# VF SERIES

# Terminal Connection Type Multi-voltage Photoelectric Sensor Power Supply Built-in





Easy to use terminal connection type



#### **New convenient construction**

The slanting step-wise terminal enables quick and easy connection.

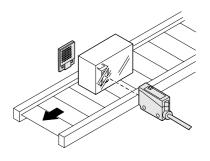


#### Multi-voltage

The VF series can operate at 24 to 240 V AC or 12 to 240 V DC, which makes it suitable for supply voltages all over the world.

Retroreflective sensor with polarizing filters VF-PRM3

VF-PRM3 ensures reliable sensing even with shiny or specular objects traveling in any direction.



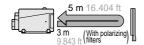
#### Long sensing range

The VF series ensures stable detection with its long sensing range.

#### Thru-beam type



#### Retroreflective type



#### Diffuse reflective type



#### Timer function models

The sensing signal can be easily converted into a signal suitable for your control process. It is also suitable for PLC input.

- Timer duration: 0.1 to 5 sec. (Variable)
- Operation: ON-delay OFF-delay ONE SHOT (Normal)

#### Non-contact output type available

The VF2 series which incorporates a dual circuit transistor output (NPN and PNP) is also available in the same sensor body. It is suited for fast switching sensing, or applications requiring a fast response.

- Output: NPN universal transistor PNP open-collector transistor
- $\bullet$  Power supply: 12 to 24 V DC  $\pm$  10 %

Please refer to p.1118, and contact our office for further details.

5 m 16.404 ft (VF-PRM3: 3 m 9.843 ft)

Reflector

Actual sensing range

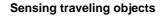
0.1 m 0.328 ft (VF-PRM3: 0.2 m 0.656 ft) Setting range of the reflector

of the sensor

Reflector

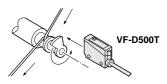
#### **APPLICATIONS**

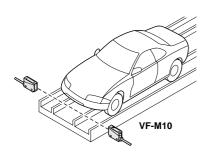
#### Car positioning at parking garage



### Sensing coil wire end

The wire is wound once round a pole having a fin. The sensor detects the rotating fin. By using the OFF-delay timer, an OFF signal can be generated when the wire ends.





#### **ORDER GUIDE**

Туре	Appearance	arance Sensing range		Timer function	Supply voltage	Output
Thru-beam		10 m	VF-M10			Relay contact 1a (Note 2)
mru-beam		32.808 ft	VF-M10T	Incorporated		
Detroroflective		0.1 to 5 m 0.328 to 16.404 ft (Note 1)	VF-RM5			
Retroreflective			VF-RM5T	Incorporated		
With polarizing filters		0.2 to 3 m 0.656 to 9.843 ft (Note 1)	VF-PRM3		24 to 240 V AC ± 10 % or 12 to 240 V DC ± 10 % (Note 2)	
Diffuse reflective	<b>─</b>	500 40.005	VF-D500		(14010-2)	
Diffuse reflective		500 mm 19.685 in	VF-D500T	Incorporated		
Long sensing		<b>1 m</b> 3.281 ft	VF-D1000			
range			VF-D1000T	Incorporated		

Reflector cannot

be placed

in this range

VF-PRM3

- Notes: 1) The sensing range for the retroreflective type sensor is specified for the RF-230 reflector. Further, the sensing range is the possible setting range for the reflector. The sensor can
  - detect an object less than 0.1 m 0.328 ft (VF-PRM3: 0.2 m 0.656 ft) away.

    2) Non-contact output type [NPN universal transistor / PNP open-collector transistor (two outputs), supply voltage 12 to 24 V DC] is available. (Four types: VF2-M10, VF2-RM5, VF2-PRM3, VF2-D500) Refer to p.1118

#### **Accessories**

MS-N70 (Sensor mounting bracket)



Two M5 (length 30 mm 1.181 in) cross-recessed hexagon bolts and two M5 nuts are attached.

• RF-230 (Reflector)



• VF-SKG (Short-circuit metal joint)





#### **OPTIONS**

Designation	Model No.		Description		
	<b>OS-VF-3 × 6</b> / Slit size 3 × 6 mm \	Slit on one side	<ul> <li>Sensing range: 2 m 6.562 ft</li> <li>Min. sensing object: φ20 mm φ0.787 in</li> </ul>		
Slit mask (For thru-beam (type sensor only)	0.118 × 0.236 in	Slit on both sides	Sensing range: 1 m 3.281 ft     Min. sensing object: 3 × 6 mm 0.118 × 0.236 in		
	OS-VF-6 × 12 (Slit size 6 × 12 mm) 0.236 × 0.472 in	Slit on one side	<ul> <li>Sensing range: 4 m 13.123 ft</li> <li>Min. sensing object: φ20 mm φ0.787 in</li> </ul>		
		Slit on both sides	Sensing range: 3 m 9.843 ft     Min. sensing object: 6 X 12 mm 0.236 X 0.472 in		
Reflector (For retroreflective type sensor only)	RF-220	Sensing range: 0.1 to 4 m 0.328 to 13.123 ft (VF-RM5□)			
Reflector	MS-RF22	For <b>RF-220</b>			
mounting bracket	MS-RF23	For <b>RF-230</b>			
Sensor checker (Note)	CHX-SC2	It is useful for beam alignment of thru-beam type sensors. The optimum receiver position is given by indicators, as well as an audio signal.			

Note: Refer to p.414~ for details on the sensor checker CHX-SC2.

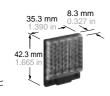
#### Slit mask

- OS-VF-3×6 • OS-VF-6 × 12



### Reflector

• RF-220



#### Reflector mounting bracket

• MS-RF23

• MS-RF22



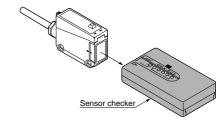




Two M3 (length 8 mm 0.315 in) screws with washers are attached.

### Sensor checker

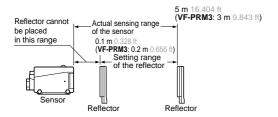
· CHX-SC2



#### **SPECIFICATIONS**

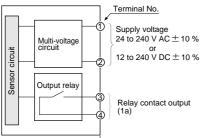
Туре			Thru-beam		Retroreflective			Diffuse reflective				
				With timer   With polarizing filters								
Iter	n	Model No.	VF-M10	VF-M10T	VF-RM5	VF-RM5T	VF-PRM3	VF-D500	VF-D500T	VF-D1000		
Sensing range		10 m 32.808 ft		0.1 to 5m 0.328 to 16.404 ft (Note 1)		0.2 to 3 m 0.656 to 9.843 ft (Note 1)			1 ft (Note 2)			
Sensing object				φ50 mm φ1.969 in or more opaque or translucent		\$50 mm \$1.969 in or more opaque, translucent or specular object (Note 1)	Opaque, translucent or transparent object					
Hysteresis		<del></del>					15 % or less of operation distance					
Supply voltage		24 to 240 V AC ± 10 % or 12 to 240 V DC ± 10 %										
Power consumption		Emitter: 3 VA or less (Average: 1.5 W or less) Receiver: 3 VA or less (Average: 1.5 W or less)  3 VA or less (Average: 1.5 W or less)										
Output		Relay contact 1a  • Switching capacity: 250 V 1A AC (resistive load) 30 V 2A DC (resistive load)  • Electrical life: 500,000 or more switching operations (switching frequency 3,600 operations/hour)  • Mechanical life: 100 million or more switching operations (switching frequency 36,000 operations/hour)										
Output operation					Switchable	either Light-ON	l or Dark-ON					
Response time		20 ms or less										
Operation indicator		Red LED (lights up when the output is ON)										
Sen	sitivity adjuste	er	Continuously variable adjuster							er		
	er function to 5 sec. vari	iable)		Selectable from ON- delay, OFF-delay & ONE SHOT		Selectable from ON- delay, OFF-delay & ONE SHOT			Selectable from ON- delay, OFF-delay & ONE SHOT		Selectable from ON- delay, OFF-delay & ONE SHOT	
	Pollution deg	gree	3 (Industrial environment)									
	Protection		IP66 (IEC)									
nce	Ambient tem	perature	-10 to +60 °C +14 to +140 °F (No dew condensation or icing allowed), Storage: -20 to +70 °C −4 to +158 °F									
Environmental resistance	Ambient hum	nidity	35 to 85 % RH, Storage: 35 to 85 % RH									
alre	Ambient illun	ninance	Sunlight: 11,000 $\ell x$ at the light-receiving face, Incandescent light: 3,500 $\ell x$ at the light-receiving face									
ment	EMC		EN 50081-2, EN 50082-2, EN 61000-6-2									
ironi	Voltage with	standability	1,500 V AC for one min. between the power supply and output terminals, 1,000 V AC for one min. between the relay contact terminals									
Ш	Insulation res	sistance	20 MΩ, or more, with 500 V DC megger between the power supply and output terminals, and between the relay contact terminals									
	Vibration res	istance	10 to 55 Hz frequency, 1.5 mm 0.059 in amplitude in X, Y and Z directions for two hours each									
	Shock resista	ance	100 m/s² acceleration (10 G approx.) in X, Y and Z directions for three times each									
Emi	Emitting element		Infrared LED (modulated) Red LED (modulated)				Red LED (modulated)	Infrared LED (modulated)				
Material		Enclosure: PBT, Lens: Acrylic (front surface of VF-PRM3: Triacetate)										
Connection method		Screw-on terminal connection										
Cable		Suitable for round cable \$\phi 6\$ to \$\phi 10\$ mm \$\phi 0.236\$ to \$\phi 0.394\$ in (Conductor cross section area: 0.25 to 0.75 mm²)										
Cable length		Total length up to 100 m 328.084 ft is possible with 0.3 mm², or more, cabtyre cable (thru-beam type: both emitter and receiver).										
Weight			ter: 75 g approx. 95 g approx.									
Accessories			MS-N70 (Sensor mounting bracket): 1 set, Gland and gland washer: 1 set, Gland packing (large / small 1 pc. each): 1 set VF-SKG (Short-circuit metal joint): 1 pc., RF-230 (Reflector): 1 pc. for the retroreflective type sensor Adjusting screwdriver: 1 pc. for the diffuse reflective type sensor and for sensors with timer functions (suffixed with 'T') (2 sets of sensor mounting bracket, gland, gland washer and gland packing are attached for the thru-beam type sensors.)									

Notes: 1) The sensing range and the sensing object for the retroreflective type sensor are specified for the **RF-230** reflector. Further, the sensing range is the possible setting range for the reflector. The sensor can detect an object less than 0.1 m 0.328 ft (VF-PRM3: 0.2 m 0.656 ft) away.



- 2) The sensing range of the diffuse reflective type sensor is specified for white non-glossy paper (200  $\times$  200 mm  $7.874 \times 7.874$  in) as the object.
- 3) If slit masks (optional) are fitted, even an object of  $3 \times 6$  mm  $0.118 \times 0.236$  in can be detected.

#### I/O CIRCUIT DIAGRAM



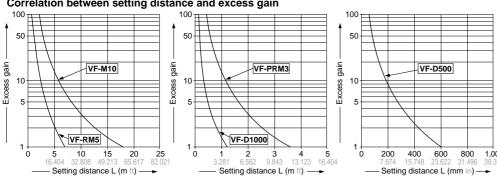
Note: The emitter of the thru-beam type sensor has only two terminals for power supply (① and ②).

### SENSING CHARACTERISTICS (TYPICAL)

#### All models

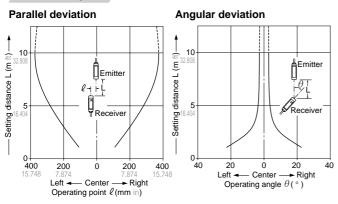
Internal circuit -

#### Correlation between setting distance and excess gain

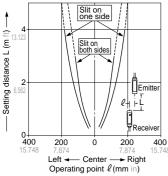




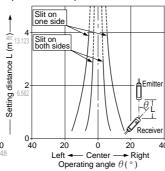
#### Thru-beam type



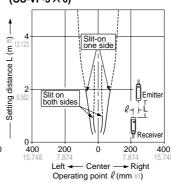
# Parallel deviation with slit masks (OS-VF-6 × 12)



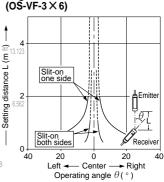
## Angular deviation with slit masks (OS-VF-6 $\times$ 12)



# Parallel deviation with slit masks (OS-VF-3 × 6)



Angular deviation with slit masks (OS-VF-3  $\times$  6)



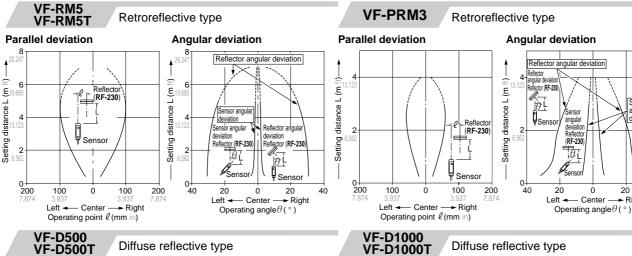
Sensor angular deviation

0

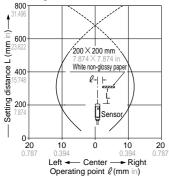
20

Right

#### SENSING CHARACTERISTICS (TYPICAL)

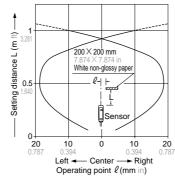


#### Sensing field



Diffuse reflective type

#### Sensing field



#### PRECAUTIONS FOR PROPER USE

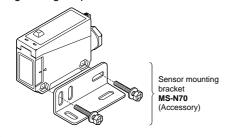
Refer to p.1135~ for general precautions.



This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

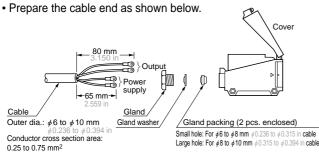
#### Mounting

The tightening torque should be 0.78 N·m or less.

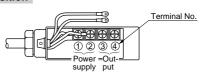


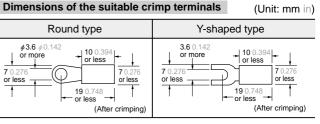
#### Wiring

• Cable must be circular and  $\phi$ 6 to  $\phi$ 10 mm  $\phi$ 0.236 to  $\phi$ 0.394 in in diameter. If the cable has a diameter other than the specified or is distorted, waterproofness cannot be maintained.



#### Terminal position





Note: Use crimp terminals with insulating sleeves. Recommended crimp terminal: Nominal size 1.25  $\times$  3.5 0.049  $\times$  0.138

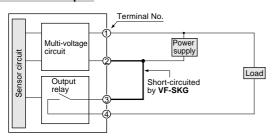
#### PRECAUTIONS FOR PROPER USE

#### Refer to p.1135~ for general precautions.

#### Mounting the short-circuit metal joint (VF-SKG)

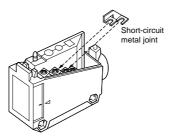
· If the sensor and the load are supplied power from the same power supply, the number of wires can be reduced by one by using the enclosed short-circuit metal joint.

#### Connection example



#### Mounting

· Loosen the screws on terminals 2 and 3. Mount the short-circuit metal joint VF-SKG on the terminals as shown on the right.



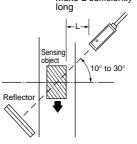
#### Retroreflective type sensor (VF-RM5 and VF-RM5T)

· Please take care of the following points when detecting materials having a gloss. Make L sufficiently

1) Make L, shown in the diagram, sufficiently long.

2 Install at an angle of 10 to 30 degrees to the sensing obiect.

**%VF-PRM3** does not need the above adjustment.



#### Retroreflective type sensor with polarizing filters (VF-PRM3)

 If a shiny object is covered or wrapped with a transparent film, such as those described below, the retroreflective type sensor with polarizing filters may not be able to detect it.

In that case, follow the steps given below.

#### Example of sensing objects

- · Can wrapped by clear film
- · Aluminum sheet covered by plastic film
- · Gold or silver color (specular) label or wrapping paper

- Tilt the sensor with respect to the sensing object while fitting.
- · Reduce the sensitivity.
- Increase the distance between the sensor and the sensing object.

#### Timer functions and output operation

• The timer incorporated models have three types of convenient timer functions.

#### ON-delay (OND)

<Function>: Neglects short output signals.

<Application>: As only long signals are extracted, this function is useful for detecting if a line is clogged, or for sensing only objects taking a long time to travel.

#### OFF-delay (OFD)

<Function>: Extends the output signal for a fixed period of

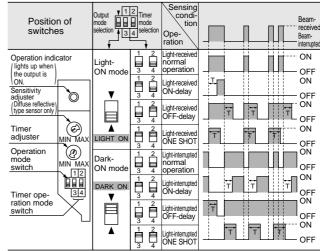
<Application>: This function is useful if the output signal is so short that the connected device cannot respond.

#### ONE SHOT (OSD)

<Function>: Outputs a fixed width signal upon sensing. <Application>: This function is useful when the input specifications of the connected device require a signal of fixed width. Of course, it is also useful for extending a short width signal to a desired width.

Various other applications are possible.

#### Selection switch and timer operation

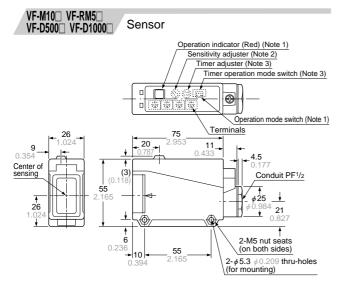


Timer period: T = 0.1 to 5 sec. (variable)

#### Others

· Do not use during the initial transient time (200 ms) after the power supply is switched on.

### **DIMENSIONS (Unit: mm in)**



Notes: 1) All units, except emitters, are incorporated with operation indicators. 2) Only the diffuse reflective type sensor is incorporated with the sensitivity adjuster.

3) Only the timer incorporated type sensors have the timer adjuster and timer operation mode switch.

Reflector (Accessory for the retroreflective type sensor)

**RF-220** 

VF-PRM3

Center of sensing

₹ 26

Sensor

20\_

(3)

**† 6** 36

10

55

Operation indicator (Red)

0

Terminals

11 0.433

Operation mode switch

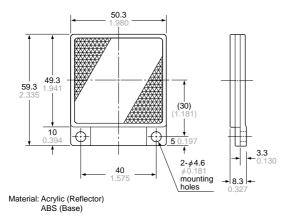
Conduit PF1/2

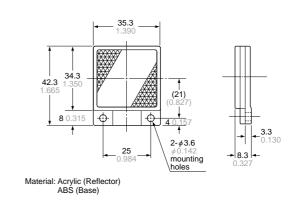
34 **21** 0.82

2-M5 nut seats (on both sides)

Reflector (Optional)

55

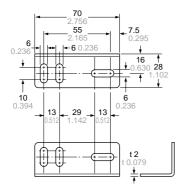




MS-N70

**RF-230** 

Sensor mounting bracket (Accessory)

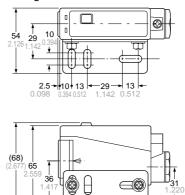


Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)

Two M5 (length 30 mm 1.181 in) cross-recessed hexagon bolts (with spring washers and plain washers) and two M5 nuts are attached.

#### **Assembly dimensions**

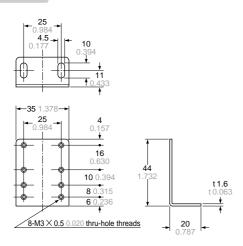
Mounting drawing with VF-PRM3



### **DIMENSIONS (Unit: mm in)**

#### MS-RF22

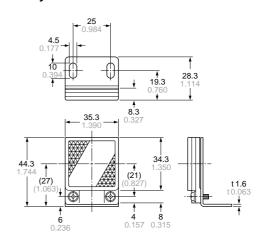
Reflector mounting bracket for RF-220 (Optional)



Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)

Two M3 (length 8 mm 0.315 in) screws with washers are attached.

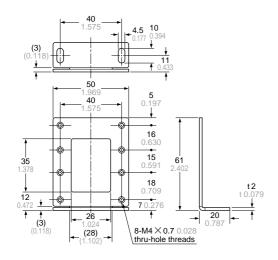
#### **Assembly dimensions**



MS-RF23

Reflector mounting bracket for RF-230 (Optional)

#### **Assembly dimensions**



Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)

Two M4 (length 10 mm 0.394 in) screws with washers are attached.

