

VF

SERIES

# Terminal Connection Type Multi-voltage Photoelectric Sensor

MS-AJ

Sensor Mounting Stand

PM

Micro

PM2

NX5

Multi-voltage Type

VF

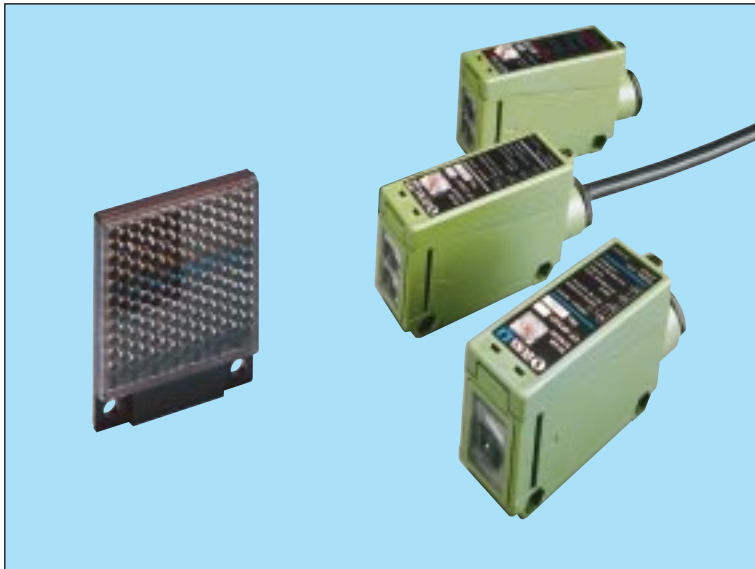
SU-7/SH

Amplifier-separated Type

SS-A5

CHX-SC2

Sensor Checker



## Easy to Use Terminal Connection Type

Conforming to Low Voltage and EMC Directives

### New Convenient Construction

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

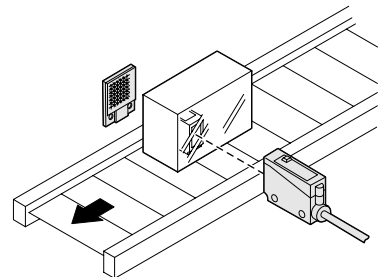


### Multi-voltage

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

### Retroreflective Sensor with Polarizing Filters VF-PRM3

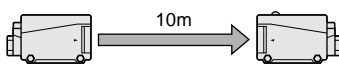
VF-PRM3 ensures reliable sensing even with shiny or specular objects traveling in any direction.



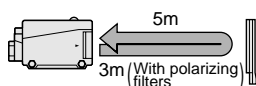
### Long Sensing Range

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

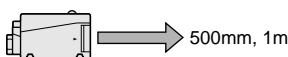
#### Thru-beam type



#### 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

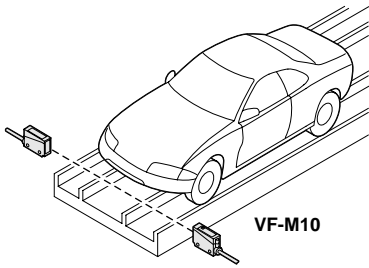
The VF2 series which incorporates a dual circuit transistor output (NPN and PNP) is also available in the same sensor body. It is suited for fast switching sensing, or applications requiring a fast response.

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

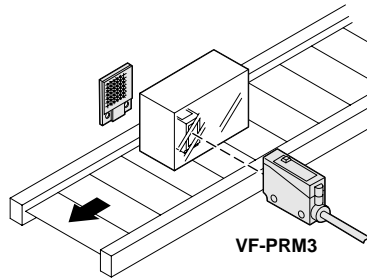
Please refer to P.798, and contact our office for further details.

## APPLICATIONS

### Car positioning at parking garage

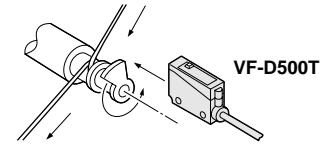


### Sensing traveling objects



### Sensing coil wire end

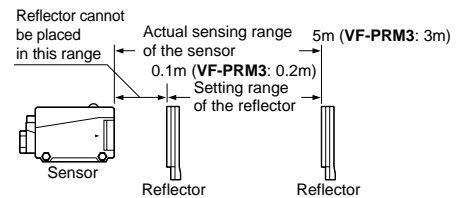
The wire is wound once round a pole having a fin. The sensor detects the rotating fin. By using the OFF-delay timer, an OFF signal can be generated when the wire ends.



## ORDER GUIDE

Type	Appearance	Sensing range	Model No.	Timer function	Supply voltage	Output
Thru-beam			VF-M10	—	24 to 240V AC ± 10% or 12 to 240V DC ± 10% (Note 2)	Relay contact 1a (Note 2)
			VF-M10T	Incorporated		
Retroreflective			VF-RM5	—		
			VF-RM5T	Incorporated		
With polarizing filters		VF-PRM3	—			
Diffuse reflective			VF-D500	—		
			VF-D500T	Incorporated		
			VF-D1000	—		
Long sensing range		VF-D1000T	Incorporated			

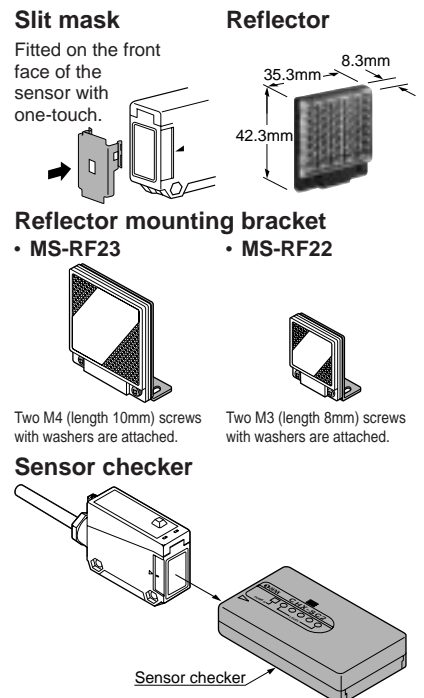
Notes: 1) The sensing range for the retroreflective type sensor is specified for the RF-230 reflector. Further, the sensing range is the possible setting range for the reflector. The sensor can detect an object less than 0.1m (VF-PRM3: 0.2m) away.  
2) Non-contact output type [NPN universal transistor/PNP open-collector transistor (two outputs), supply voltage 12 to 24V DC] is available. (Four types: VF2-M10, VF2-RM5, VF2-PRM3, VF2-D500) Refer to P.798.



## OPTIONS

Designation	Model No.	Description
Slit mask (For thru-beam type sensor only)	OS-VF-3 × 6 (Slit size 3 × 6mm)	Slit on one side • Sensing range: 2m • Min. sensing object: φ20mm
		Slit on both sides • Sensing range: 1m • Min. sensing object: 3 × 6mm
	OS-VF-6 × 12 (Slit size 6 × 12mm)	Slit on one side • Sensing range: 4m • Min. sensing object: φ20mm
		Slit on both sides • Sensing range: 3m • Min. sensing object: 6 × 12mm
Reflector (For retroreflective type sensor only)	RF-220	• Sensing range: 0.1 to 4m (VF-RM5□) 0.2 to 2m (VF-PRM3) • Sensing object: φ35mm, or more, opaque object
Reflector mounting bracket	MS-RF22	For RF-220
	MS-RF23	For RF-230
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.378~ for details on the sensor checker CHX-SC2.



Sensor Mounting Stand  
MS-AJ

Micro  
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Multi-voltage Type  
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Amplifier-separated Type  
SU-7/SH

Amplifier-separated Type  
SS-A5

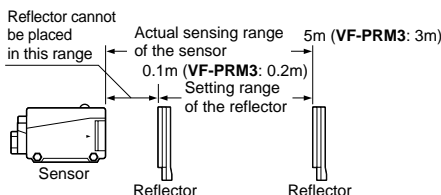
Sensor Checker  
CHX-SC2

## SPECIFICATIONS

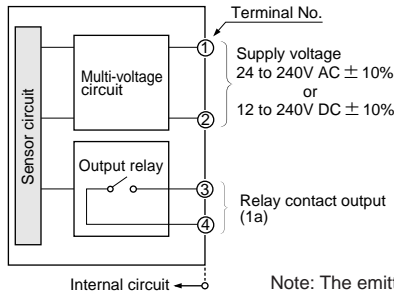
Item	Type Model No.	Thru-beam		Retroreflective			Diffuse reflective				
		VF-M10	VF-M10T	VF-RM5	VF-RM5T	VF-PRM3	VF-D500	VF-D500T	VF-D1000	VF-D1000T	
Sensing range		10m		0.1 to 5m (Note 1)		0.2 to 3m (Note 1)	500mm (Note 2)		1m (Note 2)		
Sensing object		φ20mm or more opaque object (Note 3)		φ50mm or more opaque or translucent object (Note 1)		φ50mm or more opaque, translucent or specular object (Note 1)	Opaque, translucent or transparent object				
Hysteresis								15% or less of operation distance			
Supply voltage		24 to 240V AC ± 10% or 12 to 240V DC ± 10%									
Power consumption		Emitter: 3VA or less (Average: 1.5W or less) Receiver: 3VA or less (Average: 1.5W or less)		3VA or less (Average: 1.5W or less)							
Output		Relay contact 1a • Switching capacity: 250V 1A AC (resistive load) 30V 2A DC (resistive load) • Electrical life: 100,000 or more operations (at rated AC load) 500,000 or more operations (at rated DC load) • Mechanical life: 100,000,000 or more operations									
	Utilization category	DC-12 or DC-13									
	Output operation	Switchable either Light-ON or Dark-ON									
Response time		20ms or less									
Operation indicator		Red LED (lights up when the output is ON)									
Sensitivity adjuster								Continuously variable adjuster			
Timer function (0.1 to 5 sec. variable)		—	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	—	
Environmental resistance	Pollution degree	3 (Industrial environment)									
	Protection	IP66 (IEC)									
	Ambient temperature	- 10 to + 60°C (No dew condensation or icing allowed), Storage: - 20 to + 70°C									
	Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH									
	Ambient illuminance	Sunlight: 11,000 lx at the light-receiving face, Incandescent light: 3,500 lx at the light-receiving face									
	EMC	Emission: EN50081-2, Immunity: EN50082-2									
	Voltage withstandability	1,500V AC for one min. between the power supply and output terminals, 1,000V AC for one min. between the relay contact terminals									
	Insulation resistance	20MΩ, or more, with 500V DC megger between the power supply and output terminals, and between the relay contact terminals									
	Vibration resistance	10 to 55Hz frequency, 1.5mm amplitude in X, Y and Z directions for two hours each									
	Shock resistance	100m/s <sup>2</sup> acceleration (10G approx.) in X, Y and Z directions for three times each									
Emitting element		Infrared 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 φ6 to φ10mm (Conductor cross section area: 0.25 to 0.75mm <sup>2</sup> )									
Cable length		Total length up to 100m is possible with 0.3mm <sup>2</sup> , or more, cable (thru-beam type: both emitter and receiver).									
Weight		Emitter: 75g approx. Receiver: 95g approx.			95g approx.						
Accessories		MS-N70 (Sensor mounting bracket): 1 set, Gland and gland washer: 1 set, Gland packing (large/small 1 No. each): 1 set VF-SKG (Short-circuit metal joint): 1 No., RF-230 (Reflector): 1 No. for the retroreflective type sensor Adjusting screwdriver: 1 No. 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 0.1m (VF-PRM3: 0.2m) away.

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



## I/O CIRCUIT DIAGRAM

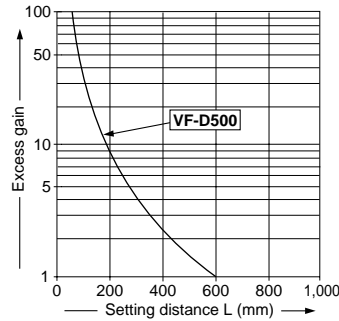
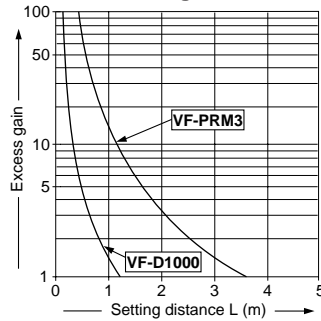
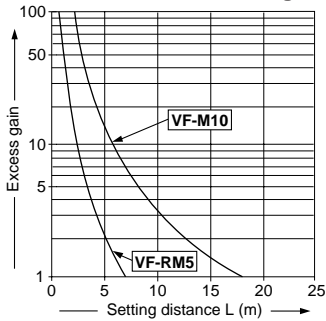


Note: The emitter of the thru-beam type sensor has only two terminals for power supply (① and ②).

## SENSING CHARACTERISTICS (TYPICAL)

### All models

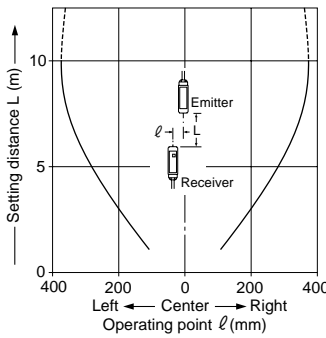
#### Correlation between setting distance and excess gain



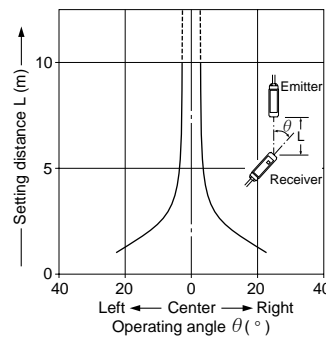
### VF-M10 VF-M10T

#### Thru-beam type

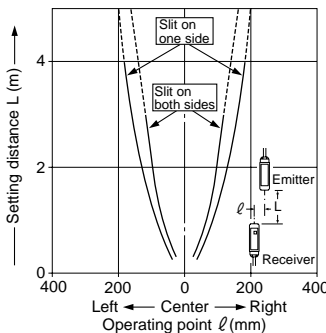
#### Parallel deviation



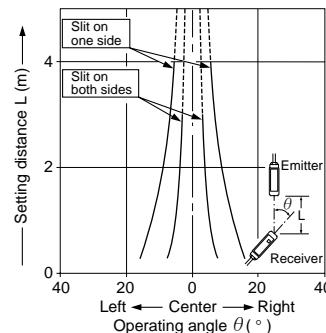
#### Angular deviation



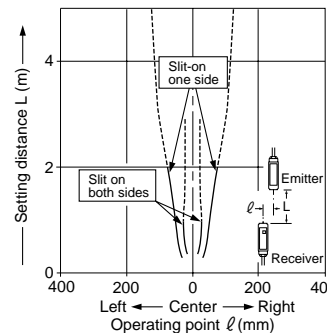
#### Parallel deviation with slit masks (OS-VF-6 X 12)



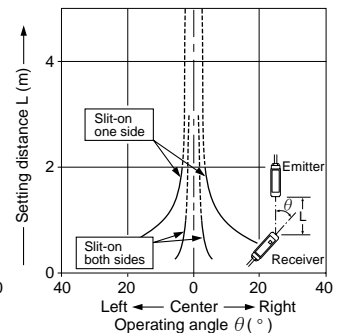
#### Angular deviation with slit masks (OS-VF-6 X 12)



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



#### Angular deviation with slit masks (OS-VF-3 X 6)



Sensor Mounting Stand  
MS-AJ

Micro  
PM

Micro  
PM2

Multi-voltage Type  
NX5

Multi-voltage Type  
VF

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Multi-voltage Type  
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Amplifier-separated Type  
SU-7/SH

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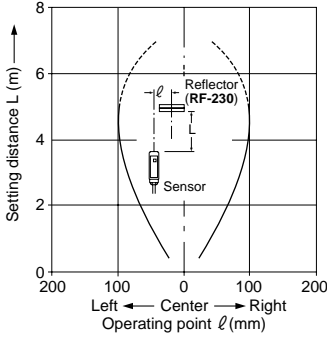
Amplifier-separated Type  
SU-7/SH

## SENSING CHARACTERISTICS (TYPICAL)

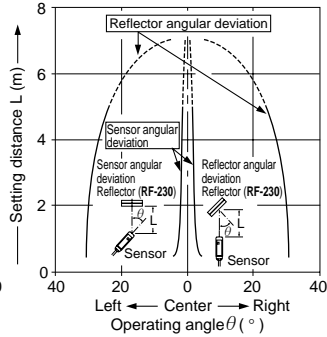
**VF-RM5  
VF-RM5T**

Retroreflective type

**Parallel deviation**



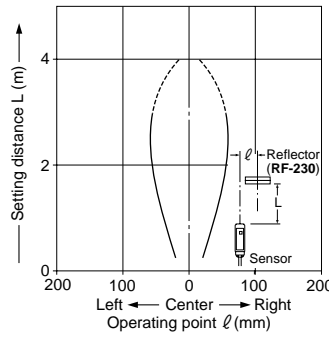
**Angular deviation**



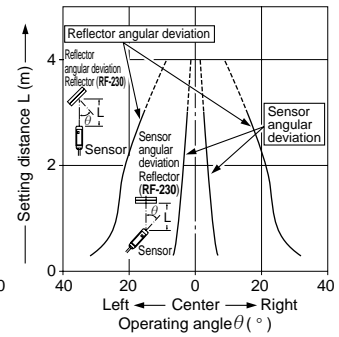
**VF-PRM3**

Retroreflective type

**Parallel deviation**



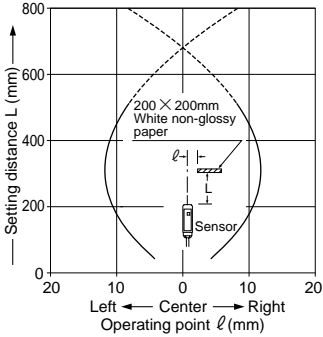
**Angular deviation**



**VF-D500  
VF-D500T**

Diffuse reflective type

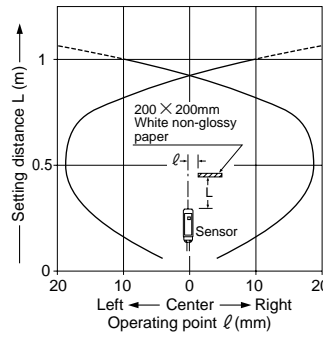
**Sensing field**



**VF-D1000  
VF-D1000T**

Diffuse reflective type

**Sensing field**



## PRECAUTIONS FOR PROPER USE

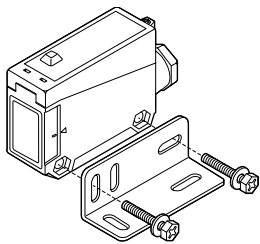
Refer to P.820~ for general precautions.



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

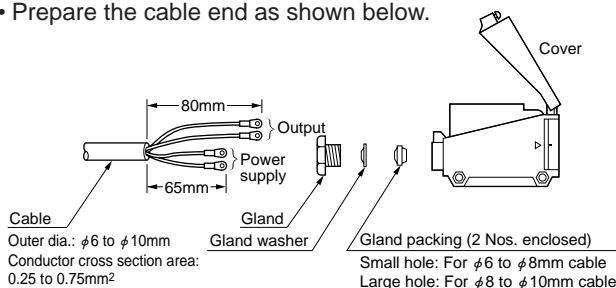
- The tightening torque should be 0.78N·m or less.



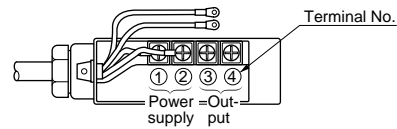
Sensor mounting bracket  
**MS-N70**  
(Accessory)

### Wiring

- Cable must be circular and  $\phi 6$  to  $\phi 10$ mm in diameter. If the cable has a diameter other than the specified or is distorted, waterproofness cannot be maintained.
- Prepare the cable end as shown below.



### Terminal position



### Dimensions of the suitable crimp terminals

(Unit: mm)

Round type	Y-shaped type

Note: Use crimp terminals with insulating sleeves.  
Recommended crimp terminal: Nominal size 1.25 × 3.5

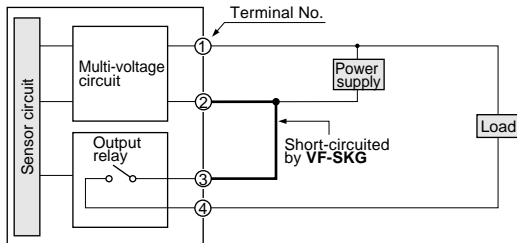
## PRECAUTIONS FOR PROPER USE

Refer to P.820~ for general precautions.

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

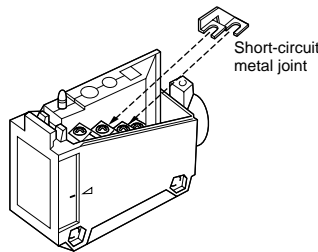
- If the sensor and the load are supplied power from the same power supply, the number of wires can be reduced by one by using the enclosed short-circuit metal joint.

#### Connection example



#### Mounting

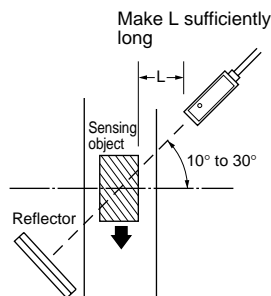
- Loosen the screws on terminals ② and ③. Mount the short-circuit metal joint **VF-SKG** on the terminals as shown on the right.



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

- Please take care of the following points when detecting materials having a gloss.

- ① Make L, shown in the diagram, sufficiently long.
- ② Install at an angle of 10 to 30 degrees to the sensing object.



- ※ **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 (glossy) label or wrapping paper

#### Steps

- 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 time.

<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

Position of switches	Output mode selection		Timer mode selection		Sensing condition	Operation
	1	2	3	4		
Operation indicator / lights up when the output is ON	Light-ON mode	Dark-ON mode	Light-ON mode	Dark-ON mode	Beam-received / Beam-interrupted	ON / OFF
Sensitivity adjuster (Diffuse reflective type sensor only)	Light-ON mode	Dark-ON mode	Light-ON mode	Dark-ON mode	Beam-received / Beam-interrupted	ON / OFF
Timer adjuster	Light-ON mode	Dark-ON mode	Light-ON mode	Dark-ON mode	Beam-received / Beam-interrupted	ON / OFF
Operation mode switch	Light-ON mode	Dark-ON mode	Light-ON mode	Dark-ON mode	Beam-received / Beam-interrupted	ON / OFF
Timer operation mode switch	Light-ON mode	Dark-ON mode	Light-ON mode	Dark-ON mode	Beam-received / Beam-interrupted	ON / OFF

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

#### Others

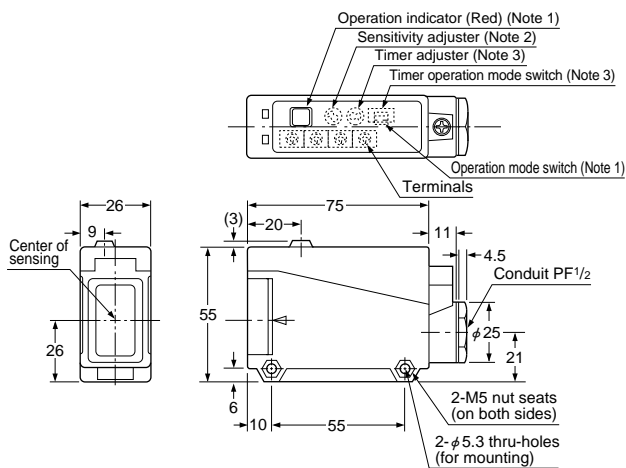
- Do not use during the initial transient time (200ms) after the power supply is switched on.



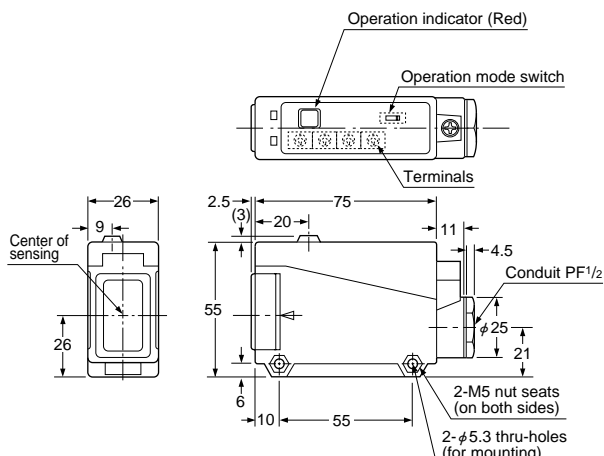
## DIMENSIONS (Unit: mm)

VF-M10 □ VF-RM5 □  
VF-D500 □ VF-D1000 □

Sensor

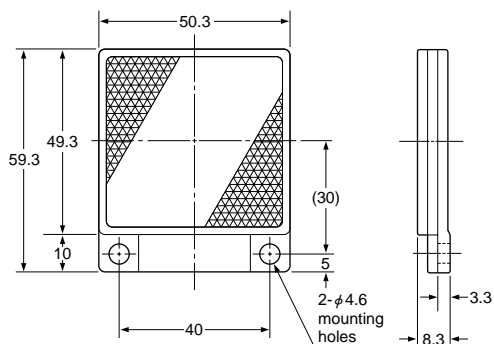


VF-PRM3 Sensor



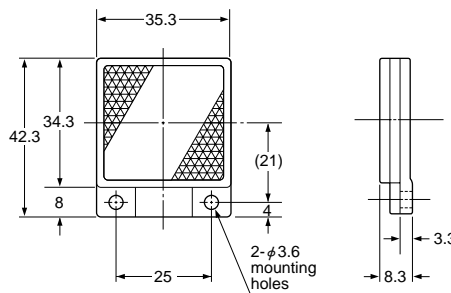
Notes: 1) All units, except emitters, are incorporated with operation indicators.  
2) Only the diffuse reflective type sensor is incorporated with the sensitivity adjuster.  
3) Only the timer incorporated type sensors have the timer adjuster.

RF-230 Reflector (Accessory for the retroreflective type sensor)



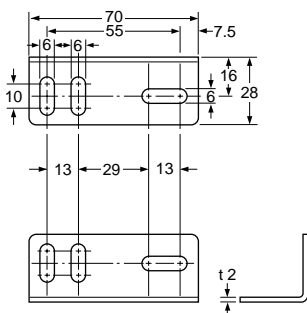
Material: Acrylic (Reflector)  
ABS (Base)

RF-220 Reflector (Optional)



Material: Acrylic (Reflector)  
ABS (Base)

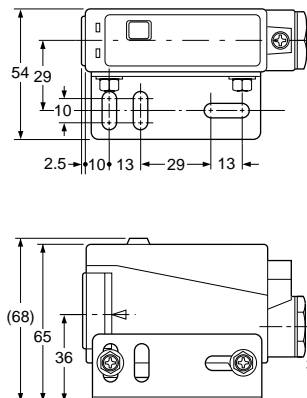
MS-N70 Sensor mounting bracket (Accessory)



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

Two M5 cross-recessed hexagon bolts  
(with spring washers and plain washers)  
and two M5 nuts are attached.

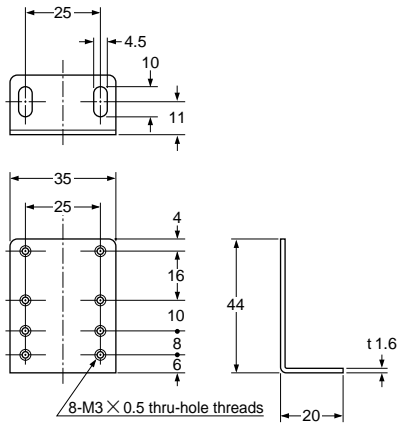
Assembly dimensions  
Mounting drawing with VF-PRM3



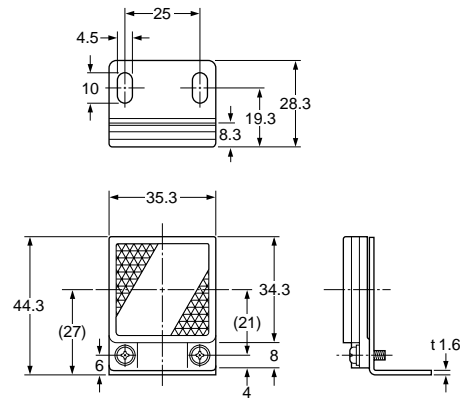
## DIMENSIONS (Unit: mm)

### MS-RF22 Reflector mounting bracket for RF-220 (Optional)

#### Assembly dimensions

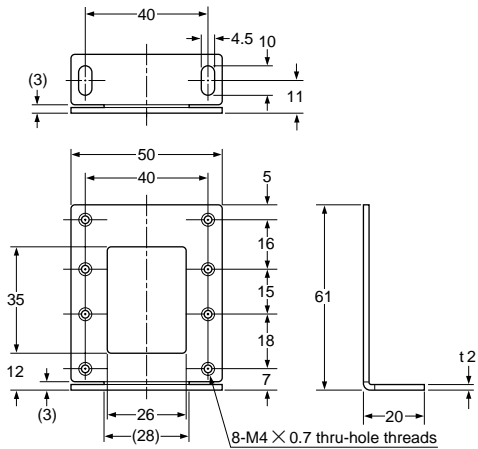


Material: Cold rolled carbon steel (SPCC)  
(Uni-chrome plated)  
Two M3 (length 8mm) screws with washers are attached.

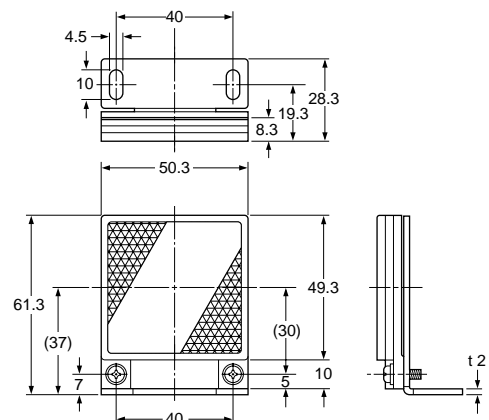


### MS-RF23 Reflector mounting bracket for RF-230 (Optional)

#### Assembly dimensions



Material: Cold rolled carbon steel (SPCC)  
(Uni-chrome plated)  
Two M3 (length 10mm) screws with washers are attached.



Sensor Mounting Stand  
MS-AJ

Micro  
PM  
PM2

Multi-voltage Type  
NX5  
VF

Amplifier-separated Type  
SU-7/SH

SS-A5

Sensor Checker  
CHX-SC2