PHOTOSWITCH DIN Rail Fiber Optic Amplifier

Catalog Numbers 46DFA-L2LBT1-A2, 46DFA-L2LBT1-F4, 46DFA-L2LBT1-Y4

Description

Bulletin 46DFA PHOTOSWITCH® DIN rail fiber-optic amplifier is a dual display that is designed for the detection of objects with the use of a standard 2.2 mm (0.09 in.) diameter fiber-optic cable. These sensors are ideal for assembly and packaging applications where you detect objects in limited spaces or applications that require high speeds. Additional sensing flexibility can be achieved when used with the wide variety of fiber-optic tips.

Bulletin 43G glass fiber-optic cables compatible with this amplifier are ideal for use in high temperature applications. For continuous movement and high-flex applications, we recommend the use of the Bulletin 43P small aperture plastic fiber cables.

Features

- Two high-visibility displays provide configuration and operation feedback that makes the sensor easy to set up, operate, and maintain.
- ECO (economy) display mode reduces amplifier power consumption by 25%.
- Teachable LED intensity provides added flexibility in applications where there’s a need to detect clear or transparent objects.
- Fast-response output using pin 2 when connected using IO-Link enables continuous sensor monitoring without impact on response time needs.
- Fast response speeds of 50 µs, 500 µs, 4 ms, and 32 ms allows operators easy adaptation of the sensor response time to their application needs.
- Built-in totalizer feature allows operator to trigger the sensor output once a certain count value has been reached.
- Cross-talk protection enables operation of sensors in close proximity without an impact on performance.
- Selectable PNP and NPN output using push button simplifies inventory.
- Embedded IO-Link 1.1 Communication protocol that is offered in all standard modes.
- IP40 rated enclosure.

Sensor Installation

Figure 1 - DIN Rail and Dedicated Mounting Bracket

1. DIN rail mount
   Hook the front tab on the rail (or mounting bracket) and then press the rear section.

2. Removal
   To remove the front tab, press the unit forward, and pull the front section up.

3. Side mount
   Install the side of the amplifier unit using an optional mounting bracket.

Figure 2 - Amplifier Case Cover

1. To open the sensor cover
   Lift the cover by pulling up the tab.

2. To remove the case cover
   The cover can be removed by pressing the edge of the fully opened cover.

3. To attach the case cover
   Place the removed cover on the amplifier unit as shown and then press the hinge.
Fiber-optic Cable Installation

**Figure 3 - Installation Into Amplifier Unit**

1. Flip down the lock lever.
2. Insert the fiber-optic cable unit until it stops.
3. After inserting the fiber-optic cable unit, flip up the lock lever and secure the cable.

**Figure 4 - Coaxial-reflection Type Fiber-optic Cable**

Attach the multi-core fiber-optic cable to the receiver side and the single-core fiber cable to the transmitter side.

**Figure 5 - Thin Fiber-optic Cable**

When using a thin fiber-optic cable unit, use the adapter that is provided with the fiber-optic cable unit.

Basic Settings and Operation

**Figure 6 - Basic Settings**

- **Operating Indicator (Orange)**
- **Setting/Teach Indicator (Orange)**
- **Threshold Level (Green)**
- **Received Light Level (Red)**
- **L: Light Operate**
- **D: Dark Operate indicator (Orange)**
- **(UP/DOWN) button**
  - To adjust threshold
  - To select settings
- **(SETTING/TEACH) button**
  - To start teaching
  - To confirm a selected setting

Teach Procedure

Hold down SET during normal operation, as shown in **Figure 7**, to start the teaching operation. Five types of teaching are available by operation of the SET button.

**Figure 7 - Normal Operation/Sensitivity Teach Flow**

- **Ready for the second-point teach.**
- **Hold down SET within 3 seconds to enter the two-point teach.**
  - Teach for the first point is complete.
- **Hold down SET for 3 seconds or more and the maximum sensitivity teach is complete.**
- **Hold down SET 8 seconds or more to enter the full auto teach.**

When the teach operation is properly completed, the set threshold is displayed.

- **Hold down SET within 3 seconds to complete the second-point teach.**
- **Hold down SET for 3 seconds or more and the position teach is complete.**
- **Hold down SET for 8 seconds or more to enter the teach window mode.**

This procedure sets the threshold as the average of the received light levels at the two positions for which teaching was performed. For example, the received light for the first point is 4000 and the received light for the second point is 2000. The threshold is automatically set to 3000.

**Figure 8 - Two-point Teach**

- **First step**
  - Object Present
  - In less than 3 seconds
  - Release the button.
  - Second step
  - Hold and maintain for less than 3 seconds.
- **Object Present**
  - Release the button to complete the two-point teach.

This procedure sets the threshold for the received light levels at the position to be detected. For example, the received light level during position teach is 1000 and the threshold is automatically set to 1000.

**Figure 9 - Position/Precision Teach**

- **Object Present**
  - Positioning
  - Hold and maintain for more than 3 seconds.
  - Release the button to complete the positioning teaching.

When the teach operation is properly completed, the set threshold is displayed.

- **Release in less than 3 seconds.**
- **Positioning**
  - Hold and maintain for more than 3 seconds.

**Figure 10 - Window Teach Mode**

- **Set two thresholds (high/low) for the 2 teaching points.**
- **Example:** Received light level for the 1st point: 4000 (high) → Received light level for the 2nd point: 2000 (low) → Thresholds are set to 4000 and 2000.

- **In less than 3 seconds.**
- **Object Present**
  - Release the button to complete the window mode teach.
**Figure 6 - Basic Settings (continued)**

Press the UP and DOWN buttons.

- **ON/OFF delay** displays the set timer mode.
- **Timer Off** moves to next when select timer off.
- **Light Operate** and **Dark Operate** can be selected.
- **Hysteresis adjustment** selects PNP or NPN.
- **IO-Link connection** is disabled when NPN is selected.

- **Light Operate/ Dark Operate**
  - Pin 4: L.O.
  - Pin 2: D.O.

- **Response time** can be selected.
  - 50us: High speed
  - 500us: Standard
  - 4ms: Long
  - 32ms: Super Long

- **Detection speed** can be selected.
  - Detection
  - Response time
  - High speed: 50us
  - Standard: 500us
  - Long: 4ms
  - Super Long: 32ms

- **Light source level adjustment** can be adjusted both automatically and manually.
- **Hysteresis** can be adjusted between 10 and 2,000.

- **Auto** and **Manual** modes can be selected.

- **Pin 2 Output Type Selection** can be selected.
- **Pin 4 Output Type Selection** can be selected.

- **Light Operate/ Dark Operate** can be a complementary output.

- **Source level adjustment** can be adjusted between 1 ms and 9,999 ms in increments of 1 ms.
  - The initial setting is 1 ms.

- **4ms: Long**
  - **50us: High speed**
  - **500us: Standard**
  - **32ms: Super Long**

- **50us**
  - **Light Operate**
  - **Dark Operate**

- **4ms**
  - **Light Operate**
  - **Dark Operate**

- **32ms**
  - **Light Operate**
  - **Dark Operate**

Press the UP and DOWN buttons to move between settings.

**NOTE:** The automatic adjustment sets an optimum light source intensity at teaching.
Figure 6 - Basic Settings (continued)

- **Pin 2 Output Type Selection**: Select PNP, NPN, or OFF (Output is disabled).

- **Rotate Display**: Used to reduce power consumption. Approx. 15 seconds after the setting, the 7-segment indication turns OFF. Pressing any button turns the display on and turns it off again after 15 seconds.

- **Standard Indication**: Besides the standard received light level indication, the zero offset indication and the % indication are available.

- **Received light level indication**: Select the Counter indication to enter the Counter mode when it returns to Normal Operation.

- **ECO mode**: When the button operation lock is set, operation of each button is enabled after the UP button is held down for approximately six seconds during normal operation. When approximately 10 seconds has elapsed without any button operation, the button operation lock is set again.

- **Button Operation Lock**: Reset sensor settings to factory default.
The threshold is automatically set to a value larger than the maximum received light level while the button is pressed. Example: Received light level: 100 and the threshold is automatically set to 200.

When selecting the percent indication for through beam types, the threshold is automatically set to a value smaller than the minimum received light level while the button is pressed. Example: Received light level: 2000 and the threshold is automatically set to 1900.

The threshold is automatically set as the average of the maximum and minimum received light levels while the button is pressed. For example, the maximum received light level is 8000 and the minimum received light level is 1000 during teaching and the threshold are automatically set to 4500.

See Table 1 for teach errors. The sensor holds the threshold before teaching and returns to normal operation when a teaching error occurs.

Teach Time Out
If the teach process has not been completed within 30 seconds, the teach process is canceled and the sensor returns to normal operation.

Sensor Functions
Four types of delay timer modes are available, see Figure 15.
Received Light Level Indication

Three types of indication are available for the received light level and threshold.

Standard Indication

The direct values of received light level and threshold are displayed without correction.

Figure 16 - Standard Indication

Percent Indication

The received light level and threshold are displayed in percent as the maximum received light level during teaching is set to 100. The same displayed values can be arranged when multiple through-beam type units are in use.

This display may not be arranged at 100 as the received light intensity varies depending on environmental factors.

Figure 17 - Percentage Indication

Figure 18 - Zero Offset Indication

Differential value is displayed in the received light level and threshold as the minimum value of the received light level during teaching is set to zero. The same displayed values can be arranged when multiple reflective-type units are in use.

Figure 19 - Percent and Zero Offset Indication Examples

Crosstalk Avoidance

The sensor offers an optical unit-to-unit crosstalk avoidance feature when multiple amplifiers are operating in close proximity. To enable this function, the Bulletin 46DFA amplifier must be installed side-by-side and as close as possible in the DIN rail. To be sure there’s a reliable crosstalk avoidance, we recommend that you use the DIN rail stop catalog number 60-BDFA-STP to firmly secure the units. This feature is disabled when the sensor is set to operate in 50 µs mode.

Figure 20 - DIN Rail Stop Catalog Number 60-BDFA-STP
**Light Source Intensity Adjustment Feature**

The light source intensity can be automatically or manually adjusted.

**Automatic Adjustment**

The light source intensity is automatically adjusted when teaching is initiated. The light source level is settable to 15 steps for the 500 µs, 4 ms, and 32 ms modes and 12 steps for the 50 µs mode. Larger numbers indicate higher light intensity.

**Manual Adjustment**

The sensitivity teach procedure does not change the light source intensity. Adjust the light source level manually when teaching errors occur (see Teach Errors in Table 1 on page 5).

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**Table 2 - Specifications**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>46DFA-L2LBT1-A2, 46DFA-L2LBT1-F4, 46DFAL2LBT1-Y4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>12…24V DC, Class 2/Ripple 10% or less</td>
</tr>
<tr>
<td>Power consumption</td>
<td>Normal mode: 1000 mW or less (40 mA or less at 24V) ECO mode: 750 mW or less (30 mA or less at 24V)</td>
</tr>
<tr>
<td>Output types</td>
<td>NPN open collector output/Load current 100 mA(30V DC, Class 2) or less/ Residual voltage: 2V or less PNP open collector output/Load Current 100 mA(30V DC class 2) or less/ residual voltage: 2V or less</td>
</tr>
<tr>
<td>Output modes</td>
<td>Selectable Light Operate (L.O.) or Dark Operate (D.O.)</td>
</tr>
<tr>
<td>Output Timers</td>
<td>ON delay, OFF delay, ON/OFF delay, Repeatable One-shot, Timer off Delay timer: 1…9999 ms (set in millisecond)</td>
</tr>
<tr>
<td>Output response time</td>
<td>Selectable: 50 µs, 500 µs, 4 ms, and 32 ms. The default setting is 500 µs.</td>
</tr>
<tr>
<td>Light source (wavelength)</td>
<td>Four-element (AlGaInP) LED (660 nm)</td>
</tr>
<tr>
<td>User interface</td>
<td>Operating indicator, setting/teaching indicator, L.O./D.O. Indicator: orange LED</td>
</tr>
<tr>
<td>Display</td>
<td>Received light level: 4 digits in red LED (50 µs mode [(0…3800), 500 µs/4 ms/32 ms mode (0…9999)] Threshold: 4 digits in green LED (50 µs mode [(0…3500, 500 µs/4 ms/32 ms mode (0…9700)])</td>
</tr>
<tr>
<td>Adjustment options</td>
<td>Teach and Set Button (SET) Threshold and Configuration adjustment (UP/DOWN)</td>
</tr>
<tr>
<td>Sensitivity setting</td>
<td>Two-point teach/max sensitivity teach/full auto teach/position teach and window mode teach</td>
</tr>
<tr>
<td>Sensitivity adjustment function</td>
<td>Provided</td>
</tr>
<tr>
<td>Light source level adjustment</td>
<td>Provided (auto/manual)</td>
</tr>
<tr>
<td>Mutual interference prevention</td>
<td>Up to 8 units (500 µs, 4 ms, and 32 ms modes only)</td>
</tr>
<tr>
<td>Protection circuit</td>
<td>Power reverse connection/output short-circuit protection</td>
</tr>
<tr>
<td>Material</td>
<td>Polycarbonate</td>
</tr>
<tr>
<td>Wiring options</td>
<td>2 m (6.56 ft) attached cable (outer dimension: 4.2 mm (0.16 in.) dia., 0.2 mm² (0.007 in.) 4 cores</td>
</tr>
<tr>
<td>Weight</td>
<td>Approximately 75 g (2.64 oz)</td>
</tr>
<tr>
<td>Ambient light</td>
<td>Illumination on light receiving surface: 3500 lx or less (incandescent lamp)</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>1…5 adjacent units in operation: -25…+55 °C (-13…+131 °F) 6 or more adjacent units in operation: -25…+50 °C (-13…+122 °F) Storage: -40…+70 °C (-40…+158 °F) (nonfreezing, noncondensing)</td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>35…85% RH (noncondensing)</td>
</tr>
<tr>
<td>MTTF</td>
<td>53 years</td>
</tr>
<tr>
<td>Protective structure</td>
<td>IP40</td>
</tr>
<tr>
<td>Vibration</td>
<td>10…55 Hz/1.5 mm (0.06 in.) double amplitude/2 hours each in X, Y, and Z directions</td>
</tr>
<tr>
<td>Shock</td>
<td>500 m/s²/3 times each in X, Y, and Z directions</td>
</tr>
<tr>
<td>Dielectric withstanding</td>
<td>1000V AC for 1 minute</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>500V DC, 20 MΩ</td>
</tr>
</tbody>
</table>

**IMPORTANT** Light source intensity can be low depending on the level set in which the light spot cannot be seen.

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**Figure 21 - Cat. No. 46DFA-L2LBT1-X Dimensions [mm (in.)]**

- **UL:** Maximum ambient temperature: 50 °C (122 °F) for single use, 40 °C (104 °F) for an installation with two or more units connected.
Table 3 - IO-Link Specifications

<table>
<thead>
<tr>
<th>Attribute</th>
<th>46DF4-12.8BT1-xx</th>
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</thead>
<tbody>
<tr>
<td>Model</td>
<td>2 m (6.56 ft) cable, 4-pin M12 QD on 150 mm (5.9 in.) pigtail, 4-pin M8 QD on 150 mm (5.9 in.) pigtail</td>
</tr>
<tr>
<td>IO-Link version</td>
<td>V.1.1</td>
</tr>
<tr>
<td>Communication mode</td>
<td>COM2 (38.4 kbps)</td>
</tr>
<tr>
<td>Cycle time</td>
<td>3.6 ms, min</td>
</tr>
<tr>
<td>Process data length</td>
<td>4 Byte</td>
</tr>
<tr>
<td>Vendor ID</td>
<td>2</td>
</tr>
<tr>
<td>Device ID</td>
<td>291</td>
</tr>
</tbody>
</table>

Figure 22 - Micro (M12) Male QD on Pigtail and Pico (M8) Male QD on Pigtail Wiring

Rockwell Automation Support

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Rockwell Otomasyon Ticaret A.Ş., Kar Plaza İş Merkezi E Blok Kar:6 34752 İçerenköy, İstanbul, Tel: +90 (216) 5698400

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