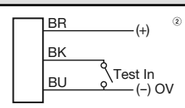
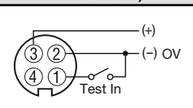
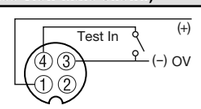
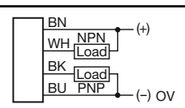
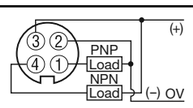
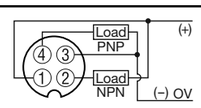
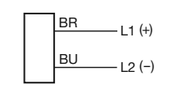
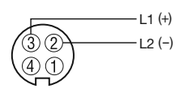
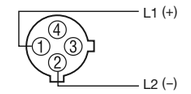
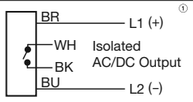
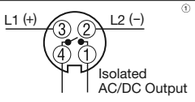
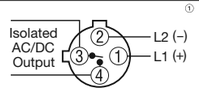
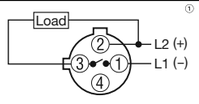
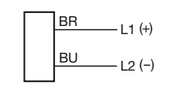
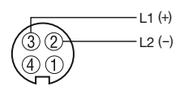
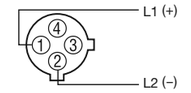
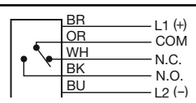
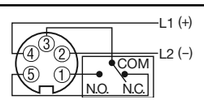
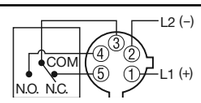
SPECIFICATIONS

	AC/DC Electromechanical Relay Models	AC/DC Solid-State Relay Models	DC Only Models
Input Voltage	12 - 240V DC 24 - 240V AC	12 - 240V DC 24 - 240V AC	10 - 40V DC
Light/Dark Operation	Switch selectable		
Operating Temperature	-13 to 122ºF (-25 to 50ºC)		
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, Overcurrent Protection and Reverse Polarity Protection		
Enclosure Rating	IP67		
Output Load	3A @ 120V AC 3A @ 240V AC 3A @ 28V AC	300 mA @ 240V AC/DC	250 mA @ 40V DC
Response Time	15 mS	2 mS	
Timer Timing Response	0 - 15 sec.		
No Load Current	<30 mA		
Leakage Current (Maximum)	—	1 mA @ 240V AC	<10 µA
Emitter LED	Diffuse, Infrared Fiberoptic models: Infrared 880 nm Reflex, Polarized Reflex, Clear Object, Visible Fiberoptic models: Visible red 660 nm		
Indicator LEDs	Yellow for Power; Green for Output; Red for Alignment		

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-Connector Models (Face View Male Shown)
10-40V DC	Thru-Beam Source			
	All Other DC Models			
12-240V DC or 24-240V AC with Solid-State Relay	Thru-Beam Source			
	All Others SS Relay Models with Isolated AC/DC Output			
	All Others SS Relay Models with Non-Isolated AC/DC Output			
12-240V DC or 24-240V AC with SPDT EM Relay	Thru-Beam Source			
	All Others EM Relay Models			

[1] Connect load to the appropriate outlet for either sinking or sourcing operation.
[2] Connecting the test input to 0V DC allows you to switch the light source off for troubleshooting while leaving the sensor under power.
[3] Over current protection is to be provided in the field. Conductor size for 20 AWG: 5 amp; 22 AWG: 3 amp; 24 AWG: 2 amp.

Powering Business Worldwide

INSTRUCTION MANUAL:
ENHANCED 50 SERIES PHOTOELECTRIC SENSORS
DIFFUSE REFLECTIVE, REFLEX, POLARIZED REFLEX, CLEAR OBJECT, AND FIBEROPTIC

MODELS COVERED IN THIS MANUAL

AC/DC Models

Style	Output Type	6-Foot Cable		Integral Micro Quick Disconnect		Integral Mini Quick Disconnect		Pigtail Micro Quick Disconnect	
		No Time Delay	With Time Delay	No Time Delay	With Time Delay	No Time Delay	With Time Delay	No Time Delay	With Time Delay
5-Foot Diffuse	Solid-State Relay	1350E-6513	1350E-8513	1350E-6543*	1350E-8543*	1350E-6503	1350E-8503	1350E-6533	1350E-8533
	Electromechanical Relay	1350E-6514	1350E-8514	N/A	N/A	1350E-6504	1350E-8504	1350E-8534	1350E-8534
10-Foot Diffuse	Solid-State Relay	1351E-6513	1351E-8513	1351E-6543*	1351E-8543*	1351E-6503	1351E-8503	1351E-6533	1351E-8533
	Electromechanical Relay	1351E-6514	1351E-8514	N/A	N/A	1351E-6504	1351E-8504	1351E-6534	1351E-8534
30-Foot Non-Polarized Reflex	Solid-State Relay	1450E-6513	1450E-8513	1450E-6543*	1450E-8543*	1450E-6503	1450E-8503	1450E-6533	1450E-8533
	Electromechanical Relay	1450E-6514	1450E-8514	N/A	N/A	1450E-6504	1450E-8504	1450E-6534	1450E-8534
16-Foot Polarized Reflex	Solid-State Relay	1451E-6513	1451E-8513	1451E-6543*	1451E-8543*	1451E-6503	1451E-8503	1451E-6533	1451E-8533
	Electromechanical Relay	1451E-6514	1451E-8514	N/A	N/A	1451E-6504	1451E-8504	1451E-6534	1451E-8534
45-Inch Clear Object Detector	Solid-State Relay	1452E-6513	1452E-8513	1452E-6543*	1452E-8543*	1452E-6503	1452E-8503	1452E-6533	1452E-8533
	Electromechanical Relay	1452E-6514	1452E-8514	N/A	N/A	1452E-6504	1452E-8504	1452E-6534	1452E-8534
Infrared Fiberoptic	Solid-State Relay	1550E-6513	1550E-8513	1550E-6543*	1550E-8543*	1550E-6503	1550E-8503	1550E-6533	1550E-8533
	Electromechanical Relay	1550E-6514	1550E-8514	N/A	N/A	1550E-6504	1550E-8504	1550E-6534	1550E-8534
Visible Fiberoptic	Solid-State Relay	1551E-6513	1551E-8513	1551E-6543*	1551E-8543*	1551E-6503	1551E-8503	1551E-6533	1551E-8533
	Electromechanical Relay	1551E-6514	1551E-8514	N/A	N/A	1551E-6504	1551E-8504	1551E-6534	1551E-8534

DC Models

Style	Output Type	6-Foot Cable		Integral Euro (Micro) Quick Disconnect		Integral Mini Quick Disconnect		Pigtail Euro (Micro) Quick Disconnect	
		No Time Delay	With Time Delay	No Time Delay	With Time Delay	No Time Delay	With Time Delay	No Time Delay	With Time Delay
5-Foot Diffuse	NPN/PNP	1350E-6517	1350E-8517	1350E-6547	1350E-8547	1350E-6507	1350E-8507	1350E-6537	1350E-8537
10-Foot Diffuse	NPN/PNP	1351E-6517	1351E-8517	1351E-6547	1351E-8547	1351E-6507	1351E-8507	1351E-6537	1351E-8537
30-Foot Non-Polarized Reflex	NPN/PNP	1450E-6517	1450E-8517	1450E-6547	1450E-8547	1450E-6507	1450E-8507	1450E-6537	1450E-8537
16-Foot Polarized Reflex	NPN/PNP	1451E-6517	1451E-8517	1451E-6547	1451E-8547	1451E-6507	1451E-8507	1451E-6537	1451E-8537
45-Inch Clear Object Detector	NPN/PNP	1452E-6517	1452E-8517	1452E-6547	1452E-8547	1452E-6507	1452E-8507	1452E-6537	1452E-8537
Infrared Fiberoptic	NPN/PNP	1550E-6517	1550E-8517	1550E-6547	1550E-8547	1550E-6507	1550E-8507	1550E-6537	1550E-8537
Visible Fiberoptic	NPN/PNP	1551E-6517	1551E-8517	1551E-6547	1551E-8547	1551E-6507	1551E-8507	1551E-6537	1551E-8537

* Versions of these sensors are available with a non-isolated output. Non-isolated output models end in -45, ex. 1350E-6545. For more information, consult wiring diagrams on Page 4.

⚠ WARNING

THESE PRODUCTS ARE NOT DESIGNED, TESTED, OR RECOMMENDED FOR USE IN HUMAN SAFETY APPLICATIONS.

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.

DO NOT USE TOOLS TO APPLY TORQUE DIRECTLY TO SENSOR BODY. ALIGN SENSOR BY HAND BEFORE TIGHTENING MOUNTING HARDWARE.

ADJUSTMENT POTS ARE 3/4 TURN DEVICES. ANY RESISTANCE ENCOUNTERED WHILE ADJUSTING THESE POTS INDICATES YOU HAVE REACHED THE ADJUSTMENT LIMIT STOP. TURNING PAST THIS STOP WILL DAMAGE THE SENSOR.

USE ONLY THE ADJUSTMENT TOOL PROVIDED OR SUITABLE SCREWDRIVER WHEN TURNING ADJUSTMENT POTS OR SETTING SWITCH POSITIONS. SHARP OBJECTS CAN DAMAGE THE SENSOR AND RESULT IN ELECTRICAL SHOCK.

ENSURE THE PRODUCT IS CONNECTED TO THE CORRECT POWER SUPPLY FOR THE APPLICATION. REFER TO THE WIRING DIAGRAMS IN THIS MANUAL.

AC/DC CONNECTOR VERSION SENSORS ARE EQUIPPED WITH AN AC-TYPE CONNECTOR. THE USE OF DC POWER WITH AC-TYPE CONNECTORS MAY NOT CONFORM WITH ESTABLISHED STANDARDS.

INTRODUCTION

Enhanced 50 Series photoelectric sensors offer flexibility, durability, and high optical performance in a low-cost self-contained package. Each sensor features several mounting options and a low-gain indicator 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 a 6-foot power cable, body-mounted quick disconnect mini connector, body mounted quick disconnect micro (AC/DC Micro or Euro (Micro)) connector, or quick disconnect micro (AC/DC Micro or Euro (Micro)) connector on a short cable pigtail. All sensors have built-in light/dark selection, and modes are available with timing features that include on-delay, off-delay, and one-shot delay.

MOUNTING

The Enhanced 50 Series sensor features a 30 mm threaded base housing and includes jam nut and washer. This allows mounting into any 1.25 inch hole. Mounting brackets. Use caution to avoid cross-threading the jam nut on the sensor body.

A second mounting method is to use #10 hardware in the mounting holes of the sensor. This is ideal for mounting the Enhanced 50 Series Sensor against a wall, piece of equipment, rail, or mounting bracket.

After mounting, ensure gain adjustment is turned fully clockwise (see Warning on Page 1 concerning pot adjustment).

DIFFUSE REFLECTIVE MODELS

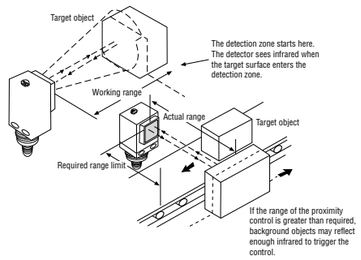
A diffuse reflective sensor operates by shining a beam of light out through the lens. When an object comes within the sensor's view, it reflects part of this beam of light back into the sensor, causing the sensor to detect the object. The maximum range at which a given object can be detected depends 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 AND SETUP FOR DIFFUSE REFLECTIVE MODELS

Select a mounting location with a clear view of the object to be detected. Avoid direct reflection from a highly reflective background (or darken the background). Mount the sensor so that it points at the most suitable part of the target object.

Be sure your power supply is off, then connect the sensor to the control circuit and power lines. Turn the power supply on and place a sample object in the beam. Slowly turn the gain adjustment clockwise (see Warning one Page 1 concerning pot adjustment) until the green (output) LED activates (assuming the sensor is in light-operate mode). Note the position and remove the sample object. Now continue turning the sensitivity setting clockwise to find the position where the green LED activates from the background reflection. Reset the sensitivity midway between the two positions. Tighten all mounting screws.

NOTE: If background reflections are low, it will be possible to achieve a maximum gain setting without the green LED lighting; in that case, set the gain midway between the first setting and maximum (this will prevent a hysteresis latch-up after sensing an object).



REFLEX, POLARIZED REFLEX, AND CLEAR OBJECT MODELS

A reflex-type 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. All these models have visible red sources. (Visible red can aid in alignment of the sensor with its retroreflector.)

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.

Clear object models are used to reliably detect semi-transparent objects (such as glass, plastic bottles or stretch-wrap film) that normally would not block enough light to cause a standard reflex sensor to switch.

USING RETROREFLECTIVE TAPE

Retroreflective tapes can have vastly different properties than corner-cube reflectors. Polarized reflex sensors will not function with some types of tape. Also, signal strength can drop dramatically as the distance between tape and sensor is reduced. If you are using a polarized sensor, or intend to mount the tape closer than 12 inches from the sensor, you must test your particular tape prior to installation.

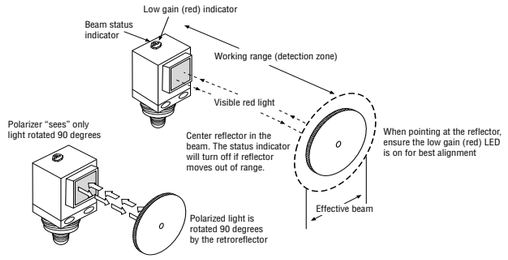
MOUNTING AND SETUP FOR REFLEX, POLARIZED REFLEX, AND CLEAR OBJECT MODELS

Locate the sensor and retroreflector on opposite sides of the target. Ensure 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 green LED goes "off" (for light-operate mode, or "on" for dark-operate mode). Position the sensor midway between the two extremes. Repeat this procedure for the other plane. After alignment, tighten all mounting screws. You can also look at the retroreflector with your eye as close to the sensor as possible and align the sensor until reflected light is brightest.

The alignment (red) indicator LED on the top of the sensor can aid in setup. Even if the sensor is working properly, it may not be optimally aligned. If this is the case, this red LED will be "off" to indicate a low gain condition. Repeating the alignment procedure until this red LED turns on will maximize the long-term reliability of the unit.

In applications where shiny objects present inadvertent detection problems in range, you may need to reduce sensor sensitivity by turning the gain adjustment counter-clockwise.

For clear object models, sensor sensitivity should be adjusted up (clockwise) for higher contrast clear objects and down (counter-clockwise) for lower contrast clear objects.



FIBER OPTIC MODELS

Fiberoptic sensors use glass (infrared models) or plastic (visible red models) fiberoptic cables to transmit light from the sensor to the sensing position and back to the sensor for detection. Fiberoptic cables are purchased separately in either single cable style (for thru-beam sensing) or duplex cable style (for diffuse reflective sensing). The cables are available with a wide assortment of sensing ends and have a jacket made from either stainless steel or a PVC-covered monocoil steel. Fiberoptic sensors are ideal for applications in which space is restricted, temperatures are high, or tight viewing angles.

OFF DELAY

In this mode, after an object leaves the detection zone delay timer starts and the sensor output does not switch until the timer has timed out. This time delay setting is variable and can be set using the adjustment pot on top of the sensor.

ONE SHOT DELAY

In this mode, after an object enters the detection zone the output switches and remains in that state for the length of the delay timer. This time delay setting is variable and can be set using the adjustment pot on top of the sensor.

INSTALLATION OF FIBER OPTIC CABLES

For infrared models with glass fibers, remove the fiber clips from the sensor nosepiece. Insert the fiber tips into the sensor and replace the clips to hold the fiber in place.

For visible models with plastic fibers, remove the fiber mounting inserts from the sensor nosepiece. Insert the cut fiber ends into the individual mounting inserts. Press the mounting inserts into the sensor nosepiece.

LIGHT OR DARK OPERATE MODES (FOR ALL MODELS)

All sensors are equipped with a light/dark operate selector switch. In Light Operate mode, the sensor output is energized when the receiver in the sensor "sees" light. For example, with a diffuse reflective sensor in Light Operate mode, the output will be energized when an object is present in the detection zone (as the sensor is "seeing" the light reflected from the target object). For a reflex sensor in Light Operate mode, the output will be energized when no object is present in the detection zone (as the sensor is "seeing" the light reflected from the reflector). In Dark Operate mode, the sensor output is energized when the receiver in the sensor does not "see" light.

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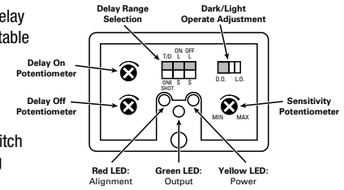
SENSORS WITH TIMING FUNCTIONS

Sensors are available with time delay functions as shown in the model table on page one of this installation guide. Sensors with built-in timing capability can be configured in four different modes using the Delay Range switch on top of the sensor. These timing capabilities are:



NO DELAY

In this mode, the time delay functionality is disabled and the sensor operates in the same way as would a standard unit. For "No Delay," the Delay Range switch must be selected to "T/D" and both delay potentiometers are turned fully CCW.

ON DELAY

In this mode, after an object enters the detection zone, the delay timer starts and the sensor output does not switch until the timer has timed out. For "On Delay," the Delay Range switch must be selected to "T/D" and the Delay On potentiometer turned CW to the desired delay time. *See **Note A** for toggling between short and long delays.*

OFF DELAY

In this mode, when an object exits the detection zone, the delay timer starts and the sensor output does not switch until the timer has timed out. For "Off Delay," the Delay Range switch must be selected to "T/D" and the Delay Off potentiometer turned CW to the desired delay time. *See **Note A** for toggling between short and long delays.*

ONE SHOT DELAY

In this mode, a change in the state of the light beam will result in a delayed output pulse. The switch labeled "D.O. / L.O." determines whether the pulse is initiated by the "light to dark" transition of the light beam or the "dark to light" transition. In the D.O. switch position, the pulse is initiated by the "light to dark" transistion, while in the L.O. position, the pulse is initiated by the "dark to light" transition.

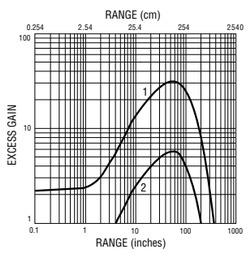
The Delay On potentiometer adjusts the delay of the time between the initiating transition and when the output pulse actually begins. The Delay Off potentiometer adjusts the duration of the output pulse. *See **Note A** for toggling between short and long delays.*

***Note A:** The positions of the Delay Range switches determine the length of time delay. When put into the "S" position, the respective delay potentiometer works over a short time delay range of 0-1.5 seconds (approximate). When put into the "L" position, the respective delay potentiometer works over a time delay range of 0-15 seconds (approximate).*

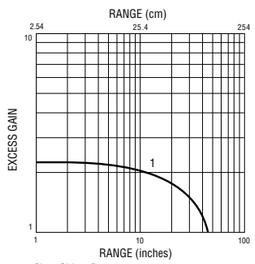
OPTICAL PERFORMANCE

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. All diffuse sensor ranges and excess gain graphs are based on a 90 percent reflectance white card.

EXCESS GAIN CURVES

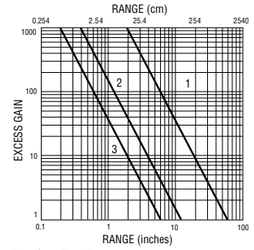


Reflex
3" Retroreflector:
1. 1450E
2. 1451E

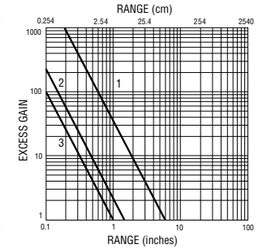


Clear Object Detector
3" Retroreflector
1. 1452E

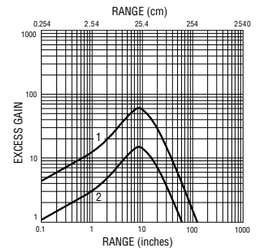
EXCESS GAIN CURVES (CON'T)



Fiber Optic Thru-Beam
.125" Dia. Glass Fiber:
1. 1550E
2. 1551E
.040" Dia. Plastic Fiber:
3. 1551E



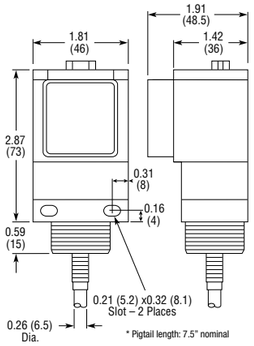
Fiber Optic Diffuse
.125" Dia. Glass Fiber:
1. 1550E
2. 1551E
.040" Dia. Plastic Fiber:
3. 1551E



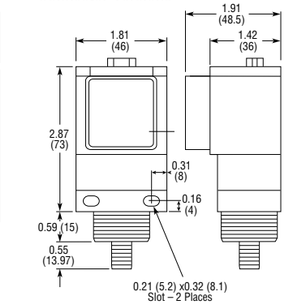
Diffuse Reflective
90% Reflectance White Card:
1. 1351E
2. 1350E

DIMENSIONS IN INCHES (MM)

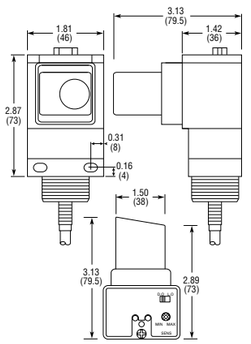
Cable and Pigtail Connector* Versions



AC/DC Micro or Euro (Micro) Connector Versions



Clear Object Versions
(Cable Version Shown)



Mini Connector Versions