

DF-G2 High Speed Expert™ Dual Display Fiber Amplifier



Quick Start Guide

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

For complete technical information about this product, including dimensions, accessories, and specifications, go to www.bannerengineering.com and search for your model number.

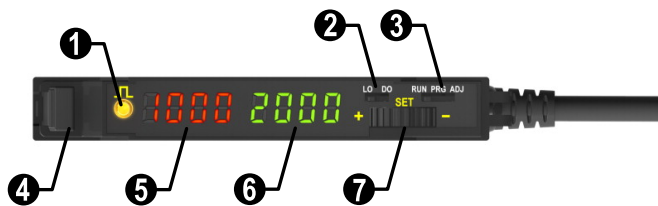


WARNING:

- **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-G2 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	Sensing Beam Color	Reference Sensing Range ¹	Outputs	Connector ²
DF-G2-NS-2M	Visible Red	1100 mm	Single NPN	2 m (6.5 ft) cable, 4-wire
DF-G2-PS-2M			Single PNP	
DF-G2W-NS-2M	Broad Spectrum White	550 mm	Single NPN	
DF-G2W-PS-2M			Single PNP	
DF-G2G-NS-2M	Visible Green	660 mm	Single NPN	
DF-G2G-PS-2M			Single PNP	
DF-G2B-NS-2M	Visible Blue	770 mm	Single NPN	
DF-G2B-PS-2M			Single PNP	
DF-G2IR-NS-2M	Infrared	2100 mm	Single NPN	
DF-G2IR-PS-2M			Single PNP	

¹ Excess gain = 1, Long Range response speed, opposed mode sensing. PIT46U plastic fiber used for visible LED models, IT.83.3ST5M6 glass fiber used for IR model

² Connector options:

- Models with a quick disconnect require a mating cordset
- For 9 m cable, change the suffix 2M to **9M** in the 2 m model number (example, DF-G2-NS-**9M**)
- For 150 mm (6 in) PVC cable with a 4-pin M8 quick disconnect, change the suffix 2M to **Q3** in the 2 m model number (example, DF-G2-NS-**Q3**)
- For 150 mm (6 in) PVC cable with a 4-pin M12 quick disconnect, change the suffix 2M to **Q5** in the 2 m model number (example, DF-G2-NS-**Q5**)
- For integral 4-pin M8 quick disconnect, change the suffix 2M to **Q7** in the 2 m model number (example, DF-G2-NS-**Q7**)

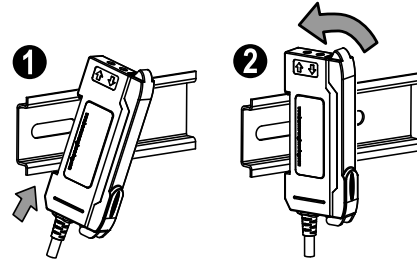


Installation Instructions

Mounting Instructions

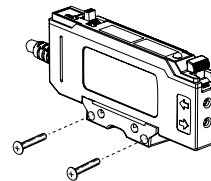
Mount on a DIN Rail

1. Hook the DIN rail clip on the bottom of the DF-G2 over the edge of the DIN rail (1).
2. Push the DF-G2 up on the DIN rail (1).
3. Pivot the DF-G2 onto the DIN rail, pressing until it snaps into place (2).



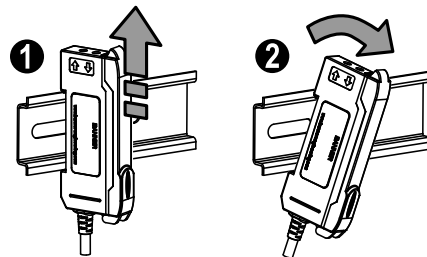
Mount to the Accessory Bracket (SA-DIN-BRACKET)

1. Position the DF-G2 in the SA-DIN-BRACKET.
2. Insert the supplied M3 screws.
3. Tighten the screws.



Remove from a DIN rail

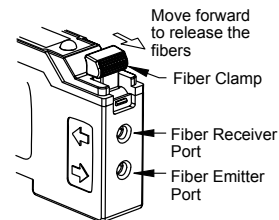
1. Push the DF-G2 up on the DIN rail (1).
2. Pivot the DF-G2 away from the DIN rail and remove it (2).



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.

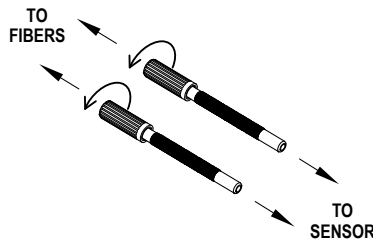


Note: For optimum performance of IR models, if applicable, glass fibers must be used.

Fiber Adapters

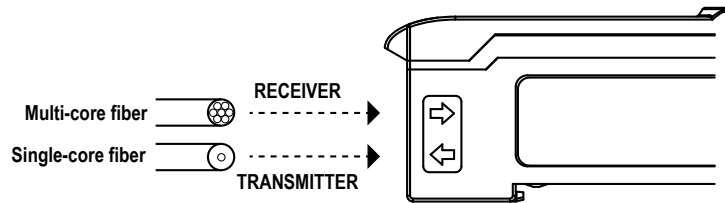


Note: If a thin fiber with less than 2.2 mm outer diameter is used, install the fiber adapter provided with the fiber assembly to ensure a reliable fit in the fiber holder. Align the fibers to the end of the adapters. Banner includes the adapters with all fiber assemblies.

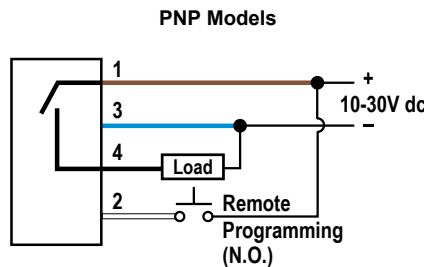
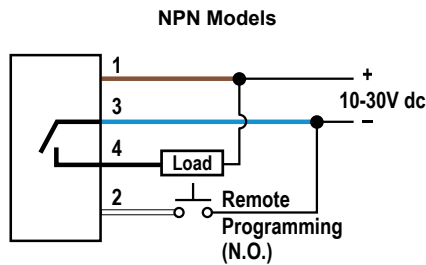


Fiber Outer Diameter (mm)	Adapter Color
Ø 1.0	Black
Ø 1.3	Red
Ø 2.2	No adapter needed

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



Key

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

Open lead wires must be connected to a terminal block.

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

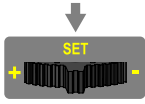


The RUN/PRG/ADJ mode switch puts the sensor in RUN, PRG (Program), or ADJ (Adjust) mode. RUN mode allows the sensor to operate normally and prevents unintentional programming changes via the +/-SET/- button. PRG mode allows the sensor to be programmed through the display driven programming menu (see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

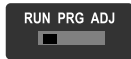
**Output LED**

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

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 177899.



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.



Program Mode

Program (PRG) mode allows the following settings to be programmed in the DF-G2:

Factory Default Settings:

Setting	Factory Default
Threshold	2011
TEACH Selection	Two-Point TEACH
Response Speed	Standard: 250 μ s
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

rocker button

To scroll through menu lists: Press “+” or “-”
To enter a choice list or to select and save: Click SET
To exit a choice list without saving: Press and hold SET for 2 seconds

PROGRAM MODE

Mode Switch to “PRG”



Menu List

Press and hold SET to exit choice list without saving

tchSEL Click SET to enter choice list
+ (RESPAY LOOP) -

2Pt tch dYn tch wind SET LI SET dr SET CAL SET

RESPSPd Click SET to enter choice list
+ (RESPAY LOOP) -

10 μ S 15 μ S 50 μ S 250 μ S 500 μ S 1000 μ S 2000 μ S

OFStPct Click SET to enter choice list

min OFSt 5 Pct 999 Pct

Autothr Click SET to enter choice list
+ (RESPAY LOOP) -

oFF On

OFFdLY Click SET to enter choice list

0 ms 9999 ms

OFF1Sho Click SET to enter choice list

0 ms 9999 ms

OnDLY Click SET to enter choice list

0 ms 9999 ms

On1Sho Click SET to enter choice list

0 ms 9999 ms

disPREAD Click SET to enter choice list
+ (RESPAY LOOP) -

disP 1234 Eco 1234 Eco 1234 (1001 still displays)

GAINSEL Click SET to enter choice list
+ (RESPAY LOOP) -

Auto GAIN Fixed Gain Set
1234 Gn 1 1234 Gn 2 ... 1234 Gn 8

FctyDef Click SET to enter choice list
+ (RESPAY LOOP) -

no YES

Click SET to select and save a choice in any list

Return to Menu List

on display represents a “w” on display represents a “m”



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).

TEACH Procedures

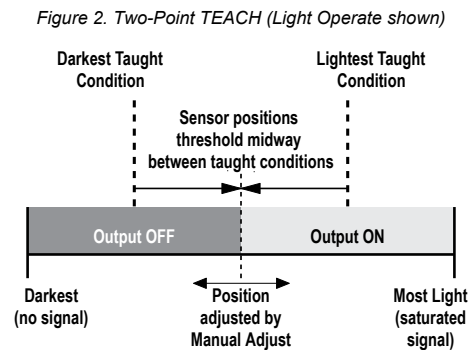
The instruction manual has detailed instructions for these TEACH modes:

- Two-Point TEACH
- Dynamic TEACH
- Window SET
- Light SET
- Dark SET
- Calibration SET

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.

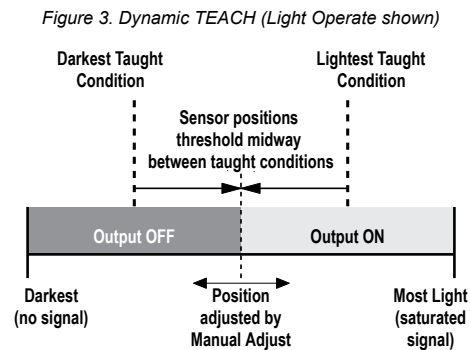


The Output ON and OFF conditions can be reversed by using the LO/DO (Light Operate/ Dark Operate) switch.

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.



The output ON and OFF conditions can be reversed using the LO/DO switch.

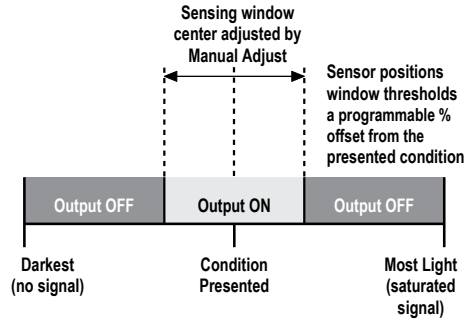
Window SET

- 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 4. Window SET (Light Operate shown)



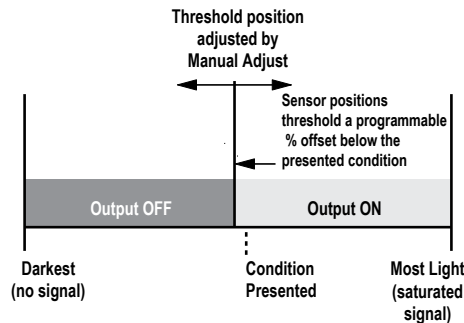
Output ON and OFF conditions can be reversed using the LO/DO switch.

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 5. Light SET (Light Operate shown)



Dark SET

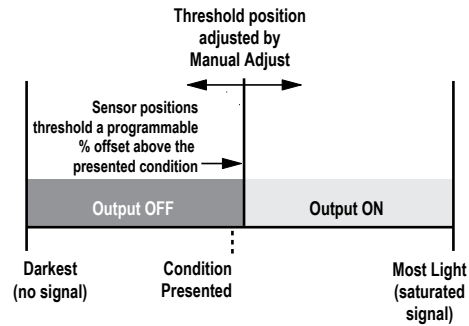
- Sets a threshold a programmable % offset above the presented condition
- Any condition lighter than the threshold condition causes the output to change state
- Threshold can be adjusted using "+" and "-" rocker button (Manual Adjust)
- Recommended for applications where only one condition is known, 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 6. Dark SET (Light Operate shown)

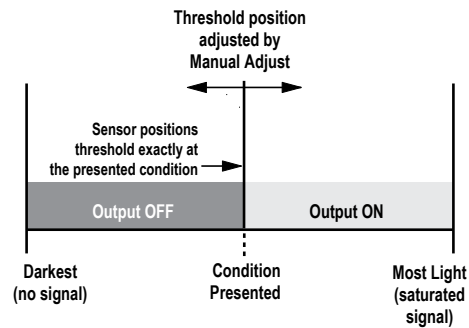


Calibration SET

- 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 7. Calibration SET (Light Operate shown)



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 Auto.

Percent 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 to 99%	FAIL	The difference of the taught conditions does not meet the required minimum
100 to 300%	PASS	The difference of the taught conditions just meets/exceeds the required minimum, minor sensing variables may affect sensing reliability
300 to 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



Percent 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

- DF-G2: Visible red, 635 nm
- DF-G2W: Broad spectrum white, 450 nm to 650 nm
- DF-G2B: Visible blue, 470 nm
- DF-G2G: Visible green, 525 nm
- DF-G2IR: Infrared, 850 nm

Supply Voltage

10 V DC to 30 V DC Class 2 (10% maximum ripple)

Power and Current Consumption (exclusive of load)

Standard display mode: 960 mW, Current consumption < 40 mA at 24 V DC
ECO display mode: 720 mW, Current consumption < 30 mA at 24 V DC

Supply Protection Circuitry

Protected against reverse polarity and transient overvoltages

Output Configuration

1 NPN or 1 PNP output, depending on model

Output Rating

100 mA maximum load (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

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

Delay at Power-Up

500 milliseconds maximum; outputs do not conduct during this time

Output Protection

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

Output Response Time

Super High Speed: 10 µs
 High Speed: 15 µs
 Fast: 50 µs
 Standard: 250 µs
 Medium Range: 500 µs
 Long Range: 1000 µs
 Long Range with immunity to Energy Efficient Lights: 2000 µs

Repeatability

Super High Speed: 5 µs
 High Speed: 5 µs
 Fast: 12 µs
 Standard: 50 µs
 Medium Range: 80 µs
 Long Range: 165 µs
 Long Range with immunity to Energy Efficient Lights: 165 µs

Construction

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

Connections

PVC-jacketed 2 m or 9 m (6.5 ft. or 30 ft.) 4-wire integral cable; or integral 4-pin M8 quick disconnect; or 150 mm (6 in.) cable with a 4-pin M12 quick disconnect; or 150 mm (6 in.) cable with a 4-pin M8 quick disconnect.

Environmental Rating

IP50, NEMA 1

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: 90% at +60 °C maximum relative humidity (non-condensing)

Certifications



Banner Engineering Corp Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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