DF-G3 Long Range Expert™ Dual Display Fiber Amplifier with Analog Output

Quick Start Guide

Advanced sensor with dual digital displays for use with plastic and glass fiber optic assemblies; analog current or voltage output models with an independent NPN or PNP discrete output are available.

This guide is designed to help you set up and install the DF-G3 Long Range Expert Dual Display Fiber Amplifier with Analog Output. For complete information on programming, performance, troubleshooting, dimensions, and accessories, please refer to the Instruction Manual at www.bannerengineering.com. Search for p/n 190341 to view the Instruction Manual. Use of this document assumes familiarity with pertinent industry standards and practices.

WARNING:

- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

Overview

Figure 1. DF-G3 Dual Output Analog with Discrete Output

1 Analog and Discrete Output LEDs
2 CH1/CH2 Switch
3 RUN/PRG/ADJ Mode Switch
4 Lever Action Fiber Clamp
5 Red Signal Level
6 Green CH1 Analog Output Signal or CH2 Threshold
7 +/SET/- Rocker Button

Models

Model	Sensing Beam Color	Reference Sensing Range [1]	Outputs	Connector [2]
DF-G3-NU-2M	Visible red, 635 nm	3000 mm	Voltage and NPN Discrete	2 m (6.5 ft) cable, 5-wire
DF-G3-PU-2M			Voltage and PNP Discrete	
DF-G3-NI-2M			Current and NPN Discrete	
DF-G3-PI-2M			Current and PNP Discrete	
DF-G3IR-NU-2M	Infrared, 850 nm	6000 mm	Voltage and NPN Discrete	2 m (6.5 ft) cable, 5-wire
DF-G3IR-PU-2M			Voltage and PNP Discrete	
DF-G3IR-NI-2M			Current and NPN Discrete	
DF-G3IR-PI-2M			Current and PNP Discrete	
Water Detection Models				
DF-G3LIR-NU-2M	Long infrared, 1450 nm	900 mm	Voltage and NPN Discrete	2 m (6.5 ft) cable, 5-wire
DF-G3LIR-PU-2M			Voltage and PNP Discrete	
DF-G3LIR-NI-2M			Current and NPN Discrete	
DF-G3LIR-PI-2M			Current and PNP Discrete	

1 Excess gain = 1 (high sensitivity), opposed mode sensing. PIT46U plastic fiber used for visible models, IT.83.3ST5M6 glass fiber used for IR models.
2 Connector options:

- A model with a QD connector requires a mating cordset (see Instruction Manual)
- For 9 m (29.5 ft) cable, change the suffix 2M to 9M in the 2 m model number (DF-G3-NS-9M)
- For 150 mm (6 in) PVC cable with a M8/Pico-style QD model, change the suffix 2M to Q3 in the 2 m model number (DF-G3-NS-Q3)
- For 150 mm (6 in) PVC cable with a M12/Euro-style model, change the suffix 2M to Q5 in the 2 m model number (DF-G3-NS-Q5)
- For integral M8/Pico-style model, change the suffix 2M to Q7in the 2 m model number (DF-G3-NS-Q7)
- For Q3 and Q7 Dual Output models, use a 5-pin M8/Pico-style or a 6-pin M8/Pico-style mating cordset

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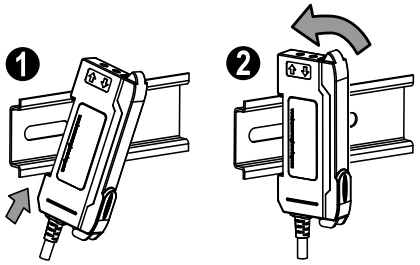
Installation Instructions

Mounting Instructions

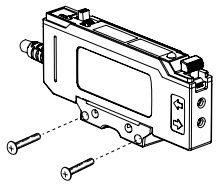
Mount on a DIN Rail

1. Hook the DIN rail clip on the bottom of the DF-G3 over the edge of the DIN rail (1).
2. Push the DF-G3 up on the DIN rail (1).
3. Pivot the DF-G3 onto the DIN rail, pressing until it snaps into place (2).



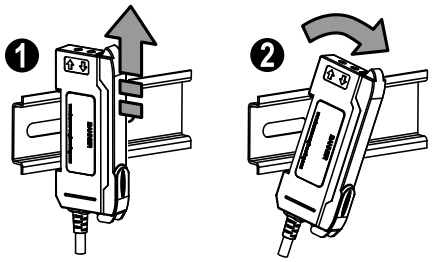
Mount to the Accessory Bracket (SA-DIN-BRACKET)

1. Position the DF-G3 in the SA-DIN-BRACKET.
2. Insert the supplied M3 screws.
3. Tighten the screws.



Remove from a DIN rail

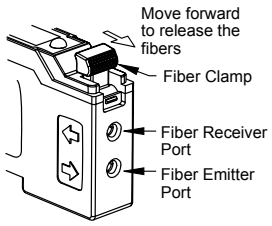
1. Push the DF-G3 up on the DIN rail (1).
2. Pivot the DF-G3 away from the DIN rail and remove it (2).



Installing the Fibers in a DF-Gx Sensor

Follow these steps to install glass or plastic fibers.

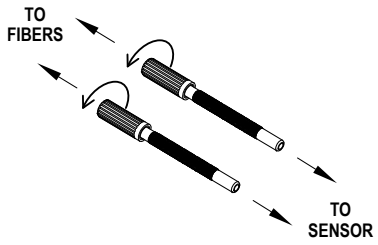
1. Open the dust cover.
2. Move the fiber clamp forward to unlock it.
3. Insert the fiber(s) into the fiber port(s) until they stop.
4. Move the fiber clamp backward to lock the fiber(s).
5. Close the dust cover.



Note: For optimum performance of IR models, if applicable, glass fibers must be used.

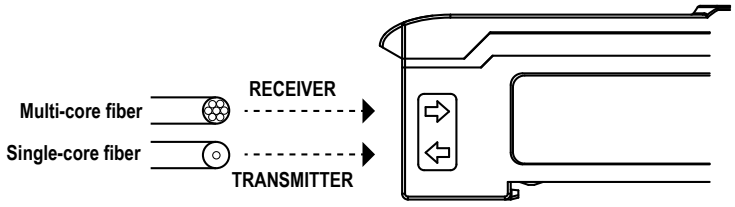
Fiber Adapters

Note: If a thin fiber with less than 2.2 mm outer diameter is used, install the fiber adapter provided with the fiber assembly to ensure a reliable fit in the fiber holder. Align the fibers to the end of the adaptors. Banner includes the adapters with all fiber assemblies.

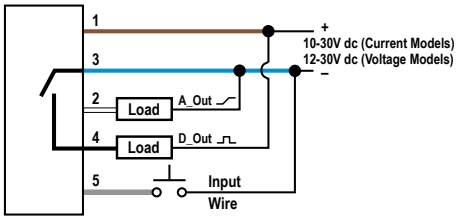
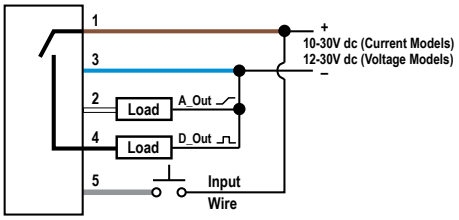


Fiber Outer Diameter (mm)	Adapter Color
Ø 1.0	Black
Ø 1.3	Red
Ø 2.2	No adapter needed

When connecting coaxial-type fiber assemblies to the amplifier, install the single-core (center) fiber to the Transmitter port, and the multi-core (outer) fiber to the Receiver port. This will result in the most reliable detection.



Wiring Diagrams

NPN Models	PNP Models	Key
		1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray (6 = no connection)

Note: Open lead wires must be connected to a terminal block.

Note: When using multiple sensors in Master/Slave mode, the gray wires from each sensor should be connected together. The remote programming function cannot be used.

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, CH1/CH2 switch, +/SET/- rocker button, dual red/green digital displays, and output LED(s).

RUN/PRG/ADJ Mode Switch

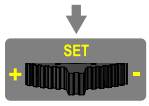
The RUN/PRG/ADJ mode switch puts the sensor in RUN, PRG (Program), or ADJ (Adjust) mode.

- RUN mode allows the sensor to operate normally and prevents unintentional programming changes via the +/SET/- rocker button.
- PRG mode allows the sensor to be programmed through the display-driven programming menu (see Program Mode).
- ADJ mode allows the user to perform Expert TEACH/SET methods and Manual Adjust (see Adjust Mode on p. 6).

CH1/CH2 Switch

The CH1/CH2 switch selects which output's parameters can be accessed and changed in the interface of the display.

- CH1 selects the Analog Output
- CH2 selects the Discrete Output



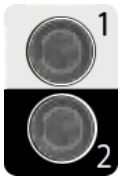
+/SET/- Rocker Button

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.

In ADJ mode, SET is used to perform TEACH/SET methods and +/- are used to manually adjust the threshold(s). In CH1 RUN mode, the rocker button is used to view the analog endpoints and midpoint signal values. The rocker button is disabled during CH2 RUN mode, except when using Window SET (see Window SET).

Red/Green Digital Displays

During RUN and ADJ modes, the Red display shows the signal level, and the Green display shows the analog output in volts or milliamps when CH1 is selected or the threshold when CH2 is selected. During PRG mode, both displays are used to navigate the display-driven programming menu.



Dual Output LEDs

The output LEDs provide a visible indication of when the associated output is active.

- 1 represents the Channel 1 analog output. When on, it indicates that the signal is within the analog range.
- 2 represents the Channel 2 discrete output. When on, it indicates that the output is conducting.

Operating Instructions

Remote Input

For more information about how to perform TEACH/SET methods and to program the sensor remotely, see www.bannerengineering.com and search 190341.

Run Mode

Run mode allows the sensor to operate normally and prevents unintentional programming changes. In CH1 RUN mode, the +/SET/- rocker button is used to view the analog endpoints and midpoint signal values. The rocker button is disabled during CH2 RUN mode, except when using Window SET (see Window SET on p. 8).

Program Mode

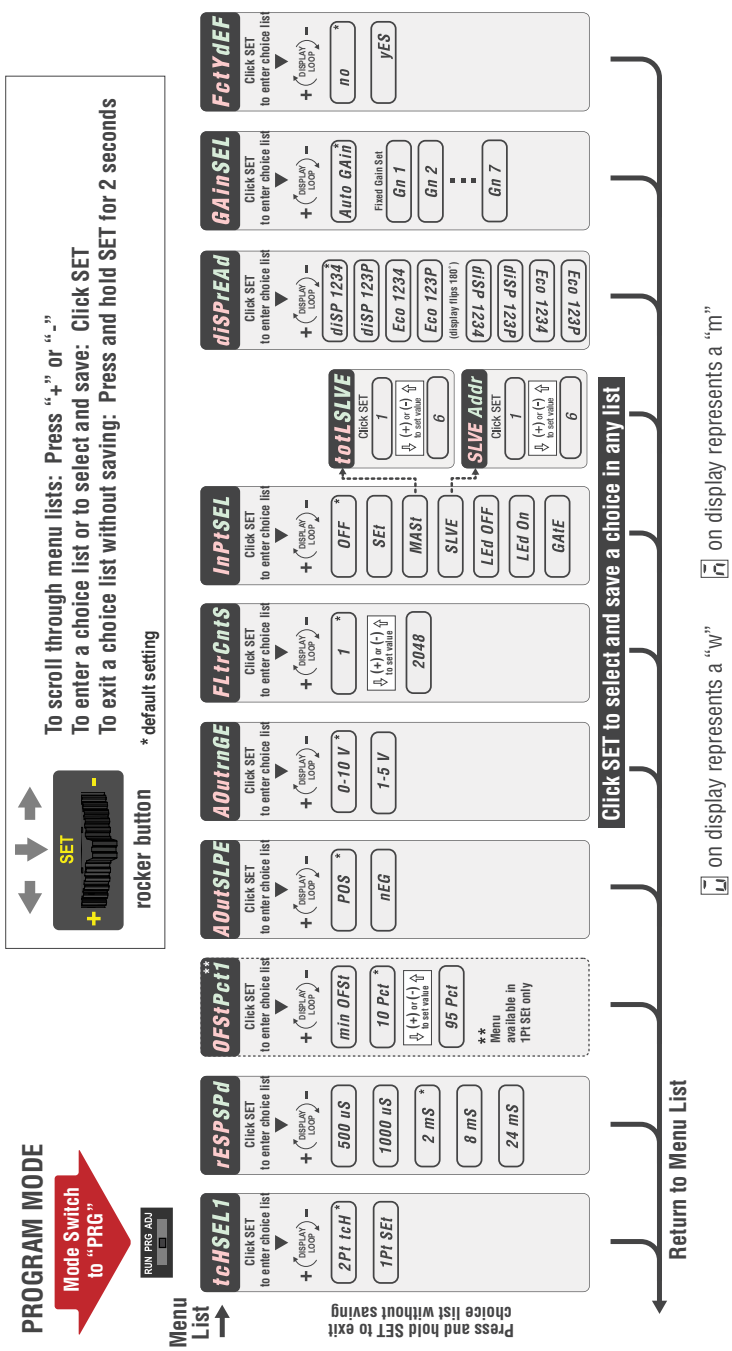
Channel 1 Analog Menu

Program (PRG) mode allows the following settings to be programmed in the DF-G3.

CH1 Analog Factory Default Settings:

tch SEL1	2-pt tch
rESP SPd	2 ms
OFSt Pct1	10 Pct
AOut SLPE	POS
AOut RnGE	0 to 10 V
FLtr CntS	1
inPt SEL	oFF
diSP rEAd	diSP 1234
GAin SEL	Auto GAin

Note: The CH1 settings programmed for rESP SPd, inPt SEL, diSP rEAd and GAin SEL also apply to CH2.



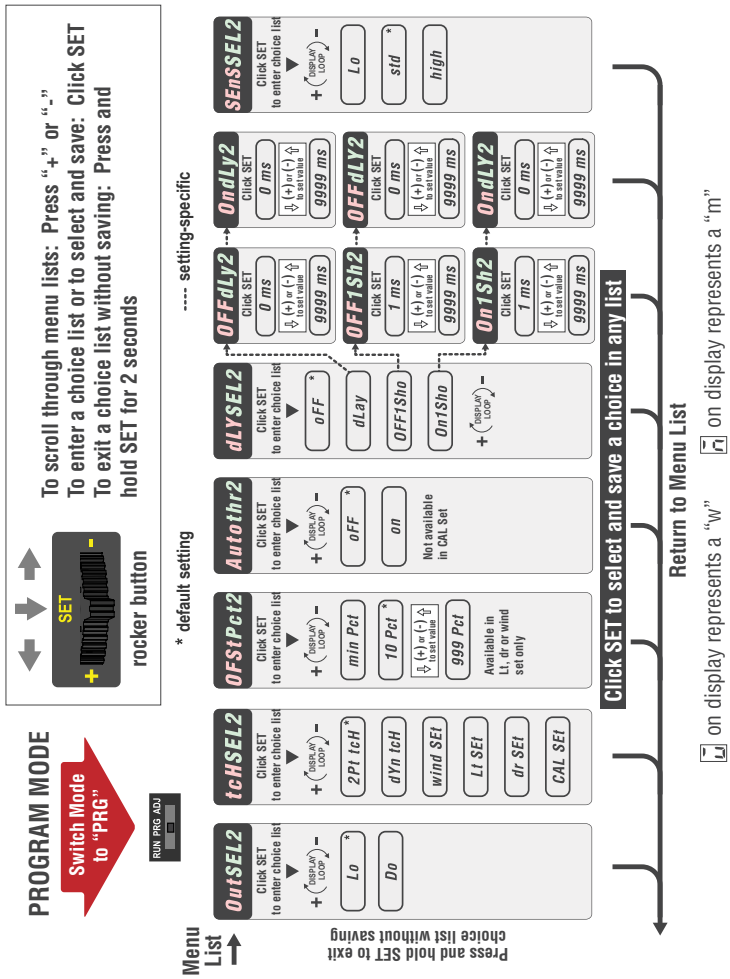
Channel 2 Discrete Menu

Program (PRG) mode allows the following settings to be programmed in the DF-G3.

When CH2 is selected in Program mode, the settings below can be configured for CH2 discrete output and are independent from CH1 settings.

CH2 Discrete Factory Default Settings:

Out SEL2	LO
tch SEL2	2-pt tch
OFSt Pct2	10 pct
Auto thr2	oFF
dLY SEL2	oFF
SEnS SEL2	Std



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 and the midpoint or endpoints of the analog output depending on whether a 1-point SET or 2-point TEACH was used.

Note: For threshold and analog endpoints, when teaching CH2, the gain setting will be the same as the gain setting made during the CH1 teach. Reteaching CH1 may invalidate the previous CH2 teach.

TEACH Procedures

The instruction manual has detailed instructions for these TEACH modes:

CH1 Analog	CH2 Discrete
• Two-Point TEACH • One-Point SET	• Two-Point TEACH • Dynamic TEACH • Window SET • Light SET • Dark SET • Calibration SET

CH1 Analog Output

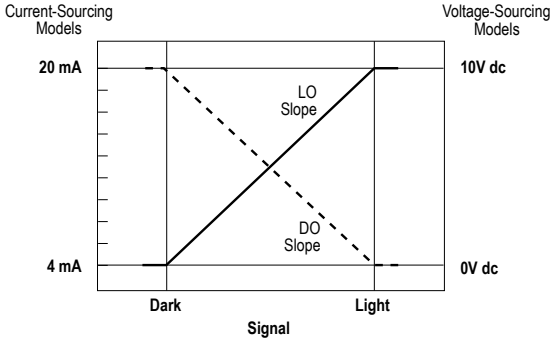
Two-Point TEACH

- Establishes defined endpoints for the analog output range
- Analog endpoints can be adjusted by using the "+" and "-" rocker button (Manual Adjust)

Two-Point TEACH is used when two conditions can be presented statically to the sensor. The first taught condition is set to 0 V (4 mA), and the second taught condition to 10 V (20 mA). The order of the taught points determines the slope. If the first taught condition is darker, the slope will be positive. If the first taught condition is lighter, the slope will be negative. Reverse the slope of the analog output by changing the AOut SLPE menu setting.

Note: Depending on the application configuration and fibers used, the analog function may or may not behave linearly. The received light intensity will be dictated by the inverse square properties of light.

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

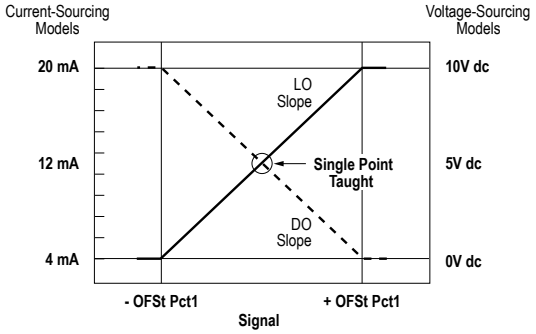


One-Point SET

- Defines the 5 V (12 mA) midpoint of the analog output
- Analog midpoint can be adjusted by using the "+" and "-" rocker button (Manual Adjust)

A single sensing condition is presented, and the sensor positions the midpoint of its analog range (5 V or 12 mA) exactly at the presented condition. The size of the window is determined by the OFSt Pct1 menu setting. The slope of the analog output is determined by the AOut SLPE setting.

Figure 3. One-Point SET (Light Operate shown)



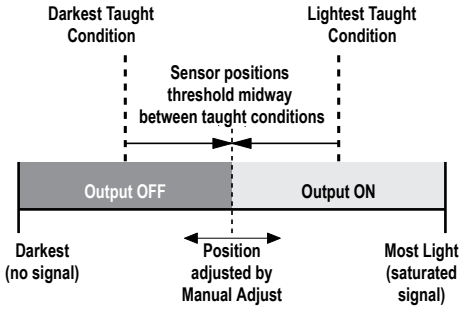
CH2 Discrete Output

Two-Point TEACH

- Establishes a single switching threshold
- Threshold can be adjusted by using the "+" 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 switch point) midway between the two taught conditions, with the Output ON condition on one side, and the Output OFF condition on the other.

Figure 4. Two-Point TEACH (Light Operate shown)



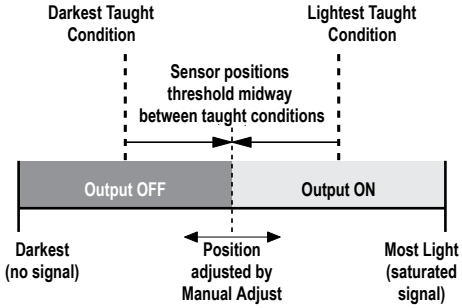
The Output ON and OFF conditions can be reversed by using the LO/DO (Light Operate/ Dark Operate) switch or through the program interface for the dual output model.

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.

Figure 5. Dynamic TEACH (Light Operate shown)



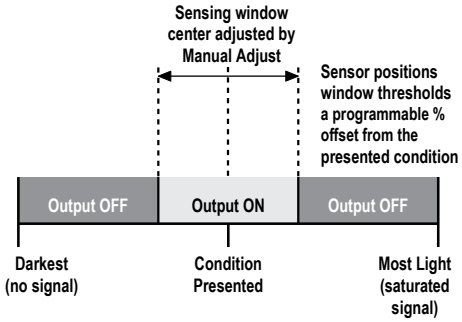
Reverse the CH2 Output ON and OFF conditions by using the LO/DO (Light Operate/ Dark Operate) selection through the program interface.

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 for programming the Offset Percent setting

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.

Figure 6. Window SET (Light Operate shown)



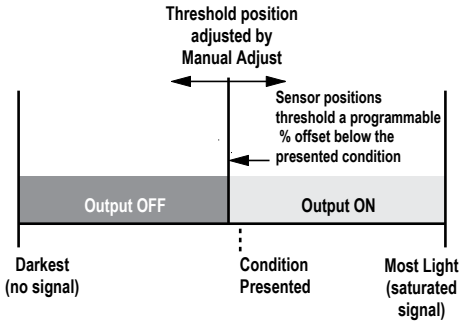
Reverse the Output ON and OFF conditions by using the LO/DO (Light Operate/ Dark Operate) selection through the program interface for the dual output model.

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 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 setting.

Figure 7. Light SET (Light Operate shown)



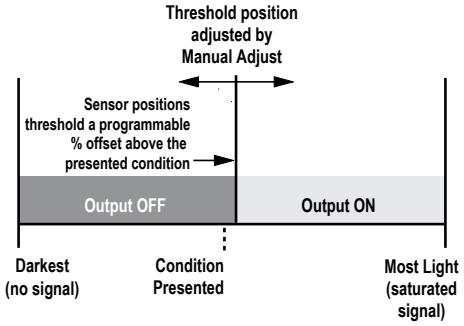
Dark SET

- 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 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 setting.

Figure 8. Dark SET (Light Operate shown)

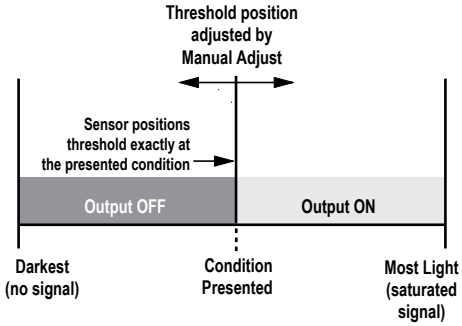


Calibration SET

- 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 setting.

Figure 9. Calibration SET (Light Operate shown)



Specifications

Sensing Beam

DF-G3: Visible red, 635 nm
DF-G3IR: Infrared, 850 nm
DF-G3LIR: Long infrared, 1450 nm

Supply Voltage

Voltage output models: 12 V DC to 30 V DC Class 2 (10% maximum ripple)
Current output models: 10 V DC to 30 V DC Class 2 (10% maximum ripple)

Power and Current Consumption (exclusive of load)

Standard display mode: 840 mW, Current consumption < 35 mA at 24 V DC
ECO display mode: 672 mW, Current consumption < 28 mA at 24 V DC

Supply Protection Circuitry

Protected against reverse polarity, overvoltage, and transient voltages

Delay at Power-Up

500 milliseconds maximum; outputs do not conduct during this time

Output Configuration

Voltage Output Models: 1 analog voltage output (user configurable as 1 V to 5 V or 0 V to 10 V) with 1 NPN or 1 PNP discrete output, depending on model.
Current Output Models: 1 analog current output (4 mA to 20 mA) with 1 NPN or 1 PNP discrete output, depending on model

Discrete Output Rating

100 mA maximum combined load—analog plus discrete outputs (derate 1 mA per °C above 30 °C)
OFF-state leakage current: < 5 µA at 30 V DC
ON-state saturation voltage: NPN: < 1.5 V; **PNP:** < 2 V

Analog Output Recovery Time

< 2 times the selected response speed

Analog Output Ripple Content (p-p)

< 0.5% of the full scale analog output

Analog Output Rating

Voltage Outputs: 2.5 kOhm minimum load resistance
Current Outputs: 1 kOhm maximum load resistance at 24 V; maximum load resistance = [(Vcc - 4)/.02] Ohms

Output Protection

Protected against output short-circuit, continuous overload, transient overvoltages, and false pulse on power-up

Response Speed and Features

Description	Response Speed	Repetition Period	Repeatability	Cross-Talk Avoidance	Energy Efficient Light Resistance	Maximum Range, Red [3]	Maximum Range, IR850 [4]
High Speed	500 µs	100 µs	100 µs	No	No	1200 mm	2400 mm
Fast	1000 µs	100 µs	150 µs	Yes	No	1500 mm	3000 mm
Standard	2 ms	100 µs	180 µs	Yes	Yes	1500 mm	3000 mm
Long Range	8 ms	100 µs	180 µs	Yes	Yes	1950 mm	3900 mm
Extra Long Range	24 ms	100 µs	180 µs	Yes	Yes	3000 mm	6000 mm

Operating Conditions

Temperature: –10 °C to +55 °C (+14 °F to +131 °F)
Storage Temperature: –20 °C to +85 °C (–4 °F to +185 °F)
Humidity: 50% at +50 °C maximum relative humidity (non-condensing)

Environmental Rating

IP50, NEMA 1

Connections

PVC-jacketed 2 m or 9 m (6.5 ft or 30 ft) 5-wire integral cable; or integral 5-pin M8 quick disconnect; or 150 mm (6 in) cable with a 5-pin M8 quick disconnect; or 150 mm (6 in) cable with a 5-pin M12 quick disconnect
For Q3 or Q7 models, either a 5-pin M8 or a 6-pin M8 mating cordset may be used

Construction

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

[3] Excess gain = 1 (high sensitivity), opposed mode sensing. PIT46U plastic fiber used for visible LED models.
[4] Excess gain = 1 (high sensitivity), opposed mode sensing. IT.83.3ST5M6 glass fiber used for IR models.

Required Overcurrent Protection

WARNING: Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

Overcurrent protection is required to be provided by end product application per the supplied table.
Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.
Supply wiring leads < 24 AWG shall not be spliced.
For additional product support, go to www.bannerengineering.com.

Supply Wiring (AWG)	Required Overcurrent Protection (Amps)
20	5.0
22	3.0
24	2.0
26	1.0
28	0.8
30	0.5

Certifications

Industrial Control Equipment 3TJJ

Class 2 power

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