Panasonic **INSTRUCTION MANUAL**

Micro Laser Distance Sensor for IO-Link (CMOS)

**HG-C1000L** Series IO-Link

ME-HGC1000LV1EN 09/2018

Thank you very much for purchasing Panasonic products. Please read this Instruction Manual carefully and thoroughly for the correct and optimum use of this product. Kindly keep this manual in a convenient place for quick reference.

## ⚠ WARNING

- This product is intended to detect objects. Do not use it to carry out safety control functions to prevent accidents.
- Never use this product as a sensing device for personnel protection.
- Do not look into the beam directly during operation.

## 1 CE marking

This product complies with the following standards and regulations.

- For the EU: EMC Directive 2014/30/EC
  Contact for CE:
  Panasonic Marketing Europe GmbH
  Panasonic Testing Center
  Winsbergring 15, 22525 Hamburg, Germany

CE

## 2 Confirmation of packed content

| | |
|---|---|
| • Sensor | 1pc. |
| • Laser warning label (JIS Standards, GB Standard) | 1 set each |
| • FDA certification label | 1pc. |
| • Instruction Manual (Japanese, English) | 1pc. per language |

## 3 Safe use of laser product

In order to prevent accidents caused by laser products and to protect the users, IEC, JIS and FDA established the following standards:

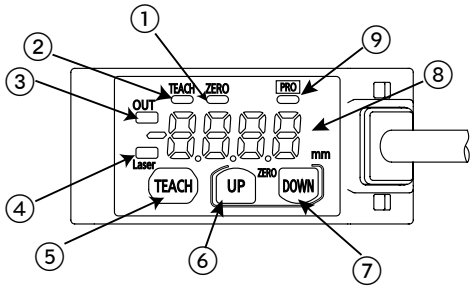
IEC: IEC 60825-1-2014 (EN 60825-1-2014)
JIS: JIS C 6802-2014
FDA: PART 1040 (Performance standards for light-emitting products)

These standards classify laser products according to their level of hazard and provide safety measures for the respective classes.

**Warning label and position**


An English warning label is attached to this product.

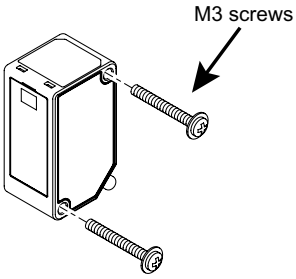
## 4 Part description

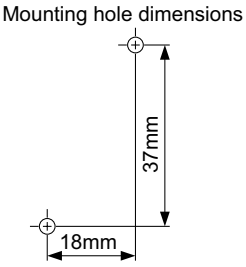



| No. | Item | |
|---|---|---|
| ① | Zero set indicator (Yellow) | Lights when the zero set function is enabled. |
| ② | Teaching indicator (Yellow). | Lights when teaching is in process |
| ③ | Output operation indicator (Orange) | Lights when the output is on |
| ④ | Laser emission indicator (Green) | Lights when the laser beam is ON |
| ⑤ | TEACH key | |
| ⑥ | UP key | |
| ⑦ | DOWN key | |
| ⑧ | Digital indicator (Red) | |
| ⑨ | PRO indicator (Yellow) | Lights in Pro mode<br>Flashes in normal status during IO-Link communication<br>OFF in normal status without IO-Link communication |

## 5 Mounting

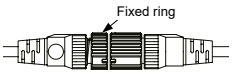
- When mounting this product, use M3 screws (prepare separately). Use a tightening torque of 0.5 N m for mounting.
- When mounting this product using the sensor mounting bracket (optional), also use a tightening torque of 0.5N·m



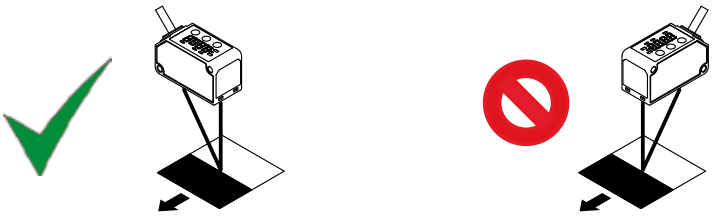

If the fixed ring loosens, the connector will come off, causing this product to generate a communication error. Before use, check that the fixed ring is not loose.

- Firmly tighten the fixed ring by rotating it.

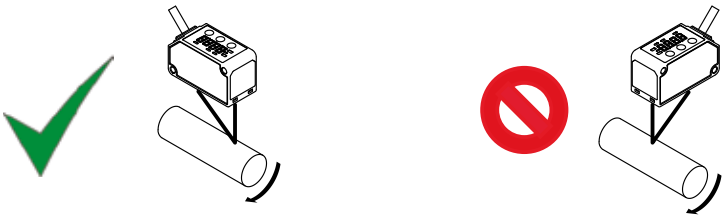



**Mounting direction**

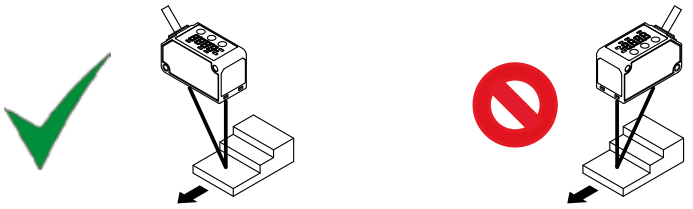
- When performing measurements of moving objects with excessively different materials and colors, mount the product in the following directions to minimize measurement errors.



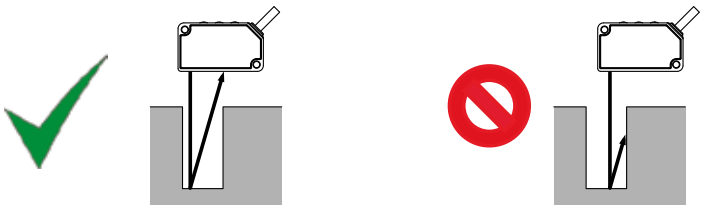
- When performing measurements of rotating objects, mount the product as follows. The effect of up/down deflection and position deviation can be minimized by mounting the sensor in the correct direction.



- When there is a step in the moving object, mount the product as follows. The effect of reflection deviation by the edges of the steps can be minimized by mounting the sensor in the correct direction.



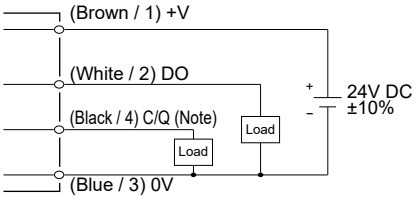
- When measuring in narrow locations or inside holes, mount the product so that optical path from the light emitting part to light-receiving part is not interrupted.



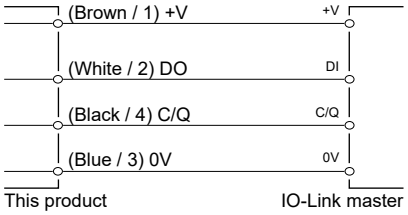
- Mount the sensor to a wall as follows, so that the multiple light reflections on the wall do not reach the light-receiving part. When the reflection factor on the wall is high, it is effective to use a dull black color.

## 6 I/O circuit diagrams

**As a general-purpose sensor**

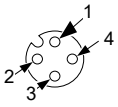



**Connected to a IO-Link master**




**Terminal arrangement of M12 connector**

Note: When the product is used as a general-purpose sensor, the IO-Link communication output (C/Q) provides the same output operation as the control output (DO).




| Terminal No. | Terminal name |
|---|---|
| 1 | +V |
| 2 | Control output (DO) |
| 3 | 0V |
| 4 | IO-Link communication (C/Q) |

・Recommended extension cable with connectors on both ends XS5W series [OMRON Corporation]

## 7 List of functions

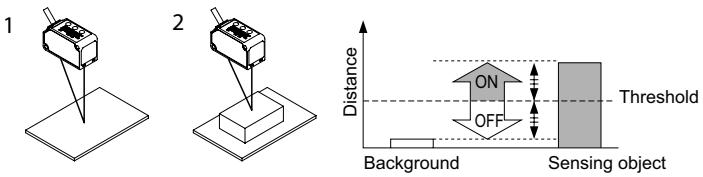
| Function | Setting on main unit | IO-Link communication setting |
|---|---|---|
| Teaching | Teaching input | Index2 |
| | Limit-teaching (UP key) | Index2 |
| | Limit-teaching (DOWN key) | Index2 |
| | Teaching cancel | Index2 |
| Sensing output setting | Normal sensing mode<br>Window comparator mode (1/2/3-point)<br>Differential mode | Index61_2 |
| Threshold setting | Threshold 1_SL | Index60_1 |
| | Threshold 2_SL | Index60_2 |
| Differential mode | Span setting | Index67_1 |
| | Threshold setting | Index67_2 |
| Peak / Bottom hold function | Setting | Index84 |
| | Release | Index2 |
| Zero set function | Save in nonvolatile memory | Index2 |
| | Execute | Index2 |
| | Release of nonvolatile memory | Index2 |
| Key lock function | Setting / Release | Index12 |
| Response Speed Setting | 10ms / 5ms / 1.5ms | Index66 |
| Output operation setting | Light-ON / Dark-ON | Index61_1 |
| Hysteresis setting | Hysteresis value | Index61_3 |
| Shift setting | Mode | Index74_1 |
| Shift amount setting | Shift amount | Index74_2 |
| Timer setting | Timer mode | Index64_1 |
| Timer period setting | Timer period | Index64_2 |
| Display setting | Normal / Invert / Offset | Index83 |
| Hold setting | ON/OFF | Index85_1 |
| ECO setting | ON/OFF | Index80 |
| Reset setting | Execute | Index2 |
| Emission halt | - | Index70 |
| Instability detection threshold | - | Index160 |
| Instability detection delay time | - | Index162 |
| Operating time | - | Index163 |
| Number of data save operations | - | Index164 |
| Notification flag setting | - | Index168 |
| Notification event code | - | Index169 |

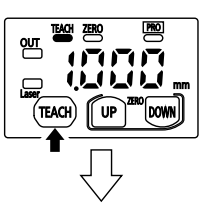
Note: For the IO-Link communication setting, refer to the attached sheet, “Index list” IMJE-HGCINDEXV1EN 09/2018.

## 8 Teaching

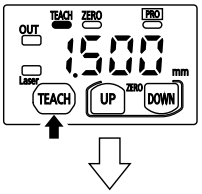
**2-point teaching**

This method is the basic teaching method.

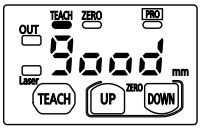


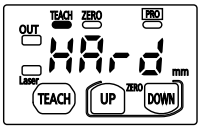

1. Press the TEACH key when the background is present.
(System command / Index2: 0x4D)




2. Press the TEACH key when the sensing object is present.
(System command / Index2: 0x4D)




Stable sensing is possible.

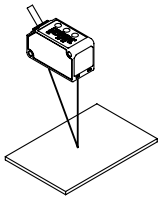


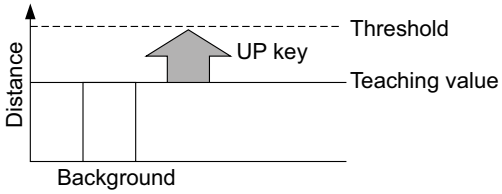

Stable sensing is not possible.

**Limit teaching**

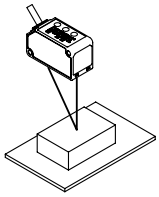
This teaching method is recommended, if small objects or objects in the background exist.

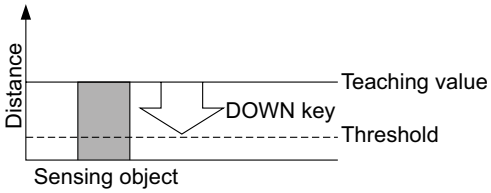
**When an object in the background is used as reference:**

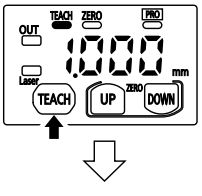




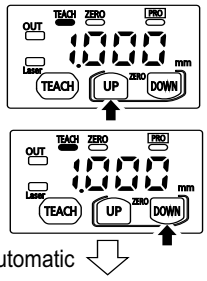

**When a sensing object is used as reference:**



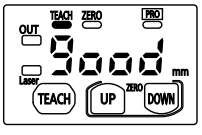



1. Press the TEACH key when the background or the sensing object is present.
(System command / Index2: 0x4D)




2. When an object in the background is used as reference, press the UP key to set the threshold on the sensor side.
(System command / Index2: 0x4B)
When a sensing object is used as a reference, press the DOWN key to set the threshold on the sensing object side.
(System command / Index2: 0x4C)

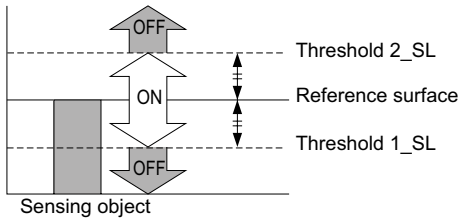


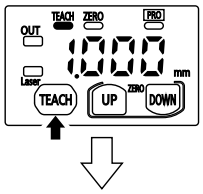

3. Teaching is completed.

**1-point teaching (window comparator mode)**

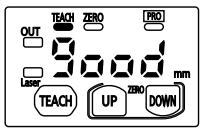
This mode is used for setting the threshold range for the distance from the reference value of the sensing object by performing a 1-point teaching. This mode is used for sensing within the threshold range.

When performing the 1-point teaching (window comparator mode), preset “Window comparator mode 1” in the sensing output setting of the PRO mode. For the setting method, refer to section 13, “**PRO mode setting**.”




1. Press the TEACH key twice when the sensing object is present.
(System command / Index2: 0x4D; Two times)



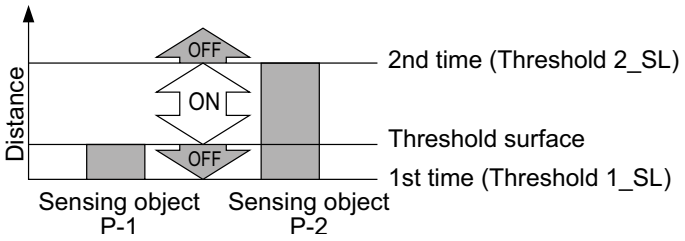

2. Teaching is completed.

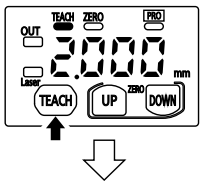
**2-point teaching (window comparator mode)**

This method is used to set the threshold range by conduction the 2-point teaching.

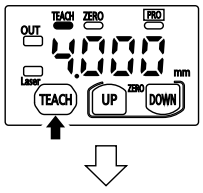
When performing the 2-point teaching (window comparator mode), preset “Window comparator mode 2” in the sensing output setting of the PRO mode. For the setting refer to section 13, “**PRO mode setting**.”

When conducting the teaching, use sensing objects (P-1 and P-2) whose distance are different from each other.

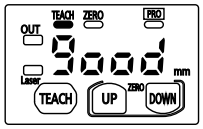


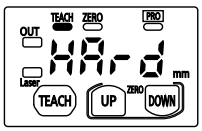

1. Press the TEACH key when the sensing object P-1 is present (1st time).
(System command / Index2: 0x4D)




2. Press the TEACH key when the sensing object P-2 is present (second time).
(System command / Index2: 0x4D)




Stable sensing is possible.




Stable sensing is not possible.

**3-point teaching (window comparator mode)**

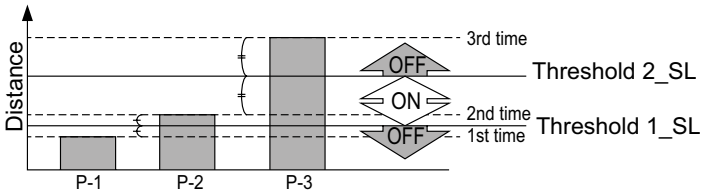
This is the method to perform 3-point teaching (P-1, P-2, P-3) and to set the threshold range by setting threshold 1_SL in the mid-point between the 1st time and 2nd time, and threshold 2_SL in the mid-point between the 2nd time and 3rd time as shown in the following figure.

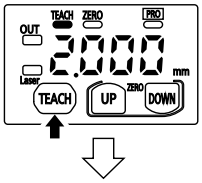
When performing 3-point teaching (window comparator mode), preset "Window comparator mode 3" in the sensing output setting of the PRO mode.

For the setting method, refer to section 13, "**PRO mode setting**."

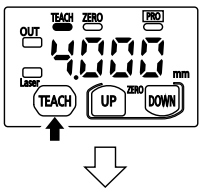
When performing teaching, use sensing objects (P-1, P-2, P-3) with different distance.

After teaching, P-1, P-2 and P-3 will be automatically rearranged from the smaller value.

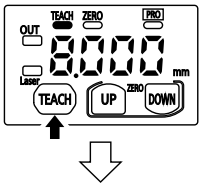


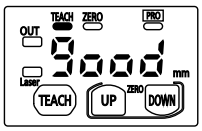

1. Press the TEACH key when the sensing object P-1 is present (1st time).
(System command / Index2: 0x4D)



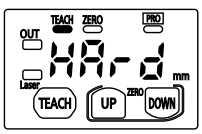

2. Press the TEACH key when the sensing object P-2 is present (second time).
(System command / Index2: 0x4D)




3. Press the TEACH key when the sensing object P-3 is present (3rd time).
(System command / Index2: 0x4D)




Stable sensing is possible.




Stable sensing is not possible.

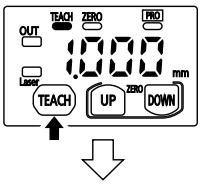
**Span adjustment in 'Rising differential mode' or 'Trailing differential mode'**

This mode is used to cancel the gradual changes in the measured values and to only detect sudden changes.

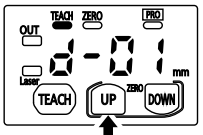
To use the Rising differential mode or Trailing differential mode, preset 'Rising differential mode' oder 'Trailing differential mode' in the sensing output setting of the PRO mode.

For the setting method, refer to section 13, "**PRO mode setting**."

The threshold can be set by using the threshold value fine adjustment function, see section 9, **"Threshold value fine adjustment function"**.



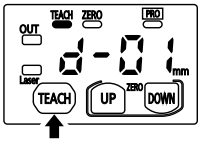

1. Press the TEACH key.




2. Press the UP key or DOWN key to select the span.

Short span Long span

d-01 ⇨ d-02 ⇨ • • • • ⇨ d-07 ⇨ d-08

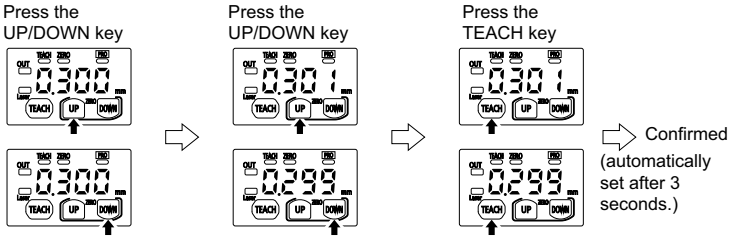



3. Press the TEACH key to set the span.

## 9 Threshold value fine adjustment function

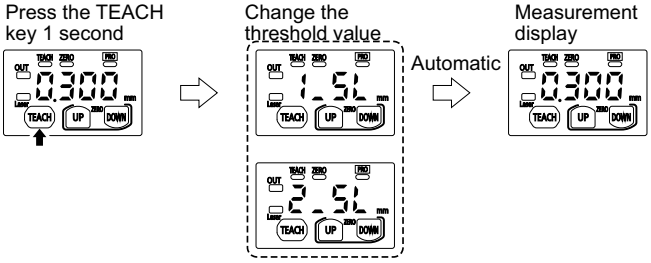
- The fine adjustment of the threshold can be performed in the measurement display.
- The fine adjustment of the threshold can be performed even after teaching.

**'Normal sensing mode', 'Rising differential mode' and 'Trailing differential mode'**

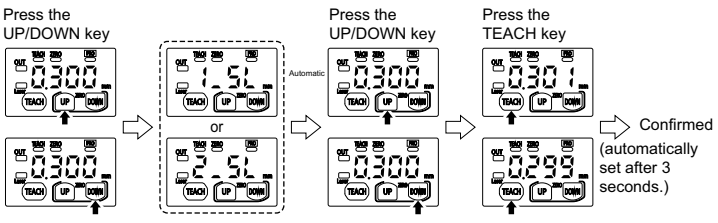



**Window comparator mode**

When the sensing output is set to window comparator mode, the display 1_SL and 2_SL can be changed only by pressing the TEACH key for 1s.



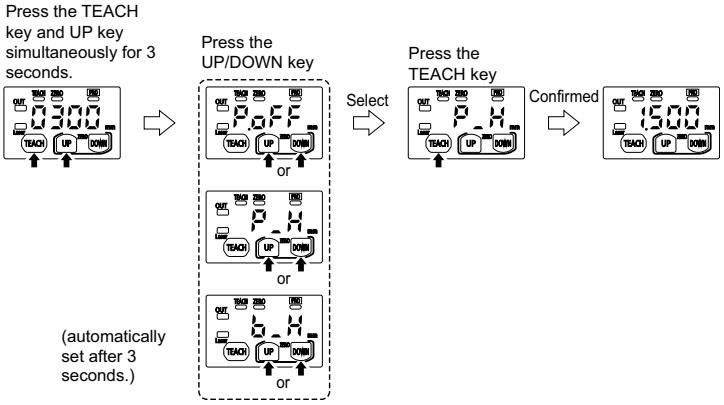

When performing a fine adjustment of the threshold of 1_SL or 2_SL, press the UP key or DOWN key. After 1_SL or 2_SL is displayed, the fine adjustment of the threshold can be performed.



## 10 Peak / bottom hold function

The peak / bottom hold function is for displaying the peak value and the bottom value.

When the zero set function is executed while the peak / bottom hold function is set to “Peak hold” or “Bottom hold”, the held measured value will be reset.




| Digital display | Description | Function |
|---|---|---|
| PoFF | Hold function release | Releases the hold status, and outputs the current measured value |
| P_H | Peak hold | Holds maximum measured value |
| b_H | Bottom hold | Holds minimum measured value |

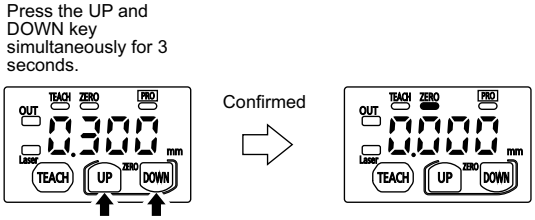
## 11 Zero set function

The zero set function is the function to compulsory set the measured value to ‘zero’.

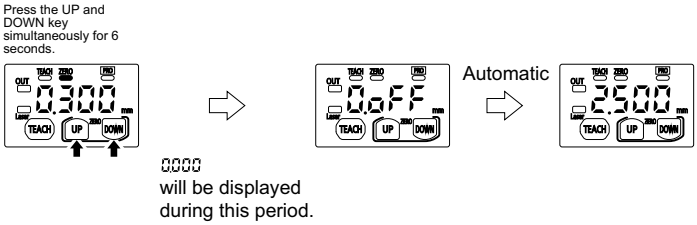
The zero set indicator (yellow) will turn ON when the zero set is valid.

When the display setting is set to Offset, the zero set function cannot be set.

**“Zero set” setting**




**Zero set release**

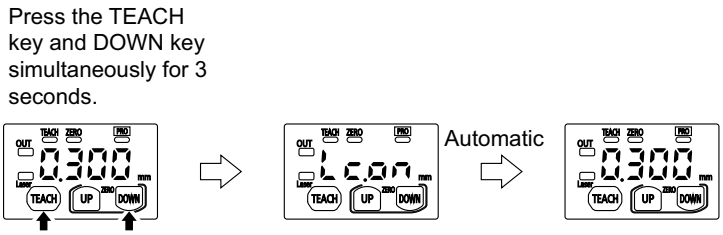



## 12 Key lock function

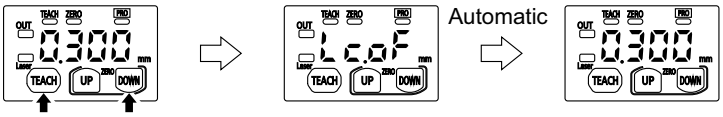
The key lock function is to prevent acceptance of key operations, so that the conditions in each setting mode are not changed accidentally.

When the key operation is performed after the key lock is set, “Loc ” will be displayed on the digital display.

**Key lock setting**

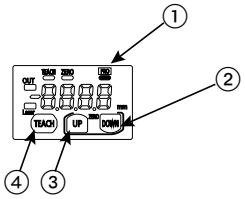



**Key lock release**




## 13 PRO mode setting

**Part description**




| No. | Item |
|---|---|
| ① | PRO indicator (Yellow) |
| ② | DOWN key (Select) |
| ③ | UP key (Select) |
| ④ | TEACH key (Confirmed) |

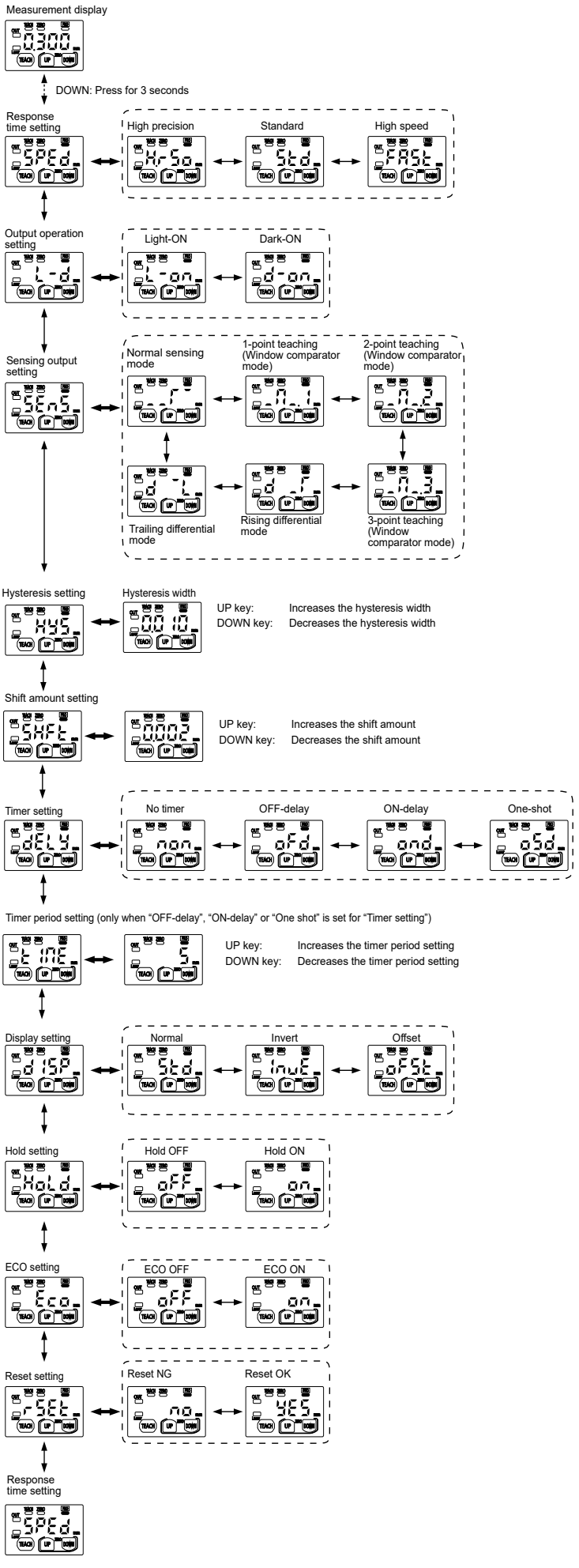
**Arrow description in figures**

| Arrow | Description |
|---|---|
| ◄► | Press the TEACH key |
| ◄– ► | Press UP key or DOWN key |
| ◄··► | Press DOWN key |

Press the DOWN key for 3 seconds or more to switch to PRO MODE. The PRO indicator (yellow) will turn ON when the PRO MODE is active. To return to the measurement display, press the DOWN key again for 3 seconds or more.

| Setting | Default setting | Description |
|---|---|---|
| Response speed | Hr5a | Set the response time.<br>“ Hr5a ”: High precision 10ms<br>“ Std ”: Standard 5ms<br>“ FASt ”: High speed 1.5ms |
| Output operation | L-on | Select the control output operation mode.<br>“ L-on ”: Light-ON, “ d-on ”: Dark-ON |
| Sensing output | nor | Set the sensing output.<br>“ nor ”: Normal sensing mode<br>“ 1Pt1 ”: 1-point teaching (Window comparator mode)<br>“ 1Pt2 ”: 2-point teaching (Window comparator mode)<br>“ 1Pt3 ”: 3-point teaching (Window comparator mode)<br>“ d rF ”: Rising differential mode<br>“ d tL ”: Trailing differential mode |
| Hysteresis | **HG-C1030L3-P**: 0.010<br>**HG-C1050L3-P** 0.03<br>**HG-C1100L3-P**: 0.07<br>**HG-C1200L3-P**: 0.2<br>**HG-C1400L3-P**: 0.8 | Set the hysteresis width.<br>**HG-C1030L3-P**: 0.001 to 5.00mm<br>**HG-C1050L3-P**: 0.01 to 15.00mm<br>**HG-C1100L3-P**: 0.02 to 35.00mm<br>**HG-C1200L3-P**: 0.1 to 80.00mm<br>**HG-C1400L3-P**: 0.2 to 200.00mm |
| Shift amount | **HG-C1030L3-P**: 0.020<br>**HG-C1050L3-P** 0.06<br>**HG-C1100L3-P**: 0.14<br>**HG-C1200L3-P**: 0.4<br>**HG-C1400L3-P**: 1.6 | Set shift amount of threshold value in limit teaching.<br>Set the shift amount to a value that is twice the value of hysteresis or more.<br>HG-C1030L3-P□: 0.002 to 10.00mm<br>HG-C1050L3-P□: 0.02 to 30.00mm<br>HG-C1100L3-P□: 0.04 to 70.00mm<br>HG-C1200L3-P□: 0.2 to 160.0mm<br>HG-C1400L3-P□: 0.4 to 400.0mm |
| Timer | non | Set the timer operation. The timer time is fixed at 5ms.<br>“ non ”: No timer,<br>“ oFd ”: OFF-delay timer<br>“ ond ”: ON-delay timer<br>“ oSd ”: One-shot timer |
| Timer period | 5 | Set the timer period when the timer setting is set to “OFF-delay timer,” “ON-delay timer” or “One-shot timer.”<br>“ 5 ”: 5ms, “ 10 ”: 10ms, “ 25 ”: 25ms,<br>“ 50 ”: 50ms, “ 100 ”: 100ms, “ 250 ”: 250ms,<br>“ 500 ”: 500ms, “ 1000 ”: 1,000ms, “ 5000 ”: 5,000ms |
| Display | Std | The display of the measured value can be changed.<br>“ Std ”: Normal<br>“ inuE ”: Invert<br>“ oFSt ”: Offset |
| Hold | oFF | Set the control output and the analogue output operation when a measurement error occurs (insufficient light intensity, saturation of light intensity, out of measurement range).<br>“ oFF ”: Hold OFF<br>“ on ”: Hold ON |
| ECO | oFF | The digital display can be set to go OFF when key operation is not performed for 30 seconds. Current consumption can be reduced.<br>“ oFF ”: ECO OFF<br>“ on ”: ECO ON |
| Reset | no | Return to the default setting (factory setting).<br>“ no ”: Reset NG<br>“ YES ”: Reset OK |

## Procedure



## 13 Error indication

In case of error, attempt the following measures.

| Error indication | Description | Solution |
|---|---|---|
| Hold OFF<br>- - - -<br>Hold ON<br>Measured value blinks | Insufficient amount of reflected light.<br>The sensing object is out of the sensing range. | Confirm that the sensing distance is within the specification range.<br>Adjust the installation angle of the sensor. |
| Er01 | Nonvolatile memory is damaged or passed its life expectancy. | Please contact our office. |
| Er11 | Load of the sensing output is short-circuited causing an over-current to flow. | Turn OFF the power and check the load. |
| Er21 | The semiconductor laser is damaged or passed its life expectancy. | Please contact our office. |
| Er31 | When zero set is set, the measurement is not performed normally.<br>Since the display setting is set to “Offset”, the zero set function can not be used. | Confirm that the sensing distance is within the specification range.<br>Set the display to any setting except “Offset. |
| Er41 | During teaching, the measurement is not performed normally. | Confirm that the sensing distance is within the specification range. |
| Er90<br>Er91<br>Er92<br>Er93 | System error | Please contact our office. |

## 14 Cautions

- This product has been developed / produced for industrial use only.
- Make sure that the power supply is OFF before starting the wiring.
- If the wiring is performed incorrectly, it will cause a failure.
- Do not run the wires together with high-voltage lines or power lines, or put them in the same raceway. This can cause malfunction due to induction.
- Verify that the supply voltage variation is within the rating.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- If noise generating devices (switching regulators, inverter motors, etc.) are used around the sensor mounting area, make sure to connect the frame ground (FG) terminal of the device.
- Do not use this product during the transient state when the power supply is turned ON.
- The overall length of the cable can be extended to 20m maximum with a cable size of min. 0.3mm$^2$.
- Make sure that stress by forcible bend or pulling is not applied to the sensor cable joint.
- Although it depends on the type, light from rapid start type or high frequency lighting type, fluorescent lights, sunlight and etc. may affect the sensing, therefore make sure to prevent direct incident light.
- This product is suitable for indoor use only.
- Keep water, oil, fingerprints and etc. which reflect light, dust or particles etc. which interrupt the light, away from the emitting / receiving surfaces of this product. If contaminants adhere to the surface, wipe off with a dust-free soft cloth, or lens cleaning paper.
- Do not use the sensor in locations where there is excessive vapor, dust or etc. or in an atmosphere where corrosive gases, etc. are generated.
- Take care that the product does not come in contact with oil, grease, organic solvents such as thinner, etc., strong acid or alkaline.
- Make sure to turn OFF the power supply, before cleaning the light emitting / receiving windows of the sensor head.
- There is a certain deviation in the directionality of this product. Install the product using a mounting bracket or similar fitting to allow the adjustment of optical axis.
- The internal memory (nonvolatile) of this product has a service life. Settings cannot be configured more than 100,000 times.

## 15 Specifications

| Discrete wire | HG-C1030L3-P | HG-C1050L3-P | HG-C1100L3-P | HG-C1200L3-P | HG-C1400L3-P |
|---|---|---|---|---|---|
| M12 connector | HG-C1030L3-P-J | HG-C1050L3-P-J | HG-C1100L3-P-J | HG-C1200L3-P-J | HG-C1400L3-P-J |
| Measurement center distance | 30mm | 50mm | 100mm | 200mm | 400mm |
| Measurement range | ±5mm | ±15mm | ±35mm | ±80mm | ±200mm |
| Repeatability | 10µm | 30µm | 70µm | 200µm | ● 300µm (measurement distance 200 to 400mm)<br>● 800µm (measurement distance 400 to 600mm) |
| Linearity | ±0,1% F.S. | | | ±0,2% F.S. | ● ±0,2% F.S.µm (measurement distance 200 to 400mm)<br>● ±0,3% F.S. (measurement distance 400 to 600mm) |
| Temperature characteristic | 0.03%F.S./°C | | | | |
| Beam diameter [3] | ≈ 50µm | ≈ 70µm | ≈ 120µm | ≈ 300µm | ≈ 500µm |
| Light source | Red semiconductor laser class 2 (JIS / IEC / FDA [2])<br>Max. output: 1mW, emission peak wavelength: 655nm | | | | |
| Supply voltage | 24V DC ±10% including ripple max. 10% (P-P) | | | | |
| Power consumption | Max. 40mA (at 24V DC supply voltage) | | | | |
| Control Output | PNP open-collector transistor<br>● Maximum source current: 50mA<br>● Applied voltage: same as supply voltage (between control output to +V)<br>● Residual voltage: max. 1.5V (at 50mA source current)<br>● Leakage current: max. 0.1mA | | | | |
| Output operation | Selectable either Light-ON or Dark-ON | | | | |
| Short-circuit protection | Incorporated (auto-reset) | | | | |
| Response time | Switchable between high speed (1.5ms), standard (5ms), and high precision (10ms) | | | | |
| IO-Link communication | ● IO-Link specification: Ver1.1<br>● Baud rate: COM3 (230.4kbps)<br>● Process data length: 4byte | | | | |
| Degree of protection | IP67 (IEC) | | | | |
| Degree of pollution | 2 | | | | |
| Ambient temperature | -10 to +45°C (no dew condensation or icing allowed)<br>Storage: -20 to +60°C | | | | |
| Ambient humidity | 35 to 85% RH, at storage: 35 to 85% RH | | | | |
| Ambient illumination | 3000ℓx max. (Illumination level of light receiving surface under incandescent light) | | | | |
| Operating altitude | Max. 2000m [4] | | | | |
| Cable | Discrete wire: 0.2mm² 4-core PVC cable, 2m long<br>M12 connector: 0.2mm² 4-core PVC cable, 0.3m long with connector | | | | |
| Material | Enclosure: die-cast aluminum, front cover: acrylic | | | | |
| Weight | ≈ 35g (without cable), ≈ 85g (including cable) | | | | |
| Applicable standards | EMC Directive | | | | |

1 Measurement conditions: 24V supply voltage, 20°C ambient temperature, 10ms response time. The subject is white ceramics.

2 This is based on the FDA Standard, according to Laser Notice No. 50 of the FDA Standard

3 This is the size in the measurement center distance. These values were defined by using $1/e^2$ (approx. 13.5%) of the center light intensity. Due to leak light outside the specified area, the reflectance around the detecting point may be higher than at the point and this may affect the measurement value.

4 Do not use or store in an environment pressurized to atmospheric pressure or higher at an altitude of 0m

Panasonic Industrial Devices SUNX Co., Ltd.
http://panasonic.net/id/pidsx/global
**Overseas Sales Dept. (Head Office)**
2431-1 Ushiyama-cho, Kasugai-shi, Aichi, 486-0901, Japan
Telefon: +81-(0)-568-33-7861 FAX: +81-568-33-8591
**Europe Headquarter: Panasonic Electric Works Europe AG**
Robert-Koch-Straße 100, D-85521 Otttobrunn, Germany
Telefon: +49-89-45354-1000