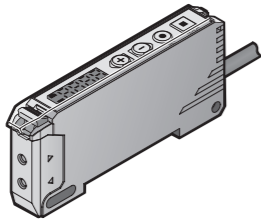


Digital Fiber Amplifier

# D1RF-T Series

D1RF-T  
D1RF-TC

OPTEX FA CO., LTD.

- Thank you for purchasing this Digital Fiber Amplifier D1RF.
- Before using this product, please read this manual carefully to ensure proper use.
- Read this manual thoroughly, and then keep this manual at hand so that it can be used whenever necessary.
- The warranty period of this product is one year after delivery. However, any fault attributable to natural disasters or any other similar disasters or modification or repair will be excluded from the scope of the warranty.

## Safety Precautions

Safety precautions for ensuring safe operation of this product are displayed as follows with the following symbols.

Precautions listed here describe important information about safety. Make sure to follow them accordingly.

### Safety Symbols

	<b>WARNING</b>	Indicates that any improper operation or handling may result in moderate or minor injury, and in rare cases, serious injury or death. Also indicates a risk of serious property damage.
	<b>CAUTION</b>	Indicates that any improper operation or handling may result in minor injury or property damage.

<b>WARNING</b>	
	Do not disassemble, repair, modify, deform under pressure, or attempt to incinerate this product. Doing so may cause injury or fire.
	This product is not explosion-proof and should not be used around flammable or explosive gases or liquids. Doing so may cause ignition resulting in an explosion or fire.
	Do not use air dusters or any spray that uses flammable gas around the product or on the inside of the product. Doing so may cause ignition resulting in an explosion or fire.
	Do not install this product in any of the following locations. Doing so may cause a fire, damage, or a malfunction. <ol style="list-style-type: none"> <li>1. Locations where dust, salt, iron powders, or vapor (steam) is present.</li> <li>2. Locations subjected to corrosive gases or flammable gases.</li> <li>3. Locations where oil or chemical splashes may occur.</li> <li>4. Locations where heavy vibrations or impacts may occur.</li> <li>5. Locations where the ambient temperature exceeds the rated range.</li> <li>6. Locations subject to rapid temperature changes (or where condensation occurs).</li> <li>7. Locations with strong electric or magnetic fields.</li> <li>8. Outdoor locations or locations subject to direct light.</li> </ol>
	This is a class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.
	This product is not intended for use with nuclear power, railways, aviation, vehicles, medical equipment, food-handling equipment, or any application where particular safety measures are required. Absolutely do not use this product for any of these fields.
	This product cannot be used in applications that directly or indirectly detect human bodies for the purpose of ensuring safety. Do not use this product as a detection device for protecting the human body.
	What to do in the event of a malfunction such as smoke being emitted from the product If you detect any malfunction including emission of smoke, abnormal smells or sounds, or the body becoming very hot, immediately stop operating the product and turn off the sensor power. Failure to do so may cause a fire. Repairing the product is dangerous and should in no way be performed by the customer. Contact an Optex FA sales representative for repairs.

<b>CAUTION</b>	
<ul style="list-style-type: none"> <li>• Make sure to turn the power off before wiring the cable or connecting/disconnecting the connector. Connecting or disconnecting while energized may damage the product or cause electric shock.</li> <li>• Avoid using the transient state while the power is on (100 ms). Output could become unstable, causing unexpected operation.</li> <li>• Do not wire with high voltage cables or power lines. Doing so may cause malfunction or damage by induction.</li> <li>• Do not bend the cable when below the freezing point. This may cause the cable to break.</li> <li>• Do not drop the product or subject the product to strong impacts. Doing so may damage the product.</li> <li>• Follow the instructions in this manual or the specified instruction manual when wiring the product or the dedicated controller for the correct wiring method. Incorrect wiring can damage the product or the controller, or cause a malfunction.</li> <li>• When disconnecting the connector, be careful not to touch the terminals inside the connector, and do not allow foreign objects to enter the connector.</li> <li>• Install this product as far away as possible from high-voltage equipment, power equipment, equipment that generates large switching surges, inverter motors, welders, or any equipment that can be a source of noise.</li> <li>• When connecting or disconnecting the cable, make sure to hold it by the connector portion, and do not apply excessive force to the cable.</li> </ul>	

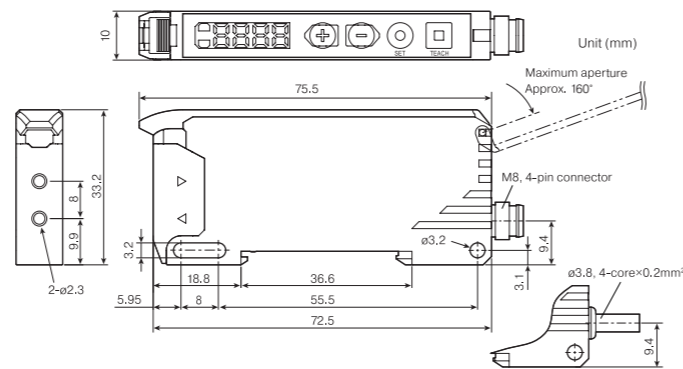
### NOTICE

- After carefully considering the intended use, required specifications, and usage conditions, install and use the product within the specified ranges.
- All specifications may be changed without notice.
- When using this product, it is the responsibility of the customer to ensure necessary safety designs in hardware, software, and systems in order to prevent any threat to life, physical health, and property due to product malfunction or failure.
- Do not use this product for the development of weapons of mass destruction, for military use, or for any other military application. Moreover, if this product is to be exported, comply with all applicable export laws and regulations, including the "Foreign Exchange and Foreign Trade Act" and the "Export Administration Regulations," and carry out the necessary procedures pursuant to the provisions therein.
- For more details on conformity to the Restriction of Hazardous Substances Directive for this product, please contact an Optex FA sales representative. Before using this product, fully examine the applicable environmental laws and regulations, and operate the product in conformity to such laws and regulations. Optex FA does not assume any responsibility for damages or losses occurring as a result of noncompliance with applicable laws and regulations.
- Detection characteristics and digital display values may vary depending on the state of the target object and variations among individual products.

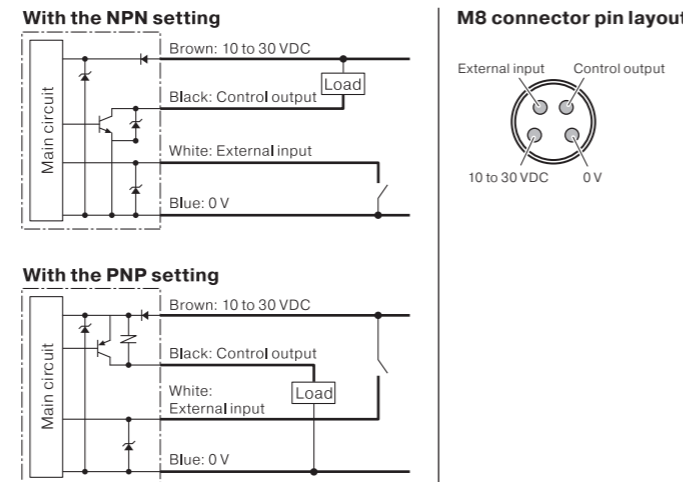
## 1. Included Accessories

This instruction manual

## 2. Dimensions



## 3. I/O Circuit Diagram

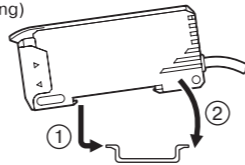


## 4. Mounting

When mounting screws, use M3 screws with a tightening torque of 0.5 N·m or less.

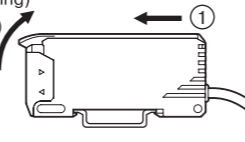
### Mounting the amplifier (DIN-rail mounting)

Hook the fiber unit connector side tab to the DIN-rail (①), and press down until the hook locks (②).



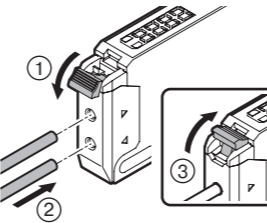
### Removing the amplifier (DIN-rail mounting)

While pressing the amplifier body in the direction of ②, lift the fiber unit connector side to remove (①).



### Mounting the fiber unit

Tilt the fiber lock lever (①), and insert the fiber through the insertion opening until it stops (②). Return the fiber lock lever to the stop position (③).



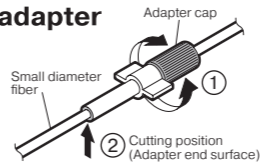
### CAUTION

When using a coaxial reflective type fiber, install single-core fiber or fiber containing white wire on the emitting side, and multi-core fiber on the receiving side.

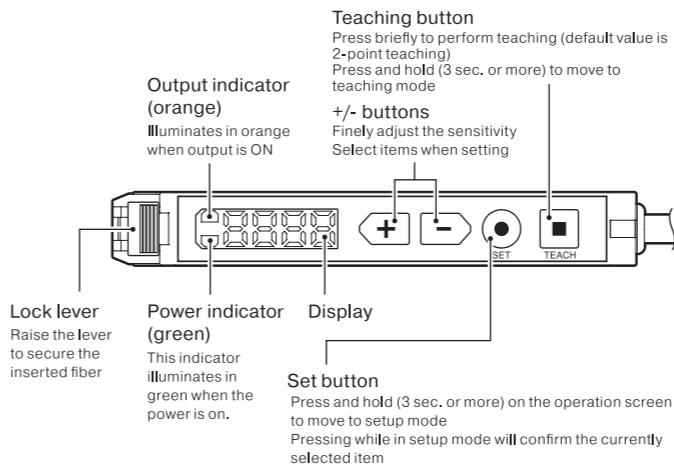


### How to use the small diameter adapter

1. With the adapter cap turned all the way to the left, insert the fiber the necessary length and turn the adapter cap to the right to lock it.
2. Cut the unnecessary parts of the fiber with fiber cutters.



## 5. Part Names



## 6. Teaching (Sensitivity Setting)

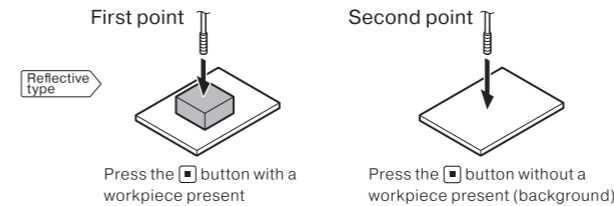
To perform teaching, first press the button for 3 sec. or more, then select teaching with the button, and confirm with the button. When teaching is performed, "good" will be displayed before returning to the operation mode.

### Detect the presence/absence of workpieces ( when teaching is possible in the present/absent state )

Configure teaching when workpieces are present and when they are absent. The threshold value is set and stored between the first and second points.

#### ● 2-point teaching

Press the button → Press the button →

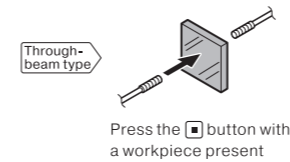


### Resistant to dust and dirt

Ideal for long distance detection and detection in severe environments. The threshold value is set to the minimum value that can be stably detected.

#### ● 1-point teaching

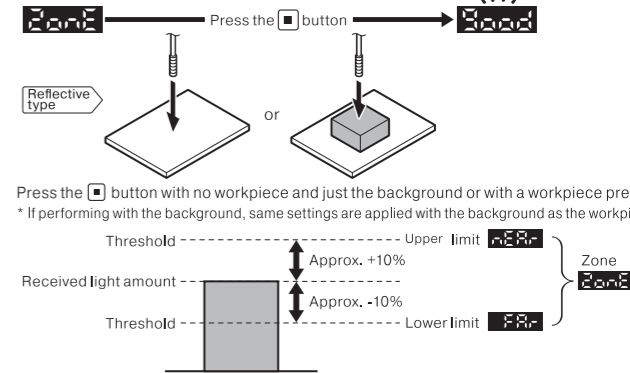
Press the button →



### Switching within a fixed range

Ideal for detecting only within a fixed range of received light. The threshold value is set within the range of approx. ±10% the received light amount.

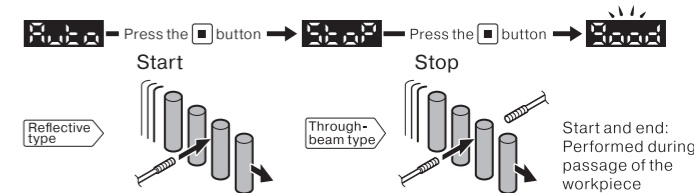
#### ● Zone teaching



### Teaching so the line does not stop

This can be applied when teaching so the line does not stop. The threshold value is set to be between the maximum value and minimum value from start to stop.

#### ● Auto-teaching



## 7. Threshold Adjusting Mode

#### ● Normally

Press the and buttons to adjust the threshold, and press the button to confirm. Returns to operation mode after confirming.

Threshold setting range	4 ~  9999	4 to 9999 (using digital display)	* Returns to operation mode if there is no operation for 5 seconds
-------------------------	-----------	-----------------------------------	--

#### ● Selecting zone teaching

[Upper limit setting] Press the and buttons to select (upper limit), and press the button to confirm. Continue by adjusting the threshold with the and buttons, and press the button to confirm. Returns to operation mode after confirming.

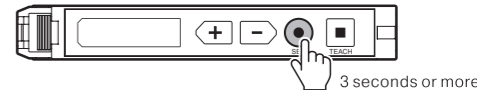
[Lower limit setting] Press the and buttons to select (lower limit), and press the button to confirm. Continue by adjusting the threshold with the and buttons, and press the button to confirm. Returns to operation mode after confirming.

Threshold setting range	4 ~  9999	4 to 9999 (using digital display)	* Returns to operation mode if there is no operation for 5 seconds
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## 8. Switch to Setup/Teaching Mode

### Move to the setup mode

Press the button for 3 sec. or more to move to setup mode.



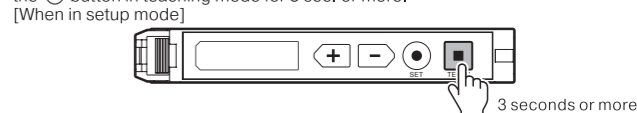
### Move to the teaching mode

Press the button for 3 sec. or more to move to teaching mode.

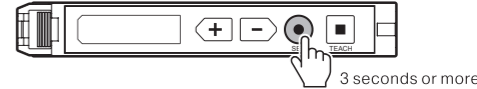


### Return to RUN mode

Return to RUN mode without going to "End" by pressing the button in setup mode or the button in teaching mode for 3 sec. or more.



[When in teaching mode]



## 9. Menu List

### Setup mode


Press the  button for 3 sec. or more


⑧ Continue to setup mode exit



#### ① Operation setting


\* is the initial value of each setting item

Output mode: Light ON/Dark ON selection

 Output turns ON during light is received. (Light ON)\*


 Output turns ON during light is not received. (Dark ON)


 and  buttons: Selection /



 button: Confirm


#### ② Response time setting

Select the response time

 Response time 250  $\mu$ s (Standard mode)\*


 Response time 50  $\mu$ s (Fast mode)


 and  buttons: Selection /


 button: Confirm


#### ③ Timer setting



Select from various timers


 Timer off\*

 OFF delay timer



 ON delay timer



 One shot timer


 and  buttons: Selection /

 button: Confirm (OFF selected)

Timer time setting


 ~  1 to 9999 (1 ms)


 and  buttons: Selection /



 button: Confirm


#### ④ Output setting

Select the output type

 NPN output\*


 PNP output



 and  buttons: Selection /


 button: Confirm


#### ⑤ Display setting



Select the normal display format


 Numerical value display\*

 Bar display (  bar illuminates in order from the right according to received light amount )

 Percentage display


 Display off


 and  buttons: Selection /


 button: Confirm



#### ⑥ Emitted light power setting


Select the emitted light power

 Emitted light power 100%\*

 Emitted light power 50%


 Emitted light power 25%


 and  buttons: Selection /



 button: Confirm


#### ⑦ Initialize setting

Select whether to perform initialization

 Do not perform initialization\*


 Return settings to their factory default settings

 and  buttons: Selection /

 button: Confirm

#### ⑧ Setup mode exit

Exit the setup mode and return to RUN mode.

 button: Confirm


① Return to operation settings

### Teaching mode

Press the  button for 3 sec. or more

(The currently selected teaching mode is displayed)


#### ① 1-point teaching

Teaching successful  Returns to RUN mode.

Perform 1-point teaching


⑤ Continue to teaching mode exit


#### ② 2-point teaching

Teaching successful  Returns to RUN mode.


Perform first point teaching


Perform second point teaching


Teaching error  : Teaching is not possible as the threshold is below the lower limit.

Teaching error  : Teaching is not possible as the difference in received light amount between the first and second points is too low.


#### ③ Zone teaching

Teaching successful  Returns to RUN mode.

Teaching error  : Teaching is not possible as the threshold is below the lower limit.


Teaching error  : Teaching is not possible as the threshold is above the upper limit.


#### ④ Auto-teaching

Teaching successful  Returns to operation mode.

Start auto-teaching


End auto-teaching

Teaching error  : Teaching is not possible as the threshold is below the lower limit.

Teaching error  : Teaching is not possible as the difference in received light amount is too low.

#### ⑤ Teaching mode exit

Returns to RUN mode.









 button: Confirm

① Returns to 1-point teaching

## 10. Convenient Functions

### Initialize settings



All settings are returned to their factory default settings.

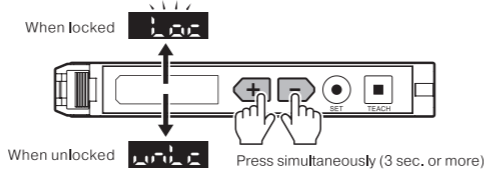
1. Press the  button for 3 sec. or more to enter setup mode.
2. Press the  button twice to display , and confirm with the  button.
3. Display  with the  button, and perform initialization with the  button.
4. Press the  button for 3 sec. or more to return to normal mode.

\* "Output setting" is not changed even if initialization is performed.

### Prevent misoperation (key lock)









Disable key operation to prevent misoperation, etc.

While in normal mode, press the  and  buttons simultaneously for 3 sec. or more. Key lock is canceled by performing the same operation.




### Display received light amount percentage

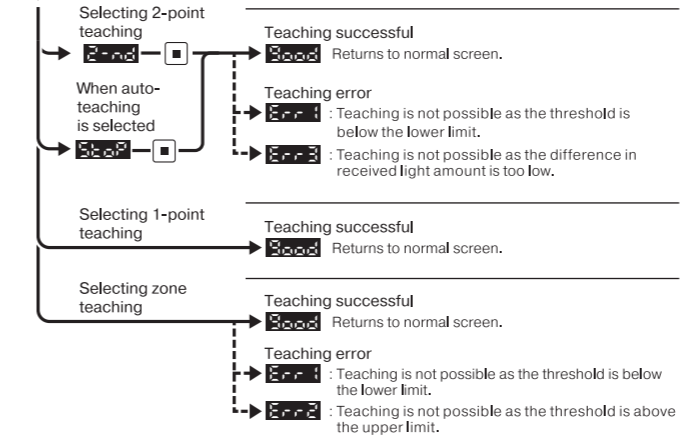
Sets the display as a percentage.

1. Press the  button for 3 sec. or more to enter setup mode.
2. Press the  button four times to display , and confirm with the  button.
3. Display  with the  button, and set the percentage display with the  button.
4. Press the  button for 3 sec. or more to return to normal mode.

### On the spot teaching (fast teaching)

Briefly press the  button for 3 sec. or less

Perform fast teaching  
(Teaching is performed with the currently selected mode)



## 11. Details on External Teaching

When using external input for teaching, the teaching method can be selected according to input time. The conditions under which external input is turned ON differs depending on the output settings.

- With the NPN setting: ON at 0 V (blue) and short circuit
- With the PNP setting: ON at 10 V to 30 V (brown) and short circuit

\* External teaching is cancelled if 8 sec. or more have passed with external input ON.

### 1-point teaching

- The received light amount is sampled when external input is turned ON.
- If external input turns OFF within 10 ms to 100 ms after it is turned ON, 1-point teaching is performed.



### Zone teaching

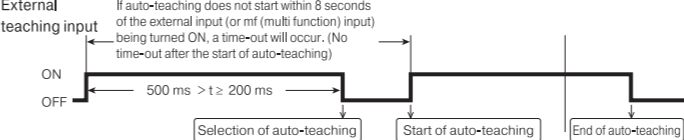
- The received light amount is sampled when external input is turned ON.
- If external input turns OFF within 100 ms to 200 ms after it is turned ON, zone teaching is performed.



### Auto-teaching

If the external input (or mf (multi function) input) is turned ON and then turned OFF within 200 ms to 500 ms, auto-teaching will be selected.

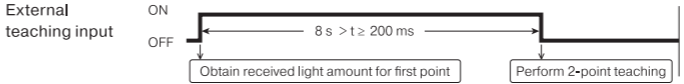
- After selecting auto-teaching, auto-teaching will start when the external input (or mf (multi function) input) is turned on.
- Auto-teaching will end when the external input (or mf (multi function) input) is turned OFF.



### 2-point teaching

If external input turns OFF more than 200 ms after it is turned ON, 2-point teaching is performed.

- The first teaching point is performed when the external input is turned ON.
- The second teaching point is performed when the external input is turned OFF.



### Minimum pulse period

Since there is an input filter time, set the minimum ON/OFF time to 10 ms or more.



## 12. Specifications

Item	D1RF-T / D1RF-TC	
Light source	Red LED	
Supply voltage	10 to 30 VDC (including 10% ripple)	
Current consumption (power)	40 mA max.	
Response time	Standard	250 $\mu$ s
	Fast	50 $\mu$ s
Control output	NPN/PNP switched by setting, Open collector, 30 V/100 mA, Residual voltage 1.8 V max.	
External input	External teaching	
Initialization time	100 ms	
Sensitivity adjustment	Teaching, fine tuning with +/- buttons	
Output mode	Light ON / Dark ON selectable	
Indicators	Output indicator: Orange, Power indicator: Green	
Digital display	7-segment, 4-digit display Received light amount / Threshold / Set value	
Protection circuit	Reverse connection protection, Overcurrent protection, 30 V max.	
Cross talk prevention	Max. 2 units	
Degree of protection	IP66	
Operating temperature/humidity	-25 to +55°C / 35 to 85% (no freezing or condensation)*2	
Storage temperature/humidity	-40 to +70°C / 35 to 95% (no freezing or condensation)	
Ambient illuminance	Sunlight: 10,000 lx or less, Incandescent light: 3,000 lx or less	
Vibration resistance	10 to 55 Hz: Double amplitude 1.5 mm; 2 hours in each of the X, Y, and Z directions	
Shock resistance	50 G (500 m/s²), 3 times in each of the X, Y, and Z directions	
Mounting	Machine screw: M3 × 2, Rail: 35 mm DIN-rail	
Connection type	Cable type: 4-wire 2 m cable, Connector type: M8, 4-pin	
Connection	1/Brown: 10 to 30 VDC, 2/White: External input, 3/Blue: 0 V, 4/Black: Control output	
Material	Housing, cover: Polycarbonate (PC)	
Outer dimensions	10 × 33.2 × 75.5 (mm)	
Included accessory(ies)	Instruction manual	
Options	Mounting bracket	
Applicable regulation(s)	EMC	EMC Directive (2014/30/EU)
	Environment	RoHS Directive (2011/65/EU), China RoHS (MIIT Order No.32)
Applicable standard(s)	EN 60947-5-2	


\*1: Target 500 mm × 500 mm reflection rate 90%, when using fiber NF-DK06

\*2: Up to 16 closely mounted units

### Model naming rules

D1RF-TC	
Common	C: Connector type / No symbol: Cable type

- Support for the China RoHS directive

 For details on the support for the China RoHS (the Administrative Measure on the Control of Pollution Caused by Electronic Information Products), see the following website.  
[http://www.optex-fa.com/rohs\\_cn/](http://www.optex-fa.com/rohs_cn/)

## OPTEX FA CO.,LTD.

[Headquarters]

91 Chudoji-Awata-cho Shimogyo-ku Kyoto 600-8815 JAPAN

TEL +81-75-325-1314 FAX +81-75-325-2936

<http://www.optex-fa.com>