

High-speed digital type

**D3RF, D3IF** series

CE

## Easy-to-use and low cost. The 3rd generation of high-speed fiber amplifiers.

**Industry's No. 1** Fastest high-speed response in the world

(according to Feb. 2010 in-house survey)

Supports cross talk prevention functions for up to  
2 units, even in the fastest mode

New generation specifications for sensing distance as well

100% display for better recognition of level change

Related  
products

CC-Link communication

**UC1**

● P.118



Potentiometer type

**BRF**

● P.130



Amplifier separate type

**DS**

● P.280



### Selection table

Type	Shape	Control output	Light source	Model (Models in parentheses are connector types)		
				NPN type	PNP type	
Stand-alone type		Single output	4 element red LED	<b>D3RF-TN</b> (D3RF-TCN4)	<b>D3RF-TP</b> (D3RF-TCP4)	
		Dual output		<b>D3RF-TDN</b>	<b>D3RF-TDP</b>	
Inter-connection master		Single output		<b>D3RF-TMN</b> (D3RF-TMCN4)	<b>D3RF-TMP</b> (D3RF-TMCP4)	
		Dual output		<b>D3RF-TDMN</b>	<b>D3RF-TDMP</b>	
Inter-connection slave		Single output		<b>D3RF-TSN</b> (D3RF-TSCN4)	<b>D3RF-TSP</b> (D3RF-TSCP4)	
		Dual output		<b>D3RF-TDSN</b>	<b>D3RF-TDSP</b>	
Water detection		Single output		Infrared LED	<b>D3IF-TN</b> (D3IF-TCN4)	<b>D3IF-TP</b> (D3IF-TCP4)

● When using the CC-Link communication unit UC1-CL11, please select an inter-connection master and slave unit.

● A connector cable is not included in the connector type. If necessary, please purchase an optional JCN series.

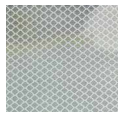
### Options/Accessories

End plate



**BEF-EB01-W190**  
(2 pieces)

Reflective sheet



**Diamond grade sheet**  
100 x 100 mm (adhesive type)

Connector cable

Straight



**JCN-S**  
Cable length: 2 m  
**JCN-5S**  
Cable length: 5 m  
**JCN-10S**  
Cable length: 10 m

L-shaped

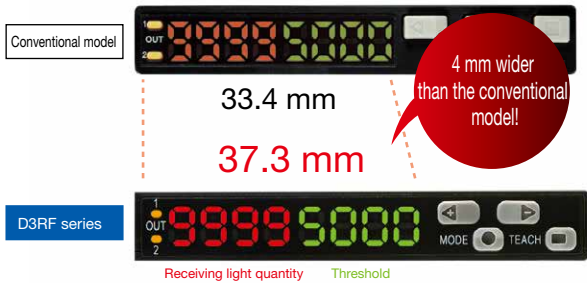


**JCN-L**  
Cable length: 2 m  
**JCN-5L**  
Cable length: 5 m  
**JCN-10L**  
Cable length: 10 m

## Easy to see and intuitive

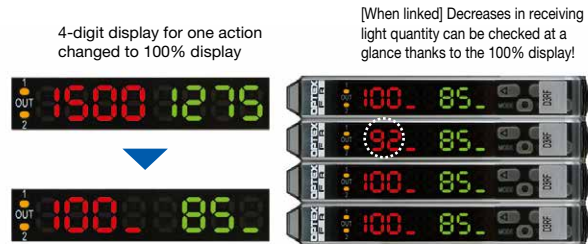
### Widest display in the industry.

The display area is equipped with the widest display in the industry, expanded by 4 mm compared to conventional models. The adoption of high brightness LEDs, a 7-segment display, **with high brightness and high visibility even from a distance** is made possible.



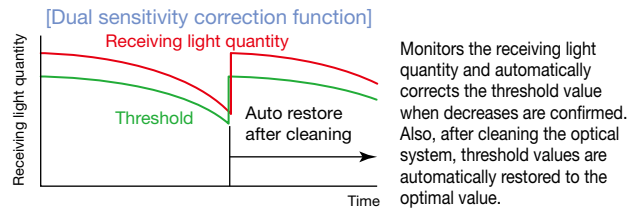
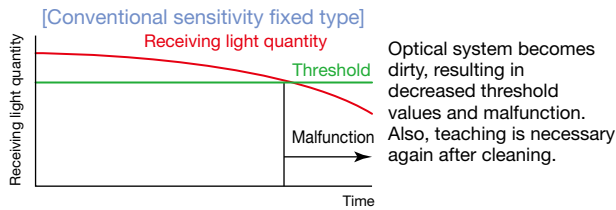
### 100% display for better recognition of level change

Display for receiving light quantity can be changed to a percentage display with one simple single action, **making changes in receiving light quantity are easy to recognize** even when linked.



### Dual "ASC" for easy maintenance (Through Teaching or Percent Teaching)

Unique functionality in which automatic sensitivity corrections are performed when light level decreases occur due to contamination of fiber tips caused by dust, etc. After cleaning, **the threshold value is automatically restored**, so there is no need for re-teaching. \*For dual output types, ASC operates only for control output 1.



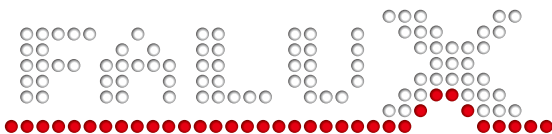
### Cordial design to prevent misoperation

By featuring a design in which basic setup can be performed by pressing the teach button for 2 seconds and in which advanced functions are performed at deeper levels, setting changes caused by misoperation can be prevented.



### "FALUX" function that suppresses fluctuations in emitting power.

A temperature correction circuit in the emitting circuit suppresses emission power fluctuations caused by temperature changes. Stable detection can be performed with little change in brightness, even immediately after turning the power on. Since the brightness of the emitting LED is constant without being influenced by the internal temperature, **heat sinks and an APC, which accelerates the deterioration of the LED, become unnecessary.**

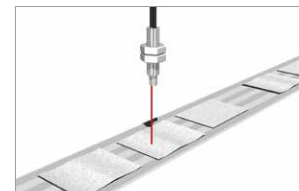


### Adjustable hysteresis

Hysteresis can be adjusted widely **from 1% to 40%**. This enables the sensor to be optimized for detecting slight differences in parts or applications with a lot of vibration.



Presence of electronic component lead



Detection of sheet material

Photoelectric Sensors

Specialized Photoelectric Sensors

Laser Displacement Sensors

Fiber Amplifiers

D3RF, D3IF

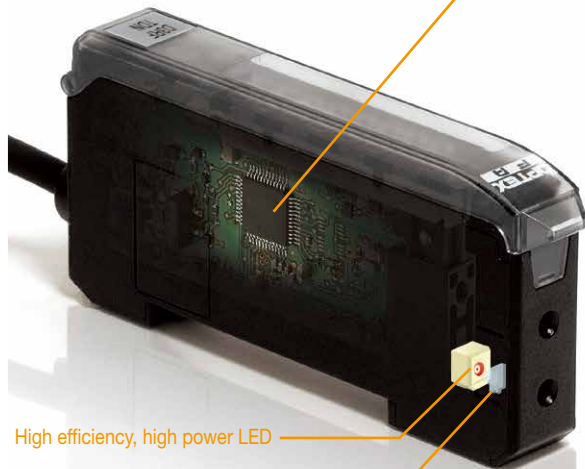
UC1-CL11

D2RF

BRF, BIF

JRF

**No. 1 in speed and power.**



Super high-speed processor "FAntron DUO" **Patent pending**

A new, in-house developed processor that achieves both long and short dual pulse emission. Resistant to ambient light, it enables high-speed, long distance detection.

Conventional model: Single pulse emitting

Emitted light waveform



Because light is emitted using one type of pulse, ambient light on the same pulse width or in the periphery can easily have an effect.

**D3RF: Dual pulse emitting**

Emitted light waveform



D3RF is the world's first to emit light using two long and short types of pulse width. By sampling these unique pulses 6 times, ambient light has little effect and high-speed/long range detection is made possible.

**Fastest high-speed response in the world**

1-HS mode **16 μs (stand-alone) 22 μs (linked)**

Our originally developed super high-speed processor "FAntron DUO" enables the fastest speed in its class at 16 μs (stand-alone/1-HS mode). It can detect **over 30,000 workpieces per second**.

Maximum speed during linked use is 22 μs (1-HS mode). **It can prevent cross talk for up to 2 units** even in maximum speed mode. Copying of setting is also possible.

Seven response times can be selected: 1-HS, 2-FS, 3-ST, 4-LG, 5-PL, 6-UL and 7-EL.

High efficiency, high power LED

Optical lens with high light collection efficiency

Light projected from the LED is collected by the lens, allowing more light to enter the fiber part with high efficiency.

**New generation specifications for sensing distance as well**

With the new built-in "FAntron DUO" processor, a long and short dual pulse width emission is realized, instead of the conventional single pulse width emissions. In addition, due to the synergistic effect of the high power LEDs and high efficiency condensing lens, sensing distance is increased **a maximum of 3x compared to conventional products** with diffuse types, and **a maximum of 5x compared to conventional products** with through-beam types. Long range detection becomes possible even for heat resistant and flexible fibers, in which until now long range detection has been difficult.

Fiber used: NF-DH01 (Reflective type/heat resistant 180°)



**Power saving in ECO mode**

Features an ECO mode that enables power saving by turning off the sub-monitor (green) and darkening the main-monitor (red).



Power consumption comparison (stand-alone single output type)

Normally **864 mW** or less



When set to power-saving mode (ECO ALL mode) **600 mW** or less

**Sensing distance comparison**

With the D3RF, in which long range detection is made possible, response time settings can also reach a maximum of 8 ms (7-EL mode). Long range detection is realized without lengthening the response time unnecessarily to several tens of ms.

	Fiber unit model	Conventional model (Long mode: 2 ms)	D3RF (7-EL mode: 8 ms)	Comparison to conventional model
Diffuse type	NF-DB01 (M6 coaxial)	450 mm	1200 mm	2.7x
	NF-DR01 (M6 R2 mm)	350 mm	1100 mm	3.1x
	NF-DH01 (heat resistant 180°C)	450 mm	1250 mm	2.8x
Through-beam type	NF-TB01 (M4 standard)	1800 mm	4000 mm	2.2x
	NF-TR01 (M4 R2 mm)	800 mm	4000 mm	5x
	NF-TH02 (heat resistant 180°C)	1000 mm	4000 mm	4x

More convenient, even when linked.

Cross talk prevention

Prevents malfunctions caused by cross talk by linking master and slave units to electrically shift the timing of the emitting element. Up to 12 units can be linked closely together, with up to 16 units in ECO mode.



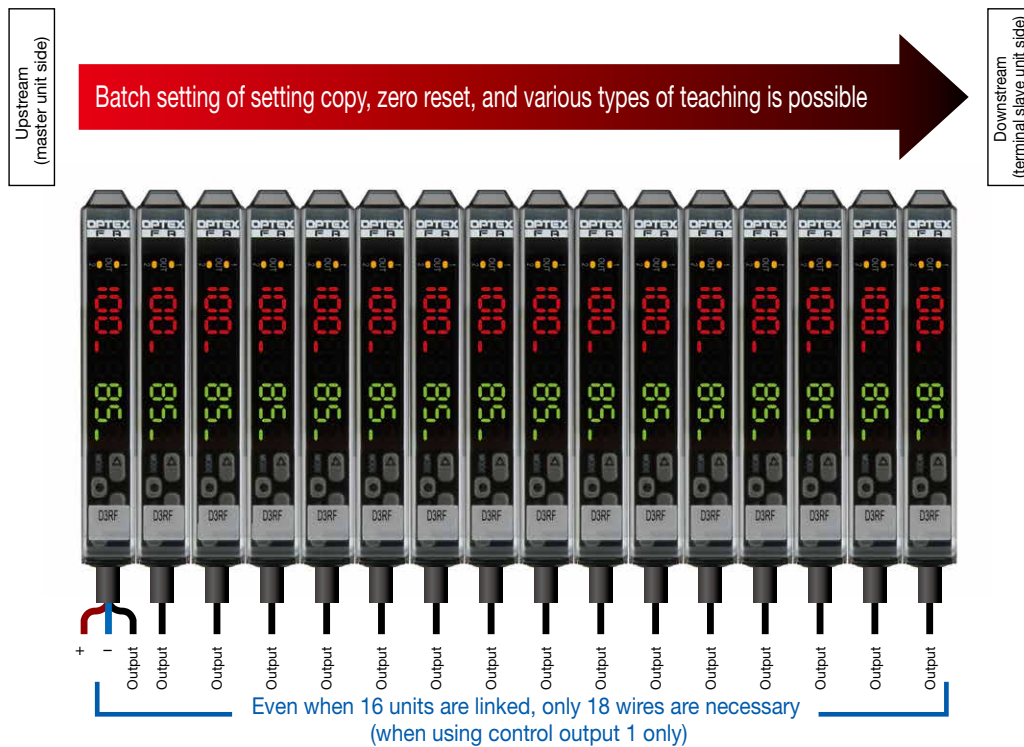
No. of units applicable to cross talk prevention (including master unit)

	Eco mode: OFF, diSP	Eco mode: rESP, ALL
1-HS mode	2 units	4 units
2-FS mode	4 units	8 units
3-ST mode	4 units	8 units
4-LG mode	8 units	16 units
5-PL mode	8 units	16 units
6-UL mode	12 units	16 units
7-EL mode	12 units	16 units

\*When linked in modes with differing response times, the number of units applicable to cross talk prevention may decrease.

Batch setting of amplifier

Settings can be made collectively for linked (expanded) amplifiers. Zero reset and various types of teaching, as well as copying of amplifier settings from upstream (master unit side) to downstream (terminal slave unit side) can be performed.



Detection of only water is possible

Employs an infrared LED (wavelength: 1.45 μm) for the light source that are absorbed by water. Detection of only water is made possible using water detection amplifier D3IF-TN and the specialized fiber unit shown on the right.

**Through-beam type fiber units NF-TW01 (P97)**  
Sensing distance max. 650 mm (7-EL mode)



Detection of chemicals in transparent bottles

**Diffuse type fiber units NF-DW01 (P97)**  
Sensing distance max. 280 mm (7-EL mode)



Detection of adhesives

Photoelectric Sensors

Specialized Photoelectric Sensors

Laser Displacement Sensors

Fiber Amplifiers

D3RF, D3IF

UC1-CL11

D2RF

BRF, BIF

JRF

## Specifications

Type			Stand-alone type	Inter-connection master	Inter-connection slave	Water detection	
Model	NPN	Single output	Cable type	<b>D3RF-TN</b>	<b>D3RF-TMN</b>	<b>D3RF-TSN</b>	<b>D3IF-TN</b>
			Connector type	<b>D3RF-TCN4</b>	<b>D3RF-TMCN4</b>	<b>D3RF-TSCN4</b>	<b>D3IF-TCN4</b>
		Dual output	Cable type	<b>D3RF-TDN</b>	<b>D3RF-TDMN</b>	<b>D3RF-TDSN</b>	-
	PNP	Single output	Cable type	<b>D3RF-TP</b>	<b>D3RF-TMP</b>	<b>D3RF-TSP</b>	<b>D3IF-TP</b>
			Connector type	<b>D3RF-TCP4</b>	<b>D3RF-TMCP4</b>	<b>D3RF-TSCP4</b>	<b>D3IF-TCP4</b>
		Dual output	Cable type	<b>D3RF-TDP</b>	<b>D3RF-TDMP</b>	<b>D3RF-TDSP</b>	-
Light source			4 element red LED (wavelength 632 nm)			Infrared LED (wavelength 1.45 μm)	
Response time *1	1-HS mode		16 μs	16 μs (when linked 22 μs)	22 μs	16 μs	
	2-FS mode		70 μs	70 μs (when linked 85 μs)	85 μs	70 μs	
	3-ST mode		250 μs				
	4-LG mode		500 μs				
	5-PL mode		1 ms				
	6-UL mode		2 ms				
	7-EL mode		8 ms				
Distance adjustment			Various types of teaching and manual adjustment				
Indicators			Single output type: Output indicator (orange) Dual output type: Output indicator (orange) x2				
Digital display			7-segment, 8-digit display (red: 4-digit, green: 4-digit)				
Control output*2			NPN/PNP open collector Max. 100 mA <sup>3</sup> /30 VDC, residual voltage: 1.8 V or less				
External input			Teach input*4, Test input, synchronous input, counter reset input*5				
Timer function			ON delay, OFF delay, one-shot, ON + OFF delay, ON + one-shot settable 0.1 to 9999 ms				
Output mode			Light ON / Dark ON selectable by setting				
No. of connectable units (including master unit)			Max. 16 units				
Connection type			Cable type: Cable length: 2 m 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)		Single output type: 864 mW (36 mA or less at 24 V) Dual output type: 936 mW (39 mA or less at 24 V)				
	Power consumption (Eco ALL)		Single output type: 600 mW (25 mA or less at 24 V) Dual output type: 672 mW (28 mA or less at 24 V)				
Applicable regulations			EMC directive (2004/108/EC)				
Applicable standards			EN 60947-5-2				
Company standards			Noise resistance: Feilen Level 4 cleared				
Environmental resistance	Ambient temperature/humidity		-25 to +55°C <sup>6</sup> / 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/s <sup>2</sup> ), 3 times in each of the X, Y, and Z directions				
	Degree of protection		IP50				
Material			Housing, cover: PC				
Weight			Cable type: Approx. 71 g / Connector type: Approx. 25 g				
Included accessories			Mounting bracket				

● Specifications are subject to change without prior notice for product improvement purposes.

\*1. When Eco mode is set to rESP or ALL, the response time is doubled.

\*2. For dual output types, the threshold value/timer and Light ON/Dark ON can be set individually for output 1 and output 2. Additionally, ASC is only available for output 1.

\*3. No. of connectable units when used stand-alone or as the master unit: 2 to 3 units. Please use a load current of 50 mA or less for 4 to 8 units, and 20 mA or less for 9 to 16 units.

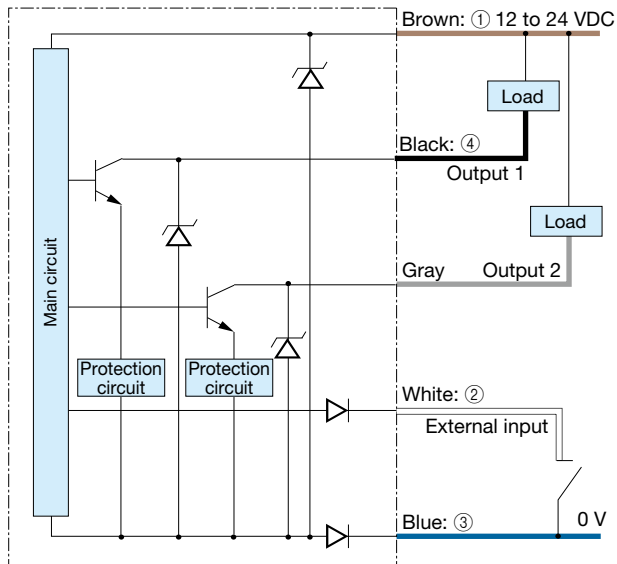
\*4. Teaching mode from external input is a mode executed in advance by the main unit (default: 2-point teaching).

\*5. The counter function is a function only for the dual output type, as counter reset input is not equipped to single output types.

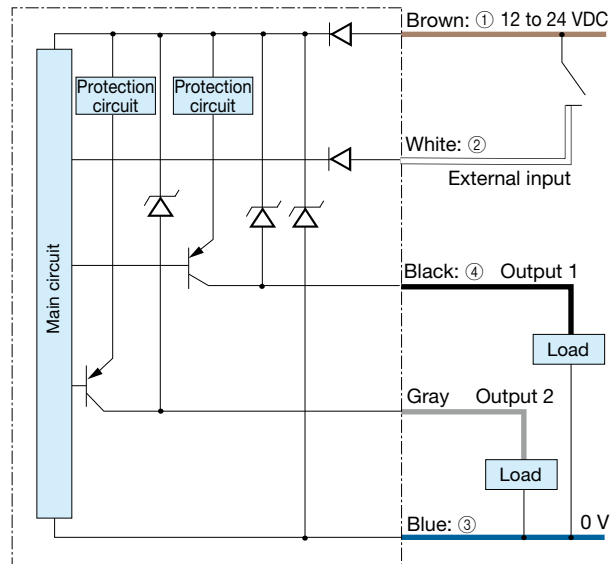
\*6. No. of connectable units when used stand-alone or as the master unit: 2 to 3 units. Keep at -25 to +50°C for 4 to 8 units, and -25 to +45°C for 9 to 16 units.

## I/O circuit diagram

### NPN output type



### PNP output type



\* Control output 2 (gray) is equipped only for dual-output types. In addition, power supply wires (brown/blue) are not equipped for inter-connection slave units.

### Connector type

(Pin configuration) Sensor side Connector cable side



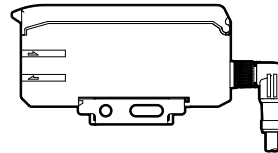
- ① 12 to 24 VDC
- ② External input
- ③ 0 V
- ④ Output 1

### Connecting

- When not used for control output 2 or external input, cut the lead wire and wrap it individually with insulating tape, and do not connect it to any other terminal.
- ① to ④ correspond to connector pin No.

### Notes

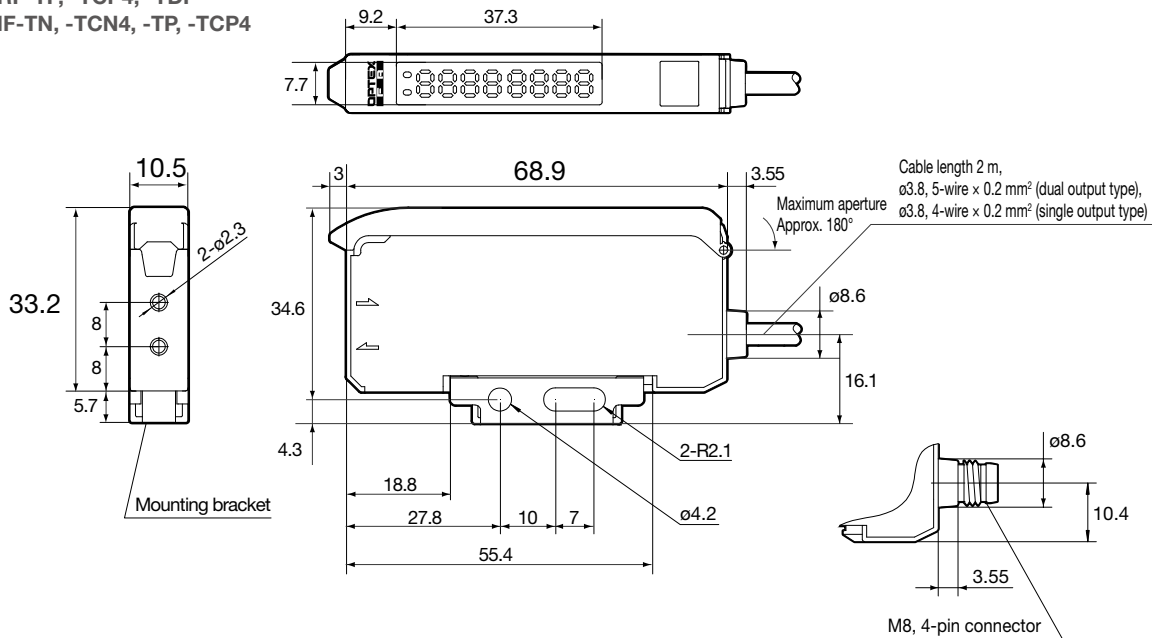
- When using a switching regulator for the power supply, be sure to ground the frame ground terminal.
- Because wiring sensor wires with high-voltage wires or power supply wires can result in malfunctions due to noise, which can cause damage, make sure to wire separately.
- Avoid using the transient state while the power is on (approx. 300 ms).
- The connector direction is set as in the diagram below when using the L-shaped connector cable. Be aware that rotation is not possible.



**Dimensions**

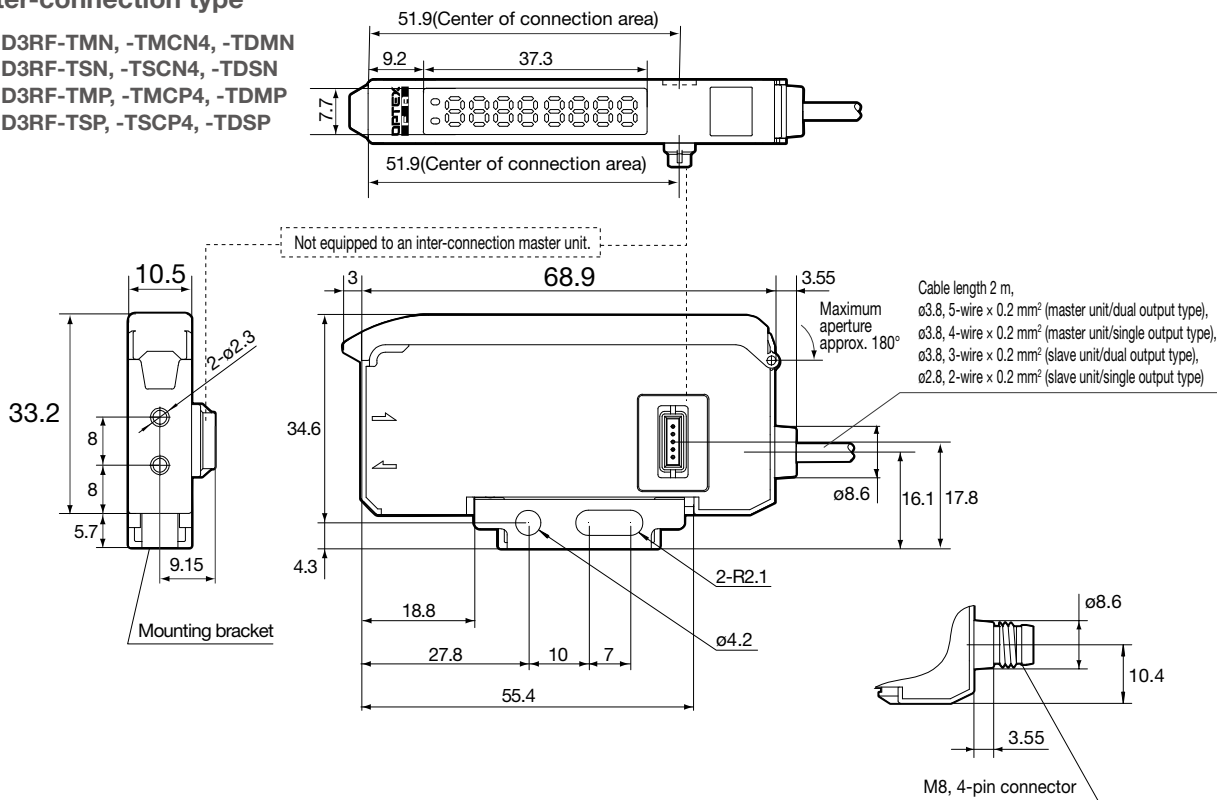
**Stand-alone type**

- D3RF-TN, -TCN4, -TDN
- D3RF-TP, -TCP4, -TDP
- D3IF-TN, -TCN4, -TP, -TCP4



**Inter-connection type**

- D3RF-TMN, -TMCN4, -TDMN
- D3RF-TSN, -TSCN4, -TDSN
- D3RF-TMP, -TMCP4, -TMPP
- D3RF-TSP, -TSCP4, -TDSP



Photoelectric Sensors

Specialized Photoelectric Sensors

Laser Displacement Sensors

Fiber Amplifiers

D3RF, D3IF

UC1-CL11

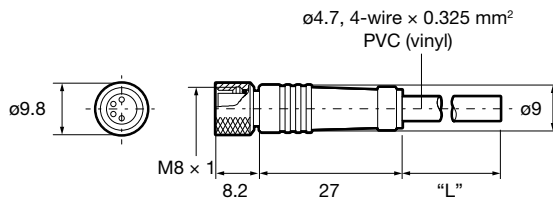
D2RF

BRF, BIF

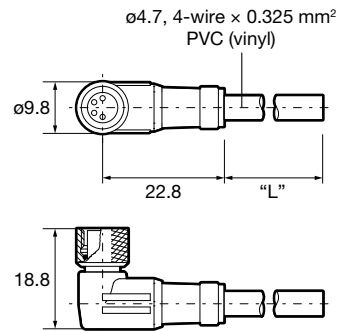
JRF

Connector cable (optional)

■ JCN-S, JCN-5S, JCN-10S



■ JCN-L, JCN-5L, JCN-10L



Photoelectric  
Sensors

Specialized  
Photoelectric  
Sensors

Laser  
Displacement  
Sensors

Fiber  
Amplifiers

D3RF, D3IF

UC1-CL11

D2RF

BRF, BIF

JRF