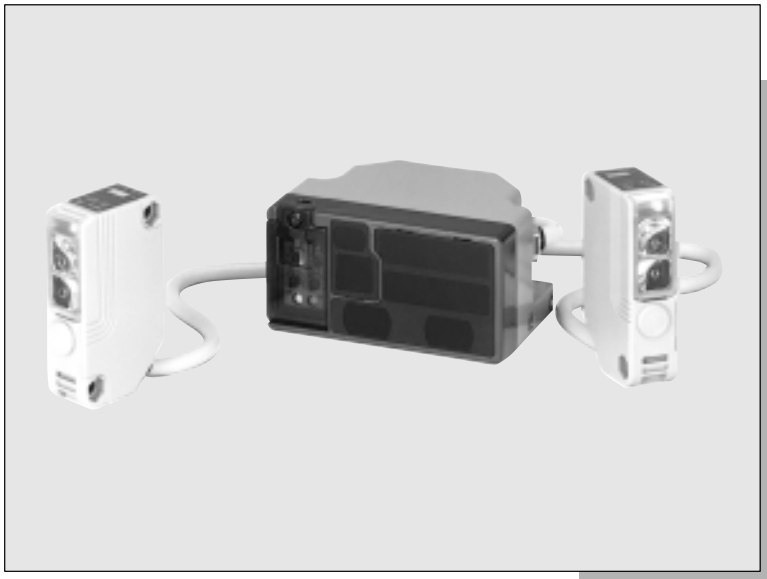
PX-2 SERIES

Long Range & Wide Area Photoelectric Sensor

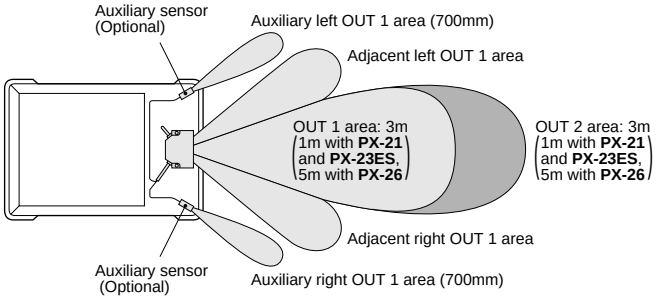


Compact Size Sensor Realizes Wide Sensing Area & Long Sensing Range

CE Marked
Conforming to EMC Directive

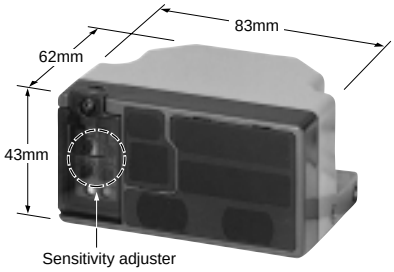
Ideal Sensing Area with Very Little Null Zone

The advanced optical system of the **PX-2** series reduces the null zones in front of an automatic guided vehicle (AGV).
The null zones at the sides are further minimized if auxiliary sensors which can be easily mounted with connectors are used.
(For **PX-24**, **PX-24ES**, **PX-23ES** and **PX-26**)



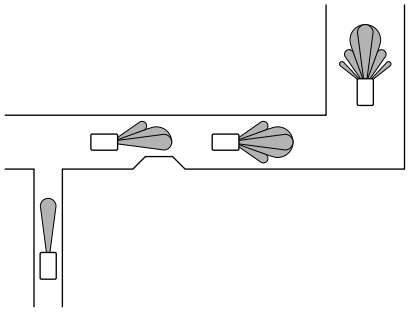
Compact Size for Space-saving

Its size is half of a conventional model, and the attached cable orientation is freely adjustable. Hence, it can also fit in a small AGV.
Moreover, sensitivity adjustment can be done on the front face.



Sensing Areas Selectable as Per Route Condition

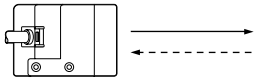
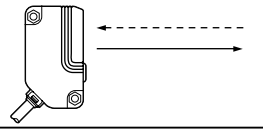
Sensing areas can be selected with switches to suit the route conditions of an AGV. Further, in case of **PX-24ES** and **PX-23ES**, the sensing areas can also be selected with external signals.



Long Sensing Range 5m Type

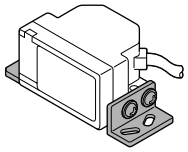
PX-26 has a long sensing range of 5m. Even on a high-speed AGV, it can detect an object quite early so that slowing down and stopping are smooth.

ORDER GUIDE

Type	Appearance	Sensing range	Model No.
Standard model		3m	**PX-22**
Standard model — Short sensing range		1m	**PX-21**
Auxiliary sensor connectable model		3m	**PX-24**
Auxiliary sensor connectable model — With external control function		3m	**PX-24ES**
Auxiliary sensor connectable model — With external control function — Short sensing range		1m	**PX-23ES**
Auxiliary sensor connectable model — Long sensing range		5m	**PX-26**
Auxiliary sensor		700mm	**PX-SB1**

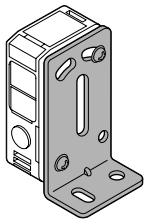
Sensor mounting bracket (Accessories)

• MS-PX-2 (Main sensor mounting bracket)



Two bracket set
Four M4 (length 8mm) screws with washers are attached.

• MS-NX5-1 (Auxiliary sensor mounting bracket)



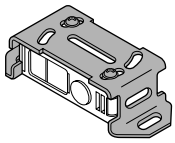
Two M4 (length 25mm) screws with washers and two M4 nuts are attached.

OPTIONS

Designation	Model No.	Description
Auxiliary sensor mounting bracket	**MS-NX5-2**	Foot biangled mounting bracket (Sensor protection bracket)
	MS-NX5-3	Back angled mounting bracket

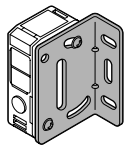
Auxiliary sensor mounting bracket

• MS-NX5-2



Two M4 (length 25mm) screws with washers and two M4 nuts are attached.

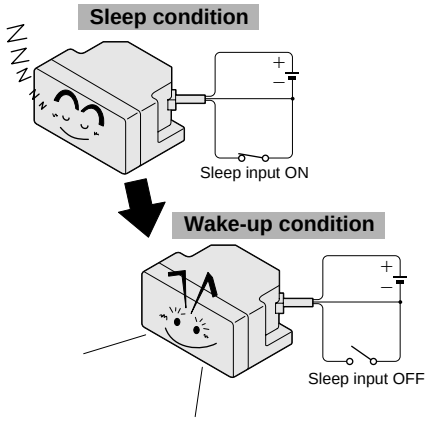
• MS-NX5-3



Two M4 (length 25mm) screws with washers and two M4 nuts are attached.

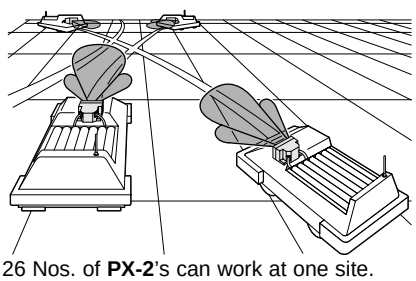
Sleep Function

The sensor can be put into the sleep (stand-by) condition when it is not used and can be restored to operating condition by an external signal.
Consequently battery is conserved as the power consumption is reduced to 1/7.



Automatic Interference Prevention Function

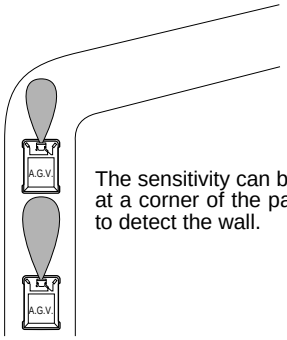
One **PX-2** sensor can simultaneously receive beams from 25 Nos. of other **PX-2** sensors without resulting in any interference. Even if AGVs are facing each other, the **PX-2** sensor on one AGV reliably detects the other AGVs.
Hence, it can be safely used even at a place where several AGVs are moving.



26 Nos. of **PX-2**'s can work at one site.

External Sensitivity Adjustment

The sensitivity of the sensor can be adjusted, within the range set by the manual adjuster, by an external input.
(For **PX-24**, **PX-24ES**, **PX-23ES** and **PX-26**)



The sensitivity can be decreased at a corner of the path so as not to detect the wall.

PX-2

SPECIFICATIONS

Main sensors

Item \ Type	Standard model		Auxiliary sensor connectable model			
		Short sensing range		With external control function	Short sensing range	Long sensing range
Model No.	**PX-22**	**PX-21**	**PX-24**	**PX-24ES**	**PX-23ES**	**PX-26**
Sensing range (OUT 1 and OUT 2 areas) (Note 1)	3m	1m	3m		1m	5m
Hysteresis	15% or less of operation distance					
Supply voltage	10 to 31V DC including ripple					
Power consumption (Note 2)	Under operation: 1.5W or less, Under sleep condition: 0.3W or less (without auxiliary sensor)					
OUT 1 (OR circuit among the effective center, left, right, adjacent left/right OUT 1 areas and the effective auxiliary left/right areas) OUT 2 (OR circuit among the effective center, left and right OUT 2 areas)	NPN open-collector transistor • Maximum sink current: 100mA • Applied voltage: 40V DC or less (between OUT 1/OUT 2 and 0V) • Residual voltage: 1.5V or less (at 100mA sink current) 0.4V or less (at 16mA sink current)					
Utilization category	DC-12 or DC-13					
Output operation	Selectable either Light-ON or Dark-ON with a switch (Output operation of OUT 1 and OUT 2 is the same.)					
Short-circuit protection	Incorporated					
Extraneous light monitor output	———		NPN open-collector transistor • Maximum sink current: 100mA • Applied voltage: 40V DC or less (between extraneous light monitor output and 0V) • Residual voltage: 1.5V or less (at 100mA sink current) 0.4V or less (at 16mA sink current)			
Output operation	———		ON when modulated beam other than its own (including auxiliary sensor's) light is received			
Short-circuit protection	———		———			
Response time	80ms or less					
Operation indicators: OUT 1 area	Red LED (lights up when the beam is received in the effective OUT 1 areas)					
Operation indicators: OUT 2 area	Yellow LED (lights up when the beam is received in the effective OUT 2 areas)					
Sensitivity adjuster	Continuously variable adjusters (OUT 1, adjacent right OUT 1, adjacent left OUT 1 and OUT 2 areas are adjusted independently.)					
External sensitivity adjustment function	———		Sensitivity adjustment is possible with an analog input.			
Sensing area	Four sensing areas are selectable with dip switches.			Four sensing areas are selectable with dip switches, and eight sensing areas are selectable with external inputs.		Fixed
Sleep function	Operating/sleep selectable with external input					
Automatic interference prevention function	Optical interference from up to 25 units is prevented.					
Environmental resistance: Pollution degree	3 (Industrial environment)					
Environmental resistance: Protection	IP65 (IEC)					
Environmental resistance: Ambient temperature	−10 to +55°C (No dew condensation or icing allowed), Storage: −20 to +70°C					
Environmental resistance: Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH					
Environmental resistance: Ambient illuminance	Sunlight: 9,000ℓx at the light-receiving face, Incandescent light: 3,000ℓx at the light-receiving face					
Environmental resistance: EMC	Emission: EN50081-2, Immunity: EN50082-2					
Environmental resistance: Voltage withstandability	1,000V AC for one min. between all supply terminals connected together and enclosure					
Environmental resistance: Insulation resistance	20MΩ, or more, with 500V DC megger between all supply terminals connected together and enclosure					
Environmental resistance: Vibration resistance	10 to 500Hz frequency, 3mm amplitude (20G max.) in X, Y and Z directions for two hours each					
Environmental resistance: Shock resistance	500m/s² acceleration (50G approx.) in X, Y and Z directions for three times each					
Emitting element	Infrared LED (modulated)					
Material	Enclosure: ABS, Lens: Acrylic, Cover: Polycarbonate					
Cable	0.3mm² 5-core cabtyre cable, 0.5m long (for input and output)		For input and output: 0.18mm² 9-core (**PX-24ES** and **PX-23ES**: 12-core) cabtyre cable, 0.5m long For auxiliary sensor connection: 0.18mm² 10-core connector attached cabtyre cable, 0.5m long			
Cable extension	Extension up to total 100m (10m for auxiliary sensor connection) is possible with 0.3mm², or more, cable.					
Weight	170g approx.		210g approx.	220g approx.		210g approx.
Accessories	**MS-PX-2** (Main sensor mounting bracket): 1 set, Adjusting screwdriver: 1 No., Matrix chart for sensing areas and external inputs: 1 sheet (**PX-24ES** and **PX-23ES** only)					

Notes: 1) The sensing range is specified for white non-glossy paper (300 × 300mm).
2) Obtain the current consumption by the following calculation.
Current consumption = Power consumption ÷ Supply voltage
(e.g.) When the supply voltage is 12V, the current consumption (operating condition) is: 1.5W ÷ 12V = 0.125A = 125mA

SPECIFICATIONS

Auxiliary sensor (Note 1)

Item / Model No.	PX-SB1
Applicable main sensor	**PX-24, PX-24ES, PX-23ES** or **PX-26**
Connectable units	Up to two **PX-SB1**'s can be connected to one main sensor.
Sensing range (Note 2)	700mm
Supply voltage	Supplied from the main sensor
Current consumption	Current consumption of the main sensor increases by 30mA approx. per auxiliary sensor.
Output	OR circuit with the main sensor's OUT 1
Operation indicator	Red LED (lights up when the beam is received)
Sensitivity adjuster	Continuously variable adjuster
Emitting element	Infrared LED (modulated)
Material	Polycarbonate
Cable	0.3mm² 5-core cabtyre cable, 2m long
Cable extension	Extension up to total 10m is possible with 0.3mm², or more, cable.
Weight	130g approx.
Accessories	**MS-NX5-1** (Auxiliary sensor mounting bracket): 1 set, Adjusting screwdriver: 1 No.

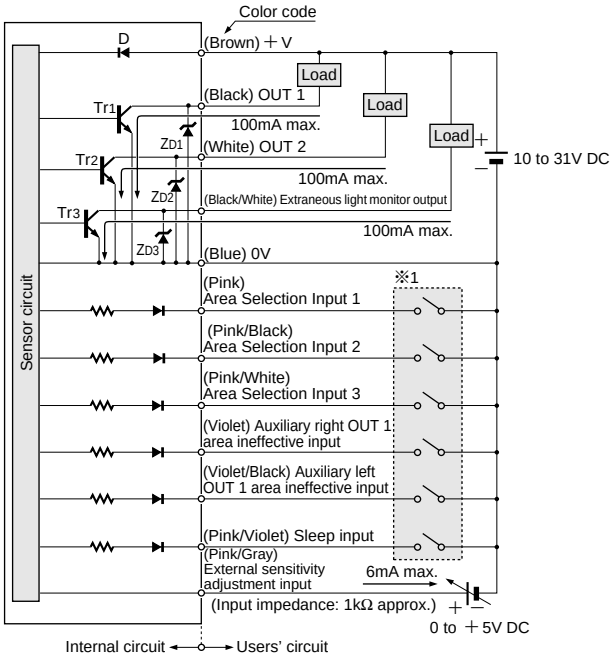
Specifications other than the above are identical with the main sensor.

Notes: 1) The auxiliary sensor cannot be used as a stand-alone unit.
2) The sensing range is specified for white non-glossy paper (300 × 300mm) as the object.

I/O CIRCUIT AND WIRING DIAGRAMS

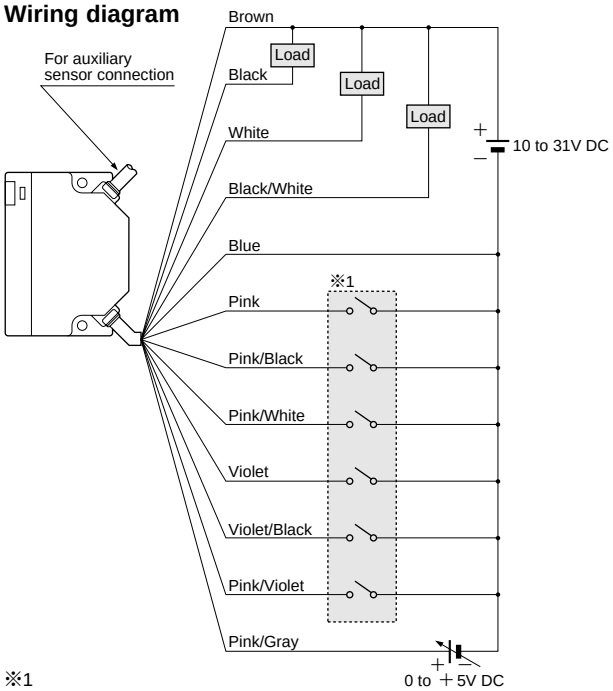
PX-24ES PX-23ES

I/O circuit diagram



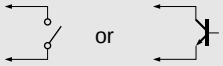
Symbols ... D: Reverse supply polarity protection diode
Z_{D1}, Z_{D2}, Z_{D3}: Surge absorption zener diode
Tr_1, Tr_2, Tr_3 : NPN output transistor

Wiring diagram



※1

Non-voltage contact or NPN open-collector transistor



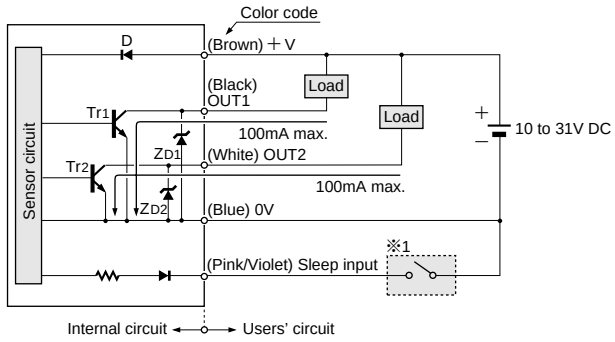
- Area selection input
  Low (0 to 1V): depends on the logic combination (refer to P.302)
  High (4.5 to 31V, or open): depends on the logic combination (refer to P.302)
- Auxiliary area ineffective input
  Low (0 to 1V): area ineffective
  High (4.5 to 31V, or open): area effective
- Sleep input
  Low (0 to 1V): sleep condition
  High [(supply voltage − 1V) to 31V, or open]: operating condition

PX-2

I/O CIRCUIT AND WIRING DIAGRAMS

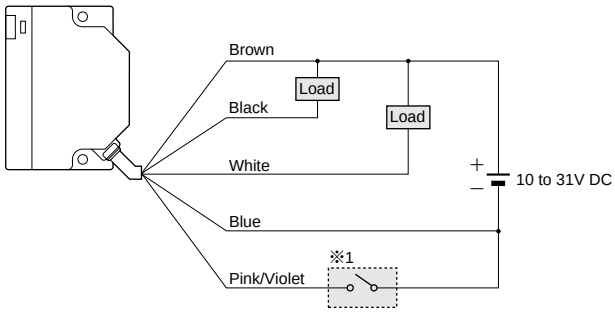
PX-22
PX-21

I/O circuit diagram



Symbols ... D: Reverse supply polarity protection diode
Z_{D1}, Z_{D2}: Surge absorption zener diode
Tr_1, Tr_2 : NPN output transistor

Wiring diagram



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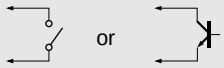
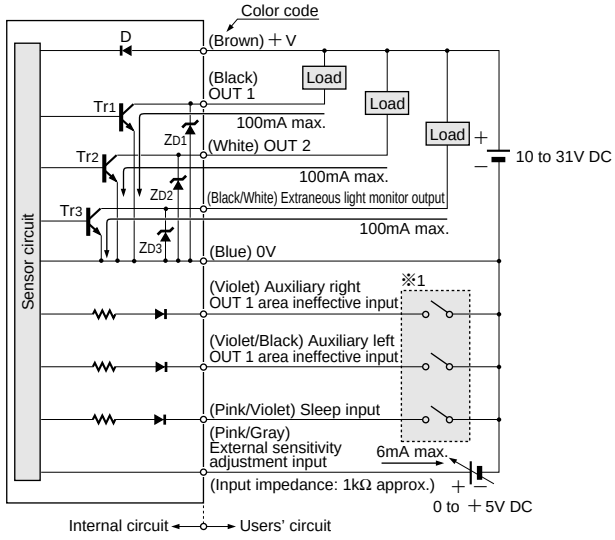
Non-voltage contact or NPN open-collector transistor



- Low (0 to 1V): sleep condition
- High [(supply voltage − 1V) to 31V, or open]: operating condition

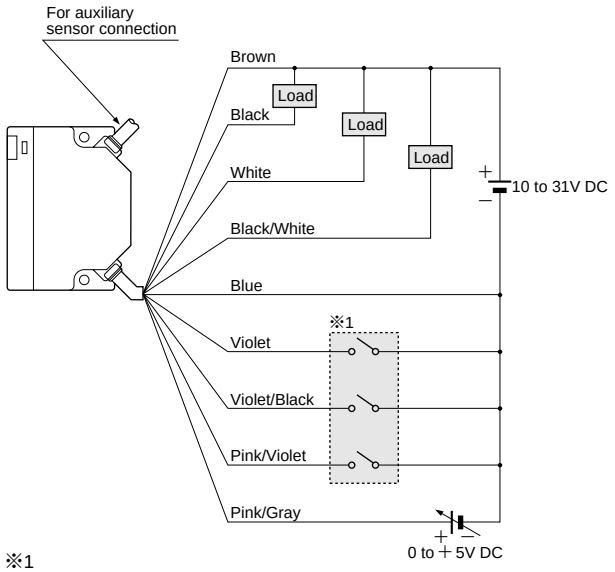
PX-24
PX-26

I/O circuit diagram



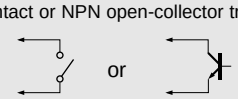
Symbols ... D: Reverse supply polarity protection diode
Z_{D1}, Z_{D2}, Z_{D3}: Surge absorption zener diode
Tr_1, Tr_2, Tr_3 : NPN output transistor

Wiring diagram



※1

Non-voltage contact or NPN open-collector transistor

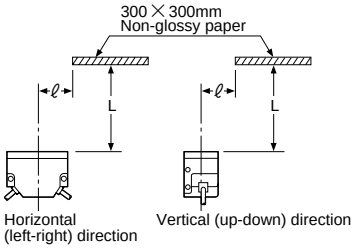


- Auxiliary area ineffective input
  Low (0 to 1V): area ineffective
  High (4.5 to 31V, or open): area effective
- Sleep input
  Low (0 to 1V): sleep condition
  High [(supply voltage − 1V) to 31V, or open]: operating condition

SENSING CHARACTERISTICS (TYPICAL)

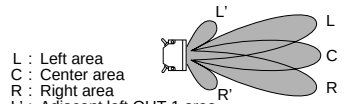
How to read sensing characteristics

• Sensing field



Note: The sensitivity has been adjusted so that the maximum sensing range for white non-glossy paper (300 × 300mm) is 3m (1m for **PX-21** and **PX-23ES**, 5m for **PX-26**) with the L, C and R areas effective.

Sensing area

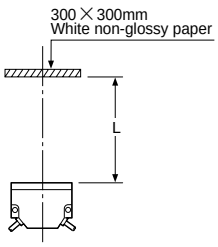


L : Left area
C : Center area
R : Right area
L' : Adjacent left OUT 1 area
R' : Adjacent right OUT 1 area

Sensing object

Type of non-glossy paper
White non-glossy paper (lightness: 9)
Gray non-glossy paper (lightness: 5)
Black non-glossy paper (lightness: 2)

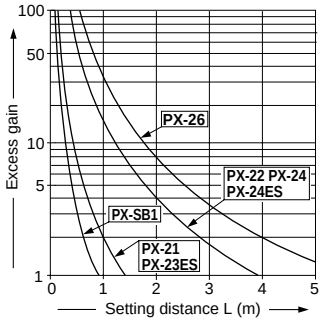
• Correlation between external sensitivity adjustment input voltage and sensing range



It shows the variation in the sensing range when the external input voltage is changed from 0 to +5V with the sensitivity adjuster set at the maximum sensing range.

All models

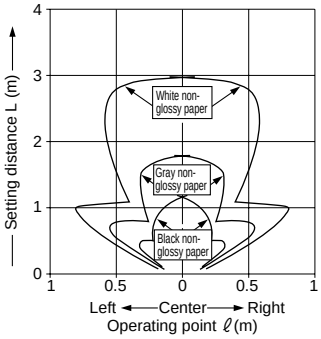
Correlation between setting distance and excess gain



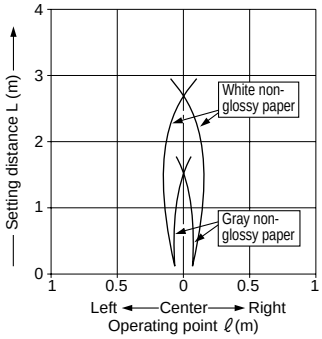
PX-22 PX-24 PX-24ES

Sensing fields

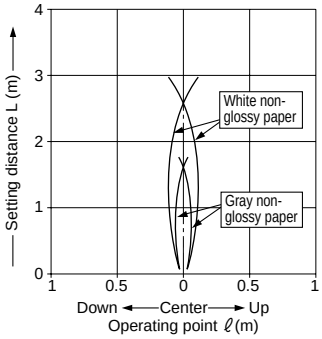
• All areas effective (Horizontal)



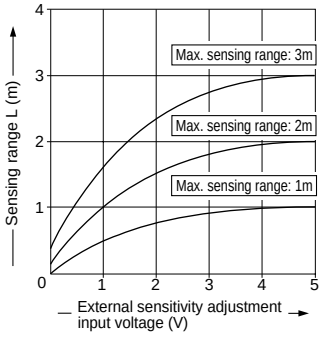
• C area effective (Horizontal)



• All areas effective (Vertical)



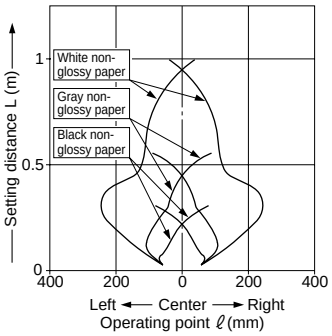
Correlation between external sensitivity adjustment input voltage and sensing range (Excluding PX-22)



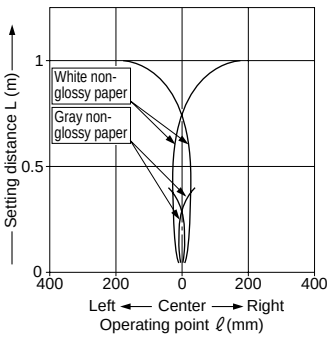
PX-21 PX-23ES

Sensing fields

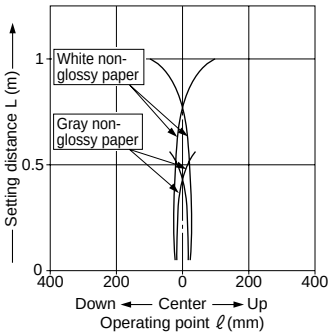
• All areas effective (Horizontal)



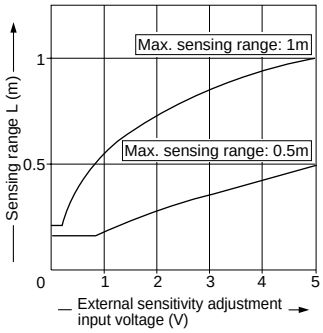
• C area effective (Horizontal)



• All areas effective (Vertical)



Correlation between external sensitivity adjustment input voltage and sensing range (PX-23ES only)



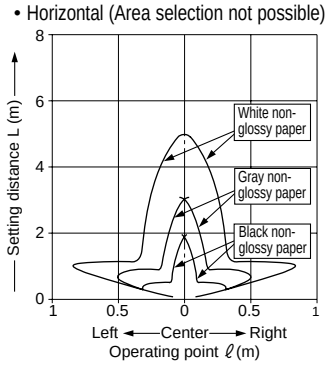
PX-2

SENSING CHARACTERISTICS (TYPICAL)

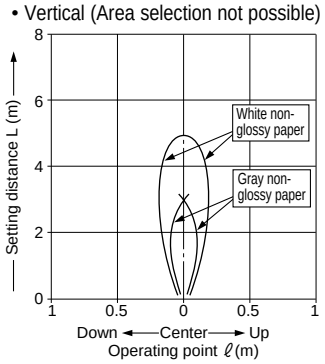
PX-26

Sensing fields

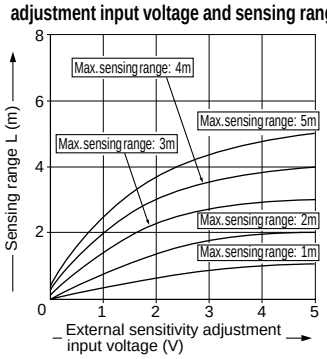
• Horizontal (Area selection not possible)



• Vertical (Area selection not possible)



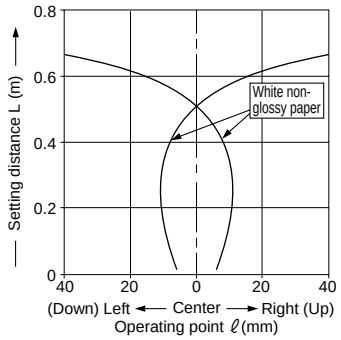
Correlation between external sensitivity adjustment input voltage and sensing range



PX-SB1

Sensing field

• Horizontal and vertical directions



PRECAUTIONS FOR PROPER USE

Refer to P.820～ for general precautions.

All models

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.

Hazard Indications

In this Instruction Manual, ⚠WARNING and ⚠CAUTION are indicated depending upon the level of danger. Please observe them strictly for the safe use of this sensor.

⚠WARNING

'**WARNING**' indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

⚠CAUTION

'**CAUTION**' indicates a hazardous situation that, if not avoided, may result in minor or moderate injury.
Further, they also indicate the condition of risk of physical damage to machinery.

⚠WARNING

• **Installation of a touch bumper**

You are requested to always install a touch bumper when this product is used on an automatic guided vehicle (AGV).

⚠CAUTION

• **Use outside Japan**

This sensor conforms to the EMC Directive. However, it is not certified by a competent body in accordance with other overseas safety standards. Since each country has its regulations, please follow the local and national regulations of the country where this sensor is used.

⚠CAUTION

• **Fail-safe measures**

This sensor is meant for proximity detection and does not possess control functions for safety maintenance.
If fail-safe measures are required, consider their incorporation in the total system.
Further, do not connect the sensor output directly to a stopping mechanism (brake).

⚠CAUTION

• **Periodical maintenance check**

The person incharge must periodically confirm the performance of the product and maintain a record of such checks. In addition, whenever the operating environment of the product is changed due to system modification, etc., performance check must be done.

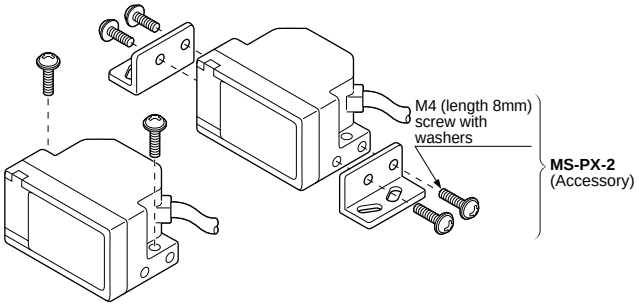
PRECAUTIONS FOR PROPER USE

Refer to P.820～ for general precautions.

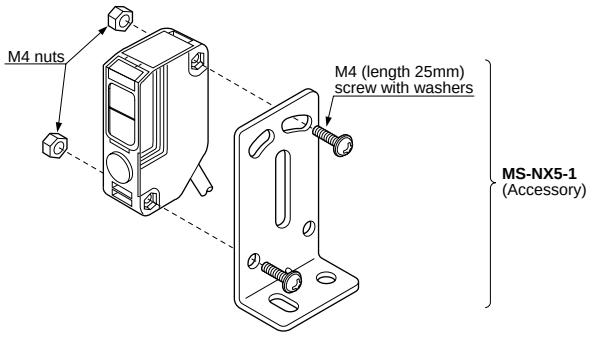
All models

Mounting

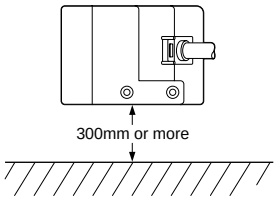
• The tightening torque for the main sensor should be 1.2N·m or less.



• The tightening torque for **PX-SB1** should be 0.8N·m or less.

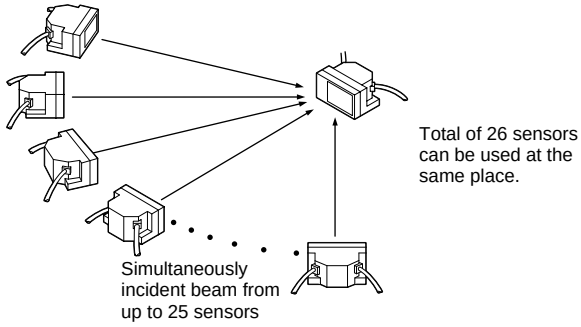


• Mount the sensor, horizontally, at least 300mm above the floor, to avoid reflection from the floor.



Automatic interference prevention function

• In case several sensors are used at the same place, take care that the number of sensors from which beams may be simultaneously incident is 25 or less.

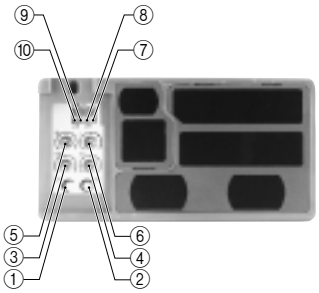


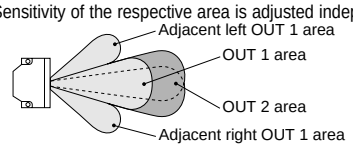
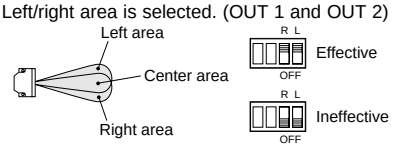
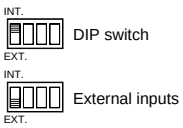
Sleep (stand-by) function

• When the sleep input is made Low, the sensor goes into the sleep state and the operation can be stopped.

Notes: 1) Response time of the sleep input is 50ms.
2) Reactivation from the sleep state to the operation state takes 0.7 sec. approx.
Operation during this transient state should be avoided.
3) When the sleep function is not used, keep the sleep input line open or insulated and prevent contact with other wires.

Functional description



	Description		Function
①	Operation indicator	OUT 2 area (Yellow LED)	Lights up when light is received in OUT 2 area.
②		OUT 1 area (Red LED)	Lights up when light is received in OUT 1 area.
③	Sensitivity adjuster	OUT 2 area	Sensitivity of the respective area is adjusted independently. 
④		OUT 1 area	
⑤		Adjacent right OUT 1 area	
⑥		Adjacent left OUT 1 area	
⑦	Sensing area selection switch (Note 1)	Left area	Left/right area is selected. (OUT 1 and OUT 2) 
⑧		Right area	
⑨	Output operation mode switch		Output operation mode of OUT 1 and OUT 2 is selected. 
⑩	External control switch (Note 2)		This switch designates whether the sensing area selection is made by the DIP switches or the external inputs. 

Notes: 1) **PX-26** does not incorporate it.
2) **PX-24ES** and **PX-23ES** incorporate it.

Sensitivity adjustment

Step	Sensitivity adjuster	Operation
①		Make sure that the output operation mode selection switch is set to L-ON (ON when receiving light), and then turn the sensitivity adjuster fully counterclockwise.
②		Place an object to be detected at the required sensing position, and turn the sensitivity adjuster gradually clockwise and mark the point Ⓐ where the indicator (Note 1) turns on.
③		Remove the object and turn the sensitivity adjuster further clockwise. Find out the point Ⓑ where the indicator turns on again. Make sure that the difference between point Ⓐ and Ⓑ is 1 div., or more, on the scale. Then, set the sensitivity adjuster at point Ⓐ.
④	———	Carry out steps ①, ② and ③ for each of the areas OUT 2, OUT 1, adjacent left/right OUT 1 and auxiliary sensors (if they are connected).
⑤	———	After all the adjustments are made, the operator must confirm that the sensing area is set correctly by observing the detection of the object as it approaches from different directions.

Notes: 1) When adjusting the sensitivity of OUT 1 area, adjacent right OUT 1 area and adjacent left OUT 1 area, this is the OUT 1 area operation indicator (red).
When adjusting the sensitivity of OUT 2 area, this is the OUT 2 area operation indicator (yellow).
2) Set areas other than the area you are adjusting as ineffective.
3) Use the accessory screwdriver to slowly turn the sensitivity adjuster. Turning with excessive force will damage the adjuster.

PX-2

PRECAUTIONS FOR PROPER USE

Refer to P.820～ for general precautions.

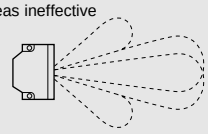
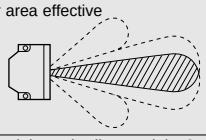
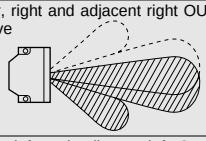
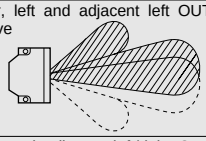
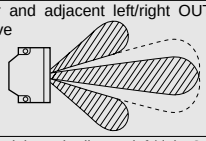
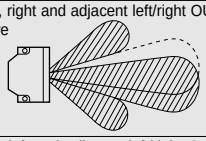
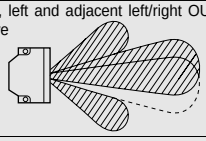
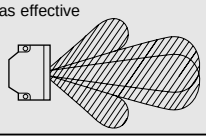
All models

Others

- Do not use during the initial transient time (0.7 sec.) after the power supply is switched on.
- Take care that an initial rush current (1.5A approx. at 10V DC and 5A approx. at 31V DC) will flow when the power supply is switched on.

PX-22 PX-21 PX-24 PX-24ES PX-23ES

Sensing area selection

Sensing area \ Setting method	Internal setting (INT. / EXT.)	Area selection inputs (Note) (PX-24ES and PX-23ES only) Input 1	Input 2	Input 3
All areas ineffective 	———	L	L	L
Center area effective 	———	H	L	L
Center, right and adjacent right OUT 1 areas effective 	———	L	H	L
Center, left and adjacent left OUT 1 areas effective 	———	H	H	L
Center and adjacent left/right OUT 1 areas effective 	R L OFF	L	L	H
Center, right and adjacent left/right OUT 1 areas effective 	R L OFF	H	L	H
Center, left and adjacent left/right OUT 1 areas effective 	R L OFF	L	H	H
All areas effective 	R L OFF	H	H	H

L: Low (0 to 1V), H: High (4.5 to 31V, or open)
Note: The response time of the area selection inputs is 80ms.

PX-24 PX-24ES PX-23ES PX-26

External sensitivity adjustment function

- The sensitivity can be adjusted, within the range set by the manual sensitivity adjuster, by an analog voltage (0 to ＋5V) applied to the external sensitivity adjustment input. The sensitivity varies with the magnitude of the applied voltage.

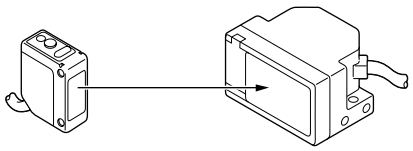
Notes: 1) The sensitivity of the auxiliary sensor is not changed.
2) Sensitivity adjustment beyond the range set by the manual sensitivity adjuster is not possible.

Input voltage	0 V ⟷	＋5V or open
Sensitivity	Minimum ⟷	Maximum (Maximum sensitivity set by the manual sensitivity adjuster)

Note: This wire should be insulated if it is not used.

Extraneous light monitor function
(Incorporated in **PX-24**, **PX-24ES**, **PX-23ES** and **PX-26** only)

- If the sensor receives modulated light other than its own (including auxiliary sensor's) light, the extraneous light monitor output turns ON. The operation of the extraneous light monitor output has absolutely no affect on sensing. It is useful for recognizing presence of other sensors near this sensor in case of intersecting AGV paths, etc.



Note: The extraneous light monitor output is not incorporated with a short-circuit protection circuit. Do not connect it directly to a power supply or a capacitive load.

PRECAUTIONS FOR PROPER USE

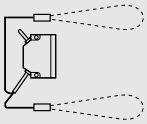
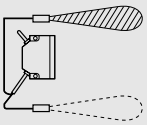
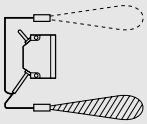
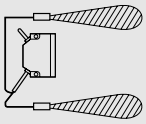
Refer to P.820～ for general precautions.

PX-SB1

This sensor must always be used with the applicable main sensor. This sensor does not work as a stand-alone unit. (It cannot be used with PX-22 or PX-21.)

Selection of the auxiliary sensing areas

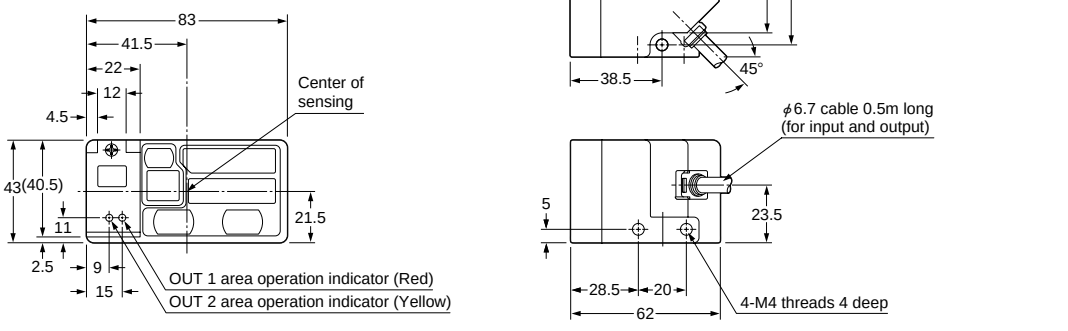
- The auxiliary sensing areas are controlled by the auxiliary area ineffective inputs of the main sensor.

Sensing area \ Area ineffective input	Auxiliary left OUT 1 area	Auxiliary right OUT 1 area
Auxiliary left/right OUT 1 areas ineffective 	L	L
Auxiliary left OUT 1 area effective 	H	L
Auxiliary right OUT 1 area effective 	L	H
Auxiliary left/right OUT 1 areas effective 	H	H

L: Low (0 to 1V), H: High (4.5 to 31V, or open)
Note: The ineffective auxiliary area inputs are not related to the external control switch on the main sensor.

DIMENSIONS (Unit: mm)

PX-2□ Main sensor

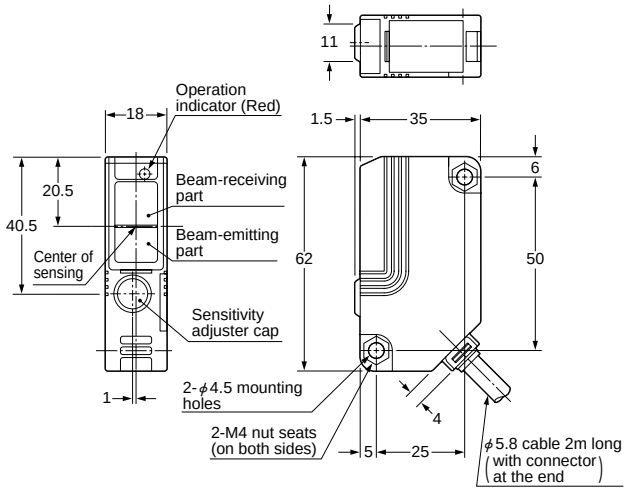


Note: **PX-22** and **PX-21** do not have this cable.

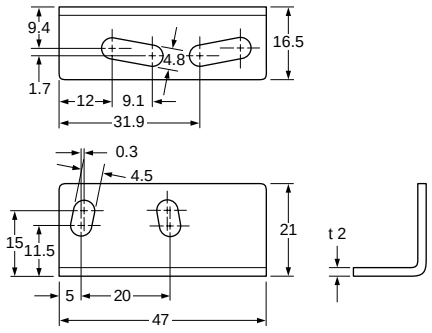
PX-2

DIMENSIONS (Unit: mm)

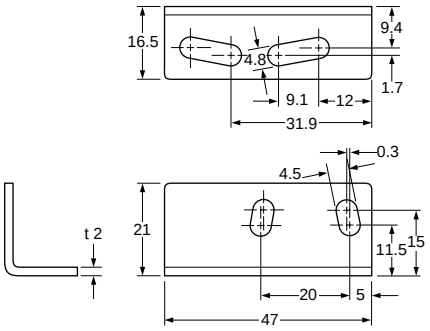
PX-SB1 Auxiliary sensor



MS-PX-2 Main sensor mounting bracket (Accessory for **PX-2**□)



Left side

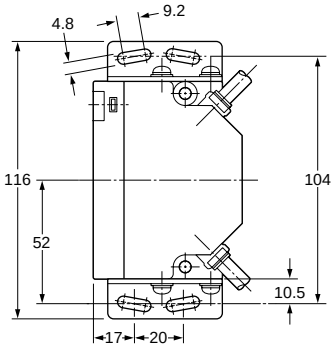


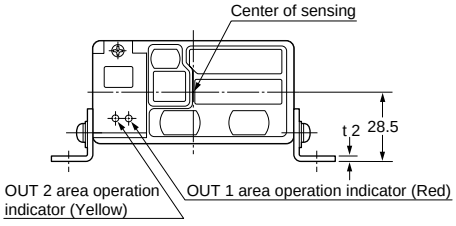
Right side

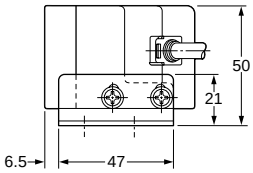
Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)
Four M4 (length 8mm) screws with washers are attached.

Assembly dimensions

Mounting drawing with **PX-24**

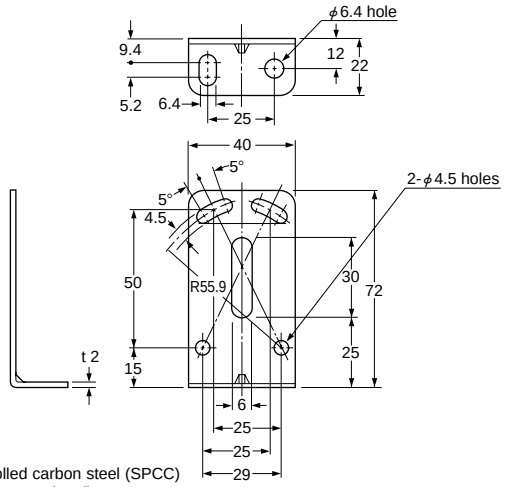






DIMENSIONS (Unit: mm)

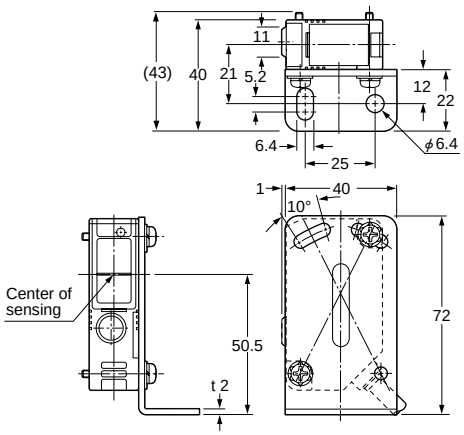
MS-NX5-1 Auxiliary sensor mounting bracket (Accessory for **PX-SB1**)



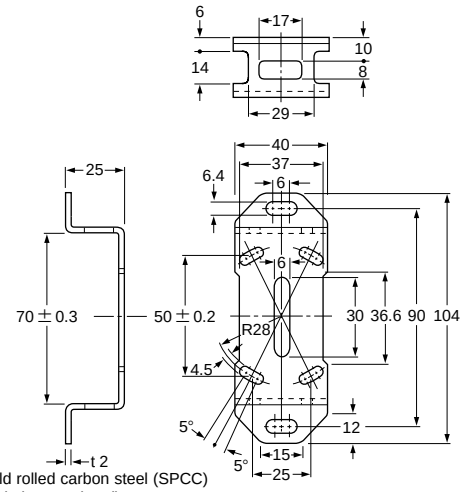
Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)

Two M4 (length 25mm) screws with washers and two M4 nuts are attached.

Assembly dimensions



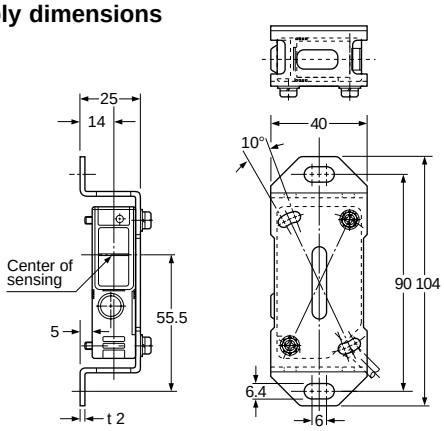
MS-NX5-2 Auxiliary sensor mounting bracket (Optional)



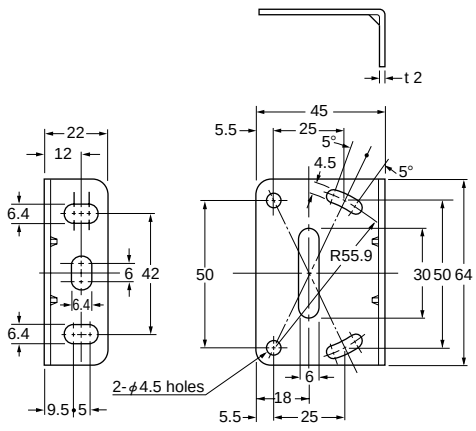
Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)

Two M4 (length 25mm) screws with washers and two M4 nuts are attached.

Assembly dimensions



MS-NX5-3 Auxiliary sensor mounting bracket (Optional)



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

Two M4 (length 25mm) screws with washers and two M4 nuts are attached.

Assembly dimensions