# DF-G2 High-Speed Expert Dual Display Fiber Amplifier with IO-Link Quick Start Guide

## Features

Advanced sensor with dual discrete outputs and IO-Link communication for use with plastic and glass fiber-optic assemblies

For complete technical information about this product, including installation instructions, application requirements and guidelines, technical specifications, and accessories, go to www.bannerengineering.com and search for your model or document p/n 193602.

**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.

## Models

| Model | Sensing Beam Color | Reference Sensing Range[1] | Channel 1 | Channel 2 | Connector |
|---|---|---|---|---|---|
| DF-G2-KD-2M | Visible red | 1100 mm | IO-Link push/pull output | PNP only output, or input | 2 m (6.5 ft) cable, 4-wire |
| DF-G2-KD-Q3 | | | | | 150 mm (6 in) PVC cable with a 4-pin M8 quick disconnect |
| DF-G2-KD-Q5 | | | | | 150 mm (6 in) PVC cable with a 4-pin M12 quick disconnect |
| DF-G2-KD-Q7 | | | | | 4-pin M8 quick disconnect |
| DF-G2IR-KD-Q5 | Infrared | 2100 mm | IO-Link push/pull output | PNP only output, or input | 150 mm (6 in) PVC cable with a 4-pin M12 quick disconnect |
| DF-G2IR-KD-Q7 | | | | | 4-pin M8 quick disconnect |

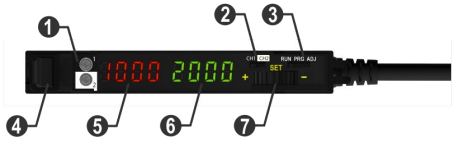
A model with a QD connector requires a mating cordset.

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

| Model | Sensing Beam Color | Reference Sensing Range | Channel 1 | Channel 2 | Connector |
|---|---|---|---|---|---|
| DF-G2IR-KD-2M | Infrared | 2100 mm | IO-Link, push/pull output | PNP only output, or input | 2 m (6.5 ft) cable, 4-wire |
| DF-G2IR-KD-Q3 | | | | | 150 mm (6 in) PVC cable with a 4-pin M8 quick disconnect |

## Overview

*DF-G2 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

## 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.

[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
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193601
p/n: 193601 Rev C

ПРОМЭЛЕКТРОНИКА/ sales@prom-elec.com




**RUN/PRG/ADJ Mode Switch**

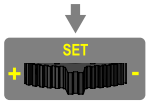
The RUN/PRG/ADJ mode switch puts the sensor in RUN, PRG (Program), or ADJ (Adjust) mode.

- 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).




**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).

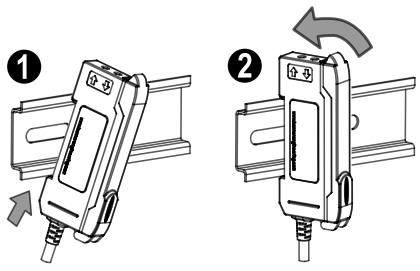
- 1 represents the Channel 1 output
- 2 represents the Channel 2 output

# Installation Instructions

## Mounting Instructions

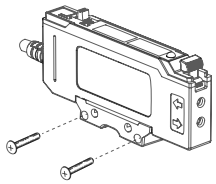
### Mount on a DIN Rail

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)

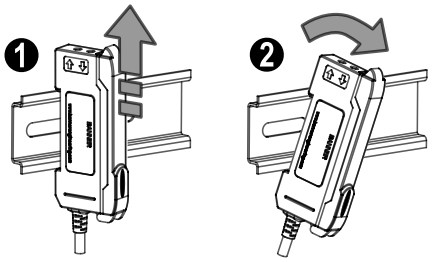
1. Position the DF-G2 in the SA-DIN-BRACKET.
2. Insert the supplied M3 screws.
3. Tighten the screws.



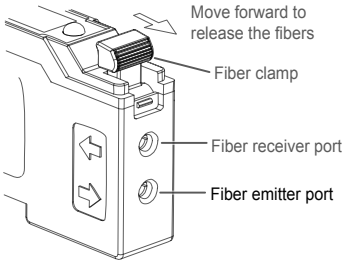

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### Remove from a DIN rail

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



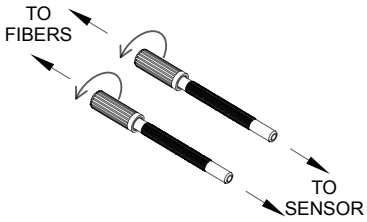

Follow these steps to install glass or plastic fibers.

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.

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

## Fiber Adapters

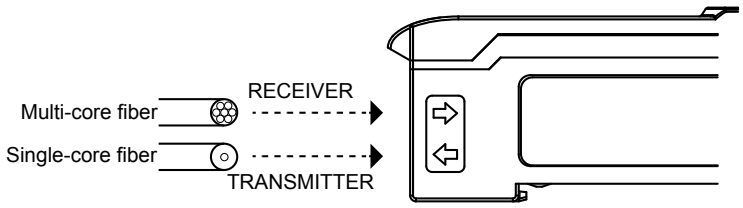
If a thin fiber with less than 2.2 mm outer diameter is used, install the fiber adapter provided with the fiber assembly to ensure a reliable fit in the fiber holder. Align the fibers to the end of the adaptors. Banner includes the adapters with all fiber assemblies.




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

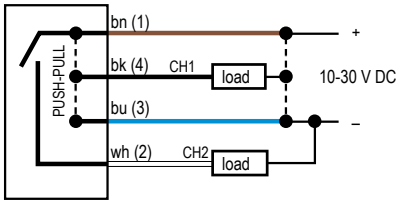
When connecting coaxial-type fiber assemblies to the amplifier, install the single-core (center) fiber to the Transmitter port, and the multi-core (outer) fiber to the Receiver port. This will result in the most reliable detection.


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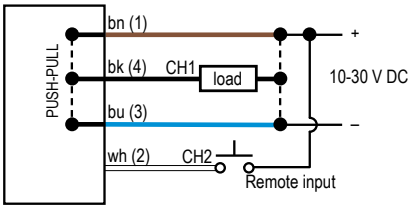



## Wiring Diagrams

*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

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

**NOTE:** The Channel 2 wire function is user-selectable. The default is 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.

# 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 193602.

## 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

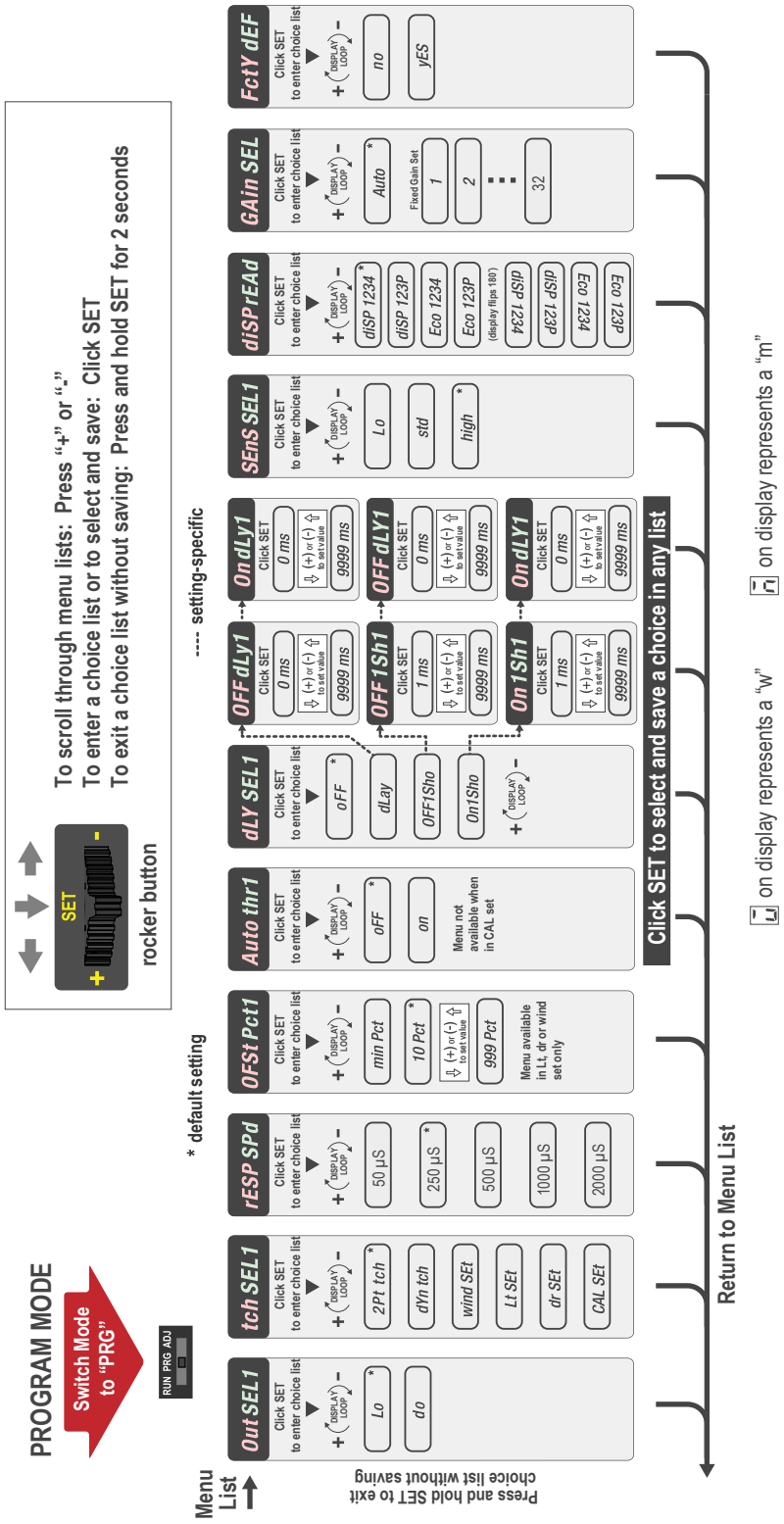
Program (PRG) mode allows the following settings to be programmed in the DF-G2.

*CH 1 Factory Default Settings*

| Setting | Factory Default |
|---|---|
| Out SEL1 | LO |
| tch SEL1 | 2-pt tch |
| rESP SPd | 250 us |
| OFSt Pct1 | 10 Pct |
| Auto thr1 | oFF |
| dLY SEL1 | oFF |
| SEnS SEL1 | high |
| diSP rEAd | diSP 1234 |
| GAin SEL | Auto |


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*CH 1 Program Mode Chart*




*CH 2 Factory Default Settings*

| Setting | Factory Default |
|---|---|
| Out SEL2 | LO |
| tch SEL2 | 2-pt tch |

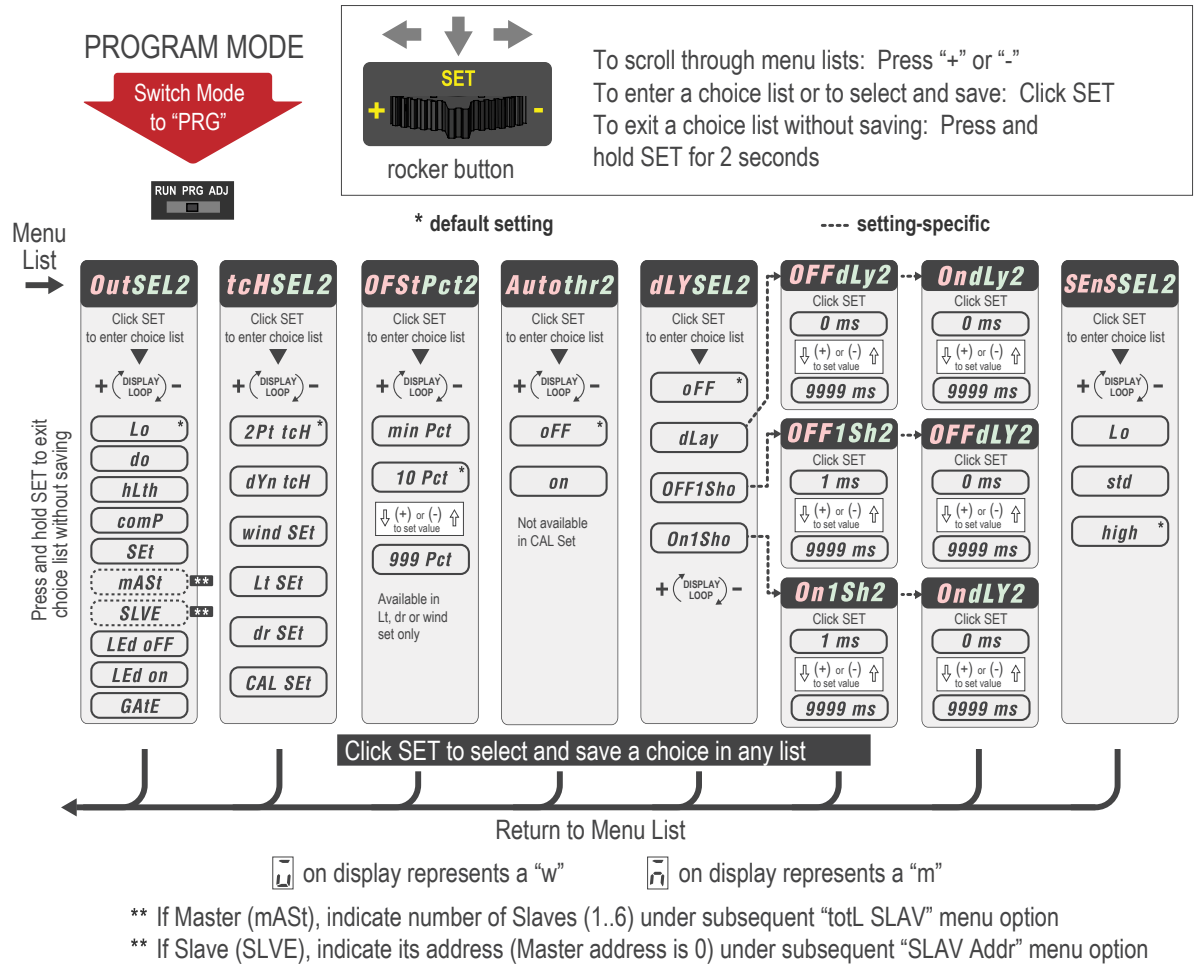
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| Setting | Factory Default |
|---|---|
| OFSt Pct2 | 10 Pct |
| Auto thr2 | oFF |
| dLY SEL2 | oFF |
| SEnS SEL2 | high |

*CH 2 Program Mode Chart*




on display represents a "w" on display represents a "m"

** If Master (mASt), indicate number of Slaves (1..6) under subsequent "totL SLAV" menu option
** If Slave (SLVE), indicate its address (Master address is 0) under subsequent "SLAV Addr" menu option

## 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


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- 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.

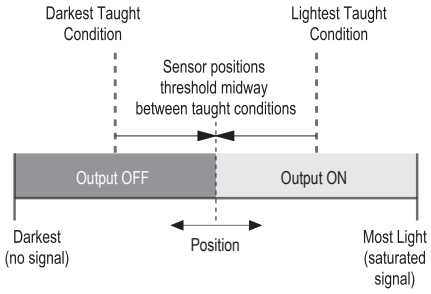
The Output ON and OFF conditions can be reversed by changing the LO/DO setting in the Program Mode menu.

## 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.

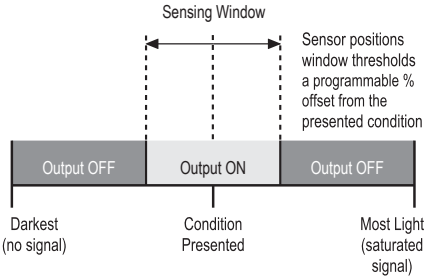
## Window SET

- 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)*




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

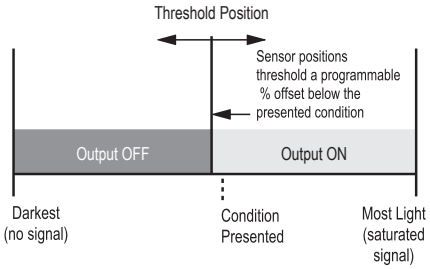

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### Light SET

- 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.

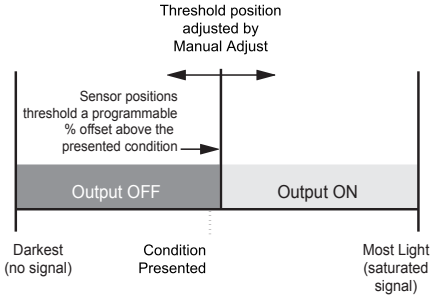
*Light SET (Light Operate shown)*




### 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

*Dark SET (Light Operate shown)*




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

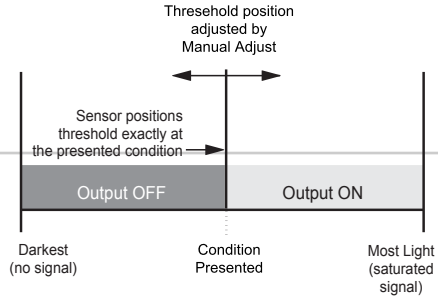
A single sensing condition is presented, and the sensor positions a threshold a programmable % offset above the presented condition. When a condition lighter than the threshold is sensed, the output either turns ON or OFF, depending on the LO/DO setting.

### 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.

| 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 |

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| Value | PASS/FAIL | Description |
|---|---|---|
| 600% + | PASS | The difference between the taught conditions greatly exceeds the required minimum, and the operation is very stable operation |

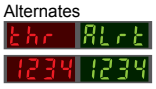
## Percent Offset after SET

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-G2: Visible red, 635 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

**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

**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 |

**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


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### 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)

### 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

Industrial Control Equipment 3TJJ

### Response Speed

See the product manual, p/n 193602.

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