DF-G1 - Expert Fiber Amplifier Install Sheet

Advanced sensor with dual digital displays for use with plastic and glass fiber optic assemblies

For the latest technical information about this product, including specifications, dimensions, and wiring, see *www.BannerEngineering.com*

Overview

Figure 1. DF-G1 Model Features

1	Output LED
2	LO/DO Switch
3	RUN/PRG/ADJ Mode Switch
4	Lever Action Fiber Clamp
5	Red Signal Level
6	Green Threshold
7	+/SET/- Rocker Button

Models

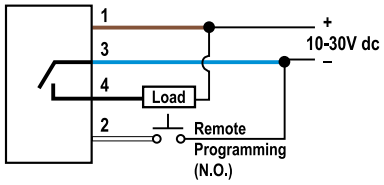
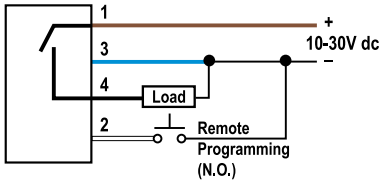
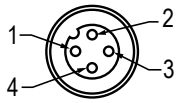
Model	Outputs	Connector*
DF-G1-NS-2M	Single NPN	2 m (6.5') cable, 4-wire
DF-G1-PS-2M	Single PNP	
DF-G1-NS-Q3	Single NPN	150 mm (6") PVC pigtail, M8 Pico QD connector, 4-pin
DF-G1-PS-Q3	Single PNP	
DF-G1-NS-Q7	Single NPN	Integral M8 Pico QD connector, 4-pin
DF-G1-PS-Q7	Single PNP	

* Cordset Options: A model with a QD connector requires a mating cordset. For 9 m cable, change the suffix 2M to **9M** in the 2 m model number (example, DF-G1-NS-**9M**). For M12 Euro QD pigtail change the suffix 2M to **Q5** in the 2 m model number (example, DF-G1-NS-**Q5**).

WARNING: Not To Be Used for Personnel Protection

Never use this product as a sensing device for personnel protection. Doing so could lead to serious injury or death. This product does NOT include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

Hookups

NPN Models	PNP Models	Key
		

1 = Brown
2 = White
3 = Blue
4 = Black

For cable options, see *http://www.bannerengineering.com*

Top Panel Interface

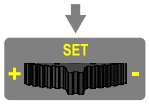
Opening the dust cover provides access to the top panel interface. The top panel interface consists of the RUN/PRG/ADJ mode switch, LO/DO switch, +/SET/- rocker button, dual red/green digital displays, and output LED.

RUN/PRG/ADJ Mode Switch

The RUN/PRG/ADJ mode switch puts the sensor in RUN, PRG (Program), or ADJ (Adjust) mode. RUN mode allows the sensor to operate normally and prevents unintentional programming changes via the +/SET/- button. PRG mode allows the sensor to be programmed through the display driven programming menu (see **Program Mode** below). ADJ mode allows the user to perform Expert TEACH/SET methods and Manual Adjust (see **Adjust Mode** below).

LO/DO Switch

The LO/DO switch is used to select Light Operate or Dark Operate mode. In Light Operate mode, the output is ON when the sensing condition is above the threshold (for Window SET, the output is ON when the sensing condition is inside the window). In Dark Operate mode, the output is ON when the sensing condition is below the threshold (for Window SET, the output is ON when the sensing condition is outside the window).



+/SET/- Rocker Button

The +/SET/- rocker button is a 3-way button. The +/- positions are engaged by rocking the button left/right. The SET position is engaged by clicking down the button while the rocker is in the middle position. All three button positions are used during PRG mode to navigate the display driven programming menu. During ADJ mode, SET is used to perform TEACH/SET methods and +/- are used to manually adjust the threshold(s). The rocker button is disabled during RUN mode, except when using Window SET, see *Window SET* on page 6 .

Red/Green Digital Displays

During RUN and ADJ mode, the Red display shows the signal level and the Green display shows the threshold. During PRG mode, both displays are used to navigate the display driven programming menu.

Output LED

The output LED provides a visible indication when the output is activated.

Remote Input

For more information about how to perform TEACH/SET methods and to program the sensor remotely, see the DF-G1 Manual.

Run Mode

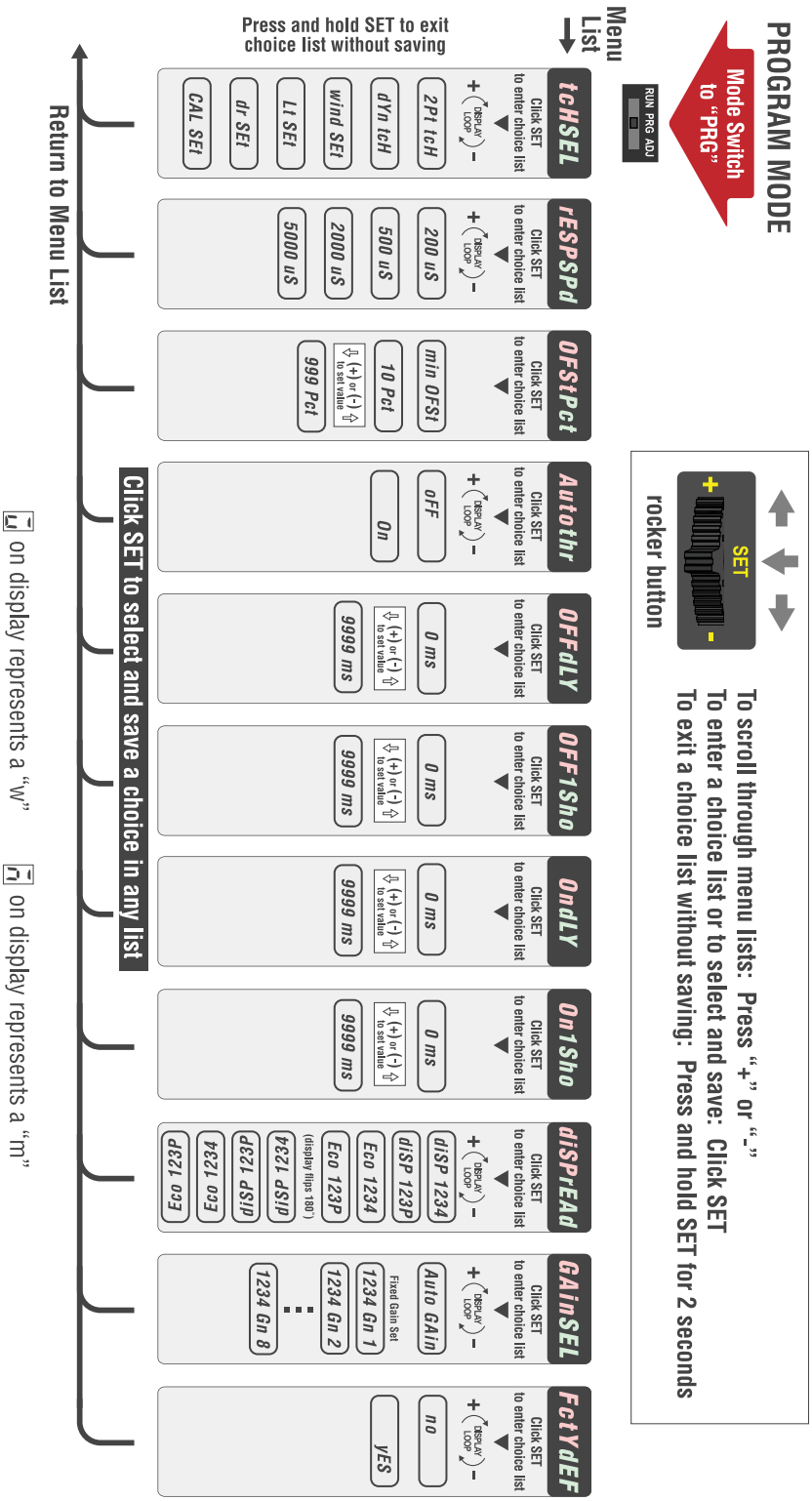
Run mode allows the sensor to operate normally and prevents unintentional programming changes. The +/SET/- rocker button is disabled during RUN mode, except when using Window SET, see *Window SET* on page 6 .

Program Mode

Program (PRG) mode allows the following settings to be programmed in the DF-G1 :

Factory Default Settings:

Setting	Factory Default
Threshold	2026
TEACH Selection	Two-Point TEACH
Response Speed	Standard - 500 us
Offset Percent	10%
Auto Thresholds	OFF
OFF Delay	0 (Disabled)
OFF One-Shot	0 (Disabled)
ON Delay	0 (Disabled)
ON One-Shot	0 (Disabled)
Display Readout	Numeric, ECO disabled, Normal Orientation
Gain Selection	Auto Gain



Adjust Mode

Sliding the RUN/PRG/ADJ mode switch to the ADJ position allows the user to perform Expert TEACH/SET methods and Manual Adjustment of the threshold(s).

Two-Point TEACH

- Establishes a single switching threshold
- Threshold can be adjusted using "+" and "-" rocker button (Manual Adjust)

Two-Point TEACH is used when two conditions can be presented statically to the sensor. The sensor locates a single sensing threshold (the switchpoint) midway between the two taught conditions, with the Output ON condition on one side, and the Output OFF condition on the other (see Figure below). The Output ON and OFF conditions can be reversed by using the LO/DO (Light Operate/ Dark Operate) switch (see **LO/DO Switch** in *Top Panel Interface* on page 2).

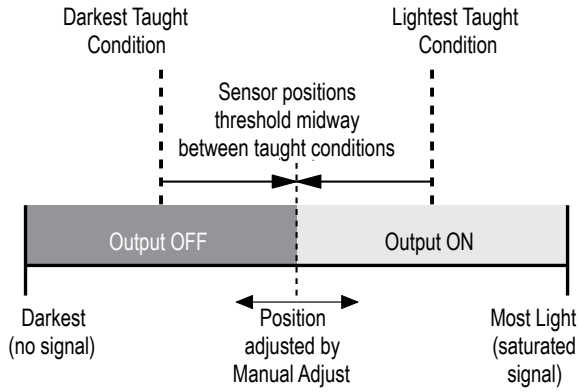
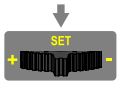
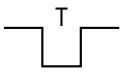
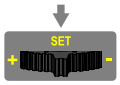
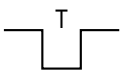


Figure 2. Two-Point TEACH (Light Operate shown)

Two-Point TEACH and Manual Adjust

- Moves switching threshold value up or down to make adjustments
- Slide Mode switch to ADJ to enter Adjust mode
- Press "+" to increase; press "-" to decrease
  - GREEN display shows the switching threshold value
  - 2 seconds after adjustment, the GREEN display will flash 3 times to confirm
- Slide Mode switch to RUN to complete operation

Remember: Manual adjustments are disabled when Auto Thresholds are ON

	SET Button 0.04 seconds ≤ "Click" ≤ 0.8 seconds	Remote Input 0.04 seconds ≤ T ≤ 0.8 seconds	Result
	Note: TEACH Selection must be programmed to **2Pt tcH** (see *Program Mode* on page 3)		
Enter Adjust Mode	Set Mode switch to ADJ 	No action required; sensor is ready for Two-Point TEACH method	**Display: Red -** Signal Level; **Green -** Threshold 
TEACH 1st Condition	• Present 1st condition • Click the SET rocker button 	• Present 1st condition • Single-pulse remote input 	**Display:** Flashes "**2Pt tch**" then holds on "**1234 2nd**" 
TEACH 2nd Condition	• Present 2nd condition • Click the SET rocker button 	• Present 2nd condition • Single-pulse remote input 	**TEACH Accepted** Displays alternate "**PASS**" and % Minimum Difference*; Sensor returns to Adjust mode  **TEACH Unacceptable** Displays alternate "**FAIL**" and % Minimum Difference*; Sensor returns to Adjust mode 
Return to RUN Mode	Move Mode switch to RUN 	No action required; sensor returns to RUN mode automatically	**Display: Red -** Signal Level; **Green -** Threshold 

* See *Troubleshooting* on page 10 for more explanation of the % Minimum Difference displayed after the Two-Point TEACH method

Dynamic TEACH

- Teaches on-the-fly
- Establishes a single switching threshold
- Threshold can be adjusted using "+" and "-" rocker button (Manual Adjust)

Dynamic TEACH is best used when a machine or process may not be stopped for teaching. The sensor learns during actual sensing conditions, taking multiple samples of the light and dark conditions and automatically setting the threshold at the optimum level (see Figure below).

The output ON and OFF conditions can be reversed using the LO/DO switch (see **LO/DO Switch** in *Top Panel Interface* on page 2).

Dynamic TEACH and Manual Adjust

- Moves switching threshold value up or down to make adjustments
- Slide Mode switch to ADJ to enter Adjust mode
- Press "+" to increase; press "-" to decrease
  - GREEN display shows the switching threshold value
  - 2 seconds after adjustment, GREEN display will flash 3 times to confirm
- Slide Mode switch to RUN to complete operation

Remember: Manual adjustments are disabled when Auto Thresholds are ON

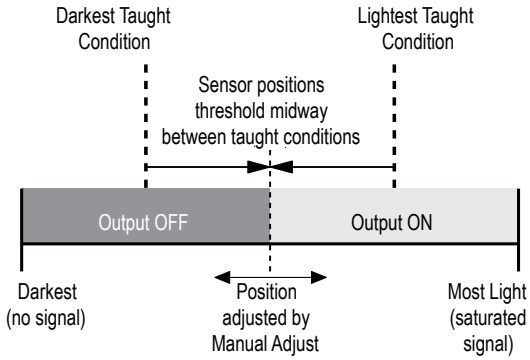
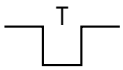
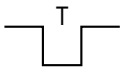


Figure 3. Dynamic TEACH (Light Operate shown)

	SET Button 0.04 seconds ≤ "Click" ≤ 0.8 seconds	Remote Input 0.04 seconds ≤ T ≤ 0.8 seconds	Result
	Note: TEACH Selection must be programmed to **dYn tcH** (see *Program Mode* on page 3)		
Enter Adjust Mode	• Set Mode switch to ADJ 	No action required; sensor is ready for Dynamic TEACH method	**Display: Red -** Signal Level; **Green -** Threshold 
Enter Dynamic TEACH	• Click the SET rocker button 	• Single-pulse remote input 	**Display:** Flashes "**dYn tch**" then holds on "**1234 dYn**" 
Present ON and OFF Conditions	• Present ON and OFF conditions	• Present ON and OFF conditions	**Display: Red -** Signal Level; **Green -** Threshold 
Exit Dynamic TEACH	• Click the SET rocker button 	• Single-pulse remote input 	**TEACH Accepted** Displays alternate "**PASS**" with % Minimum Difference*, Sensor returns to Adjust mode  **TEACH Unacceptable** Displays alternate "**FAIL**" with % Minimum Difference*, Sensor returns to Adjust mode 
Return to RUN Mode	• Move Mode switch to RUN 	No action required; sensor returns to RUN mode automatically	**Display: Red -** Signal Level; **Green -** Threshold 

* See *Troubleshooting* on page 10 for more explanation of the % Minimum Difference displayed after the Dynamic TEACH method

Window SET

- Sets window thresholds that extend a programmable % offset above and below the presented condition
- All other conditions (lighter or darker) cause the output to change state
- Sensing window center can be adjusted using “+” and “-” rocker button (Manual Adjust)
- Recommended for applications where a product may not always appear in the same place, or when other signals may appear
- See Program Mode in the user's manual for programming the Offset Percent setting (to increase/decrease the window size)

A single sensing condition is presented, and the sensor positions window thresholds a programmable % offset above and below the presented condition. In LO mode, Window SET designates a sensing window with the Output ON condition inside the window, and the Output OFF conditions outside the window (see Figure below).

Output ON and OFF conditions can be reversed using the LO/DO switch (see **LO/DO Switch** in *Top Panel Interface* on page 2).

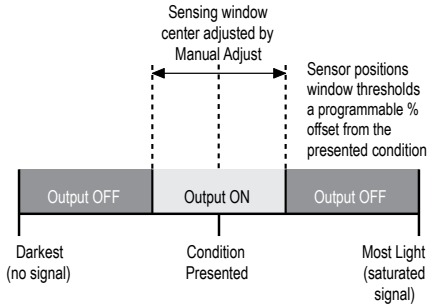
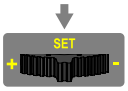
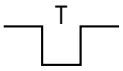
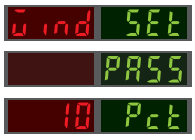
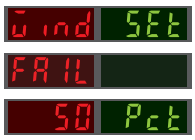
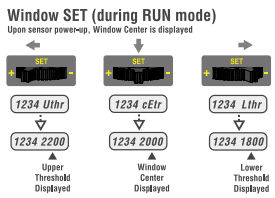


Figure 4. Window SET (Light Operate shown)

Window SET and Manual Adjust

- Moves sensing window center value up or down to make adjustments
- Slide Mode switch to ADJ to enter Adjust mode
- Press “+” to increase; press “-” to decrease
  - GREEN display shows the sensing window center value
  - 2 seconds after adjustment, the GREEN display will flash 3 times to confirm
- Slide Mode switch to RUN to complete operation

Remember: Manual adjustments are disabled when Auto Thresholds are ON

	SET Button 0.04 seconds ≤ "Click" ≤ 0.8 seconds	Remote Input 0.04 seconds ≤ T ≤ 0.8 seconds	Result
	Note: TEACH Selection must be programmed to **wind SEt** (see *Program Mode* on page 3)		
Enter Adjust Mode	• Set Mode switch to ADJ 	No action required; sensor is ready for Window SET method	**Display: Red -** Signal Level; **Green -** Threshold 
SET Sensing Condition	• Present sensing condition • Click the SET rocker button 	• Present sensing condition • Single-pulse the remote input 	**Threshold Condition Accepted** Displays read "**wInd SEt**" then alternate "**PASS**" with % Offset*; Sensor returns to Adjust mode  **Threshold Condition Unacceptable** Displays read "**wInd SEt**" then alternate "**FAIL**" with minimum % Offset* for sensing condition; Sensor returns to Adjust mode 
Return to RUN Mode	• Move Mode switch to RUN 	No action required; sensor returns to RUN mode automatically	**Display: Red -** Signal Level; **Green -** Window Center (see Figure below for instructions on how to display upper and lower thresholds)  

* See *Troubleshooting* on page 10 for more explanation of the % Offset displayed after the Window SET method

Light SET

- Sets a threshold a programmable % offset below the presented condition
- Changes output state on any condition darker than the threshold condition
- Threshold can be adjusted using "+" and "-" rocker button (Manual Adjust)
- Recommended for applications where only one condition is known, for example a stable light background with varying darker targets
- See *Program Mode* on page 3 for programming the Offset Percent setting

A single sensing condition is presented, and the sensor positions a threshold a programmable % offset below the presented condition. When a condition darker than the threshold is sensed, the output either turns ON or OFF, depending on the LO/DO switch setting (see **LO/DO Switch** in *Top Panel Interface* on page 2).

Light SET and Manual Adjust

- Moves switching threshold value up or down to make adjustments
- Slide Mode switch to ADJ to enter Adjust mode
- Press "+" to increase; press "-" to decrease
  - GREEN display shows the switching threshold value
  - 2 seconds after adjustment, the GREEN display will flash 3 times to confirm
- Slide Mode switch to RUN to complete operation

Remember: Manual adjustments are disabled when Auto Thresholds are ON

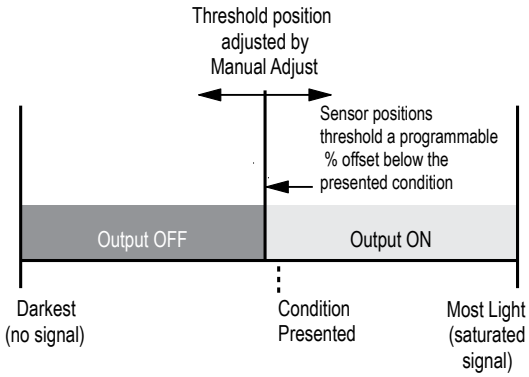
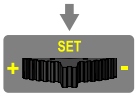
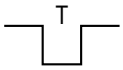


Figure 5. Light SET (Light Operate shown)

	SET Button 0.04 seconds ≤ "Click" ≤ 0.8 seconds	Remote Input 0.04 seconds ≤ T ≤ 0.8 seconds	Result
	Note: TEACH Selection must be programmed to **Lt SEt** (see *Program Mode* on page 3)		
Enter Adjust Mode	• Set Mode switch to ADJ 	No action is required; sensor is ready for Light SET method	**Display: Red -** Signal Level; **Green -** Threshold 
SET Sensing Condition	• Present sensing condition • Click the SET rocker button 	• Present sensing condition • Single-pulse the remote input 	**Threshold Condition Accepted** Displays read "**Lt SEt**" then alternate "**PASS**" with % Offset*; Sensor returns to Adjust mode  **Threshold Condition Unacceptable** Displays read "**Lt SEt**" then alternate FAIL with minimum % Offset* for sensing condition; Sensor returns to Adjust mode 
Return to RUN Mode	• Move Mode switch to RUN 	No action required; sensor returns to RUN mode automatically	**Display: Red -** Signal Level; **Green -** Threshold 

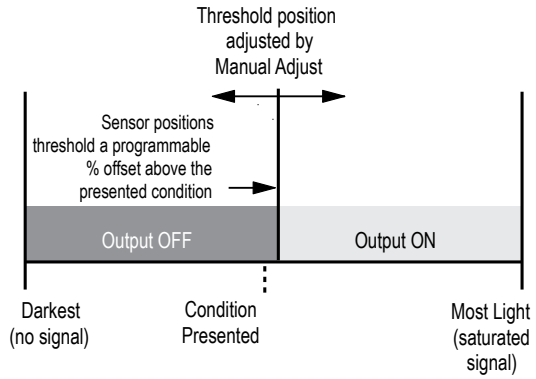
* *Troubleshooting* on page 10 for more explanation of the % Offset displayed after the Light SET method

Dark SET

- Sets a threshold a programmable % offset above the presented condition
- Any condition lighter than the threshold condition causes the output to change state
- Threshold can be adjusted using "+" and "-" rocker button (Manual Adjust)
- Recommended for applications where only one condition is known, for example a stable dark background with varying lighter targets
- See *Program Mode* on page 3 for programming the Offset Percent setting

NOTE: Offset Percent MUST be programmed to **Minimum Offset** to accept conditions of no signal (0 counts).

A single sensing condition is presented, and the sensor positions a threshold a programmable % offset above the presented condition. When a condition lighter than the threshold is sensed, the output either turns ON or OFF, depending on the LO/DO switch setting (see **LO/DO Switch** in *Top Panel Interface* on page 2).

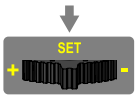
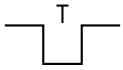


Dark SET and Manual Adjust

- Moves switching threshold value up or down to make adjustments
- Slide Mode switch to ADJ to enter Adjust mode
- Press "+" to increase; press "-" to decrease
  - GREEN display shows the switching threshold value
  - 2 seconds after adjustment, the GREEN display will flash 3 times to confirm
- Slide Mode switch to RUN to complete operation

Remember: Manual adjustments are disabled when Auto Thresholds are ON

Figure 6. Dark SET (Light Operate shown)

	SET Button 0.04 seconds ≤ "Click" ≤ 0.8 seconds	Remote Input 0.04 seconds ≤ T ≤ 0.8 seconds	Result
	Note: TEACH Selection must be programmed to **dr SEt** (see *Program Mode* on page 3)		
Enter Adjust Mode	• Set Mode switch to ADJ 	No action required; sensor is ready for Dark SET method	**Display: Red -** Signal Level; **Green -** Threshold 
SET Sensing Condition	• Present sensing condition • Click the SET rocker button 	• Present sensing condition • Single-pulse the remote input 	**Threshold Condition Accepted** Displays read "**dr SEt**" then alternate "**PASS**" with % Offset*; Sensor returns to Adjust mode  **Threshold Condition Unacceptable** Displays read "**dr SEt**" then alternate "**FAIL**" with minimum % Offset* for sensing condition; Sensor returns to Adjust mode 
Return to RUN Mode	• Move Mode switch to RUN 	No action required; sensor returns to RUN mode automatically	**Display: Red -** Signal Level; **Green -** Threshold 

* See *Troubleshooting* on page 10 for more explanation of the % Offset displayed after the Dark SET method

Calibration SET

- Sets a threshold exactly at the presented condition
- Threshold can be adjusted using “+” and “-” rocker button (Manual Adjust)

A single sensing condition is presented, and the sensor positions a threshold exactly at the presented condition. When a condition lighter than the threshold is sensed, the output either turns ON or OFF, depending on the LO/DO switch setting (see **LO/DO Switch** in *Top Panel Interface* on page 2).

Calibration SET and Manual Adjust

- Moves switching threshold value up or down to make adjustments
- Slide Mode switch to ADJ to enter Adjust mode
- Press “+” to increase; press “-” to decrease
  - GREEN display shows the switching threshold value
  - 2 seconds after adjustment, the GREEN display will flash 3 times to confirm
- Slide Mode switch to RUN to complete operation

Remember: Auto Thresholding is automatically disabled in Calibration SET

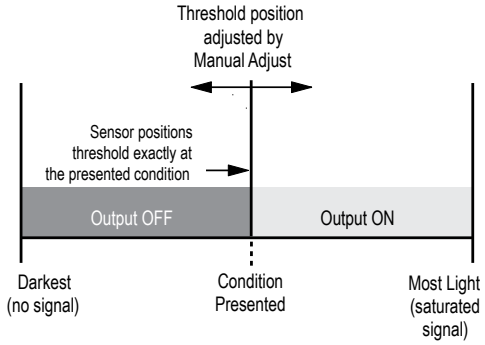
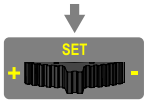
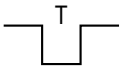


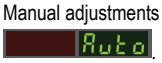
Figure 7. Calibration SET (Light Operate shown)

	SET Button 0.04 seconds ≤ "Click" ≤ 0.8 seconds	Remote Input 0.04 seconds ≤ T ≤ 0.8 seconds	Result
	Note: TEACH Selection must be programmed to **CAL SEt** (see *Program Mode* on page 3)		
Enter Adjust Mode	• Set Mode switch to ADJ 	No action required; sensor is ready for Calibration SET method	**Display: Red -** Signal Level; **Green -** Threshold 
SET Sensing Condition	• Present sensing condition • Click the SET rocker button 	• Present sensing condition • Single-pulse the remote input 	**Threshold Condition Accepted** Displays read "**cAL SEt**" then flashes "**PASS**"; Sensor returns to Adjust mode  **Threshold Condition Unacceptable** Displays read "**cAL SEt**" then flashes "**FAIL**"; Sensor returns to Adjust mode 
Return to RUN Mode	• Move Mode switch to RUN 	No action required; sensor returns to RUN mode automatically	**Display: Red -** Signal Level; **Green -** Threshold 

Troubleshooting

Manual Adjustments Disabled

Manual adjustments are disabled when Auto Thresholds are ON. If a manual adjustment is attempted while Auto Thresholds are ON, the Green display will flash



% Minimum Difference after TEACH

The Two-Point and Dynamic TEACH methods will flash a % minimum difference on the displays after a PASS or FAIL.

Value	PASS/FAIL	Description
0-99%	FAIL	The difference of the taught conditions does not meet the required minimum
100-300%	PASS	The difference of the taught conditions just meets/exceeds the required minimum, minor sensing variables may affect sensing reliability
300-600%	PASS	The difference of the taught conditions sufficiently exceeds the required minimum, minor sensing variables will not affect sensing reliability
600% +	PASS	The difference of the taught conditions greatly exceeds the required minimum, very stable operation

% Offset after SET

The Window, Dark, and Light SET methods will flash a % offset on the displays after a PASS or FAIL.

SET Result	% Offset Meaning
PASS (with % Offset)	Displays the % offset used for the SET method
FAIL (with % Offset)	Displays the minimum required % offset necessary to PASS the SET method
FAIL (without % Offset)	Presented condition cannot be used for the SET method

Threshold Alert or Threshold Error

Severe contamination/changes in the taught condition can prevent the Auto Thresholds algorithm from optimizing the threshold(s).

State	Display	Description	Corrective Action
Threshold Alert	Alternates  and 	The threshold(s) cannot be optimized, but the sensor's output will still continue to function	Cleaning/correcting the sensing environment and/or a re-teach of the sensor is highly recommended
Threshold Error		The threshold(s) cannot be optimized, and the sensor's output will stop functioning	Cleaning/correcting the sensing environment and/or a re-teach of the sensor is required

Specifications

Sensing Beam
660 nm visible red

Supply Voltage
10 to 30V dc (10% max ripple)

Power and Current Consumption (exclusive of load)
Standard display mode: 960 mW, Current consumption < 40 mA @ 24V dc
ECO display mode: 720 mW, Current consumption < 30 mA @ 24V dc

Supply Protection Circuitry
Protected against reverse polarity, over voltage, and transient voltages

Delay at Power Up
500 milliseconds max.; outputs do not conduct during this time

Output Configuration
1 current sourcing (PNP) or 1 current sinking (NPN) output, depending on model

Output Rating
100 mA max. load (derate 1 mA per °C above 30° C)
OFF-state leakage current: < 5 µA at 30V dc
ON-state saturation voltage: NPN: < 1.5V; **PNP:** < 2V

Output Protection
Protected against output short-circuit, continuous overload, transient over-voltages, and false pulse on power up

Output Response Time
High Speed - 200 us; Standard - 500 us; Long Range - 2 ms; Extra Long Range - 5 ms

Repeatability
High Speed - 66 us, Standard/Long Range/Extra Long Range - 100 us

Construction
Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover

Environmental Rating
IEC IP50, NEMA 1

Operating Conditions
Temperature: -10° to +55° C (+14° to 131° F)
Storage: -20° to +85° C (-4° to +185° F)
Relative Humidity: 90% @ 60° C (non-condensing)

Certifications
CE

BANNER®
more sensors, more solutions