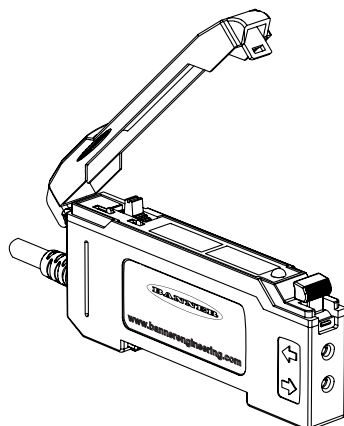


# DF-G1 - Expert Dual Display Fiber Amplifier Manual

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



## Features

- Easy to read dual digital displays show both signal level and threshold simultaneously
- Lever action fiber clamp provides stable, reliable, and trouble-free fiber clamping
- Simple user interface ensures easy sensor set-up and programming via displays and switches/buttons, or remote input teach wire
- *Expert* TEACH and SET methods ensure optimal gain and threshold for all applications, especially low contrast applications
- User has full control over all operating parameters: threshold, Light Operate or Dark Operate, output timing functions, gain level, and response speed
- Thermally stable electronics minimize warm-up drift and the effect of side-by-side mounting of multiple fiber amplifiers
- ECO (economy) display mode reduces amplifier power consumption by 25%
- Cross talk avoidance algorithm allows two sensors to operate in close proximity for many applications
- Response speeds of: 200  $\mu$ s (High Speed), 500  $\mu$ s (Standard), 2 ms (Long Range), and 5 ms (Extra Long Range) allow operator to optimize for fast or long distance applications
- Sleek 10 mm wide housing mounts to 35 mm DIN standard rail
- Visible red LED sensing beam

## 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	

\* Connection options: A model with a QD connector requires a mating cordset (see [Quick-Disconnect Cordsets](#) on page 26).

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.



# Overview

The DF-G1 is an easy-to-use, DIN-rail-mountable fiber optic sensor. It provides high-performance sensing in low-contrast applications.

The sensor's compact housing has dual digital displays (Red/Green) and a bright output LED for easy programming and status monitoring during operation. The sensor features a single discrete output, either NPN or PNP, by model.

The DF-G1 features increased temperature compensation compared with previous fiber optic sensors. An accessory clamp is available to secure a bank of connected sensors together on a DIN rail (see [Accessories](#) on page 27).

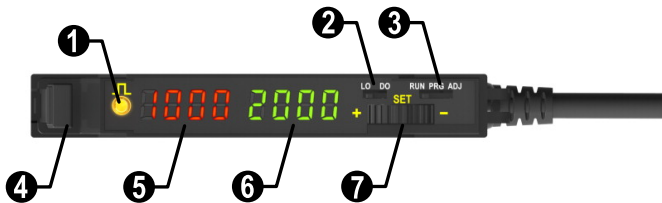


Figure 1. DF-G1 Model Features

1	Output LED
2	LO/DO Switch
3	RUN/PRG/ADJ Mode Switch
4	Lever Action Fiber Clamp (see <a href="#">Dimensions</a> on page 25)
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, LO/DO switch, +/-SET/- rocker button, dual red/green digital displays, and output LED.

## RUN/PRG/ADJ Mode Switch



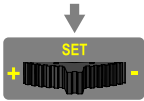
The RUN/PRG/ADJ mode switch puts the sensor in RUN, PRG (Program), or ADJ (Adjust) mode. RUN mode allows the sensor to operate normally and prevents unintentional programming changes via the +/-SET/- button. PRG mode allows the sensor to be programmed through the display driven programming menu (see [Program Mode](#) on page 3 ). ADJ mode allows the user to perform Expert TEACH/SET methods and Manual Adjust (see [Adjust Mode](#) on page 7 ).

## 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 [Figure 8](#). on page 12 .

## 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.

# 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 [Figure 8](#). on page 12 .


 RUN PRG ADJ

## Program Mode

Program (PRG) mode allows the following settings to be programmed in the DF-G1 (refer to diagrams on pages 6-7 for programming).

### TEACH Selection

The DF-G1 can be programmed for one of the following TEACH/SET methods:

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



**NOTE:** A **TEACH Selection** must be selected by programming before TEACH/SET methods can be used.

### Response Speed


The DF-G1 can be programmed for one of the following Response Speeds:

Response Speed	Display Range	Crosstalk Avoidance Algorithm
200 us (High Speed)	0 - 4000	Disabled
500 us (Standard)	0 - 4000	Enabled
2000 us (Long Range)	0 - 9999	Enabled
5000 us (Extra Long Range)	0 - 9999	Enabled

### Offset Percent

The Offset Percent is used during the Window, Light, or Dark SET methods. The threshold(s) are positioned a programmable % offset from the taught condition. The allowable range depends upon the Response Speed Mode, as shown below:

Response Speed	MIN %	MAX %
200 us (High Speed)	10	999
500 us (Standard)	10	999
2000 us (Long Range)	2	999
5000 us (Extra Long Range)	2	999

 The offset percent can also be programmed to **Minimum Offset**. This allows the DF-G1 to set the threshold(s) as close as possible to the presented condition, but still provide for reliable sensing.



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

### Auto Thresholds

Auto Thresholds can be programmed to be ON/OFF. The Auto Thresholds algorithm continuously tracks slow changes in the taught condition(s), and optimizes the threshold(s) to provide for reliable sensing. For Two-Point and Dynamic TEACH, the algorithm optimizes the threshold to be centered between the light and dark conditions. For Window, Light, and Dark SET, the algorithm optimizes the threshold(s) to maintain the programmed Offset Percent from the taught condition.

- After programming Auto Thresholds to ON, it is highly recommended to re-perform the TEACH/SET method
- Manual Adjustments are disabled when Auto Thresholds are ON
- Auto Thresholds are automatically disabled in Calibration SET (see [Calibration SET](#) on page 17)
- Severe contamination/changes in the taught condition can prevent the Auto Thresholds algorithm from optimizing the threshold(s). If this occurs, the DF-G1 will enter a **Threshold Alert** or **Threshold Error** state. See [Troubleshooting](#) on page 19 for more explanation.

### Delays/Timers OFF dLY OFF 1SHd On dLY On 1Shd

ON/OFF Delays and ON/OFF One-Shot timers can be programmed between 1 - 9999 ms (a value of 0 disables the delay/timer). **Figure 2** defines how the delays/timers affect the output behavior.

Some combinations of delays/timers are not allowed. The DF-G1 programming menu automatically disables invalid combinations of delays/timers. The following table shows the allowable combinations of delays/timers:

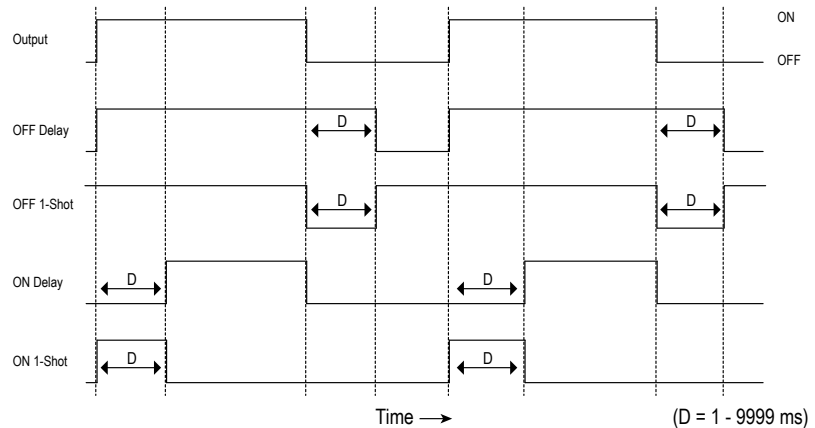


Figure 2. DF-G1 Delays/Timers

	OFF Delay	OFF One-Shot Timer	ON Delay	ON One-Shot Timer
OFF Delay	-	OK	OK	N/A
OFF One-Shot Timer	OK	-	N/A	N/A
ON Delay	OK	N/A	-	OK
ON One-Shot Timer	N/A	N/A	OK	-

### Display Readout dISP rEd

The readout of the digital displays can be programmed for the following options:

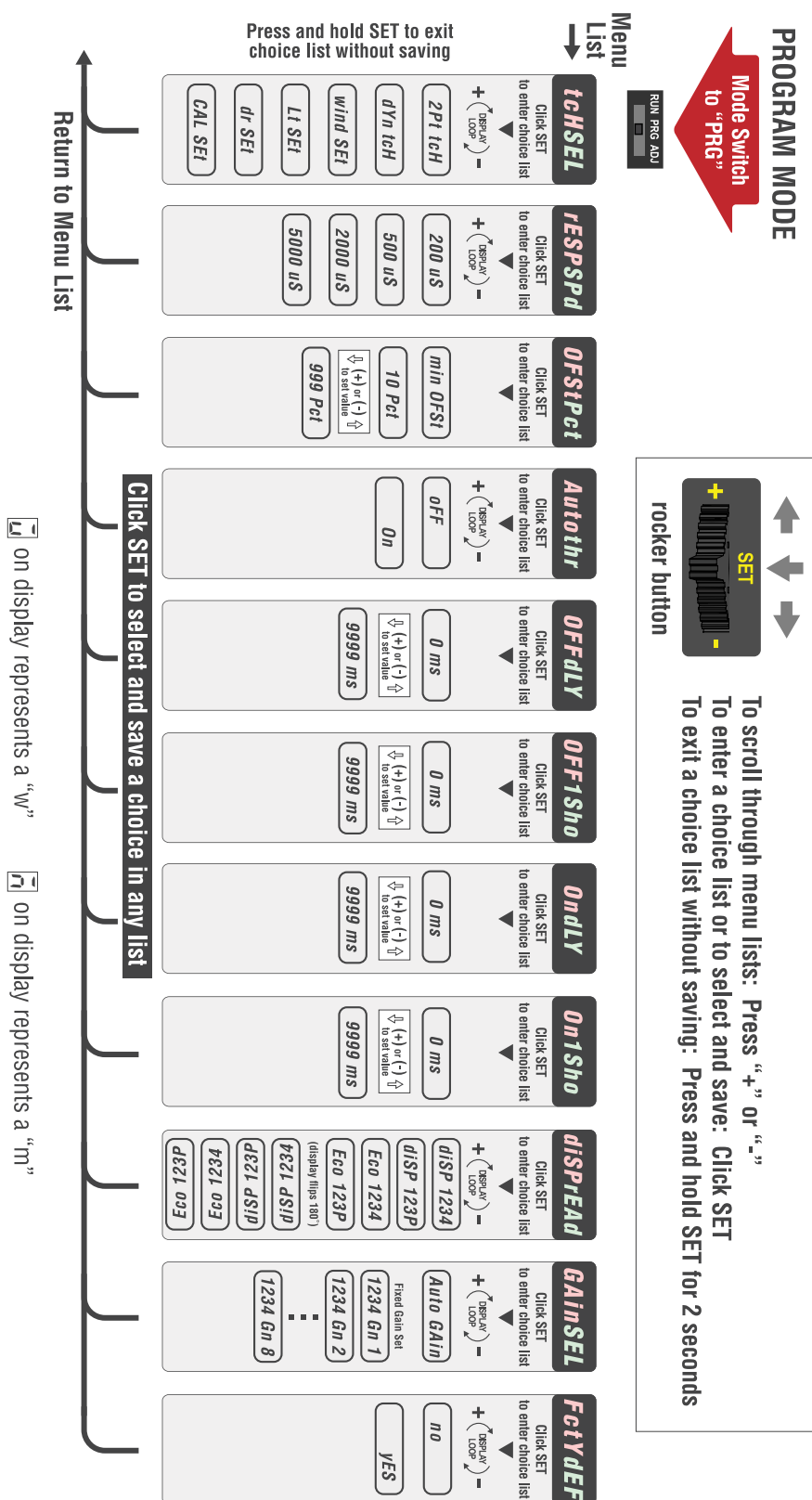
- Signal/Threshold readout - Numeric (1234) or % (123P)
- ECO mode - Enabled or Disabled (ECO mode dims the displays to reduce current consumption)
- Display Orientation - Normal (1234) or Flipped (ᴉɹɹl)

### Gain Selection GR In SEL

The DF-G1 can operate in Auto Gain mode or the Gain can be fixed to be in Gain 1...8. In Auto Gain, the DF-G1 optimizes the gain during a TEACH/SET method for the presented condition(s). While viewing the fixed gains in the Gain Selection choice list, the DF-G1 will automatically switch to the selected gain and display the measured signal on the Red display. This allows for easy and quick evaluation of the fixed gain mode.

### Factory Defaults FctY dEF

The Factory Defaults menu allows the DF-G1 to be easily restored back to original factory default settings (see **Factory Default Settings** in [Specifications](#) on page 20).

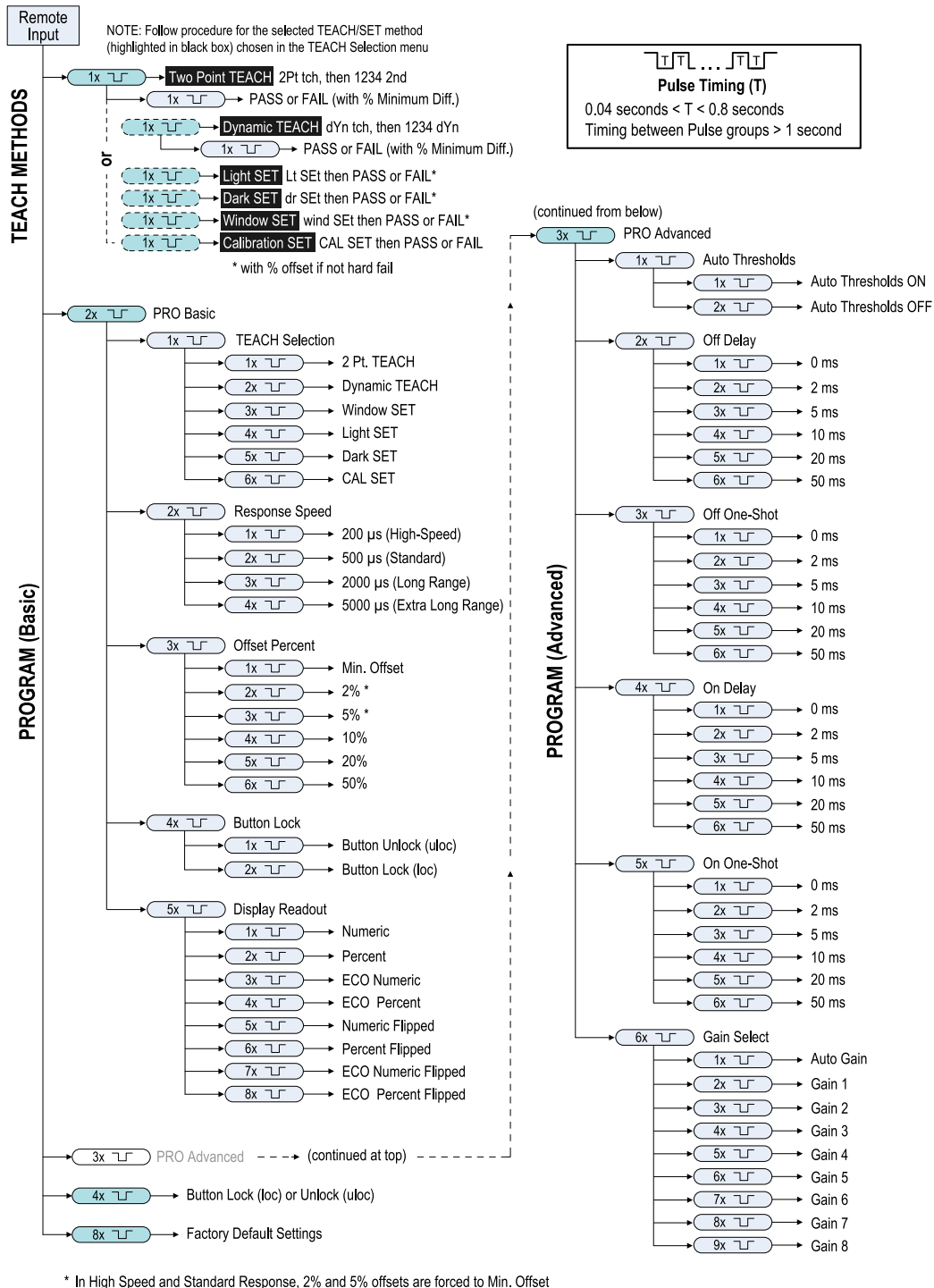


**Figure 3.**

## Remote Input

The remote input may be used to perform TEACH/SET methods and to program the sensor remotely. Connect the white input wire of the sensor to ground (0V dc), with a remote switch connected between them. Pulse the remote input according to the diagram shown below in **Figure 6**. Follow the instructions in the TEACH/SET sections in [Adjust Mode](#) on page 7 to perform a TEACH/SET method.

TEACH methods and remote programming modes may be exited either after a 60-second timeout or by holding the remote input low for > 2 seconds, the sensor will return to RUN mode without saving any new settings.



**Figure 4. Remote Input Flowchart**



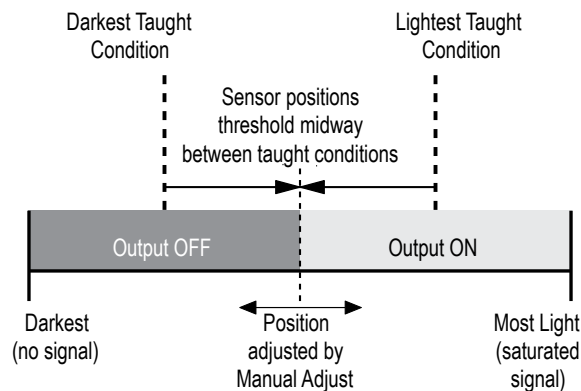
## Adjust Mode

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).



**Figure 5. 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 (see **LO/DO Switch** in [Top Panel Interface](#) on page 2).





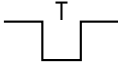

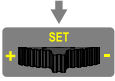
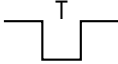

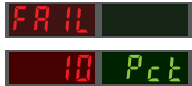
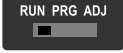

## Two-Point TEACH and Manual Adjust

- 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

## Two-Point TEACH

	SET Button $0.04 \text{ seconds} \leq \text{"Click"} \leq 0.8 \text{ seconds}$	Remote Input $0.04 \text{ seconds} \leq T \leq 0.8 \text{ seconds}$	Result
 <b>Note:</b> TEACH Selection must be programmed to <b>2Pt tch</b> (see <a href="#">Program Mode</a> on page 3 )			
<b>Enter Adjust Mode</b>	Set Mode switch to ADJ 	No action required; sensor is ready for Two-Point TEACH method	<b>Display: Red - Signal Level;</b> <b>Green - Threshold</b> 
<b>TEACH 1st Condition</b>	<ul style="list-style-type: none"> <li>Present 1st condition</li> <li>Click the SET rocker button</li> </ul> 	<ul style="list-style-type: none"> <li>Present 1st condition</li> <li>Single-pulse remote input</li> </ul> 	<b>Display:</b> Flashes "2Pt tch" then holds on "1234 2nd" 
<b>TEACH 2nd Condition</b>	<ul style="list-style-type: none"> <li>Present 2nd condition</li> <li>Click the SET rocker button</li> </ul> 	<ul style="list-style-type: none"> <li>Present 2nd condition</li> <li>Single-pulse remote input</li> </ul> 	<b>TEACH Accepted</b> Displays alternate "PASS" and % Minimum Difference*; Sensor returns to Adjust mode 
			<b>TEACH Unacceptable</b> Displays alternate "FAIL" and % Minimum Difference*; Sensor returns to Adjust mode 
<b>Return to RUN Mode</b>	Move Mode switch to RUN 	No action required; sensor returns to RUN mode automatically	<b>Display: Red - Signal Level;</b> <b>Green - Threshold</b> 

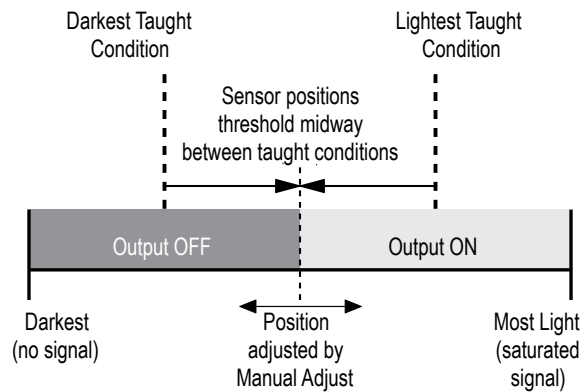
\* See [Troubleshooting](#) on page 19 for more explanation of the % Minimum Difference displayed after the Two-Point TEACH method



## 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).



**Figure 6. Dynamic TEACH (Light Operate shown)**

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).




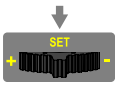
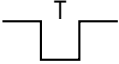


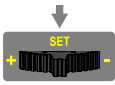
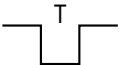




### Dynamic TEACH and Manual Adjust

- 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

## Dynamic TEACH

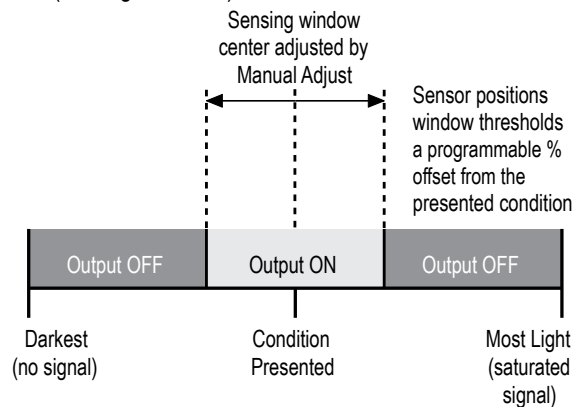
	SET Button 0.04 seconds ≤ "Click" ≤ 0.8 seconds	Remote Input 0.04 seconds ≤ T ≤ 0.8 seconds	Result
 <b>Note:</b> TEACH Selection must be programmed to <b>dYn tch</b> (see <a href="#">Program Mode</a> on page 3 )			
<b>Enter Ad-just Mode</b>	<ul style="list-style-type: none"> <li>Set Mode switch to ADJ</li> </ul> 	No action required; sensor is ready for Dynamic TEACH method	<b>Display: Red - Signal Level;</b> <b>Green - Threshold</b> 
<b>Enter Dy-namic TEACH</b>	<ul style="list-style-type: none"> <li>Click the SET rocker button</li> </ul> 	<ul style="list-style-type: none"> <li>Single-pulse remote input</li> </ul> 	<b>Display: Flashes "dYn tch"</b> then holds on "1234 dYn" 
<b>Present ON and OFF Conditions</b>	<ul style="list-style-type: none"> <li>Present ON and OFF conditions</li> </ul>	<ul style="list-style-type: none"> <li>Present ON and OFF conditions</li> </ul>	<b>Display: Red - Signal Level;</b> <b>Green - Threshold</b> 
<b>Exit Dy-namic TEACH</b>	<ul style="list-style-type: none"> <li>Click the SET rocker button</li> </ul> 	<ul style="list-style-type: none"> <li>Single-pulse remote input</li> </ul> 	<b>TEACH Accepted</b> Displays alternate "PASS" with % Minimum Difference*, Sensor returns to Adjust mode 
			<b>TEACH Unacceptable</b> Displays alternate "FAIL" with % Minimum Difference*, Sensor returns to Adjust mode 
<b>Return to RUN Mode</b>	<ul style="list-style-type: none"> <li>Move Mode switch to RUN</li> </ul> 	No action required; sensor returns to RUN mode automatically	<b>Display: Red - Signal Level;</b> <b>Green - Threshold</b> 

\* See [Troubleshooting](#) on page 19 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](#) on page 3 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).



**Figure 7. Window SET (Light Operate shown)**

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














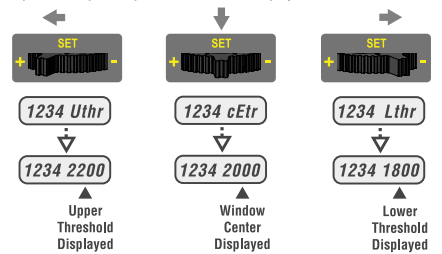
### Window SET and Manual Adjust

- 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

## Window SET

	SET Button $0.04 \text{ seconds} \leq \text{"Click"} \leq 0.8 \text{ seconds}$	Remote Input $0.04 \text{ seconds} \leq T \leq 0.8 \text{ seconds}$	Result
 <b>Note:</b> TEACH Selection must be programmed to <b>wind SET</b> (see <a href="#">Program Mode</a> on page 3 )			
Enter Ad-just Mode	<ul style="list-style-type: none"> <li>Set Mode switch to ADJ</li> </ul> 	No action required; sensor is ready for Window SET method	<b>Display: Red - Signal Level;</b> <b>Green - Threshold</b> 
SET Sens-ing Con-di-tion	<ul style="list-style-type: none"> <li>Present sensing condition</li> <li>Click the SET rocker but-ton</li> </ul> 	<ul style="list-style-type: none"> <li>Present sensing condition</li> <li>Single-pulse the remote in-put</li> </ul> 	<b>Threshold Condition Accep-ted</b>   Displays read " <b>wInd SET</b> " then alternate " <b>PASS</b> " with % Off-set*; Sensor returns to Adjust mode  <b>Threshold Condition Unac-ceptable</b>   Displays read " <b>wInd SET</b> " then alternate " <b>FAIL</b> " with minimum % Offset* for sensing condition; Sensor returns to Adjust mode 
Return to RUN Mode	<ul style="list-style-type: none"> <li>Move Mode switch to RUN</li> </ul> 	No action required; sensor re-turs to RUN mode automati-cally	<b>Display: Red - Signal Level;</b> <b>Green - Window Center</b> (see Figure below for instructions on how to display upper and lower thresholds)  <div style="text-align: center;"> <b>Window SET (during RUN mode)</b>            Upon sensor power-up, Window Center is displayed    <b>Figure 8.</b> </div>

\* See [Troubleshooting](#) on page 19 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).

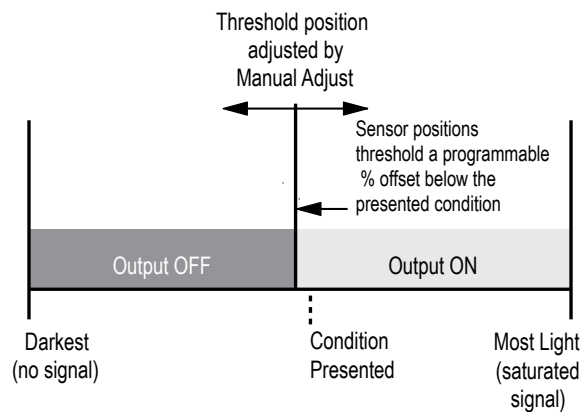


Figure 9. Light SET (Light Operate shown)


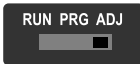

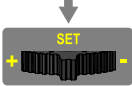







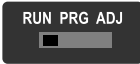

### Light SET and Manual Adjust

- 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

## Light SET

	SET Button 0.04 seconds ≤ "Click" ≤ 0.8 seconds	Remote Input 0.04 seconds ≤ T ≤ 0.8 seconds	Result
 <b>Note:</b> TEACH Selection must be programmed to <b>Lt SET</b> (see <a href="#">Program Mode</a> on page 3 )			
<b>Enter Ad-just Mode</b>	<ul style="list-style-type: none"> <li>Set Mode switch to ADJ</li> </ul> 	No action is required; sensor is ready for Light SET method	<b>Display: Red - Signal Level;</b> <b>Green - Threshold</b> 
<b>SET Sensing Condition</b>	<ul style="list-style-type: none"> <li>Present sensing condition</li> <li>Click the SET rocker button</li> </ul> 	<ul style="list-style-type: none"> <li>Present sensing condition</li> <li>Single-pulse the remote input</li> </ul> 	<b>Threshold Condition Accepted</b>   Displays read "Lt SET" then alternate "PASS" with % Offset*; Sensor returns to Adjust mode  <b>Threshold Condition Unacceptable</b>   Displays read "Lt SET" then alternate FAIL with minimum % Offset* for sensing condition; Sensor returns to Adjust mode 
<b>Return to RUN Mode</b>	<ul style="list-style-type: none"> <li>Move Mode switch to RUN</li> </ul> 	No action required; sensor returns to RUN mode automatically	<b>Display: Red - Signal Level;</b> <b>Green - Threshold</b> 

\* [Troubleshooting](#) on page 19 for more explanation of the % Offset displayed after the Light SET method

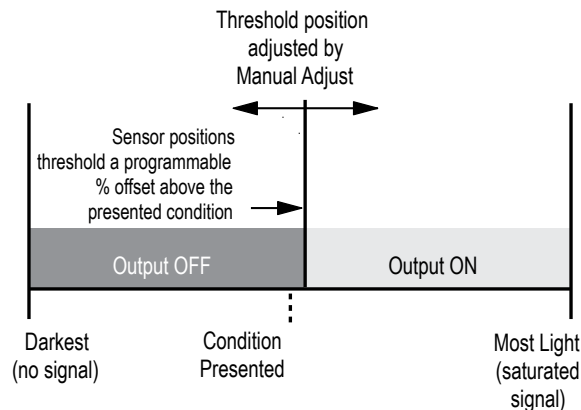
## Dark SET

- 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).



**Figure 10. Dark SET (Light Operate shown)**


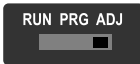

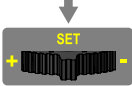
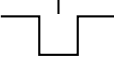






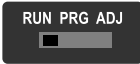

### Dark SET and Manual Adjust

- 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

## Dark SET

	SET Button 0.04 seconds ≤ "Click" ≤ 0.8 seconds	Remote Input 0.04 seconds ≤ T ≤ 0.8 seconds	Result
 <b>Note:</b> TEACH Selection must be programmed to <b>dr SET</b> (see <a href="#">Program Mode</a> on page 3 )			
<b>Enter Ad-just Mode</b>	<ul style="list-style-type: none"> <li>Set Mode switch to ADJ</li> </ul> 	No action required; sensor is ready for Dark SET method	<b>Display: Red - Signal Level;</b> <b>Green - Threshold</b> 
<b>SET Sensing Condition</b>	<ul style="list-style-type: none"> <li>Present sensing condition</li> <li>Click the SET rocker button</li> </ul> 	<ul style="list-style-type: none"> <li>Present sensing condition</li> <li>Single-pulse the remote input</li> </ul> 	<b>Threshold Condition Accepted</b>    <p>Displays read "dr SET" then alternate "PASS" with % Offset*; Sensor returns to Adjust mode</p> <b>Threshold Condition Unacceptable</b>    <p>Displays read "dr SET" then alternate "FAIL" with minimum % Offset* for sensing condition; Sensor returns to Adjust mode</p>
<b>Return to RUN Mode</b>	<ul style="list-style-type: none"> <li>Move Mode switch to RUN</li> </ul> 	No action required; sensor returns to RUN mode automatically	<b>Display: Red - Signal Level;</b> <b>Green - Threshold</b> 

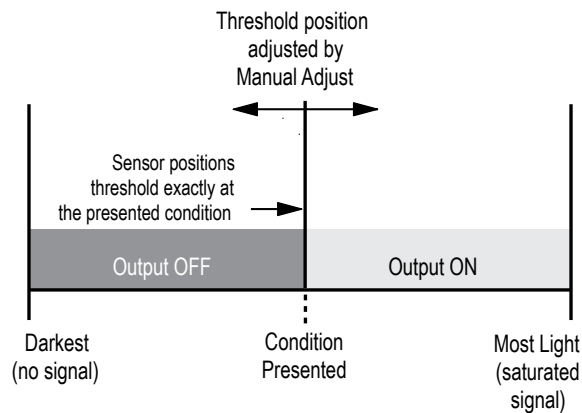
\* See [Troubleshooting](#) on page 19 for more explanation of the % Offset displayed after the Dark SET method



## 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).



**Figure 11. Calibration SET (Light Operate shown)**


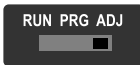


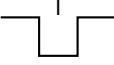




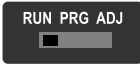

### Calibration SET and Manual Adjust

- 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

## Calibration SET

	SET Button 0.04 seconds ≤ "Click" ≤ 0.8 seconds	Remote Input 0.04 seconds ≤ T ≤ 0.8 seconds	Result
 <b>Note:</b> TEACH Selection must be programmed to <b>CAL SET</b> (see <a href="#">Program Mode</a> on page 3 )			
Enter Ad-just Mode	<ul style="list-style-type: none"> <li>Set Mode switch to ADJ</li> </ul> 	No action required; sensor is ready for Calibration SET method	<b>Display: Red - Signal Level; Green - Threshold</b> 
SET Sensing Condition	<ul style="list-style-type: none"> <li>Present sensing condition</li> <li>Click the SET rocker button</li> </ul> 	<ul style="list-style-type: none"> <li>Present sensing condition</li> <li>Single-pulse the remote input</li> </ul> 	<b>Threshold Condition Accepted</b>   Displays read "cAL SET" then flashes "PASS"; Sensor returns to Adjust mode
			<b>Threshold Condition Unacceptable</b>   Displays read "cAL SET" then flashes "FAIL"; Sensor returns to Adjust mode
Return to RUN Mode	<ul style="list-style-type: none"> <li>Move Mode switch to RUN</li> </ul> 	No action required; sensor returns to RUN mode automatically	<b>Display: Red - Signal Level; Green - Threshold</b> 

## 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 µs

Standard - 500 µs

Long Range - 2 ms

Extra Long Range - 5 ms

### Repeatability

High Speed - 66 µs, Standard/Long Range/Extra Long Range - 100 µs

### Connections

PVC-jacketed 2 m or 9 m (6.5' or 30') 4-wire integral cable or integral 4-pin Pico-style QD or Pico-style 150 mm (6") pigtail QD or Euro-style 150 mm (6") pigtail QD

### Indicators

**Red 4-digit Display:** Signal Level

**Green 4-digit Display:** Threshold

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

**Yellow LED:** Output conducting

### Construction

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

## Adjustments

3-way RUN/PRG/ADJ Mode Switch

2-way LO/DO 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)

### Factory Default Settings:

Setting	Factory Default
Threshold	2026
TEACH Selection	Two-Point TEACH
Response Speed	Standard - 500 µs
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

### Environmental Rating

IEC IP50, NEMA 1

### Operating Conditions

**Temperature:** -10° to +55° C (+14° to 131° F)

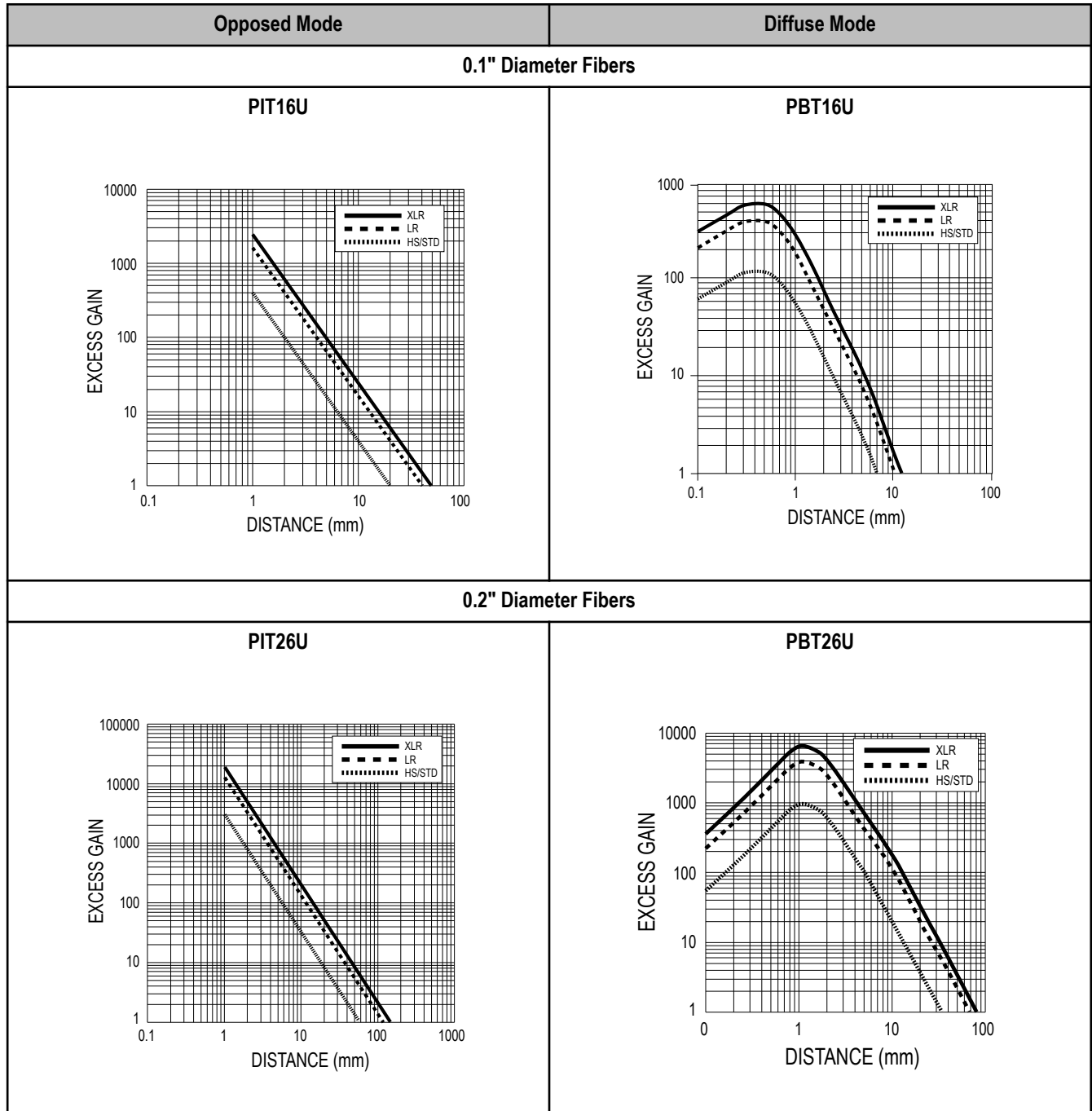
**Storage:** -20° to +85° C (-4° to +185° F)

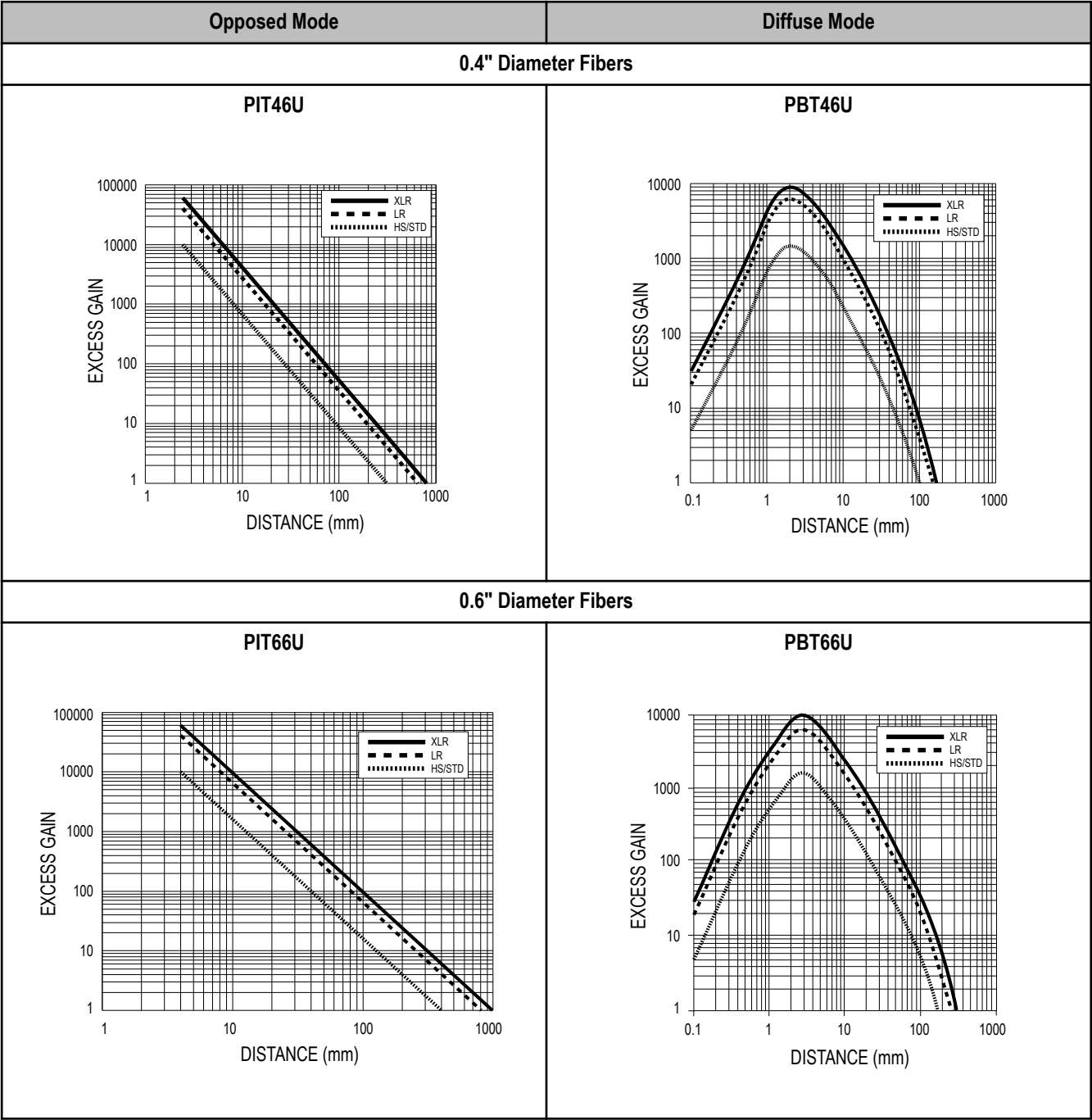
**Relative Humidity:** 90% @ 60° C (non-condensing)

### Certifications

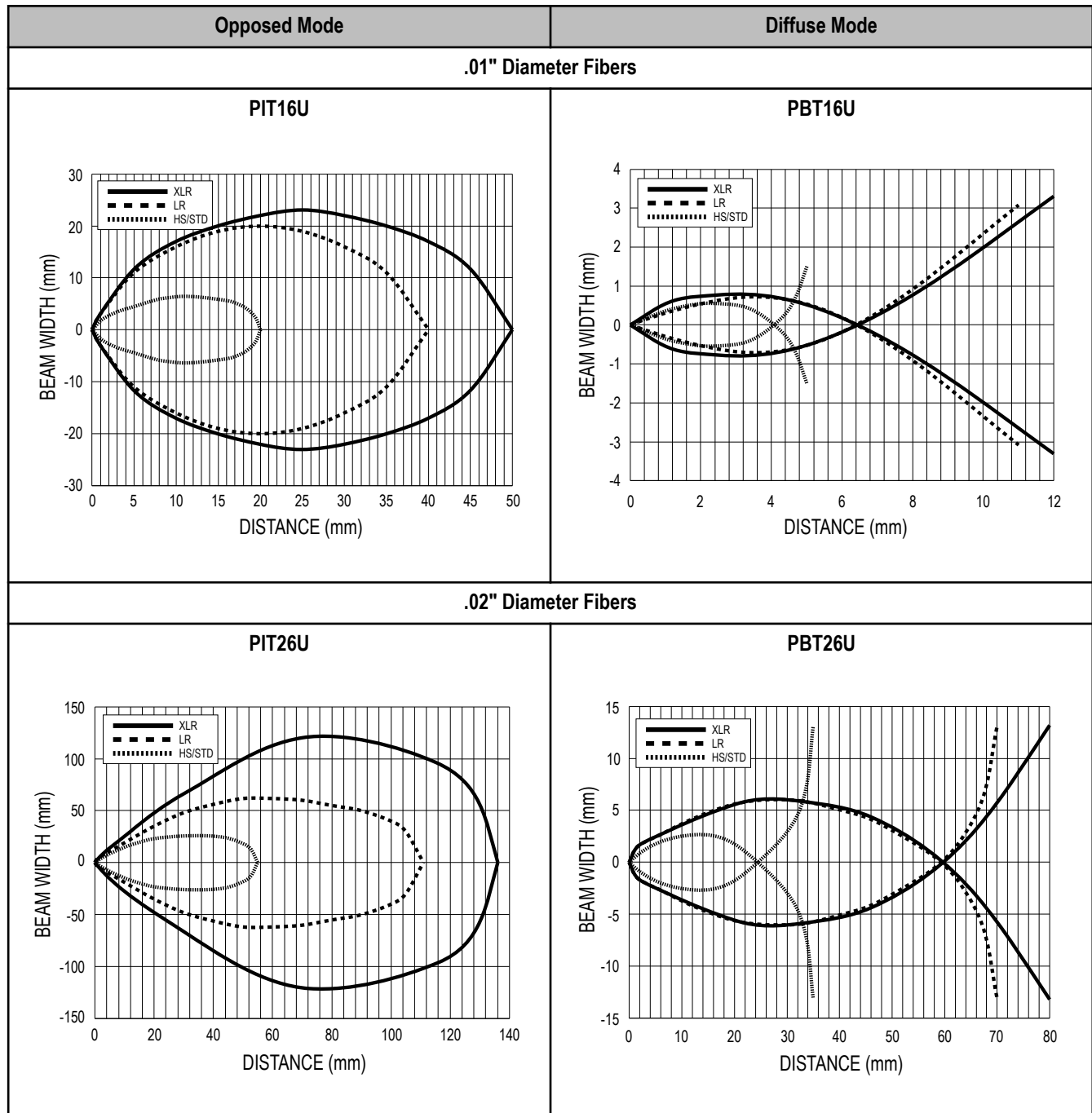


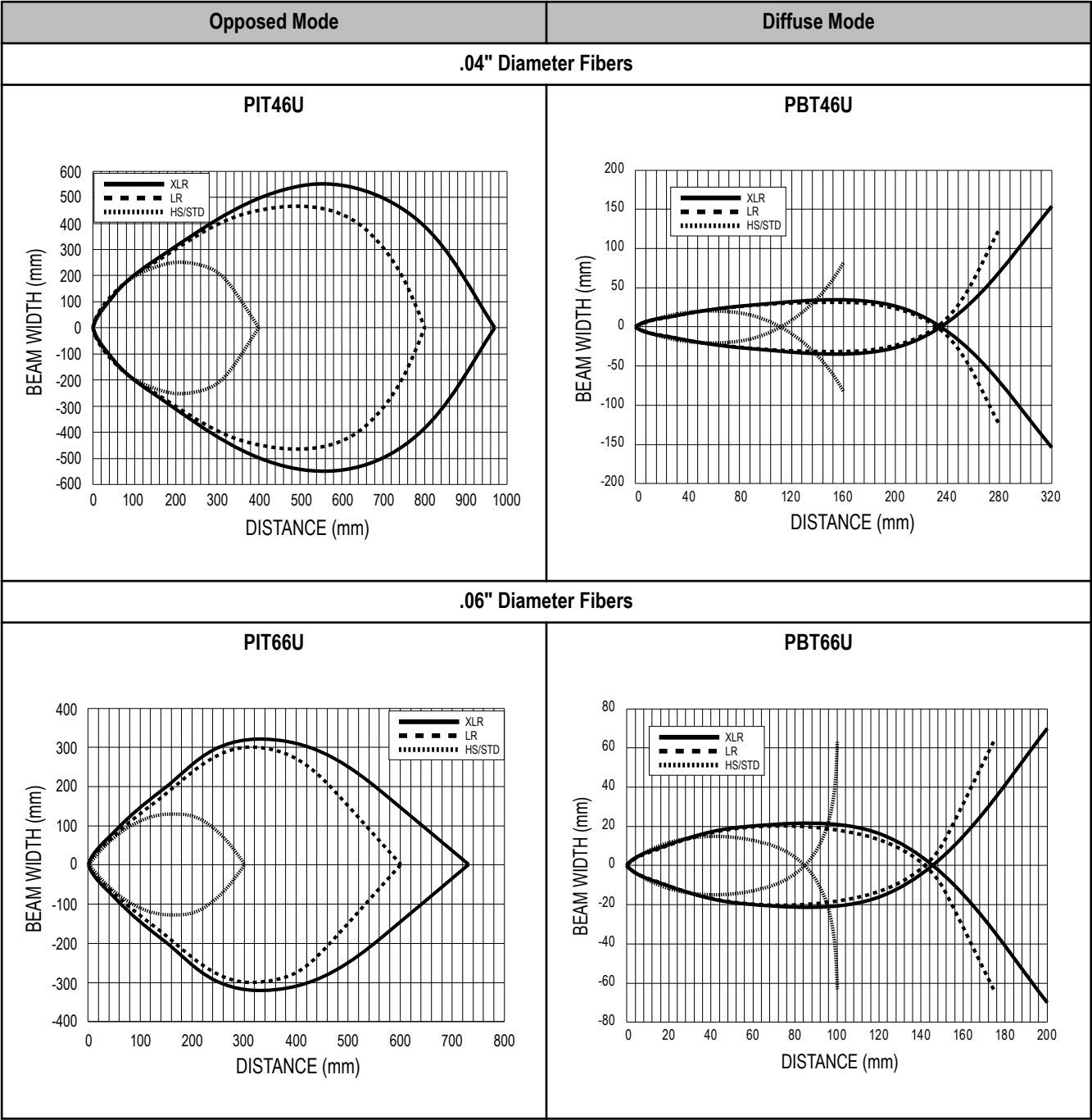
## Excess Gain Curves





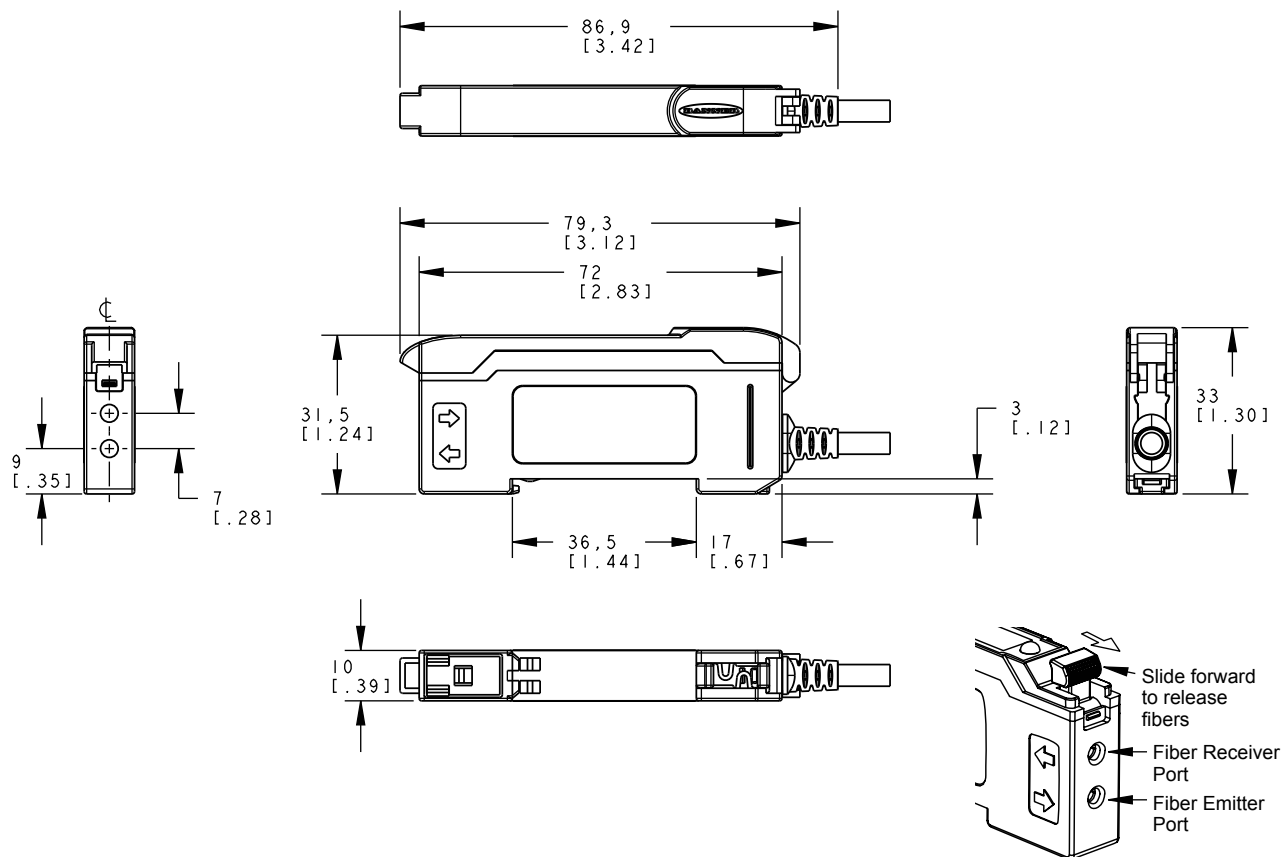
## Beam Patterns



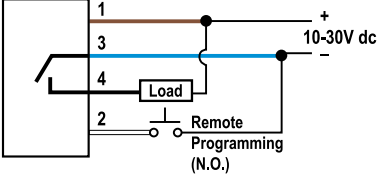
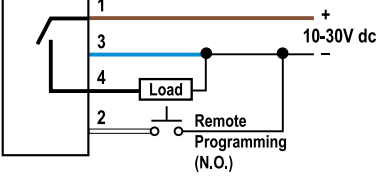
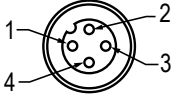




## Dimensions

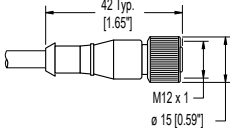
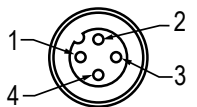
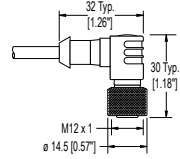


## Hookups

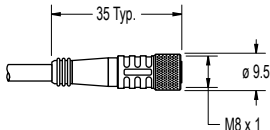
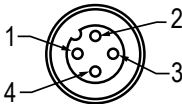
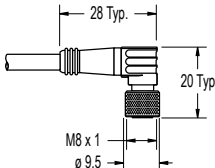
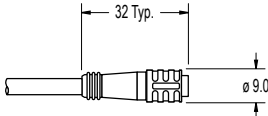
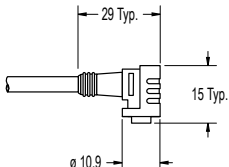
NPN Models	PNP Models	Key
		 <p>           1 = Brown            2 = White            3 = Blue            4 = Black         </p>

## Quick-Disconnect Cordsets

### 4-Pin Threaded M12/Euro-Style Cordsets

Style	Model	Length	Dimensions	Pinout
Straight	<b>MQDC-406</b>	1.83 m (6')		
	<b>MQDC-415</b>	4.57 m (15')		
	<b>MQDC-430</b>	9.14 m (30')		
	<b>MQDC-450</b>	15.20 m (50')		
Right-angle	<b>MQDC-406RA</b>	1.83 m (6')		1 = Brown 2 = White 3 = Blue 4 = Black
	<b>MQDC-415RA</b>	4.57 m (15')		
	<b>MQDC-430RA</b>	9.14 m (30')		
	<b>MQDC-450RA</b>	15.20 m (50')		

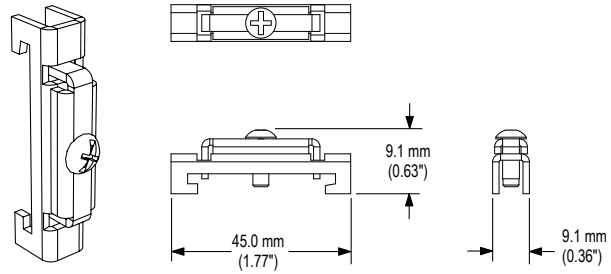
### 4-Pin M8/Pico-Style Cordsets

Style	Model	Length	Dimensions	Pinout
Threaded Straight	<b>PKG4M-2</b>	2 m (6.5')		  1 = Brown 2 = White 3 = Blue 4 = Black
	<b>PKG4M-5</b>	5 m (16.5')		
	<b>PKG4M-9</b>	9 m (30')		
Threaded Right-angle	<b>PKW4M-2</b>	2 m (6.5')		
	<b>PKW4M-5</b>	5 m (16.5')		
	<b>PKW4M-9</b>	9 m (30')		
Snap-On Straight	<b>PKG4-2</b>	2 m (6.5')		
	<b>PKG4-5</b>	5 m (16.5')		
	<b>PKG4-9</b>	9 m (30')		
Snap-On Right-Angle	<b>PKW4Z-2</b>	2 m (6.5')		
	<b>PKW4Z-5</b>	5 m (16.5')		
	<b>PKW4Z-9</b>	9 m (30')		

## Accessories

### SA-DIN-CLAMP

- Pair of metal DIN rail end stops; slide onto DIN rail at either side of DF-G1 sensor stack
- Combination (#2 Phillips, #8 standard slotted) set screw

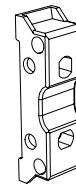


### SA-DIN-BRACKET

- 1 plastic bracket with mounting screws

### SA-DIN-BRACKET-10

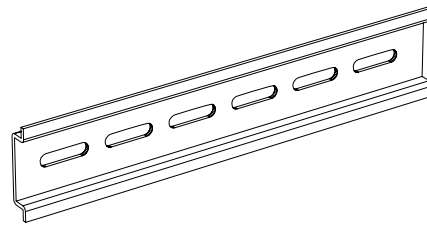
- Package of 10 plastic brackets with mounting screws



### DIN-35-..

- 35 mm DIN Rail

Model	Length
DIN-35-70	70 mm
DIN-35-105	105 mm
DIN-35-140	140 mm



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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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