Instruction Manual
E51 Thru-Beam Photoelectric Sensor

INTRODUCTION

The E51 Thru-Beam Photoelectric Sensor consists of two separate components; a source which produces a modulated infrared light beam, and a detector which detects the emitted infrared light beam. The detector is "tuned" to receive modulated infrared light, and to resist the effects of ambient light.

The detector head (Catalog Number E51DC1) mounts on any E51 solid state switch body. It is a modular component of a sensor and is not an operative device by itself. The complete detector is comprised of three components: the sensor head, a solid-state plug-in switch body and a wiring receptacle. The switch body and wiring receptacles are shared with other E51 sensors for other applications such as inductive proximity sensors. The components are readily assembled to form a complete, self-contained photoelectric detector. The detector head can be mounted in any one of four discrete positions, located ninety degrees apart.

Solid state plug-in switch bodies are available for use with the photoelectric detector head in several configurations with different optional features.

The following catalog numbers represent the photoelectric sources available, each designed to operate at a different voltage.

E51DEL	120 V AC - 50/60 Hz.
E51DEL40	240 V AC - 50/60 Hz.
E51DEL24	24 V AC - 50/60 Hz.
E51DED	10-30 V DC

All AC sources plug into our standard Catalog No. E50RA wiring receptacle.

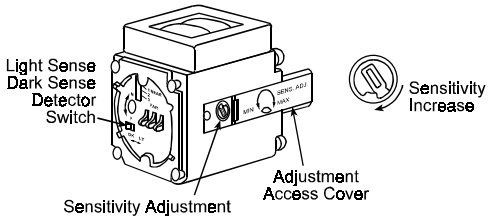
The DC source plugs into our standard Catalog No. E51RN wiring receptacle.

The source head can be mounted in any one of four discrete positions located ninety degrees apart.

DETECTOR SENSITIVITY ADJUSTMENT

The sensitivity adjustment is located on the detector head. For most applications the adjustment should be left on the high fully clockwise setting. For some applications, the amount of light energy available may be too high, and the sensitivity will need to be reduced for proper operation. This may occur when the detector and source are located substantially closer than the rated sensing distance and/or when the objects sensed are translucent to the infrared beam. Some materials usually thought to be opaque such as thin sections of paper, plastic, wood, etc., may be translucent to the infrared beam. For these applications the sensitivity must be reduced.

To reduce sensitivity, first insert a small screwdriver into the slot at the base of the access cover and gently twist to open and slide the cover upwards, exposing the control pot. Next, insert the screwdriver into the adjustment pot and turn in a "counterclockwise" direction to reduce sensitivity. Set position of the pot for optimum performance.



CAUTION

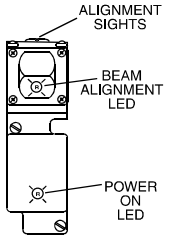
DO NOT APPLY POWER TO THE SWITCH WHILE THE HEAD IS NOT ATTACHED. DO NOT ATTACH THE HEAD WHILE POWER IS APPLIED TO THE SWITCH. LINE VOLTAGE WITH RESPECT TO GROUND IS PRESENT ON EXPOSED SWITCHBODY PRINTED CIRCUIT BOARD WITH HEAD REMOVED.

SENSING MODE

Dark Sensing - The sensor output will be energized when it detects an absence of light. The Thru-Beam sensor is a dark sensing device when used with the LT/DK switch in the DK position.

Light Sensing - The sensor output will be energized when it detects the presence of light. The Thru-Beam sensor is a light sensing device when used with the LT/DK switch in the LT position.

Each source contains a "Power On" LED which illuminates with power applied to the device. Also included in the lower half of the lens of each source is a visible Beam Alignment LED which illuminates when infrared light is being emitted from the upper half of the lens (See illustration below.)



SOURCE-DETECTOR ALIGNMENT PROCEDURE

Alignment of the emitted infrared beam can be accomplished by first using the sights on top of the source head to approximately locate the detector or vice versa. To further aid in alignment, the Beam Alignment LED is used as follows. When viewed from the detector head, the point at which the Beam Alignment LED in the source head appears brightest indicates approximate correct beam alignment. With the detector head aimed directly at the source, continue with the following alignment procedures.

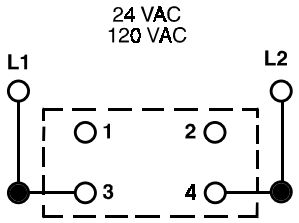
1. Move the detector back and forth in the horizontal axis to find the extreme positions where the output indicator on the detector goes “off” (for dark operate models, or “on” for light operate models). Position the detector midway between the two extremes. Repeat this procedure for the vertical axis, then tighten the detector in place.
2. Now repeat the final alignment procedure for the source. Assistance may be required to observe the red LED on the detector. Or, a test lamp, observable from the source location, may be connected in the detector load circuit.
3. Steps 1 to 2 will give a coarse alignment. Refine the alignment by covering half of the detector lens to reduce Excess Gain. Then repeat the steps above with the detector lens half covered.

TARGET SENSING AREA

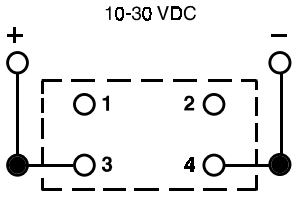
In order for the target to be detected it must fully block the light beam that travels in a straight line from the source lens to the detector lens. This is known as the “effective beam” and is roughly the same size and shape as the lens (about 0.8 inch in diameter). The target being sensed must be at least the size of this effective beam to be detected.

MAINTENANCE

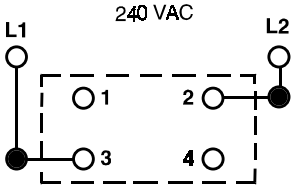
When the sensor is used under contaminating conditions, periodic cleaning of lens in source and detector with a clean, dry cloth is recommended.



E51DEL, E51DEL24
SOURCE WIRING DIAGRAM



E51DED
SOURCE WIRING DIAGRAM



E51DEL40
SOURCE WIRING DIAGRAM

GLOSSARY

Ambient Light — Light in the area of a photoelectric sensor which does not originate with its light source.

Infrared (IR) — An invisible light beyond the range of the visible spectrum in the red region.

Modulated Light — The infrared source is pulsed at a specific frequency so that the photodetector, tuned to the same pulse frequency, detects only the desired light source. This eliminates interference by ambient light.

Thru-Beam — The source and detector - switchbody combination are positioned opposite each other, so that light from the source shines directly at the detector. The object to be detected passes between the two.

Time Delay Before Availability — The response time is the time between the application of power to the photoelectric sensor and the availability of the photoelectric sensor to function as intended.

Response Time — The time it takes for a device to respond to an input signal. The sum of the sensor, amplifier, and output response is the total response time.

⚠ CAUTION

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⚠ CAUTION

WHEN SENSOR HEADS ARE ADDED OR CHANGED, THE HEAD MUST BE SECURELY TIGHTENED TO THE SWITCHBODY ASSEMBLY. TO ASSURE AND MAINTAIN A GOOD SEAL, 18 IN.-LBS. OF TORQUE ARE REQUIRED AT THE SENSOR HEAD SCREWS. (APPLY 12IN.-LBS. FOR E51SCN SWITCHES ONLY.)

EXCESS GAIN

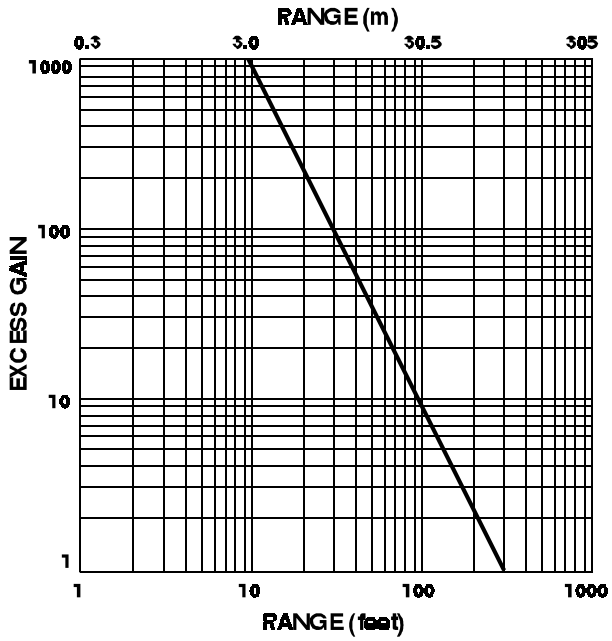
Excess Gain is a measure of the amount of light available to the detector as compared to the minimum amount necessary to operate the detector circuits. Expressed as a ratio, it indicates the amount of extra light available to overcome contamination. This extra light strength permits detection despite the attenuation of smoke, fog, dirt or dust. The curves show the relationship between Excess Gain and Scanning Distance - these curves are based on “clean air”.

The Excess Gain chart expresses the gain required to overcome the effects of some commonly encountered environmental conditions. If the gain required is not available, the device can not be used under the conditions listed.

EXCESS GAIN REQUIREMENTS [1]

Condition of environment where device is to be used.	Correction Factor	
	Location of Source or Detector	Location of both Source and Detector
Clean Air (Ideal conditions, climate controlled or sterile areas)	1.0	1.0
Relatively Clean (Office buildings)	1.25	1.6
Lightly Dirty (Warehouses, post offices, clean processes)	1.6	3.2
Dirty (Steel mills, saw mills, paper plants)	8.0	64
Very Dirty (Steam tunnels, car washes, grinding/cutting tools with coolants)	25	625
Extremely Dirty (Coal bins, grain elevators, fast buildup of thick layers)	100	10,000

[1] Figures are approximate and average — may be subjectively varied by as much as ±50%.



SPECIFICATIONS

Source

Operational Voltage
- E51DEL24 ..... 24 Vac - 50/60 Hz
- E51DEL ..... 120 Vac - 50/60 Hz
- E51DEL40 ..... 240 Vac - 50/60 Hz
- E51DED ..... 10 - 30 Vdc

Field of View ..... 36 inch diameter at 20 feet

Burden Current
- DEL, DEL40, DED ..... 30 mA
- DEL24 ..... 50 mA

Detector

Electrical Specifications ..... See instruction publication for specific switch body used

Operation Mode ..... Light or dark detect - selectable

Sensitivity Control Range ..... Min 10-1; Typ 15-1

Response Time
- AC Switch body ..... 10 mS
- DC Switch body ..... 5 mS

Maximum Operating Frequency
- AC Switch body ..... 50 Hz
- DC Switch body ..... 100 Hz

E51 Thru-Beam System

Ambient Temperature Range ..... -25° to 70° C (13° to 158° F)

Enclosure Rating ..... NEMA 3, 3S, 4, 4X, 6, 6P, 13

Vibration ..... 30 g over 10 Hz - 2 KHz, Sine

Shock ..... 50 g for 10 mS - 1/2 Sine pulse

Approvals ..... UL, CSA

Materials
- Head ..... PAE/Polysulfone
- Body
  - E51SCN ..... PAE
  - All others ..... Die cast metal

Optical Specifications

Type ..... Thru-beam

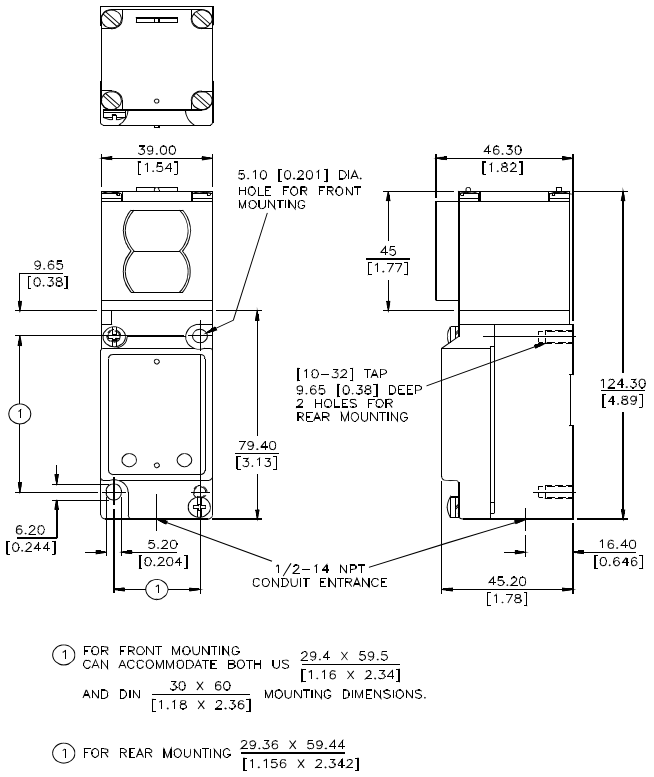
Range ..... 300 feet

Field of View ..... 18” diameter at 20 feet

Effective Beam ..... 0.8” diameter

Sunlight Immunity ..... 10,000 foot-candles

Source Light ..... Infrared, 880 nm



The installation and use of Cutler-Hammer products should be in accordance with the provisions of the U.S. National Electric Code and/or other local codes or industry standards that are pertinent to the particular end use. Installation or use not in accordance with these codes and standards could be hazardous to personnel and/or equipment.

Still Need Help?

Contact the Cutler-Hammer Sensor Application Engineers

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Effective 5/13/97
Printed in U.S.A.