DF-G3 Long Range Expert Dual Display Fiber Amplifier with Dual Discrete Outputs and IO-Link Quick Start Guide

Product Description

Advanced Sensor with Dual Displays for use with Plastic and Glass Fiber Optic Assemblies

This guide is designed to help you set up and install the DF-G3 Long Range Expert Dual Display Fiber Amplifier with Dual Discrete Outputs and IO Link. For complete information on programming, performance, troubleshooting, dimensions, and accessories, please refer to the Product Manual at www.bannerengineering.com. Search for part number 193604 to view the Product 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

DF-G3 IO Link Model Features



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

Models

Models	Sensing Beam Color	Reference Sensing Range[1]	Channel 1	Channel 2	Connector
DF-G3-KD-2M	Visible Red	3000 mm	IO-Link, push/pull output	PNP only output, or input	2 m (6.5 ft) cable, 4-wire
DF-G3IR-KD-2M	Infrared, 850 nm	6000 mm			

- To order the 150 mm (6 in) PVC cable model with a 4-pin M12 quick disconnect, replace the suffix "2M" with "Q5" in the model number. For example, DF-G3-KD-Q5.
- To order the 4-pin M8 integral quick disconnect model, replace the suffix "2M" with "Q7" in the model number. For example, DF-G3-KD-Q7.
- Models with a quick disconnect require a mating cordset.

The following models are no longer available for order but are still covered by the information in this document.

Models	Sensing Beam Color	Reference Sensing Range	Channel 1	Channel 2	Connector
DF-G3-KD-Q3	Visible Red	3000 mm	IO-Link, push/pull output	PNP only output, or input	150 mm (6 in) PVC cable with a 4-pin M8 quick disconnect
DF-G3IR-KD-Q3	Infrared, 850 nm	6000 mm			
DF-G3IR-KD-Q7					4-pin M8 quick disconnect

[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.

Original Instructions
01-Apr-26

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193603
p/n: 193603 Rev C

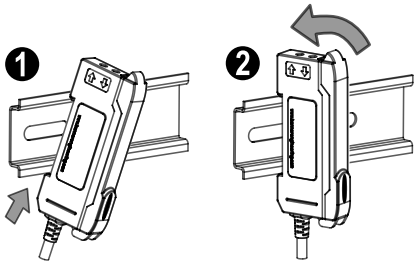
ПРОМЭЛЕКТРОНИКА/ sales@prom-elec.com

Installation Instructions

Mounting Instructions

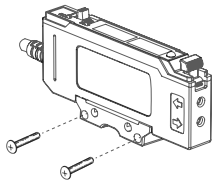
Mount on a DIN Rail

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).



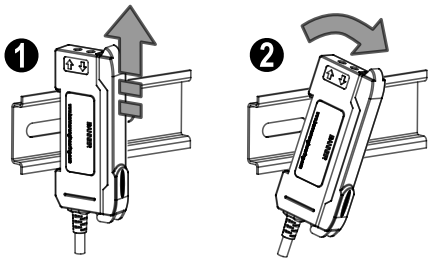
Mount to the Accessory Bracket (SA-DIN-BRACKET)

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).

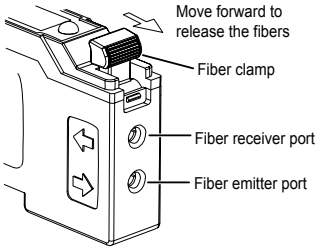


Installing the Fibers in a DF-Gx Sensor

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.

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



Fiber Adapters

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.

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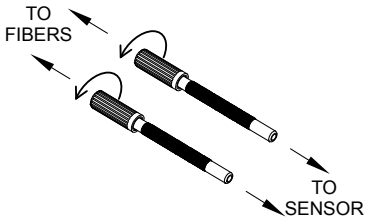
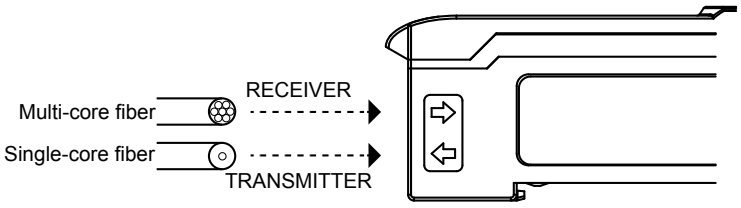


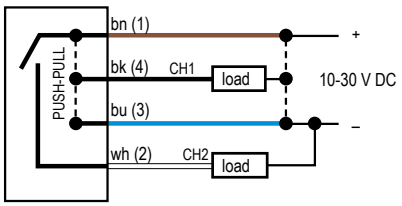
Fiber Outer Diameter (mm)	Adapter Color
Ø 1.0	Black
Ø 1.3	Red
Ø 2.2	No adapter needed

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.

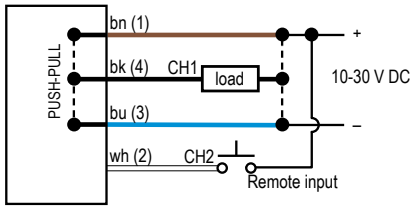


Wiring Diagrams

Channel 1 as a Push-Pull discrete output, Channel 2 as PNP discrete output



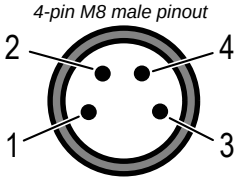
Channel 1 as a Push-Pull discrete output, Channel 2 as remote input



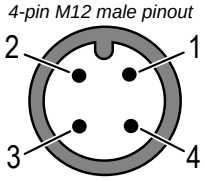
Key

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

4-pin M8 male pinout



4-pin M12 male pinout



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

NOTE: The Channel 2 wire function is user-selectable. The default is an independent Light Operate (LO) PNP output. See the Remote Input section for details regarding use as remote input or the Sync Master/Slave section for use as a synchronization output.

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.

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RUN/PRG/ADJ Mode Switch

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

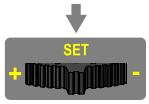
- RUN mode allows the sensor to operate normally and prevents unintentional programming changes via the +/SET/- rocker button.
- PRG mode allows the sensor to be programmed through the display-driven programming menus (see "Program Mode" on page 4
- ADJ mode allows the user to perform Expert TEACH/SET methods and Manual Adjust (see Adjust Mode).



CH1/CH2 Switch (Dual Output Mode)

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

+/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.

Red/Green Digital Displays



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



Dual Output LEDs

The output LEDs provide a visible indication when the associated output is active (conducting).

- 1 represents the Channel 1 output
- 2 represents the Channel 2 output

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 193604.

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-G3.

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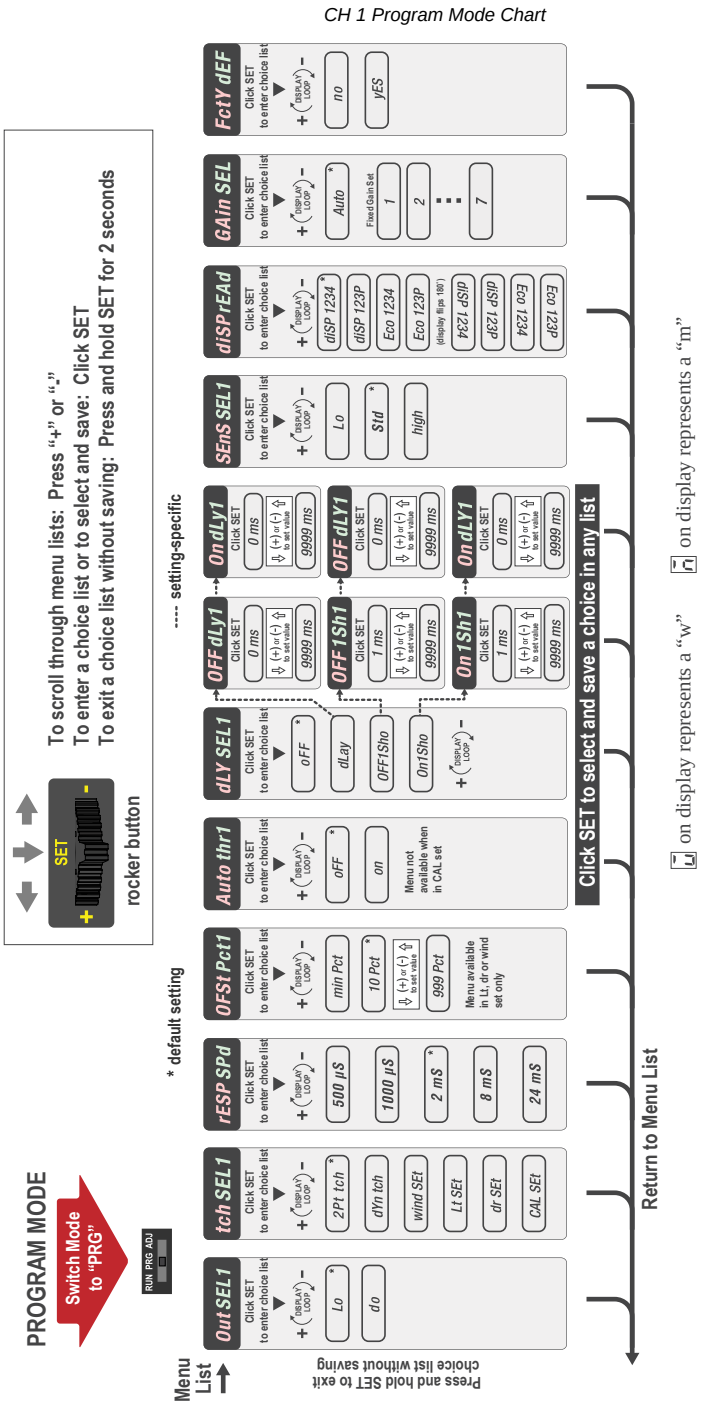
CH 1 Program Mode Chart



CH 1 Factory Default Settings:

Setting	Factory Default
Out SEL1	LO
tch SEL1	2-pt tch
rESP SPd	2 mS
OFSt Pct1	10 Pct
Auto thr1	oFF
dLY SEL1	oFF
SEnS SEL1	Std
diSP rEAd	diSP 1234
GAin SEL	Auto

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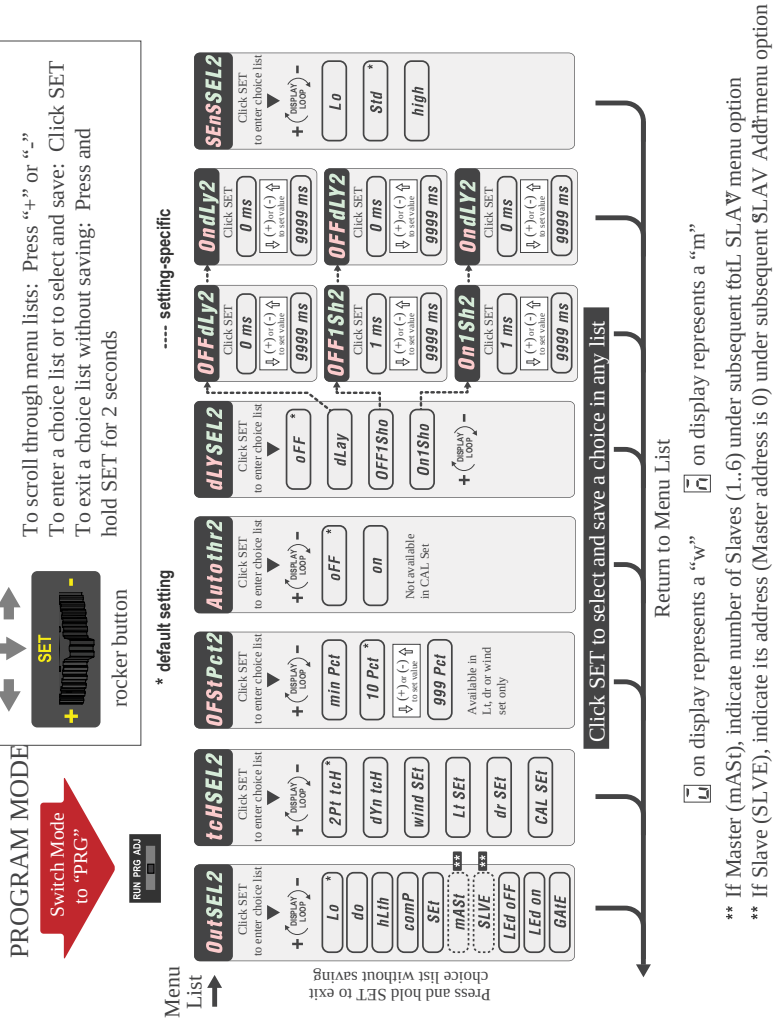
CH 2 Program Mode Chart



CH 2 Factory Default Settings:

Setting	Factory Default
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(s).

> **NOTE:** For the Dual Output models, 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:

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

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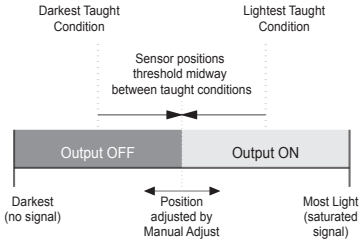
Two-Point TEACH

- 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.

Two-Point TEACH (Light Operate shown)



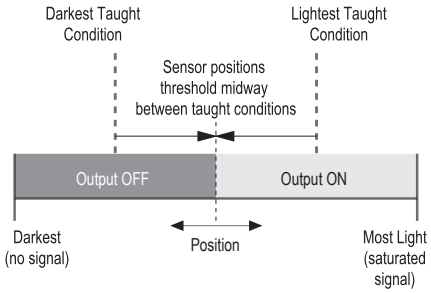
The Output ON and OFF conditions can be reversed by changing the LO/DO setting in the Program Mode menu.

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.

Dynamic TEACH (Light Operate shown)



The Output ON and OFF conditions can be reversed by changing the LO/DO setting in the Program Mode menu.

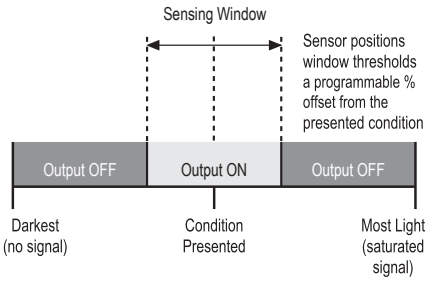
Window SET

- 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.

NOTE: For Window SET and Light SET, the maximum offset threshold percent is 90%.

Window SET (Light Operate shown)



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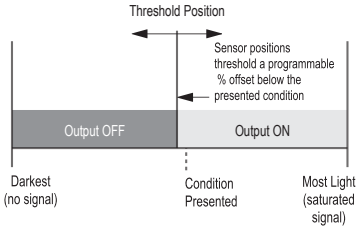
Output ON and OFF conditions can be reversed by changing the LO/DO setting in the Program Mode menu.

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.

Light SET (Light Operate shown)



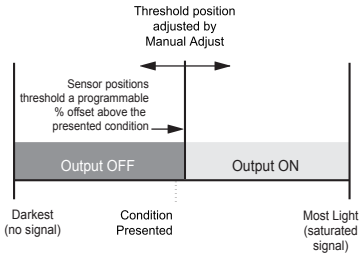
Dark SET

- 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.

Dark SET (Light Operate shown)

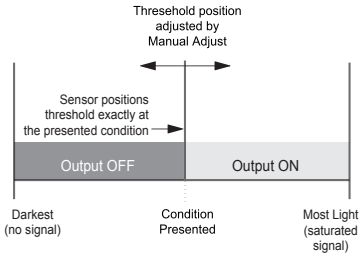


Calibration SET

- 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.

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 flash a % minimum difference on the displays after a PASS or FAIL.

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

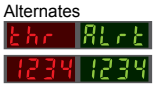
Percent Offset after SET

The Window, Dark, and Light SET methods 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)	The 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-G3: Visible red, 635 nm

DF-G3IR: 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

Delay at Power-Up

500 milliseconds maximum; outputs do not conduct during this time

Output Configuration

CH1 = IO-Link, Push/pull

CH2 = PNP only output or input

Output Rating

100 mA maximum load each output (derate 1 mA per °C above 30° C)

100 mA max total load current for sensor

OFF-state leakage current: < 5 µA PNP at 30 V DC (N.A. push/pull);

ON-state saturation voltage: < 2 V

IO-Link Interface

Supports smart sensor profile: Yes

Baud rate: 38400 bps

Process data widths: 16 bits

IODD files: Provides all programming options of the display, plus additional functionality

Output Protection

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

Construction

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

Connections

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

Adjustments

3-way RUN/PRG/ADJ Mode Switch

2-way CH1/CH2 Switch

3-way +/SET/- Rocker Button

- Expert-style teaching (Two-Point and Dynamic TEACH, Light/Dark/Window/Calibration SET)
- Manually adjust sensitivity (from "+" and "-" rocker button only)
- Response Speed, TEACH Selection, Offset Percent, Auto Thresholds, Delays/Timers, Display Readout, Gain Selection, Factory Defaults (from top panel or remote input)
- Top panel interface lockout (from remote input only)

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Indicators

Red 4-digit Display: Signal Level

Green 4-digit Display: Threshold

(In Program Mode, Red and Green displays are used for programming menus)

Amber LED: Output conducting

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

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Industrial Control Equipment 3TJJ

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

Response Speed

Description	Response Speed	Repetition Period	Repeatability	Cross-Talk Avoidance	Energy Efficient Light Resistance	Maximum Range, Red[2]	Maximum Range, IR850[3]	Maximum Range, LIR1450[4]
High Speed	500 µs	100 µs	100 µs	No	No	1200 mm	2400 mm	360 mm
Fast	1000 µs	100 µs	150 µs	Yes	No	1500 mm	3000 mm	450 mm
Standard	2 ms	100 µs	180 µs	Yes	Yes	1500 mm	3000 mm	450 mm
Long Range	8 ms	100 µs	180 µs	Yes	Yes	1950 mm	3900 mm	585 mm
Extra Long Range	24 ms	100 µs	180 µs	Yes	Yes	3000 mm	6000 mm	900 mm

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For patent information, see www.bannerengineering.com/patents.

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

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