

Installation Instructions—PHOTOSWITCH® Series 9000 Diagnostic Photoelectric Sensors

All Sensors		Standard Diffuse	Retroreflective	Polarized Retroreflective	Transmitted Beam		
					Receiver	Light Source 1 ☉	Light Source 2 ☉
1	Sensor Type	Diagnostic					
2	Sensing Distance	1.5m (5ft)	—	—		61m (200ft)	152m (500ft)
	78mm (3in) Reflector	—	9.1m (30ft)	4.9m (16ft)	—		
	32mm (1.25in) Reflector	—	3.6m (12ft)	2m (6.5ft)	—		
	16mm (0.625in) Reflector	—	3m (10ft)	0.9m (3ft)	—		
3	Transmitting LED	Infrared 880nm	Visible Red 660nm		—	Infrared 880nm	
4	Indicators	Yellow: Power, Green: Output, Red: Stability, Flashing Green: 0.7 < Margin < 1.0, Flashing Yellow: 1.0 < Margin < 1.5					
5	Field of View	3.5°	1.5°				
6	Sensitivity Adjustment	Single Turn Potentiometer					
7	Operating Temperature	0° C to +70° C (0° F to +158° F)					
8	Relative Humidity	5% to 95%					
9	Housing / Lens Material	Valox®/Acrylic					
10	Operating Environment	NEMA 3, 4X, 6P, 12, 13, IP67					
11	Approvals	UL listed, CSA certified, CE marked for all applicable directives					
12	Protections	All Versions: False Pulse, Solid State Output Versions: Short Circuit, DC Versions: Reverse Polarity and Overload					
13	Vibration	10–55 Hz, 1 mm amplitude, Meets or exceeds IEC 947–5–2					
14	Shock	30G with 1 ms pulse duration, Meets or exceeds IEC 947–5–2					

10-30V DC Sensors—Selectable NPN/PNP N.O./N.C. Dynamic/Static

15	Catalog Number—2m 300V cable	42GDP-9000	42GDU-9000	42GDU-9200	42GDR-9000	42GRL-9000	42GRL-9040
	Catalog Number—4-pin DC micro QD	42GDP-9000-QD	42GDU-9000-QD	42GDU-9200-QD	42GDR-9000-QD	42GRL-9000-QD	42GRL-9040-QD
	Catalog Number—4-pin mini QD	42GDP-9000-QD1	42GDU-9000-QD1	42GDU-9200-QD1	42GDR-9000-QD1	42GRL-9002-QD	42GRL-9042-QD
16	Supply Current	30mA				15mA	
17	Output Energized	Light/Dark Selectable				—	—
18	Load Current	100mA				—	—
19	Leakage Current	10µA				—	—
20	Power Consumption	1 watt max					
21	Response Time	2ms			5ms	—	—

90-264V AC, 95-264V DC Sensors—N.O. Relay, Diagnostic: SPST Relay, N.O./N.C. Selectable

15	Catalog Number—2m 300V cable	42GDP-9004	42GDU-9004	42GDU-9204	42GDR-9004	—	—
	Catalog Number—5-pin mini QD	42GDP-9004-QD	42GDU-9004-QD	42GDU-9204-QD	42GDR-9004-QD	—	—
16	Supply Current	15mA					
17	Output Energized	Light/Dark Selectable				—	—
18	Load Current	Sensor: 2A@120V AC, Diagnostic: 1A@120V AC, 0.5A@240V AC				—	—
19	Leakage Current	—					
20	Power Consumption	4 watts/4VA max					
21	Response Time	15ms				—	—

90-264V AC, 95-264V DC Sensors—N.C. Relay, Diagnostic: SPST Relay, N.O./N.C. Selectable

15	Catalog Number—2m 300V cable	42GDP-9005	42GDU-9005	42GDU-9205	42GDR-9005	—	—
	Catalog Number—5-pin mini QD	42GDP-9005-QD	42GDU-9005-QD	42GDU-9205-QD	42GDR-9005-QD	—	—
16	Supply Current	15mA					
17	Output Energized	Light / Dark Selectable				—	—
18	Load Current	Sensor: 2A@120V AC, Diagnostic: 1A@120V AC, 0.5A@240V AC				—	—
19	Leakage Current	—					
20	Power Consumption	4 watts/4VA max					
21	Response Time	15ms				—	—

❶ Transmitted Beam Source rated 10-264V AC/DC.

Operation

Series 9000 Diagnostic photoelectric sensors provide additional information about the operation of the sensor and application. A separate discrete output signal is provided when a failure has been detected or when there is insufficient application quality. The exact nature of the failure or application problem is communicated through a series of LED indicators on top of the sensor.

Other standard Series 9000 features are built into these sensors, see page 1–33 of the C112 *Sensor* catalog for a description.

Diagnostic Output

The Diagnostic Output signals that the sensor may be operating in an unstable state or that a sensor output is shorted/overloaded.

Insufficient Application Quality

The sensor measures margin values to determine application quality. If the operating margin for an application is too high or too low, the diagnostic output will change state.

In a diffuse application, the peak margin when detecting the target may be too low (operating margin 1.0 to 1.5), or the margin when detecting the background may be too high (operating margin 0.7 to 0.99). In a retroreflective or polarized retroreflective application the margin when detecting the reflector or reflective tape may be too low (operating margin 1.0 to 1.5) or the margin when target is detected may be too low (operating margin 0.7 to 0.99).

The LED indicators will identify the specific application problem. Refer to *Indicators* for a description.

Overload or Short Circuit at Outputs

10–30V DC sensors have a single output that is switch selectable for NPN or PNP and Light Operate or Dark Operate. If a short circuit or overload is detected in the output, the diagnostic output will change state. The LED indicators will provide information about this condition, refer to *Indicators* for a description.

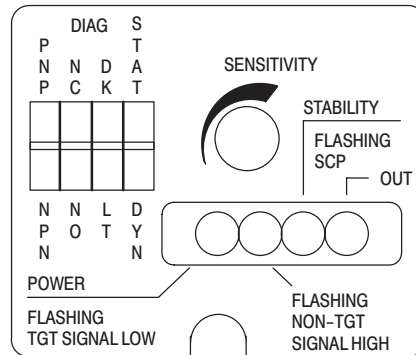
Adjustments and Indicators

Refer to the Top View illustrations on the right.

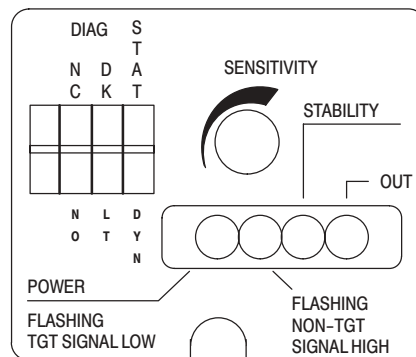
Switch Selectable Features

- NPN/PNP (DC sensors only)—Select NPN or PNP Sensor and Diagnostic Outputs
- NC/NO—Configure Diagnostic Output for Normally Open or Normally Closed operation
- DK/LT—Configure Sensor output for Dark Operate (DK) or Light Operate (LT)
- STAT/DYN—Select Static or Dynamic Diagnostic Output Operation (see below)

Top View Detail (DC)



Top View Detail (AC/DC)



Indicators

The function of the LED indicators is shown in the table in the last column on this page (from left to right). Whenever the Yellow indicator is On steady, the sensor is operating in a stable condition and there are no faults. Whenever the sensor is powered, but the Yellow indicator is off or flashing, the flashing indicators will show the source of the problem.

Static and Dynamic Diagnostic Operating Modes

Static or Dynamic diagnostic sensing modes are switch selectable.

The Static mode is designed for web sensing or other applications in which an immediate diagnostic output is required when an unstable sensing condition occurs (operating margin is greater than 0.7 and less than 1.5).

The Dynamic mode is useful in repetitive applications where targets are constantly moving into and out of the sensor's field of view. These applications could include packages moving on a conveyor, material on a moving product line, etc. To minimize "nuisance" diagnostic outputs due to occasional, random fluctuations in operating margin, sensors set in the Dynamic mode provide a diagnostic output only after detection of seven successive "unstable" signals.

Dynamic Diagnostic Operating Mode (refer to illustration on next page)

Condition 1: The amount of reflected light detected by the sensor when the target is present (diffuse sensing) or when the target is absent (retroreflective, polarized retroreflective, or transmitted beam sensing) is too low. This may be due to dust or dirt on the lenses or misalignment. The Diagnostic Output changes state after the sensor senses 7 consecutive low margin signals from these targets (operating margin below 1.5). At the same time the yellow TGT SIGNAL LOW indicator flashes and the red STABILITY indicator turns off.

Corrective Action: Clean the lenses and/or realign the sensor(s). The Diagnostic Output will return to the original state when a stable operating margin (operating margin of 1.5 or greater) is achieved. The yellow TGT SIGNAL LOW indicator stops flashing and the red STABILITY indicator turns on.

Condition 2: The amount of light detected by the Receiver when the target is absent (diffuse sensing) or when the target is present (retroreflective, polarized retroreflective, or transmitted beam sensing) is too high. This may also be due to a reflective background (diffuse sensing) or targets that are too small or translucent for reliable sensing (retroreflective, polarized retroreflective, or transmitted beam sensing). The Diagnostic Output changes state after the sensor senses 7 consecutive high margin signals (operating margin remains above 0.7). At the same time the green NON-TGT SIGNAL HIGH indicator begins to flash and the red STABILITY turns off.

Corrective Action: Reduce the sensitivity of the sensor (both Light Source and Receiver intensity are adjustable on transmitted beam sensors) and/or reposition the sensors and targets. The Diagnostic Output will return to the original state when a stable operating margin (below 0.7) is achieved. The green NON-TGT SIGNAL HIGH indicator stops flashing and the red STABILITY indicator turns on.

Static Diagnostic Operating Mode (refer to illustration on next page)

The Diagnostic Output changes state immediately whenever the detected margin is between 0.7 and 1.5 indicating that the application is unstable. Both the green NON-TARGET SIGNAL HIGH and yellow TARGET SIGNAL LOW indicators will flash. The indicators will stop flashing and the Diagnostic Output will return to the original state when a stable operating margin is achieved (below 0.7 or above 1.5).

Indicators (Left to Right)

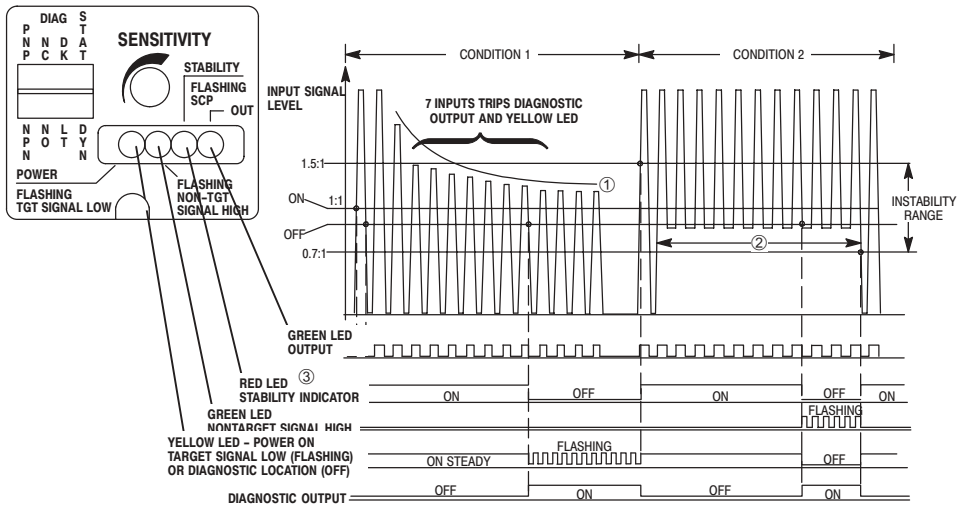
Label	Color	State	Diagnostic Operating Mode	
			Static	Dynamic
POWER	Yellow	On Steady	Sensor Power On	
FLASHING TGT SIGNAL LOW		Flashing	Unstable operation (0.7 < Margin < 1.5)	1.0 < Margin > 1.5 for seven successive operations Diffuse: Target margin too low Retro / Polarized Retro: Reflector margin too low Transmitted Beam unbroken beam margin too low
FLASHING NON-TGT SIGNAL HIGH		Flashing	Unstable operation (0.7 < Margin < 1.5)	0.7 < Margin < 1.0 for seven successive operations Diffuse: Background margin too high Retro / Polarized Retro: Target margin too high Transmitted Beam broken beam margin too high
STABILITY(1)	Red	On Steady	Stable operation (Margin < 0.7 or Margin > 1.5)	
FLASHING SCP		Off	Unstable operation (0.7 < Margin < 1.5)	
		Flashing(2)	Overload or short circuit at sensor output	
OUTPUT	Green	On	Output energized	

(1) To prevent potentially confusing indications during rapid signal transitions, the red STABILITY indicator has a typical delay of 100ms before it turns off.

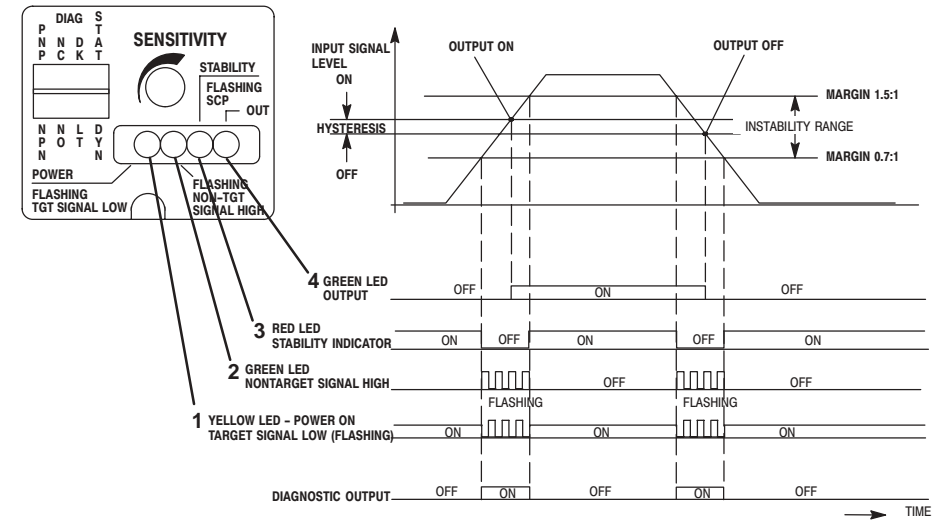
As a result, the indicator will not turn off for quick, brief events. (The Diagnostic Output has no delay.)

(2) 10–30V DC sensors only.

DYNAMIC Operating Mode



STATIC Operating Mode

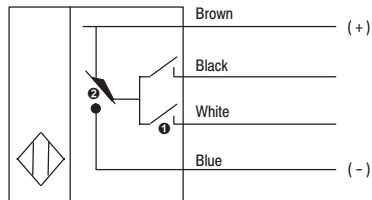


Wiring Diagrams

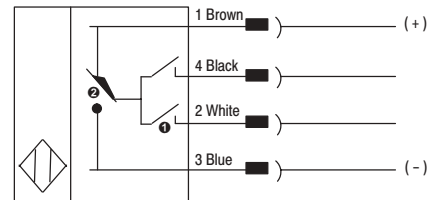
DC Sensors

Cable Version:

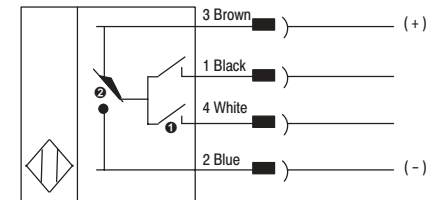
Models: 42G __-9xx0



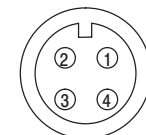
Models: 42G __-9xx0-QD



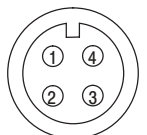
Models: 42G __-9xx0-QD1



QD



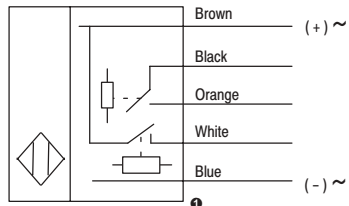
QD1



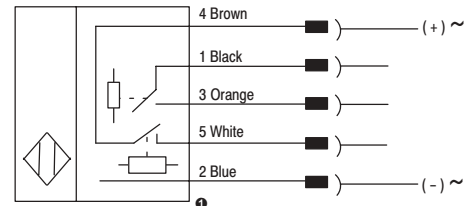
AC/DC Sensors

Cable Version:

Models: 42G __-9x04

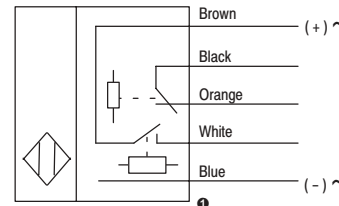


Models: 42G __-9x04-QD

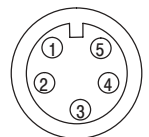
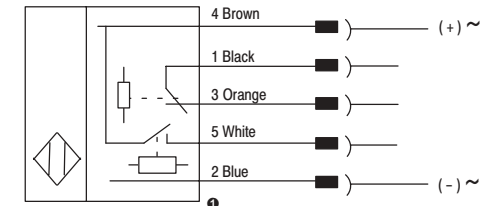


Cable Version:

Models: 42G __-9x05



Models: 42G __-9x05-QD



① NO/NC Selectable

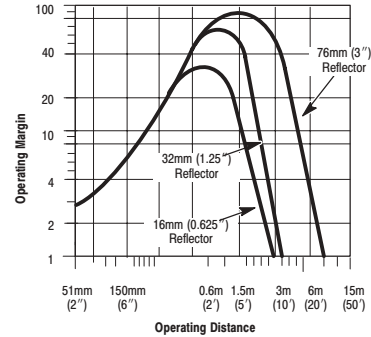
② PNP/NPN Selectable

Note: Details regarding connection of Allen-Bradley Series 9000 photoelectric sensors to Allen-Bradley Programmable Controllers can be found in Publication 42GR-7.4.

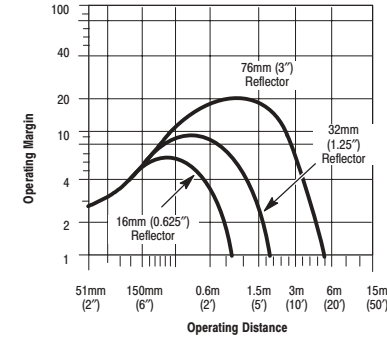
All wire colors shown refer to Allen-Bradley quick-disconnect cables.

Typical Response Curves

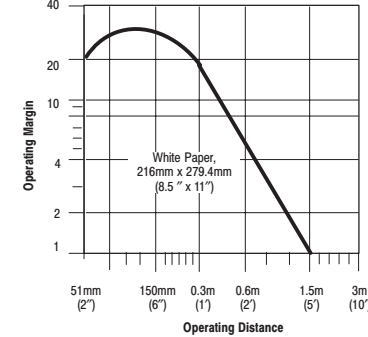
Retroreflective



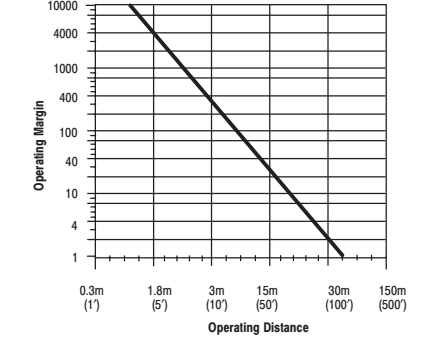
Polarized Retroreflective



Standard Diffuse

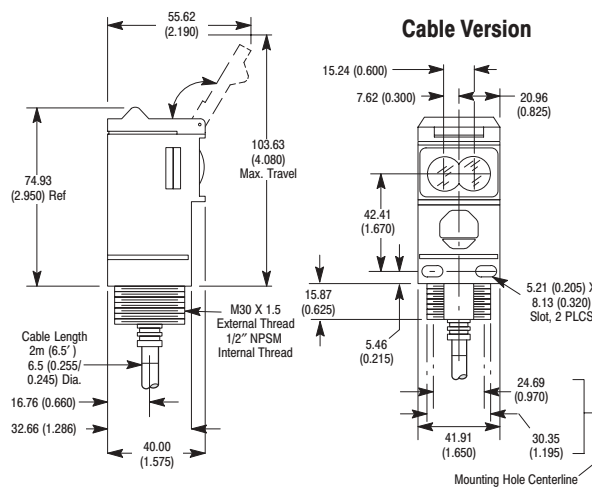


Transmitted Beam

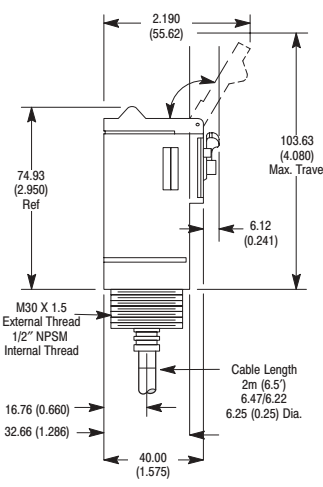


Dimensions—mm (inches)

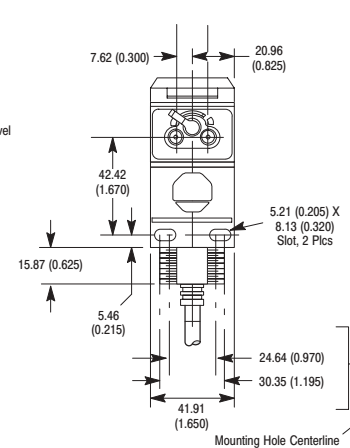
All Versions Except Fiber Optic



Fiber Optic

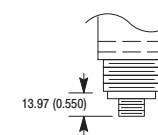


Cable Version

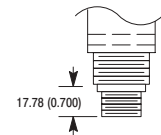


Connector Version

Micro Style



Mini Style

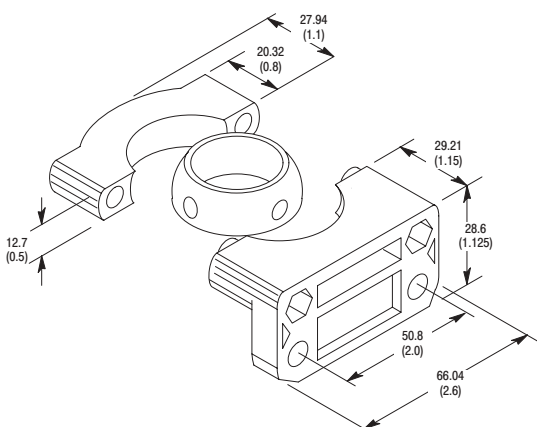


Thread Size

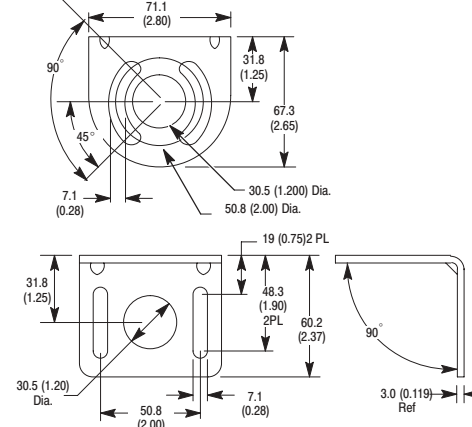
	AC	DC
Micro Style	1/2-20 UNF 2 Keyways	M12 x 1 1 Keyway
Mini Style		7/8-16 UN 1 Keyway

Accessories—mm (inches)

Swivel/Tilt Mounting Assembly #60-2439



Universal Mounting Assembly #60-2421



360° Rotation Mounting Assembly #60-2513

