



# CCD Thrubeam Type Laser Sensor IG Series

## Instruction manual

Read this instruction manual carefully prior to operating the IG Series CCD Thrubeam Laser Sensor.

After reading, keep this manual in a safe place so that you can refer to it at any time.

- For details of each function, refer to "CCD Thrubeam Laser Sensor IG Series User's Manual".
- You can download "CCD Thrubeam Laser Sensor IG Series User's Manual" from KEYENCE homepage (<http://www.keyence.co.jp/>).

	Failure to follow these instructions may lead to injury.
	Failure to follow these instructions may lead to product damage (product malfunction, etc.).
	This provides additional helpful information to ensure your understanding of the unit's functions.
	This references information that will aid your understanding of the text descriptions.

### Safety Information for IG series

#### General precautions

- At startup and during operation, be sure to monitor the functions and performance of this product and confirm normal operation.
- We recommend that you take substantial safety measures to avoid any damage in the event that a problem occurs.
- If the product is modified or used in any way other than described in the specifications, its functions and performance cannot be guaranteed.
- Do not use this product for the purpose of protecting the human body.
- Do not subject this device to rapid temperature changes, otherwise product failure may occur.

	<ul style="list-style-type: none"> <li>The IG Series is intended for measuring objects. Do not use this product for the purpose of protecting the human body.</li> <li>This product is not made with an explosion proof construction. Do not use it in a location where any flammable gases, liquid, or powder exist.</li> </ul>
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### Safety Precautions on Laser Product

	<ul style="list-style-type: none"> <li>This product employs a semiconductor laser for its light source.</li> <li>Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.</li> <li>Follow the instructions mentioned in this manual. Otherwise, injury to the human body (eyes and skin) may result.</li> </ul> <p>Precautions on class 1 laser products</p> <ul style="list-style-type: none"> <li>Do not disassemble this product. Laser emission from this product is not automatically stopped when it is disassembled.</li> <li>Do not stare into the beam.</li> </ul>
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Sensor head	IG-010/028
Wavelength	660 nm
Output	62 μW
Pulse width	48 μs
FDA(CDRH)Part1040.10*	Class 1 Laser Product
IEC60825-1	Class 1 Laser Product

\* The classification is based on IEC60825-1 standard following the Laser Notice No. 50 from FDA (CDRH).

#### Laser emission stop input

When the laser emission stop input is activated, the laser emission stops by setting the external input to ON (for 2 ms or more). The laser emission continues to stop while the external input is ON. When the external input is set to OFF, the laser is emitted within 2 ms. For details of the discrete outputs or analog output conditions during the laser emission stop input, refer to the User's Manual "11. External input".

### Abnormal conditions

	<p>If the following conditions occur, turn off the power immediately. Continuing to use this product under abnormal conditions may cause product failure.</p> <ul style="list-style-type: none"> <li>When water or foreign matter enters the IG Series</li> <li>When the IG Series is dropped or the case is damaged</li> <li>When the IG Series produces smoke or an unpleasant smell</li> </ul>
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### Precautions on use

	<ul style="list-style-type: none"> <li>Use with the specified power source and voltage. Otherwise, fire, electric shock or product failure may result.</li> <li>Never disassemble or modify this product. Fire or electric shock may result.</li> </ul>
	<ul style="list-style-type: none"> <li>Before disconnecting the cables, make sure to turn off the main unit and devices connected to the main unit. Otherwise, the unit could be damaged.</li> <li>Do not turn off the power to the unit while it is being programmed. Some or all of the set data may be lost.</li> </ul>

#### Installation environment

To ensure that it is being safely used, do not install this product in the following locations.

- High-humidity, dusty and poorly-ventilated locations.
- High-temperature locations where the unit is exposed to direct sunlight.
- Locations where there is corrosive gas or combustible gas.
- Locations where the unit may be directly subjected to vibration or impact.
- Locations where water, oil, or chemicals may splash onto the unit.
- Locations where the static electricity tend to be generated.

#### Influence of dirt

- Measurement errors may occur due to dust, water, oil, etc.
- Remove such dirt stuck to transmitter and receiver with either an air purge or wipe with a soft cloth moistened with alcohol for heavy dirt. If the transmitter and receiver get scratched, measurement errors may occur.
- Remove dirt attached to the target with either an air purge or it off.
- If dirt is floating within the measurement range, take adequate measures, such as installing a dust protection cover or air purging.

#### Anti-noise prevention

When the unit is installed near a noisy source such as a power generator or high-voltage line, operational errors or product failure may occur. Take adequate measures such as using a noise filter, arranging cords appropriately, or insulating the amplifier and sensor head.

#### Warm up

Wait approximately 10 minutes after power up before using the IG series so as to allow for the display value to stabilize upon warm up.

### Other Precautions

#### Power source

- Operation errors may occur due to noise superimposed upon the power source. Make certain to use the direct current stabilized power source which uses an insulation transformer.
- When using a commercially available switching regulator, make sure to properly ground the frame.

### Precautions on UL Certificate

The IG series complies with the following UL and CSA standards. The IG series has obtained UL and C-UL certificate.

- Applicable standard UL508 Industrial Control Equipment
- CAN/CSA C22.2 No. 14-M05 Industrial Control Equipment
- UL File No.E301717
- UL category: NRKH, NRKH7

#### Precautions

- The IG series must have its power supplied from a Class 2 power source according to NFPA70 (NEC: National Electrical Code).
- The UL certificate for the IG series is for the sensor head and amplifier used in combination. The IG series sensor head must be used together with the IG series sensor amplifier unit exclusively.
- Power supply/Control input/Control output shall be connected to a single Class2 source only.
- Use with over current protection device which is rated 30V or more and not more than 1A.

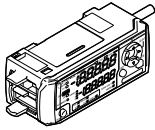
## Checking the Package Contents

Before using the unit, confirm that the parts and equipment listed below are included in the package of the model you purchased.

### ■ Sensor amplifier

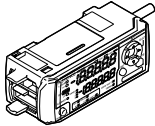
#### ● DIN rail mount type

IG-1000 (main unit)



Amplifier x 1      Instruction manual x 1

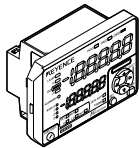
IG-1050 (expansion unit)



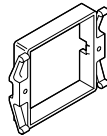
Amplifier x 1

#### ● Panel mount type

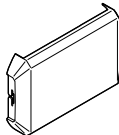
IG-1500 (main unit)



Amplifier x 1



Panel mounting  
tool  
x 1



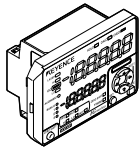
Front protection  
cover  
x 1



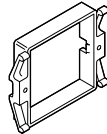
Power/Input-  
output cable (2 m)  
x 1  
(Number of cable  
cores: 12)

Instruction manual x 1

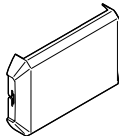
IG-1550 (expansion unit)



Amplifier x 1



Panel mounting  
tool  
x 1



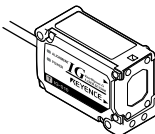
Front protection  
cover  
x 1



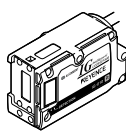
Expansion cable  
(50 mm) x 1

### ■ Sensor head

IG-010 (10 mm width)



Transmitter (T) x 1

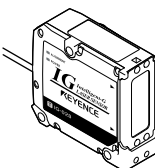


Receiver (R) x 1

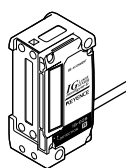


Sensor head  
connection cable x 2  
(2 m)

IG-028 (28 mm width)



Transmitter (T) x 1



Receiver (R) x 1



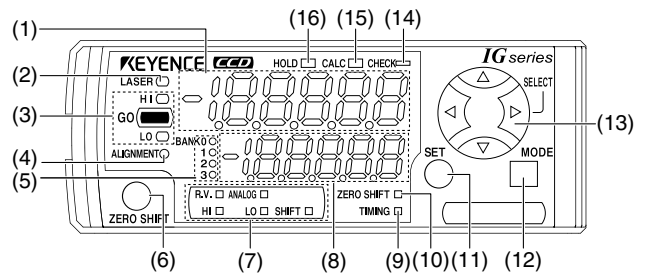
Sensor head  
connection cable x 2  
(2 m)

We have thoroughly inspected the package contents before shipment. However, in the event of defective or broken items, please contact your nearest KEYENCE office.

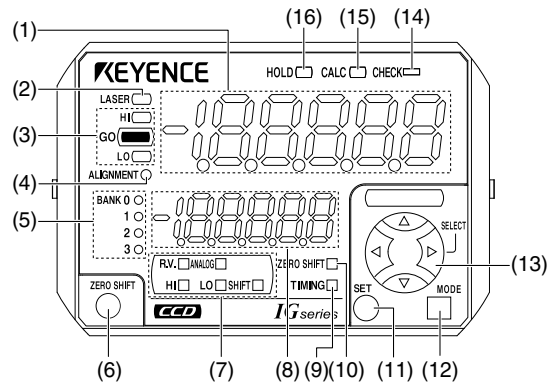
## Part names

### ■ Sensor amplifier

#### ● DIN rail mount type (IG-1000/IG-1050)

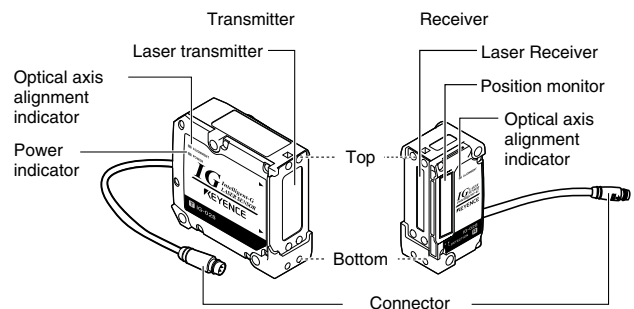


#### ● Panel mount type (IG-1500/IG-1550)



- (1) Main display
- (2) Laser emission indicator [LASER]
- (3) Judgment indicator [HI / GO / LO]
- (4) Optical axis alignment indicator [ALIGNMENT]
- (5) Bank indicator [BANK 0 to 3]
- (6) Zero shift button [ZERO SHIFT]
- (7) Sub display identification indicator [R.V. / ANALOG / HI / LO / SHIFT]
- (8) Sub display
- (9) Timing input indicator [TIMING]
- (10) Zero shift indicator [ZERO SHIFT]
- (11) SET button [SET]
- (12) MODE button [MODE]
- (13) Arrow buttons
- (14) Check indicator [CHECK]
- (15) Calculation indicator [CALC]
- (16) Hold indicator [HOLD]

### ■ Sensor head



#### Note

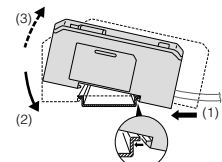
Use the transmitter and receiver in combination with the same serial number. If they are used in combination with different serial numbers, the operation and accuracy are not guaranteed. The serial number is located on top of the transmitter and receiver.

Transmitter	Receiver
SERIAL No. 12345678	No. 12345678

## Mounting the Amplifier

### ■ DIN rail mount type, main unit (IG-1000)

Align the claw at the bottom of the main body with the DIN rail. While pushing the main body in the direction of the arrow (1), tilt the amplifier in the direction of the arrow (2).



To remove the amplifier, raise the main body in the direction of the arrow (3) while pushing it in the direction of the arrow (1).

## ■ DIN rail mount type, expansion unit (IG-1050)

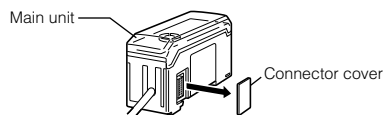
Up to 3 expansion units can be connected to one main unit.

	<ul style="list-style-type: none"> <li>When connecting multiple amplifiers (expansion units), first check to make sure that the power is turned off to all of the main and expansion units. Connecting the units with the power turned on could damage them.</li> <li>Push the amplifiers (expansion units) as far as possible into the main unit. If they are connected at an angle or not inserted securely, the units could get damaged.</li> </ul>
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### Note

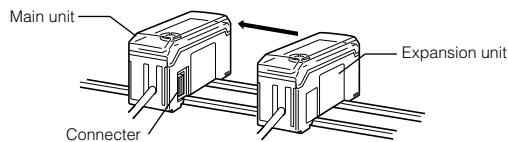
- When connecting the expansion units, make sure to initialize the expansion units and set the output polarity.
- When turning on the amplifier for the first time after connecting the sensor head please reference  
"Operation When the Power is Turned on for the First Time" (page 6)
  - When initializing the unit please reference  
"Initial Reset (Initialize)" (page 7)
- Expansion units with different setting of output polarity (such as an NPN output expansion unit to a PNP output main unit) cannot be connected together.
  - Expansion units using DIN rail mount cannot be connected to a panel mount style main unit.

- Remove the expansion protective cover from the IG-1000 (main unit).



- Install the amplifiers (main and expansion units) onto the DIN rail.

- Push the expansion unit into the main unit connector until a clicking sound can be heard.



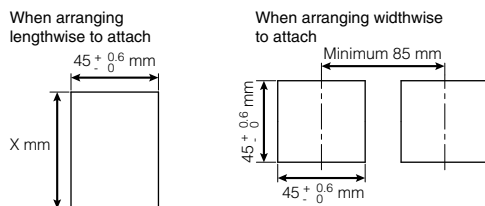
- Install the end units (OP-26751: 2 units per set) (sold separately) on both sides of the amplifiers (main or expansion units). Secure the end units in place with screws on top (2 on each end unit).  
The end units are mounted in the same way as the amplifiers.

### Note

Mount the amplifiers securely using the end units (OP-26751: 2 units per set) (sold separately) or a commercially available DIN rail mounting tool to prevent the amplifiers from slipping and coming off from the DIN rail due to machine vibration.

## ■ Panel mount type, main unit (IG-1500)

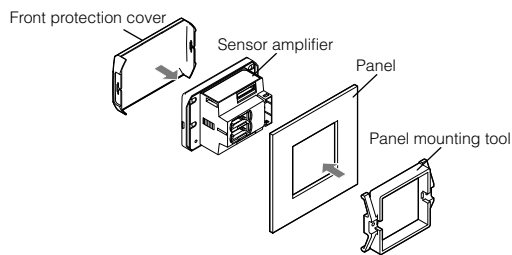
- Make a hole on the panel to attach according to the measurement below.



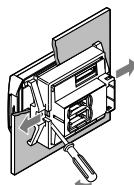
- Thickness of the panel mounting part 1 to 6 mm
- $X = 48 \times (\text{Number of amplifier}) - 3$

- Insert the back side of amplifier to the hole of the panel.

- Arrange the panel mounting tool in the direction below, mount to the amplifier from the back and attach the front protection cover to the amplifier.



To remove the panel mounting tool, widen the claws at both ends of the panel mounting tool using a slotted screwdriver, as demonstrated in the pictorial on the right.



## ■ Panel mount type, expansion unit (IG-1550)

Up to 3 expansion units can be connected to one main unit.

	<ul style="list-style-type: none"> <li>When connecting the expansion cable, make sure to turn off the power beforehand. Inserting or removing the cable with the power turned on may cause damage to the units.</li> <li>Push the expansion cable connector securely all the way. If it is connected at an angle or not inserted securely, the units could get damaged.</li> </ul>
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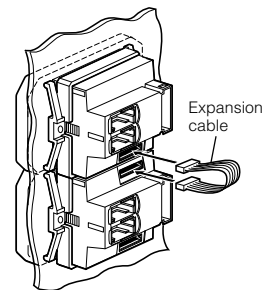
### Note

- When connecting the expansion units, make sure to initialize the connected expansion units and set the output polarity.
- When turning on the amplifier for the first time after connecting the sensor head please reference  
"Operation When the Power is Turned on for the First Time" (page 6)
  - When initializing the unit please reference  
"Initial Reset (Initialize)" (page 7)
- Expansion units with different setting of output polarity (such as an NPN output expansion unit to a PNP output main unit) cannot be connected together.
  - Expansion units using panel mount cannot be connected to a DIN rail mounted main unit.

- Make the appropriate number of hole in the panel according to the number of amplifiers required (main and connected expansion units).  
For the panel cutting measurement, refer to the "Panel mount type, main unit".

- Install the amplifiers (expansion units) on the panel.  
For the amplifier mounting method, refer to the "Panel mount type, main unit".

- Connect the amplifiers (main and expansion units) using the expansion cable (50 mm) supplied with the expansion unit.



When arranging the amplifiers as depicted in the pictorial on the left, the 300 mm expansion cable (OP-35361) is required.

## Mounting the Sensor Head

If the mounting distance between the transmitter and receiver is as follows, the optical axis alignment is not required when mounting within the "parallel acceptable range" and "tilt acceptable range".

- IG-010 : 3 to 500 mm
- IG-028 : 50 to 500mm

However if the distance is out of the above range(s), adjust the optical axis after mounting.

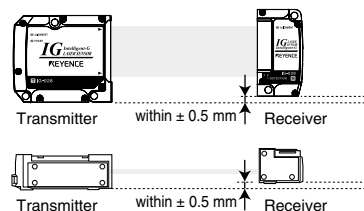
☐ "Optical axis alignment" (page 6)

### Note

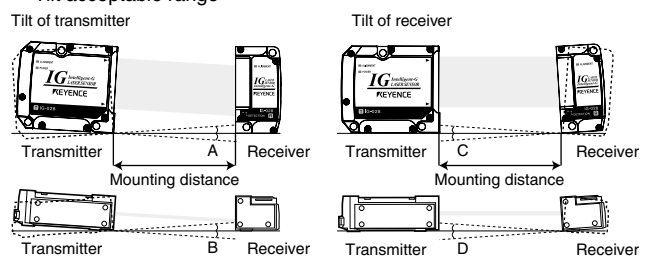
The minimum detectable object, linearity and temperature characteristics found in the specifications are valid only if the sensor head is mounted within the "parallel acceptable range" and "tilt acceptable range".

☐ "Specifications" (page 10)

### ● Parallel acceptable range



### ● Tilt acceptable range



Mounting distance	A	B	C	D
500 mm or less	within $\pm 0.05^\circ$	within $\pm 0.05^\circ$	within $\pm 1^\circ$	within $\pm 2^\circ$
100 mm or less	within $\pm 0.2^\circ$	within $\pm 0.2^\circ$	within $\pm 1^\circ$	within $\pm 2^\circ$

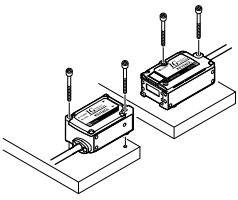
● When mounting the sensor head from the lateral side

Mounting from the sensor side

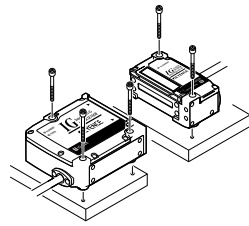
Mount using the commercially available screws (IG-010: M3, IG-028: M4)

Tightening torque: 1.6 N·m or less

IG-010



IG-028

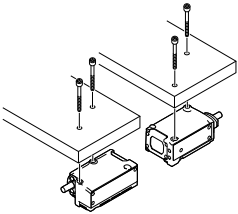


Mounting from the jig side

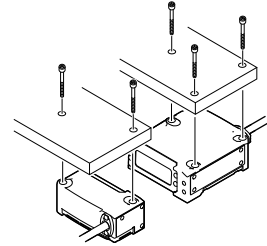
Mount using the commercially available screws (IG-010: M4, IG-028: M5, length: board thickness + 5 mm or less).

Tightening torque: 1.6 N·m or less

IG-010



IG-028

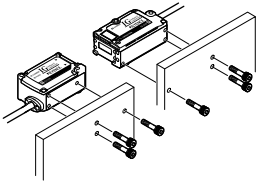


● When mounting from the bottom side

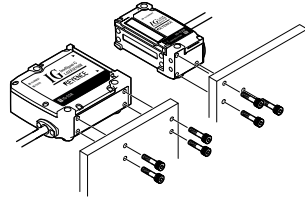
Mount using the commercially available screws (M3, length(IG-010): board thickness + 4 mm or less, length(IG-028): board thickness + 5 mm or less).

Tightening torque: 1.6 N·m or less

IG-010



IG-028



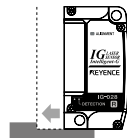
● When the mounting bracket (IG-TB01/IG-TB02: optional) is used

1

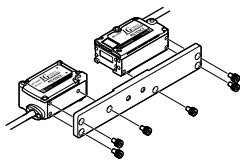
Attach the mounting bracket to the sensor head.

Press the sensor head to the mounting bracket firmly and mount with the hexagon socket head bolt (M3, length: 5 mm).

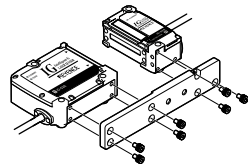
Tightening torque: 1.6 N·m or less



IG-010



IG-028

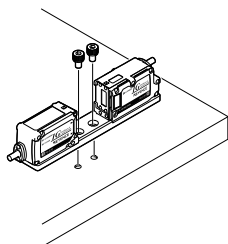


2

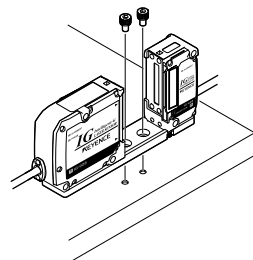
Mount the mounting bracket.

Use the commercially available hexagon socket head bolt (M4) to mount the mounting bracket through its holes.

IG-010



IG-028



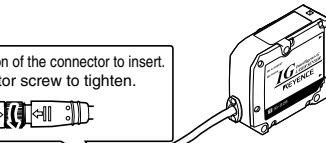
## Connection and Wiring

### ■ Connecting the sensor head and amplifier

1

Attach the sensor head connection cables to the transmitter and receiver cables respectively.

- (1) Align the arrow position of the connector to insert.
- (2) Rotate the connector screw to tighten.



The red O-ring is attached to the transmission cable and the blue O-ring to the receiver cable. Connect the sensor head connection cable with red O-ring attached to the transmitter and connect the sensor head connection cable with the blue O-ring attached to the receiver.

**Note**

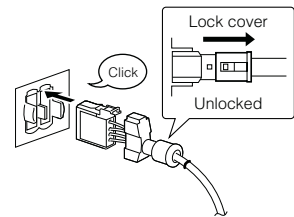
Tighten the connectors securely by hand.

If they are loose, the environment resistance IP67 cannot be guaranteed.

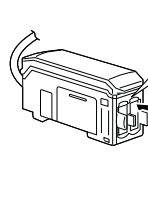
2

Attach the sensor head connection cable on the receiver side to the [R] connector of amplifier.

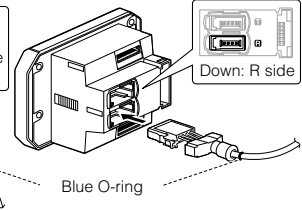
Remove the lock cover of the connector and insert it into the connectors (R) of amplifier until a clicking sound can be heard.



DIN rail mount type  
(IG-1000/IG-1050)

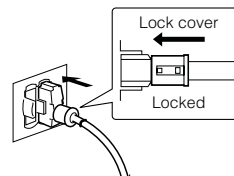


Panel mount type  
(IG-1500/IG-1550)



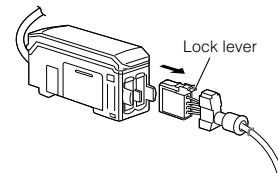
3

Attach the lock cover to the connector to secure the cable.



**Note**

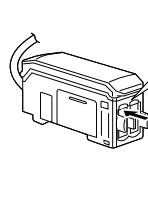
When removing the sensor head connection cable, push the lock lever and pull it out.



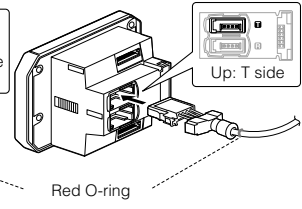
4

Attach the sensor head connection cable on the transmitter side to the [T] connector of amplifier.

DIN rail mount type  
(IG-1000/IG-1050)



Panel mount type  
(IG-1500/IG-1550)

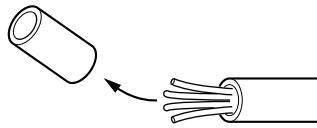


The connection procedure is the same as that for the receiver side.

## ■ Attaching the sensor head cable connector (OP-84338: optional)

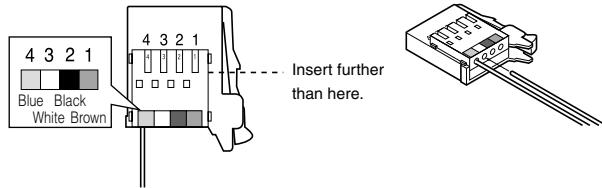
Cut the sensor head cable to the required length and attach the new connector to use the sensor. The method for attaching the connector is the same for both the transmitter and the receiver.

- 1 Cut the cable to the required length and strip approx. 15 mm of insulation from the end of it.

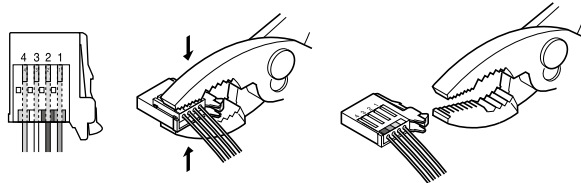


**Note** Do not strip the core wire insulation.

- 2 Insert each color coded cable into the same colored marked points on the connector.



- 3 Confirm that all the cables are inserted properly into the connector and crimp them using a pair of pliers or similar tool.

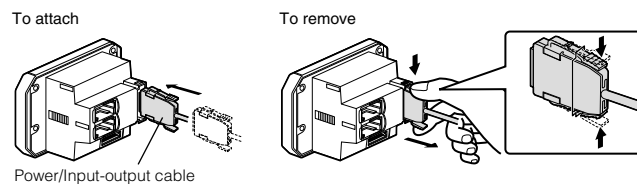


**Note** Once the connector has been installed, make sure to connect it to the amplifier and confirm that the sensor operates normally. Once the connector is crimped, it cannot be reused.

## ■ Amplifier wiring

- Connecting power/Input-output cable (IG-1500/IG-1550 panel mount type)

Connect the power/Input-output cable to the panel mount type main unit and Input-output cable to the expansion units.

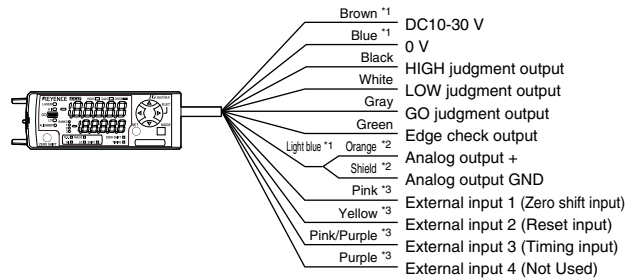


Power/Input-output cable

- Note**
- The number of core wires for the power/Input-output cable for the main unit is 12, and the number of core wires for the Input-output cable for the expansion units is 8.
  - Power for the expansion units is supplied from the main unit.
  - If the input-output cable is not used for the expansion units, cut the cable at the connector base, or terminate them separately for future use.

## ● Power/Input-output cable

The following information shows the details of power/Input-output cable. For information about the input-output circuit, see page 9 of this Instruction Manual.

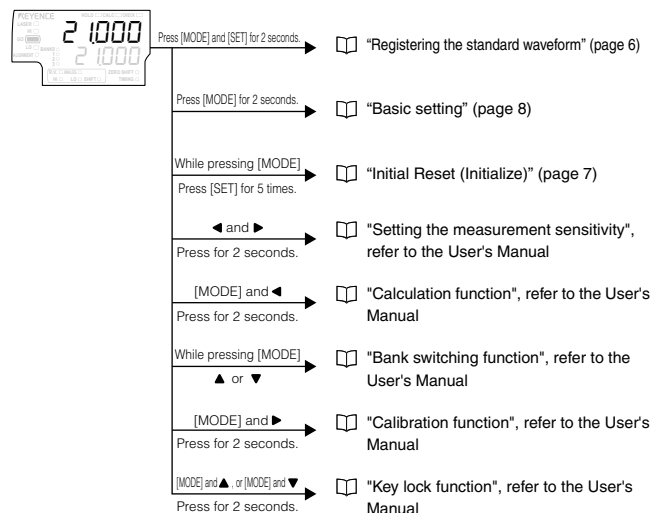


- \*1 IG-1050/IG-1550 (expansion unit) do not have brown, blue, or light blue wires. Power is supplied to the expansion units through IG-1000/IG-1500 (main unit).
- \*2 The Analog output can be set for the following: "Not used (OFF)", 0 - 5 V,  $\pm 5$  V, 1 - 5 V and 4 - 20 mA". Please reference, "Operation When the Power is Turned on for the First Time" (page 6) and "Initial Reset (Initialize)" (page 7)
- \*3 In addition to the selections noted on the pictorial above, the External inputs can also be selected to perform the following: Bank A, Bank B, Laser emission stop input and Not used (OFF). The Gain input can be selected only for the external input 4. For details, refer to the User's Manual.

## Amplifier functions and displays

### ■ Setting method

Basic display



### ■ Basic display

- R.V. (internal measurement value) and P.V. (judgment value)

R.V. (internal measurement value) means the value displayed when the desired object to be measured is inserted into the measurement range.

\* R.V. = Raw Value

P.V. (judgment value) is the value associated with the output state (ON or OFF) depending on the tolerance setting value. Also, the analog output is based on the P.V. value.

\* P.V. = Present Value

□ "Setting the Tolerance Setting Value" (page 6)

The P.V. (judgment value) and R.V. (internal measurement value) are basically the same, however, those values differ when the hold function and calculation function are used.

### ● Main display

P.V. (judgment value) is displayed on the main display.



Normal

The same value as the R.V. (internal measurement value) is displayed and the output will send its signal based on the value.



When the hold function is being used

The held value is displayed and the output will send its signal depending on the value.

For details, refer to the User's Manual.



When the calculation function is used

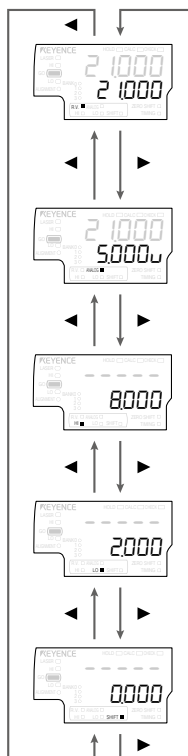
Main unit : The calculation result with expansion units is displayed and the output will send its signal depending on the value.

Expansion units : The P.V. (judgment value) on the expansion unit alone is displayed and the output will send its signal depending on the value.



## ● Sub display

The sub display switches each time the ◀▶ button is pressed. According to the type of displayed value selected, the sub display identification indicator will show one of the following: [R.V. / ANALOG / HI / LO / SHIFT]



### R.V. (internal measurement value)

The actual measurement value for the object is displayed. This displayed value is not held.

- With the pin size judging mode or pin interval judging mode, the R.V. (internal measurement value) for each pin size and each pin interval can be displayed.

☐ "1. Measurement mode" (page 8)

The analog output will only be displayed for the main unit and only when it is enabled.

The voltage value (unit: V) or current value (unit: mA) of the analog output is displayed.

☐ "Operation When the Power is Turned on for the First Time" (page 6)

☐ "Initial Reset (Initialize)" (page 7)

### HIGH side setting value

The upper limit of the acceptable range (tolerance setting value) for the object that is being measured is displayed. Also, the setting value can be changed. If the P.V. (judgment value) exceeds the value set here, the HIGH output signal will be sent.

☐ "Setting the Tolerance Setting Value" (page 6)

### LOW side setting value

The lower limit of the acceptable range (tolerance setting value) for the object that is being measured is displayed. Also, the setting value can be changed. If the P.V. (judgment value) falls below the value set here, the LOW output signal will be sent.

☐ "Setting the Tolerance Setting Value" (page 6)

### Shift target value

When the zero shift button is pressed or the zero shift input is set to ON, the R.V. (internal measurement value) will be matched to the value set here.

☐ "Zero shift function" (page 7)

## Operation When the Power is Turned on for the First Time

When the amplifier is turned on for the first time after the sensor head is connected, the initial setting display appears. Make the initial setting according to the following procedure as this is necessary for both the main unit and the expansion units when units are added.

- Press the ▲/▼ button to select the polarity of the signal output and the edge check output and press the [MODE] button.

Setting value	Description
nPN	NPN output
pNP	PNP output



- Press the ▲/▼ button to select the analog output method and press the [MODE] button.

Setting value	Description
oFF	Not output
0-5V	Analog output after the judgment value is converted to the range from 0 to 5 V.
±5-5V	Analog output after the judgment value is converted to the range of ±5 V.
1-5V	Analog output after the judgment value is converted to the range from 1 to 5 V.
4-20mA	Analog output after the judgment value is converted to the range from 4 to 20 mA.



After the setting is complete, [Err] blinks several times on the sub display and changes to the basic display.

### Note

The initial setting display appears only when the power is turned on for the first time. It will not appear when the power is turned on the second time or thereafter. To change the initial setting, perform the initial reset.

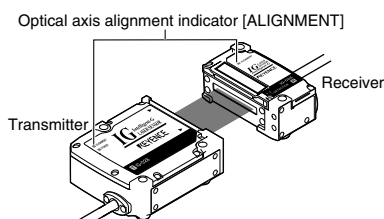
☐ "Initial Reset (Initialize) page 7"

- Perform "Optical Axis Alignment" and "Standard Light-Receiving Amount Registry" (page 6). Make other settings as necessary.

## Optical Axis Alignment

If the optical axis alignment indicators [ALIGNMENT] of transmitter, receiver and amplifier do not both light up upon power up, align the optical axis of the sensor head.

Adjust the angle of the transmitter and receiver while a target object is not present within the measuring range. Then fix mount the transmitter and receiver once the alignment indicators [ALIGNMENT] light up.



## Registering the standard waveform (Gain adjustment)

The measurements will be stabilized once the standard waveform has been registered. (Gain adjustment)

The total light received will be registered as 100%.

Register the standard waveform when the unit is used for the first time, when the setting environment is changed, or when the measurement sensitivity is changed. For details, refer to the User's Manual.

- Confirm that the optical axis alignment indicators [ALIGNMENT] of the transmitter, receiver and amplifier are lit up. If the optical axis adjustment indicators are off, align the optical axis.
- Press the [MODE] and [SET] buttons at the same time for approx. 2 seconds on the basic display.

### Note

If attempting to register the standard waveform while the optical axis alignment indicators [ALIGNMENT] are off, an error message will be displayed and the standard waveform cannot be registered.

"Error message and countermeasures" (page 8)

### Reference

The standard waveform can be registered by the external input as well. Select the "Gain input" for the external input 4 (purple wire).

## Setting the Tolerance Setting Value (Threshold)

There are two types of tolerance setting values: HIGH (upper limit) and LOW (lower limit). The value displayed will output its signal as one of the following 3 levels: When the value exceeds the upper limit (HIGH); when the value is within the tolerance range (GO); and when the value falls below the lower limit (LOW).

"4. Output format" (page 8)

### ■ Automatic setting (Tolerance tuning)

When the object to be measured is present, and the measurement value for the master workpiece is set, the HIGH (upper limit) and LOW (lower limit) will be automatically set with the master workpiece measurement value centered.

- Press the ◀▶ buttons several times on the basic display. Then display the R.V. (internal measurement value) on the sub display (lower level).
- Measure the master workpiece and press the [SET] button. The P.V. (judgment value) will be set as a standard value for the tolerance settings.
- Press the ▲/▼ buttons to set the tolerance width and press the [SET] button.

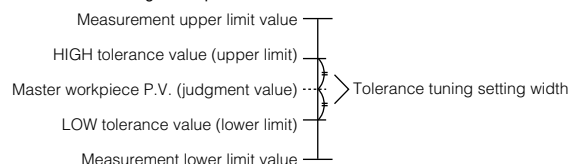


Setting range	Default value
0.000 to 99.999	0.100



After [Err] blinks several times, the display returns to the R.V. (internal measurement value).

The tolerance tuning is complete.



### Note

The tolerance tuning cannot be performed when the P.V. (judgment value) is displayed as [----].

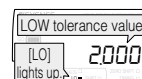
### Reference

When the tuning result exceeds the setting range (-99.999 to 99.999), the limit values of the setting range become the High and Low tolerances.

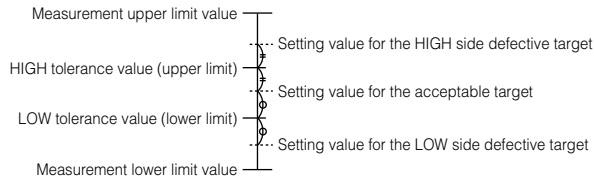
### ■ Automatic setting (2-point tuning)

The following will explain how to set up a mean tolerance level that distinguishes between acceptable vs. defective targets.

- Press the ◀▶ buttons several times until the HIGH tolerance value on the sub display (lower level) is shown.
- Place the acceptable target within the measuring range and press the [SET] button. The R.V. (internal measurement value) will be registered and [H, 5Err] will be shown on the main display (upper level).
- Now place the defective target within the measuring range and press the [SET] button. The R.V. (internal measurement value) will be registered and after [5Err] blinks on the main display (upper level), the P.V. (judgment value) will be shown. On the sub display (lower level), the medium value between the acceptable target value registered in step 2 and the HIGH side defective target value will now be displayed. The HIGH tolerance value (upper limit) is now setup.
- Press the ▶ button once and display the LOW tolerance value on the sub display (lower level).
- Measure the acceptable target again and press the [SET] button. The R.V. (internal measurement value) is now registered. [L, 5Err] will be shown on the main display (upper level).



- 6** Measure the LOW side defective target and press the [SET] button. The R.V. (internal measurement value) is now registered. After [SEt] blinks on the main display (upper level), the P.V. (judgment value) will be shown. On the sub display (lower level), the medium value between the acceptable target value registered on step 5 and the LOW side defective target value will be displayed. The LOW side setting value (lower limit) is complete. The 2-point tuning is complete.



## Manual setting

Set the HIGH tolerance value (upper limit) and LOW tolerance value (lower limit) to an arbitrary value.

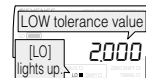
- 1** Press the ◀▶ buttons several times on the basic display. Then display the HIGH side setting value on the sub display (lower level).



- 2** Press ▲▼ buttons to set the HIGH tolerance value.

Setting range	Default value
-99.999 to 99.999	8.000

- 3** Press the ▶ button once and display the LOW tolerance value on the sub display (lower level).



- 4** Press the ▲▼ buttons to set the LOW side setting value.

Setting range	Default value
-99.999 to 99.999	2.000

The tolerance settings are complete.

### Note

When setting the tolerance value manually or with the 2-point tuning, make sure to set "HIGH tolerance value then the LOW tolerance value"

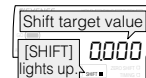
## Zero Shift Function

When the [ZERO SHIFT] button is pressed or the external zero shift input (pink wire) has been activated, the R.V. (internal measurement value) now becomes the newly shifted target value.

### Setting the shift target value

- 1** Use the ◀▶ buttons on the basic display to navigate your way to the shift target value on the sub display (lower level).

- 2** Press the ▲▼ buttons to change the shift target value.



Setting range	Default value
-99.999 to 99.999	0.000

The shift target value has now been set.

### Activating the zero shift

Press the [ZERO SHIFT] button or short the external pink wire to 0V or 24VDC (based on the NPN or PNP setup).

The zero shift indicator [ZERO SHIFT] will light up for approx. 0.5 second and the current R.V. (internal measurement value) will now become the shifted target value.

### Note

- When using the external zero shift function, any newly shifted states will be lost when the unit is powered down unless the memory function is utilized. For details, refer to the User's Manual.
- When the R.V. (internal measurement value) is [----], the zero shift function cannot be used.

### Cancelling the zero shift

Press the zero shift button [ZERO SHIFT] for 2 seconds or more.

[rESEt] is displayed on the sub display and the zero shift is cancelled.

## Initial Reset (Initialize)

The initial reset initializes all settings except for the calibration setting and standard waveform registry (Gain adjustment).

When using initial reset, the output polarity (NPN / PNP) edge check output, and the analog output settings can be changed.

- 1** While holding down the [MODE] button on the basic display, press the [SET] button 5 times. [rESEt] will be displayed on the main display.

- 2** Press ▲▼ button to select [yES] and press the [MODE] button.

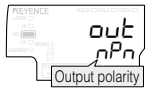
When [MODE] and [ZERO SHIFT] buttons are pressed at the same time for approx. 2 seconds, the display units (inch / mm) can be accessed. [mm] and [inch], represent "mm" and "inch" respectively.

Press the [MODE] button.



- 3** Press ▲▼ button to select the output polarity and press the [MODE] button.

Setting value	Description
nPn	NPN output
PnP	PNP output



- 4** Press the ▲▼ buttons to select the analog output and press [MODE] button.

Setting value	Description
oFF	Not using the analog output
0-5u	Analog output range is from 0 to 5 V.
-5-5u	Analog output range is from $\pm 5$ V.
1-5u	Analog output range is from 1 to 5 V.
4-20mA	Analog output range is from 4 to 20 mA.



After the initialization is complete, [End] blinks several times on the sub display and the basic display is restored.

## Setting Method

### Calling the setting display

Hold the [MODE] button for approx. 2 seconds on the basic display.

The setting display appears.

### Basic operations on the setting display

To change the setting, press the ▲▼ button

To move the next item, press the [MODE] button or ▶ button

To return to the previous item, press the ◀ button

To skip the rest of the settings and finish: Press and hold the [MODE] button for approx. 2 seconds.

### Setting procedures (Basic)

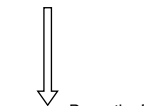


Basic display



Press the [MODE] button for 2 seconds.

**"1. Measurement mode"** Use ▲▼ to select. Setting the edge control/positioning, outer diameter/width, inner diameter/opening, glass edge, pin position (See User's Manual), pin interval (See User's Manual), pin diameter (See User's Manual), specified edges interval (See User's Manual)



Press the [MODE] or ▶ button.

**"2. Measurement direction"** Use ▲▼ to select. Setting the top and bottom



Press the [MODE] or ▶ button.

**"3. Averaging"** Use ▲▼ to select. Setting the averaging



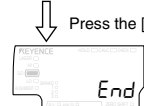
Press the [MODE] or ▶ button.

**"4. Output state"** Use ▲▼ to select. Setting N.O. (Normally Open) and N.C. (Normally Closed)



Press the [MODE] or ▶ button.

**"Basic setting complete"** Press the [MODE] button or the ▶ button to return to the basic display.



Press the ▼ or ▲ button.

**"Advanced settings"** See User's Manual Press the ◀ button to return to the basic display. When the advanced setting is selected, the following items can be set. For details, see the User's Manual. "5. Hold function" "6. Timing input" "7. Delay timer" "8. Hysteresis" "9. Edge check function" "10. Analog output scaling" "11. External input" "12. Standard waveform memory function" "13. Zero shift value memory function" "14. Interference prevention function" "15. Number of digit displayed" "16. Power saving function" "17. Position monitor" "18. Display color"



Press the [MODE] or ▶ button.

Advanced setting

## Basic functions

### ■ 1. Measurement mode

Setting the position to measure.

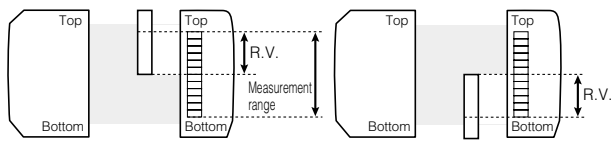
**Note** At the point when the selection is switched on the setting display, it is reflected to the R.V. (internal measurement value).

Measurement mode		Default value
R. Ed9	Edge control/Positioning mode,	○
b. d. R	Outer diameter/Width measurement mode	
c. in5	Inner diameter/Opening measurement mode	
d. 9.5	Glass edge mode	
E. Po5 to h. u5r	Pin position measurement mode, Pin interval judgment mode, Pin diameter judgment mode, Specified edge interval measurement mode	

#### ● Edge control/Positioning mode

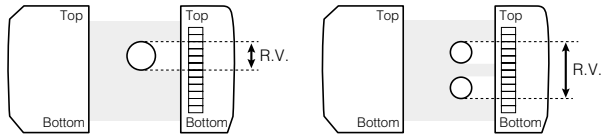
When the measurement direction [t o P] (top) is selected, the distance from the top edge of the measurement range to bottom side of the measured target is the R.V. (internal measurement value). When [b t r] (bottom) is selected, the distance from the bottom edge of the measurement range to the top side of the measured target is the R.V. (internal measurement value). If there is no measurement target, R.V. (internal measurement value) will display [----].

**When the measurement direction is [t o P]** **When the measurement direction is [b t r]**



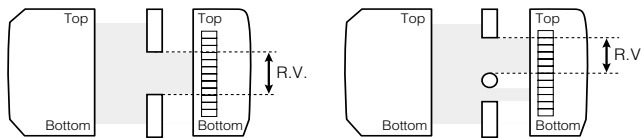
#### ● Outer diameter/Width measurement mode

The distance from the top edge of the target closest to the top of the measuring range to the bottom edge of the target closest to the bottom of the measuring range will be calculated as the R.V. (internal measurement value). If there is no target present, the R.V. (internal measurement value) will display [----].



#### ● Inner diameter/Opening measurement mode

The distance from the bottom edge of the target closest to the top of the measuring range to the top edge of the next target near the bottom of the measuring range will be calculated as the R.V. (internal measurement value). If there is no target present, the R.V. (internal measurement value) will display [----].



#### ● Glass edge mode

This operation is the same as that for the Edge control/Positioning mode, however the measurement sensitivity is increased.

**Reference** For details of other measurement modes, see the User's Manual.

### ■ 2. Measurement direction

Setting the measurement direction of the master workpiece to the sensor head.

Setting value	Description	Default value
t o P	Measures the distance from the top side of sensor head to the specified edge.	○
b t r	Measures the distance from the bottom side of sensor head to the specified edge.	

### ■ 3. Averaging (Response time)

The response time is the time from when the sensor head starts the measuring operation to the point where the output signal is sent. When the average number of times is increased, the response time becomes longer, but the R.V. (internal measurement value) and P.V. (judgment value) will be more stable.

Setting range	Default value
h5P / 1 / 2 / 4 / 16 / 32 / 64 / 128 / 256 / 512 / 1024 / 2048 / 4096	16

- Reference**
- The response time for [h5P] (High speed) is 1.96 ms.
  - 1 indicated in [ ] means the average number. The response time can be calculated 256 times or less: Response time = Number of times for averaging x 0.98 + 2.94 ms  
512 times or more: Response time = Number of times for averaging ÷ 256 x 257 x 0.98 + 1.96 ms
  - When "Pin interval judgment mode" or "Pin diameter judgment mode" is selected in "1. Measurement mode", the setting range and the response time will differ.

### ■ 4. Output method

Setting the judgment output method

Setting value	Description	Default value
n o	Output is normally open	○
n c	Output is normally closed	

**Reference**

Normally open [n o]

Normally closed [n c]

judgment	judgment output			judgment	judgment output		
	HIGH	GO	LOW		HIGH	GO	LOW
HIGH	ON	OFF	OFF	HIGH	OFF	ON	ON
GO	OFF	ON	OFF	GO	ON	OFF	ON
LOW	OFF	OFF	ON	LOW	ON	ON	OFF
[----]	OFF	OFF	OFF	[----]	ON	ON	ON
Error	ON	OFF	ON	Error	OFF	ON	OFF

### Error Displays and Corrective Actions

**Reference**

"4. Output format" (page 8)

- The edge check output operates regardless of the error.
- When [Erc] is displayed, all the outputs will turn OFF.
- When an error is displayed, the analog voltage output will be 5.5 V and analog current output will be 3.0 mA.

Error indication	Error	Actions
	The transmitter and receiver are not connected.	Connect the transmitter and receiver.
	The transmitter and receiver are broken.	Replace the transmitter and receiver.
	The sensor head cable of the transmitter and receiver is disconnected.	Replace the sensor head cable.
	The transmitter and receiver are reversely connected to the amplifier.	Connect the transmitter and receiver correctly.
	Displayed alternately.	
	The receiver is not connected.	Connect the receiver.
	The receiver is broken.	Replace the transmitter and receiver.
	The sensor head cable of the receiver is disconnected	Replace the sensor head cable.
	The transmitter is not connected.	Connect the transmitter.
	The transmitter is broken.	Replace the transmitter and receiver.
	The sensor head cable of the transmitter is disconnected.	Replace the sensor head cable.
	The laser of the transmitter has been damaged.	Replace the transmitter and receiver.
	Reading/writing the nonvolatile memory (EEPROM) storage data failed.	Turn the power on again.
	Data has been written in the nonvolatile memory (EEPROM) over 500 thousands times and malfunction occurred.	Replace the transmitter and receiver.
	The transmitter and receiver type (Measurement range) do not match.	Replace with the same type (measurement range) of the transmitter and receiver.
	The standard waveform was not registered properly.	Do not turn off the sensor head or disconnect it from the sensor amplifier while registering the standard waveform. Register the standard waveform again.
	Overcurrent was detected on the output.	<ul style="list-style-type: none"> <li>Check the load and reduce the current to within the rated range.</li> <li>Check that the output wire does not touch another wire or a frame.</li> </ul>
	Reading/writing the nonvolatile memory (EEPROM) storage data failed.	Turn the power on again and perform the initial reset.
	Data has been written in the nonvolatile memory (EEPROM) over 1 million times and malfunction occurred.	Replace the amplifier unit if data writing is necessary.
	Communication is not possible between the amplifiers.	Turn the power on and check the connection status between amplifiers.
	The light-receiving amount is too large to register the standard waveform.	Check whether too much ambient light or light from another sensor enters the receiver or not.
	The light-receiving amount is too small to register the standard waveform.	<ul style="list-style-type: none"> <li>Align the optical axis so the optical axis alignment indicator lights up.</li> <li>Clean the sensor head's transmitter and receiver.</li> </ul>
	The standard waveform cannot be registered because the receiver is receiving the laser light of the transmitter from another amplifier.	Use the transmitter and receiver associated with their designated amplifier.

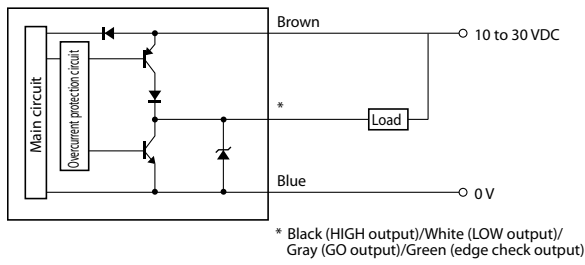


## Circuit Diagram

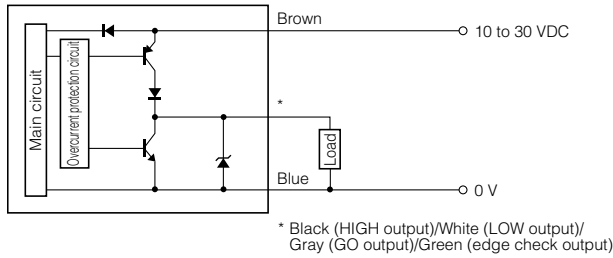
### ■ Sensor head

#### ● Output circuit

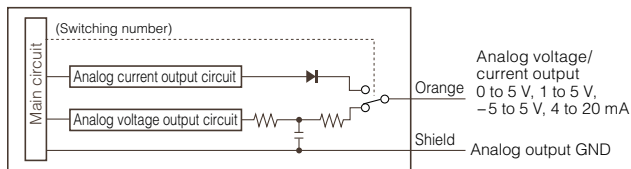
When NPN output is selected



When PNP output is selected

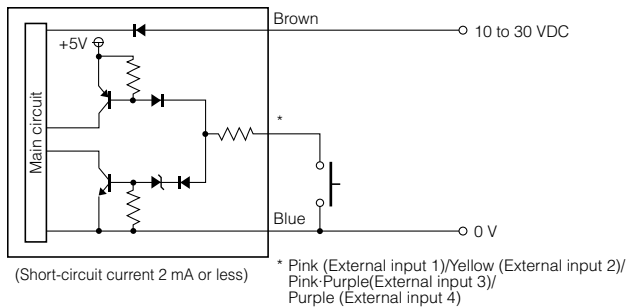


#### ● Analog output circuit

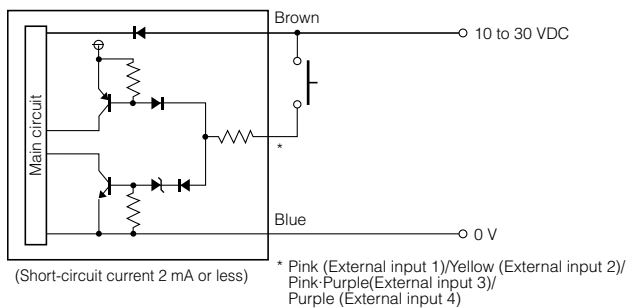


#### ● Input circuit

When NPN output is selected



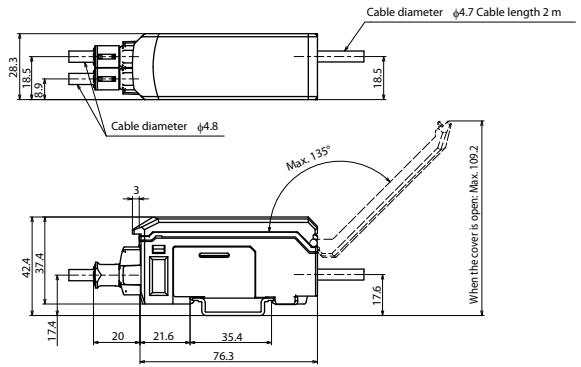
When PNP output is selected



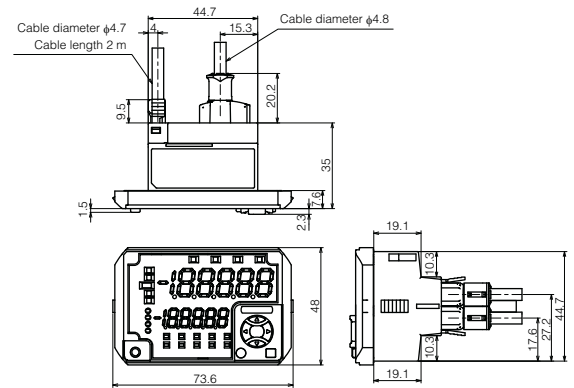
## Dimensions

### ■ Sensor amplifier

#### ● IG-1000/IG-1050



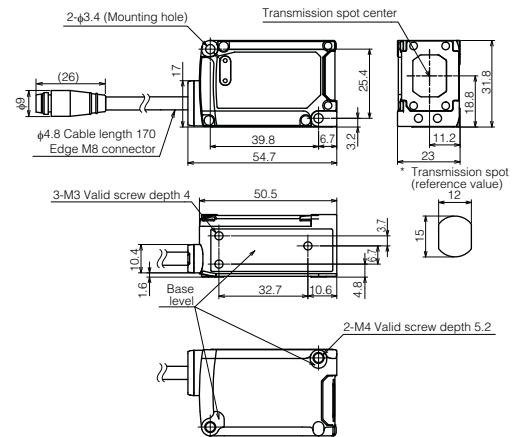
#### ● IG-1500/IG-1550



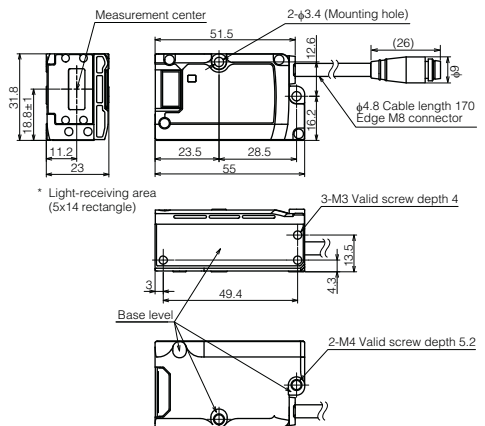
### ■ Sensor head

#### ● IG-010

Transmitter

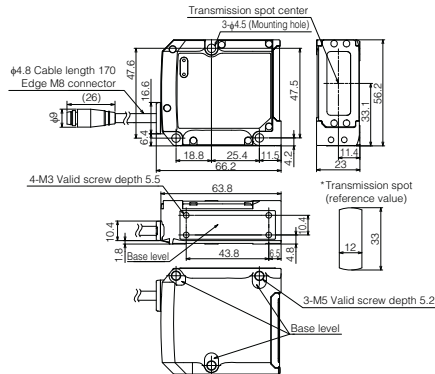


Receiver

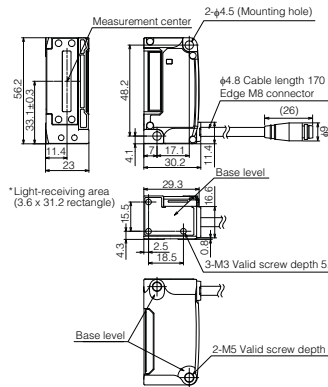


## ● IG-028

### Transmitter



### Receiver



## Specifications

### ■ Sensor amplifier

Model		IG-1000	IG-1050	IG-1500	IG-1550
Amplifier type		DIN rail mount		Panel mount	
Main unit/Expansion unit		Main unit	Expansion unit	Main unit	Expansion unit
Analog output		Yes	No	Yes	No
Power supply voltage		DC10-30 V, Ripple (P-P): 10% included, Class2			
Power consumption (including analog current output)	Normal	2700 mW or less (at 30 V: 90 mA or less)		2880 mW or less (at 30 V: 96 mA or less)	
	Power saving function (HALF)	2300 mW (at 30 V: 77 mA or less)			
	Power saving function (ALL)	2200 mW (at 30 V: 74 mA or less)			
Digital display method		Dual 7-seg display Upper level: Red, 5 digits Lower level: Green, 5 digits		Dual 7-seg display Upper level: Red/Green, 2 colors, 5 digits Lower level: Green, 5 digits	
Display range		-99.999 to 99.999, -99.99 to 99.99, -99.9 to 99.9, -99 to 99 (switchable)			
Display resolution		1 μm, 10 μm, 100 μm, 1000 μm (selectable)			
Operation status indicator		Judgment indicator: Red/Green 2 colors (HI, LO, GO) Bank indicator: Green LED x 4 Laser emission indicator: Green LED Others: Green LED x 8, Red LED x 3			
Output	Judgment output (selectable between NPN and PNP)	NPN (PNP) open collector x3ch, DC 30 V (Power supply voltage) or less, residual voltage 1 V (2 V) or less, NO/NC selectable Max. 50 mA/ch *1			
	Response time (judgment output)	1.96 to 4031.72 ms*2			
	Edge check output (selectable between NPN and PNP)	NPN (PNP) open collector x1ch, DC 30 V (Power supply voltage) or less, residual voltage 1 V (2 V) or less, NO/NC selectable Max. 50 mA *1, response time 20 ms			
Output	Analog output (selectable among ±5V, 1-5 V, 0-5 V, 4-20 mA)		Voltage output		Current output
		Output range	±5 V (full scale 10 V)	4-20 mA (full scale 16 mA)	
		Output resistance	100 Ω	-	
		Maximum load resistance	-	350 Ω	
		Repetition accuracy	±1 mV	±1.5 μA	
		Display accuracy	±0.05 %ofF.S.	±0.25 %ofF.S.	
		Temperature characteristics	±0.005 %ofF.S./°C	0.01%ofF.S./°C	
		Update cycle	Same as sensor head sampling cycle		
		Response time	Same as Response time (judgment output)		
Time constant *3	10 μs (90 % response)	30 μs (90 % response)			
Input	Gain input	Input time: 20 ms or more Response delay time: 120 ms or less (Nonvolatile memory (EEPROM) 1.5 s)			
	Reset input	Input time: 20 ms or more, Response delay time: 20 ms or less			
	Timing input	Input time: 2 ms or more, Response delay time: 2 ms or less			
	Zero shift input	Input time: 20 ms or more, Response delay time: 20 ms or less			
	Bank A input/ Bank B input	Input time: 20 ms or more, Response delay time: 20 ms or less*4			
	Laser emission stop input	Input time: 2 ms or more, Response delay time: 2 ms or less			
Environment t resistance	Ambient temperature	-10 - +50°C (No freezing)			
	Ambient humidity	35 - 85%RH (No condensation)			
	Vibration resistance	10 - 55 Hz Double amplitude1.5 mm XYZeach axis: 2 hours			
	Pollution degree	2			
Material		Main unit case/Front sheet: Polycarbonate Key top: Polyacetal Cable: PVC			
Weight (including supplied items)		Approx. 150 g	Approx. 140 g	Approx. 170 g	Approx. 165 g

\*1 When expansion units are added: Max. 20 mA/ch

\*2 □ "3. Average number of times" (page 8)

\*3 Delay time that occurs from the analog output circuit after the judgment is output.

\*4 For detailed time chart, refer to the User's Manual.

## ■ Sensor head

Model	IG-010	IG-028
Operation principle	CCD detector	
Light source	Visible light semiconductor laser (Wavelength: 660 nm)	
Mounting distance	0 to 1000 mm	0 to 1500 mm
Measurement range	10 mm	28 mm
Sampling cycle	980μs (when averaging is set to [hsp]: 490μs)	
Smallest detectable object *2	φ0.2 mm (Setting distance: 40 mm or less), φ0.5 mm (Setting distance: 500 mm)	φ0.2 mm (Setting distance: 50 mm or less), φ0.5 mm (Setting distance: 500 mm)
Repeatability *3	5 μm (Setting distance: 100 mm) 10 μm (Setting distance: 500 mm) 80 μm (Setting distance: 1000 mm)	5 μm (Setting distance: 100 mm) 10 μm (Setting distance: 500 mm) 80 μm (Setting distance: 1000 mm) 140 μm (Setting distance: 1500 mm)
Linearity *4	±0.28 %ofF.S. (±28 μm)	±0.1 %ofF.S. (±28 μm)
Temperature characteristics *5	±0.03 %ofF.S./°C (±3 μm/°C)	±0.01 %ofF.S./°C (±3 μm/°C)
Operation indicator	Transmitter	Optical axis alignment indicator: Green LED Power indicator: Green LED
	Receiver	Optical axis alignment indicator: Green LED Position monitor: Dual bar LED (Red, Green)
Environment resistance	Protection structure	IP67
	Ambient temperature	-10 to +45°C (No freezing)
	Ambient humidity	35 to 85%RH (No condensation)
	Ambient light *6	Incandescent lamp: 5000 lx Sunlight: 5000 lx
	Vibration resistance	10 to 55 Hz Double amplitude 1.5 mm XYZeach axis: 2 hours
Material	Pollution degree	2
	Case	Zinc die-cast (Lower case), PBT (Upper case), Poly Arylate (PAR) (Display part), SUS304 (Metallic part)
	Lens cover	Glass
Cable		PVC
Weight (including supplied items)		Approx. 380 g

\*1 The classification is based on IEC60825-1 standard following the Laser Notice No.50 from FDA (CDRH).

\*2 When the measurement target object is measured at the center position of the setting distance. When the sensitivity setting is set to the high sensitivity mode: φ0.1 mm (Setting distance: 100 mm) When the measurement mode is set to the glass edge mode, a glass edge of 0.1 mm or more can be detected (Setting distance: 500 mm).

\*3 When the light quantity from the transmitter is cut by half at the center position of the setting distance. Vibration width when the averaging is set to 16 and sampling is performed for 30 seconds (When the analog output is used, the margin of error of analog output is added.)

\*4 When the setting distance is 100 mm, and light from the transmitter is blocked by an object at 50 mm from the receiver. Margin of error to the ideal line.

\*5 When the setting distance is 100 mm, and light is shielded by half at 50 mm position from the receiver.

\*6 Excluding when the average number of times is set to [h5P]

## Warranty

KEYENCE products are strictly factory-inspected. However, in the event of a failure, contact your nearest KEYENCE office with details of the failure.

### 1. WARRANTY PERIOD

The warranty period shall be for one year from the date that the product was delivered to the location specified by the purchaser.

### 2. WARRANTY SCOPE

- If a failure attributable to KEYENCE occurs within the above mentioned warranty period, we will repair the product, free of charge. However, the following cases shall be excluded from the warranty scope.
  - Any failure resulting from improper conditions, improper environments, improper handling, or improper usage other than described in the instruction manual, the user's manual, or the specifications specifically arranged between the purchaser and KEYENCE.
  - Any failure resulting from factors other than a defect of our product, such as the purchaser's equipment or the design of the purchaser's software.
  - Any failure resulting from modifications or repairs carried out by any person other than KEYENCE staff.
  - Any failure that can certainly be prevented when the expendable part(s) is maintained or replaced correctly as described in the instruction manual, the user's manual, etc.
  - Any failure caused by a factor that cannot be foreseen at a scientific/technical level at the time when the product was shipped from KEYENCE.
  - Any disaster such as fire, earthquake, and flood, or any other external factor, such as abnormal voltage, for which we are not liable.
- The warranty scope is limited to the extent set forth in item (1), and KEYENCE assumes no liability for any purchaser's secondary damage (damage of equipment, loss of opportunities, loss of profits, etc.) or any other damage resulting from a failure of our product.

### 3. PRODUCT APPLICABILITY

KEYENCE products are designed and manufactured as general-purpose products for general industries. Therefore, our products are not intended for the applications below and are not applicable to them. If, however, the purchaser consults with us in advance regarding the employment of our product, understands the specifications, ratings, and performance of the product on their own responsibility, and takes necessary safety measures, the product may be applied. In this case, the warranty scope shall be the same as above.

- Facilities where the product may greatly affect human life or property, such as nuclear power plants, aviation, railroads, ships, motor vehicles, or medical equipment
- Public utilities such as electricity, gas, or water services
- Usage outdoors, under similar conditions or in similar environments

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