



# Instruction Manual—55 Series Photoelectric Diffuse Reflective, Reflex & Fiber Optic Sensors

Models covered in this manual:		AC/DC Models w/ Cable		AC/DC Models w/ Connector		DC-only Models w/ Cable		DC-only Models w/ Connector	
Style	Output Type	Light Operate	Dark Operate	Light Operate	Dark Operate	Light Operate	Dark Operate	Light Operate	Dark Operate
10-inch	Solid-State	1355A-6513	1355AD6513	1355A-6503	1355AD6503	1355A-6517	1355AD6517	1355A-6507	1355AD6507
	Diffuse	Relay Contact	1355R-6513	1355RD6513	1355R-6503	1355RD6503	1355R-6517	---	1355R-6507
24-inch	Solid-State	1356A-6513	1356AD6513	1356A-6503	1356AD6503	1356A-6517	1356AD6517	1356A-6507	1356AD6507
	Diffuse	Relay Contact	1356R-6513	1356RD6513	1356R-6503	1356RD6503	1356R-6517	---	1356R-6507
72-inch	Solid-State	1357A-6513	1357AD6513	1357A-6503	1357AD6503	1357A-6517	1357AD6517	1357A-6507	1357AD6507
	Diffuse	Relay Contact	1357R-6513	1357RD6513	1357R-6503	1357RD6503	1357R-6517	---	1357R-6507
Standard	Solid-State	1455A-6513	1455AD6513	1455A-6503	1455AD6503	1455A-6517	1455AD6517	1455A-6507	1455AD6507
	Reflex	Relay Contact	1455R-6513	1455RD6513	1455R-6503	1455RD6503	1455R-6517	---	1455R-6507
Polarized	Solid-State	1456A-6513	1456AD6513	1456A-6503	1456AD6503	1456A-6517	1456AD6517	1456A-6507	1456AD6507
	Reflex	Relay Contact	1456R-6513	1456RD6513	1456R-6503	1456RD6503	1456R-6517	---	1456R-6507
Fiber	Solid-State	1555A-6513	1555AD6513	1555A-6503	1555AD6503	1555A-6517	1555AD6517	1555A-6507	1555AD6507
	Optic	Relay Contact	1555R-6513	1555RD6513	1555R-6503	1555RD6503	1555R-6517	---	1555R-6507



## CAUTION

**DURING INSTALLATION, CORRECT POWER CONNECTIONS MUST BE MADE FIRST TO ENSURE FAIL-SAFE SHORT CIRCUIT PROTECTION OF THE OUTPUTS. REFER TO THE WIRING DIAGRAMS IN THIS MANUAL.**

**THESE PRODUCTS ARE NOT DESIGNED, TESTED, NOR RECOMMENDED FOR USE IN HUMAN SAFETY APPLICATIONS.**

### INTRODUCTION

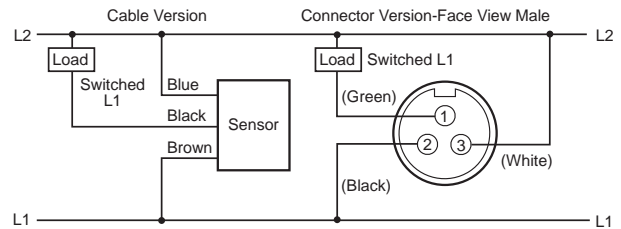
55 Series Photoelectric Sensors offer flexibility, durability and high optical performance in a low-cost, self-contained package. Each sensor features a built-in swivel mounting bracket for quick installation and easy alignment. Models are available for operation with DC power, or AC and DC power in a single unit. Sensors are wired using either a 6-foot power cable or a quick-disconnect mini-connector.

### WIRING DIAGRAMS

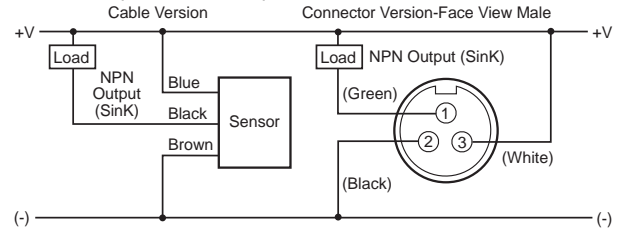
For wiring cable versions, the color codes shown are the actual wire colors emanating from the sensor. For connector versions, the pin numbering and color codes shown are typical of several manufacturers, however, variations are possible. **In case of discrepancies, rely on function indicated and pin location rather than pin number or color code.**

\* For use with Listed Attachment Plug Receptacles, Rated min. 2 A, 240 V ac Employing Types S, SO, SJ, SE, SJT or the equivalent Flexible Cord and having min. 20 AWG

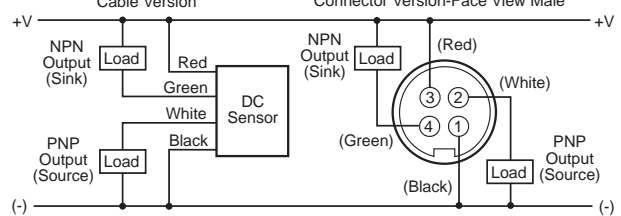
### AC/DC Models (AC Connection)



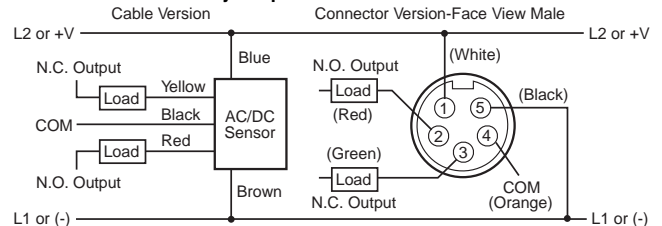
### AC/DC Models (DC Connection)



### DC Models

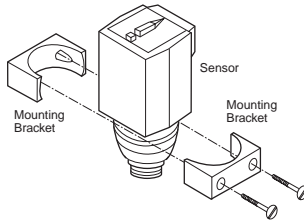


### AC/DC Models with Relay Output



**SENSOR MOUNTING**

Mount the sensor using the patented ball swivel mounting bracket built



into the sensor. Use two 0.203 inch diameter holes drilled 1.18 inches apart. The ball swivel feature allows a 10° tilt from vertical, and a 360° rotation to aid alignment.

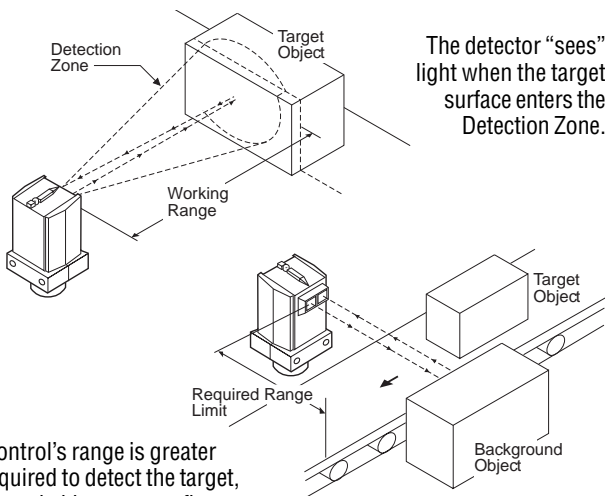
**DIFFUSE REFLECTIVE SENSORS**

A diffuse reflective sensor operates by shining a beam of light out through the lens. When an object comes within the sensor's view, it reflects part of this beam of light back to the sensor causing the sensor to detect the object. The maximum range at which a given object can be detected depends on how well its surface reflects light—the less light it reflects back, the shorter the range. The ability of a surface to reflect light depends primarily upon its material of construction, color, and texture.

**MOUNTING LOCATION AND SET-UP - DIFFUSE REFLECTIVE**

Select a mounting location with a clear view of the object to be detected. Mount the sensor so that it points at the most suitable surface of the target—usually a large, bright, non-shiny, flat surface that is perpendicular to the line of sight of the sensor. It may be helpful to temporarily mount or hold the sensor in that position in order to test the suitability of the chosen location.

Check to ensure that the sensor will not detect the background either before or after sensing the target. If the sensor detects the background,



If the control's range is greater than required to detect the target, background objects may reflect enough light to trigger the control. Remove or darken the background so that it is no longer detected.

then remove or darken the background. If that is not possible, move the sensor farther away from the background, making sure it will still detect the target. If the background has a glossy or shiny surface, angle the sensor in relation to the background to eliminate direct reflection.

**REFLEX SENSORS**

A reflex sensor has both a light source and detector in the same unit. The source sends a beam of light to a retroreflector which returns it back to the detector. A break in the light beam causes the sensor to change output state. 1455 models have an infrared light source, while 1456 models have a visible red light source.

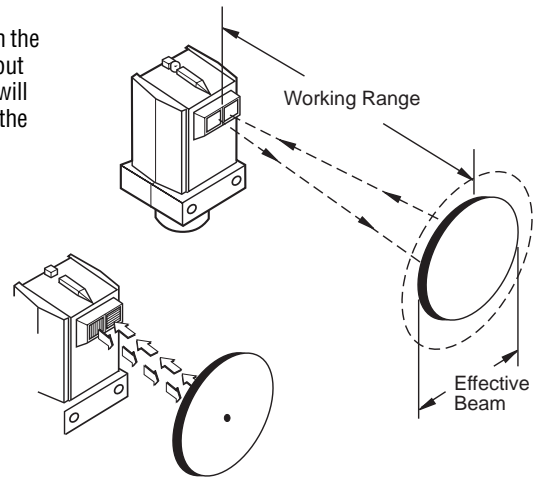
Polarized models are used to reliably detect shiny targets that may reflect the light beam back to the sensor instead of interrupting the beam. The polarizing filter conditions the beam so that light reflected off the retroreflector is detected, but light reflected by the target is not.

**MOUNTING LOCATION AND SET-UP - REFLEX**

Locate the sensor and retroreflector on opposite sides of the target. Ensure that the area of the target to be detected will block the entire beam.

With power applied to the sensor, aim the unit directly at the center of the retroreflector. Move the sensor back and forth in one plane to find the extreme positions where the LED goes "off" (for light-operate models, or "on" for dark-operate models). Position the sensor midway between the two extremes. Repeat this procedure for the other plane. After alignment, tighten all mounting screws. For visible red models, you can also look at the retroreflector with your eye as close to the

Center the retroreflector in the beam. The output indicator LED will change state if the retroreflector moves out of range.



Polarized models "see" only light rotated 90°. Polarized light is rotated 90° by the retroreflector.

sensor as possible and align the sensor until reflected light is brightest.

Stretch wrap material over a shiny surface may reflect enough light to false trigger a polarized reflex sensor. In this case, tilt the alignment axis of the sensor relative to the shiny surface.

**FIBER OPTIC SENSORS**

55 Series fiber optic sensors use glass fiber optic cables to transmit light from the sensor to the sensing position and back to the sensor for detection. Fiber optic cables are purchased separately in either single cable style (for thru-beam sensing), or duplex cable style (for diffuse reflective sensing). They are available with a wide assortment of sensing ends and have a jacket made from either stainless steel or a PVC covered monocoil steel.

Fiber optic sensors are ideal for applications in which space is restricted, temperatures are high, or tight viewing angles are required.

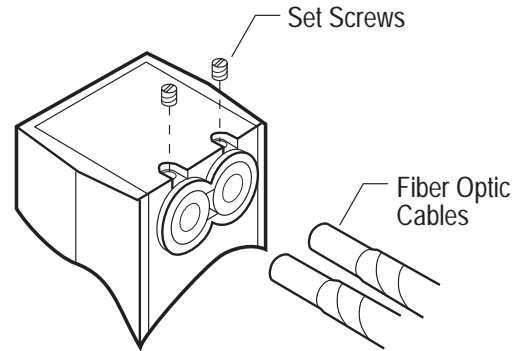
**MOUNTING LOCATION/INSTALLATION OF FIBER OPTIC CABLES**

Mount the sensor in a location that allows easy access for installing fiber optic cables, and also provides some degree of protection for the sensor if the application is in a harsh environment.

To mount the fibers in the sensor, hold the fiber at the interface between the solid and flexible portion of the fiber tip and firmly push into the hole in the brass collar on the front of the sensor as shown below. The

tip must pass through the "O" ring seal behind the collar and rest against the photo-element inside the sensor. Mount the other fiber in the same manner. Use care when handling the fibers—do not use excessive force or sharply bend the fiber optic cable as this may cause breakage of the glass filaments inside and degrade performance. Secure the fibers by tightening the set screws with the Allen wrench provided.

Position and mount the sensing end of fiber optic cable as detailed in the manual provided with your cables. Secure the cable between the sensing end and the sensor so as to provide maximum protection from shock, vibration, and any other physical abuse.



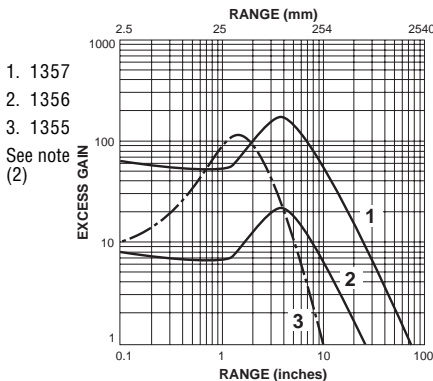
**OPTICAL PERFORMANCE**

All optical specifications are guaranteed to be the minimum performance under clean conditions of any product delivered from stock. Typical performance may be higher. Dirt in the environment will affect optical performance by reducing the amount of light the control receives. For

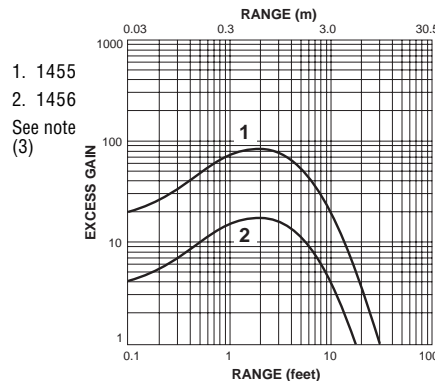
best results, sensors should be used at distances where excess gain is higher than 1.5 (1.5 times the amount of sensing power required to detect an object under ideal conditions). Higher excess gain will allow the sensor to overcome higher levels of contamination on the lens.

Sensor Type	1355	1356	1357	1455	1456	1555
Source	Infrared	Infrared	Infrared	Infrared	Visible red	Infrared
Maximum Range	10 inches	24 inches	72 inches	30 feet	15 feet	See note (1)
Optimum Range	0.25 to 5	1 to 8 inches	1 to 36 inches	0 to 15 feet	0.5 to 6 feet	---
Field of View	1 inch diameter at 10 inches	1 inch diameter at 10 inches	5.5 inch diameter at 24 inches	2 inch diameter at 100 inches	2 inch diameter at 100 inches	Varies with fiber

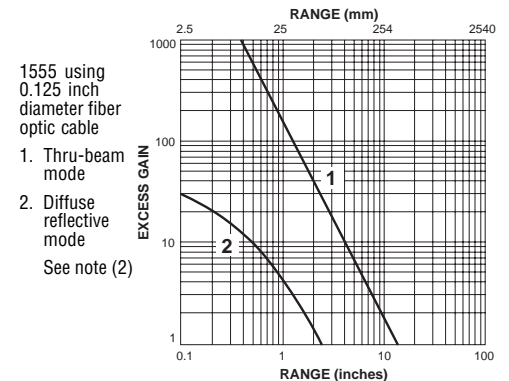
- (1) Thru-beam range is 12 inches; diffuse reflective range is 2.25 inches.
- (2) Performance to a 90% reflectance white card
- (3) Performance to a 3-inch retroreflector



- 1. 1357
  - 2. 1356
  - 3. 1355
- See note (2)



- 1. 1455
  - 2. 1456
- See note (3)



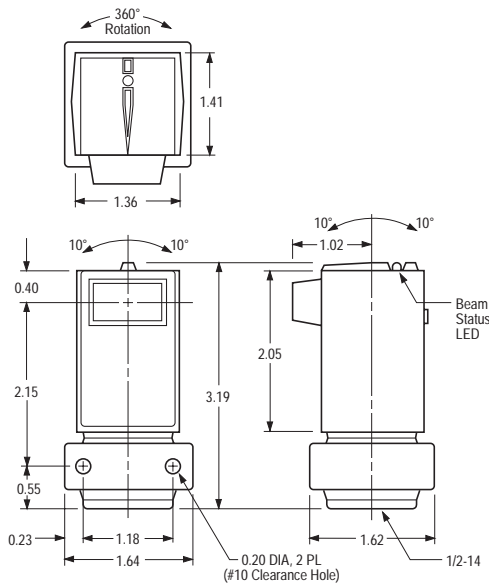
- 1555 using 0.125 inch diameter fiber optic cable
- 1. Thru-beam mode
  - 2. Diffuse reflective mode
- See note (2)

**SPECIFICATIONS**

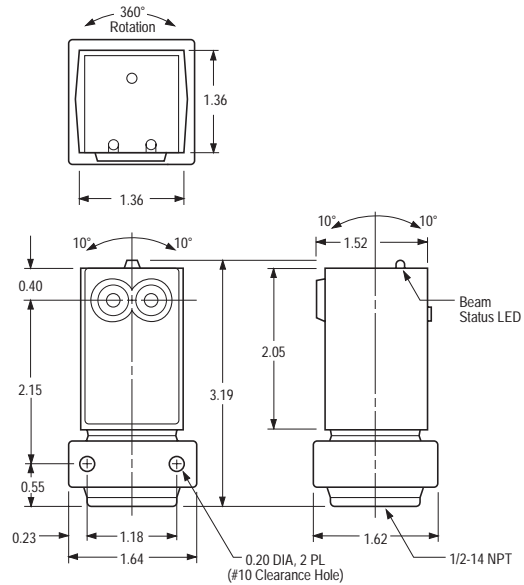
	AC/DC MODELS (AC Operation)	AC/DC MODELS (DC Operation)	DC-ONLY MODELS
<b>Input Voltage</b>	20 to 264 V ac, 50/60 Hz	15 to 30 V dc (15 to 24 V dc above 55° C/131° F)	10 to 30 V dc (10 to 24 V dc above 55° C/131° F)
<b>Power Dissipation</b>	2W maximum	2W maximum	1 W maximum
<b>Output - Standard Models</b>	VMOS (bi-directional)	NPN (sink)	NPN and PNP (dual outputs)
<b>Current Switching</b>	300 mA maximum	300 mA maximum	PNP (source): 100 mA maximum; NPN (sink): 250 mA max. (120 mA max. above 55° C/131° F)
<b>Voltage Switching</b>	375 V peak maximum	375 V peak maximum	30VDC maximum
<b>Off-State Leakage</b>	250 µA typical; 500 µA maximum	250 µA typical; 500 µA maximum	10 µA maximum
<b>Surge Current</b>	2 A maximum	2 A maximum	1 A maximum
<b>On-State Voltage Drop</b>	4 V maximum at 300 mA	1.8 V at 10 mA; 3.5 V at 300 mA	NPN: 400 mV at 10 mA, 2 V at 250 mA; PNP: 3 V at 100 mA
<b>Response Time</b>	10 mS	10 mS	1 mS
<b>Short Circuit Protection</b>	Sensor will turn off immediately when a short or overload is detected (Indicator LED will flash). Turn power OFF and back ON to reset. <b>IMPORTANT:</b> During installation, correct power connections must be made first to ensure fail-safe short circuit protection of the outputs.		
<b>Output - Relay Models</b>	SPDT Relay contact	SPDT Relay contact	Not Available on DC-only models
<b>Current Switching</b>	3 Amps	3 Amps	
<b>Voltage Switching</b>	375 V peak maximum/275 VAC	30VDC maximum	
<b>Response Time</b>	25 mS	25 mS	
<b>Relay Life Expectancy</b>	>250,000 operations at rated load, 30 million operations at no load		
<b>Light/Dark Operation</b>	By model		
<b>Temperature Range</b>	Operating and Storage: -40° to +158° F (-40° to +70° C)		
<b>Material of Construction</b>	Lens: Nylon; Body: Noryl® (avoid exposing to chlorinated, halogenated, or aromatic hydrocarbons)		
<b>Cable/Connector</b>	6-foot cable; Mini Connector; see wiring diagrams for number of wires/pins		
<b>Vibration</b>	15 g or 0.06 inch displacement, whichever is less, over 10 Hz to 2 kHz;		
<b>Shock</b>	Standard models: 40 g for 6 mS and 500 g for 2 mS, 1/2 sinewave pulse; Relay models: no contact transfer at 20 g.		
<b>Indicator LED</b>	Lights steady when output is ON; Flashes when short circuit protection is in latch condition on standard models only		
<b>Enclosure Ratings</b>	NEMA 1, 3, 4, 6, 12, and 13 (Our products conform to NEMA tests as indicated, however, some severe washdown applications can exceed these NEMA test specifications. If you have questions about a specific application, contact our Applications Department.)		
<b>Sunlight Immunity</b>	10,000 foot-candles		
<b>Approvals</b>	UL and CSA Pending		

**APPROXIMATE DIMENSIONS (SHOWN IN INCHES)**

**Diffuse Reflective and Reflex Models**



**Fiber Optic Models**



**Still Need Help?**  
 Contact the  
 Cutler-Hammer Sensor  
 Application Engineers  
**1-800-426-9184**  
 Fax: 425-513-5356

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