KEYENCE

96M13643

96M13643-3

CMOS Multi-Function Analog Laser Sensor IL Series

Instruction Manual

Read this manual before using the product in order to achieve maximum performance.
Keep this manual in a safe place after reading it so that it can be used at any time.
For details of functions, refer to the IL Series User's Manual.
The IL Series User's Manual can be downloaded from the KEYENCE web site:
http://www.keyence.com/

■ Symbols

The following symbols alert you to important messages. Be sure to read these messages carefully.

DANGER	**It indicates a hazardous situation which, if not avoided, will result in death or serious injury.**
WARNING	**It indicates a hazardous situation which, if not avoided, could result in death or serious injury.**
CAUTION	**It indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.**
NOTICE	**It indicates a situation which, if not avoided, could result in product damage as well as property damage.**
Important	**It indicates cautions and limitations that must be followed during operation.**
Point	**It indicates additional information on proper operation.**
Reference	It indicates tips for better understanding or useful information.

Safety Information for IL series

DANGER	• **This product is just intended to detect the object(s). Do not use this product for the purpose to protect a human body or a part of human body.** • **This product is not intended for use as explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.**

Safety Precautions on Laser Product

- **Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.**
- **Follow the instructions mentioned in this manual. Otherwise, injury to the human body (eyes and skin) may result.**
- **Do not disassemble this product. Laser emission from this product is not automatically stopped when it is disassembled.**
- **Precautions on class 2 laser products**
  - Do not stare into the direct or specularly reflected beam.
  - Do not direct the beam at other people or into areas where other people unconnected with the laser work might be present.
  - Be careful of the path of the laser beam.
    When the laser beam is reflected or diffused from a mirror surface, and this reflection may cause danger, block this reflection using a surrounding enclosure.
  - Install the products so that the path of the laser beam is not as the same height as that of human eye.

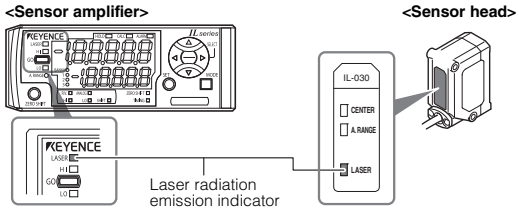
Item		Description	
Model		IL-030	IL-065/IL-100/IL-300/ IL-600/IL-2000
Wavelength		655 nm	655 nm
FDA (CDRH) Part1040.10	Laser Class	Class 1 Laser Product*	Class 2 Laser Product*
	Output	220 µW	560 µW
IEC 60825-1	Laser Class	Class 1 Laser Product	Class 2 Laser Product
	Output	220 µW	560 µW

* The classification is implemented based on IEC60825-1 following the requirement of Laser Notice No.50 of FDA (CDRH).

Safety measures for the laser

■Laser radiation emission indicator

The laser radiation emission indicator is lit during laser emission. It flashes when laser emission is stopped.



■ Laser emission stop input

When laser emission stop input is set as an external input, laser emission can be stopped by turning on the external input (input response time 20 ms). Laser emission stays stopped while the external input is on. The laser is emitted within 20 ms after the external input is turned off. For the conditions of detection outputs and analog outputs during laser emission stop input, refer to "Chapter 4-2 11. External Input" of the User's Manual.

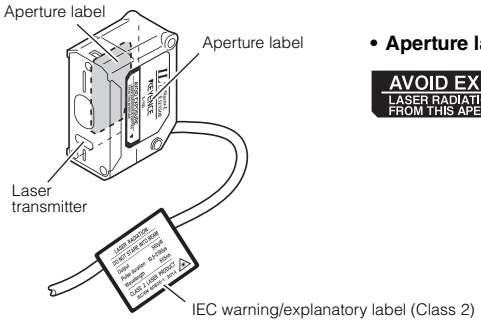
■ Warming up

Wait about 30 minutes after turning on the power.
The circuit is not stable immediately after the power turns on, so the display value may gradually drift.

■ Laser warning labels

The following diagrams show the type and position of laser warning labels of the IL Series.

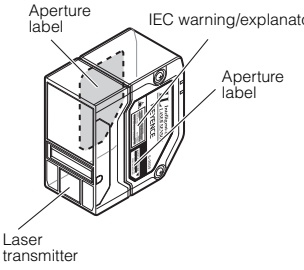
● **IL-065/IL-100/IL-300/IL-600**



• **Aperture label**

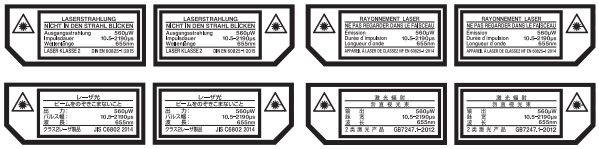
• **IEC warning/explanatory label (CLASS 2)**

● **IL-2000**



• **Aperture label**

• **IEC warning/explanatory label (CLASS 2)**



The IEC warning/explanatory labels are only included with Class 2 laser products.
Use the suitable IEC warning/explanatory label included in the package of this product according to the countries and/or regions where this product is used. In this case, it can be affixed on the IEC warning/explanatory label, which has already been affixed to this product.

Precautions on Regulations and Standards

CE Marking

Keyence corporation has confirmed that this product complies with the essential requirements of the applicable EC Directives, based on the following specifications. Be sure to consider the following specifications when using this product in the Member States of European Union.

■ EMC Directive

- **Applicable standards EN61326-1, Class A**
- **The length of the sensor head cable and all I/O cables must be less than 30m.**

Remarks
These specifications do not give any guarantee that the end-product with this product incorporated complies with the essential requirements of EMC Directive. The manufacturer of the end-product is solely responsible for the compliance on the end-product itself according to EMC Directive.

CSA Certificate

IL series complies with the following CSA and UL standards and has been certified by CSA (Class 2252 05 / Class 2252 85).

- **Applicable standard: CAN/CSA C22.2 No.61010-1**
  UL61010-1
- **Use the following power supply.**
  CSA/UL certified power supply that provides Class 2 output as defined in the CEC (Canadian Electrical Code) and NEC (National Electrical Code), or CSA/UL certified power supply that has been evaluated as a Limited Power Source as defined in CAN/ CSA-C22.2 No. 60950-1/UL60950-1
- **Use this product at the altitude of 2000 m or less.**
- **Indoor use only.**
- **The sensor head cable and the sensor head connection cable must be installed with avoiding mechanical damage (e.g.: crushing).**
- **The power/input-output cable for amplifier unit is for internal wiring only.**
- **The following cables are rated 30 V.**
  - sensor head cable
  - sensor head connection cable
  - power/input-output cable for amplifier unit

  Install these cables where it is separated from the circuit over 30 V.

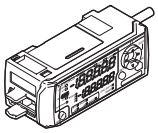
Checking the Package Contents

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

■ Sensor amplifier unit

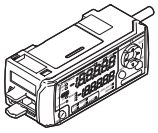
- **DIN rail mount type**

IL-1000 (main unit)



Amplifier x 1 Instruction manual x 1

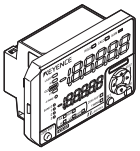
IL-1050 (expansion unit)



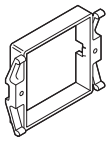
Amplifier x 1

- **Panel mount type**

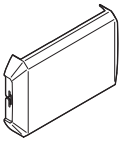
IL-1500 (main unit)



Amplifier x 1



Panel mounting bracket x 1

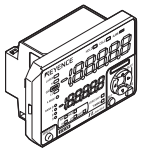


Front protection cover x 1

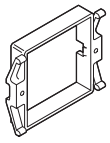
Power/Input-output cable (2 m) x 1 (Number of cable cores: 12)

Instruction manual x 1

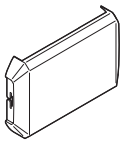
IL-1550 (expansion unit)



Amplifier x 1



Panel mounting bracket x 1



Front protection cover x 1

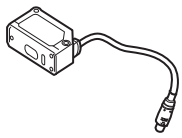
Expansion cable (50 mm) x 1

Input-output cable (2 m) x 1
(Number of cable cores: 8)

■ Sensor head

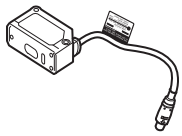
- **Sensor head**

IL-030 (30 mm width)



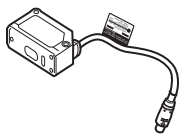
Sensor head x 1
Mounting bracket x 1
Insulating sheet x 1
Flat nut x 1
M3 x L30 screw x 2

IL-065 (65 mm type)/IL-100 (100 mm type)



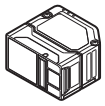
Sensor head x 1
Mounting bracket x 1
Insulating sheet x 1
Flat nut x 1
M3 x L30 screw x 2
Laser warning sticker x 1

IL-300 (300 mm type)/IL-600 (600 mm type)

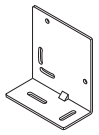


Sensor head x 1
Mounting bracket x 1
Insulating sheet x 1
Flat nut x 1
M4 x L35 screw x 2
Laser warning sticker x 1

IL-2000 (2000 mm type)



Sensor head x 1
M5 x L60 screw x 2
Laser warning sticker x 1



IL-2000 head mounting bracket x 1
Flat nut x 1
M5 x L60 screw x 2

OP-87606

Sensor head connection cable (M8 straight connector) x 1

OP-87056 (2 m)
OP-87057 (5 m)
OP-87058 (10 m)
OP-87059 (20 m)

Sensor head connection cable (M8 L-shaped connector) x 1

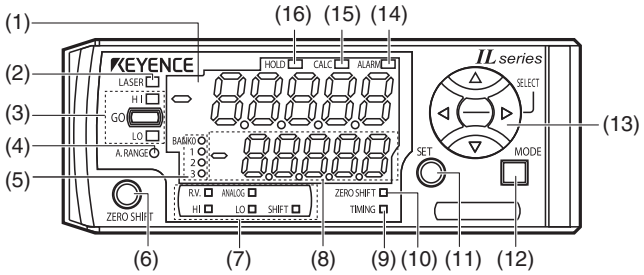
OP-87660 (2 m)
OP-87661 (5 m)
OP-87662 (10 m)
OP-87663 (20 m)

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

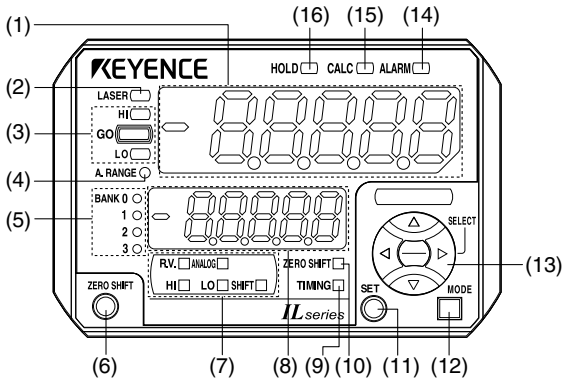
Part names

■ Sensor amplifier unit

- **DIN rail mount type (IL-1000/IL-1050)**

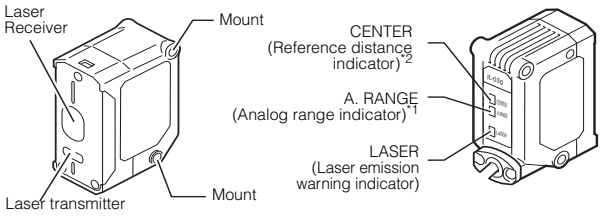


- **Panel mount type (IL-1500/IL-1550)**



(1) Main display
(2) Laser emission warning indicator [LASER]
(3) Judgment indicator [HI / GO / LO]
(4) Analog range indicator [A.RANGE]
(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) Alarm indicator [ALARM]
(15) Calculation indicator [CALC]
(16) Hold indicator [HOLD]

■ Sensor head



*1 By default (normal display mode), the analog range indicator lights when the P.V. (judgment value) is within analog output range. The indicator lights within the following detection range, when the analog output setting is OFF and with the expansion units.
For more information, such as mode changes, refer to the User's Manual.

- IL-030: 30 mm ±5 mm
- IL-065: 65 mm ±10 mm
- IL-100: 100 mm ±20 mm
- IL-300: 300 mm ±140 mm
- IL-600: 600 mm ±400 mm
- IL-2000: 2000 mm ±1000 mm

*2 By default (normal display mode), the reference distance indicator lights when the detection distance is within the following range.
For more information, such as mode changes, refer to the User's Manual.

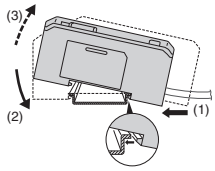
- IL-030: 30 mm ±0.25 mm
- IL-065: 65 mm ±0.5 mm
- IL-100: 100 mm ±1 mm
- IL-300: 300 mm ±7 mm
- IL-600: 600 mm ±20 mm
- IL-2000: 2000 mm ±50 mm

Mounting the Amplifier

■ DIN rail mount type, main unit (IL-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 (IL-1050)

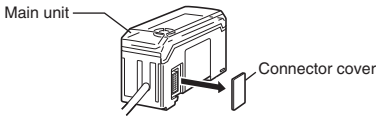
Expansion units must be connected to the main unit before they can be used.
Up to 7 expansion units can be connected to one main unit.

NOTICE	• **Expansion units must be mounted on the DIN rail.** • **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. Installing an expansion unit with power on may damage this device.** • **Push the amplifiers (expansion units) as far as possible into the main unit. If they are connected at an angle or not inserted securely, this device could get damaged.**

Point

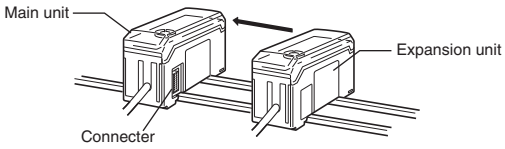
- **When connecting the expansion units, make sure to initialize the expansion units and set the output polarity.**
  (1) When turning on the amplifier for the first time after connecting the sensor head please reference
  "Operation When the Power is Turned on for the First Time" (Page 6)
  (2) When initializing the unit please reference
  "Initial Reset (Initialize)" (Page 8)
- **Expansion units with different settings for 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.**

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



2 Install the amplifiers (expansion units) onto the DIN rail.
Do the same as instructed under "DIN rail mount type, main unit."

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



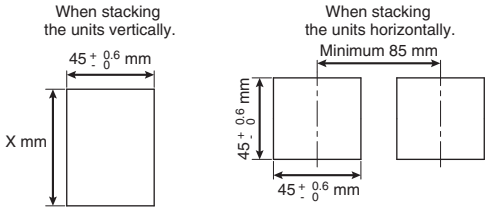
4 Install the end units (OP-26751: 2 units per set) (sold separately) on both sides of the amplifiers (main or expansion units). Secure the end units in place with screws on top (2 on each end unit).
The end units are mounted in the same way as the amplifiers.

Point

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 (IL-1500)

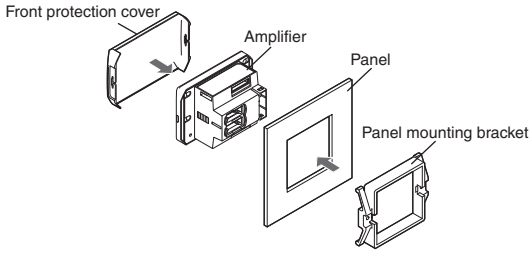
1 Make a hole on the panel as shown in the diagrams below.

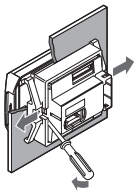


- Panel thicknes 1 to 6 mm
- X = 48 × (Number of amplifiers) - 3

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

3 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 screwdriver, as demonstrated in the image on the right.

■ Panel mount type, expansion unit (IL-1550)

Expansion units must be connected to the main unit before they can be used.
Up to 7 expansion units can be connected to one main unit.

NOTICE	• **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.** • **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.**

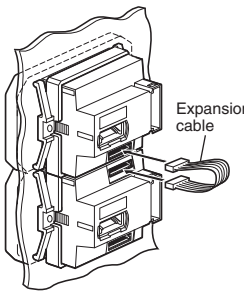
Point

- **When connecting the expansion units, make sure to initialize the connected expansion units and set the output polarity.**
  (1)When turning on the amplifier for the first time after connecting the sensor head please refer to
  "Operation When the Power is Turned on for the First Time" (Page 6)
  (2)When initializing the unit please refer to
  "Initial Reset (Initialize)" (Page 8)
- **Expansion units with different settings for 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.**

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

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

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



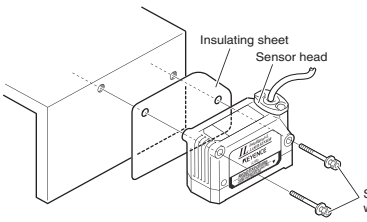
Reference When arranging the amplifiers side by side, the 300 mm expansion cable (OP-35361) is required.

Mounting the sensor head

Attach the sensor head using the dedicated mounting bracket.
When the dedicated bracket is not used, place the included insulation sheet between the mounting surface and the sensor head as indicated in the diagram. (When the dedicated bracket is used, or when the IL-2000 is used, the insulation sheet is unnecessary.)

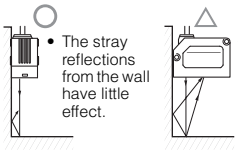
Point

The optical axis may vary by approximately ±1.5° (IL-2000), or ±2.0° (IL-030/IL-065/IL-100/IL-300/IL-600).



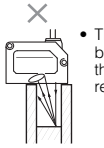
Tightening torque:
1.2 Nm (12kgf•cm) or less (IL-030/IL-065/IL-100)
2.7Nm (27kgf•cm) or less (IL-300/IL-600)
3.0Nm (30kgf•cm) or less (IL-2000)

- **Mounting when detecting targets close to a wall**



- The stray reflections from the wall have little effect.
- Variations in the detection value are possible due to stray laser light.

- **Mounting when detecting targets in a hole**



- The target cannot be detected when the transmitter or receiver is blocked.

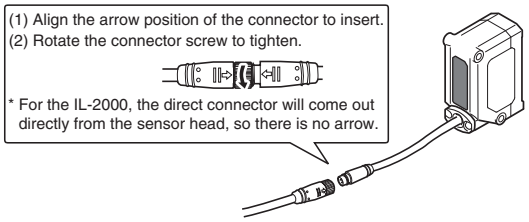
- **When detecting uneven workpieces**

- Stable detection possible even on uneven areas.
- Incorrect values can be detected on the uneven areas.

Connection and Wiring

■ Connecting the sensor head and amplifier

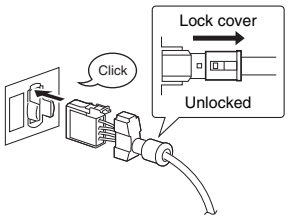
1 Attach the sensor head connection cables to the sensor head cable.



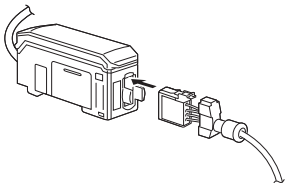
Point **Tighten the connectors securely by hand.**
If they are loose, the environment resistance IP67 cannot be guaranteed.

2 Attach the sensor head connection cable to the amplifier connector.

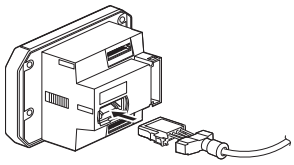
Remove the lock cover of the connector and insert it into the connectors of amplifier until a clicking sound can be heard.



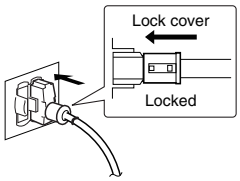
DIN rail mount type
(IL-1000/IL-1050)



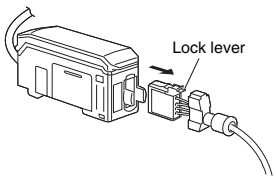
Panel mount type
(IL-1500/IL-1550)



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



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

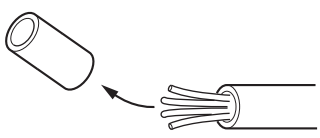


■ Attaching the sensor head cable connector

(OP-84338: optional)

Cut the sensor head cable to the required length and attach the new connector to use the sensor.

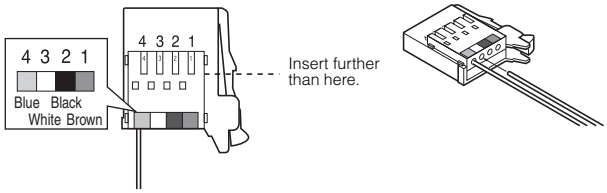
1 Cut the cable to the required length and strip approx. 15 mm of insulation from the end.



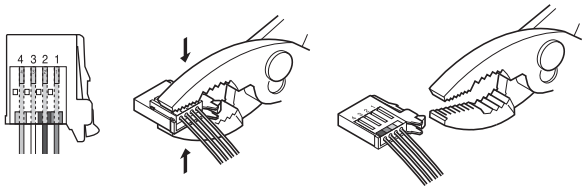
Point **Do not strip the core wire insulation.**

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

Each cable is secured temporarily when it is inserted completely.



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



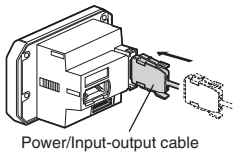
Point **Once the connector has been installed, make sure to connect it to the amplifier and confirm that the sensor operates normally.**
If the sensor head does not function properly, crimp the connector again using pliers or a similar tool.
Once the connector is crimped, it cannot be reused.

■ Amplifier wiring

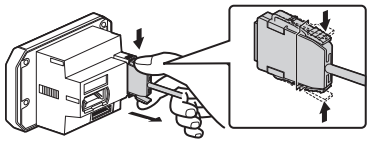
● Connecting power/Input-output cable (IL-1500/IL-1550 panel mount type)

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

To attach



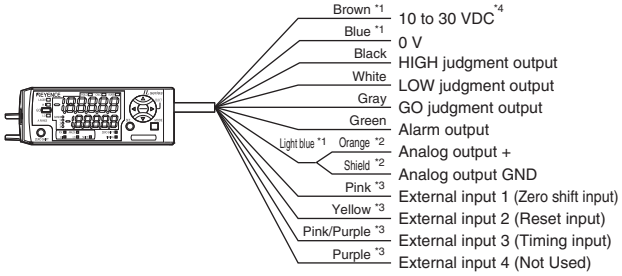
To remove



Point
- **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.**
- **When not using the I/Os of expansion units, cut the cable near the connector.**

● Power/Input-output cable

The following information shows the details of power/Input-output cable. For information about the input-output circuit, see page 11 of this Instruction Manual.



*1 IL-1050/IL-1550 (expansion unit) do not have brown, blue, or light blue wires. Power is supplied to the expansion units through the IL-1000/IL-1500 (main unit).

*2 The Analog output can be set for the following: "Not used (OFF), 0 to 5 V, ±5 V, 1 to 5 V and 4 to 20 mA".
Please reference, "Operation When the Power is Turned on for the First Time" (Page 6) and "Initial Reset (Initialize)" (Page 8).

*3 In addition to the selections noted on the image above, the external inputs can also be selected to perform the following: Bank A input, Bank B input, Laser emission stop input and Not used (OFF).

*4 When connecting six or more expansion units, ensure that the power voltage is 20 to 30 V.

Amplifier functions and displays

■Setting method

Basic display

Press [MODE] for 2 seconds → "List of Advanced Setting Items" (Page 9)

While pressing [MODE] press [SET] for 5 times → "Initial Reset (Initialize)" (Page 8)

Press [MODE] and ◀ for 2 seconds → "Calculation function", refer to the User's Manual

While pressing [MODE] ▲ or ▼ → "Bank switching function", refer to the User's Manual

Press [MODE] and ▶ for 2 seconds → "Calibration function", refer to the User's Manual

[MODE] and ▲, or [MODE] and ▼ press for 2 seconds → "Key lock function", refer to the User's Manual

■ Basic display

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

P.V. (judgment value) is the value used for setting the judgment output to ON or OFF based 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 (Threshold)" (Page 7)

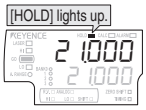
R.V. (internal measurement value) means the value displayed when the desired object to be measured is inserted into the measurement range.
* R.V. = Raw Value

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

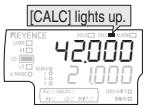
● Main display

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.



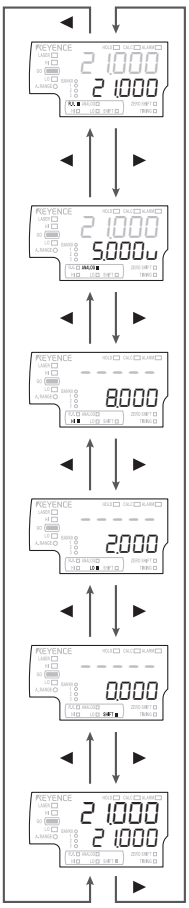
When the hold function is used, when the step count filter is used
The held value is displayed and the output will send its signal depending on the value.
For details, refer to the User's Manual.



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.
For details, refer to the User's Manual.

● Sub display

The sub display switches with each push of the ◀ or ▶ button. 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.

Analog output (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 8)

HIGH limit 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 (Threshold)" (Page 7)

LOW limit 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 (Threshold)" (Page 7)

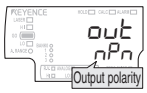
Shift target value
When the zero shift button is pressed or the zero shift input is set to ON, the R.V. (internal measurement value) will be matched to the value set here.
"Zero Shift Function" (Page 7)

Calculation value screen (appearing only when both the main unit and the calculation function are used)
After [CALC] has displayed once during the transition, the calculation value (CALC value) is displayed. The display is not held.

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.

1 Use the ▲/▼ button to select the desired output polarity, then press the [MODE] button.



Setting value	Description
nPn	NPN output
PnP	PNP output

2 Press the ▲/▼ button to select the analog output method and press the [MODE] button. (for IL-1000/IL-1500 only)

Setting value	Description
oFF	Not output
0-5u	Analog output after the judgment value is converted to the range from 0 to 5 V.
-5-5u	Analog output after the judgment value is converted to ±5 V.
1-5u	Analog output after the judgment value is converted to the range from 1 to 5 V.
4i20r	Analog output after the judgment value is converted to the range from 4 to 20 mA.

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

Point

Once the initial setting is completed, from then on the initial setting display will not appear when the power is turned on again. To change the initial setting, perform the initial reset.
"Initial Reset (Initialize)" (Page 8)

3 Make other settings as necessary.

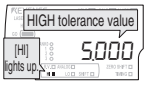
Setting the Tolerance Setting Value (Threshold)

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).
"5. Output method" (Page 10)

■ Manual setting

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

1 Press the ◀/▶ button several times on the basic display. Then display the HIGH tolerance value on the sub display (lower level).



2 Press ▲/▼ button to set the HIGH tolerance value.

IL-030/IL-065/IL-100

Setting range	Default value
-99.999 to 99.999	5.000

IL-300/IL-600

Setting range	Default value
-999.99 to 999.99	50.00

IL-2000

Setting range	Default value
-9999.9 to 9999.9	500.0

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

4 Press the ▲/▼ button to set the LOW side setting value.

IL-030/IL-065/IL-100

Setting range	Default value
-99.999 to 99.999	-5.000

IL-300/IL-600

Setting range	Default value
-999.99 to 999.99	-50.00

IL-2000

Setting range	Default value
-9999.9 to 9999.9	-500.0

The tolerance settings are complete.

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

■ Automatic setting (When other than step count filter)

● Tolerance tuning

When a reference workpiece (master workpiece) is available, set the measured value of the master workpiece. The HIGH tolerance value (upper limit) and LOW tolerance value (lower limit) will be automatically set symmetrically with respect to the measured value of the master workpiece.

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

● 2-point tuning

If there are an acceptable target and a HIGH or LOW defective target, these two targets can be registered. As a result, the middle value between the acceptable and the HIGH or LOW defective is set as the tolerance value.

Point **The 2-point tuning cannot be performed when the R.V. value (internally measured value) is displayed as [-----].**

For details of tolerance tuning and 2 point tuning, refer to the User's Manual.

■ Automatic setting (when step count filter)

● 2 point tuning

When there is a standard step, 2 times the value of the step will be set as HIGH (upper limit value) and half of the value of the step will be set as LOW (lower limit value) automatically.
If the step of the measured value of the upper part is A, and the measured part of the lower part of the step is B, it will be set as
HIGH = <(A-B) x 2>, LOW = <(A-B)÷2>

Point **When the R.V. value is [-----], the 2 point tuning cannot occur. If it does occur, (no.vAL) will be displayed on the main screen, and the number of points will decrease. The setting value cannot be changed.**

● 1 point tuning

Based on the presently displayed P.V. value, 2 times the value of the P.V. value will be set as HIGH (upper limit value), and half of the value of the P.V. value will be set as LOW (lower limit value). If the P.V. value is A, it will be set as
HIGH = <(A) x 2>, LOW = <(A) ÷ 2>

Point **When the P.V. value is [-----], 1 point tuning cannot occur. If it does occur, (no.vAL) will be displayed on the main screen, and the number of points will decrease. The setting value cannot be changed.**

For details of 2 point tuning and 1 point tuning, refer to the User's Manual.

Zero Shift Function

When the [ZERO SHIFT] button is pressed or the external zero shift input* has been activated, the R.V. (internal measurement value) now becomes the newly shifted target value.
*Zero shift via external input is provided by assigning zero shift input to the external input 1 (pink wire).

■ Setting the shift target value

1 Use the ◀/▶ button on the basic display to display the shift target value on the sub display (lower level).

2 Press the ▲/▼ button to change the shift target value.

IL-030/IL-065/IL-100

Setting range	Default value
-99.999 to 99.999	0.000

IL-300/IL-600

Setting range	Default value
-999.99 to 999.99	0.00

IL-2000

Setting range	Default value
-9999.9 to 9999.9	0.0

The shift target value has now been set.

■ Activating the zero shift

Press the [ZERO SHIFT] button or assign zero shift input to an external input.
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.

Point
- **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. value (internal measurement value) is [-----], and when (3. AVE) is set to (HPF), the zero-shift function cannot occur.**

■ Cancelling the zero shift

Press the zero shift button [ZERO SHIFT] for 2 seconds or more.
The main display shows [5h ıFt] while the sub display shows [rESEt], indicating that the zero shift has been cancelled and set back to the factory setting.

Initial Reset (Initialize)

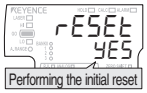
The initial reset initializes all settings except for the calibration setting.
The initial reset can also be used to change the judgment output and analog output settings.

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.

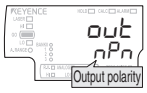
2 Press ▲/▼ button to select [YES] and press the [MODE] button.

If [no] is selected, initial reset is omitted, and you can only change the settings of output polarity and analog output.



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 ▲/▼ button to select the analog output and press [MODE] button. (for IL-1000/IL-1500 only)

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 ±5 V.
1-5u	Analog output range is from 1 to 5 V.
AnPr	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.

Reference If any button other than the ▲/▼ button and [MODE] button are pressed halfway through the initial reset procedure, the initial reset is stopped and returned to the screen displayed in step 2.

Operations required when the model of the connected head is changed

When the model of the connected head is changed, it is necessary to initialize the zero shift and calibration functions.
Once the model of the connected head is changed, the screen appears as follows:

▼or ▲ button

To basic display

Selecting [YES] triggers initialization, including the calibration function.
When initialization is completed, [End] flickers on the sub display several times, and then the basic display appears again.
Selecting [no] suppresses initialization. Separately, set the zero-shift and calibration function.

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)

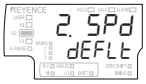
Basic display

Press the [MODE] button for 2 seconds.

"1. Measurement direction"

Use ▲/▼ to select.
Setting the measurement direction.

Press the [MODE] or ▶ button.



"2. Sampling rate"

Use ▲/▼ to select.
Setting the sampling rate.

Press the [MODE] or ▶ button.

"3. Averaging rate, Step count filter, High-pass filter"

Use ▲/▼ to select.
Setting the averaging
When selecting diFF it will be set as Step count filter, when selecting HPF it will be set as High-pass filter.

Press the [MODE] or ▶ button.

"4. Alarm setting"

Use ▲/▼ to select.
Setting the default, clamp, and user.

Press the [MODE] or ▶ button.

"5. Output state"

Use ▲/▼ to select.
Setting N.O. (Normally Open) and N.C. (Normally Closed)

"Basic setting complete"

Press the [MODE] or ▶ button.

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.
"6. Hold function" "7. Timing input" "8. Delay timer" "9. Hysteresis" "11. External input" "12. Bank switching method" "13. Zero shift value memory function" "14. Interference prevention function" "16. Power saving function" "17. Head display mode" "18. Display color"

Press the [MODE] or ▶ button.

"10. Analog output scaling (IL-1000/IL-1500)" (Page 10)
"15. Number of digit displayed" (Page 10)

Advanced setting

List of Advanced Setting Items

The advanced settings enable settings of the items listed below.
For details, refer to the User's Manual.

Type	Setting item	Description
Advanced settings	6. Hold function 6. HLd	Sets how to hold a judgment value (P.V. value) under specific conditions.
	7. Timing input 7. t in	Sets how to use the timing input that is used with the hold function.
	8. Delay timer 8. dLY	Sets the delay timer for judgment output.
	9. Hysteresis 9. HYS	Sets a hysteresis value for tolerance judgment value.
	10. Analog output scaling 10.AnG (page 10)	Sets the analog output scaling for judgment value (P.V. value).
	11. External input 11. in	Sets how to assign the four external inputs.
	12. Bank switching method 12.bnt	Sets how to switch banks.
	13. Zero shift value memory function 13.SFt	Sets the nonvolatile memory (EEPROM) to store the shifted display condition established by the zero shift function.
	14. Interference prevention function 14. inF	Sets the use of the mutual-interference prevention function.
	15. Number of digit displayed 15.dSP (page 10)	Sets the number of digits for displaying judgment value (P.V. value), internally measured value (R.V. value), and calculated value (CALC value).
	16. Power saving function 16.Eco	Sets the power saving function for indicator lamps.
	17. Head display mode 17.HEd	Sets lighting conditions for the indicators on the head.
	18. Display color 18.CoL	Sets the lighting colors of the judgment indicator, and the display colors of the main display of the panel-mounting amplifiers (IL-1500/IL-1550).

Basic Setting

■ 1. Measurement direction

Sets whether the display value increases or decreases as the workpiece moves toward the sensor head.

Setting value	Description	Default value
nor	The display value increases as the workpiece moves toward the head.	○
rEu	The display value decreases as the workpiece moves toward the head.	

■ 2. Sampling rate

The sampling rate is the rate at which data is sampled.
Usually, use the default value. It can be increased for faster sampling, or decreased when the received light intensity is low.

Setting range		Default value
dEFLt/033/ 1/2/5	(Unit: ms)	dEFLt

- As for dEFLt, IL-030/IL-065/IL-100 is 1ms, IL-300/IL-600 is 2 ms, and IL-2000 is 5 ms.
- When the mutual-interference prevention function is enabled, the sampling rate of the expansion units is set equal to that of the main unit, so that the sampling rate setting screen for expansion unit is skipped.
- When the calculation function is enabled, the sampling rate of expansion unit 1 is set equal to that of the main unit, so that the sampling rate setting screen for expansion unit 1 is skipped. Expansion unit 2 and following, units are each set individually.
- When the mutual-interference prevention function is enabled, 2 ms or 5 ms cannot be set.
- When 2 ms or 5 ms is selected under IL-030/IL-065/IL-100, and dEFLt, 2 ms or 5 ms is selected under IL-300/IL-600/IL-2000, the mutual-interference prevention function cannot be set.
  When the [FrEQ] setting, if "3.AVE" is [HPF], is 50 Hz/100 Hz, IL-030/IL-065/IL-100 cannot be set to 2 ms/5 ms, and the IL-300/IL-600/IL-2000 cannot be set to dEFLt/ 2 ms/5 ms.
  When "3.AVE" is [d iFF], 5 ms cannot be set.

■ 3. Averaging rate, Step count filter, High-pass filter

● Averaging

The average value is moved and averaged. If the measured values fluctuate, stable measurements can be obtained by increasing the average number of times. Also, when selecting [d iFF], the Step count filter function, or [HPF] the High-pass filter function will be enabled.

Item	Setting range (Rate)	Default value
Averaging	1/2/4/8/ 16/32/64/ 128/256/5 12/ 1024/2048/ 4096/d iFF/HPF	16

● Step count filter

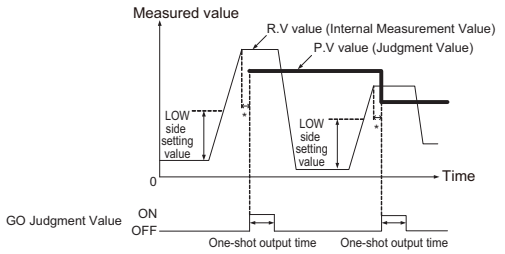
Acknowledge the steps above the specified height (LOW setting value), it is the filter that does the one shot output. If the steps are acknowledged, the internal measurement value (R.V.) from the time that there is a sudden change in the + direction until that change has stopped will be the P.V. (Judgment Value). Also, the set one shot time, will make the Go decision output on, and will hold the P.V. (Judgment Value) until the next steps are acknowledged.

Item	Setting range (ms)	Default value
One-shot time	2 to 9999	10

CAUTION

- **Use work pieces moving at 200 mm/s or faster.**
- **Set the HIGH side setting value as larger than the step.**
- **Set the LO side setting value for approximately half of the desired step.**
- **When the LO side setting is less than 0, no matter what step, the P.V. (Judgment Value) will not operate. Concerning LO side setting value settings, refer to "Setting the Tolerance Setting Value (Threshold)" (Page 7)**
- **While the timing input is ON, The P.V. (Judgment Value) will not renew. When OFF, The operation will restart using the first taken value as a standard.**
- **The sampling rate will be 5 ms and when at dEFLt the IL-2000 cannot be set to diFF.**

Reference



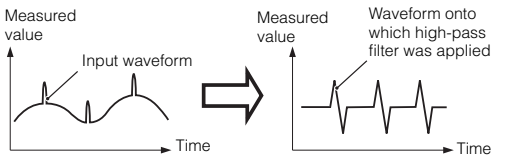
* The sampling cycle is 5.5 ms when 0.33 ms, 6 ms when 5.5 ms, and 8 ms when 2 ms.

● High-pass filter

This function ignores fluctuations which are less than an arbitrary frequency (cut-off frequency), and displays the results. This is effective to ignore gradual changes and only capture the sudden changes. When [HPF] is selected on the averaging setting screen, the cut-off frequency setting screen will open.

Item	Setting range (Hz)	Default value
Cut-off frequency	0.1/02/05/ 1/2/5/ 10/20/50/ 100	0.1

Reference The following process takes place when the high-pass filter is set.



■ 4. Alarm setting

The IL Series becomes unmeasurable if the measurement range is exceeded or the received light intensity is too high/low. (If the unmeasurable state repeats the number of times set for alarm, the screen displays [-----].)
The alarm setting determines how to deal with the data in the unmeasurable condition.

The alarm output is ON during measurable state. It turns OFF when the alarm or error state occurs (Normally Closed).

Setting value	Description	Default value
Default dEFLt	When measurement is impossible, this option sets the default number of samples for which the previous normal value is held. Sampling rate: 0.33 ms → 6 times; Other than 0.33 ms → 7 times	○
Clamp CLP	When measurement is impossible, the previous normal value is held until the measurable state is restored.	
User setting USr	When measurement is impossible, this option sets the number of samples for which the previous normal value is held. The settable range is as follows: Setting range: 2 to 1000 times; Default value: 7 times	

- If measurement is impossible immediately after powering on or immediately after reset input, the display [-----] is held.
- If the default or user setting is selected and measurement remains impossible after the number of alarms, the measured value is displayed as [-----]. This state is called the alarm state.
- When the amplifier is in alarm state and valid measurement values are obtained for a number of samples equal to the averaging value + 2, the amplifier recovers from the alarm state and displays the measured value.
- If measurement is restored before the number of sampling times specified for the default or user setting, the hold function is cancelled.

- The alarm output after power up or reset input is ON until the amplifier recognizes an unmeasurable state even if [-----] is displayed.
- The alarm output is turned ON once a reset is executed in response to reset input.
- The alarm output operates as a normally closed contact irrespective of how the output method is changed ("5. Output method" (page 8)).
- The alarm output is not held by timing input.

■ 5. Output method

Setting the judgment output method

Setting value	Description	Default value
no	Output is normally open	○
nC	Output is normally closed	

The alarm output operates as a normally closed contact irrespective of the setting of output method.

Reference

Normally open [no]

Judgment	Judgment output		
	HIGH	GO	LOW
HIGH	ON	OFF	OFF
GO	OFF	ON	OFF
LOW	OFF	OFF	ON
P.V. value is [----]	OFF	OFF	OFF
Error	ON	OFF	ON

Normally closed [nC]

Judgment	Judgment output		
	HIGH	GO	LOW
HIGH	OFF	ON	ON
GO	ON	OFF	ON
LOW	ON	ON	OFF
P.V. value is [----]	ON	ON	ON
Error	OFF	ON	OFF

■ 10. Analog output scaling (IL-1000/IL-1500)

Sets the analog output scaling for judgment value (P.V. value).
This screen is skipped if the analog output is set to OFF.

Analog output	Description	Default value
Default dEFLt	Scaling is disabled.	○
Free range FrEE	Scaling is enabled. The range of analog output can be changed by specifying the upper and lower limits of judgment value (P.V. value).	
Bank bAnK	A different scaling is provided for each bank. The upper and lower limits are specified for each bank.	

● Default relationship of voltage vs. analog output

Model	Upper limit	Lower limit
IL-030	5.000	-5.000
IL-065	10.000	-10.000
IL-100	20.000	-20.000
IL-300	140.00	-140.00
IL-600	400.00	-400.00
IL-2000	1000.0	-1000.0

The upper and lower output limits for the different selections of analog outputs are as follows:

Analog setting	Upper output limit	Lower output limit
oFF	No output.	
0-5v	5 V	0 V
-5-5v	5 V	-5 V
1-5v	5 V	1 V
4-20r	20 mA	4 mA

● How to set a free range

IL-030/IL-065/IL-100

Item	Setting range	Default value
Upper limit	-99.999 to 99.999	10.000
Lower limit	-99.999 to 99.999	-10.000

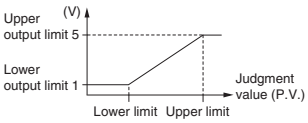
IL-300/IL-600

Item	Setting range	Default value
Upper limit	-999.99 to 999.99	100.00
Lower limit	-999.99 to 999.99	-100.00

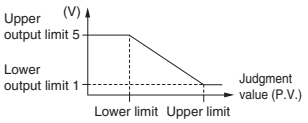
IL-2000

Item	Setting range	Default value
Upper limit	-9999.9 to 9999.9	1000.0
Lower limit	-9999.9 to 9999.9	-1000.0

Example 1: Lower limit < upper limit
(Analog output 1 to 5 V)



Example 2: Lower limit > upper limit
(Analog output 1 to 5 V)

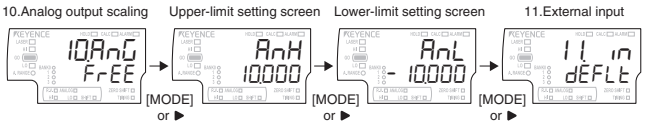


Reference

If the upper limit and lower limit are set equal, the analog output is provided as follows:
Judgment value (P.V. value) ≤ upper limit: analog output = lower limit (1 V if the range is 1 to 5 V)
Judgment value (P.V. value) > upper limit: analog output = upper limit (5 V if the range is 1 to 5 V)

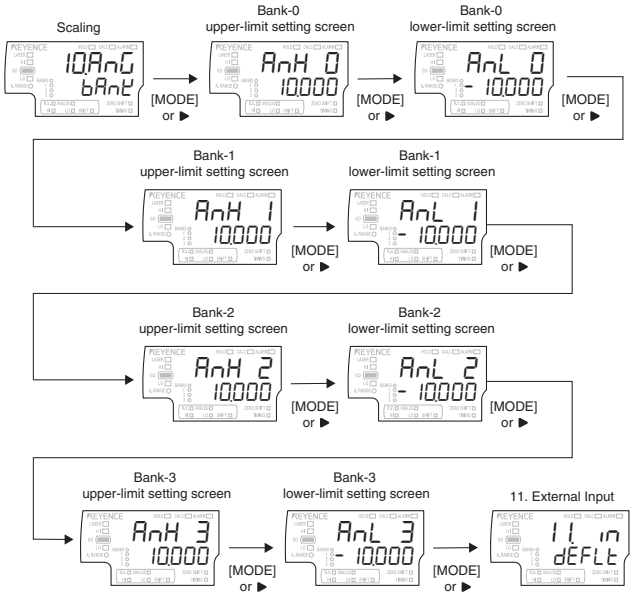
Screens for setting upper limit and lower limit

The following screens are skipped if the default state [dEFLt] is set.
Selecting the free range option causes transition to the upper-limit setting screen and lower-limit setting screen.



On each setting screen, press the ▲/▼ button to specify the upper and lower limits.

Selecting the bank option causes transition to the upper-limit setting screen and lower-limit setting screen.



On each setting screen, press the ▲/▼ button to specify the upper and lower limits.

■ 15. Number of digit displayed

Sets the number of digits for displaying judgment value (P.V. value), internally measured value (R.V. value), and calculated value (CALC value).

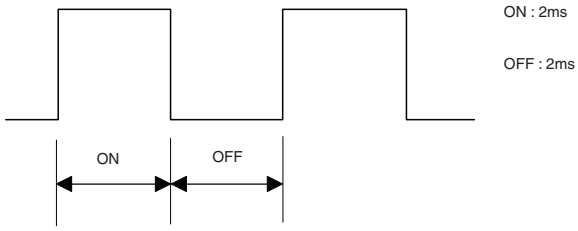
Number of digit displayed	Description	Default value
dEFLt	A different value is displayed for each head.*1	○
0.001	Displayed to three decimal places.*2	
0.01	Displayed by truncating the third decimal place.*3	
0.1	Displayed by truncating the second decimal place.	
1	Displayed by truncating the first decimal place.	

*1 The 7 segment inscription of [dEFLt], IL-030/IL-065/IL-100: 0.01, IL-300/IL-600: 0.1, IL-2000: 1.
*2 This cannot be set under IL-300/IL-600/IL-2000.
*3 This cannot be set under IL-2000.

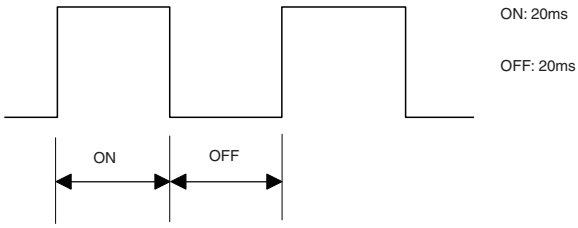
Minimum input time for external input

The minimum input time for external input is as follows:

Timing input



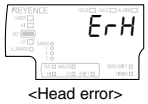
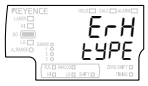
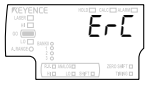
Zero shift input, reset input, bank switching input, or emission stop input

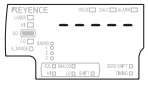
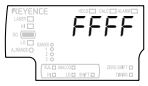


Displayed Contents and Corrective Actions

Reference When an error is displayed, the judgment output changes to the error state and the alarm output will turn OFF.
"5. Output method" (Page 10)

- When [ErC] is displayed, all the judgment outputs and alarm outputs will turn OFF.
- When the error display is other than [ErC] or [ErE] or [-----] is displayed, the analog voltage output is 5.5 V and the analog output current is 3.0 mA.

Error indication	Error contents	Remedy
 <Head error>	Sensor head is not connected. Head cable is broken. Sensor head is damaged.	• Check that the sensor head is connected. • Check that the head cable is not broken. • Check the connection of the head cable to the connector. • After checking these points, turn on the power again. • Check the model of the sensor head and the sensor amplifier.
 <Laser error>	The laser in the sensor head is broken.	Replace the sensor head.
 <Head model error>	A sensor head is connected that is incompatible with the IL-1000/IL-1050/IL-1500/ IL-1550.	Check the models of the sensor head and sensor amplifier.
 <EEPROM error>	Data read/write error	Perform the initial reset (initialization).
	Data has been written in the EEPROM over 1 million times and can no longer be updated.	Replace the amplifier unit if data writing is necessary.
	Overcurrent is detected in the output.	• Check the load and reduce the current to within the rated range. • Check that the output wire does not touch another wire or a frame.
	Communication is not possible between amplifiers.	Turn off the power and check the connections between amplifiers.

Other indication	Displayed contents	Remedy
	Button operation is prohibited.	The read/write setting switch on the communication unit DLRS1A is set to the RW side. Set it to the R side. RS-232C Communication Unit DLRS1A User's Manual.
	There is no workpiece or background within the measurement distance range, or no light is entering the receiver.	Set a workpiece or background in the distance for detection from the sensor.
	Reading exceeds the measurement distance range.	Set a workpiece or background in the distance for detection from the sensor.
	Light intensity is saturated.	Tilt the sensor head so that specular reflection does not enter the sensor.
	The key lock is enabled and button operations are prohibited.	Unlock the key lock state.

Troubleshooting

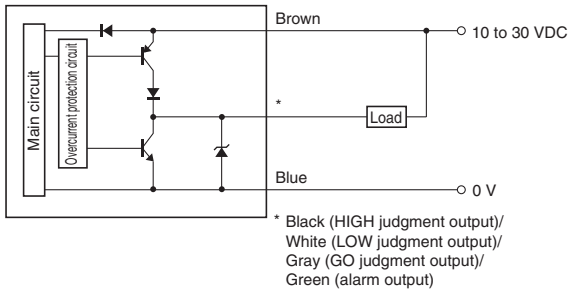
Problem	Cause and solutions
The external input does not function.	Check the settings for the external input. "Chapter 4-2 11.External input" of the User's Manual.
The current settings can no longer be determined. The user wants to return the unit to the factory defaults.	Perform initial reset (initialization). "Initial Reset (Initialize)" (Page 8)

Circuit Diagram

■ Sensor head

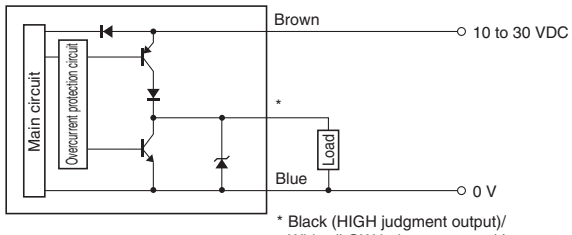
● Output circuit

When NPN output is selected



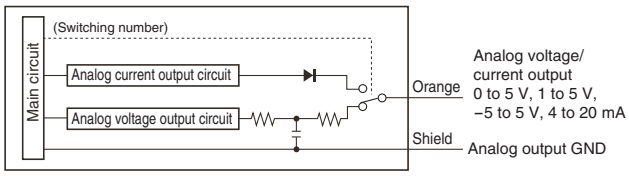
* Black (HIGH judgment output)/ White (LOW judgment output)/ Gray (GO judgment output)/ Green (alarm output)

When PNP output is selected



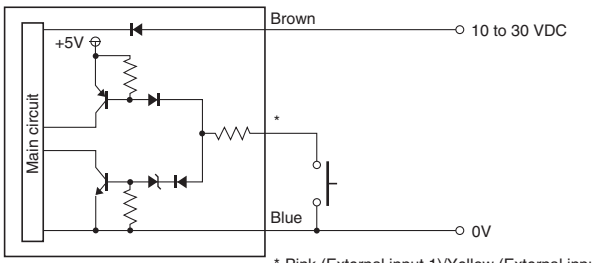
* Black (HIGH judgment output)/ White (LOW judgment output)/ Gray (GO judgment output)/ Green (alarm output)

● Analog output circuit



● Input circuit

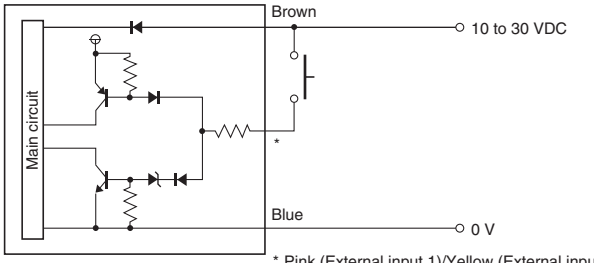
When NPN output is selected



(Short-circuit current 2 mA or less)

* Pink (External input 1)/Yellow (External input 2)/ Pink·Purple (External input 3)/ Purple (External input 4)

When PNP output is selected



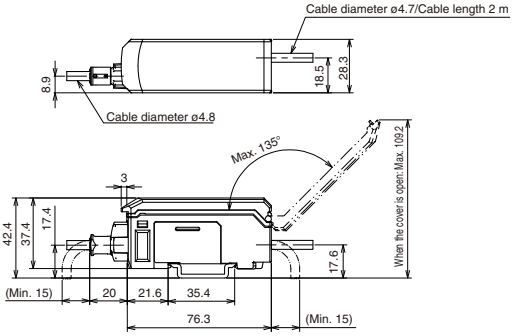
(Short-circuit current 2 mA or less)

* Pink (External input 1)/Yellow (External input 2)/ Pink·Purple (External input 3)/ Purple (External input 4)

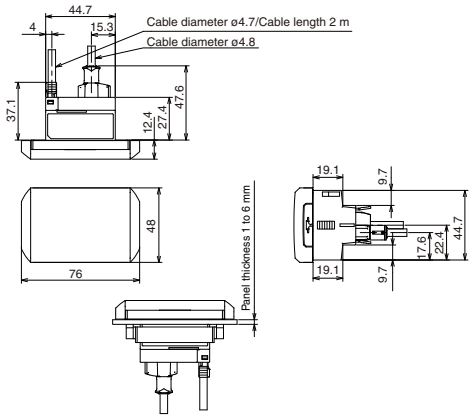
Dimensions

■Sensor amplifier

● IL-1000/IL-1050

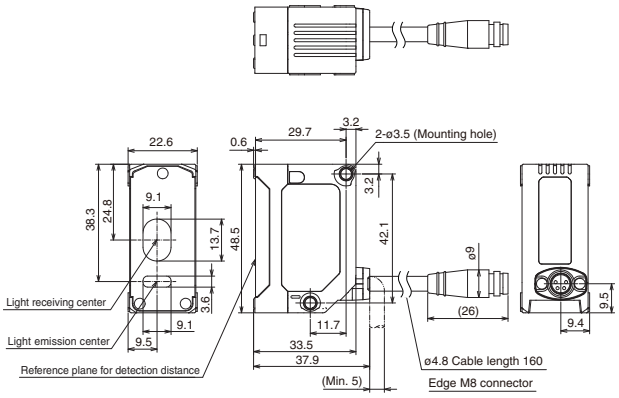


● IL-1500/IL-1550

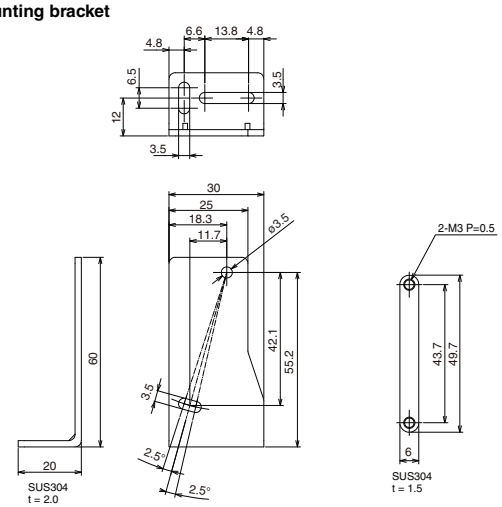


■ Sensor head

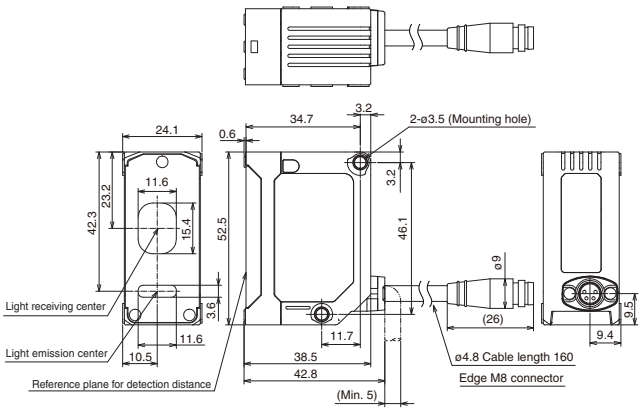
● IL-030



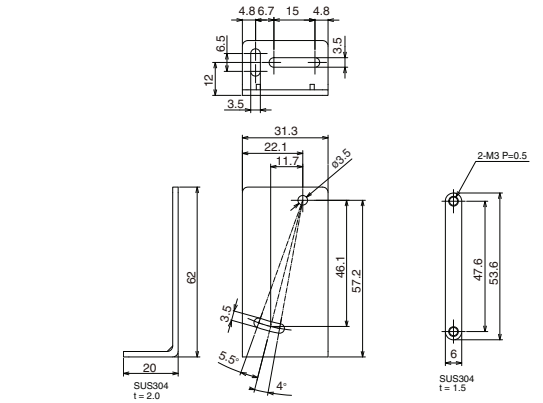
Mounting bracket



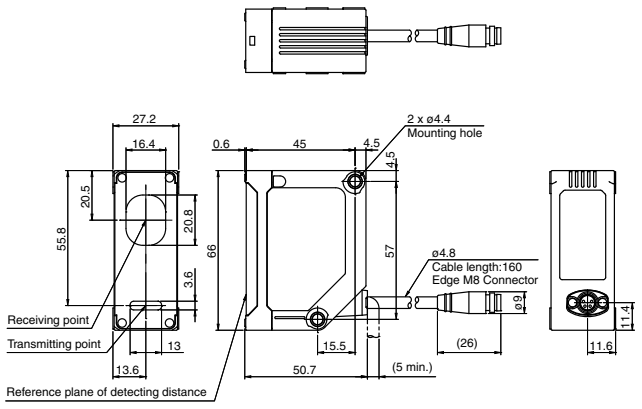
● IL-065/IL-100



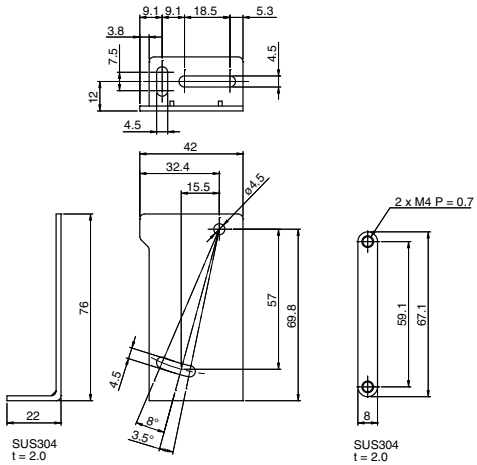
Mounting bracket



● IL-300/IL-600

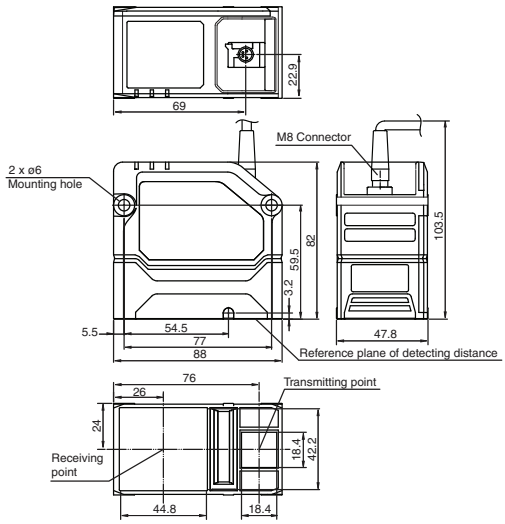


Mounting bracket

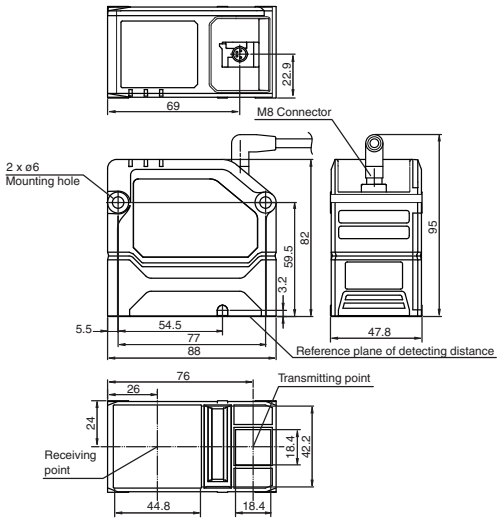


● **IL-2000**

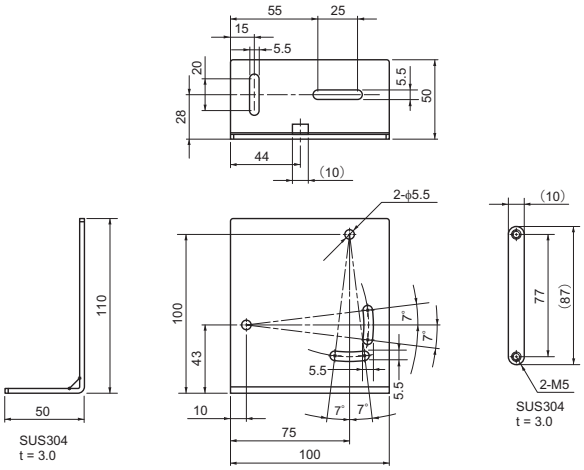
When using the straight connector



When using the L-shaped connector

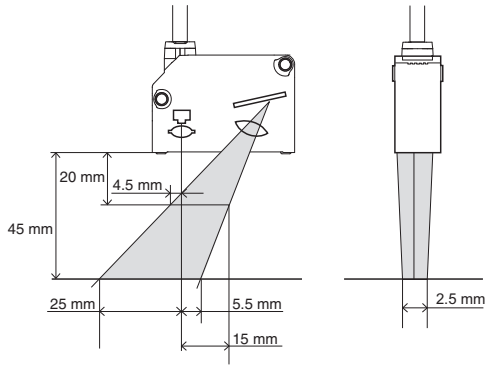


Mounting bracket (OP-87606)

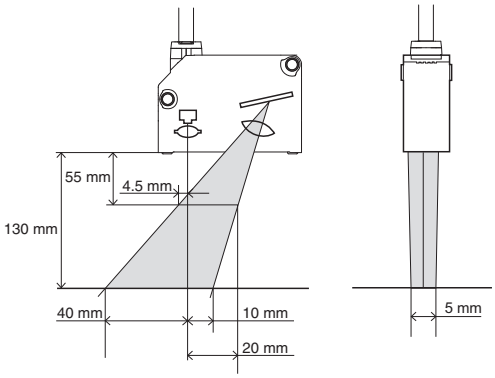


Mutual Interference

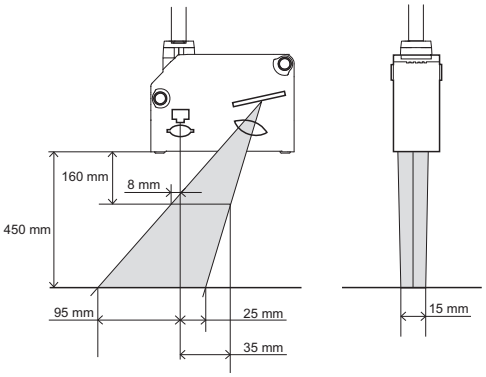
● **IL-030**



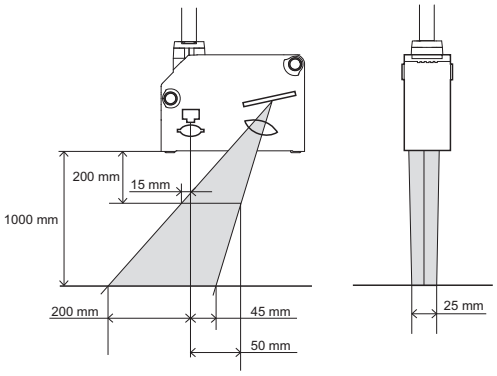
● **IL-065/IL-100**



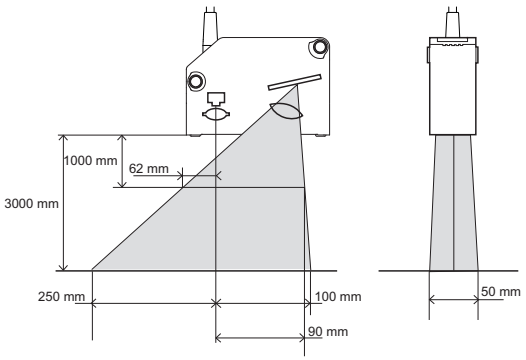
● **IL-300**



● **IL-600**



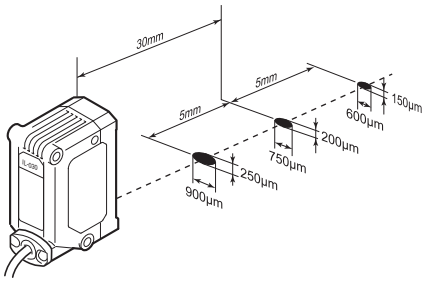
● **IL-2000**



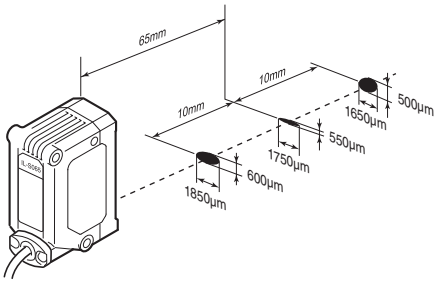
The above figure depicts the optical axis of the IL series.
The optical axis may vary by approximately ±1.5° (IL-2000), or ±2.0° (IL-030/IL-065/IL-100/IL-300/IL-600).

Spot Diameter

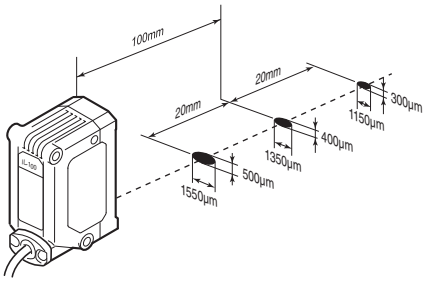
● **IL-030**



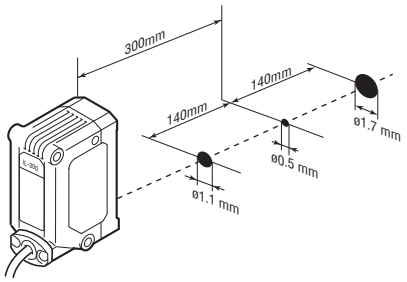
● **IL-065**



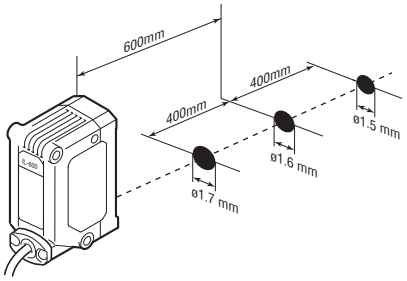
● **IL-100**



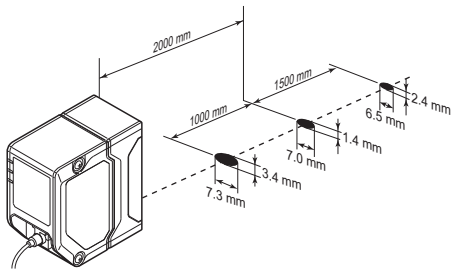
● **IL-300**



● **IL-600**



● **IL-2000**



The optical axis may vary by approximately ±1.5° (IL-2000), or ±2.0° (IL-030/IL-065/IL-100/IL-300/IL-600).

Analog Output Accuracy

The analog output can be selected from ±5 V, 1 to 5 V, 0 to 5 V, and 4 to 20 mA.

	Voltage output	Current output
Output range	±5 V (Full scale 10 V)	4 to 20 mA (Full scale16 mA)
Output resistance	100Ω	-
Maximum load resistance	-	350Ω
Repeatability	±1 mV	±1.5 µA
Accuracy to displayed value	±0.05% of F.S.	±0.25% of F.S.
Temperature characteristic	±0.005% of F.S./°C	±0.01% of F.S./°C
Updating cycle	Same as sampling rate of sensor head*1	

*1 When the average number of times for the data obtained at the sampling rate is 256 or less.

Specifications

■ Sensor head

Model		IL-030	IL-065	IL-100	IL-300	IL-600	IL-2000
Mounting distance		30 mm	65 mm	100 mm	300 mm	600 mm	2000 mm
Measurement range		20 to 45 mm	55 to 105 mm	75 to 130 mm	160 to 450 mm	200 to 1000 mm	1000 to 3500 mm
Amplifier type		Red semiconductor laser; wavelength 655 nm (visible light)					
	Laser Class	Class 1 Laser Product (FDA (CDRH) Part1040.10[*1], IEC 60825-1:2014)	Class 2 Laser Product (FDA (CDRH) Part1040.10[*1], IEC 60825-1:2014)				
	Output	220 µW	560 µW				
Spot diameter (at the reference distance)		Approx. 200 × 750 µm	Approx. 550 × 1750 µm	Approx. 400 × 1350 µm	Approx. ø500 µm	Approx. ø1600 µm	Approx. 1400 × 7000 µm
Linearity[*2] [*3]		±0.1% of F.S. (When used under 25 to 35 mm)	±0.1% of F.S. (When used under 55 to 75 mm)	±0.15% of F.S. (When used under 80 to 120 mm)	±0.25% of F.S. (When used under 160 to 440 mm)	±0.25% of F.S. (When used under 200 to 600 mm) ±0.5% of F.S. (When used under 200 to 1000 mm)	±0.16% of F.S. (When used under 1000 to 3500 mm)
Repeatability[*4]		1 µm	2 µm	4 µm	30 µm	50 µm	100 µm
Sampling rate		0.33/1/2/5 ms (Variable to 4 levels)					
Operating indicators		Laser emission warning indicator: green LED, Analog range indicator: orange LED, Reference distance indicator: red/green LED					
Temperature characteristic[*3]		0.05% of F.S./°C	0.06% of F.S./°C	0.06% of F.S./°C	0.08% of F.S./°C	0.08% of F.S./°C	0.016% of F.S./°C
Environmental resistance	Enclosure rating	IP67					
	Ambient light[*5]	Incandescent lamp: 5000 lx	Incandescent lamp: 7500 lx	Incandescent lamp: 7500 lx	Incandescent lamp: 5000 lx	Incandescent lamp: 5000 lx	Incandescent lamp: 10000 lx
	Ambient temperature	-10 to +50°C (No condensation and freezing)					
	Relative humidity	35 to 85% RH (No condensation)					
	Vibration	10 to 55 Hz, 1.5 mm double amplitude, 2 hours each for X, Y, and Z axes					
	Pollution degree	3					
Material		Housing material: PBT, Metal: SUS304, Packing: NBR, Lens cover: Glass, Cable: PVC					
Weight		Approx. 60 g	Approx. 75 g		Approx. 135 g		Approx. 350 g

*1 The classification is implemented based on IEC60825-1 following the requirement of Laser Notice No.50 of FDA (CDRH).

*2 Value when measuring the KEYENCE standard target (white diffuse object).

*3 The F.S. of each model is as shown to the right. IL-030: ±5 mm, IL-065: ±10 mm, IL-100: ±20 mm, IL-300: ±140 mm, IL-600: ±400 mm, IL-2000: +1000 to -1500 mm

*4 Is the value for when our standard object (white diffuse object) is measured at an average of 128 times and with a sampling rate of 1 ms from a standard distance. (IL-300/IL-600 is 2 ms and IL-2000 is 5 ms).

*5 Value when the sampling rate is set to 2 ms or 5 ms.

■ Amplifier unit

Model		IL-1000	IL-1500	IL-1050	IL-1550
Amplifier type		DIN rail mount	Panel mount	DIN rail mount	Panel mount
Main unit/Expansion unit		Main unit		Expansion unit	
Head compatibility		Yes			
Display	Minimum display unit	IL-030: 1 µm, IL-065/IL-100: 2 µm, IL-300: 10 µm, IL-600: 50 µm, IL-2000: 100 µm			
	Display range	IL-030/IL-065/IL-100: ±99.999 mm to ±99 mm (Variable to 4 levels) IL-300/IL-600: ±999.99 mm to ±999 mm (Variable to 3 levels) IL-2000: ±9999.9 mm to ±9999 mm (Variable to 2 levels)			
	Display rate	Approx. 10 times/sec			
Analog voltage output*1		±5 V, 1 to 5 V, 0 to 5 V Output impedance 100 Ω		No	
Analog current output*1		4 to 20 mA Maximum load resistance 350 Ω			
Control input*2	Bank switching input	Non-voltage input			
	Zero shift input				
	Emission stop input				
	Timing input				
	Reset input				
Control output*3	Judgment output	Open collector (NPN/PNP switchable, N.O./N.C. switchable)			
	Alarm output	Open collector (NPN/PNP switchable, N.C. switchable)			
Power supply	Power voltage*4	10 to 30 VDC, including ripple (P-P) 10% Class2 or LPS*5		Supplied from main unit	
	Power consumption (without load)	2300 mW or less (at 30 V, 77 mA max.)*6	2500 mW or less (at 30 V, 84 mA max.)*7	2000 mW or less (at 30 V, 67 mA max.)	2200 mW or less (at 30 V, 74 mA max.)
Environmental resistance	Ambient temperature	-10 to +50°C (No freezing)			
	Relative humidity	35 to 85% RH (No condensation)			
	Vibration	10 to 55 Hz, 1.5 mm double amplitude, 2 hours each for X, Y, Z axes			
	Pollution degree	2			
Materials		Main unit case/Front panel: polycarbonate, Keytop: polyacetal, Cable: PVC			
Mass (including accessories)		Approx. 150 g	Approx. 170 g	Approx. 140 g	Approx. 160 g

*1 ±5 V, 1 to 5 V, 0 to 5 V, or 4 - 20 mA should be selected.

*2 The four external input wires are assigned with desired inputs. Rated no-voltage input: ON voltage 2 V or less; OFF current 0.02 mA or less.
Rated voltage input is max. input rating 30 V or less, ON voltage 7.5 V or more, and OFF current 0.05 mA or less.

*3 Rated NPN open collector output: max. 50 mA/ch (20 mA/ch when expansion units are connected), 30 V or less, residual voltage 1 V or less. (1.5 V or less when five or more expansion units are connected.)
Rated PNP open collector output: max. 50 mA/ch (20 mA/ch when expansion units are connected), power voltage or less, residual voltage 2 V or less. (2.5 V or less when five or more expansion units are connected.)

*4 When connecting five or more expansion units, ensure that the power voltage is 20 to 30 V.

*5 Use Class 2 or LPS power supply with the overcurrent protection device rated 2.5 A or less.

*6 18 W max. (Total power consumption when connecting seven expansion units and DL Series)

*7 19.5 W max. (Total power consumption when connecting seven expansion units and DL Series)

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