL110 reflector. Purchase additional reflectors separately.

Wiring Diagrams (Pin numbers are for reference only. Rely on pin location when wiring.)

Operating Voltage	Models	Cable Models	Mini-Connector Models (Face View Male Shown)	Micro and Euro (Micro) Connector Models (Face View Male Shown)
10-40 VDC	Clear Object			
12 – 240 VDC or 24 – 240 VAC Solid-State Relay	Clear Object			
12 – 240 VDC or 24 – 240 VAC SPDT EM Relay	Clear Object			

① Connect load to appropriate output for either sinking or sourcing operation.

Enhanced 50 Series Photoelectric Sensors Accessories

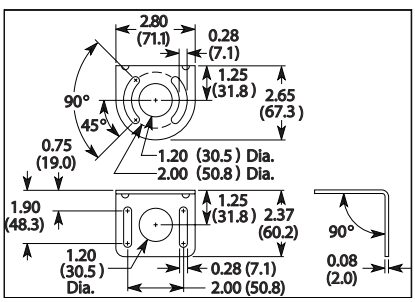
Mounting brackets

Short, tall or ball-swivel style of mounting brackets are available. All styles allow 360° rotation of the sensor.

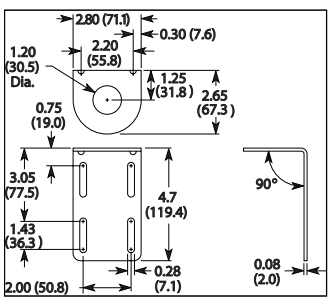
Note: Cutler-Hammer parts available for sale to North America locations only.

Enhanced 50 Series Accessories Selection Chart		
Part Number	***Price***	***Description***
6150E-6501	<--->	Short right angle metal mounting bracket. Allows full 360° rotation of sensor and up to 1.5" of vertical adjustment. Nickel plated.
6150E-6502	<--->	Tall right angle metal mounting bracket. Allows full 360° rotation of sensor, up to 1.5" of vertical adjustment in each slot, and 3.5" overall positioning adjustment
6150E-6503	<--->	Right angle plastic mounting bracket with ball swivel. Allows full 360° rotation of sensor. Ball swivel allows for ±30° sensor angle

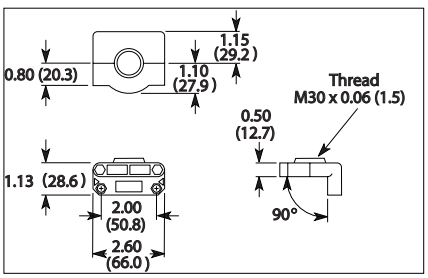
6150E-6501



6150E-6502



6150E-6503



Approximate dimensions in inches (millimeters)

Specifications	
Model	***RL110***[3]
Price	<--->
% Sensing Range Using Enhanced 50 Series[1]	100%
Dimensions	Diameter: 84 mm
Degree of Protection[2]	IEC IP67
Mounting	one 5 mm dia. hole
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.
3 All reflective sensors are shipped with an RL110 reflector.

RL series reflectors

- Suitable for use with polarized light photoelectric sensors
- 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 of the environment. 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°.

Enhanced 50 Series Photoelectric Sensors Connector Cables

Enhanced 50 Series Cables Selection Chart				
Part Number	**Price**	**Description**	**Gauge**	**Pin-Out Diagram**
CSDS4A4CY2202	<--->	DC Euro (Micro) connector cable for quick-disconnect photoelectric sensors, straight female, DC 4-pin/4-wire, PVC, 6 feet (2 meter) length	22	1-Brown 2-White 3-Blue 4-Black
CSDS4A4CY2205	<--->	DC Euro (Micro) connector cable for quick-disconnect photoelectric sensors, straight female, DC 4-pin/4-wire, PVC, 16.4 feet (5 meter) length	22	
CSAS4F4CY2202	<--->	AC Micro connector cable for quick-disconnect photoelectric sensors, straight female, AC 4-pin/4-wire, PVC, 6 feet (2 meter) length, 1/2" - 20 UNF thread	22	1-Red/Black 2-Red/White 3-Red 4-Green
CSAS4F4CY2205	<--->	AC Micro connector cable for quick-disconnect photoelectric sensors, straight female, AC 4-pin/4-wire, PVC, 16.4 feet (5 meter) length, 1/2" - 20 UNF thread	22	
CSAS5A5CY2202	<--->	AC Micro connector cable for quick-disconnect photoelectric sensors, straight female, AC 5-pin/5-wire, PVC, 6 feet (2 meter) length, 1/2" - 20 UNF thread	22	1-Brown 2-Blue 3-Gray 4-Black 5-White
CSAS5A5CY2205	<--->	AC Micro connector cable for quick-disconnect photoelectric sensors, straight female, AC 5-pin/5-wire, PVC, 16.4 feet (5 meter) length, 1/2" - 20 UNF thread	22	
CSMS4A4CY1602	<--->	Mini connector cable for quick-disconnect photoelectric sensors, straight female, 4-pin/4-wire, PVC, 6 feet (2 meter) length, 7/8" - 16 UN thread	16	1-Black 2-Blue 3-Brown 4-White
CSMS4A4CY1606	<--->	Mini connector cable for quick-disconnect photoelectric sensors, straight female, 4-pin/4-wire, PVC, 19.69 feet (6 meter) length, 7/8" - 16 UN thread	16	
CSMS5A5CY1602	<--->	Mini connector cable for quick-disconnect photoelectric sensors, straight female, 5-pin/5-wire, PVC, 6 feet (2 meter) length, 7/8" - 16 UN thread	16	1-Black 2-Blue 3-Orange 4-Brown 5-White
CSMS5A5CY1606	<--->	Mini connector cable for quick-disconnect photoelectric sensors, straight female, 5-pin/5-wire, PVC, 19.69 feet (6 meter) length, 7/8" - 16 UN thread	16	

Note: Cutler-Hammer parts available for sale to North America locations only.

CSDS4A4CY2205

CSAS4F4CY2205

CSAS5A5CY2202

Connector Cables Specifications		
	Micro Style	**Mini Style**
Jacket Material	PVC	PVC
Contact Material	Gold-plated copper alloy	Gold-plated brass
Coupling Nut Material	Zinc die-cast epoxy-coat	Zinc die cast epoxy-coat
O-ring	Nitrile rubber	None
Cable	PVC insulation and jacket, stranded copper conductors	
Cable Strain Relief	35 pounds minimum	
Voltage Rating	320 V (24 VDC for LED plugs)	600 V
Current Rating	4A	4-pin: 10A 5-pin: 8 A
Contact Resistance	5 mΩ maximum	5 mΩ maximum
Isolation Resistance	1000 MΩ minimum	1000 MΩ minimum
Protection	IP67	NEMA 6P, IP68
Temperature Range	-25° to 90°C	-20° to 105°C
Cable Diameter (3/C = 3 Conductor)	**22 AWG PVC:** 4/C: 0.21 inch (5.3 mm) 5/C: 0.20 inch (5.1 mm)	**16AWG PVC:** 4/C: 0.42 inch (10.7 mm) 5/C: 0.50 inch (12.7 mm)
Bend Radius	Minimum recommended bend radius is 12X cable diameter	

CSMS4A4CY1602

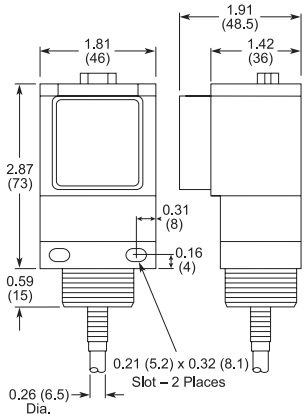
CSMS5A5CY1602

Enhanced 50 Series Photoelectric Sensors Dimensions

Sensor Dimensions

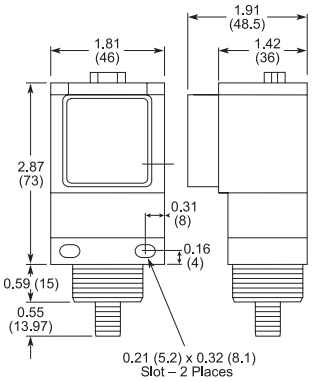
(inches (mm)

Cable and Pigtail Connector* Version

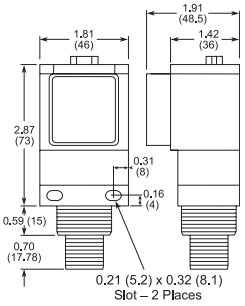


* Pigtail length: 7.5" nominal

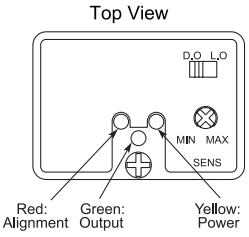
AC/DC Micro or Euro (Micro) Connector Versions



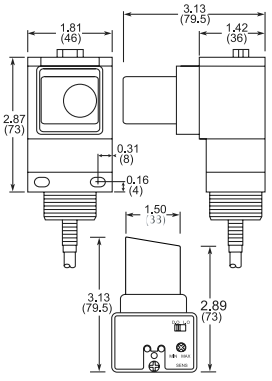
Mini Connector Versions



Top View



Clear Object Versions (Cable Version Shown)

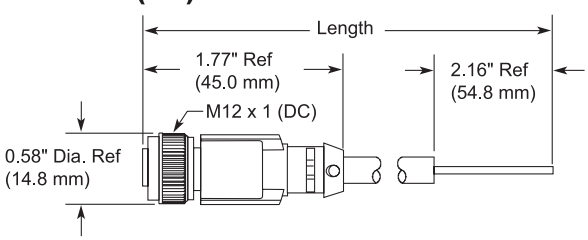


Connector Cables Dimensions

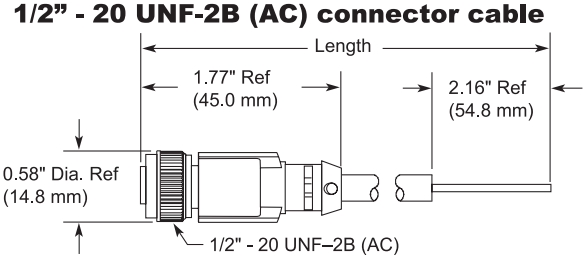
(in/mm)

Micro Style Connector Cables

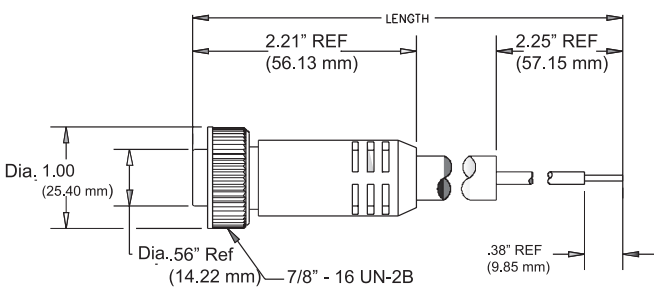
M12 x 1 (DC) connector cable



1/2" - 20 UNF-2B (AC) connector cable



Mini Style Connector Cables



DFT Series Fiber Photoelectric Amplifiers

Compact rectangular plastic DIN-rail mount with Teach function - DC

- 4 models available
- DIN-rail mounting
- Bargraph signal-strength indicator
- NPN or PNP, Light-on/Dark-on selectable outputs
- Red LED with visible spot
- IP64 rated

DFT Series Fiber Photoelectric Amplifier Selection Chart							
Part Number	**Price**	**Sensing Range**	**Output State**	**Logic**	**Connection**	**Wiring**	**Dimensions**
DFT-AN-1A	<--->	Optical fiber dependent	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Diagram 1	Figure 1
DFT-AN-1F	<--->				M8 (8mm) connector	Diagram 1	Figure 2
DFT-AP-1A	<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1
DFT-AP-1F	<--->				M8 (8mm) connector	Diagram 2	Figure 2

Specifications		
Type	**DFT-AN-1***	**DFT-AP-1***
Sensing Distance	See Optical Fibers Table	
Light Spot Diameter	N/A	
Emission	red (680nm)	
Sensitivity	Dual Teach function	
Output Type	NPN Light On or Dark On Selectable	PNP Light On or Dark On Selectable
Operating Voltage	10-30VDC	
No-Load Supply Current	≤25mA	
Operating (Load) Current	≤200mA	
Off-state (Leakage) Current	≤0.1mA	
Voltage Drop	2V maximum at 200mA	
Switching Frequency	1.5kHz	
Ripple	≤20%	
Time Delay Before Availability (tv)	80ms	
Short-Circuit Protection	Yes (switch autoresets after overload is removed)	
Operating Temperature	-25° to +55° C (-13° to 131° F)	
Protection Degree	IEC IP64	
LED Indicators -Switching Status	Yellow (output energized)	
Housing Material	PBT	
Lens Material	Acrylic	
Shock/Vibration	See terminology section	
Tightening Torque	N/A	
Weight (cable/connector)	68g (2.39oz) / 17g (0.60oz)	
Connectors	2m (6.5') axial cable; M8 (8mm) connector	
Agency Approvals	UL file E328811	

Dimensions

(mm)

Figure 1

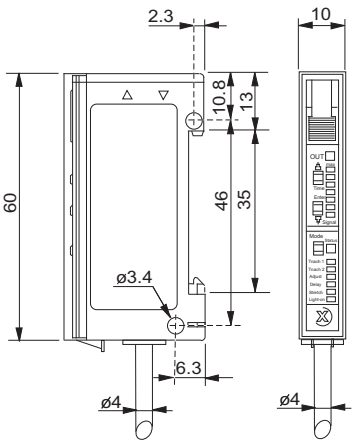
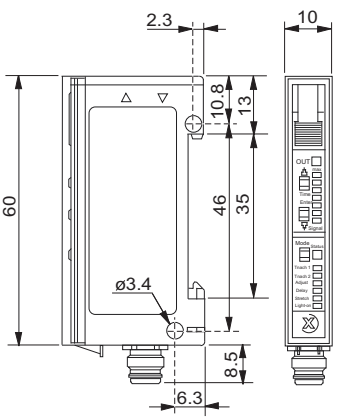
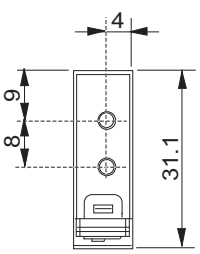


Figure 2





Wiring diagrams

Switching Element Function		
	Thru-beam and Reflective Models	**Diffuse Reflective Models**
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

Diagram 1

NPN Output

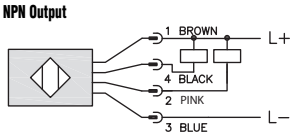
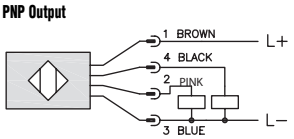


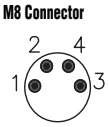
Diagram 2

PNP Output



Connector

M8 Connector



DFP Series Fiber Photoelectric Amplifiers

Compact rectangular plastic DIN-rail mount- DC

- 4 models available
- DIN-rail mounting
- 12-turn potentiometer sensitivity setting with illuminated scale
- NPN or PNP, Light-on/Dark-on selectable outputs
- Red LED with visible spot
- IP64 rated

DFP Series Fiber Photoelectric Amplifier Selection Chart

Part Number	Price	Sensing Range	Output State	Logic	Connection	Wiring	Dimensions
DFP-AN-1A	<--->	Optical fiber dependent	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Diagram 1	Figure 1
DFP-AN-1F	<--->				M8 (8mm) connector	Diagram 1	Figure 2
DFP-AP-1A	<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1
DFP-AP-1F	<--->				M8 (8mm) connector	Diagram 2	Figure 2

Specifications

Type	DFP-AN-1*	DFP-AP-1*
Sensing Distance	See Optical Fibers Table	
Light Spot Diameter	N/A	
Emission	red (680nm)	
Sensitivity	12-turn Potentiometer with illuminated scale	
Output Type	NPN Light On or Dark On Selectable	PNP Light On or Dark On Selectable
Operating Voltage	10-30VDC	
No-load Supply Current	≤15mA	
Operating (Load) Current	≤200mA	
Off-state (Leakage) Current	≤0.1mA	
Voltage Drop	2V maximum at 200mA	
Switching Frequency	1.5kHz	
Ripple	≤20%	
Time Delay Before Availability (tv)	300ms	
Short-Circuit Protection	Yes (switch autoresets after overload is removed)	
Operating Temperature	-25° to 55°C (-13° to 131°F)	
Protection Degree	IEC IP64	
LED Indicator - Switching Status	Pin 4 (black): switching status - yellow Pin 2 (pink): excess gain status - green	
Housing Material	PBT	
Lens Materials	Acrylic	
Shock/Vibration	See terminology section	
Tightening Torque	N/A	
Weight (cable/connector)	69g (2.44oz) / 18g (0.63oz)	
Connectors	2m (6.5') axial cable; M8 (8mm) connector	
Agency Approvals	UL file E32881	

Switching Element Function

	Thru-beam and Reflective Models	Diffuse Reflective Models
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

Dimensions

(mm)

Figure 1

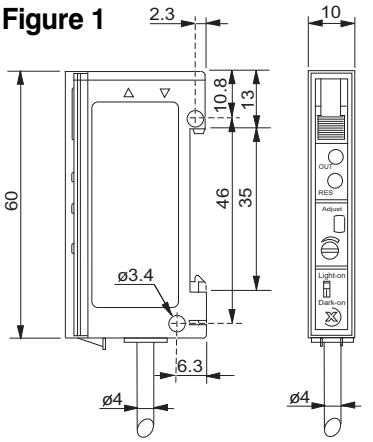
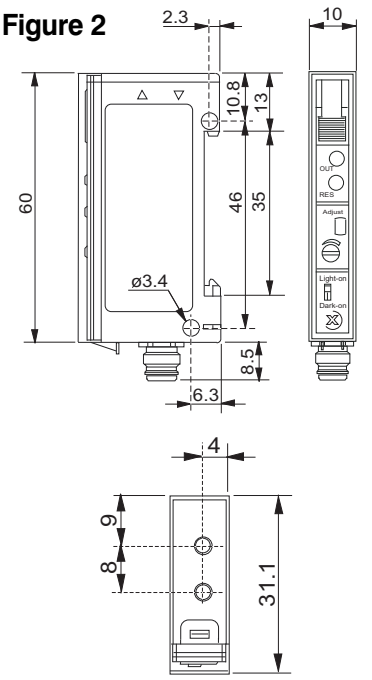


Figure 2



Wiring diagrams

Diagram 1

NPN Output

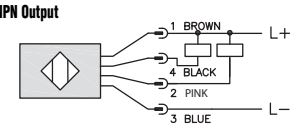
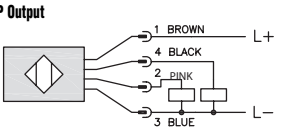


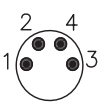
Diagram 2

PNP Output



Connector

M8 Connector



SSF Series Fiber Photoelectric Amplifiers

M18 (18 mm) plastic with Teach function - DC

- 4 models available
- Sensitivity adjustment using Teach button
- NPN or PNP, Light-on/Dark-on selectable outputs
- Red LED with visible spot
- IP67 rated

SSF Series Fiber Photoelectric Amplifier Selection Chart							
Part Number	**Price**	**Sensing Range**	**Output State**	**Logic**	**Connection**	**Wiring**	**Dimensions**
SSF-0N-0A	<--->	Optical fiber dependent	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Diagram 1	Figure 1
SSF-0N-0E	<--->				M12 (12mm) connector		Figure 2
SSF-0P-0A	<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1
SSF-0P-0E	<--->				M12 (12mm) connector		Figure 2

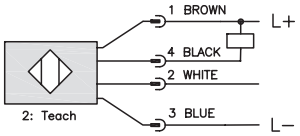
Specifications		
Type	**SSF-0N-0***	**SSF-0P-0***
Sensing Distance	See Optical Fibers Table	
Light Spot Diameter	N/A	
Emission	Red LED	
Sensitivity	Teach button	
Output Type	NPN Light On or Dark On Selectable	PNP Light On or Dark On Selectable
Operating Voltage	10-30VDC	
No-load Supply Current	≤20mA	
Load Current	≤100mA	
Leakage Current	≤10µA	
Voltage Drop	2V maximum	
Switching Frequency	800Hz	
Ripple	≤10%	
Time Delay Before Availability (tv)	150ms	
Short-Circuit Protection	Yes (switch autoresets after overload is removed)	
Temperature	-25° to +70°C (-13° to 158°F)	
Protection Degree	IP67	
LED Output Indicator	Yellow (output energized)	
Housing Material	PBT	
Lens Materials	Acrylic	
Shock/Vibration	See terminology section	
Tightening Torque	40 Nm (29l lb-ft)	
Weight (cable/connector)	100g (3.53oz)	
Connectors	2m (6.5') axial cable; M12 (12mm) connector	
Agency Approvals	CE	

Switching Element Function		
	Thru-beam and Reflective Models	**Diffuse Reflective Models**
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

Wiring diagrams

Diagram 1

NPN Output



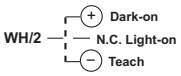
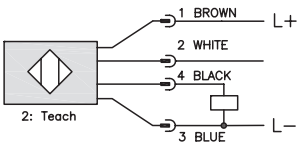
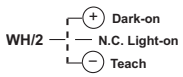


Diagram 2

PNP Output





Connector

M12 Connector

Dimensions

(mm)

Figure 1

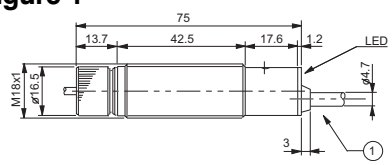
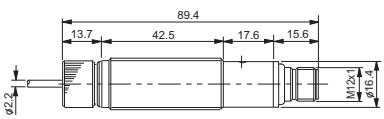
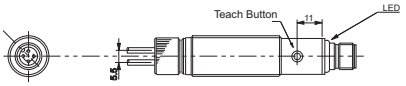


Figure 2



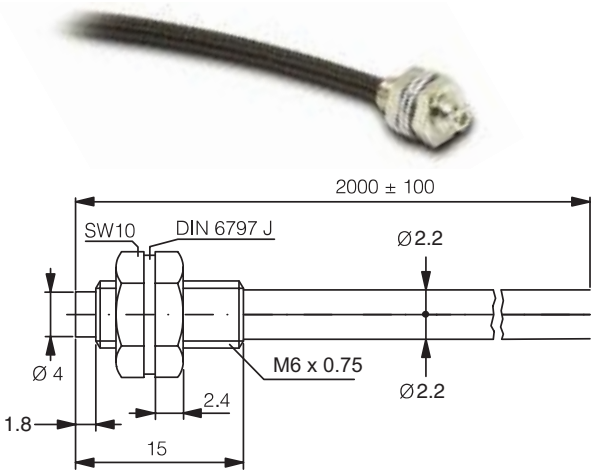


Cuttable Optical Fibers (2.2 mm Diameter)

CF-DB1-20 diffuse reflection

<---->

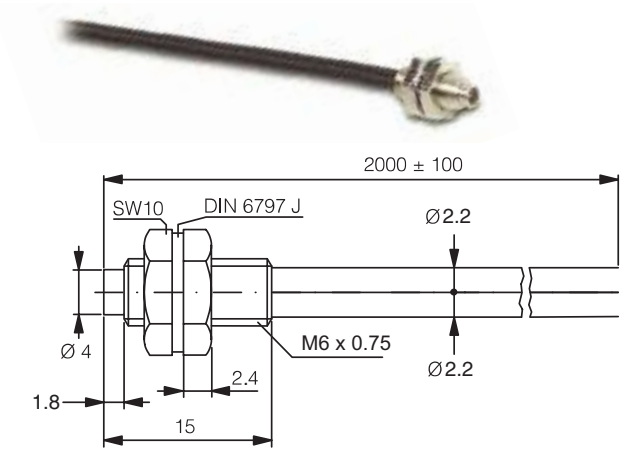
Specifications	
Optical Fiber Core Ø	1 mm (0.039in)
Sensing Distance with DFT and DFP series	200 mm (7.87in)
Fiber Length (L)	2.0 m (78.74in)
Fiber Bending Radius	25 mm (0.98in)
Free Cut	Yes
Head Size	M6
Thread Pitch	0.75 mm
Protection Degree	IEC IP67
Agency Approvals	UL file 328811
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass



CF-DB2-20 diffuse reflection

<---->

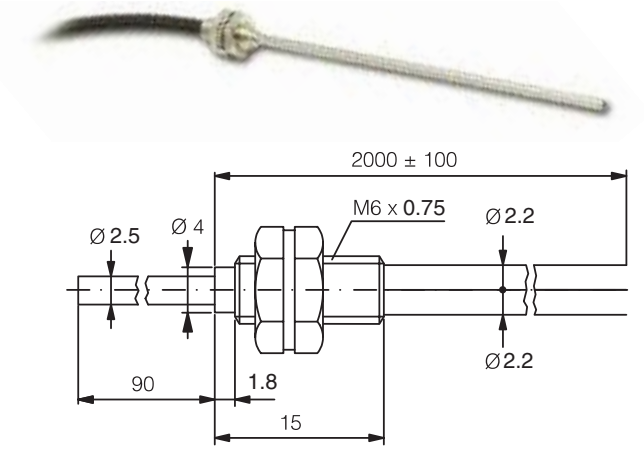
Specifications	
Optical Fiber Core Ø	1.5 mm (0.06in)
Sensing Distance with DFT and DFP Series	260 mm (10.27in)
Fiber Length (L)	2.0 m (78.74in)
Fiber Bending Radius	40 mm (1.57in)
Free Cut	Yes
Head Size	M6
Thread Pitch	0.75 mm
Protection Degree	IEC IP67
Agency Approvals	UL file 328811
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass



CF-DB3-20 diffuse reflection

<---->

Specifications	
Optical Fiber Core Ø	1 mm (0.039in)
Sensing Distance with DFT and DFP Series	200 mm (7.87in)
Fiber Length (L)	2.0 m (78.74in)
Fiber Bending Radius	25 mm (0.98in)
Bendable light-outlet tube	Yes, 25 mm (0.98in) radius
Free Cut	Yes
Head Size	M6
Thread Pitch	0.75 mm
Protection Degree	IEC IP67
Agency Approvals	UL file 328811
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass

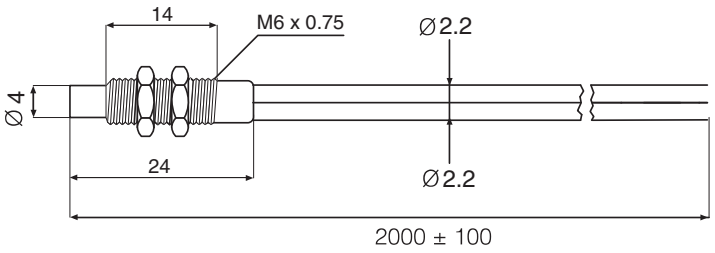


Cuttable Optical Fibers (2.2 mm Diameter)

CF-CB1-20 diffuse reflection

<---->

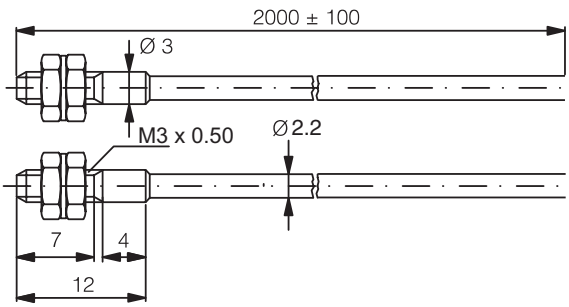
Specifications	
Optical Fiber Core Ø	1 mm (0.039in)
Sensing Distance with SSF Series	50 mm (1.97in)
Fiber Length (L)	2.0 m (78.74in)
Fiber Bending Radius	25 mm (0.98in)
Free Cut	Yes
Head Size	M6
Thread Pitch	0.75 mm
Protection Degree	IEC IP67
Temperature Range	-40° to +70°C (-40° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass



CF-TB1-20 through-beam

<---> Includes 2 optical fiber cables

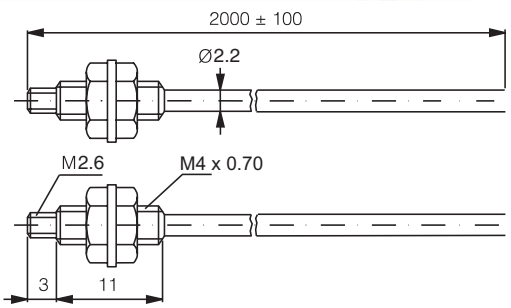
Specifications	
Optical Fiber Core Ø	0.5 mm (0.02in)
Sensing Distance with DFT and DFP Series	200 mm (7.87in)
Fiber Length (L)	2.0 m (78.74in) ea. piece
Fiber Bending Radius	25 mm (0.98in)
Free Cut	Yes
Head Size	M3
Thread Pitch	0.5 mm
Protection Degree	IEC IP67
Agency Approvals	UL file 328811
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass



CF-TB2-20 through-beam

<---> Includes 2 optical fiber cables

Specifications	
Optical Fiber Core Ø	1 mm (0.039in)
Sensing Distance with DFT and DFP Series	700 mm (27.56in)
Fiber Length (L)	2.0 m (78.74in) ea. piece
Fiber Bending Radius	25 mm (0.98in)
Free Cut	Yes
Head Size	M4
Thread Pitch	0.7 mm
Protection Degree	IEC IP67
Agency Approvals	UL file E328811
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass

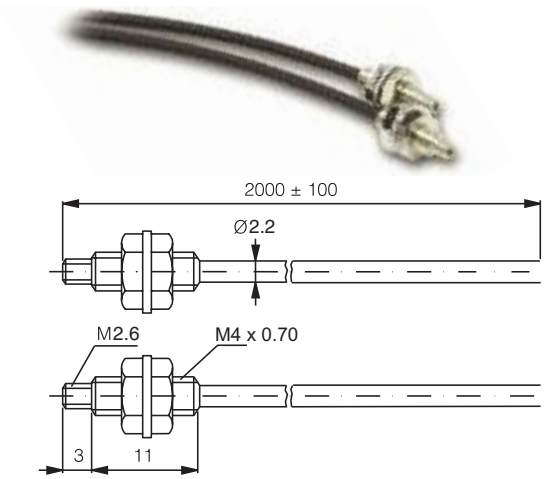


Cuttable Optical Fibers (2.2 mm Diameter)

CF-TB3-20 through-beam

<---> Includes 2 optical fiber cables

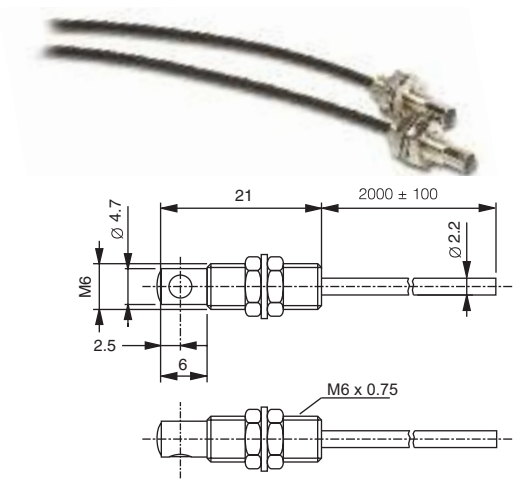
Specifications	
Optical Fiber Core Ø	1.5 mm (0.06in)
Sensing Distance with DFT and DFP Series	900 mm (35.43in)
Fiber Length (L)	2.0 m (78.74in) ea. piece
Fiber Bending Radius	40 mm (1.57in)
Free Cut	Yes
Head Size	M4
Thread Pitch	0.7 mm
Protection Degree	IEC IP67
Agency Approvals	UL file E328811
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass



CF-TB4-20 90° through-beam

<---> Includes 2 optical fiber cables

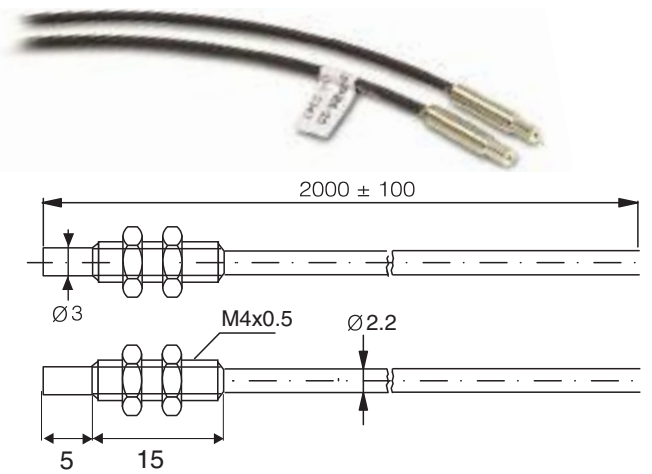
Specifications	
Optical Fiber Core Ø	1.0 mm (0.039in)
Sensing Distance with DFT and DFP Series	1800 mm (70.87in)
Fiber Length (L)	2.0 m (78.74in) ea. piece
Fiber Bending Radius	25 mm (0.98in)
Free Cut	Yes
Head Size	M6
Thread Pitch	0.75 mm
Protection Degree	IEC IP67
Agency Approvals	UL file E328811
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass



CF-RB6-20 through beam

<---> Includes 2 optical fiber cables

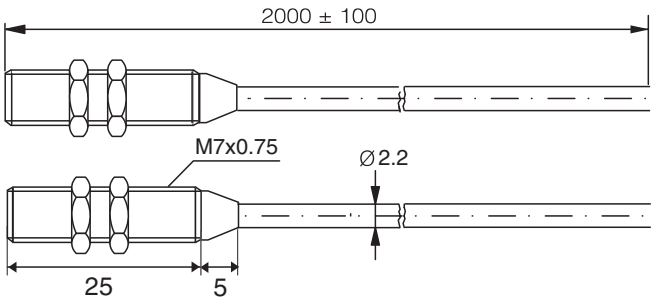
Specifications	
Optical Fiber Core Ø	1.0 mm (0.039in)
Sensing Distance with SSF Series	120 mm (4.72in)
Fiber Length (L)	2.0 m (78.74in) ea. piece
Fiber Bending Radius	25 mm (0.98in)
Free Cut	Yes
Head Size	M4
Thread Pitch	0.50 mm
Protection Degree	IEC IP67
Temperature Range	-40° to +70°C (-40° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass



Cuttable Optical Fibers (2.2 mm Diameter)

CF-RBA-20 through-beam with lenses <---> Includes 2 optical fiber cables

Specifications	
Optical Fiber Core Ø	1.0 mm (0.039in)
Sensing Distance with SSF series	1200 mm (47.24in)
Fiber Length (L)	2.0 m (78.74in) ea. piece
Fiber Bending Radius	25 mm (0.98in)
Free Cut	Yes
Head Size	M7
Thread Pitch	0.75 mm
Protection Degree	IEC IP67
Temperature Range	-40° to +70°C (-40° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass



BX Series High Resolution Area Sensor

High resolution area sensor (light screen) - DC

- 70 mm controlled area height
- Operating distance up to 2m
- Adjustable sensitivity
- NPN or PNP with NO/NC selectable output
- Emitter and receiver LED status indicators
- IP67 rated

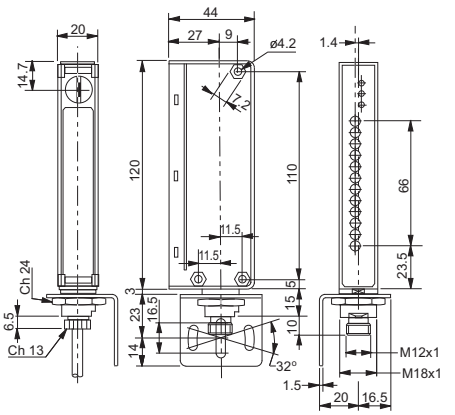
BX80 Series Area Sensor Selection Chart							
Part Number	**Price**	**Function**	**Sensing Range**	**Output State**	**Logic**	**Connection**	**Wiring**
BX80B-1N-0H	<--->	Receiver	2m (78.74in)	N.O./N.C. selectable	NPN	M12 (12mm) connector	Figure 1
BX80B-1P-0H	<--->	Receiver			PNP		Figure 2
BX80S-10-0H	<--->	Emitter			Receiver dependent		Receiver dependent

Specifications	
Type	Thru-beam
Sensing Distance	2m (2.56 ft)
Light Spot Diameter	N/A
Emission	Infrared (880nm)
Sensitivity	Fixed
Output Type	NPN or PNP; N.O./N.C.selectable
Operating Voltage	12-24VDC
No-load Supply Current	Emitter: 100mA; Receiver: 50mA
Operating (Load) Current	≤100mA
Off-state (Leakage) Current	≤10µA
Voltage Drop	1.2volt maximum at 100mA
Switching Frequency	50Hz
Ripple	≤10%
Time Delay Before Availability (tv)	500ms
Short-Circuit Protection	Yes (switch autoresets after overload is removed)
Operating Temperature	-25° to 50°C (-13° to 122°F)
Protection Degree (DIN 40050)	IEC IP67
Emitter's LED Indicators - Switching Status	Green (power), Red (sync. alarm), Yellow (area occupied)
Receiver's LED Indicators - Switching Status	Green (power), Red (alignment alarm), Yellow (output energized)
Housing Material	Polybutylene Terephthalate (PBT)
Lens Material	Polycarbonate (PC)
Shock/Vibration	See terminology section
Tightening Torque	25 Nm (18.44 lb-ft) max.
Weight	300g (10.58oz)
Agency Approvals	cULus E187310, CE

Switching Element Function		
	Thru-beam and Reflective Models	**Diffuse Reflective Models**
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

Dimensions

(mm)



Wiring diagrams

Figure 1

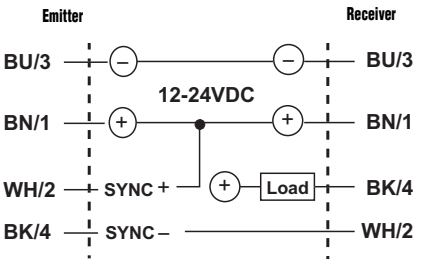
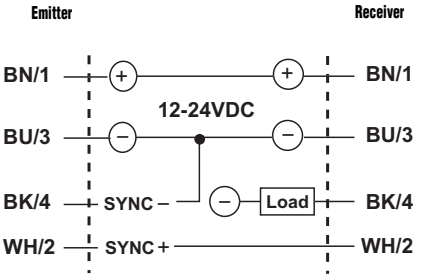
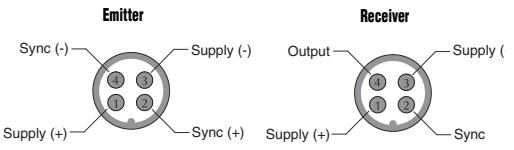


Figure 2



Connectors



Accessories: Reflectors and Shutters

RL series reflectors for polarized reflective photoelectric sensors (all models)

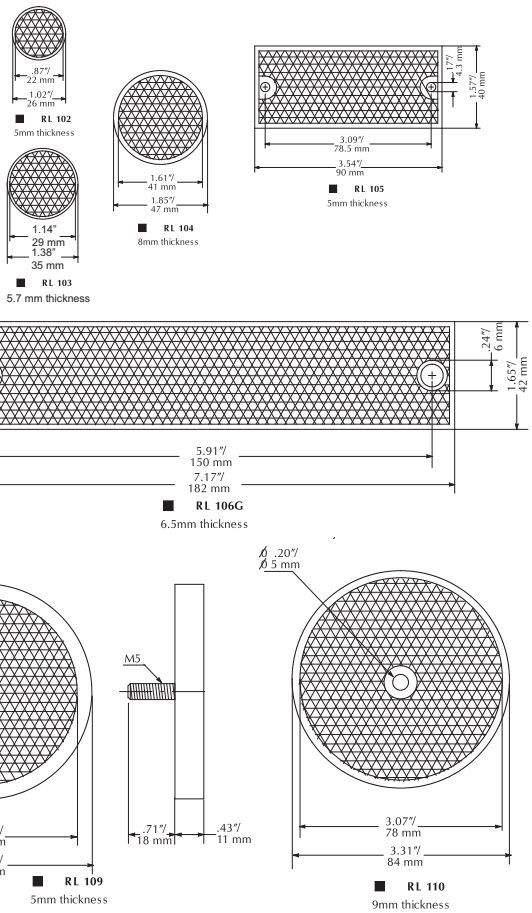
- Suitable for use with polarized light photoelectric sensors
- Shapes and sizes for most applications
- Miniature types for close mounting in multiple sensor installations
- Single hole, dual hole and stud mounting types available
- 10 reflectors per package

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

inches [mm]



Specifications						
Model	***RL102***	***RL103***	***RL104***	***RL105***	***RL106G***	***RL110*** [3]
Price (10 per pack)	<--->	<--->	<--->	<--->	<--->	<--->
% Sensing Range Using SSP [1]	50%	40%	50%	50%	50%	100%
% Sensing Range Using QXP [1]	--	35%	60%	50%	45%	100%
Dimensions	Ø26mm	Ø36mm	Ø47mm	90x40mm	182x42mm	Ø84mm
Degree of Protection [2]	IEC IP67					
Mounting	Customer-supplied adhesive or other mounting method required			two Ø4.3mm holes	two Ø6mm holes	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

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)	N/A	N/A	1	1.5	3.5	6.5
object (mm)	N/A	N/A	1.5	2	3	4

- 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.

Accessories: Reflectors, Adapters & Mounting Brackets

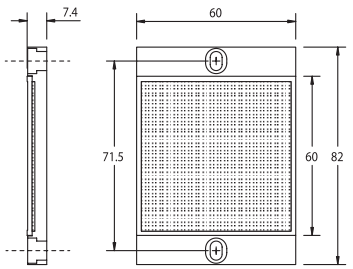
RL series reflectors for polarized reflective Laser photoelectric sensors (FALN series)

- 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.

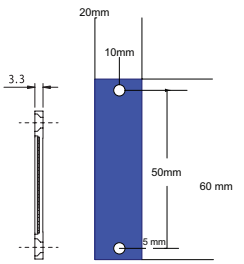
RL201



<--->

(5 per pack)

RL203



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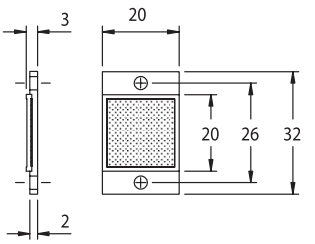
(5 per pack)

RL204



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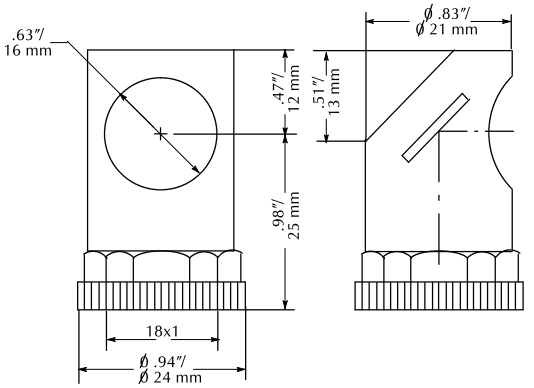
(5 per pack)

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%.

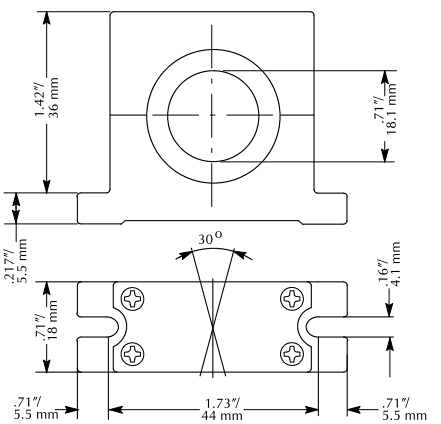
<--->



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).

<--->

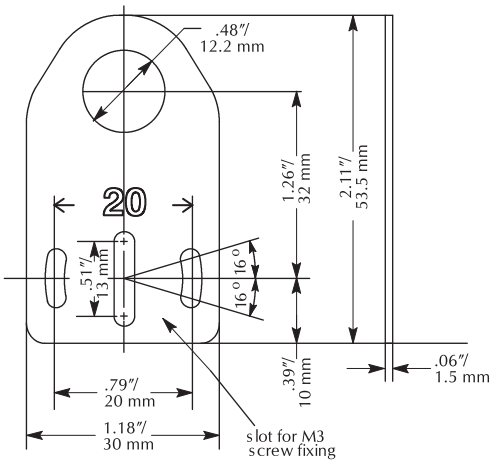


Accessories: Mounting Brackets

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.

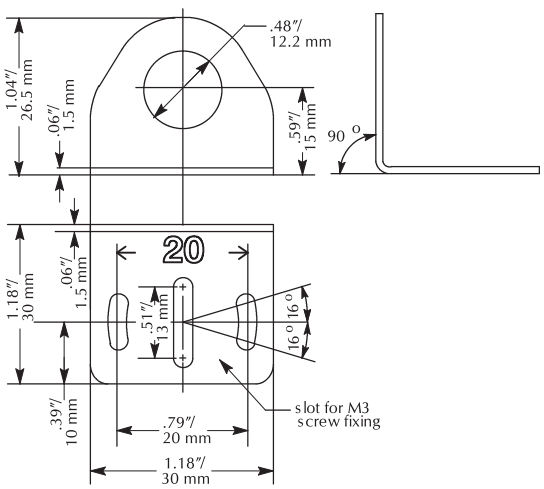
Brackets		
Part Number	**Price**	**Description**
ST12A	<--->	Metal axial bracket for 12 mm sensors, 1/pk
ST12A7W	<--->	316L stainless steel axial bracket for 12 mm sensors, 1/pk



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.

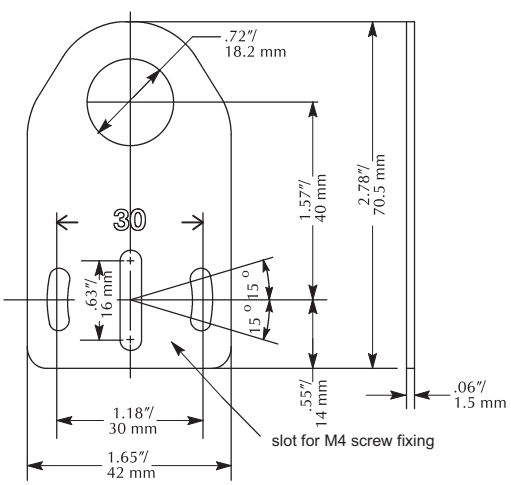
Brackets		
Part Number	**Price**	**Description**
ST12C	<--->	Metal right angle bracket for 12 mm sensors, 1/pk
ST12C7W	<--->	316L stainless steel right angle bracket for 12 mm sensors, 1/pk



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.

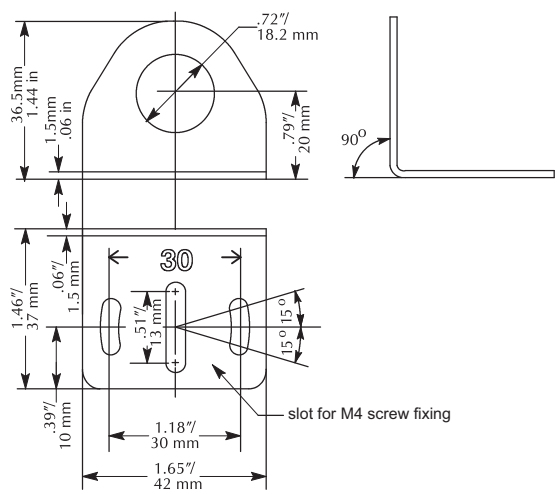
Brackets		
Part Number	**Price**	**Description**
ST18A	<--->	Metal axial bracket for 18 mm sensors, 1/pk
ST18A7W	<--->	316L stainless steel axial bracket for 18 mm sensors, 1/pk



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



Photoelectric Sensor Terminology

Background suppression

These sensors function in an identical manner to energetic diffuse sensors, but using the angle of incidence, rather than the amount of reflected light. For this reason, the operating distance depends only to a slight extent on the target's size, color, or surface nature. The target can therefore be accurately recognized even on a light background.

Break N.C. (normally closed)

This feature causes load current to flow when a target is not detected and not to flow when a target is detected.

Clearance

The photo sensors must not be mutually influenced. For this reason, a minimum distance ***a*** between sensors has to be provided. This distance depends strongly upon the model used and the actual sensitivity setting.

Correction factors

The specified operating distance ***s*** refers to exactly defined measuring conditions (see sensing distance in specifications tables). Other arrangements generally result in a reduction of the operating distance. When this occurs, a correction factor must be applied.

DC out:

A sensor with two power supply wires and two optically decoupled output terminals. Because of its decoupled static relay, it is capable of offering NPN, PNP, parallel and series configurations as well as interfacing with any input desired. The changeover (make-break) function allows switching from N.O. to N.C. and vice versa by simply reversing the polarity of the power supply leads, allowing complex logical functions.

Diffuse-reflection photo-sensor

With this type of device, the emitter and receiver form part of the same unit. The optical beams are either parallel or slightly converging. The presence of an object in the optical field causes diffused reflection of the luminous beam. The receiver detects the reflection from the object itself. The reflective properties of the object are important. It is generally possible to reliably detect the presence of any object unless it is perfectly reflective or black. Clear objects with a reflective power of 90% are detected close to the rated operating distance. Dark objects with 18% reflectivity are detected at about half the normal operating distance.

Dual Teach function

Teach1: With no target present, the operating distance is automatically adjusted to the available background in such a way that the background will not be detected. Thus, with respect to the target, maximum excess light is achieved. **Teach 2**: The teach process takes place in two stages; the first on the target, the second on the background. The device subsequently sets the operating distance to an intermediate value. This provides the best results where there is little difference in signal strength between the target and the background. The **Adjust** mode can be used to manually tune the detection zone or to fine tune after using the either Teach function.

Excess light indication Gain)

The excess light indication circuit senses the excess radiation power that falls upon the light incidence surface and is processed by the light receiver. The excess light can decrease in time due to dirt, change in the reflection factor of the object, and aging of the emitter diode, so that reliable operation may no longer be guaranteed. Some of the units are therefore equipped with a second LED (green) which lights up when more than approximately 80% of the available operating distance is used. Given this situation in units without the second green LED, the yellow LED will flash. Models with an excessive light output make the excess light signal available to the user for further processing. Unreliable operating conditions may be checked by the control system.

Inductive-load Protection

Unless otherwise stated, DC sensors are fitted with an inductive-load (surge) protection which consists of a diode or Zener diode.

IR light

IR is the abbreviation for InfraRed. This refers to any electromagnetic radiation with a wavelength longer than that of normal visible light (wavelength range approx. 380 to 780 nm). Wavelengths of approx. 780 to 1500 nm are used. IR light cannot be used with plastic fibers due to their high attenuation in this range. Red light is used instead. Usual polarization filters do not work properly in the IR range, therefore red light is also used for reflex sensors.

Leakage current

The leakage current is the current that passes through the output transistor when it is blocked. This must be taken into account, especially in the case of parallel connection of several sensors.

Load resistance

From the selected supply voltage UB and the specified maximum output current of the photoelectric sensor, the lowest permissible load resistance for trouble-free operation can be calculated. With a voltage of 24V and a specified maximum output current of 200 mA, the minimum load resistance is 120 Ohms; for 15V, the value is 75 Ohms (R=V/I. In this example,120 Ohms = 24V/.2A).

Make-break or complementary function:

A switching element combination that contains one make function and one break function.

In order to establish a relationship between the two different modes, you must distinguish between type D sensors (light diffusion) and types R and T (light reflection or transmission):

Type	Dark operate	Light operate
Diffuse Reflective	N.C.	N.O.
Retroreflective	N.O.	N.C.
Through-beam	N.O.	N.C.

Photoelectric Sensor Terminology

Make N.O. (normally open)

Causes load current to flow when a target is detected and not to flow when a target is not detected.

Open collector

An output transistor is not internally connected to a pull-up or pull-down load in an open collector model. Therefore, it is possible to connect an external load supplied by an external voltage. If the output is not the open-collector type, it is possible for the load to be supplied by an external voltage using a blocking diode in series with the output. This solution increments the output voltage drop.

Optical fibers

An optical fiber consists of:

- A core through which the light is transmitted
- A lining that ensures reflection of the light and keeps it within the core
- A sheath that protects the actual fiber from the outside environment

The light travelling inside the fiber is reflected by the surface separating the core from the lining. This is because the refractive index of the core is greater than that of the lining. In order for a light ray to enter the fiber, it must reach the surface of the fiber with an angle of incidence lower than the critical angle limit, which is the angle beyond which the rays enter the lining and are scattered onto the protective covering.

Standard: 0F Series, "uncuttable" fiber, with special connection for MSF amplifier.

Acceptance angle

The acceptance angle is the angle inside which a light ray is accepted by the fiber. It is also the angle with which the light is discharged from the fiber. This angle produces the size of the spot generated by a fiber photocell.

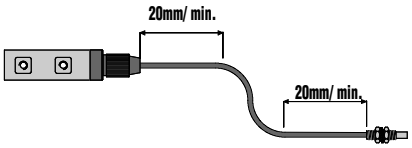
For plastic fibers, the opening angle is 60°; for glass fibers, it is 70°.

Attenuation

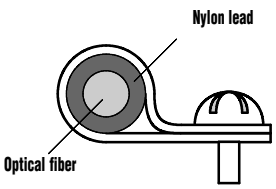
Attenuation is the reduction in signal power caused by the length of the fiber. This parameter must be considered if using fibers with length greater than the standard size.

Installation

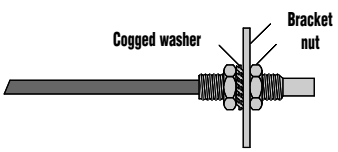
- Do not subject the fibers to a tractive force exceeding 3 kg.
- Keep the radius of curvature as wide as possible.
- Do not bend near the amplifier or termination.
- Secure the fibers using nylon fairleads or cable clamps to avoid causing pressure that could deform the fiber.
- Adjust the ring nut using the following maximum torque wrench settings:
  - M7: 4.5 Nm (39.83 lb-in)
  - M6: 1.2 Nm (10.62 lb-in)
  - M4: 0.8 Nm (7.08 lb-in)
  - M3: 0.8 Nm (7.08 llb-in)
- Set the smooth terminations of the optical fiber using a dowel following the maximum torque wrench settings:
- Ø (diameter)= 3 mm: 0.25 Nm (2.2 lb-in)



- Ø (diameter) > 3 mm: 0.5 Nm (4.43 lb-in)



- Insert the fiber in the amplifier:
- CF series: loosen the ring nuts on the fiber carriers, insert the two optical fibers in their special seats, push down in order to overcome the resistance of the internal O-ring, then tighten the ring nuts securely.
- 0F Series: insert the special termination in the fiber-carrier seat of the MSF ampli-



fier and tighten the ring nut securely.

Please note:

It is important that the minimum radius of curvature be followed to avoid performance loss or breakage of bendable fiber terminations:

- Plastic fiber with core diameter 0.5 mm: Rmin = 5 mm
- Plastic fiber with core diameter 1 mm: Rmin = 10 mm

Overvoltage protection

When an inductive load is switched off, the output voltage (when there is no protection circuit present) rises to such a high value that the output transistor may be destroyed. For this reason, our photo sensors feature a built-in Zener diode at the output, which limits the output voltage to a safe value (3-wire types). When connecting an inductive load with a current greater than 100 mA, and a switching frequency exceeding 10 Hz, the addition of a protective diode placed directly at the load terminal is recommend to limit the power loss of the built-in Zener diode.

Polarity reversal protection

All our photo sensors are protected against polarity reversal at all terminals. However, operation, is only possible if the sensor is connected the right way.

Protection degree

For information on how to define your IP Rating, see the APPENDIX section of this desk reference.

Polarized reflective photoelectric sensor

This is a variant of the reflective photo sensor. A polarizing filter is placed in the emitter's optical path. A polarizing filter in the receiver is oriented at a right angle to the filter in the emitter. This results in the elimination of reflections from surfaces other than the reflector. The light from the reflector possesses a component that is strongly polarized in a perpendicular direction to the incident light. It becomes the only recognizable reflected-light source.

Photoelectric Sensor Terminology

Reflective photoelectric sensor

The emitter and receiver form part of the same unit. The optical beams are parallel. The emitter's luminous beam hits a reflector and is redirected toward the receiver. Detection occurs when the path of the beam is interrupted by the presence of an opaque object. Operating distance mainly depends on the quality of the reflector used and on the optical-beam angle.

Shock

In accordance with IEC 68-2-27:

- Pulse shape: half-sine
- Peak acceleration: 30g
- Pulse duration: 11ms
- Short circuit protection

All DC devices feature a built-in protection circuit against short-circuits and overloads. Short-circuits between the output and both power supply terminals do not damage the switch and may be applied permanently. The same applies for overloads. During a short-circuit condition, the LEDs do not operate.

Status indicators

The LED indicators can be classified according to color:

Continuous green:Power on

Continuous yellow: Output on

Continuous red: Fault — When there is only one LED, it is usually red and indicates the output state.

Switching element functions

Dark operate

Allows current to flow when the path of the light beam does not reach receiver and will prevent flow when the path of the light beam does reach receiver.

Light operate

Allows current to flow when the path of the light beam reaches receiver and will prevent flow when the path of the light beam does not reach receiver.

Tightening torque

Over-tightening of the nuts can mechanically damage the photoelectric sensor. The following tightening torques should therefore not be exceeded:

M5 x 1 1.5 Nm

M18 x 1 20 Nm

M30 x 1.5 40 Nm

Through-beam photoelectric sensor

Emitter and receiver are housed in two separate units and are installed one in front of the other. Detection occurs when the path of the beam is interrupted by the presence of an opaque object.

Types of output and load connections

3-wire NPN

There are two power wires and one output wire. The switching element is connected between the output wire and the negative terminal, and the load is connected between the output wire and the positive terminal. In the ON state, the current sinks from the load into the switching element.

3-wire PNP

There are two power wires and one output wire. The switching element is connected between the output wire and the positive terminal, and the load is connected between the output wire and the negative terminal. In the ON state, the current flows from the switching element into the load.

4-wire NPN or PNP

(Programmable output state)

There are two power wires, one N.O./N.C. selection input and one output wire. The output state is programmable, connecting the input wire to one of the power supply lines.

4-wire NPN or PNP

(Complementary outputs)

There are two power wires, one N.O. output and one N.C. output.

4-wire NPN and PNP

There are two power wires and the output type is wiring programmable. The NPN output is available by connecting the PNP terminal to the negative power supply line. The PNP output is available by connecting the NPN terminal to the positive power supply line.

2-wire AC

The two leads make up the switching element itself. In the ON state, with one terminal connected to the phase and the other to the load, current is drawn from the phase line and supplied to the load through the output terminal. The other load terminal is connected to the neutral line.

3-wire AC

These models have two power supply wires and one output. The switching element is connected between output terminal and phase line. In the ON state, current is drawn from the phase line and supplied to the load through the output terminal. The other load terminal is connected to the neutral line.

Vibration

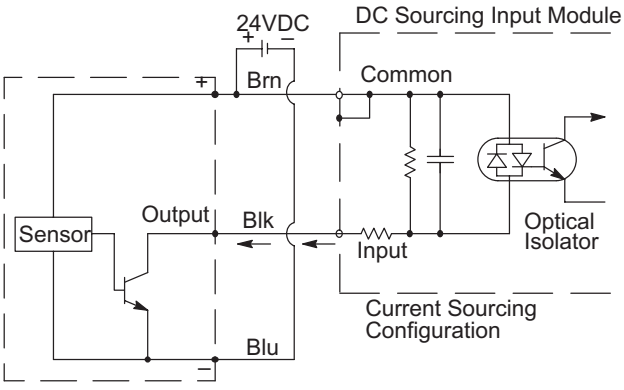
In accordance with IEC 68-2-6:

- Frequency Range: 10-55 Hz
- Amplitude: 1 mm
- Sweep cycle duration: 5 min.
- Duration of endurance at 55 Hz: 30 min. in each of the three axis directions

Photoelectric Sensor Terminology

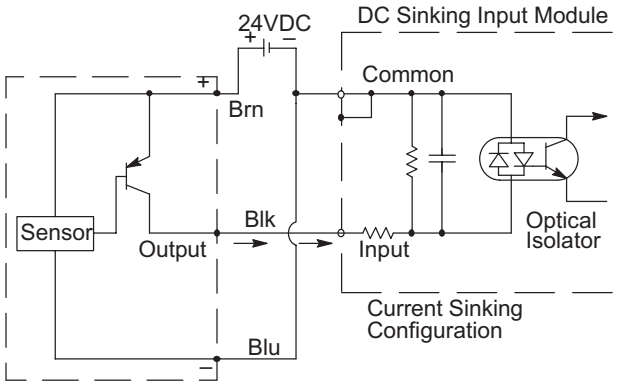
Field Device Examples - 3 Wire Connections

NPN (Sinking)
Field Device Example



(NPN) Current Sinking
Field Device

PNP (Sourcing)
Field Device Example



(PNP) Current Sourcing
Field Device