FASTUS
Good Thinking, Good Future
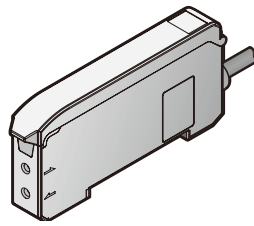
Instruction Manual

White Light Source Digital Fiber Amplifier

D3WF Series

D3WF-TP   D3WF-TMCP4
D3WF-TN   D3WF-TMCN4
             D3WF-TSCP4
             D3WF-TSCN4

OPTEX FA CO., LTD.

- Thank you for purchasing this White Light Source Digital Fiber Amplifier D3WF.
- 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

⚠ WARNING	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.
⚠ CAUTION	Indicates that any improper operation or handling may result in minor injury or property damage.

⚠ WARNING

🚫	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. 1. Locations where dust, salt, iron powders, or vapor (steam) is present. 2. Locations subjected to corrosive gases or flammable gases. 3. Locations where oil or chemical splashes may occur. 4. Locations where heavy vibrations or impacts may occur. 5. Locations where the ambient temperature exceeds the rated range. 6. Locations subject to rapid temperature changes (or where condensation occurs). 7. Locations with strong electric or magnetic fields. 8. Outdoor locations or locations subject to direct light.
🚫	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.

⚠ CAUTION

- 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.
- Avoid using the transient state while the power is on (300 ms). Output could become unstable, causing unexpected operation.
- Do not wire with high voltage cables or power lines. Doing so may cause malfunction or damage by induction.
- Do not bend the cable when below the freezing point. This may cause the cable to break.
- Do not drop the product or subject the product to strong impacts. Doing so may damage the product.
- 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.
- When disconnecting the connector, be careful not to touch the terminals inside the connector, and do not allow foreign objects to enter the connector.
- 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.
- When connecting or disconnecting the cable, make sure to hold it by the connector portion, and do not apply excessive force to the cable.
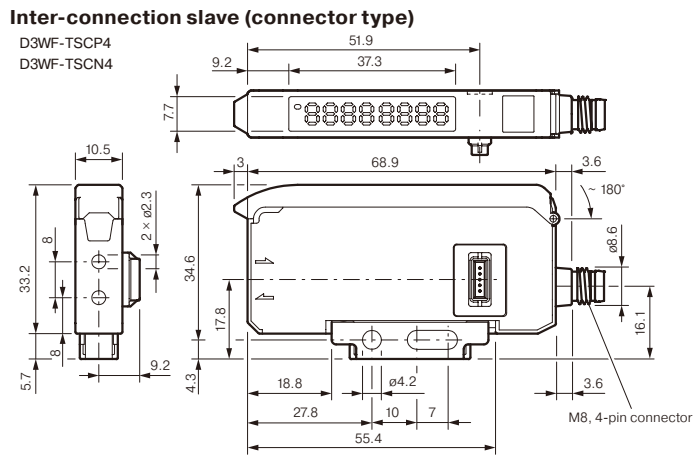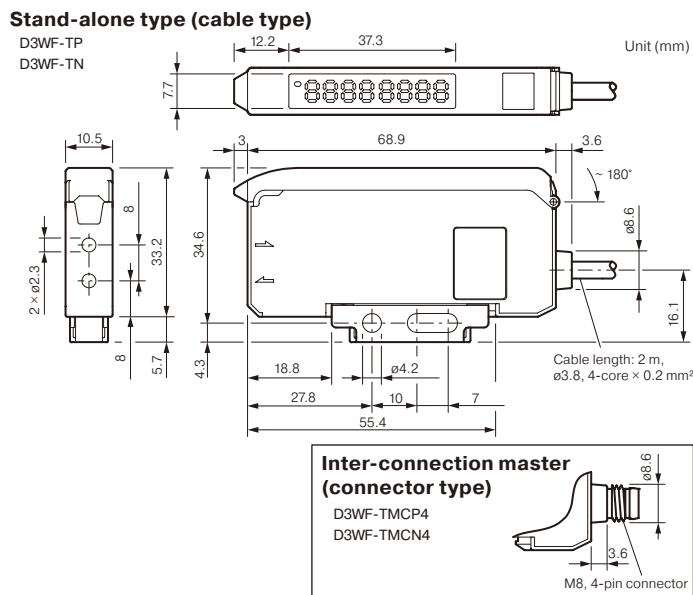
NOTICE

- 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.
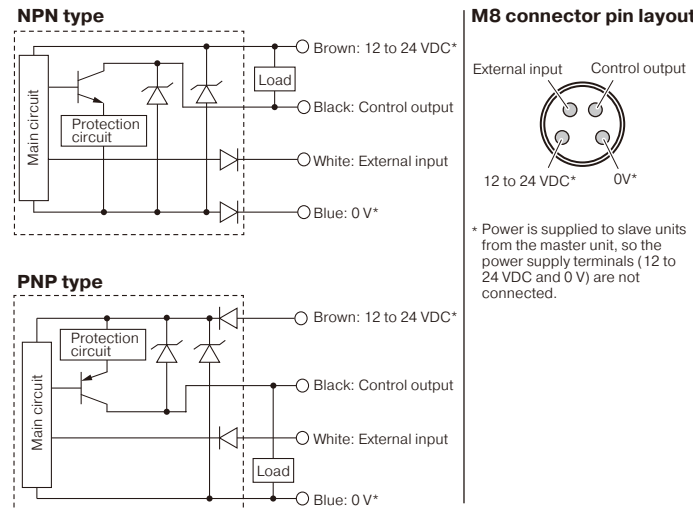
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1. Included Accessories

- This instruction manual
- Mounting bracket

2. Dimensions

Stand-alone type (cable type)

D3WF-TP
D3WF-TN

Unit (mm)

Cable length: 2 m, ø3.8, 4-core × 0.2 mm²

Inter-connection master (connector type)

D3WF-TMCP4
D3WF-TMCN4

M8, 4-pin connector

Inter-connection slave (connector type)

D3WF-TSCP4
D3WF-TSCN4

M8, 4-pin connector

3. I/O Circuit Diagram

NPN type

- Brown: 12 to 24 VDC*
- Black: Control output
- White: External input
- Blue: 0 V*

PNP type

- Brown: 12 to 24 VDC*
- Black: Control output
- White: External input
- Blue: 0 V*

* Power is supplied to slave units from the master unit, so the power supply terminals (brown: 12 to 24 VDC and blue: 0 V) are not connected.

M8 connector pin layout

External input   Control output

12 to 24 VDC*   0V*

* Power is supplied to slave units from the master unit, so the power supply terminals (12 to 24 VDC and 0 V) are not connected.

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4. Mounting
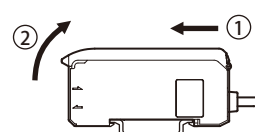
Mounting the amplifier

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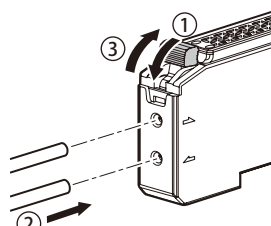
Protective cover
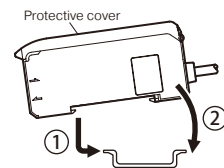
Removing the amplifier

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

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).
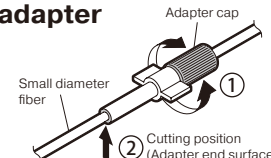
> **CAUTION**
> When using a coaxial reflective type fiber, install single-core fiber or fiber containing white line on the emitting side, and multi-core fiber on the receiving side.
>
> Receiving side
> Emitting side
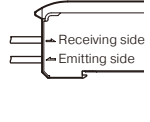
How to use the small diameter adapter

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.

Adapter cap
Small diameter fiber
Cutting position (Adapter end surface)

Installing additional amplifier units

1. Mount each amplifier unit on the DIN-rail.
2. Slide the slave unit and connect it to the inter-connection connector.
3. Use the end plates to secure the amplifier units from both sides.

Slave unit   Protective cover
Master unit
Connecting terminal
End plates (BEF-EB01-W190)
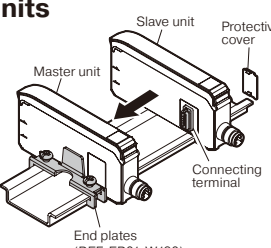
> **CAUTION**
> - Be sure to turn off the power before performing this work.
> - When installing additional amplifier units, be sure to use a DIN-rail and end plates.
> - After installing additional amplifier units, check the ambient temperature.
> - To prevent connecting terminals from being short-circuited, be sure to attach protective covers to connecting terminals that are not in use.
> - Do not remove inter-connected amplifiers from the DIN-rail.

5. Part Names
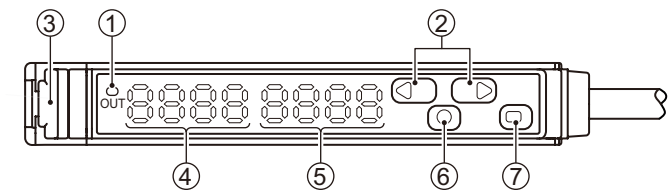
No.	Name	Details
①	Output indicator (orange)	Illuminates in orange when output is ON.
②	Selection buttons (+/− buttons)	Finely adjust the sensitivity. Select items when setting.
③	Lock lever	Raise the lever to secure the inserted fiber.
④	Main display (red)	Shows the current receiving light level on a 7-segment display.
⑤	Sub display (green)	Shows the current threshold on a 7-segment display.
⑥	Mode button	Used when configuring settings.
⑦	Teaching button	Used when performing teaching.

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6. Teaching (Sensitivity Setting)

Configure the mark detection settings (perform teaching).
There are three types of teaching (dynamic teaching, 2-point teaching, and 1-point teaching). Select the mode that matches the application.

Teaching without stopping the line

Pass a non-marked part of the workpiece followed by a marked part of the workpiece by the sensor to perform teaching.

● Dynamic teaching

Press the ■ button for 3 seconds or more to switch to teaching mode.

Press the ■ button to start teaching.

Move the workpiece, passing the marked and non-marked parts by the sensor. The thresholds for the marked and non-marked parts are set automatically.

Press the ■ button twice to complete the teaching settings.

Move the workpiece. If the output indicator turns off when there is no mark and illuminates in orange when there is a mark, the teaching settings have been completed correctly.

Teaching with marked and non-marked parts

Perform teaching when a mark is present and when no mark is present.
The threshold value is set and stored between the first and second points. Perform teaching with the marked part for the first point and with the non-marked part for the second point.

● 2-point teaching

Press the ■ button for 3 seconds or more to switch to teaching mode.

Press the ◄ or ► button a few times to display the above screen and switch to 2-point teaching mode.

With the marked part in front of the sensor, press the ■ button. The threshold with the mark present is set.

With a non-marked part in front of the sensor, press the ■ button. The threshold without a mark present is set. This completes the 2-point teaching settings.

Teaching just with the marked part

Ideal for detecting only within a fixed range of received light.
The threshold is set in the range of the receiving light level ± approximately 10% (default value). Perform teaching with the marked part detected.

● 1-point teaching

Press the ■ button for 3 seconds or more to switch to teaching mode.

Press the ◄ or ► button a few times to display the above screen and switch to 1-point teaching mode.

With the marked part in front of the sensor, press the ■ button. The threshold with the mark present is set.

Threshold — Near upper limit
Approx. +10%*
Receiving light level — Zone
Approx. −10%*
Threshold — Far lower limit

* Default value

The threshold can be selected from ±10%, ±20%, and ±50% of the receiving light level. For details on how to configure the settings, see "Setup mode, 1-point teaching zone setting" under [7 Menu List] on the back of this document.

7. Menu List

The following three types of display screens are available.

Operation mode	Setup mode	Teaching mode
This display is used when performing actual detections. It is displayed when the power turns on.	This display is used when configuring settings. Press the mode button for 3 seconds or more to switch to this display.	This display is used when performing teaching. Press the teaching button for 3 seconds or more to switch to this display.
Example `200  100`	Example `L - -d  Aut`	Example `dYnStrt`
Receiving light level Threshold	Name of the function to set Set value of the function	Name of the teaching type to set

Setup mode

Press the (●) button for 3 seconds or more in the operation mode

⑥ Move to setup mode exit

① **Output mode setting**
`L - -d`
Automatic/Light ON/Dark ON selection
* is the initial value of each setting item.
- `Aut` Settings are configured automatically during teaching. (Automatic)*
- `LGt` Output turns ON during light intake. (Light ON)
- `dAr` Output turns ON during light is not received. (Dark ON)
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

② **1-point teaching zone setting**
`SEnS`
Set the threshold zone of 1-point teaching
- `10` Set the threshold to the receiving light level ± 10%.*
- `20` Set the threshold to the receiving light level ± 20%.
- `50` Set the threshold to the receiving light level ± 50%.
- Increasing the percentage widens the range of the threshold.
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

③ **Timer setting**
`dLY`
Select from various timers
- `oFF` Timer off*
- `ofdY` OFF delay timer
- `ondY` ON delay timer
- `Shot` One shot timer
- `onoF` ON delay OFF delay timer
- `onSh` ON delay one-shot timer
- Each timer can be set to a value in the range of 0.1 `0.1` to 9999 `9999` ms.
- When `onoF` or `onSh` is selected, the ON delay and OFF delay timers and the ON delay and one-shot timers can be set separately.
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

④ **Advanced settings**
`Pro`
Switches to the "Advanced setup mode."

⑤ **Initialization**
`rES`
Select whether to perform initialization
- `no` Do not perform initialization*
- `YES` Return settings to their factory default settings
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

⑥ **Setup mode exit**
`End`
Exit the setup mode and return to the operation mode.

① Move to operation settings

Advanced setup mode

Normally, the amplifier can be used just with setup mode, but configure the settings in advanced setup mode if necessary.

Advanced settings
`Pro`

① **Response time settings**
`rESP`
* is the initial value of each setting item.
Select the response time
- `16uS` Response time 16 µs *
- `200u` Response time 200 µs
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

② **Zero reset setting**
`oFSt`
Zero reset setting
- `oFF` Do not execute the zero reset.*
- `on` Execute the zero reset from the current receiving light level.
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

③ **Display setting**
`d-SP`
Select the normal display format
- `d-9` Numerical value display*
- `bAr` Bar display (bar illuminates in order from the right according to received light amount)
- `Pct` Percentage display
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

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④ **Power-saving mode setting**
`Eco`
Select whether to enable power-saving mode
- `oFF` Disable power-saving mode.*
- `on` Enable power-saving mode.
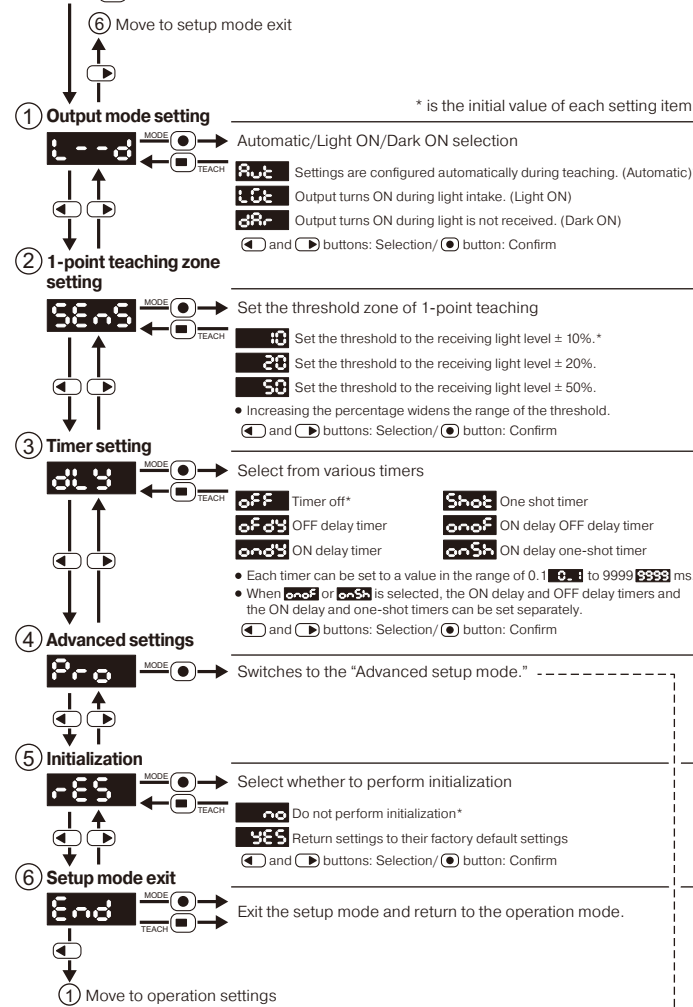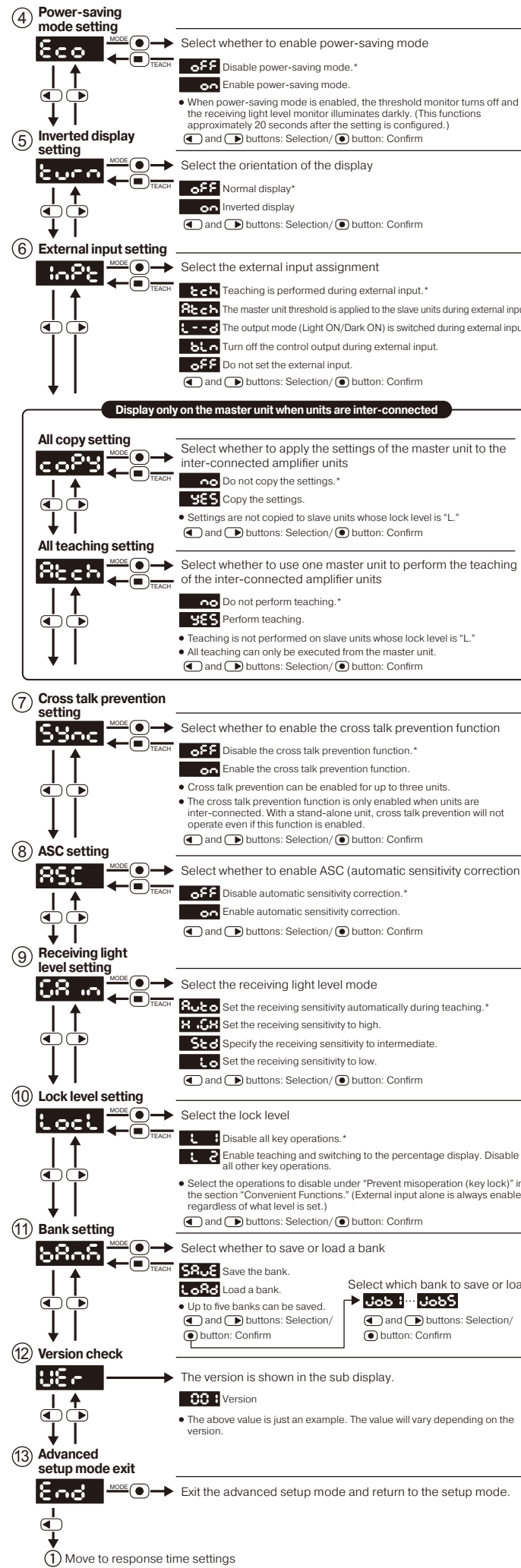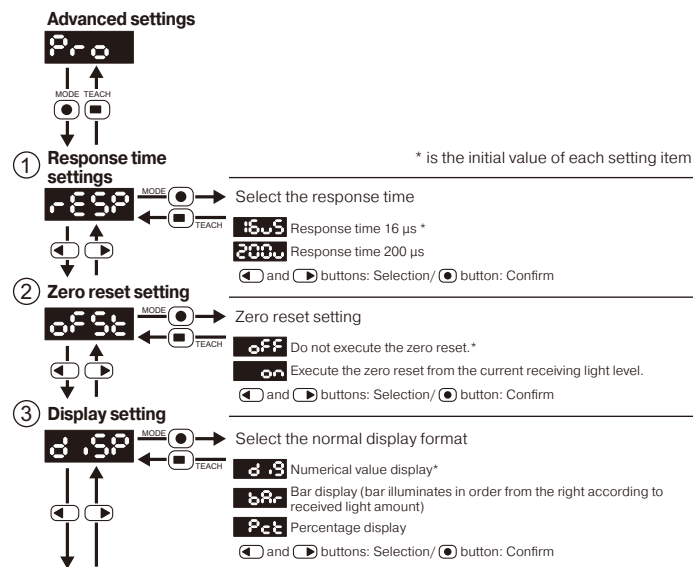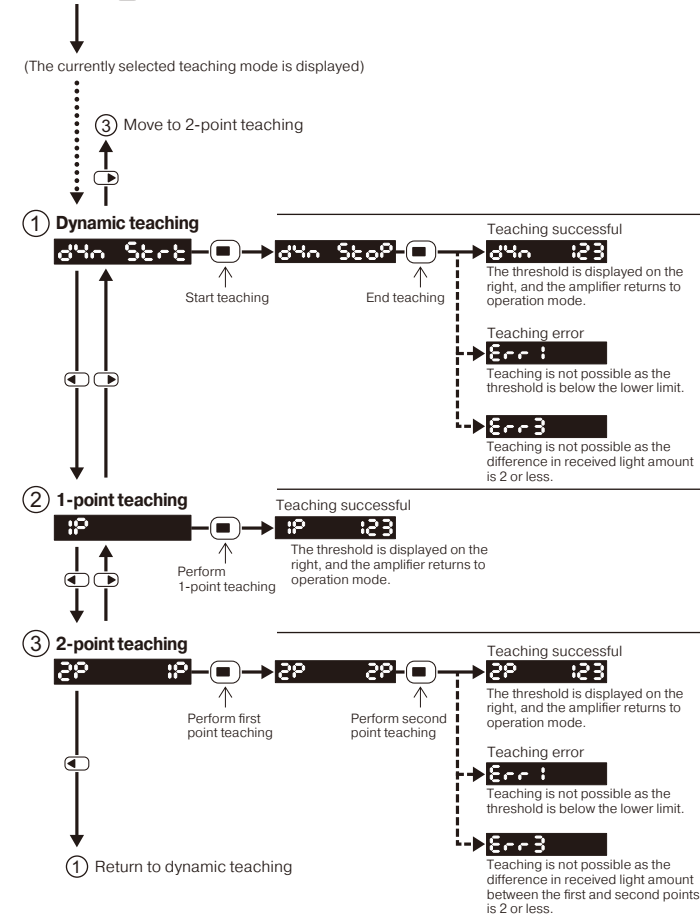- When power-saving mode is enabled, the threshold monitor turns off and the receiving light level monitor illuminates darkly. (This functions approximately 20 seconds after the setting is configured.)
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

⑤ **Inverted display setting**
`turn`
Select the orientation of the display
- `oFF` Normal display*
- `on` Inverted display
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

⑥ **External input setting**
`inPt`
Select the external input assignment
- `tch` Teaching is performed during external input.*
- `Atch` The master unit threshold is applied to the slave units during external input.
- `L - -d` The output mode (Light ON/Dark ON) is switched during external input.
- `bLn` Turn off the control output during external input.
- `oFF` Do not set the external input.
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

Display only on the master unit when units are inter-connected

All copy setting
`coPY`
Select whether to apply the settings of the master unit to the inter-connected amplifier units
- `no` Do not copy the settings.*
- `YES` Copy the settings.
- Settings are not copied to slave units whose lock level is "L."
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

All teaching setting
`Atch`
Select whether to use one master unit to perform the teaching of the inter-connected amplifier units
- `no` Do not perform teaching.*
- `YES` Perform teaching.
- Teaching is not performed on slave units whose lock level is "L."
- All teaching can only be executed from the master unit.
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

⑦ **Cross talk prevention setting**
`SYnc`
Select whether to enable the cross talk prevention function
- `oFF` Disable the cross talk prevention function.*
- `on` Enable the cross talk prevention function.
- Cross talk prevention can be enabled for up to three units.
- The cross talk prevention function is only enabled when units are inter-connected. With a stand-alone unit, cross talk prevention will not operate even if this function is enabled.
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

⑧ **ASC setting**
`ASC`
Select whether to enable ASC (automatic sensitivity correction)
- `oFF` Disable automatic sensitivity correction.*
- `on` Enable automatic sensitivity correction.
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

⑨ **Receiving light level setting**
`GA in`
Select the receiving light level mode
- `Auto` Set the receiving sensitivity automatically during teaching.*
- `H iGH` Set the receiving sensitivity to high.
- `Std` Specify the receiving sensitivity to intermediate.
- `Lo` Set the receiving sensitivity to low.
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

⑩ **Lock level setting**
`Loc`
Select the lock level
- `L 1` Disable all key operations.*
- `L 2` Enable teaching and switching to the percentage display. Disable all other key operations.
- Select the operations to disable under "Prevent misoperation (key lock)" in the section "Convenient Functions." (External input alone is always enabled regardless of what level is set.)
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

⑪ **Bank setting**
`bAnG`
Select whether to save or load a bank
- `SAuE` Save the bank.
- `LoAd` Load a bank.
- Up to five banks can be saved.
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

Select which bank to save or load
`Job 1` … `Job5`
- (◀) and (▶) buttons: Selection/ (●) button: Confirm

⑫ **Version check**
`UEr`
The version is shown in the sub display.
- `00` Version
- The above value is just an example. The value will vary depending on the version.

⑬ **Advanced setup mode exit**
`End`
Exit the advanced setup mode and return to the setup mode.

① Move to response time settings

Teaching mode

Press the (■) button for 3 seconds or more in the operation mode

(The currently selected teaching mode is displayed)

③ Move to 2-point teaching

① **Dynamic teaching**
`dYn Strt` → `dYn StoP` → Teaching successful `dYn  123`
Start teaching End teaching
The threshold is displayed on the right, and the amplifier returns to operation mode.
Teaching error `Err 1`
Teaching is not possible as the threshold is below the lower limit.
`Err3`
Teaching is not possible as the difference in received light amount is 2 or less.

② **1-point teaching**
`iP` → `iP  123`
Perform 1-point teaching
Teaching successful
The threshold is displayed on the right, and the amplifier returns to operation mode.

③ **2-point teaching**
`2P  iP` → `2P  2P` → `2P  123`
Perform first point teaching Perform second point teaching
Teaching successful
The threshold is displayed on the right, and the amplifier returns to operation mode.
Teaching error `Err 1`
Teaching is not possible as the threshold is below the lower limit.
`Err3`
Teaching is not possible as the difference in received light amount between the first and second points is 2 or less.

① Return to dynamic teaching

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8. Convenient Functions

Initialize settings

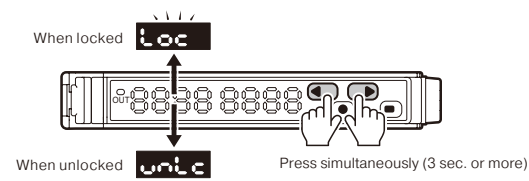All settings are returned to their factory default settings.
1. Press the (●) button for 3 sec. or more to enter setup mode.
2. Press the (▶) button multiple times to display `rES`, and then confirm with the (●) button.
3. Display `YES` with the (◀)(▶) button, and perform initialization with the (●) button.

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

Prevent misoperation (key lock)

Disable key operation to prevent misoperation, etc.
While in operation mode, press the (◀) and (▶) buttons simultaneously for 3 seconds or more. Key lock is canceled by performing the same operation.

When locked `Loc`

When unlocked `UnLc`

Press simultaneously (3 sec. or more)

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 multiple times to display `Pro`, and then confirm with the (●) button.
3. Press the (▶) button multiple times to display `d-SP`, and confirm with the (●) button.
4. Display `Pct` with the (◀)(▶) button, and set the percentage display with the (●) button.

Threshold adjusting mode setting

1. In operation mode, press the (◀) and (▶) buttons to adjust the threshold, and then confirm with the (●) button.
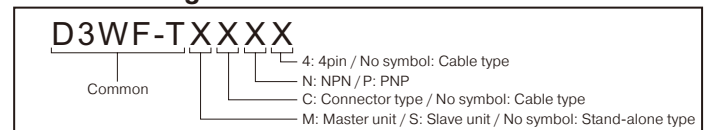2. Returns to operation mode after confirming.

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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9. Specifications

Type		Stand-alone type	Inter-connection master	Inter-connection slave
Model	NPN	D3WF-TN	D3WF-TMCN4	D3WF-TSCN4
	PNP	D3WF-TP	D3WF-TMCP4	D3WF-TSCP4
Light source		White LED		
Response time		High: 16 µs*[1], Standard: 200 µs		
Sensitivity adjustment		Various types of teaching and manual adjustment		
Indicators		Output indicator (orange)		
Digital display		7-segment, 8-digit display (red: 4-digit, green: 4-digit)		
Control output		NPN/PNP open collector max. 100 mA*[2]/ 30 VDC, residual voltage: 1.8 V or less		
External input		Teaching input,*[3] all teaching input, output mode selection, control output OFF, input OFF		
Cross talk prevention		—	Can be enabled for up to three units depending on the settings	
Timer function		ON delay, OFF delay, one-shot, ON + OFF delay, ON + one-shot settable to 0.1 to 9999 ms		
Output mode		Light ON/Dark ON, set automatically during teaching, switched with external input and the settings		
No. of connectable units		Max. 16 (including master unit)		
Connection type		Cable type: 2m length	Connector type: M8, 4-pin	
Insulation resistance		20 MΩ or more (with 500 VDC)		
Rating	Supply voltage	12 to 24 VDC ± 10%, including 10% ripple (p-p)		
	Power consumption (normally)	864 mW (36 mA or less at 24 V)		
	Power consumption (Eco mode)	720 mW (30 mA or less at 24 V)		
Warm-up time		300 ms		
Applicable regulations	EMC	EMC directive (2014/30/EU)		
	Environment	RoHS directive (2011/65/EU), China RoHS (MIIT Order No. 32)		
Applicable standards		EN 60947-5-2		
Company standards		Noise resistance: Feilen Level 3 cleared		
Photobiological safety		Risk group 2 (IEC 62471/JIS C 7550)		
Environmental resistance	Ambient temperature/ humidity	−25 to +55°C*[4]/35 to 85%RH (no freezing or condensation)		
	Ambient illuminance	Sunlight: 10000 lx or less, Incandescent light: 3000 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	Approx. 50 G (500 m/s²), 3 times in each of the X, Y, and Z directions		
	Protection circuit	Reverse connection protection, overcurrent protection		
	Degree of protection	IP50		
Material		Housing, cover: PC		
Weight		Approx. 71 g (Including cable)	Approx. 25 g	
Included accessories		Mounting bracket		

*1: The response time is 32 µs when inter-connection type units are inter-connected and the cross talk prevention function is on.
*2: When used as a stand-alone unit or when the number of inter-connected units including the master unit is 2 or 3. Use a load current of 50 mA or less for 4 to 8 units and 20 mA or less for 9 to 16 units.
*3: Teaching mode from external input is a mode executed in advance by the main unit (default: dynamic teaching).
*4: When used as a stand-alone unit or when the number of inter-connected units including the master unit is 2 or 3. Keep at −25 to +50°C for 4 to 8 units and −25 to +45°C for 9 to 16 units.
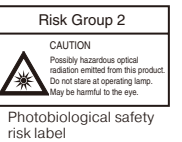
Model naming rules

`D3WF-TXXXX`
Common
- 4: 4pin / No symbol: Cable type
- N: NPN / P: PNP
- C: Connector type / No symbol: Cable type
- M: Master unit / S: Slave unit / No symbol: Stand-alone type

Eye safety

This product is included in the scope of "IEC 62471/JIS C 7550: Photobiological safety of lamps and lamp systems," a standard issued by the International Electrotechnical Commission (IEC). This product corresponds to "risk group 2," which is explained below.
"Risk group 2" indicates moderate risk to organisms. Lamps in this group do not pose a hazard because organisms are protected by way of blinking and other such aversion responses to very bright light sources or by way of thermal discomfort. However, the light may become very intense if it is condensed or under similar usage conditions, which may have an adverse effect on the eyes, so do not look directly at the light source.

Risk Group 2
CAUTION
Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. May be harmful to the eye.
Photobiological safety risk label

- Support for the China RoHS directive
(10) 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.
https://www.optex-fa.com/rohs_cn/

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