

# SU-7 SERIES SH SERIES

## Amplifier-separated Slim Body Automatic Sensitivity Setting Photoelectric Sensor

MS-AJ

Sensor Mounting Stand

PM

Micro

PM2

NX5

Multi-voltage Type

VF

Multi-voltage Type

SU-7/SH

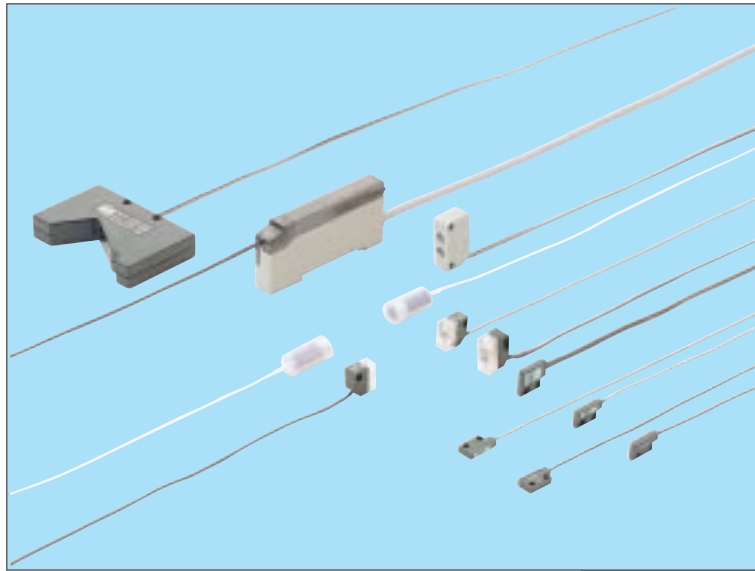
Amplifier-separated Type

SS-A5

Amplifier-separated Type

CHX-SC2

Sensor Checker



Simple and Suitable  
for Compact Design

**Attention !!!**

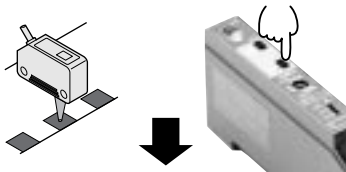
**Non conforme**

**CEM**

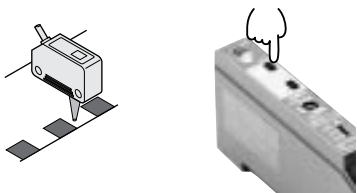
### Simple Automatic Sensitivity Setting

Anyone can achieve the optimum sensitivity by just pressing two buttons.

- Aligning with the mark to be detected, press the 'ON' button.



- Aligning with the background, press the 'OFF' button.



### Thickness: 10mm

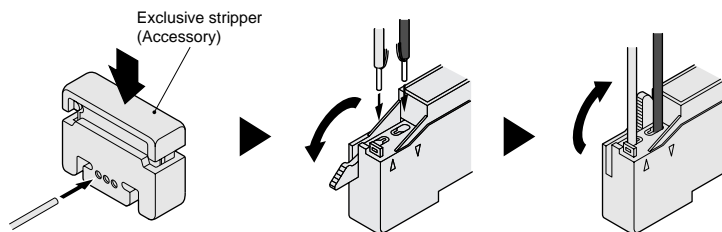
Installation space can be greatly reduced as the SU-7 amplifier is just 10mm thick.



### Quick Wire Connection

A snap of the lever secures the connection of the sensor head cables on the SU-7 amplifier. It is no longer required to strip the wire insulation. Further, the exclusive stripper (accessory) can be used to easily peel off the sensor cable outer sheath.

- Strip the cable sheaths with the exclusive stripper.
- Insert the wires into the
- Flip up and lock the lever.



Caution: The outer fluorine sheath of the chemical resistant type sensor head, SH-61R, cannot be cut off with the dedicated stripper.

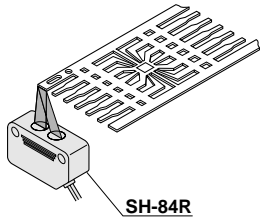
### Nine Advanced Functions for Versatile Sensing

- Limit sensitivity setting** All models  
Sensitivity for detection of minute differences can be set by the press of one button without an object being present.
- Sensitivity shift** All models  
The set threshold level can be shifted from the center towards either ON or OFF level.
- Remote sensitivity selection** SU-79  
The amplifier stores four channels of sensitivities. They can be selected by the remote inputs.
- Remote sensitivity setting** SU-77  
The sensitivity can be adjusted from a remote place.
- External synchronization** SU-75  
The timing for sensing can be specified by an external input.
- Test input** SU-75  
Convenient for start-up inspection.
- Sensitivity margin indication** All models  
The number of blinks of the stability indicator indicates the degree of sensitivity margin.
- ON-delay/OFF-delay timer** SU-7 SU-77 SU-79 SU-7J  
The timer can be selected for either ON or OFF delay of 0 to 5 sec.
- Interference prevention** All models  
Two sensor heads can be mounted closely.

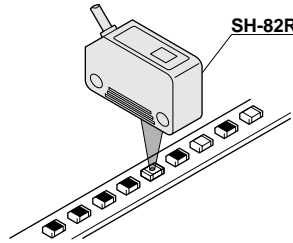
Refer to 'PRECAUTIONS FOR PROPER USE' for further details.

## APPLICATIONS

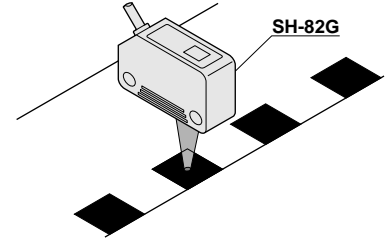
### Determining position of lead frame



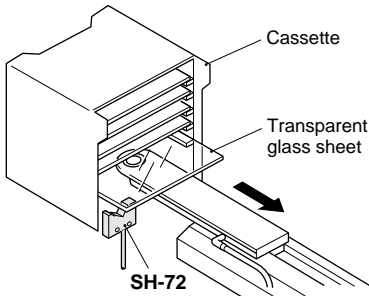
### Identifying top face from bottom face of chip components



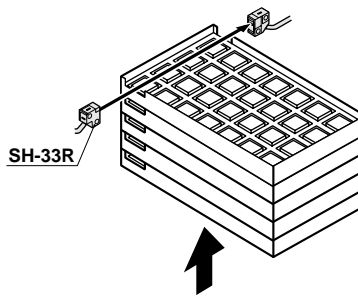
### Detecting red mark on white paper



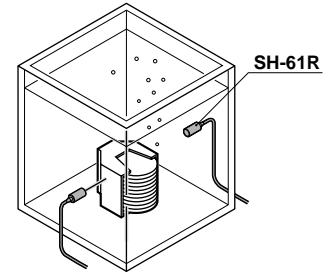
### Detecting transparent glass sheets in cassette



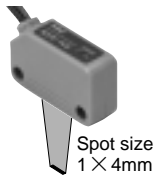
### Detecting IC height



### Detecting wafer cassette in quartz tank containing cleaning liquid

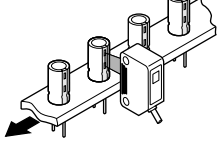


### Line-focus Type/SH-84R



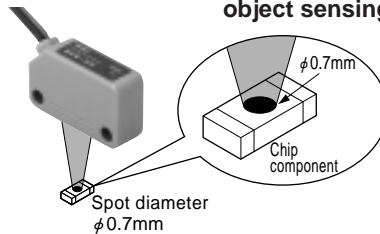
- Suitable for detecting printed characters  
It can be used to detect printed characters because of its line shaped projected area of 1 × 4mm.

(e.g.) Detecting polarity marks on capacitors



- **Strong against position deviation**  
Since it makes a judgment based upon the total light incident on the sensing area, it is not easily affected by a deviation in sensing object position.

### Pinpoint Type with Red LED Beam/SH-82R



- Suitable for tiny object sensing

- **Spot diameter:  $\phi 0.7\text{mm}$**   
Top/bottom face of a chip component can be easily discriminated.

### Pinpoint Type with Green LED Beam/SH-82G



- **Red/white color discrimination**  
Discrimination between red/white, red/yellow or red/orange, which is difficult with the red LED type, is easy with SH-82G.

### Chemical Resistant Type/SH-61R

- **Strong against chemicals**  
Since the sensor heads and the attached cables are covered by fluorine resin, SH-61R can be used in a harsh chemical environment. Moreover, it has a long sensing range of 2.5m.

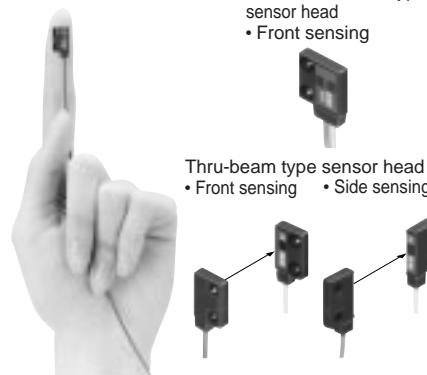
### Glass Sheet Detection Type/SH-72



- **Reliable glass sheet detection**  
Its unique optical system enables detection of transparent glass sheet, as well as, specular film deposited glass sheet at the same distance.
- **No dead zone**
- **Repeatability: 0.03mm**
- **Not affected by background**

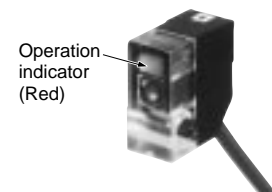
### Ultra-slim Type/SH-2□

- **Compact size: 0.3cm<sup>3</sup> Thickness: 3mm**
- **Versatile mounting**  
Diffuse reflective type sensor head  
• Front sensing



### Ultra-small Type/SH-3□

- **Sensor head with indicator**  
An operation indicator, which enables an easy check of the operation at site, has been incorporated.



- **2m long sensing range with red LED beam (SH-33R)**  
Visible red LED beam makes alignment easy.

Sensor Mounting Stand  
MS-AJ

PM

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Sensor Checker  
CHX-SC2













# SU-7/SH

**AUDIN**


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## ORDER GUIDE

### Sensor heads

Type	Appearance	Sensing range	Model No.	Emitting element	Operation indicator
Ultra-slim type	Thru-beam Front sensing		<b>SH-21</b>	Infrared LED	—
	Side sensing		<b>SH-21E</b>		
	Diffuse reflective Front sensing		50mm	<b>SH-22</b>	
Ultra-small type	Thru-beam		<b>SH-31R</b>	Red LED	Incorporated
			<b>SH-31G</b>	Green LED	
			<b>SH-33R</b>	Red LED	
	Diffuse reflective		100mm	<b>SH-32R</b>	
Chemical resistant type	Thru-beam		<b>SH-61R</b>	Red LED	Incorporated
	Convergent reflective (Using optional mounting bracket MS-SH6-2)				
Mark sensor	Pinpoint		10 to 14mm (Convergent point: 12mm) (Spot diameter: φ0.7mm)	<b>SH-82R</b>	Red LED
	Line-focus		10 to 14mm (Convergent point: 12mm) (Spot diameter: φ1mm)	<b>SH-82G</b>	Green LED
			17 to 23mm (Convergent point: 20mm) (Spot size: 1 × 4mm)	<b>SH-84R</b>	Red LED
Glass sheet detection sensor		0.5 to 7.5mm (with transparent glass sheet)	<b>SH-72</b>	Infrared LED	—

### Amplifiers

Type	Appearance	Model No.	Functions (●: Incorporated)									
			Automatic sensitivity setting	Sensitivity shift	Limit sensitivity setting	Remote sensitivity setting	Remote sensitivity selection	Sensitivity margin indication	External synchronization	Test input	Timer	Interference prevention
NPN output type		<b>SU-7</b>	●	●	●	—	—	●	—	—	●	●
		<b>SU-75</b>	●	●	●	—	—	●	●	●	—	●
		<b>SU-77</b>	●	●	●	●	—	●	—	—	●	●
		<b>SU-79</b>	●	●	●	—	●	●	—	—	●	●
PNP output type	Standard type	<b>SU-7P</b>	●	●	●	—	—	●	—	—	●	●

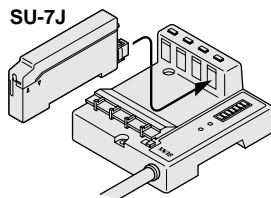
## ORDER GUIDE

### Plug-in connector type

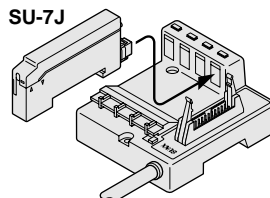
The NPN output type is also available as an intergrated plug-in connector type.

Model No.: **SU-7J**

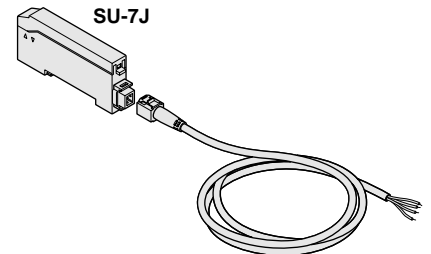
It is usable with the sensor & wire-saving link system **S-LINK**, sensor block for simple wiring **SL-BMW** or **SL-BW**, or with connector attached cable **CN-54-C2** or **CN-54-C5**.



Sensor & wire-saving link system **S-LINK**  
(Refer to P.26~ for details.)



Sensor block for simple wiring **SL-BMW, SL-BW**  
(Refer to P.54~ for details.)



Connector attached cable  
**CN-54-C2** (2m long)  
**CN-54-C5** (5m long)

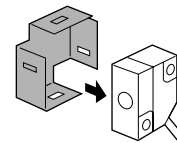
## OPTIONS

Designation	Model No.	Description																															
Slit mask (For SH-31R, SH-31G and SH-33R only)	<b>OS-SS3</b>	This is a convenient slit mask having four types of slits.																															
		<table border="1"> <thead> <tr> <th rowspan="2">Slit size</th> <th rowspan="2">Fitting</th> <th colspan="3">Sensing range</th> <th rowspan="2">Min. sensing object</th> </tr> <tr> <th>SH-31R</th> <th>SH-31G</th> <th>SH-33R</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0.5 × 3mm</td> <td>One side</td> <td>500mm</td> <td>50mm</td> <td>750mm</td> <td rowspan="2">φ3mm</td> </tr> <tr> <td>Both sides</td> <td>250mm</td> <td>25mm</td> <td>400mm</td> <td>0.5 × 3mm</td> </tr> <tr> <td rowspan="2">1 × 3mm</td> <td>One side</td> <td>700mm</td> <td>70mm</td> <td>1,000mm</td> <td rowspan="2">φ3mm</td> </tr> <tr> <td>Both sides</td> <td>500mm</td> <td>50mm</td> <td>750mm</td> <td>1 × 3mm</td> </tr> </tbody> </table>	Slit size	Fitting	Sensing range			Min. sensing object	SH-31R	SH-31G	SH-33R	0.5 × 3mm	One side	500mm	50mm	750mm	φ3mm	Both sides	250mm	25mm	400mm	0.5 × 3mm	1 × 3mm	One side	700mm	70mm	1,000mm	φ3mm	Both sides	500mm	50mm	750mm	1 × 3mm
		Slit size			Fitting	Sensing range			Min. sensing object																								
			SH-31R	SH-31G		SH-33R																											
0.5 × 3mm	One side	500mm	50mm	750mm	φ3mm																												
	Both sides	250mm	25mm	400mm		0.5 × 3mm																											
1 × 3mm	One side	700mm	70mm	1,000mm	φ3mm																												
	Both sides	500mm	50mm	750mm		1 × 3mm																											
Sensor head mounting bracket (For the ultra-small type only)	<b>MS-SS3-1</b>	Mounting bracket for the ultra-small sensor head (The thru-beam type sensor head needs two brackets)																															
Sensor head mounting bracket (For the mark-sensor only)	<b>MS-DS-1</b>	Mounting bracket for the mark sensor head																															
Sensor head mounting bracket (For SH-61R only)	<b>MS-SH6-2</b>	The emitter and the receiver are fixed together at an angle for use as a convergent reflective type sensor.																															
Sensor checker (Note)	<b>CHX-SC2</b>	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 of the sensor checker **CHX-SC2**.

### Slit mask

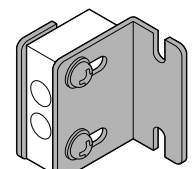
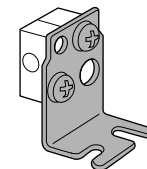
The sensor head and the slit mask are mounted together.



### Sensor head mounting bracket

• **MS-SS3-1**

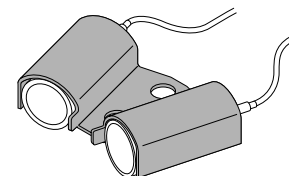
• **MS-DS-1**



Two M3 (length 12mm) screws with washers are attached.

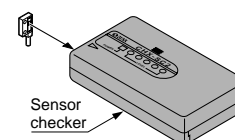
Two M3 (length 14mm) screws with washers are attached.

### • **MS-SH6-2**



No screw is attached.

### Sensor checker



Sensor Mounting Stand  
**MS-AJ**

Micro  
**PM**

Micro  
**PM2**

Multi-voltage Type  
**NX5**

Multi-voltage Type  
**VF**

Amplifier-separated Type  
**SU-7/SH**

Amplifier-separated Type  
**SS-A5**

Sensor Checker  
**CHX-SC2**

# SU-7/SH

## SPECIFICATIONS

### Sensor heads (for general use)

Item	Model No.	Ultra-slim type			Ultra-small type				
		Thru-beam		Diffuse reflective	Thru-beam			Diffuse reflective	
		Front sensing	Side sensing		Red LED	Green LED	Red LED		
		<b>SH-21</b>	<b>SH-21E</b>	<b>SH-22</b>	<b>SH-31R</b>	<b>SH-31G</b>	<b>SH-33R</b>	<b>SH-32R</b>	
Applicable amplifiers	SU-7 series								
Sensing range		300mm		50mm (Note 1)	1m	100mm	2m	100mm (Note 1)	
Sensing object		Min. $\phi$ 0.3mm opaque object (under the optimum condition) (Note 2)		Min. $\phi$ 0.3mm copper wire (with 3mm setting distance and at the max. sensitivity)	Min. $\phi$ 1mm opaque object (with 1m setting distance and at the optimum sensitivity) (Note 3)	Min. $\phi$ 1mm opaque object (with 100mm setting distance and at the optimum sensitivity) (Note 3)	Min. $\phi$ 1mm opaque object (with 2m setting distance and at the optimum sensitivity) (Note 3)	Opaque, translucent or transparent object	
Hysteresis		—————		15% or less of operation distance	—————			15% or less of operation distance	
Repeatability (perpendicular to sensing axis)		0.03mm or less		0.15mm or less	0.1mm or less				
Operation indicator		—————			Red LED (lights up when the sensing output of the amplifier is ON, incorporated on the emitter of the thru-beam type sensor head)				
Environmental resistance	Pollution degree	—————			3 (Industrial environment)				
	Protection	IP62 (IEC)			IP66 (IEC)				
	Ambient temperature	- 10 to + 60°C (No dew condensation or icing allowed) Storage: - 20 to + 70°C			- 25 to + 60°C (No dew condensation or icing allowed) Storage: - 30 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							
	Vibration resistance	10 to 55Hz frequency, 1.5mm amplitude in X, Y and Z directions for two hours each							
	Shock resistance	500m/s <sup>2</sup> acceleration (50G approx.) in X, Y and Z directions for three times each							
Emitting element		Infrared LED (modulated)			Red LED (modulated)	Green LED (modulated)	Red LED (modulated)		
Material		Enclosure: Polycarbonate (glass fiber reinforced)			Enclosure: ABS, Lens: Polycarbonate				
Cable		0.089mm <sup>2</sup> (ultra-slim type: 0.057mm <sup>2</sup> ) single core (diffuse reflective type: two parallel single core wires) shielded cable, 3m long							
Cable extension		Extension up to total 5m (ultra-small type: 10m) is possible with an equivalent cable (thru-beam type: both emitter and receiver).							
Weight		Emitter: 12g approx. Receiver: 12g approx.		24g approx.	Emitter: 10g approx. Receiver: 10g approx.			20g approx.	
Accessory		Sensor head mounting screw: 2 sets (SH-22: 1 set)							

Notes: 1) The sensing range of the diffuse reflective type sensor is specified for white non-glossy paper (50 × 50mm) as the object.

2) The optimum condition is the condition when the sensitivity is adjusted so that the operation indicator just lights up at the given distance in the light received condition.

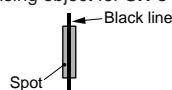
3) The optimum sensitivity stands for the sensitivity level when the operation indicator just lights up in the light received condition.

## SPECIFICATIONS

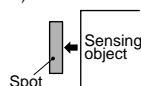
### Sensor heads (For special applications)

Item	Model No.	Chemical resistant type		Mark sensor			Glass sheet detection sensor	
		Thru-beam	Pinpoint		Line-focus			
			Red LED	Green LED				
		<b>SH-61R</b>	<b>SH-82R</b>	<b>SH-82G</b>	<b>SH-84R</b>	<b>SH-72</b>		
Applicable amplifiers	SU-7 series							
Sensing range	2.5m (5 to 80mm when mounted on optional mounting bracket (MS-SH6-2) and used as convergent reflective type (Conv. point: 25mm) (Note 2))	10 to 14mm (Convergent point: 12mm) [Spot diameter: $\phi$ 0.7mm] (Note 1)	10 to 14mm (Convergent point: 12mm) [Spot diameter: $\phi$ 1mm] (Note 1)	17 to 23mm (Convergent point: 20mm) [Spot size: 1 × 4mm] (Note 1)	0.5 to 7.5mm (with transparent glass sheet)			
Sensing object	Min. $\phi$ 5mm opaque object (Min. $\phi$ 1mm steel wire when mounted on optional mounting bracket (MS-SH6-2) and used as convergent reflective type (with 25mm setting distance and at the max. sensitivity (Note 3))	Min. 0.07mm width black line on white paper (with 12mm setting distance and at the optimum sensitivity (Note 3))	Min. 0.2mm width black line on white paper (with 12mm setting distance and at the optimum sensitivity (Note 3))	Min. 0.07mm width black line on white paper (Note 4) (with 20mm setting distance and at the optimum sensitivity (Note 3))	□24mm or more transparent glass, aluminum-evaporated mirror, etc.			
Hysteresis	(15% or less of operation distance when mounted on optional mounting bracket (MS-SH6-2) and used as convergent reflective type.	10% or less of operation distance			5% or less of operation distance			
Repeatability (perpendicular to sensing axis)	0.1mm or less (0.1mm or less of operation distance when mounted on optional mounting bracket (MS-SH6-2) and used as convergent reflective type. (with 25mm setting distance and at the max. sensitivity (Note 3))	0.02mm or less	0.03mm or less	0.03mm or less (Note 5)	0.03mm or less (along sensing axis)			
Operation indicator	Orange LED (lights up when the sensing output of the amplifier is ON, incorporated on the emitter)	Red LED (lights up when the sensing output of the amplifier is ON)			—			
Environmental resistance	Protection	IP67 (IEC)						
	Ambient temperature	- 10 to + 55°C (No dew condensation or icing allowed), Storage: - 20 to + 70°C					- 10 to + 60°C (No dew condensation or icing allowed) Storage: - 10 to + 60°C	
	Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH						
	Ambient illuminance	Sunlight: 11,000 lx (SH-61R: 7,000 lx) at the light-receiving face, Incandescent light: 3,500 lx (SH-61R: 2,000 lx) at the light-receiving face						
	Vibration resistance	10 to 500Hz frequency, 3mm amplitude (SH-72: 10 to 55Hz frequency, 1.5mm amplitude) in X, Y and Z directions for two hours each						
	Shock resistance	500m/s <sup>2</sup> acceleration (50G approx.) in X, Y and Z directions for three times each						
Emitting element	Red LED (modulated)		Green LED (modulated)	Red LED (modulated)	Infrared LED (modulated)			
Material	Enclosure: Fluorine resin Cable sheath: Fluorine resin	Enclosure: Polycarbonate, Lens: Acrylic				Enclosure: Polycarbonate		
Cable	0.089mm <sup>2</sup> single core, two parallel (SH-61R: 0.089mm <sup>2</sup> single core) shielded cables, 2m long (SH-72: 3m long)							
Cable extension	Extension up to total 5m is possible with an equivalent cable (SH-61R: both emitter and receiver).							
Weight	Emitter: 15g approx. Receiver: 15g approx.	40g approx.				25g approx.		
Accessory	MS-SH6-1 (Sensor head mounting bracket): 2 Nos.							

- Notes: 1) The sensing range of the mark sensor is specified for white non-glossy paper (50 × 50mm) as the object.  
2) The sensing range for the chemical resistant type sensor used in the convergent reflective mode is specified for white non-glossy paper (150 × 150mm) as the object.  
3) The optimum sensitivity stands for the sensitivity level when the operation indicator just lights up in the light received condition.  
4) The minimum sensing object for SH-84R is specified for the case when the sensor detects a black line with respect to the spot as shown below.



- 5) The repeatability for SH-84R is specified for the case when the sensing object approaches the spot sideways as shown below (0.12mm if it approaches from above or below).





# SU-7/SH

## SPECIFICATIONS

### Amplifiers

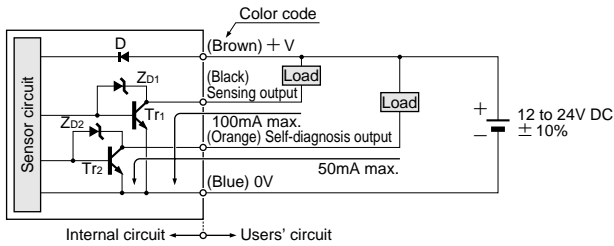
Type	NPN output type				PNP output type	
	Standard type	External synchronization input type	Remote sensitivity setting type	Remote sensitivity selection type	Standard type	
Item	Model No.	SU-7	SU-75	SU-77	SU-79	SU-7P
Applicable sensor heads	SH series					
Supply voltage	12 to 24V DC $\pm$ 10% Ripple P-P 10% or less					
Current consumption	35mA or less					
Sensing output	NPN open-collector transistor <ul style="list-style-type: none"> <li>• Maximum sink current: 100mA</li> <li>• Applied voltage: 30V DC or less (between sensing output and 0V)</li> <li>• Residual voltage: 1.0V or less (at 100mA sink current) 0.4V or less (at 16mA sink current)</li> </ul>				PNP open-collector transistor <ul style="list-style-type: none"> <li>• Maximum source current: 100mA or less</li> <li>• Residual voltage: 2.0V or less (at 100mA source current) 1.0V or less (at 16mA source current)</li> </ul>	
Utilization category	DC-12 or DC-13					
Output operation	Selectable either Light-ON or Dark-ON with the ON and OFF buttons (Selectable with the external inputs for <b>SU-77</b> )					
Short-circuit protection	Incorporated					
Self-diagnosis output	NPN open-collector transistor <ul style="list-style-type: none"> <li>• Maximum sink current: 50mA</li> <li>• Applied voltage: 30V DC or less (between self-diagnosis output and 0V)</li> <li>• Residual voltage: 1.0V or less (at 50mA sink current) 0.4V or less (at 16mA sink current)</li> </ul>				PNP open-collector transistor <ul style="list-style-type: none"> <li>• Maximum source current: 50mA or less</li> <li>• Residual voltage: 2.0V or less (at 50mA source current) 1.0V or less (at 16mA source current)</li> </ul>	
Output operation	ON under unstable sensing condition (restored automatically after 40ms approx.), or if the sensing output is short-circuited (restored when short-circuit is rectified). (For the remote sensitivity adjustment type, it turns ON for 40ms approx. also after the remote sensitivity input is received.)					
Short-circuit protection	—					
Response time	0.6ms or less (0.8ms or less when the interference prevention function is used)					
Operation indicator	Red LED (lights up when the sensing output is ON)					
Stability indicator	Green LED <ul style="list-style-type: none"> <li>'RUN' mode: Lights up under stable light received condition or stable dark condition</li> <li>'SET' mode: At the time of sensitivity setting, blinks twice when the difference between ON and OFF levels is greater than the hysteresis, but blinks 15 times when it is equal to or less than the hysteresis. Also blinks twice after the interference prevention is set</li> <li>'SET' mode → When 'SIF' or 'RUN' mode is selected: Blinks from 0 to 5 times according to the sensitivity margin</li> </ul>					
Test input function	—	Incorporated	—	—	—	
External synchronization function	—	Incorporated (Either gate or edge trigger is selectable)	—	—	—	
Remote sensitivity setting function	—	—	Incorporated	—	—	
Remote sensitivity selection function	—	—	—	Incorporated (Stores four sensitivities)	—	
Sensitivity shift & limit sensitivity setting functions	Shifts the set sensitivity level					
Interference prevention function	Incorporated					
Timer function	ON-delay/OFF-delay timer (variable 0 to 5 sec.)	—	ON-delay/OFF-delay timer (variable 0 to 5 sec.)			
Pollution degree	3 (Industrial environment)					
Ambient temperature	- 10 to + 55°C (No dew condensation or icing allowed), Storage: - 20 to + 70°C					
Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH					
EMC	Emission: EN50081-2, Immunity: EN50082-2					
Voltage withstandability	1,000V AC for one min. between all supply terminals connected together and enclosure					
Insulation resistance	20M $\Omega$ , or more, with 250V DC megger between all supply terminals connected together and enclosure					
Vibration resistance	10 to 150Hz frequency, 0.75mm 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					
Material	Enclosure: Heat-resistant ABS, Cover: Polycarbonate, Cable lock lever: PPS					
Cable	0.15mm <sup>2</sup> 6-core ( <b>SU-7</b> and <b>SU-7P</b> : 0.2mm <sup>2</sup> 4-core) cabtyre cable, 2m long					
Cable extension	Extension up to total 100m is possible with 0.3mm <sup>2</sup> , or more, cable.					
Weight	65g approx.					
Accessories	<b>MS-DIN-2</b> (Amplifier mounting bracket): 1 No., <b>SU-CT1</b> (Stripper): 1 No.					

## I/O CIRCUIT AND WIRING DIAGRAMS

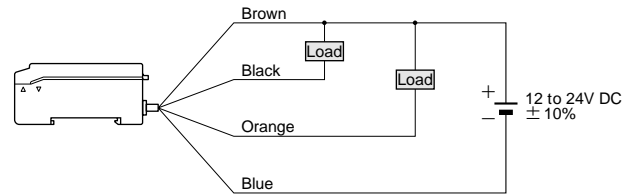
### SU-7 SU-7J

Standard type • NPN output

#### I/O circuit diagram



#### Wiring diagram

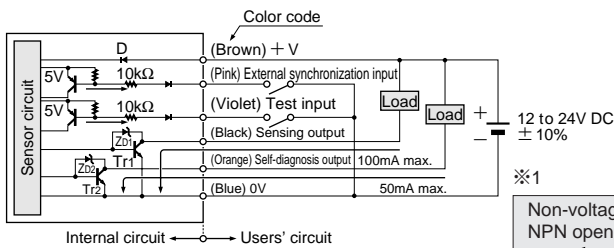


Symbols ... D: Reverse supply polarity protection diode  
 ZD1, ZD2: Surge absorption zener diode  
 Tr1, Tr2 : NPN output transistor

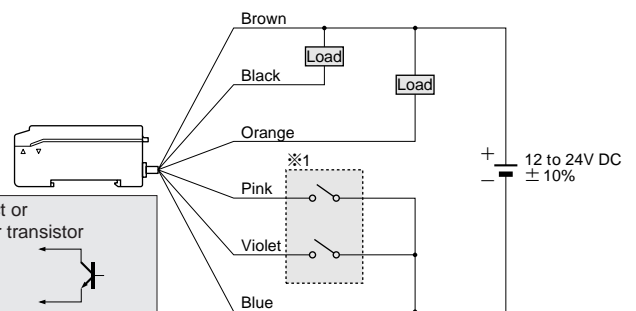
### SU-75

External synchronization input type

#### I/O circuit diagram



#### Wiring diagram



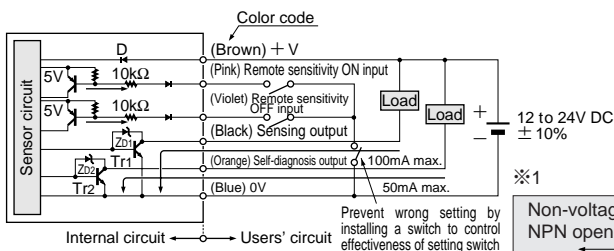
Symbols ... D: Reverse supply polarity protection diode  
 ZD1, ZD2: Surge absorption zener diode  
 Tr1, Tr2 : NPN output transistor

\*1  
 Non-voltage contact or  
 NPN open-collector transistor  
  
 Low: 0 to 1V  
 High: 4.5V to 30V, or open

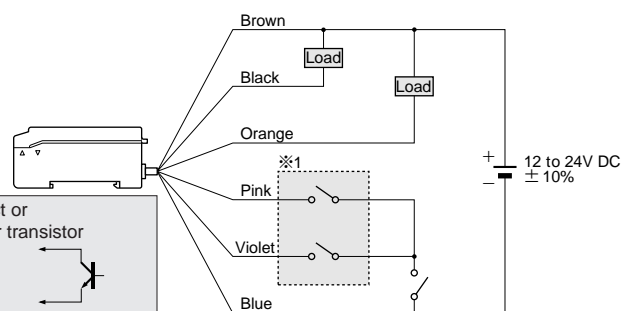
### SU-77

Remote sensitivity setting type

#### I/O circuit diagram



#### Wiring diagram



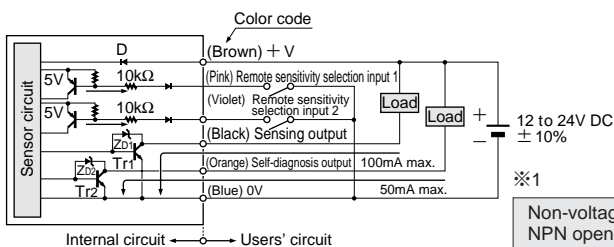
Symbols ... D: Reverse supply polarity protection diode  
 ZD1, ZD2: Surge absorption zener diode  
 Tr1, Tr2 : NPN output transistor

\*1  
 Non-voltage contact or  
 NPN open-collector transistor  
  
 Low: 0 to 1V  
 High: 4.5V to 30V, or open

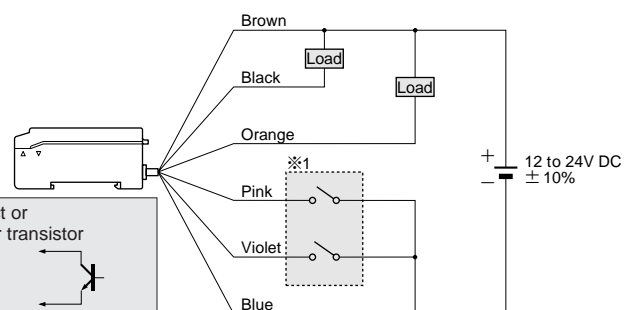
### SU-79

Remote sensitivity selection type

#### I/O circuit diagram



#### Wiring diagram



Symbols ... D: Reverse supply polarity protection diode  
 ZD1, ZD2: Surge absorption zener diode  
 Tr1, Tr2 : NPN output transistor

\*1  
 Non-voltage contact or  
 NPN open-collector transistor  
  
 Low: 0 to 1V  
 High: 4.5V to 30V, or open

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

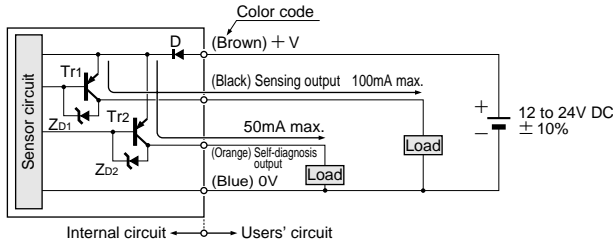


# SU-7/SH

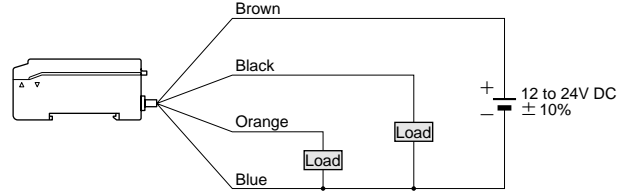
## I/O CIRCUIT AND WIRING DIAGRAMS

### SU-7P Standard type • PNP output

#### I/O circuit diagram



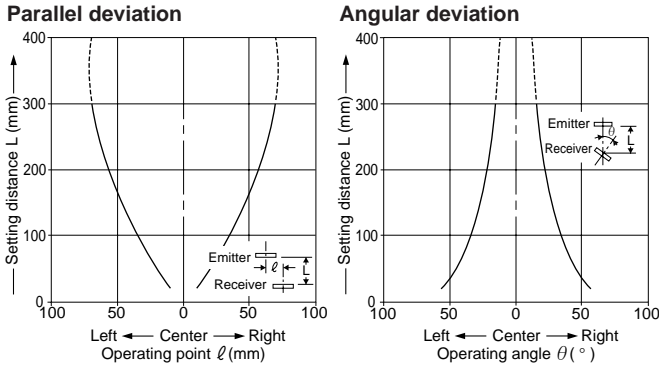
#### Wiring diagram



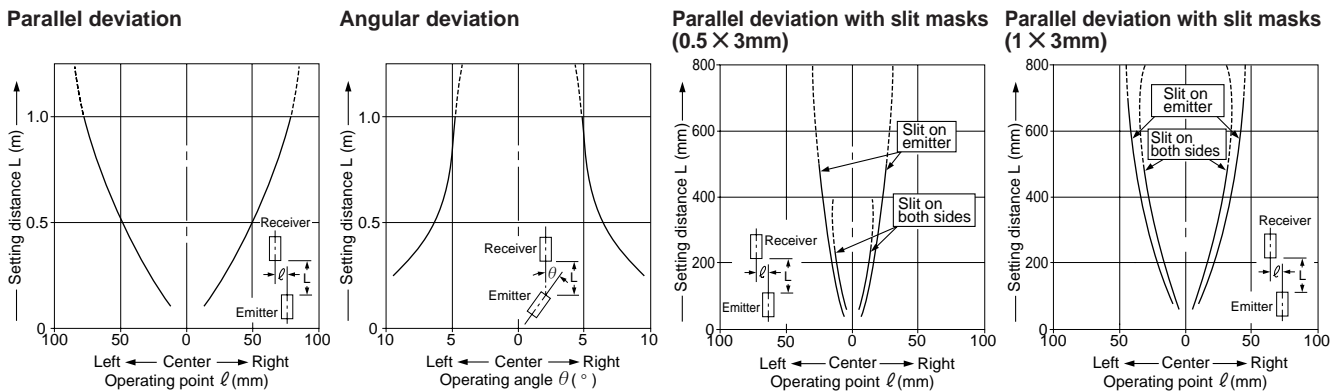
Symbols ... D: Reverse supply polarity protection diode  
 ZD1, ZD2: Surge absorption zener diode  
 Tr1, Tr2: PNP output transistor

## SENSING CHARACTERISTICS (TYPICAL)

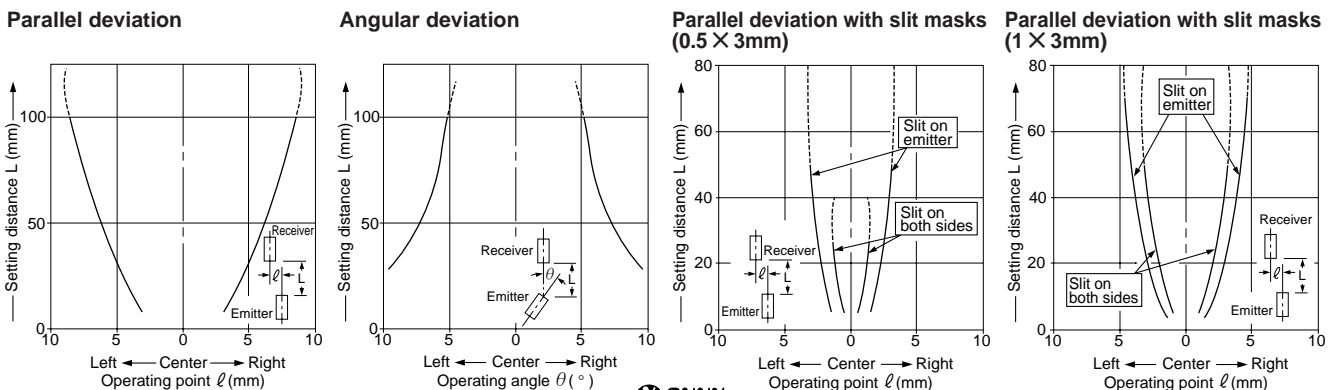
### SH-21 SH-21E Thru-beam type



### SH-31R Thru-beam type



### SH-31G Thru-beam type

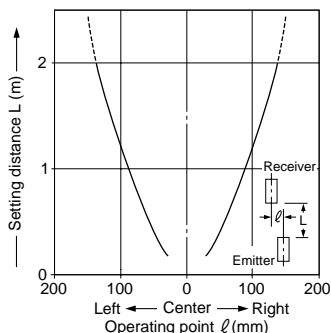


## SENSING CHARACTERISTICS (TYPICAL)

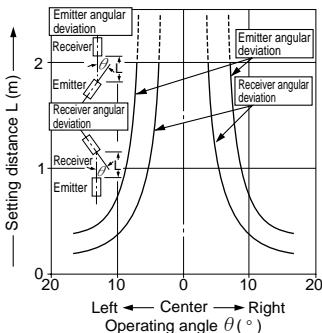
### SH-33R

Thru-beam type

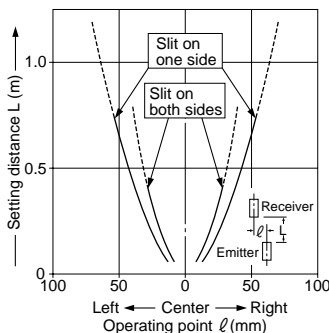
#### Parallel deviation



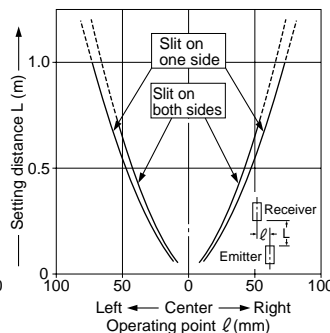
#### Angular deviation



#### Parallel deviation with slit masks (0.5 x 3mm)



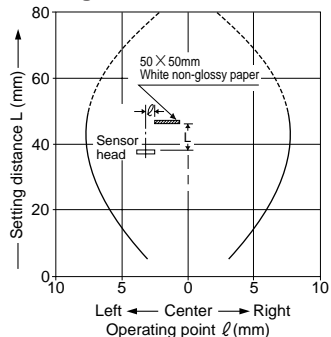
#### Parallel deviation with slit masks (1 x 3mm)



### SH-22

Diffuse reflective type

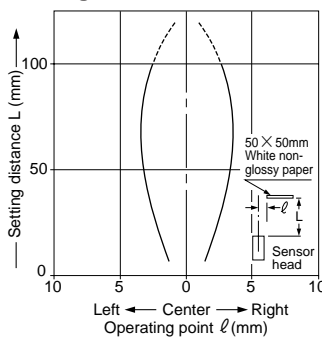
#### Sensing field



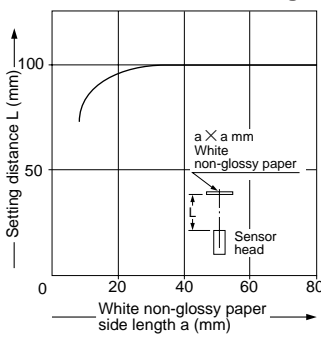
### SH-32R

Diffuse reflective type

#### Sensing field



#### Correlation between sensing object size and sensing range

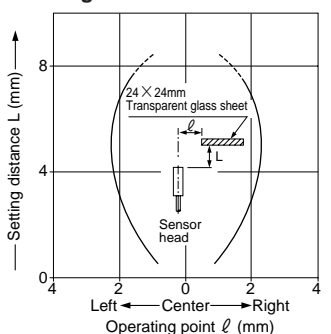


As the sensing object size becomes smaller than the standard size (white non-glossy paper 50 x 50mm), the sensing range shortens, as shown in the left graph. (For plotting the left graph, the sensitivity has been set such that a 50 x 50mm white non-glossy paper is just detectable at a distance of 100mm.)

### SH-72

Glass sheet detection sensor

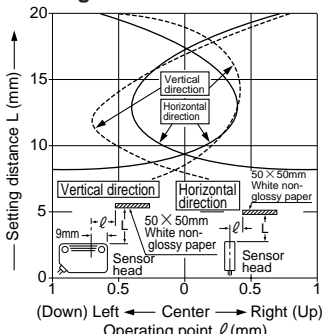
#### Sensing field



### SH-82R

Mark sensor

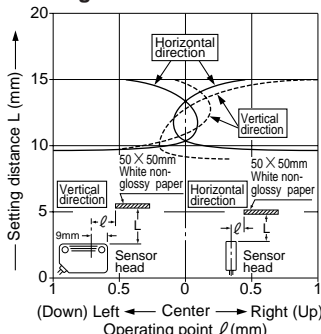
#### Sensing field



### SH-82G

Mark sensor

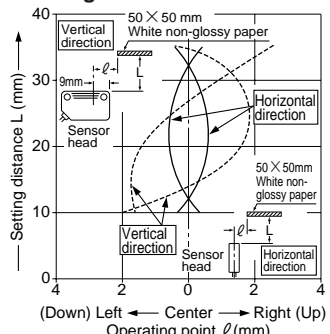
#### Sensing field



### SH-84R

Mark sensor

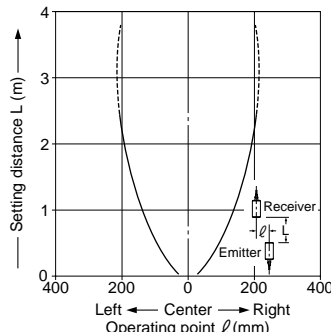
#### Sensing field



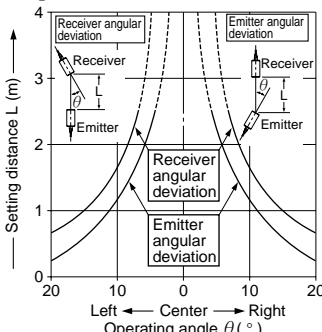
### SH-61R

Chemical resistant type

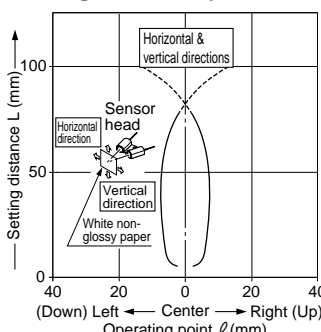
#### Parallel deviation



#### Angular deviation



#### Sensing field with optional mounting bracket (MS-SH6-2)



Sensor Mounting Stand MS-AJ

Micro PM

PM2

Multi-voltage Type NX5

VF

Amplifier-separated Type SS-A5

SU-7/SH

Sensor Checker CHX-SC2

# SU-7/SH

## PRECAUTIONS FOR PROPER USE

Refer to P.820~ for general precautions.

### Sensor head



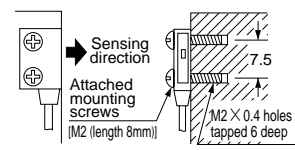
This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

Always use the sensor head and the exclusive amplifier together as a set.

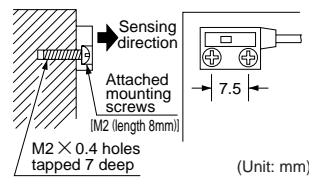
### Mounting

#### Ultra-slim type

- With tapped screws  
<Side sensing>

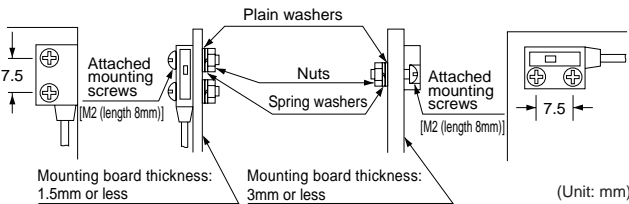


#### <Front sensing>



The tightening torque should be 0.14N·m or less.

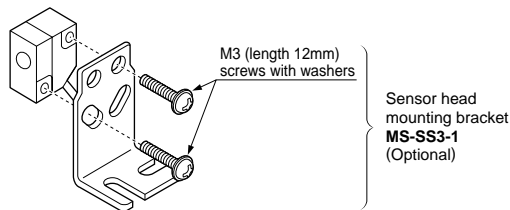
- With attached screws and nuts  
<Side sensing>



The tightening torque should be 0.14N·m or less.

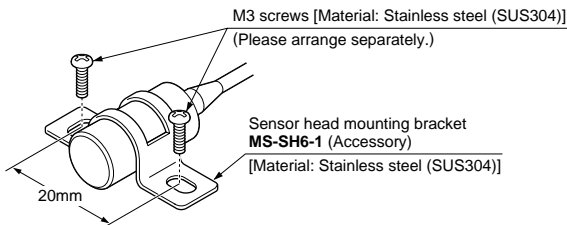
#### For ultra-small type, mark sensor & glass sheet detection sensor

- The tightening torque should be 0.29N·m or less when mounting the sensor head with the screws.

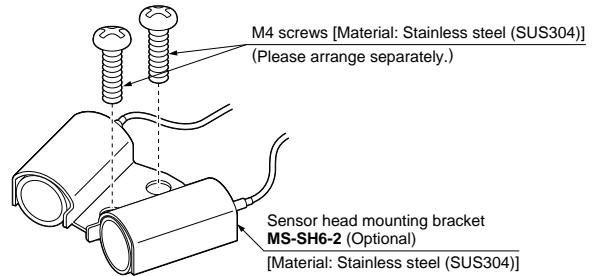


#### Chemical resistant type

- Use M3 screws to mount the sensor head with the attached sensor head mounting bracket.



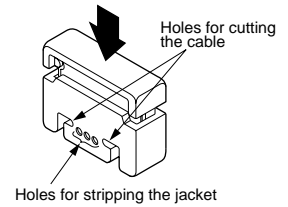
- Use M4 screws to assemble the sensor head with the optional sensor head mounting bracket **MS-SH6-2**, in order to form the convergent sensing mode.



### Wiring

- Trim the cable ends

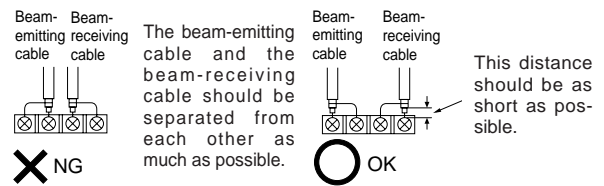
The stripper **SU-CT1** helps you to cut the cable and peel the outer jacket off the cable. To cut the cable or to strip the jacket, insert the cable into an appropriate hole as shown in the right figure and press the blade down.



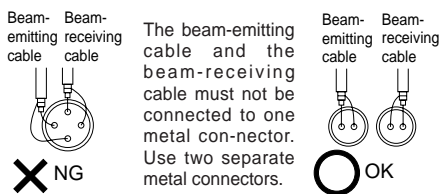
Note: The outer fluorine resin jacket of **SH-61R** cannot be peeled off with **SU-CT1**.

- If the attached sensor head cables need to be extended, use two single core shielded cables of at least equivalent quality. If a joint terminal or connector is used for extension, refer to the figures below. (The shielded extension cable must be of  $\phi$  1.45mm outer diameter.)

#### Connection with joint terminal



#### Connection with metal connector



### In case of chemical resistant type sensor head

- Do not use where it can be exposed to molten alkali metals (sodium, potassium, lithium, etc.), fluorine gas (F<sub>2</sub>), ClF<sub>3</sub>, OF<sub>2</sub> (including gaseous state), etc.
- In case of cable extension, the extended portion should be placed in an area where it is not exposed to chemicals.

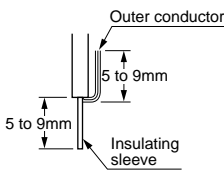
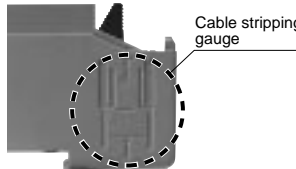
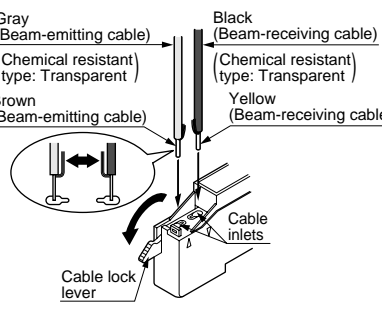
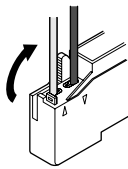
## PRECAUTIONS FOR PROPER USE

Refer to P.820~ for general precautions.

### Amplifier

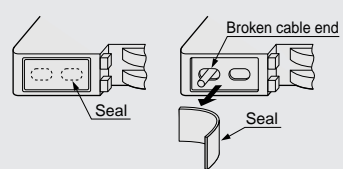
#### Connection with the sensor head cable

Follow the procedure given below to connect the sensor heads. If the connection is not secure, the sensor will not work properly.

Step	Operation
①	Remove the cover.
②	<p>Trim the cable ends with the stripper <b>SU-CT1</b> or a pair of nippers as shown on the right. Do not peel the insulating sleeve off the inner conductor.</p>  <p>A cable stripping gauge appears on the side of the <b>SU-7</b> amplifier. Using this gauge, it is possible to obtain the given cable dimensions.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>At the time of shipment, the inner conductor is stripped and cannot be used as it is. Make sure to trim the cables.</p> </div> 
③	<p>Snap the cable lock lever down and put the cables into the insertion holes of the amplifier with the outer shield wires facing each other.</p>  <p>Cables should be inserted straight without bending.</p>
④	<p>Pull the cable lock lever back to lock the cables.</p> 
⑤	Put the cover on the <b>SU-7</b> amplifier.

#### Caution

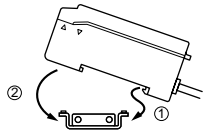
- After locking, if the lock is released and the cable is removed, it can be locked again, as it is, only once. If the locking is repeated three times or more, repeat the process from Step ②. If the cables are locked and released repeatedly, note that the cable ends may break, resulting in a bad connection.
- If there is a shred of the cable left inside the cable inlet, remove it before connecting the sensor head cables. Turn the amplifier upside down, and tap it around the holes. If the shred still remains, peel the bottom seal off the amplifier, and drop it out. (The seal is reusable.)



#### Mounting

##### How to mount the amplifier

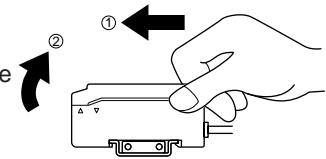
- ① Fit the rear part of the amplifier on the attached amplifier mounting bracket (**MS-DIN-2**) or a 35mm width DIN rail.
- ② Press down the front part of the amplifier on the amplifier mounting bracket (**MS-DIN-2**) or the DIN rail to fit it.



Attached amplifier mounting bracket or 35mm width DIN rail

##### How to remove the amplifier

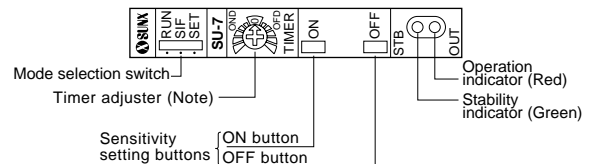
- ① Push the amplifier forward.
- ② Lift up the front part of the amplifier to remove it.



#### Wiring

- The self-diagnosis output is not incorporated with a short-circuit protection circuit. Do not connect it directly to a power supply or a capacitive load.

#### Part description



Note: In case of **SU-75**, this is the external synchronization selection switch.

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

# SU-7/SH

## PRECAUTIONS FOR PROPER USE

Refer to P.820~ for general precautions.

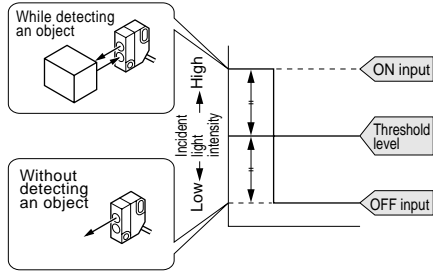
### Amplifier

#### Sensitivity setting

##### Normal sensitivity setting

#### Standard setting

The sensor recognizes the ON and OFF levels by your pressing of the buttons. The threshold level is automatically set at the middle between ON and OFF levels.



#### Setting procedure

##### <In case of sensing output ON with object present>

Step	Operation
①	Set the sensor heads within the sensing range.
②	Set the mode selection switch to 'SET'.
③	Press the ON button with the object present. (Release it within 3 sec.) <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Thru-beam type</p> </div> <div style="text-align: center;"> <p>Diffuse reflective type</p> </div> </div>
④	When the ON level is recognized by the sensor, the stability indicator (green) blinks.
⑤	Press the OFF button with the object absent. (Release it within 3 sec.) <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Thru-beam type</p> </div> <div style="text-align: center;"> <p>Diffuse reflective type</p> </div> </div>
⑥	<ul style="list-style-type: none"> <li>The stability indicator blinks twice if the difference between the ON and OFF levels is sufficient for stable detection.</li> <li>The stability indicator blinks 15 times if the difference between the ON and OFF levels is so small that stable detection is not possible. (Even though the sensitivity can be set and the sensor can work, the sensing will be ambiguous.)</li> </ul>
⑦	Set the mode selection switch to 'RUN'. Now the sensitivity setting buttons (ON/OFF buttons) become ineffective. Even if the buttons are touched by mistake, the set sensitivity does not change.

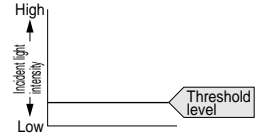
##### <In case of sensing output ON with object absent>

In the above procedure, press the ON button with the object absent, and press the OFF button with the object present.

##### Maximum sensitivity setting

#### Full power setting

The maximum sensitivity is set. Take care that, in case of the diffuse reflective type, if a background object is present, the sensing output may turn ON even without the sensing object.



#### Setting procedure

Step	Operation
①	Make sure that the sensor receives no light.
②	Set the mode selection switch to 'SET'.
③	Press the 'ON' button in the Light-ON mode.  Press the 'OFF' button in the Dark-ON mode.
④	When the input is recognized by the sensor, the stability indicator (green) blinks.
⑤	Press the 'OFF' button in the Light-ON mode.  Press the 'ON' button in the Dark-ON mode.
⑥	When the input is recognized by the sensor, the stability indicator (green) blinks.
⑦	Set the mode selection switch to 'RUN'.

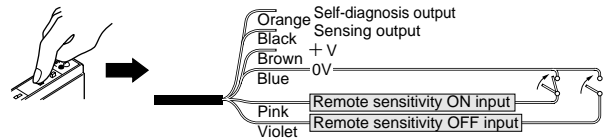
#### How to set sensitivity with external inputs

#### Remote sensitivity setting (SU-77 only)

Instead of pressing buttons, the sensitivity can be set with the remote sensitivity setting inputs. (There is no external sensitivity shift mode.)

#### Setting procedure

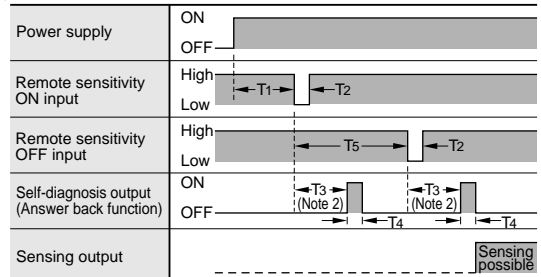
The procedure is the same as for setting with sensitivity buttons, except that instead of pressing the buttons, the remote sensitivity setting input wire is short-circuited to 0V. The mode selection switch is set to either the 'SET' or 'RUN' side.



#### Time chart

The self-diagnosis output stays ON for approx. 40ms after ON input or OFF input is recognized by the sensor.

(If the difference between the ON and OFF levels (the difference between incident light levels) is so small that stable detection is not possible, it does not turn ON.)



T1 ≥ 1,000ms, 3,000ms < T2 ≤ 5ms, T3 = 310ms, T4 = 40ms, T5 ≥ 500ms

Notes: 1) Signal condition ... Low: 0 to 1V, High: 4.5 to 30V, or open Input impedance: 10kΩ

2) Do not move the object, etc., or change the incident light intensity during T3.



## PRECAUTIONS FOR PROPER USE

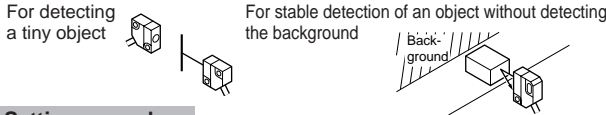
Refer to P.820~ for general precautions.

### Amplifier

#### ●Sensitivity for detecting minute differences

##### Limit sensitivity setting

Setting for minute detection is possible just by pressing a button once without the object being present.



##### Setting procedure

Step	Operation
①	Set the sensor without an object and under stable light receiving condition. <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><b>Thru-beam type</b></p> </div> <div style="text-align: center;"> <p><b>Diffuse reflective type</b></p> </div> <div style="text-align: center;"> <p><b>Mark sensor</b></p> </div> </div>
②	Set the mode selection switch to 'SET'. 
③	By pressing either ON or OFF button for 3 sec. or more, the threshold level is set 15% either lower or higher than the object absent level as shown in the right figure. (Please note that the output operation cannot be reversed.) For example, press the ON button for detecting a tiny object. 
④	Set the mode selection switch to 'RUN'. 

#### ●For applications in which beam intensity fluctuates

##### Sensitivity shift

If the incident light is stable in either the object present or object absent state, by shifting the threshold level towards this state, stable sensing is possible even if the incident light is unstable in the other state. The setting level is the same as for limit sensitivity setting. However, since the operating level is shifted after the normal sensitivity setting, output operation is selectable.

##### Setting procedure

Step	Operation
①	Set the sensitivity by following the standard setting procedure. (If the sensitivity margin is small, sensitivity shift cannot be done.)
②	Set the mode selection switch to 'SIF'. 
③	Press the sensitivity setting button which was pressed in the stable light received condition. For example, for a diffuse reflective type sensor, in case a background object is present, press the button which was pressed with only the background object being sensed. 
④	Set the mode selection switch to 'RUN'. 

#### Remote sensitivity selection function (SU-79 only)

• SU-79 can store four channels of sensitivity levels, which can be selected as per your requirement.

##### Sensitivity storage

Step	Operation																				
①	Set the mode selection switch to 'SET'. 																				
②	Designate the channel that is to store the sensitivity by making the remote sensitivity selection inputs 1 and 2 suitably High or Low. <b>Wiring</b>  <b>Signal condition</b> Low: 0 to 1V High: 4.5 to 30V, or open Input impedance: 10kΩ  <b>Channel selection</b> <table border="1"> <thead> <tr> <th>Channel</th> <th>Input</th> <th>Remote sensitivity selection input 1</th> <th>Remote sensitivity selection input 2</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td>Low</td> <td>Low</td> </tr> <tr> <td>2</td> <td></td> <td>Low</td> <td>High</td> </tr> <tr> <td>3</td> <td></td> <td>High</td> <td>Low</td> </tr> <tr> <td>4</td> <td></td> <td>High</td> <td>High</td> </tr> </tbody> </table>	Channel	Input	Remote sensitivity selection input 1	Remote sensitivity selection input 2	1		Low	Low	2		Low	High	3		High	Low	4		High	High
Channel	Input	Remote sensitivity selection input 1	Remote sensitivity selection input 2																		
1		Low	Low																		
2		Low	High																		
3		High	Low																		
4		High	High																		
③	Set the sensitivity. 																				
④	Designate another channel and set the sensitivity again.																				
⑤	Set the mode selection switch to 'RUN'. 																				

##### Sensitivity selection

Step	Operation
①	Set the mode selection switch to 'RUN'. 
②	Designate the channel you wish to select by making the remote sensitivity selection inputs 1 and 2 suitably High or Low.

#### Stability margin indication function

• After setting the sensitivity, the margin of stability can be determined. When the mode selection switch is changed from 'SET' to 'SIF' or 'RUN', the stability indicator (green) blinks. The number of blinks indicates the margin of stability.

Number of blinks	0	1	2	3	4	5
Margin (%) (Margin with respect to threshold level)	Under 15	15 to 30	30 to 45	45 to 60	60 to 75	Over 75

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



# SU-7/SH

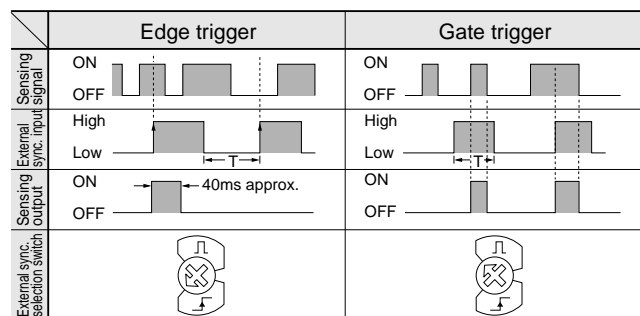
## PRECAUTIONS FOR PROPER USE

Refer to P.820~ for general precautions.

### Amplifier

#### External synchronization function (SU-75 only)

• The external synchronization function can be used to control the timing of sensing. Edge trigger or gate trigger are available.

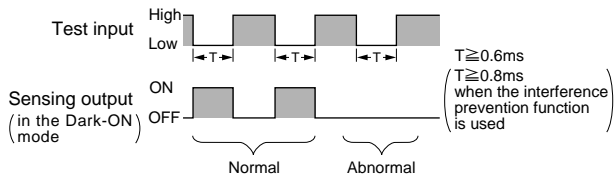


$T \geq 0.6\text{ms}$  ( $T \geq 0.8\text{ms}$  when the interference prevention function is used)

Note: The external synchronization selection switch must be turned fully clockwise or counterclockwise.

#### Test input function (SU-75 only)

• When the test input (violet) is short-circuited to 0V (Low), the beam emission is halted. This function is useful for a start-up test since the sensing output can be made ON/OFF without the sensing object. Short-circuit to 0V and open the input, repeatedly. If the sensing output follows this operation, the sensor is working well, else not.



#### Timer function (Except for SU-75)

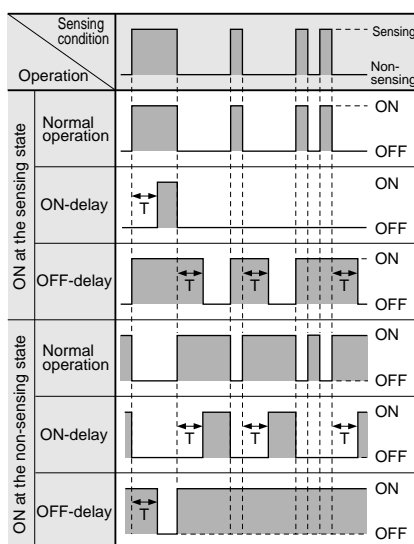
• Every SU-7 series amplifier (except for SU-75) is incorporated with a variable ON/OFF delay timer for 0 to 5 sec.

##### ON-delay

As only longer 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

Since the output signal is extended for a fixed time interval, this function is useful if the output signal is so short that the connected device cannot respond.

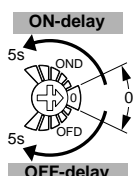


Timer period:  $T = 0$  to 5 sec.

#### • Timer period setting

Adjust the time duration of ON or OFF delay by turning the timer adjuster.

Note: Adjust the timer under 'SET' mode. Adjustment is not allowed in 'SIF' or 'RUN' mode.



#### Interference prevention function

• Every SU-7 amplifier is incorporated with an interference prevention function. By setting different emission frequencies, sensor heads can be mounted close together (up to 2 Nos.).

##### Setting

Step	Operation
①	Set the mode selection switch to 'SET'.
②	Press both 'ON' and 'OFF' buttons <u>simultaneously</u> for 2 sec. or more. The stability indicator (green) blinks.
③	Press 'ON' button. (The stability indicator blinks twice.) [Response time: 0.6ms or less (Note)]
④	Set the mode selection switch to 'RUN'. (This completes the setting for one amplifier.)
⑤	Apply steps ① and ② to the second amplifier.
⑥	Press the 'OFF' button. (The stability indicator blinks twice.) [Response time: 0.8ms or less (Note)]
⑦	Set the mode selection switch to 'RUN'. (This completes the setting.)

##### Cancellation

Step	Operation
①	Press both 'ON' and 'OFF' buttons <u>simultaneously</u> for 2 sec. or more. The stability indicator (green) blinks.
②	Press both 'ON' and 'OFF' buttons simultaneously again. (The stability indicator blinks twice.)

Note: The interference prevention function increases the hysteresis and the response time. After it is set, make sure to check the operation.

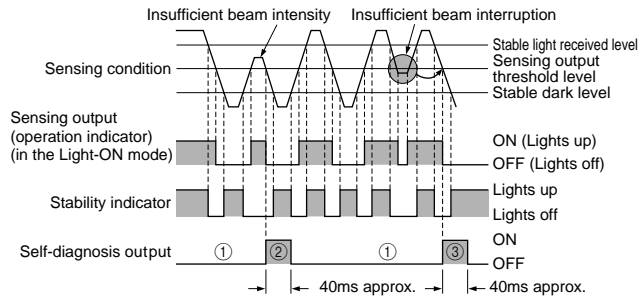
## PRECAUTIONS FOR PROPER USE

Refer to P.820~ for general precautions.

### Amplifier

#### Self-diagnosis function

- The sensor checks the incident light intensity, and if it is reduced due to dirt or dust, or beam misalignment, an output is generated.



- The self-diagnosis output transistor stays in the 'OFF' state during stable sensing.
- When the sensing output changes, if the incident light intensity does not reach the stable light received level or the stable dark level, the self-diagnosis output becomes ON. It is automatically restored after 40ms approx. Further, the self-diagnosis output changes state when the sensing output changes from Light to Dark state. (It is not affected by the output operation of the sensing output.)
- In case of insufficient beam interruption, there will be a time lag before the self-diagnosis output turns ON.

#### Others

- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.

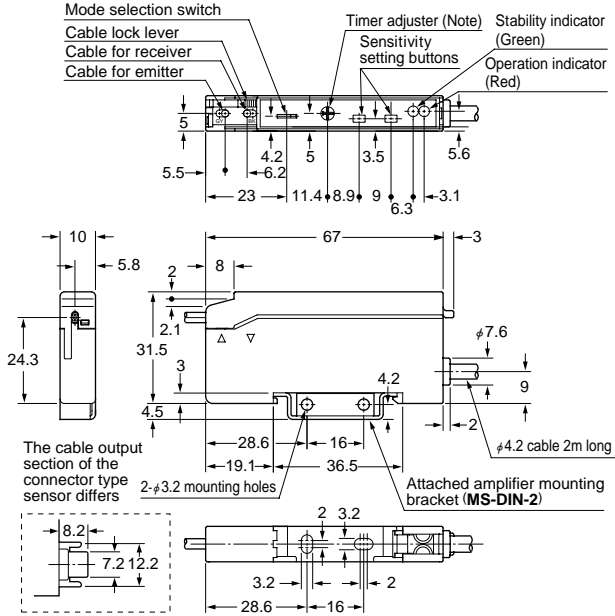
Sensor Checker CHX-SC2	Amplifier-separated Type SS-A5	Multi-voltage Type VF	Micro PM2	Sensor Mounting Stand MS-AJ
		NX5	PM	

# SU-7/SH

## DIMENSIONS (Unit: mm)

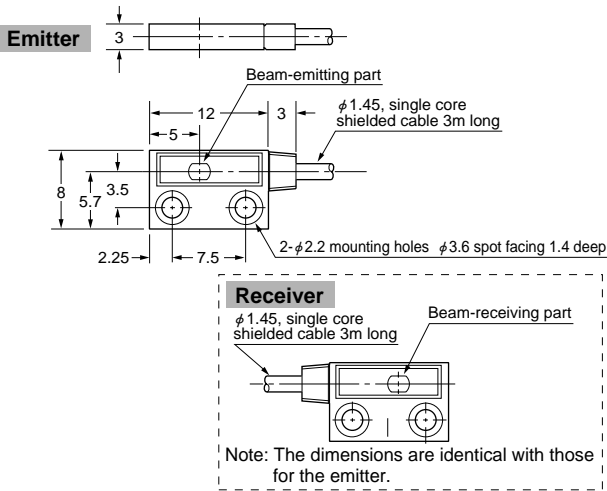
### SU-7 Amplifier

#### Assembly dimensions with attached amplifier mounting bracket

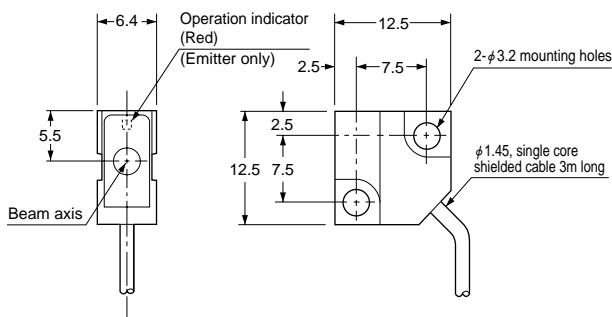


Notes: 1) It is the external synchronization selection switch on SU-75.  
2) The top view is shown without the cover or the sensor head cable.

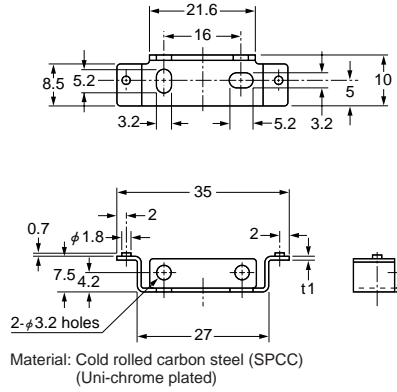
### SH-21 Sensor head



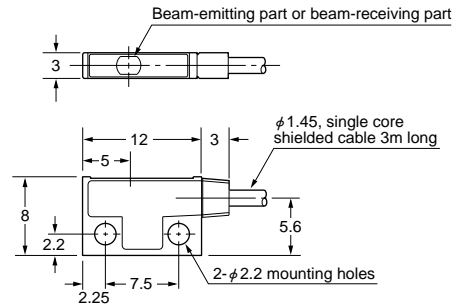
### SH-31R SH-31G SH-33R Sensor head



### MS-DIN-2 Amplifier mounting bracket (Accessory for amplifier)

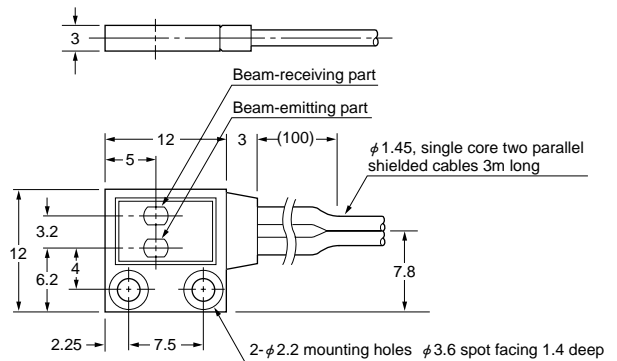


### SH-21E Sensor head

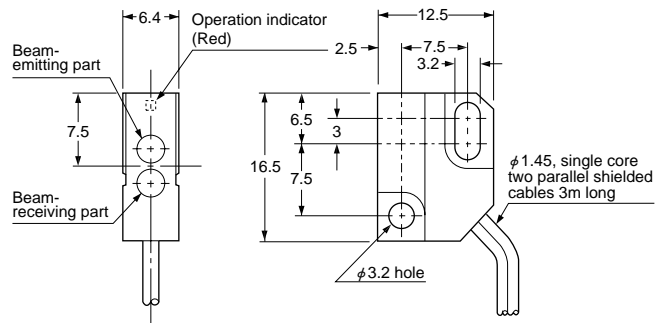


Note: The above dimensions are identical for the emitter and the receiver.

### SH-22 Sensor head



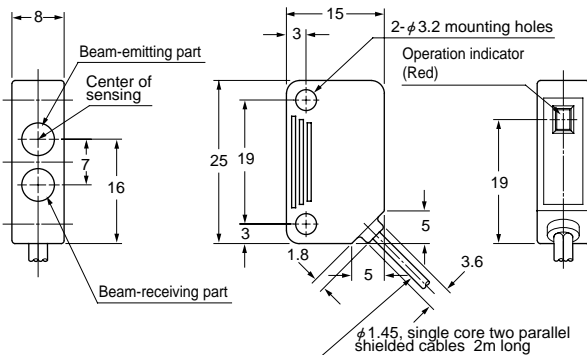
### SH-32R Sensor head



## DIMENSIONS (Unit: mm)

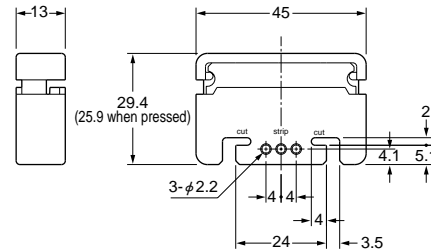
**SH-82R SH-82G SH-84R**

Sensor head



**SU-CT1**

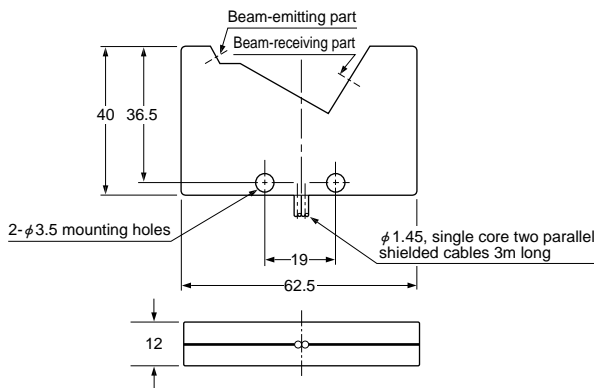
Stripper (Accessory for amplifier)



Material: POM

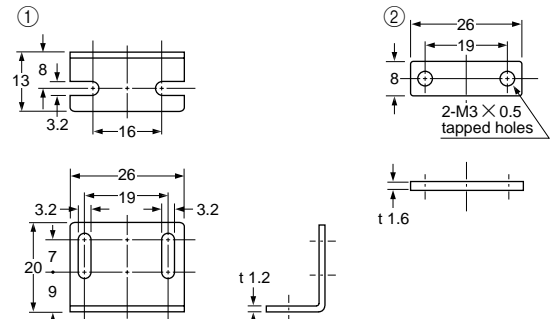
**SH-72**

Sensor head



**MS-DS-1**

Sensor head mounting bracket (Optional)

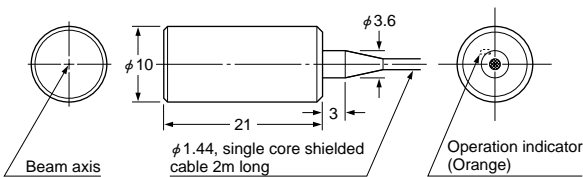


Material: Cold rolled carbon steel (SPCC) (Uni-chrome palated)

Two M3 (length 14mm) screws with washers are attached.

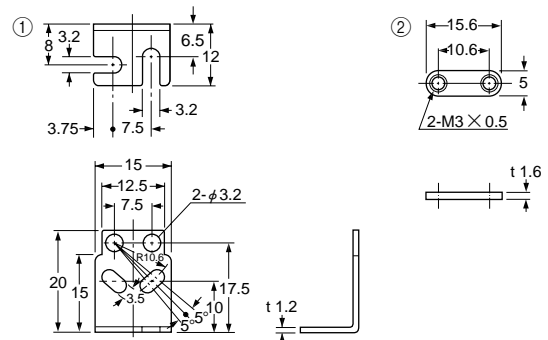
**SH-61R**

Sensor head



**MS-SS3-1**

Sensor head mounting bracket (Optional)

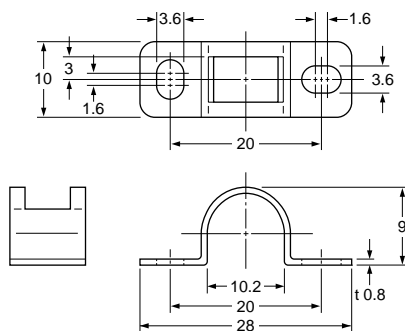


Material: Cold rolled carbon steel (SPCC) (Uni-chrome palated)

Two M3 (length 12mm) screws with washers are attached.

**MS-SH6-1**

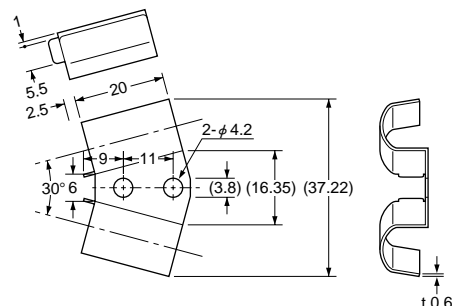
Sensor head mounting bracket (Accessory for SH-61R)



Material: Stainless steel (SUS304)

**MS-SH6-2**

Sensor head mounting bracket (Optional)



Material: Stainless steel (SUS304)

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