Digital Fiber Amplifier

D3RF/D3IF Series

D3RF-T □ D3IF-T □
D3RF-TC □4 D3IF-TC □4
D3RF-TD □

Instruction Manual

●Thank you for purchasing D3RF Series. We hope you are fully satisfied with this product and enjoy its performance.
●Carefully read this instruction manual and keep it for future reference.

Carefully read and understand the safety precautions before operation.
The important information is provided to protect your health and property.
Do not apply any other installing or operating procedure other than that discribed in this manual.

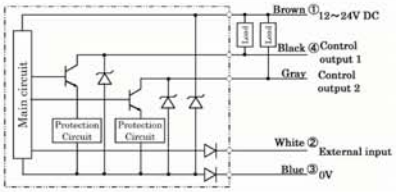
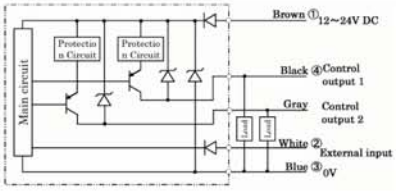
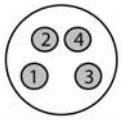
Safety Precautions

CAUTION

●It is dangerous to wire or attach/remove the connector with the power on. Make sure to turn off the power before operation.
●Make sure to use the product with the protective cover attached and closed.
●Installing in the following places may result in malfunction:
1. A dusty or steamy place.
2. A place generating corrosive gas.
3. A place directly receiving scattering water or oil.
4. A place suffered from heavy vibration or impact.
●The product is not designed for outdoor use.
●Do not use the sensor in transient state after power on (approx. 300ms).
●Do not wire with the high voltage cable or the power line. Failure to do this will cause malfunction by induction or damage.
●The sensor performance or digital display values may depend on the individual units or the condition of detected product.
●This product is not an explosion-proof construction. Do not use the product under flammable, explosive gas or liquid environment.
●Do not use the product in water.
●Do not disassemble, repair, or convert the product. Failure to do this may cause failure, fire, or electric shock.
●Operate within the rated range.

This product cannot be use as a safety device to protect human body.

Input/Output Schematic

NPN	
PNP	
Pin layout	 1 12-24VDC 2 External Input 3 0V 4 Control output 1

* Gray line (Control output 2) is only for the 2 output type (D3RF-TD).

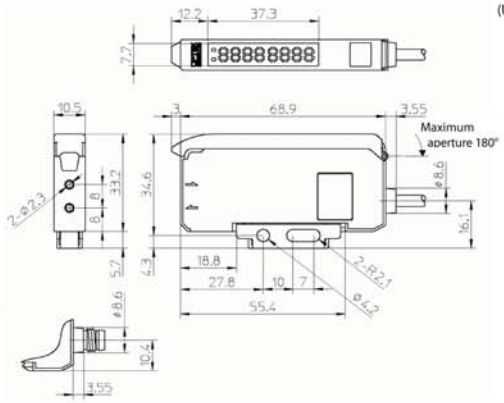
Specifications

Model		Standard type	Moisture sensing type
Cable Type	1 output	D3RF-T (N/P)	D3IF-T (N/P)
	2 output	D3RF-TD (N/P)	-
M8 Connector Type	1 output	D3RF-TC (N/P) 4	D3IF-TC (N/P)4
	2 output	-	-
Power sourse, voltage		12-24VDC±10%including a ripple	
Power consumption	Normal	1 output : 864mW max.(36mA or less / 24V) ,2 output : 936mW max.(39mA or less / 24V)	
	Eco All	1 output : 600mW max.(25mA or less / 24V) ,2 output : 672mW max.(28mA or less / 24V)	
Response Time		1-HS:16μs / 2-FS:70μs / 3-ST:250μs / 4-LG:500μs / 5-PL:1ms / 6-UL:2ms / 7-EL:8ms	
Control output		1 output / 2 output , NPN / PNP Open collector 100mA / 30V or less Load current : 100mA or less , Residual voltage : 1.8V or less	
Output method		Light on / Dark on Switching type in the function	
Short-circuit protection		Incorporated	
Light source		Red LED (632nm)	IR LED (1,450nm)
Indicator light / Display	1 output	Output Indicator light : Orange (Ch 1) / 7 segment 8 digit display	
	2 output	Output Indicator light : Orange (Ch 1 / Ch 2) /7 segment 8 digit display	-
Sensitivity setting		Teaching / Manual adjustment	
Timer function		OFF,On delay timer,Off delay timer,One-shot timer, On delay-off delay timer,On delay-one-shot timer	
Timer time		0.1ms～9.999s	
External input setting		Teach-in, Emitter stop, Synchronous, Counter reset (only for 2 output type)	
Output setting	1 output	Output 1	
	2 output	Output 2	-
Operating temperature /humidity		-25～+55℃/35～85%RH (No freezing and No condensation)	
Store temperature /humidity		-30～+70℃/35～85%RH (No freezing and No condensation)	
Shock resistance		10～55Hz Amplitude 1.5mm 2 hours for each direction of X,Y and Z	
Protective category		IP50	
Material		PC : Cover, Case	
Weight		Cable type : 71g (Including cordes)	
		M8 Connector type : 25g	

Dimensions

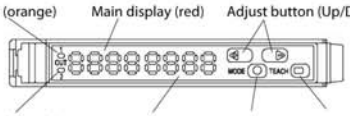
(Unit: mm)

D3RF-T □
D3RF-TD □
D3IF-T □



D3RF-TC □4
D3IF-TC □4

Display/Indicator/Buttons



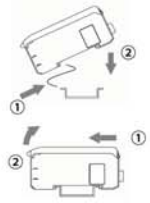
*2 output type (D3RF-TD) only

Installing Amplifier

■Mounting and Removing to/from DIN rail

●Mounting of Amplifier Unit
Hook the claw on the connecting side of fiber cable to the DIN rail. Then press down the hook until it locks.

●Removing of Amplifier Unit
Pushing the unit to the direction of ①, hold up the connecting side of fiber cable and remove the unit.



■How to connect the fiber cables

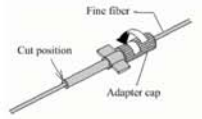
① Open fiber lock lever.
② Insert fiber into holes to stop.
③ Return fiber lock lever until it stops.

CAUTION

With Coaxial reflection fiber, set single core fiber or white-lined fiber

■How to use Fine fiber

① Turn adapter cap anticlockwise completely, then appropriately insert the fiber.
② Cut the excess fiber with fiber cutter.



Display and Buttons

■Switching display

Display shows as follows according to its mode

Operating (RUN mode)	Setup	Teaching
It shows as example when it's actually detecting object. It goes to this mode after power up. Ex.) 200 100 Sensing level / Threshold	It switches to this Setup mode by pressing "MODE" button over 3 seconds. Ex.) L--d L on Function / Setup Value	It switches to this Teaching mode by pressing "TEACH" button over 3 seconds. Ex.) 2Pt 1Pt Mode of teaching

■Buttons

Buttons work as follows according to its mode

Buttons	Operating (RUN mode)	Setup / Teaching
Adjust (+ UP)	Increase threshold level	Change the Setup function and mode of Teaching
Adjust (- DOWN)	Decrease threshold level	
MODE	Switch to Setup mode	Set the setup
TEACHING	Switch to Teaching mode	Execute Teaching

Setup menu

Basic menu

These are basic menu that to be setup before using.
Please refer Expert menu for further setup function.

Display	Menu	Function
L--d	Output mode	Switch Light ON and Dark ON
rESP	Response speed	Set response speed
dELy	Timer/Delay	Set Timer and Delay
Eprt	Expert mode	Enter to Expert mode (refer Expert menu)
rSEt	Initialize	Initialize setup to default
End	Exit	Exit setup mode

Expert menu

These are menu for function that setup in detail.
Expert menu is available from "Eprt" in Basic menu.

Display	Menu	Function
0rSt	Zero reset	Set main display to 0 (zero).
diSP	Display mode	Set display mode for operating (RUN mode)
Eco	Eco mode	Set Eco mode
turn	Rotation	Rotate the display 180 degree
HyS	Hysteresis	Specify hysteresis percentage
PrcS	Detection mode	Set detection mode (edge/level)
cnt	Counter	Switch ON/OFF Counter and specify UP/DOWN direction
InPt	External input	Set function of external input
ASc	ASC	Set ON/OFF ASC (Automatic Sensitivity Control)
Spor	Emitter Power	Specify Emitter power
LocL	Lock level	Specify level of Key Lock
SAuE	Save	Save the current setup
End EPrt	Exit	Exit expert menu
Loc	Lock	Lock buttons (refer useful function)

Teaching menu

Threshold level can be set by these menu.
Please refer "Teaching".

Display	Menu	Function
2Pt	2 Point Teaching	Set the threshold at the center between with object and without object.
1Pt	1 Point Teaching	Set the threshold at minimum level that can detect object stably with.
thru	Through Teaching	Set the threshold at around 90% of sensing level without object for through beam application.
ZonE	Zone Teaching	Set the threshold at around sensing level ±10%.
Auto	Automatic Teaching	Set the threshold at the center between maximum and minimum level.
P-t	Percent Teaching	Threshold can be set any percentage.
0P-t	Zero % Teaching	Set the threshold at any percentage and execute zero reset.
End tEch	End of Teaching	Exit Teaching mode.

Basic setup

Press "MODE" button over 3 sec.

Choose the setup value by d
Define the setup by and go back to top of each menu.
"†" is default value.

1. Output mode

L--d L on

Top

Choose Light ON or Dark ON

L on	ON by sensing light (Light ON)	†
d on	ON by blocking light (Dark ON)	

2. Response speed

rESP Stnd

Top

Choose response speed

1-HS	High Speed	response time:16µs	
2-FS	Fast	response time:70µs	
3-St	Standard	response time:250µs	†
4-Lg	Long	response time:500µs	
5-PL	Power Long	response time:1ms	
6-UL	Ultra Long	response time:2ms	
7-EL	Extra Long	response time:8ms	

Choose faster mode when detect object moving fast at closer distance. Choose slower mode for detecting object at longer distance. The faster the shorter sensing distance.

3. Timer/Delay

dELy oFF

Top

Set Timer and/or Delay

oFF	OFF †
oFdy	OFF delay timer
ondy	ON delay timer
Shot	One shot timer
onof	ON delay and OFF delay timer
onSh	ON delay and One shot timer

Timer can be set from 0.1 to 9999ms.

0_1 0.1 ~ 9999 9999

*When choose "onoF" or "onSh", each ON delay/OFF delay and ON delay/One shot timer can be set individually.

4. Expert mode

Eprt

Top

A Enter to Expert mode (refer Expert menu)

5. Initialize

rSEt no

Top

Initialize setup to default

no	No initializing †
init	Setup to default
uSEr	Setup with saved parameters

*"uSEr" is shown only when there is saved parameter by "SAVE" in Expert mode. Refer "Expert mode4-12. Saving user parameter"

End

Exit Basic menu.

Go back to RUN mode.
*It goes back to RUN mode when there is no button operation for 30 seconds. It can be changed to RUN mode by single action as well. Please refer "Useful function ■Switching to RUN mode by single action"

Setup Threshold manually

At RUN mode, press t :hreshold display blinks that shows it can be adjusted.
Adjust the threshold by r u can adjust upper and lower threshold when it's Zone Teaching mode.

RUN mode

200 100

Press MODE button or leave for 5 seconds then, it goes back to RUN mode.

Zone Teaching

Lower (Far)

200 FAr

Press MODE button while "Far" is blinking.

200 100

Adjust the threshold

Upper (Near)

200 nEA

Press MODE button while "Near" is blinking.

200 100

Adjust the threshold

Teaching

Press TEACH button for 3 seconds.

Choose Teaching mode by pressing ◁ or ▷
Then, press ⊡ to confirm.
When Teaching is done, it goes back to RUN mode after the threshold blinks.
You can refer current sensing level by pressing MODE ⊙ while teaching.

1. 2 point Teaching

2Pt 1Pt → Press TEACH 1st ⊡ → 2Pt 2Pt → Press TEACH 2nd ⊡ → 2Pt 250

Top
Threshold is set at center of 1st and 2nd level.
Teach twice with object and without object.

Diffuse reflective

1st: With object to detect

2nd: Without object

2. 1 point Teaching (1)

1Pt → Press TEACH ⊡ → 1Pt 250

Top
Threshold is set at minimum level that enable stable detection.
Good for long distance

Thru-beam

With object to detect

Diffuse reflective

Without object and background

3. 1 point Teaching (2)

1Pt → Press TEACH ⊡ → 1Pt 250

Top
Teaching with only background for diffuse reflective mode. Threshold is set at minimum level that enable stable detection.

Diffuse reflective

Without object and with background

4. Through Teaching

thru → Press TEACH ⊡ → thru 250

To
Threshold is set at around 90% of sensing level.
Good for detecting transparent object like Glass and Film.

Thru-beam

Without object

Reflective

V-42 reflector

Without object and with reflector

5. Zone Teaching

ZonE → Press TEACH ⊡ → ZonE 25

To
Threshold is set at around sensing level ±10%.
Good for detecting object in the area specified.

Diffuse reflective

Threshold
Sensing level
Threshold

≒+10%
≒-10%

Near
Upper
Zone
Lower
Far

Without object and with background or with object.
*When Zone teaching is done with only background, threshold level will be set at around +/- 10% from the background.

6. Automatic Teaching

Auto Strt → Press TEACH Start ⊡ → Auto StoP → Press TEACH Stop ⊡ → Auto 250

Top
Threshold is set at the center between maximum and minimum level. Good for teaching without stopping production line.

Diffuse reflective

Thru-beam

Teaching is executed while object is moving on the production line.

7. Percent Teaching

P-t 90_ → Press TEACH ⊡ → P-t 90_ → Adjust percentage ◁/▷ → P-t 85_ → Press TEACH ⊡ → Teaching 100_ 85

Top
You can set threshold at any percentage adjusted.
By setting sensing level without object that block the beam as 100%, it can detect the level as relative percentage level.
Re-Teaching can be done by single button action while RUN mode. Refer "Useful function■Fitting in".

Thru-beam

Without object

8. Zero percent Teaching

0P-t 10_ → Press TEACH ⊡ → 0P-t 10_ → Adjust percentage ◁/▷ → 0P-t 15_ → Press TEACH ⊡ → Teaching 0_ 15

Top
Set any percentage adjusted to 0% as threshold.
For diffuse reflective mode, set the sensing level with only background 0% and detect the level as relative percentage level.
Re-Teaching can be done by single button action while RUN mode. Refer "Useful function■Fitting in".

Diffuse reflective

Without object and with background

End tEch

Exit the Teaching mode
⊡ By pressing TEACH button, it goes back to RUN mode.

Expert mode

Setup parameters for further function.

A From A "Basic menu"

Choose the setup value by ◁ or ▷
Define the setup by ⊙ and go back to top of each menu.
"†" is default value.

4-1.Zero reset

0rSt oFF ⊙

Top

Set main display to 0 (zero)

oFF	No action †
on	Reset the main display

Reset the sensing level shown on the main display to zero and shift the threshold shown on the sub display as much as the main display shifted. This function is not active when percent mode and edge detection mode.

◁/▷

4-2.Display mode

diSP dig ⊙

Top

Choose display mode from following three

dig	Digital mode †	Ex.) 200 220 (Sensing level / Threshold)
bAr	Bar display mode Bar increases according to sensing level from right	Ex.)
Pct	Percent mode "_" means it's percentage	Ex.) 100 110 (Sensing level 100% / Threshold 110%)

◁/▷

4-3.Eco mode

Eco oFF ⊙

Top

Set Eco mode

oFF	No action †
diSP	Power off sub display (green) and darken main display (red).
rESP	Double emitting cycle. Actual response time will be doubled as well.
ALL	Power off sub display, darken main display and double emitting cycle. Actual response time will be doubled as well.Brightness of the display will be changed 20 seconds after the setup.

Current consumption of "Eco ALL" will be 30% less than "Eco oFF".

◁/▷

4-4.Rotation

turn oFF ⊙

Top

Rotate the display 180 degree

oFF	No action †	Ex.) turn oFF
on	Rotate the display	Ex.)

This is effective when you have to mount the sensor opposite direction.

◁/▷

4-5.Hysteresis

HyS P 5 ⊙

Top

Set Hysteresis percentage

P 5 †

Set from 1 % to 40 %

P 1 (1%) ~ P 40 (40%)

Set the hysteresis according to the condition. When it's unstable because of chattering, set bigger percentage. When to detect slight difference, set smaller percentage.

◁/▷

4-6.Detection mode

PrcS Stnd ⊙

Top

Set Detection mode

Stnd	Detect by sensing level †
hd_9	Detect UP edge
hd7	Detect Down edge

⊙

Set filter level for edge detection

FiLt 1000	1,000 Hz †	Faster
FiLt 200	200 Hz	↕ speed of edge detection
FiLt 50	50 Hz	
FiLt 20	20 Hz	
FiLt 5	5 Hz	Slower

◁/▷

Edge detection mode:
Detect changes of sensing level in a certain period.
"Detect UP edge" : Detect the sensing level increasing
"Detect Down edge" : Detect the sensing level decreasing
*Only Automatic Teaching can be executed when edge detection is activated.
*Percent display mode is unavailable when edge detection is activated.
*Only CH1 can be set Edge detection for the 2 output type (D3RF-TD).
*Hysteresis will be fixed to 1% when Edge detection is active.
*Edge detection won't work correctly when the sensing level is saturated or there is no light received.
*Filter to be "Slower" to detect sensing level that swings slower.

C B

C B

Choose the setup value by ◁ d ▷
Define the setup by ⊙ and go back to top of each menu.
"†" is default value.

4-7.Counter

cnt oFF → ⊙

Top

Switch ON/OFF Counter and specify UP/DOWN direction

oFF	Counter OFF †
uPc	Set counting direction UP
dnc	Set counting direction DOWN

◁ / ▷

Set counter value from 2 to 9999

*This function is only for "ch2" of the 2 output type (D3RF-TD).
*Threshold of CH1 is used for this function so please change to CH1 when you set threshold.

4-8.External input

InPt rtch → ⊙

Top

Set function of external input

rtch	External Teaching †
tESt	Emitting OFF input
SYnc	Synchronous input (hold the output)
crSt	Counter reset

◁ / ▷

*"crSt" is available only on the 2 output type (D3RF-TD).

4-9.ASC

ASc oFF → ⊙

Top

Set ON/OFF ASC (Automatic Sensitivity control)

OFF	ASC OFF †
on	Correction speed : Standard
FASt	Correction speed : Fast
High	Correction speed : Fastest

◁ / ▷

ASC:
Adjust the threshold according to sensing level that is affected by environmental condition automatically.
It corrects the threshold even when the sensing level changes quickly by cleaning up contamination. This is only for Through Teaching and Percent Teaching.
ASC speed:
"on" : adjust threshold "1" every three seconds
"FASt" : adjust threshold "1" every one second
"High" : adjust threshold "1" every 0.25 seconds
*Edge detection is unavailable when ASC is active.
*ASC is not available after Zone Teaching is executed.
*ASC is not available on CH2 output.

4-10.Emitter power

Spor ||| → ⊙

Top

Specify emitter power

|||	Maximum †
||	Three power level can be chosen
		Minimum

◁ / ▷

Normally, maximum level is OK. Please lower the emitter power when sensing level is saturated.

4-11.Lock level

LocL L 1 → ⊙

Top

Specify level of Key Lock

L 1	Lock level 1 † Lock whole Keys (buttons)
L 2	Lock level 2 Lock Keys except Teaching button and buttons for switching percent display and standard level display.Only channel of the 2 output type (D3RF-TD) can be changed.

◁ / ▷

You can Lock buttons actually by pressing ◁ ▷ conds at a time.
*External inputs are active on any Lock level.

4-12.Save

SAuE no → ⊙

Top

Save the current setup parameters

no	No action †
YES	Save the current setup

◁ / ▷

End EPrt Exit Expert menu

⊙

EPrt Go to top of Expert menu

Note
•Some menu won't be shown depends on the setup. It's not a malfunction.
•Time of pressing buttons to activate not specified on this manual is 0.3 seconds.
•When the parameter value is ready to set, sub display will blink.
•Following parameters of the 2 output type (D3RF-TD) can be specified individually for Output 1 (ch1) and Output 2 (ch2). Other parameters are specified commonly. Threshold, Output mode, Timer and its value, Teaching menu

Useful function

■Switch channel (only for the 2 output type D3RF-TD)
Press ▭ button then, the channel number will be blinking and switch to the channel.

200 250 → ▭ ch2 (CH2) → 200 100 (CH2 display) → ▭ ch1 (CH1) → CH1 display → 200 250

Threshold of CH2 will be copied to CH1 under following condition after external teaching.
This is useful when you want to set single threshold level to both CH1 and CH2.
- ASC and Edge detection are inactive.
- Teaching mode of CH1 is same as CH2.
- Display is showing level of CH2.
*You can switch channel from any setup menu.

■Key Lock
Make the buttons unavailable to prevent operation mistake.
Press ◁ ▷ r 3 seconds to Lock buttons at a time while RUN mode.
Do same to cancel it..

Locked: Loc ↔ ◁ ▷ Released: unLc

You can choose a Lock level from two in "Expert mode 4-11.Lock level".

■Switching to RUN mode by single action
By pressing ▭ button for 3 seconds in setup menu while sub display is not blinking,

■Switching to percent display by single action
Press ◁ nd ▭ ttons at a time then, the display switches to percent display.

Sensing level: 5000 ↔ ◁ ▭ Percent display: 100_

You can setup this function at "Expert mode 4-2.Display mode" as well.
Do same to get back to standard display mode.

■Fitting in (set sensing level to "100%"/"0%")
When "Percent Teaching" or "Zero % Teaching" is chosen in Teaching menu, you can set the sensing level to "100%" or "0% by pressing ▷ bu ▭ ns at a time.
This is effective when detection get unstable.

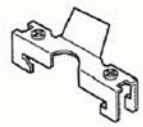
Before Fitting: 90_ → ▷ ▭ After Fitting: 100_

Error

Following are error messages when error occurred while Teaching. Please try again accordingly.

Err1	Sensing level is not enough
Err2	Sensing level is saturated
Err3	Difference of sensing level between two points

Option

	End unit
	BEF-EB01- W190 (2 pieces)

- Specification is subject to change without notice.
- Please contact following when you had any problems and questions regarding to this products.

RAMCO INNOVATIONS
www.optex-ramco.com
Phone (515) 225-6933
Fax (515) 225-0063
Toll Free (800) 280-6933

Digital Fiber Amplifier

D3RF Series

D3RF-TM ☐ D3RF-TDM ☐
D3RF-TMC ☐4
D3RF-TS ☐ D3RF-TDS ☐
D3RF-TSC ☐4

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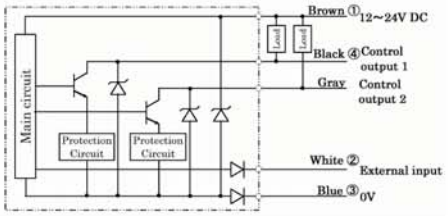
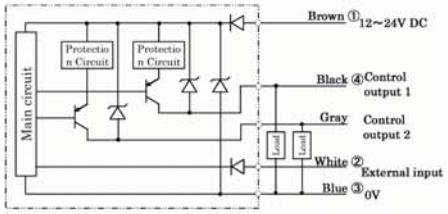
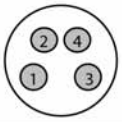
NPN	
PNP	
Pin layout	 1 12-24VDC 2 External Input 3 0V 4 Control output 1

* Slave unit doesn't have the power supply cables (Brown and Blue).
* Gray line (Control output 2) is only for the 2 output type (D3RF-TDM/S)

Specifications

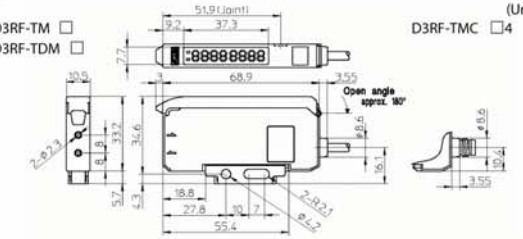
			Model
Cable Type	Master unit	1 output	D3RF-TM (N/P)
		2 output	D3RF-TDM (N/P)
	Slave unit	1 output	D3RF-TS (N/P)
		2 output	D3RF-TDS (N/P)
M8 Connector Type	Master unit	1 output	D3RF-TMC (N/P)4
		2 output	-
	Slave unit	1 output	D3RF-TSC (N/P) 4
		2 output	-
Power sourse, voltage			12-24VDC±10%including a ripple
Power consumption		Normal	1 output : 864mW max.(36mA or less / 24V) ,2 output : 936mW max.(39mA or less / 24V)
		Eco All	1 output : 600mW max.(25mA or less / 24V) ,2 output : 672mW max.(28mA or less / 24V)
Response Time			1-HS : 16μs（no interconnection）, 22us（interconnected）/ 2-FS : 70us（no interconnection）, 85us（interconnected） 3-ST : 250μs / 4-LG : 500μs / 5-PL : 1ms / 6-UL : 2ms / 7-EL : 8ms
Control output			1 output / 2 output , NPN / PNP Open collector 100mA / 30V or less Load current : 100mA or less , Residual voltage : 1.8V or less
Output method			Light on / Dark on Switching type in the function
Short-circuit protection			Incorporated
Light source			Red LED （632nm）
Indicator light /Display		1 output	Output Indicator light : Orange (Ch 1) / 7 segment 8 digit display
		2 output	Output Indicator light : Orange (Ch 1 / Ch 2) /7 segment 8 digit display
Sensitivity setting			Teaching / Manual adjustment
Timer function			OFF,On delay timer,Off delay timer,One-shot timer, On delay-off delay timer,On delay-one shot timer
Timer time			0.1ms～9.999s
External input setting			Teach-in, Emitter stop, Synchronous, Counter reset (only for 2 output type)
Output setting		1 output	Output 1
		2 output	Output 2
Number of cross talk prevention			1-HS : 2units/ 2-FS・3-ST : 4units/ 4-LG・5-PL : 8units/ 6-UL・7-EL : 12units *1
Operating temperature /humidity			-25～+55℃/35～85%RH (No freezing and No condensation) *2
Store temperature /humidity			-30～+70℃/35～85%RH (No freezing and No condensation)
Shock resistance			10～55Hz Amplitude 1.5mm 2 hours for each direction of X,Y and Z
Protective category			IP50
Protective category			PC : Cover, Case
Weight			Cable type : 71g (Including cordes) M8 Connector type : 25g

*1 These mean maximum number of units can be prevented cross talk. Response Time of every unit must be set same mode.
*2 Temp./Maximum units interconnected: -25℃～55℃/ 3 units (output current: 100mA max.),
-25℃～50℃/ 8 units (output current: 50mA max.), -25℃～45℃/16 units (output current: 20mA max.)

Dimensions

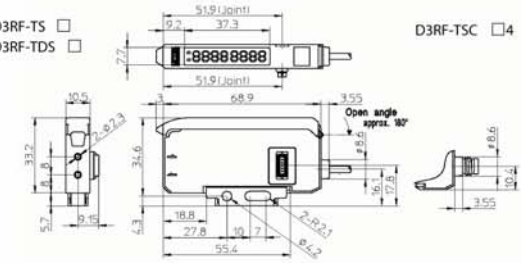
(Unit:mm)

D3RF-TM ☐
D3RF-TDM ☐



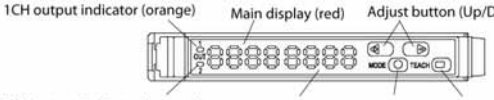
D3RF-TMC ☐4

D3RF-TS ☐
D3RF-TDS ☐



D3RF-TSC ☐4

Display/Indicator/Buttons



* 2 output type (D3RF-TDM/S) only

Installing Amplifier

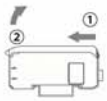
Mounting and Removing to/from DIN rail

- Mounting of Amplifier Unit

Hook the claw on the connecting side of fiber cable to the DIN rail. Then press down the hook until it locks.

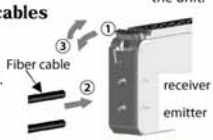
- Removing of Amplifier Unit

Pushing the unit to the direction of ①, hold up the connecting side of fiber cable and remove the unit.



How to connect the fiber cables

① Open fiber lock lever.
② Insert fiber into holes to stop.
③ Return fiber lock lever until it stops.

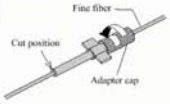


CAUTION

With Coaxial reflection fiber, set single core fiber or white-lined fiber to the emitter. Then set Multi core fiber to the receiver.

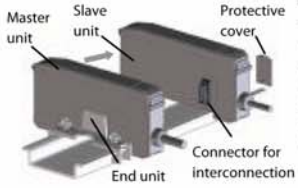
How to use Fine fiber

① Turn adapter cap anticlockwise completely, then appropriately insert the fiber.
② Cut the excess fiber with fiber cutter.



Interconnection

Mount each sensor on DIN rail and slide to interconnect one by one. Mount the End Plates at both ends.
* Up to 16 units can be interconnected.



Note

- Confirm that Power supply is OFF while Installation.
- Use DIN rail and End Plates (BEF-EB01-W190) for installation.
- Confirm that environmental temperature is in specification. (refer a note *2 at "Specifications")
- Install the protective cover at the end connector of slave unit.
- Don't remove sensors from DIN rail while it's interconnected. Remove the End plates, slide the sensor and remove one by one from DIN rail.

Display and Buttons

■Switching display

Display shows as follows according to its mode

Operating (RUN mode)	Setup	Teaching
It shows as example when it's actually detecting object. It goes to this mode after power up. Ex.) 200 100 (Sensing level / Threshold level)	It switches to this Setup mode by pressing "MODE" button over 3 seconds. Ex.) L--d L on (Function / Setup Value)	It switches to this Teaching mode by pressing "TEACH" button over 3 seconds. Ex.) 2Pt 1Pt (Mode of teaching)

■Buttons

Buttons work as follows according to its mode

Buttons	Operating (RUN mode)	Setup / Teaching
Adjust (+ UP)	Increase threshold level	Change the Setup function and mode of Teaching
Adjust (- DOWN)	Decrease threshold level	
MODE	Switch to Setup mode	Set the setup
TEACHING	Switch to Teaching mode	Execute Teaching

Setup menu

Basic menu

These are basic menu that to be setup before using.
Please refer Expert menu for further setup function.

Display	Menu	Function
L--d	Output mode	Switch Light ON and Dark ON
rESP	Response speed	Set response speed
dELy	Timer/Delay	Set Timer and Delay
Eprt	Expert mode	Enter to Expert mode (refer Expert menu)
rSEt	Initialize	Initialize setup to default
End	Exit	Exit setup mode

Expert menu

These are menu for function that setup in detail.
Expert menu is available from "Eprt" in Basic menu.

Display	Menu	Function
0rSt	Zero reset	Set main display to 0 (zero).
diSP	Display mode	Set display mode for operating (RUN mode)
Eco	Eco mode	Set Eco mode
turn	Rotation	Rotate the display 180 degree
HyS	Hysteresis	Specify hysteresis percentage
PrcS	Detection mode	Set detection mode (edge/level)
cnt	Counter	Switch ON/OFF Counter and specify UP/DOWN direction
InPt	External input	Set function of external input
coPy	Copy setup	Copy setup to sensors interconnected
AL 0	All Zero Clear/ Reset	Set all display of sensors interconnected to Zero "0"
Atch	All Teaching	Execute Teaching on every sensor interconnected
ASc	ASC	Set ON/OFF ASC (Automatic Sensitivity Control)
Spor	Emitter Power	Specify Emitter power
LocL	Lock level	Specify level of Key Lock
SAuE	Save	Save the current setup
End EPrt	Exit	Exit expert menu
Loc	Lock	Lock buttons (refer useful function)

Teaching menu

Threshold level can be set by these menu.
Please refer "Teaching".

Display	Menu	Function
2Pt	2 Point Teaching	Set the threshold at the center between with object and without object.
1Pt	1 Point Teaching	Set the threshold at minimum level that can detect object stably with.
thru	Through Teaching	Set the threshold at around 90% of sensing level without object for through beam application.
ZonE	Zone Teaching	Set the threshold at around sensing level ±10%.
Auto	Automatic Teaching	Set the threshold at the center between maximum and minimum level.
P-t	Percent Teaching	Threshold can be set any percentage.
0P-t	Zero % Teaching	Set the threshold at any percentage and execute zero reset.
End tEch	End of Teaching	Exit Teaching mode.

Basic setup

Press "MODE" button over 3 sec.

Choose the setup value by ◁ and ▷
Define the setup by ○ and go back to top of each menu.
"†" is default value.

1. Output mode — L--d L on (Top)

Choose Light ON or Dark ON

L on	ON by sensing light (Light ON) †
d on	ON by blocking light (Dark ON)

2. Response speed — rESP Stnd (Top)

Choose response speed

1-HS	High Speed	response time:16μs(no slave unit), 22μs(with slave unit)
2-FS	Fast	response time:70μs(no slave unit), 85μs(with slave unit)
3-St	Standard	response time:250μs †
4-Lg	Long	response time:500μs
5-PL	Power Long	response time:1ms
6-UL	Ultra Long	response time:2ms
7-EL	Extra Long	response time:8ms

Choose faster mode when detect object moving fast at closer distance. Choose slower mode for detecting object at longer distance.The faster the shorter sensing distance.

3. Timer/Delay — dELy oFF (Top)

Set Timer and/or Delay

oFF	OFF †
oFdy	OFF delay timer
ondy	ON delay timer
Shot	One shot timer
onof	ON delay and OFF delay timer
onSh	ON delay and One shot timer

Timer can be set from 0.1 to 9999ms.

0 1 (0.1) ~ 9999 (9999)

*When choose "on of" or "onSh", each ON delay/OFF delay and ON delay/One shot timer can be set individually.

4. Expert mode — Eprt (Top)

A Enter to Expert mode (refer Expert menu)

5. Initialize — rSEt no (Top)

Initialize setup to default

no	No initializing †
init	Setup to default
uSEr	Setup with saved parameters

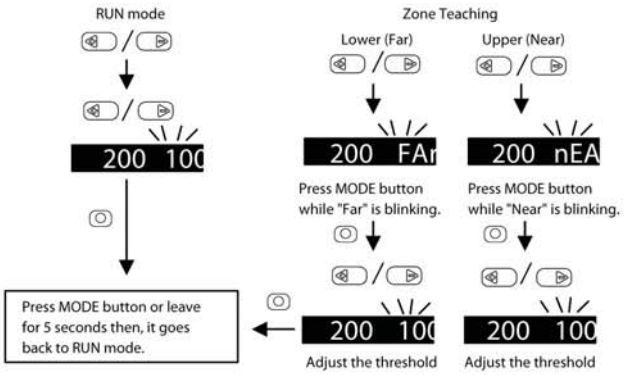
*"uSEr" is shown only when there is saved parameter by "SAVE" in Expert mode. Refer "Expert mode4-15. Saving user parameter"

End — Exit Basic menu.

Go back to RUN mode.
*It goes back to RUN mode when there is no button operation for 30 seconds. It can be changed to RUN mode by single action as well.
Please refer "Useful function ■Switching to RUN mode by single action"

Setup Threshold manually

At RUN mode, press ◁ ▷ threshold display blinks that shows it can be adjusted.
Adjust the threshold by ◁ or ▷ you can adjust upper and lower threshold when it's Zone Teaching mode.



Teaching

Press TEACH button for 3 seconds.

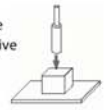
Choose Teaching mode by pressing r
Then, press to confirm.
When Teaching is done, it goes back to RUN mode after the threshold blinks.
You can refer current sensing level by pressing MODE while teaching.

1. 2 point Teaching

2Pt 1Pt —Press TEACH 1st→ 2Pt 2Pt —Press TEACH 2nd→ 2Pt 250

Top
Threshold is set at center of 1st and 2nd level.
Teach twice with object and without object.

Diffuse reflective



1st: With object to detect

2nd: Without object

2. 1 point Teaching (1)

1Pt —Press TEACH→ 1Pt 250

Top
Threshold is set at minimum level that enable stable detection.
Good for long distance

Thru-beam

With object to detect

Diffuse reflective

Without object and background

3. 1 point Teaching (2)

1Pt —Press TEACH→ 1Pt 250

Top
Teaching with only background for diffuse reflective mode. Threshold is set at minimum level that enable stable detection.

Diffuse reflective

Without object and with background

4. Through Teaching

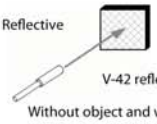
thru —Press TEACH→ thru 250

Top
Threshold is set at around 90% of sensing level.
Good for detecting transparent object like Glass and Film.

Thru-beam

Without object

Reflective



V-42 reflector

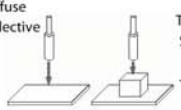
Without object and with reflector

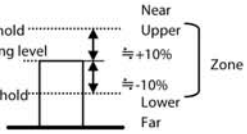
5. Zone Teaching

ZonE —Press TEACH→ ZonE 25

Top
Threshold is set at around sensing level ±10%.
Good for detecting object in the area specified.

Diffuse reflective





Teaching to be done with object or with only background.
*When Zone teaching is done with only background, threshold level will be set at around +/- 10% from the background.

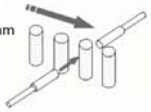
6. Automatic Teaching

Auto Strt —Press TEACH Start→ Auto StoP —Press TEACH Stop→ Auto 250

Top
Threshold is set at the center between maximum and minimum level. Good for teaching without stopping production line.

Diffuse reflective

Thru-beam



Teaching is executed while object is moving on the production line.

7. Percent Teaching

P-t 90_ —Press TEACH→ P-t 90_ —Adjust percentage→ P-t 85_ —Press TEACH→ Teaching 100_ 85

Top
You can set threshold at any percentage adjusted.
By setting sensing level without object that block the beam as 100%, it can detect the level as relative percentage level.
Re-Teaching can be done by single button action while RUN mode. Refer "Useful function■Fitting in".

Thru-beam

Without object

8. Zero percent Teaching

0P-t 10_ —Press TEACH→ 0P-t 10_ —Adjust percentage→ 0P-t 15_ —Press TEACH→ Teaching 0_ 15

Top
Set any percentage adjusted to 0% as threshold.
For diffuse reflective mode, set the sensing level with only background 0% and detect the level as relative percentage level.
Re-Teaching can be done by single button action while RUN mode. Refer "Useful function■Fitting in".

Diffuse reflective

Without object and with background

End tEch — Exit the Teaching mode
By pressing TEACH button, it goes back to RUN mode.

Expert mode

Setup parameters for further function.

A — From A "Basic menu"

Choose the setup value by d
Define the setup by and go back to top of each menu.
"†" is default value.

4-1.Zero reset

0rSt oFF

Top

Set main display to 0 (zero)

oFF	No action †
on	Reset the main display

Reset the sensing level shown on the main display to zero and shift the threshold shown on the sub display as much as the main display shifted. This function is not active when percent mode and edge detection mode.

4-2.Display mode

diSP dig

Top

Choose display mode from following three

dig	Digital mode †	Ex.) 200 220 (Sensing level / Threshold)
bAr	Bar display mode Bar increases according to sensing level from right	Ex.)
Pct	Percent mode "_" means it's percentage	Ex.) 100 110 (Sensing level 100% / Threshold 110%)

4-3.Eco mode

Eco oFF

Top

Set Eco mode

oFF	No action †
diSP	Power off sub display (green) and darken main display (red).
rESP	Double emitting cycle. Actual response time will be doubled as well.
ALL	Power off sub display, darken main display and double emitting cycle. Actual response time will be doubled as well.Brightness of the display will be changed 20 seconds after the setup.

Current consumption of "Eco ALL" will be 30% less than "Eco oFF".

4-4.Rotation

turn oFF

Top

Rotate the display 180 degree

oFF	No action †	Ex.) turn oFF
on	Rotate the display	Ex.)

This is effective when you have to mount the sensor opposite direction.

4-5.Hysteresis

HyS P 5

Top

Set Hysteresis percentage

P 5 †
Set from 1 % to 40 %
P 1 (1%) ~ P 40 (40%)

Set the hysteresis according to the condition. When it's unstable because of chattering, set bigger percentage. When to detect slight difference, set smaller percentage.

4-6.Detection mode

PrcS Stnd

Top

Set Detection mode

Stnd	Detect by sensing level †
hd_9	Detect UP edge
hd7_	Detect Down edge
diFF	Differential mode

Set filter level for edge detection

FiLt 1000	1,000 Hz †	Faster
FiLt 200	200 Hz	
FiLt 50	50 Hz	speed of edge detection
FiLt 20	20 Hz	
FiLt 5	5 Hz	Slower

Edge detection mode:
Detect changes of sensing level in a certain period.
"Detect UP edge" : Detect the sensing level increasing
"Detect Down edge" : Detect the sensing level decreasing
*Only Automatic Teaching can be executed when edge detection is activated.
*Percent display mode is unavailable when edge detection is activated.
* Only CH1 can be set Edge detection for the 2 output type (D3RF-TDM/S).
*Hysteresis will be fixed to 1% when Edge detection is active.
*Edge detection won't work correctly when the sensing level is saturated or there is no light received.
*Filter to be "Slower" to detect sensing level that swings slower.

Differential mode:
It detects difference of sensing level from the sensor unit next to it at master side.The display shows "1024" when sensing levels are same. When the sensing level is smaller than the sensor unit at master side, the display shows smaller value than "1024". When its bigger, the display shows bigger value than "1024".
* Differential mode is available only for the slave unit (D3RF-TS/TDS).

C B

C B

Choose the setup value by d
Define the setup by and go back to top of each menu.
"†" is default value.

4-7.Counter

cnt oFF

Top

Switch ON/OFF Counter and specify UP/DOWN direction

oFF	Counter OFF †
uPc	Set counting direction UP
dnc	Set counting direction DOWN

Set counter value from 2 to 9999
*This function is only for "ch2" of the 2 output type (D3RF-TDM/S).
*Threshold of CH1 is used for this function so please change to CH1 when you set threshold.

4-8.External input

InPt rtch

Top

Set function of external input

rtch	External Teaching †
tESt	Emitting OFF input
SYnc	Synchronous input (hold the output)
crSt	Counter reset
Atch	Set Teaching input for all sensor units

*"crSt" is available only on the 2 output type (D3RF-TDM/S)
*"Atch" is available only on the master unit (D3RF-TM/TDM)

4-9.Copy setup

coPy no

Top

Copy the master setup to other slave units

no	No action †
YES	Copy the setup

* "Copy setup" is available only on the master unit (D3RF-TM/TDM)
* The setup of slave unit that is locked by "Key Lock" function won't be changed.

4-10.All Zero Clear/Reset

AL 0 no

Top

Reset the displays of sensor units interconneted to Zero "0"

no	No action †
cLr	Standard mode
YES	Reset display to Zero "0"

The displays of master unit and other slave units interconnected will be reset to Zero "0". The reset functionality is same as "4-1.Zero reset".
* "All Zero Clear/Reset" is available only on the master unit (D3RF-TM/TDM).
* The display of slave unit that is locked as "Lock level 1" won't be changed.

4-11.All Teaching

Atch no

Top

Execute Teaching on every sensor interconnected

no	No action †
YES	Execute All Teaching

Teaching mode of each sensor unit can be independently set.
When one of the master unit and slave units is set as 2 point Teaching, the display of the master unit shows "Atch 2Pt" so press MODE button for 2nd Teaching.
* The Teaching for the slave unit locked as "Lock level 1" by "Key Lock" function will be inactive.
* "All Teaching" is available only on the master unit (D3RF-TM/TDM)

4-12.ASC

ASc oFF

Top

Set ON/OFF ASC (Automatic Sensitivity Control)

OFF	ASC OFF †
on	Correction speed : Standard
FASt	Correction speed : Fast
High	Correction speed : Fastest

ASC:
Adjust the threshold according to sensing level that is affected by environmental condition automatically.
It corrects the threshold even when the sensing level changes quickly by cleaning up contamination. This is only for Through Teaching and Percent Teaching.
ASC speed:
"on" : adjust threshold "1" every three seconds
"FASt" : adjust threshold "1" every one second
"High" : adjust threshold "1" every 0.25 seconds
*Edge detection is unavailable when ASC is active.
*ASC is not available after Zone Teaching is executed.
*ASC is not available on CH2 output .

4-13.Emitter power

Spor |||

Top

Specify emitter power

|||	Maximum †
||	Three power level can be chosen
		Minimum

Normally, maximum level is OK. Please lower the emitter power when sensing level is saturated.

4-14.Lock level

LocL L 1

Top

Specify level of Key Lock

L 1	Lock level 1 † Lock whole Keys (buttons)
L 2	Lock level 2 Lock Keys except Teaching button and buttons for switching percent display and standard level display. Only channel of the 2 output type (D3RF-TDM/S) can be changed.

You can Lock buttons actually by pressing conds at a time.
*External inputs are active on any Lock level.

E D

4-15.Save

SAuE no

Top

Save the current setup parameters

no	No action †
YES	Save the current setup

End EPrt Exit Expert menu

EPrt Go to top of Expert menu

Note
•Some menu won't be shown depends on the setup. It's not a malfunction.
•Time of pressing buttons to activate not specified on this manual is 0.3 seconds.
•When the parameter value is ready to set, sub display will blink.
•Following parameters of the 2 output type (D3RF-TDM/S) can be specified individually for Output 1 (ch1) and Output 2 (ch2). Other parameters are specified commonly. Threshold, Output mode, Timer and its value, Teaching menu

Useful function

■Switch channel (only for the 2 output type D3RF-TDM/S)
Press button then, the channel number will be blinking and switch to the channel.

200 250 → ch2 (CH2) → 200 100

CH1 display ← ch1 (CH1) ← CH2 display

Threshold of CH2 will be copied to CH1 under following condition after external teaching.
This is useful when you want to set single threshold level to both CH1 and CH2.
- ASC and Edge detection are inactive.
- Teaching mode of CH1 is same as CH2.
- Display is showing level of CH2.
*You can switch channel from any setup menu.

■Key Lock
Make the buttons unavailable to prevent operation mistake.
Press r 3 seconds to Lock buttons at a time while RUN mode.
Do same to cancel it..

Locked Loc ↔ Released unLc

You can choose a Lock level from two in "Expert mode 4-14.Lock level".

■Switching to RUN mode by single action
By pressing button for 3 seconds in setup menu while sub display is not blinking,

■Switching to percent display by single action
Press nd ttons at a time then, the display switches to percent display.

Sensing level 5000 450 ↔ Percent display 100_ 90

You can setup this function at "Expert mode 4-2.Display mode" as well.
Do same to get back to standard display mode.

■Fitting in (set sensing level to "100%"/"0%")
When "Percent Teaching" or "Zero % Teaching" is chosen in Teaching menu, you can set the sensing level to "100%" or "0% by pressing bu s at a time.
This is effective when detection get unstable.

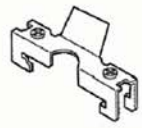
Before Fitting 90 85 → After Fitting 100 85

Error

Following are error messages when error occurred while Teaching. Please try again accordingly.

Err1	Sensing level is not enough
Err2	Sensing level is saturated
Err3	Difference of sensing level between two points

Option

	End unit
	BEF-EB01- W190 (2 pieces)

- Specification is subject to change without notice.
- Please contact following when you had any problems and questions regarding to this products.

RAMCO INNOVATIONS
www.optex-ramco.com
Phone (515) 225-6933
Fax (515) 225-0063
Toll Free (800) 280-6933