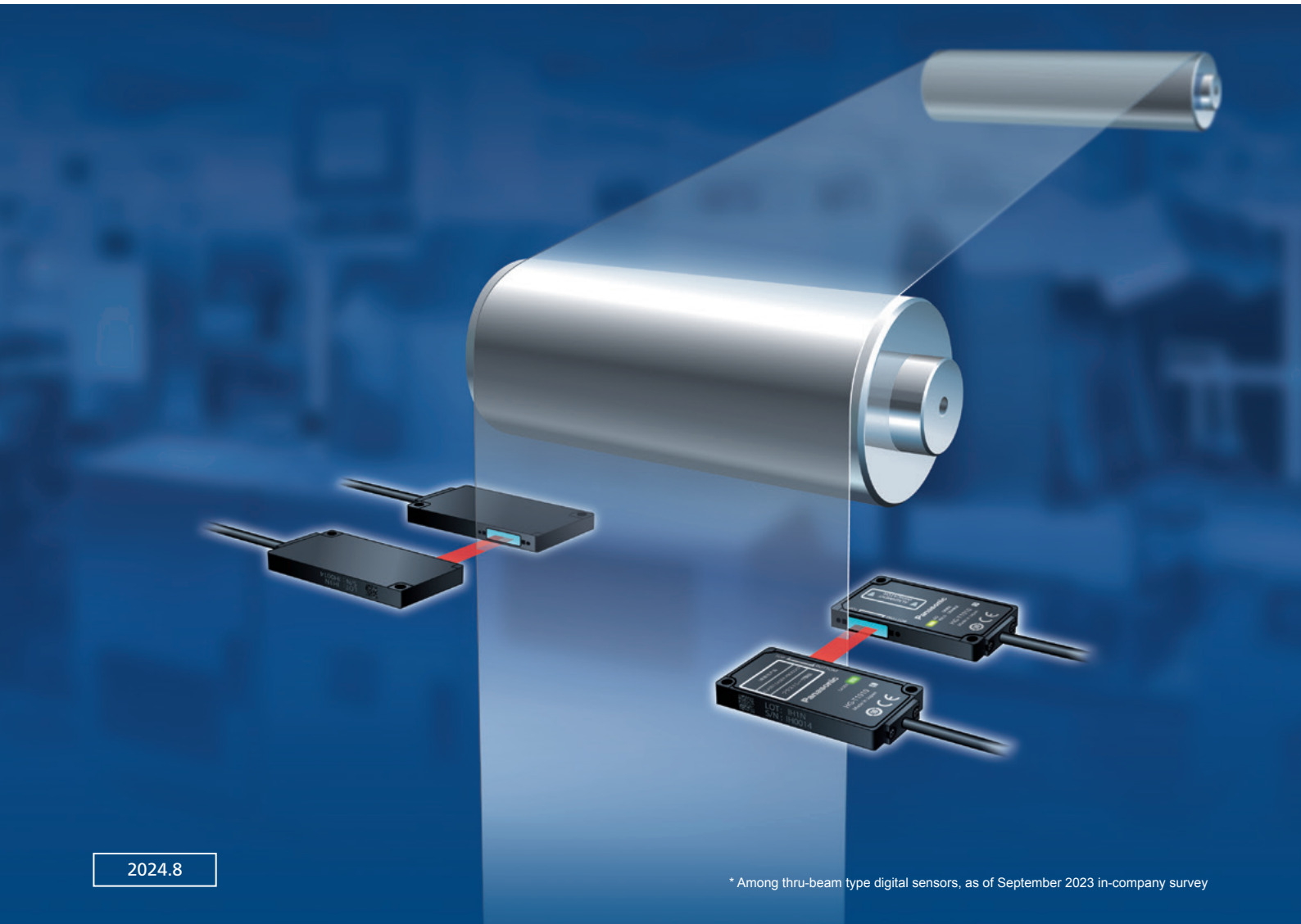
Panasonic
INDUSTRY

CMOS Type | Self-Monitoring Sensor

# Thru-beam Type
# Digital Displacement Sensor
## HG-T SERIES

CE | UKCA | FDA

## The Industry's Highest-Class* Measurement Accuracy Is Now Yours.
### Equipped with Self-monitoring Function



2024.8

* Among thru-beam type digital sensors, as of September 2023 in-company survey

# Ultra-slim

## HG-T series

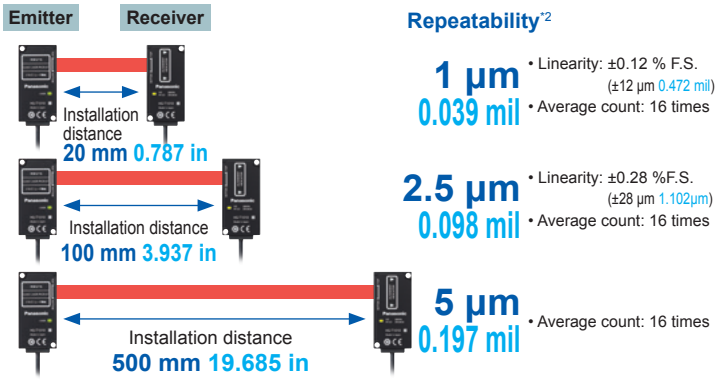

The ultra-slim unit with a thickness of 8 mm 0.315 in allows easy installation in a limited space such as the inside of equipment.

## Wide-angle measurement

The belt-shaped laser beam with a measurement width of 10 mm 0.394 in is used for measurement of dimensions and positions.


## Industry's highest*1 measurement accuracy

The **HG-T** series boasts repeatability*2 of 1 µm 0.039 mil and offers the highest*1 measurement accuracy in the industry.




- Sampling cycle setting can be selected from two options.
  Standard: 1 ms, High speed: 0.5 ms.
- Average count setting can be selected from 11 options.
  1 time, 2 times, 4 times, 8 times, 16 times, 32 times, 64 times, 128 times, 256 times, 512 times, 1,024 times

*1 As of September 2023, in-company survey
*2 This is the P-P value of digital measurement value with half shading at the middle position of the installation distance.

## Two types of sensor heads are available.

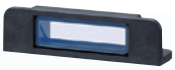
Two types of sensor heads, one with a standard type receiver and the other with a slim type receiver, are available.

| Standard type | Slim type |
|---|---|
| HG-T1010 | HG-T1110 |


## Side view attachment is available (optional). HG-T1010

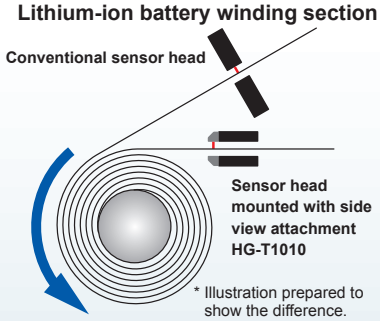
Side view attachment (optional) is available for the standard type sensor head **HG-T1010**. This attachment can bend the laser beam at a right angle to allow flexible installation of the sensor head.

**Side view attachment HG-TSV10**



Two M2 (length 4 mm 0.157 in) screws with washers are attached.


**■Application example: Lithium-ion battery winding section**




* Illustration prepared to show the difference.

**Use of the side view attachment enables the installation of the sensor head closer to the winding section than when a conventional sensor head is used, thus contributing to the improvement of winding accuracy.**

* Two side view attachment units are required when using the attachment on both emitter and receiver.
* The slim type sensor head **HG-T1110** cannot be mounted with the side view attachment.
* Be sure to confirm proper detection using actual equipment in advance when using the attachment.

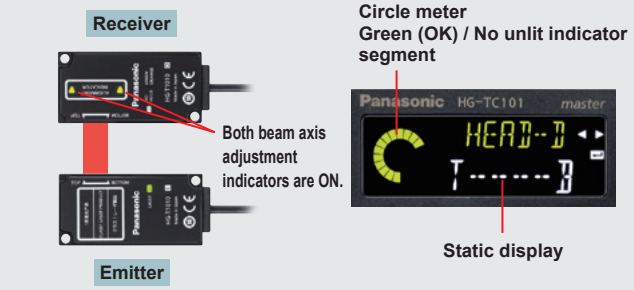
# Ease of Installation

## Beam axis adjustment assist function

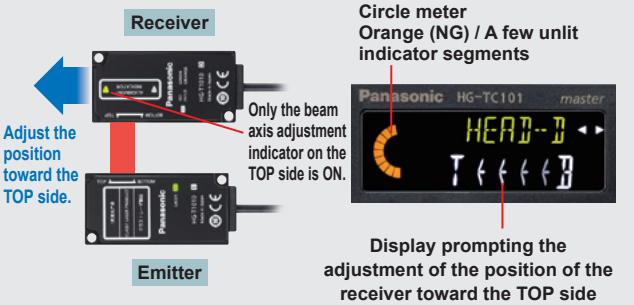
The standard type sensor head **HG-T1010** indicates the direction of receiver displacement relative to the emitter on the controller's display screen and with the beam axis adjustment indicators on the receiver in an easy-to-understand fashion.

* The slim type sensor head **HG-T1110** displays the displacement information only on the controller's display section.

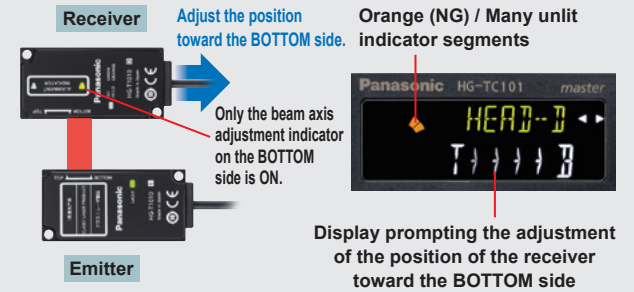
### When beam axis is aligned properly




### When beam axis is displaced slightly toward the BOTTOM side

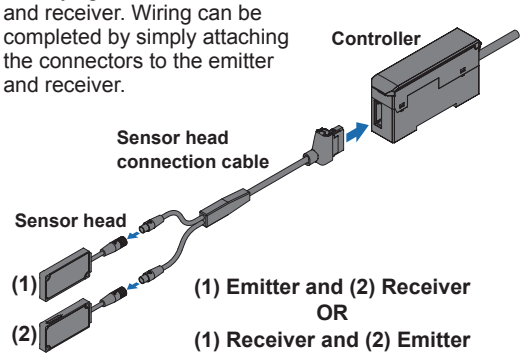



### When beam axis is displaced significantly toward the TOP side




## Automatic emitter / receiver cable recognition

The **HG-T** series automatically recognizes the positional relationship of the emitter and receiver connected to the sensor head connection cable at the time the controller is turned ON. This function eliminates the need for identifying the correct cables to connect to the emitter and receiver. Wiring can be completed by simply attaching the connectors to the emitter and receiver.

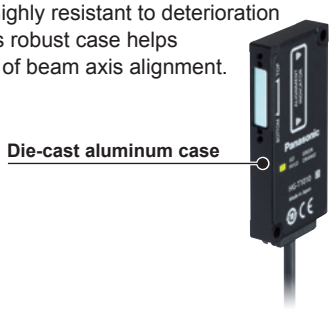



**Emitter and receiver can be connected to either connectors!**

* The sensor head connection cable is branched into two cables on the sensor head connecting side, but the two cables can be connected interchangeably to the emitter and receiver.

## Die-cast aluminum case

The sensor head case is made of light and strong die-cast aluminum. It minimizes measurement fluctuations due to temperature effects. The die-cast aluminum case does not easily become distorted in shape by tightening of mounting screws as compared to a resin case. It is highly resistant to deterioration due to ageing. This robust case helps prevent deviations of beam axis alignment.




## IP67 protection

The **HG-T** series features a protection structure of IP67 (IEC) so it can be used in a place where the product may be exposed to water or large amounts of dust.

* Note that if the beam emitting / receiving surfaces of the sensor head are adhered with water or dust, correct measurements become inaccurate.
* The sensor head is watertight, but the connectors are not structurally resistant to dust, water or corrosion. Therefore, the **HG-T** series cannot be submerged in water or placed under falling water for measurement operation. Be sure to use the product in an appropriate environment.

# High-performance Controller

## Dual display for added indication flexibility (equipped with NAVI function)

The 2-line digital display simultaneously shows head measurement (measured value) and judgment value (calculated value).

## All-direction LCD

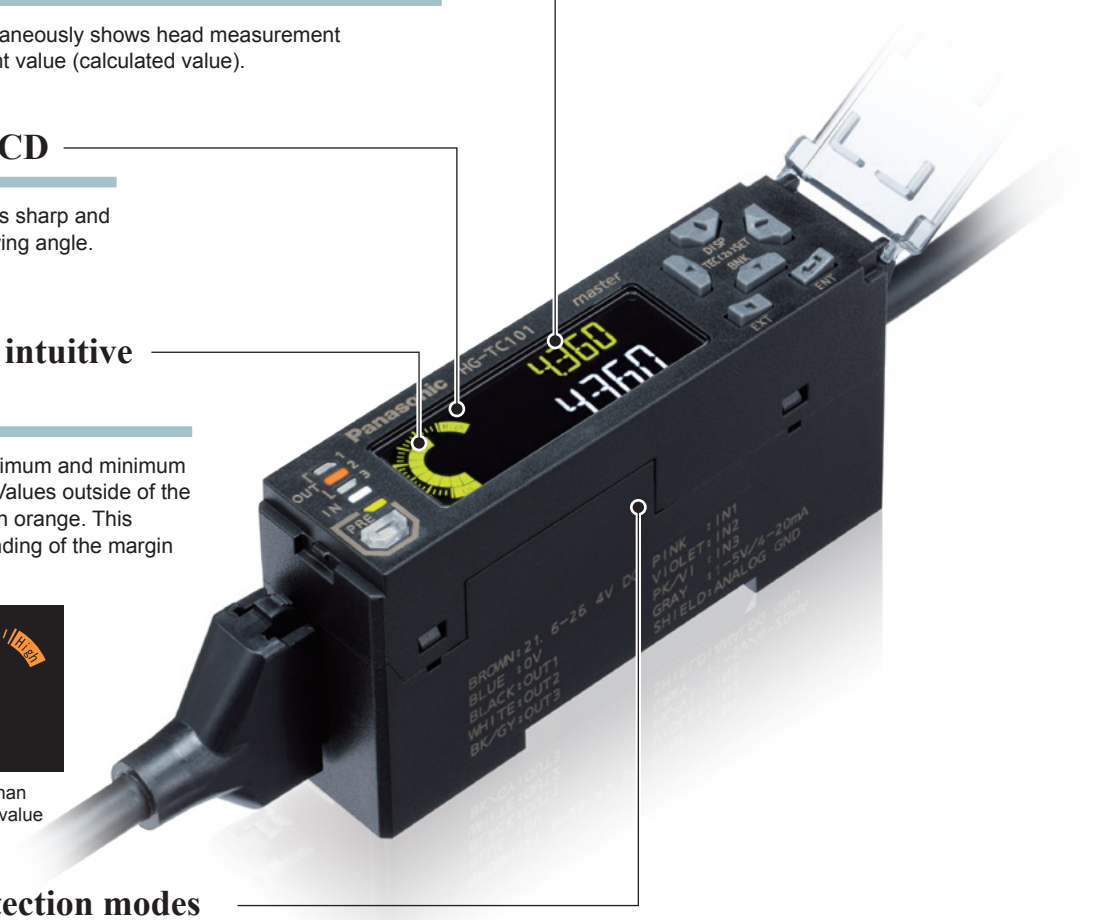
The high-contrast LCD provides sharp and clear indications and wide viewing angle.

## Equipped with intuitive circle meter

Values between allowable maximum and minimum values are indicated in green. Values outside of the allowable range are indicated in orange. This provides at-a-glance understanding of the margin to the tolerance limits.


Higher than maximum value

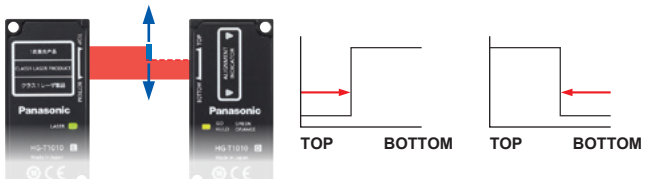

Lower than minimum value




## Six types of detection modes

### Auto edge detection mode

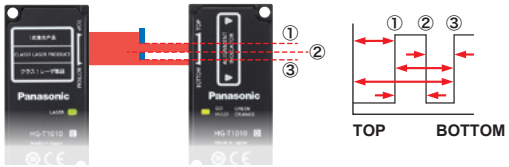
Edge detection can be started from either the TOP or BOTTOM without registering the detection direction. This eliminates the need for checking the detection direction.




### User assigned edge detection mode

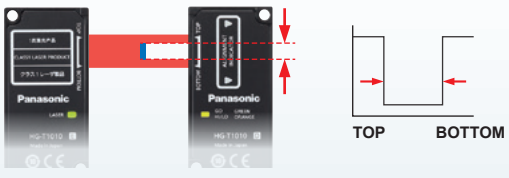
* Provided in products manufactured in November 2020 and after.

The user can select any two edges from multiple edges on the measurement target and obtain the measurement of the distance between the two edges.



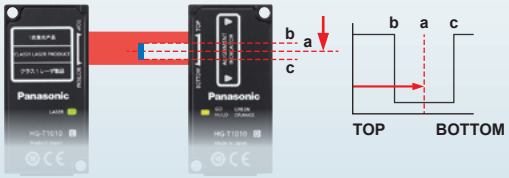

### Edge detection mode


### External form / width detection mode



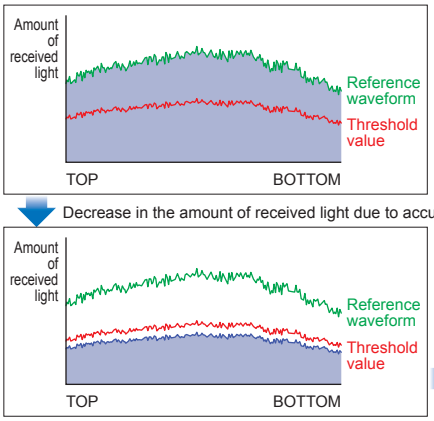

### Inside diameter / gap detection mode


### Central position detection mode



## Monitoring of effects caused by stains

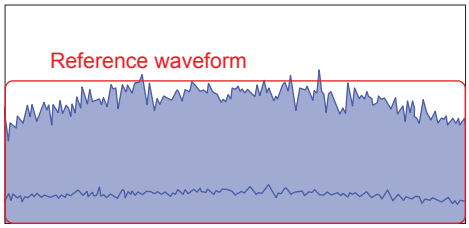
Notifies when the detection performance decreases due to accumulated stains.




An alarm is output when the amount of received light decreases below the threshold value, with the condition of the reference waveform considered as 100 %.

**Alarm output**

Checks the degree of contamination based on the amount of light of the reference waveform (considered as 100 %).



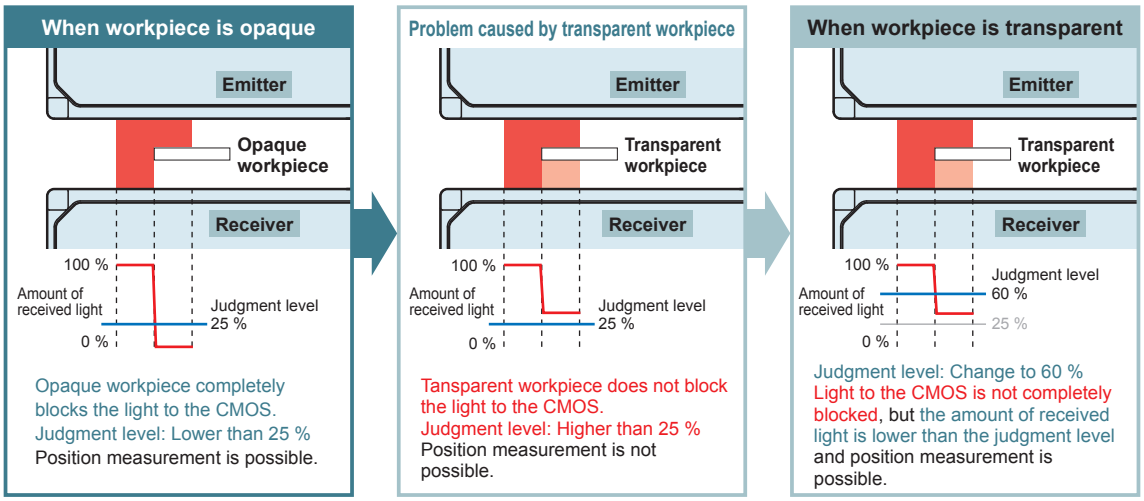

**Stain check setting items**
One of the following four settings can be selected.

- Low sensitivity setting ON (LOW) [default]
- High sensitivity setting ON (HIGH)
- User setting ON (USER)
  Adjustable in the range of 50 to 95 %
- Stain check OFF (OFF)

* The reference waveform can be confirmed by using a combination of the "**HG-T Configuration Tool**" USB-based PC setting software and USB communication unit **SC-HG1-USB** or RS-485 communication unit **SC-HG1-485**. For details, refer to page 15.

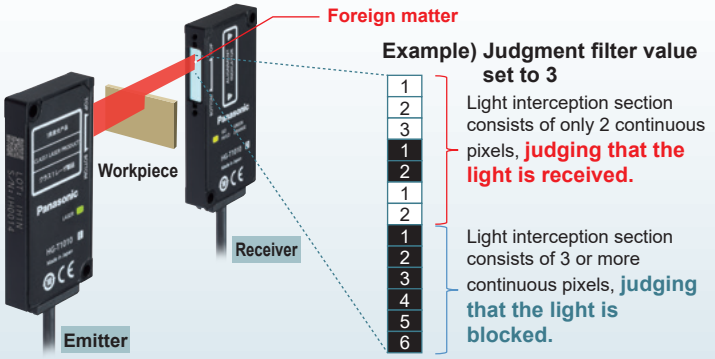
## Stable measurement of even transparent workpieces

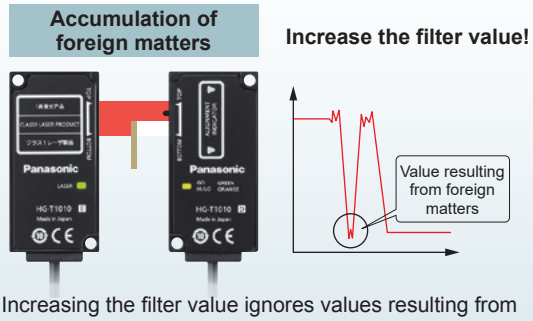
The judgment level can be adjusted according to the degree of transparency.




## Elimination of effects caused by fine foreign matters

The judgment filter value can be adjusted for the prevention of erroneous detections due to fine foreign matters.
The judgment filter value can be set to a desired value between 3 and 50.



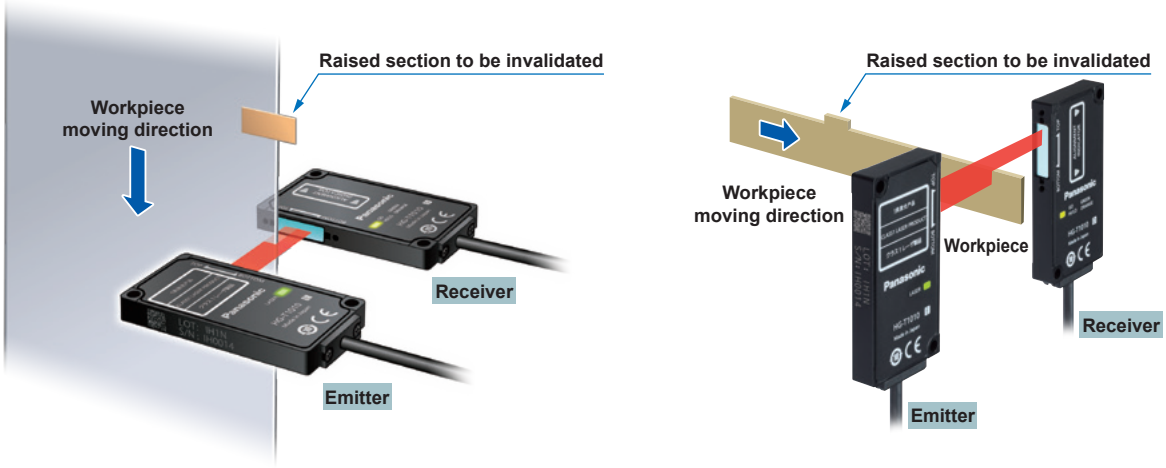




Increasing the filter value ignores values resulting from foreign matters.

## Invalidation of abrupt changes in measurements

* Provided in products manufactured in November 2020 and after.

If there is an abrupt change at the edge of workpiece, this function invalidates the change and stabilizes the judgment value.

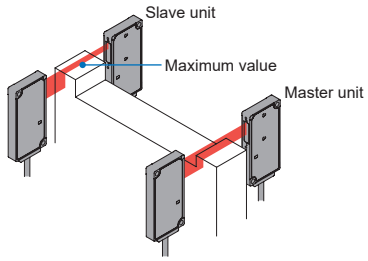



## Equipped with 5 arithmetic functions

Calculation is performed using the measurements obtained by the connected controller. The judgment result can be displayed on the digital display of the master unit or output from the master unit. Connect only the controller to be used for calculation purposes.

### 1 Maximum value

The largest measured value among those in the master and slave units is set as calculated value.

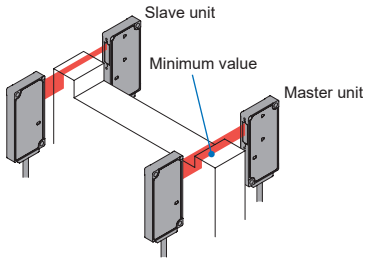



In above case:
[Master unit] Calculated value
= Largest [Slave unit] Measured value

* None of the connected slave units outputs judgment result. (Always OFF)

### 2 Minimum value

The smallest measured value among those in the master and slave units is set as calculated value.

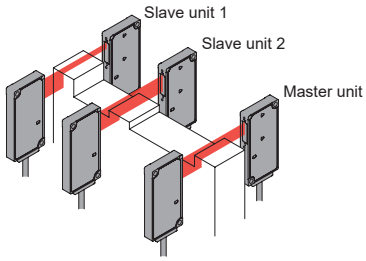



In above case:
[Master unit] Calculated value
= Smallest [Master unit] Measured value

* None of the connected slave units outputs judgment result. (Always OFF)

### 3 Average value

The average value of the measured values in the master and slave units is set as calculated value.

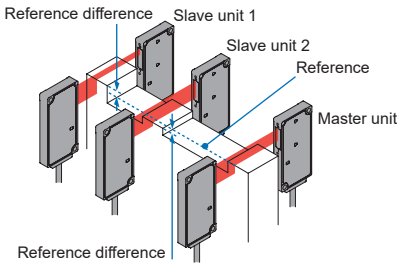



[Master unit] Calculated value = ([Master unit] + [Slave unit 1] + ... + [Slave unit n]) / (1 + n)
n = Number of slave units

* None of the connected slave units outputs judgment result. (Always OFF)

### 4 Reference value

Each slave unit sets the difference between its measured value and the master unit's measured value as calculated value.
Each slave unit outputs judgment result.

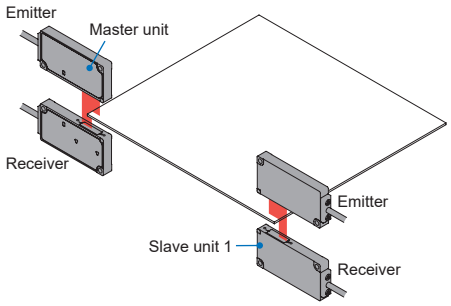



In above case:
[Slave unit 1] Calculated value =
[Slave unit 1] Measured value – [Master unit] Measured value
[Slave unit 2] Calculated value =
[Slave unit 2] Measured value – [Master unit] Measured value

* The master unit performs judgment operation without performing calculation.
* The master unit cannot use the hold function.

### 5 Thickness / width

Two sensor heads clamp the detection target and computes its thickness/width.



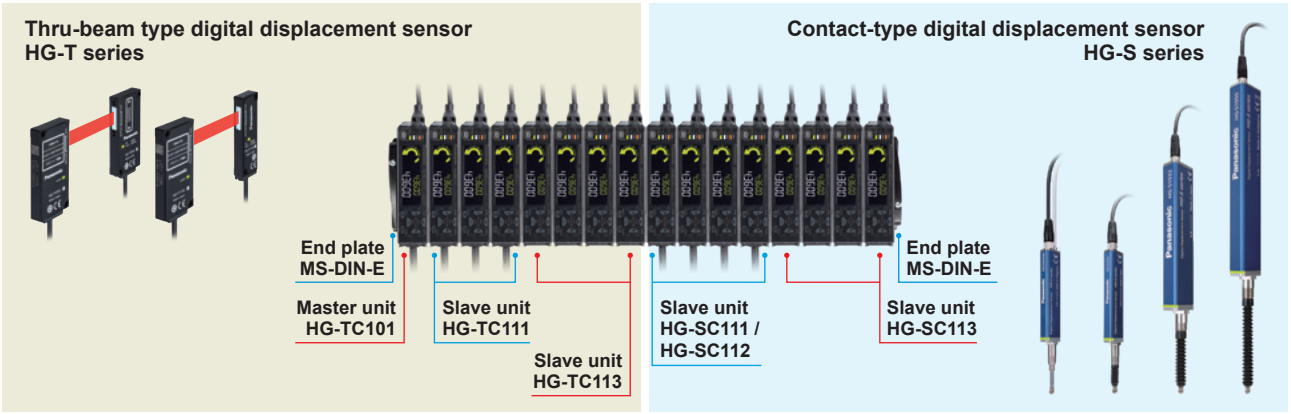

Calculated value = [Master unit] Measured value + [Slave unit 1] Measured value

* The slave unit close to the master unit does not output the judgment result. (Always OFF)
* When two or more slave units are connected, the second and subsequent slave units perform ordinary judgment operations without performing calculation.

## Connectable to compact-type digital displacement sensor HG-S series

When the **HG-TC□**[*1] controller is combined with the **HG-SC□**[*1] controller for contact-type digital displacement sensor **HG-S** series, up to 15 slave units (up to 14 slave units if communication unit for digital displacement sensors is connected) can be connected to one master unit.
Connect the same-series slave units close to the master unit and connect slave units of other series on the far side.
*1 Be sure to use controllers manufactured in or after February 2019.

**< Example: Connection of 8 units of HG-S series to 8 units of HG-T series (NPN output type) >**




* When connecting slave units to a master unit, connect only NPN output types, or only PNP output types. Dissimilar output types cannot be connected together.
* After the connection, attach end plates (optional) to both ends of the controller for secure installation.
* If **HG-TC□** and **HG-SC□** controllers are used in combination, there are limitations on the functions below.

| Item | Description of limitation |
|---|---|
| Calculation function | Calculation is only performed when the slave unit is the same series as the master unit. Calculation is not performed when the slave unit series is different from the master unit series. “CALC” does not appear in the display of a slave unit of a different series. |
| Input all | The master unit only performs input all when the slave units are the same series.<br>A slave unit of a different series from the master unit does not perform input even when the external input settings match those of the master unit. |
| Copy function | Copying is only performed when the slave unit is the same series as the master unit.<br>When copying is executed, “NOW COPY” appears even on the display of a slave unit of a different series from the master unit, but copying is not performed. |

## Contact-type digital displacement sensor

Self-Monitoring Sensor

### Contact-type digital displacement sensor HG-S SERIES

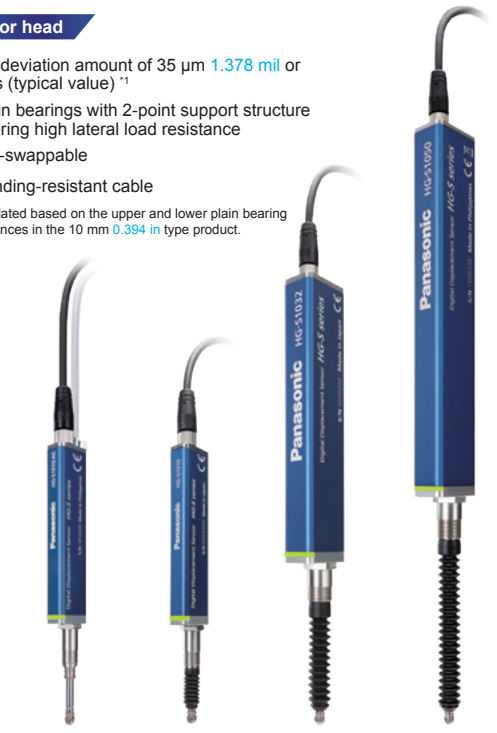
CE UKCA

**The optical absolute method eliminates “value skipping” and “unset zero point”!**

**Sensor head**

- Tip deviation amount of 35 µm 1.378 mil or less (typical value) *1
- Plain bearings with 2-point support structure offering high lateral load resistance
- Hot-swappable
- Bending-resistant cable

*1: Calculated based on the upper and lower plain bearing clearances in the 10 mm 0.394 in type product.




10 mm 0.394 in type | 10 mm 0.394 in type | 32 mm 1.260 in type | 50 mm 1.969 in type

Air-driven type | Regular type

**Development target:**

### Slim & Robust

- The 10 mm 0.394 in type has a slim 11 × 18 × 84.5 mm 0.433 × 0.709 × 3.327 in body, for easy adjacent installation
- Class-top robustness in the industry

Lateral load resistance No. 1* in class | Vibration / impact resistance No. 1* in class

* As of October 2023, in-company survey.

**Development goal:**

### Highest Resolution in Class

- Resolution of 0.1 µm 0.004 mil* and indication accuracy of 1.0 µm 0.039 mil or less*
- Absolute value scale reading for elimination of “value skipping” and “unset zero point”

Resolution No. 1* in class | Optical absolute method

* In the case of high-precision sensor heads (**HG-S1110□**). As of October 2023, in-company survey.

**Controller**

**Development focus:**

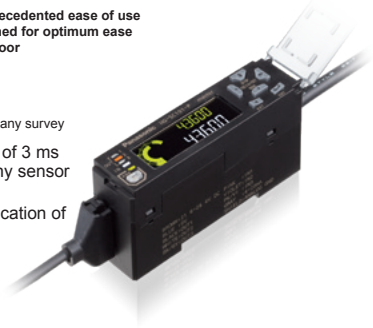
### Intuitive Dual Display

- 2-line digital display for unprecedented ease of use
- Full-fledged functions designed for optimum ease of operation on production floor

Industry’s first*

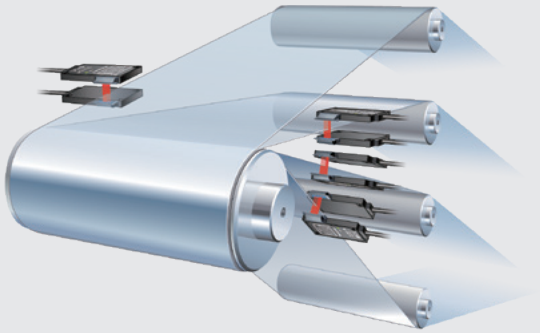
* As of September 2015, in-company survey

- High-speed response of 3 ms in combination with any sensor head
- Alarm setting for notification of upward thrust



# Applications

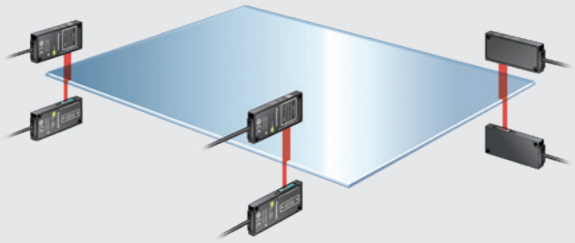
## Measurement of meandering on lithium-ion battery winding machine



Use of the side view attachment (optional) enables the mounting of the sensor near the winding core for improved meander measurement accuracy.

High accuracy | Space saving | Tab cancel | Stable detection of transparent objects

## Glass substrate positioning



The judgment level adjustment function ensures stable detection and measurement of even transparent workpieces.

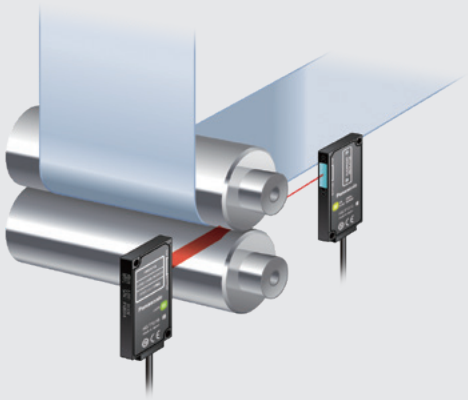
High accuracy | Stable detection of transparent objects

## Detection of lifted bearing parts


Use of the side view attachment (optional) enables the flexible installation of the sensor in a limited space.

High accuracy | IP67 | Stain check function

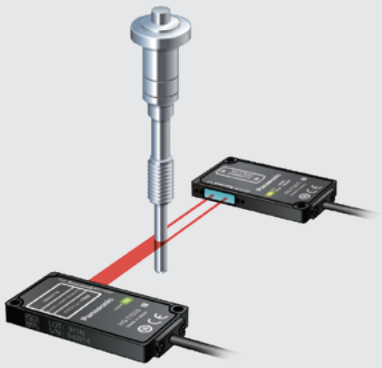
## Detection of clearance between rollers



The clearance between rollers can be measured for stabilizing the workpiece quality. The compact head is easy to install.

High accuracy | Various detection modes

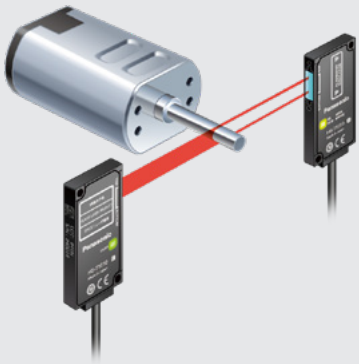
## Shaft diameter measurement



Shaft diameters can be measured. The original head structure and proprietary algorithm achieve stable detection without being affected by secondary reflections by metal surfaces.

High accuracy | Space saving

## Measurement of motor shaft eccentricity



Shaft eccentricity can be measured by using the central position detection mode and measuring the distance to the shaft center.

High accuracy | Various detection modes

# Communication unit for digital displacement sensors

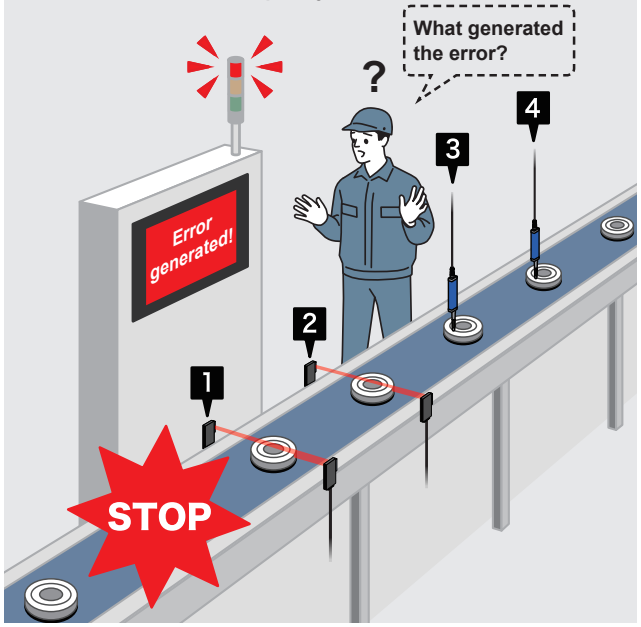
Compatible with self-monitoring function

## Suitable for use on manufacturing lines Sensor equipped with a new self-monitoring function!

**A sensor with a self-monitoring function diagnoses its own state and notifies when readjustment of settings / setup is required or when maintenance is needed.
The sensor determines its status and indicates "Normal," "Notification," "Caution" or "Fault."
When not in normal status, the sensor checks the cause of problem and corrective measure, thus reducing equipment downtime and maintenance workload.**

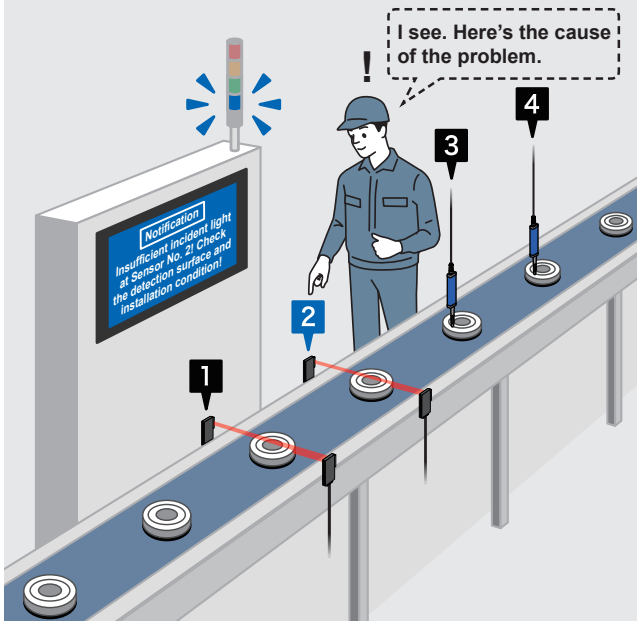
### Conventional manufacturing line

If an error is generated, the line stops. However, the cause of the error cannot be identified quickly.




### Manufacturing line installed with self-monitoring sensors

Each sensor informs of its status so that even if a problem occurs, the error generating source can be identified immediately and the detail be grasped.

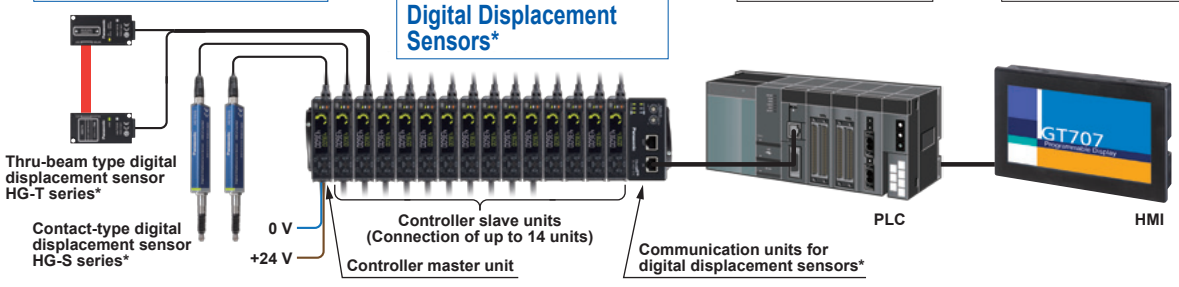



### Self-monitoring function: Four types of status indication and judgment of state

| Status | Judgement of the state | |
|---|---|---|
| Normal | Operation is normal. | |
| Notification | Check the settings.<br>Detected state is unstable. | * Recover to the normal state through checking installation and settings. Reduction in the incident light intensity. |
| Caution | Getting close to the end of service life.<br>Reached the state where the device should be replaced. | * Limitation in the writing frequency into the memory or in the operation hours, etc. |
| Fault | Short-circuited or broken.<br>Reached the state where it is impossible to control as a device. | * Short-circuited output, damaged EEPROM, etc. |

### Example of a system that utilizes the self-monitoring function

HG-T / HG-S series* + Communication Unit for Digital Displacement Sensors* + PLC + HMI




* To use the self-monitoring function with the thru-beam type digital displacement sensors **HG-T** series and contact-type digital displacement sensors **HG-S** series, a communication unit for digital displacement sensors (any of the following: **SC-HG1-ETC**, **SC-HG1-CEF**, **SC-HG1-C** or **SC-HG1-485**) that supports the self-monitoring function is required.

# Identification of malfunctioning location and cause

**The sensor self-diagnoses its state, so if a malfunction occur, it is easy to identify the problem location and discover the cause of the problem. Therefore, even if there is no experienced worker or skilled technician at the site to respond to the problem, it is possible to take an appropriate measure immediately. This minimizes the restoration time and reduces the maintenance workload.**

**Reduction of downtime**

**Reduction of maintenance workload**

**Dirty detection surface**

**End-of-life / damaged sensor**

**Positional deviation**

# Easy planning of maintenance schedule

**Conventional sensors can generate unexpected malfunctions and require many hours for maintenance and replacement; thus, an unscheduled shutdown of the manufacturing line may be required from time to time. The self-monitoring function notifies the sensor replacement timing, thus allowing for planning the most efficient maintenance and replacement schedule. This helps prevent unexpected shutdowns of the manufacturing line and improves productivity.**

**Improved productivity**

**Predictive maintenance**

## Details of self-monitoring function

**HG-T** series' self-monitoring function

| Status | Response parameter | Measures | Controller **HG-TC**□ | |
|---|---|---|---|---|
| | | | Error code (Note 1) | Measurement alarm (Note 1) |
| Notification | Sensor head unconnected | Status check | E200 | — |
| | Connected sensor head incompatible | Status check | E230 | — |
| | Connected unit count check error | Status check | E160 (For master units only) | — |
| | NPN / PNP output type mixture error | Status check | E100 (For master units only) | — |
| | Calculated unlit count error | Status check | E110 (For master units only) | — |
| | Copy executionerror (Slave unit problem) | Status check | E170 (For master units only) | — |
| | Detection capability limit (obtained edge information) (Note 2) | Sensing object check | — | Measurement alarm 1 |
| | The amount of entering light is too much due to the influences of ambient light, etc. (Note 2) | Status check | — | Measurement alarm 1 |
| | The amount of entering light decreases due to stain on the detection surface, beam axis misalignment, etc. | Sensing object check | — | Measurement alarm 2 |
| | The specified measurement direction differs from the insertion direction of the detected object. | Status check / Sensing object check | — | Measurement alarm 2 |
| Caution | Controller cumulative run time exceeded (87,600 hours) | Controller replacement | — | — |
| | Sensor head cumulative run time exceeded (87,600 hours) | Sensor head replacement | — | — |
| | Controller memory saving count exceeded (1,000,000 times) | Controller replacement | — | — |
| | Sensor head memory saving count exceeded (for receivers only, 1,000,000 times) | Sensor head replacement | — | — |
| Fault | Controller memory function damaged | Controller replacement | E600 | — |
| | | | E610 | |
| | | | E620 | |
| | Sensor head memory function damaged | Sensor head replacement | E630 (For receivers only) E640 (For emitters only) | — |
| | Output section short-circuit error | Status check / Replacement | E700 | — |
| | Detection circuit damaged | Sensor head replacement | E240 | — |
| | System error | Controller replacement | E900 | — |
| | | | E910 | |
| | | | E911 | |
| | | | E912 | |
| | | | E920 | |

Notes: 1) Error codes and alarms are displayed on **HG-TC**□ controllers.
2) If "Alarm condition selection (ALM.CND)" is set to "Hold last value (HOLD)", Measurement alarm 1 is not notified.

# Communication unit for digital displacement sensors

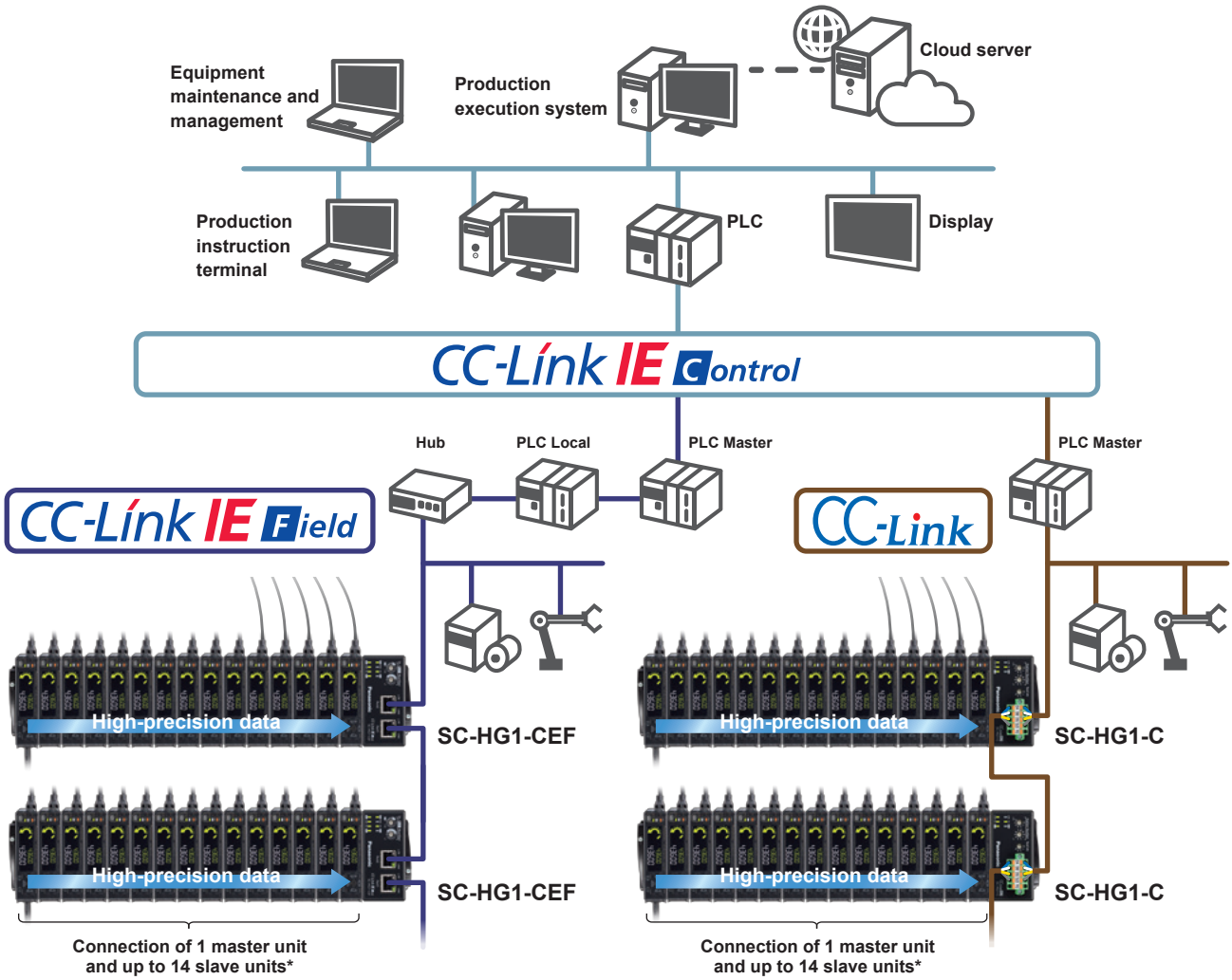
Compatible with self-monitoring function

# Direct transfer of measurement data obtained by multiple sensors to host device!

## CC-Link IE Field Communication Unit / CC-Link Communication Unit

Compatible with self-monitoring function

**Use of our communication unit for digital displacement sensors allows direct connection to the CC-Link / CC-Link IE Field network.**
**This enables real-time acquisition of digital data and ON / OFF information without any program.**
**Furthermore, it can be used to change controller settings and log measurement data via CC-Link / CC-Link IE Field network, for example, for predictive maintenance of digital displacement sensors.**




* When connected to a communication unit for digital displacement sensor, up to 14 slave units can be connected per master unit.

CC-Link IE Field communication unit

SC-HG1-CEF

CC-Link IE Field

**Communication speed: 1 Gbps**

* Units shipped in and after December 2019 are compatible with self-monitoring function.

CC-Link communication unit

SC-HG1-C

CC-Link Supports iQSS

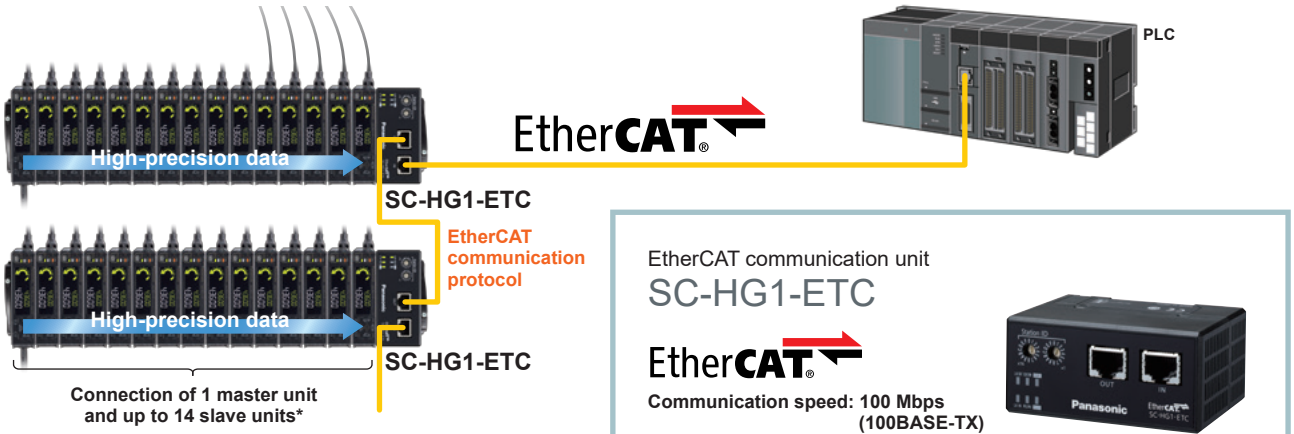
**Communication speed: 10 Mbps (max.)**

* Units manufactured in and after December 2019 are compatible with self-monitoring function.

## EtherCAT Communication Unit

**Compatible with self-monitoring function**

**Our product line also includes a communication unit that enables connection with EtherCAT.**
**This unit communicates measurement (judgment) data and error codes cyclically at a high-speed sampling rate and transfers the data to the host device with accuracy intact.**
**Furthermore, settings of multiple sensors can be read and written, and the bank can be switched via EtherCAT.**




* When connected to a communication unit for digital displacement sensor, up to 14 slave units can be connected per master unit.

EtherCAT communication unit
### SC-HG1-ETC

EtherCAT

**Communication speed: 100 Mbps (100BASE-TX)**



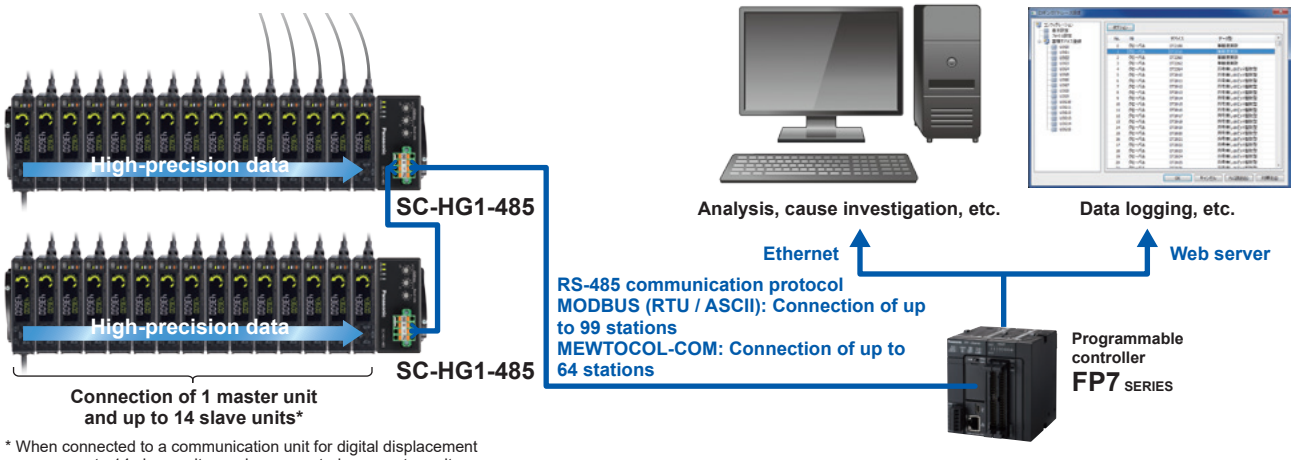
* Supports the self-monitoring function regardless of the manufacturing date.

* EtherCAT is a registered trademark patent-protected technology, licensed by Beckhoff Automation GmbH of Germany.

## RS-485 Communication Unit

**Compatible with self-monitoring function**

**For use of high-precision measurement results as traceability data. Transfers not only measurements results obtained at multiple points but also setting statuses as digital data in a batch.**
**Provides powerful support to the management of inspection records and identification of failure causes.**




* When connected to a communication unit for digital displacement sensor, up to 14 slave units can be connected per master unit.

RS-485 communication unit
### SC-HG1-485

**Communication speed: 1.2 kbps / 2.4 kbps / 4.8 kbps / 9.6 kbps / 19.2 kbps / 38.4 kbps / 57.6 kbps / 115.2 kbps**

* Units manufactured in and after November 18 2019 are compatible with self-monitoring function.

## USB-based PC setting software

### HG-T Configuration Tool

- **Compatible communication unit: SC-HG1-USB / SC-HG1-485**
- **Compatible OS: Microsoft Windows® 8 (8.1) (32 bit / 64 bit), Microsoft Windows® 10 (32 bit / 64 bit)**
- **Required RAM: 2 GB or more**
- **Required hard disk space: 200 MB or more**
- **Communication interface: USB2.0 (SC-HG1-USB), RS-485 (SC-HG1-485)**

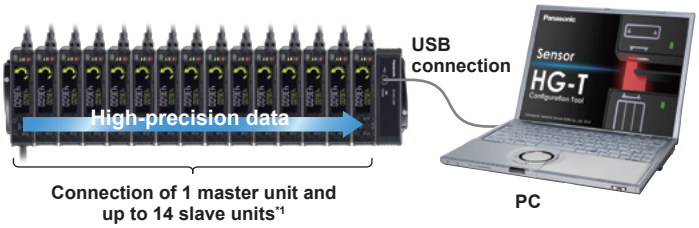
* **SC-HG1-485** supported by Ver. 1.20 or newer version of **HG-T Configuration Tool**
* For the detail of the USB-based PC setting software, refer to page 15.
* Microsoft and Windows are registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

# Communication unit for digital displacement sensors

## USB communication unit

*** Not compatible with self-monitoring function.**

**The USB communication unit provides convenient functions that facilitate the setting of the HG-T series while observing the waveform of received light by operating the dedicated USB-based PC setting software. The USB-based PC setting software can be downloaded free from our website.**




* When connected to the communication unit for digital displacement sensor, up to 14 slave units can be connected per master unit.

USB communication unit

### SC-HG1-USB

**Communication specification: USB 2.0 Full Speed***
**Communication protocol: Proprietary protocol**
**USB port: USB Mini-B (1 port)**

* Dependent on PC environment.

## USB-based PC setting software

### HG-T Configuration Tool

- **Compatible communication unit: SC-HG1-USB / SC-HG1-485**
- **Compatible OS: Microsoft Windows® 11 (64 bit), Microsoft Windows® 10 (32 bit / 64 bit)**
- **Required RAM: 2 GB or more**
- **Required hard disk space: 200 MB or more**
- **Communication interface: USB2.0 (SC-HG1-USB), RS-485 (SC-HG1-485)**

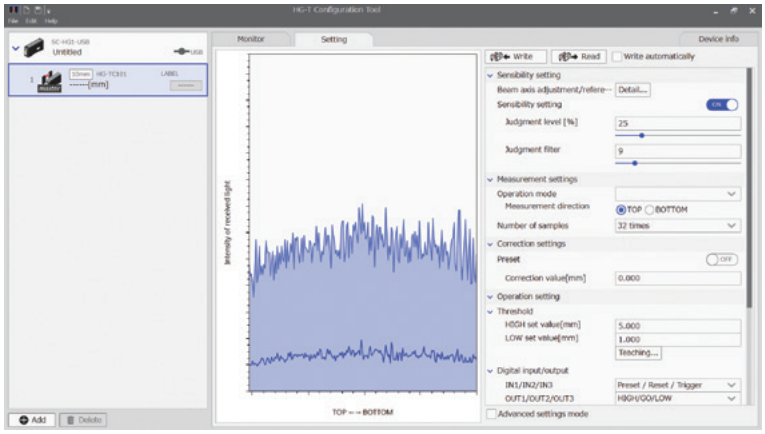
* **SC-HG1-485** supported by Ver. 1.20 or newer version of **HG-T Configuration Tool**
* For the detail of the USB-based PC setting software, refer to page 15.
* 

# Convenient Tool Software

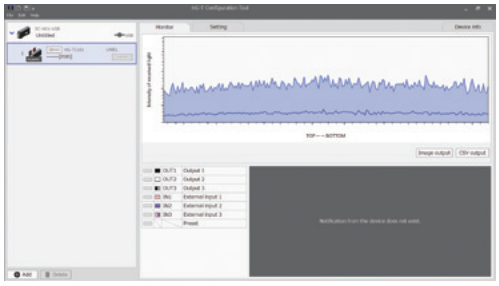
**When the USB-based PC setting software, "HG-T Configuration Tool," is used together with the USB communication unit SC-HG1-USB or RS-485 communication unit SC-HG1-485, current values and settings in the HG-T series can be confirmed and changed using a PC.**

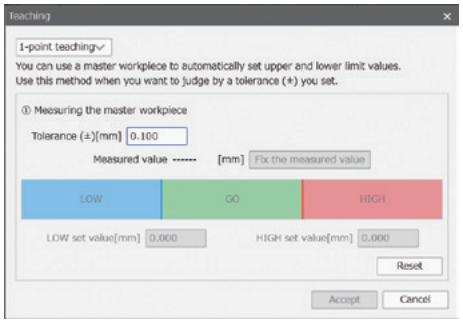
## USB-based PC setting software

### HG-T Configuration Tool



Settings such as name, judgment level and filter value can be changed for each controller while observing the waveform.





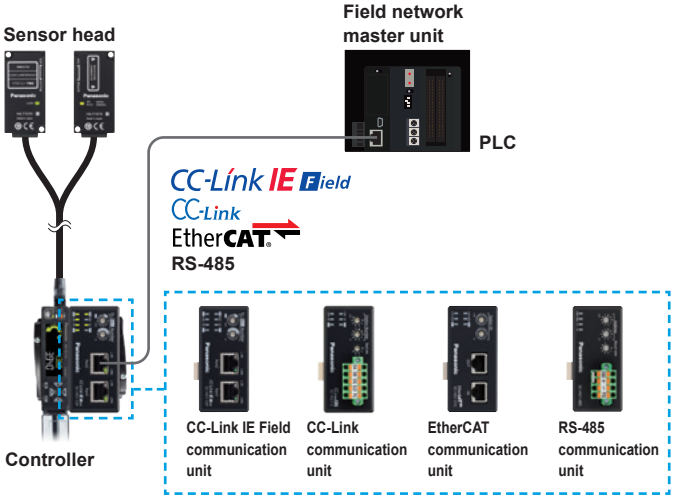

- **Compatible communication unit*1*2*3: SC-HG1-USB, SC-HG1-485**
- **Compatible OS*4*5: Microsoft Windows® 11 (64 bit), Microsoft Windows® 10 (32 bit / 64 bit)**
- **Required RAM: 2 GB or more**
- **Required hard disk space: 200 MB or more**
- **Communication interface: USB2.0 (SC-HG1-USB), RS-485 (SC-HG1-485)**

*1: **SC-HG1-485** supported by Ver. 1.20 or newer version of **HG-T Configuration Tool**
*2: **SC-HG1-USB** and **SC-HG1-485** cannot be used simultaneously.
*3: To connect **SC-HG1-485** via USB, the customer must arrange a USB2.0→RS-485 converter.
*4: Microsoft and Windows are registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
*5: OS versions of which Microsoft has ended support are excluded.

The USB-based PC setting software, "**HG-T Configuration Tool**," can be downloaded free from our website.

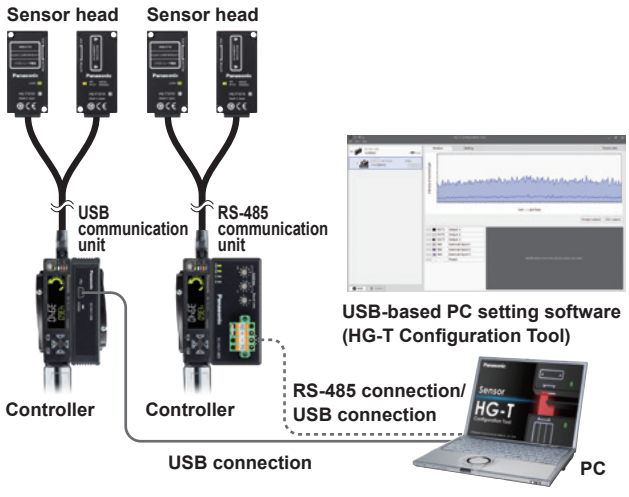
## System configuration

### Connecting to PLC




**Our product lineup includes communication units compatible with a variety of field networks such as CC-Link, CC-Link IE Field and EtherCAT. They can link with a production system and enable the incorporation and utilization of IoT.**

### Connecting to PC




* USB communication unit and RS-485 communication unit cannot be used simultaneously.
* To connect RS-485 communication unit via USB, the customer must arrange a USB2.0→RS-485 converter.

# ORDER GUIDE

## Sensor heads

| Type | | Appearance | Measurement width | Installation distance | Repeatability (Note 1) | Laser class | Model No. |
|---|---|---|---|---|---|---|---|
| Measurement width 10 mm 0.394 in | Standard type |  Emitter: 8 × 30 × 60 mm 0.315 × 1.181 × 2.362 in Receiver: 8 × 30 × 60 mm 0.315 × 1.181 × 2.362 in | 10 mm 0.394 in | 0 to 500 mm 0 to 19.685 in (Note 3) | 1 µm 0.039 mil [Installation distance: 20 mm 0.787 in] 2.5 µm 0.098 mil [Installation distance: 100 mm 3.937 in] 5 µm 0.197 mil [Installation distance: 500 mm 19.685 in] | Class 1 [IEC / EN / JIS / GB / KS / FDA (Note 2)] | **HG-T1010** |
| | Slim type |  Emitter: 8 × 30 × 60 mm 0.315 × 1.181 × 2.362 in Receiver: 8 × 20 × 60 mm 0.315 × 0.787 × 2.362 in | | | | | **HG-T1110** |

Notes: 1) This is the P-P value of digital measurement value with half shading at the middle position of the installation distance.
2) This product complies with the FDA regulations (FDA 21 CFR 1040.10 and 1040.11) in accordance with FDA Laser Notice No. 56, except for complying with IEC 60825-1 Ed. 3.
3) When side view attachment **HG-TSV10** is attached, 0 to 100 mm 0 to 3.937 in (typical)

## Sensor head connection cables

| Type | Appearance | Model No. | Cable length | Description |
|---|---|---|---|---|
| Sensor head connection cables |  | **CN-HT-C2** | 2 m 6.562 ft | This cable is used to connect the sensor head to the controller. The cable is branched into two cables on the sensor head connecting side, but the two cables can be connected interchangeably to the emitter and receiver. |
| | | **CN-HT-C5** | 5 m 16.404 ft | |
| | | **CN-HT-C10** | 10 m 32.808 ft | |
| | | **CN-HT-C20** | 20 m 65.617 ft | |

## Controllers

| Type | | Appearance | Model No. | Output | Maximum number of connectable controllers |
|---|---|---|---|---|---|
| Master unit | High performance type |  | **HG-TC101** | NPN open-collector transistor | Up to 15 slave units can be connected per master unit (Note) |
| | | | **HG-TC101-P** | PNP open-collector transistor | |
| Slave units | High performance type |  | **HG-TC111** | NPN open-collector transistor | |
| | | | **HG-TC111-P** | PNP open-collector transistor | |
| | Wire-saving type |  | **HG-TC113** | — | |

Note: When connected to a communication unit for digital displacement sensor, up to 14 slave units can be connected per master unit.

# ORDER GUIDE

## Communication units for digital displacement sensors

| Type | Appearance | Model No. | Description |
|---|---|---|---|
| CC-Link IE Field communication unit<br>Compatible with self-monitoring function (Note 1) |  | **SC-HG1-CEF** | Can directly send high-precision measurement values to a CC-Link IE Field host device.<br>• Communication method: CC-Link IE Field<br>• Number of connected units<br>Host (CC-Link IE Field): Max. 121 units (1 master station, 120 slave stations)<br>Controllers: Maximum of 15 units (1 master, 14 slaves) per **SC-HG1-CEF** unit |
| CC-Link communication unit<br>Compatible with self-monitoring function (Note 1) |  | **SC-HG1-C** | Can directly send high-precision measurement values to CC-Link Master.<br>• Communication method<br>Switchable CC-Link Ver.1.10 or 2.00<br>• Number of occupied station<br>CC-Link Ver.1.10: 4 stations, CC-Link Ver.2.00: Switchable 2 or 4 stations<br>• Number of connected units<br>Controllers: Maximum of 15 units (1 master, 14 slaves) per **SC-HG1-C** unit |
| EtherCAT communication unit<br>Compatible with self-monitoring function (Note 1) |  | **SC-HG1-ETC** | Can directly send high-precision measurement values to EtherCAT Master.<br>• Communication protocol: EtherCAT<br>• Number of connected units<br>Controllers: Maximum of 15 units (1 master, 14 slaves) per **SC-HG1-ETC** unit |
| RS-485 communication unit<br>Compatible with self-monitoring function (Note 1) |  | **SC-HG1-485** | Can directly send high-precision measurement values by RS-485 communication.<br>• Communication protocol: MODBUS (RTU / ASCII) / MEWTOCOL-COM<br>• Number of connected units<br>Host (RS-485): 1 to 99 units when MODBUS (RTU / ASCII) is used, 1 to 64 units when MEWTOCOL-COM is used<br>Controllers: Maximum of 15 units (1 master, 14 slaves) per **SC-HG1-485** unit<br>When used together with the "**HG-T Configuration Tool**" USB-based PC setting software (Ver. 1.20 or newer), current values and settings in the **HG-T** series can be confirmed or changed on the PC screen.<br>* The USB-based PC setting software, "**HG-T Configuration Tool**," can be downloaded free from our website. |
| USB communication unit<br>(Note 2) |  | **SC-HG1-USB** | When used together with the "**HG-T Configuration Tool**" USB-based PC setting software, current values and settings in the **HG-T** series can be confirmed or changed on the PC screen.<br>* The USB-based PC setting software, "**HG-T Configuration Tool**," can be downloaded free from our website.<br>• Communication specification: USB 2.0 Full Speed (Note 3)<br>• Communication protocol: Proprietary protocol<br>• USB port: USB Mini-B (1 port)<br>• Number of connectable units<br>Controller: Up to 15 units (1 master unit, 14 slave units) per **SC-HG1-USB** unit |

Notes: 1) The following products support the self-monitoring function:
**SC-HG1-CEF**: Products shipped in and after December 2019, **SC-HG1-C**: Products manufactured in and after December 2019, **SC-HG1-ETC**: All, **SC-HG1-485**: Products manufactured on and after November 18, 2019.
2) The USB communication unit cannot be used with contact-type digital displacement sensors **HG-S** series.
3) Dependent on PC environment.

## End plates

| Type | Appearance | Model No. | Description |
|---|---|---|---|
| End plates |  | **MS-DIN-E** | End plates are used to securely hold the controller and communication unit for digital displacement sensors connected on a DIN rail by pressing from both ends. Be sure to use the end plates when connecting units.<br>2 pcs per set |

# OPTIONS

| Type | Appearance | Model No. | Description |
|---|---|---|---|
| Side view attachment |  | **HG-TSV10** | Designed for exclusive use with the **HG-T1010** standard type sensor head.<br>This attachment can bend the laser beam at a right angle, thus allowing flexible installation of the sensor head.<br>Two M2 (length 4 mm 0.157 in) screws with washers are attached.<br>* Two pieces of attachment are required when using the attachment on both emitter and receiver.<br>* Be sure to confirm proper detection using actual equipment in advance when using the attachment. |

# SPECIFICATIONS

## Sensor heads

| Item \ Type | | Measurement width 10 mm 0.394 in / Standard type | Measurement width 10 mm 0.394 in / Slim type |
|---|---|---|---|
| Model No. | | **HG-T1010** | **HG-T1110** |
| Applicable regulations | | CE Marking (EMC Directive, RoHS Directive), UKCA Marking (EMC Regulations, RoHS Regulations), FDA regulations | |
| Compatible controller | | **HG-TC101** (**-P**), **HG-TC111** (**-P**), **HG-TC113** | |
| Position detection method | | CMOS-based | |
| Installation distance | | 0 to 500 mm 0 to 19.685 in [When side view attachment HG-TSV10 is attached, 0 to 100 mm 0 to 3.937 in (typical)] | |
| Measurement width | | 10 mm 0.394 in | |
| Light source | | Red semiconductor laser: Class 1 [IEC / EN / JIS / GB / KS / FDA (Note 2)]<br>Maximum output: 0.3 mW, Peak emission wavelength: 655 nm | |
| Repeatability (Note 3) | | 1 µm 0.039 mil (Installation distance: 20 mm 0.787 in)<br>2.5 µm 0.098 mil (Installation distance: 100 mm 3.937 in)<br>5 µm 0.197 mil (Installation distance: 500 mm 19.685 in) | |
| Linearity (Note 4) | | ±0.12 % F.S. (Installation distance: 20 mm 0.787 in)<br>±0.28 % F.S. (Installation distance: 100 mm 3.937 in) | |
| Minimum sensing object (Note 5) | | ø0.5 mm ø0.020 in (Installation distance: 500 mm 19.685 in) | |
| Temperature characteristics (Note 6) | | ±0.03 % F.S./°C | |
| Operation indicator | Emitter | Laser radiation indicator (Green) | |
| | Receiver | Beam axis adjustment indicator (Orange / Green), Judgment output indicator (Orange / Green) | Judgment output indicator (Orange / Green) |
| Pollution degree | | 2 | |
| Operating altitude | | 2,000 m 6,561.68 ft or less (Note 7) | |
| Environmental resistance | Protection | IP67 (IEC) (Excluding connectors) | |
| | Ambient temperature | -10 to +45 °C +14 to +113 °F (No dew condensation or icing allowed), Storage: -20 to +60 °C -4 to +140 °F | |
| | Ambient humidity | 35 to 85 % RH, Storage: 35 to 85 % RH | |
| | Ambient illuminance | Incandescent light: 5,000 lx or less at the light-receiving face (Note 8) | |
| | Insulation resistance | 20 MΩ or higher, using 250 V DC megger (between all terminals and case) | |
| | Vibration resistance | 10 to 55 Hz frequency, 1.5 mm 0.059 in double amplitude in X, Y and Z directions for two hours each | |
| | Shock resistance | 196 m/s$^2$ acceleration in X, Y and Z directions three times each | |
| Grounding method | | Capacitor grounding | |
| Material | | Case: Die-cast aluminum, Light emitting and light receiving surfaces: Glass | |
| Cable | | 0.2 m 0.656 ft 4-core shielded cable with round connectors | |
| Net weight | | Emitter: 30 g approx., Receiver: 30 g approx. | Emitter: 30 g approx., Receiver: 25 g approx. |

Notes: 1) Specification values are based on the digital measurement values obtained by the sensor head and controller **HG-TC**□. Where measurement conditions have not been specified precisely, the conditions used were as follows: ambient temperature = +20 °C +68 °F, controller's average count setting 16 times, measurement target = nontransparent knife edge, installation distance = 100 mm 3.937 in, positional condition of measurement target = Half shading at the middle position of installation distance.
2) This product complies with the FDA regulations (FDA 21 CFR 1040.10 and 1040.11) in accordance with FDA Laser Notice No. 56, except for complying with IEC 60825-1 Ed. 3.
3) This is the P-P value of digital measurement value with half shading at the middle position of the installation distance.
4) Indicates an error with the ideal straight line of digital measured values.
5) When the light is blocked at the center position of 500 mm 19.685 in installation distance
6) When the light is half-blocked at the center position of 100 mm 3.937 in installation distance
7) Do not use or store in an environment that has been pressurized to an air pressure higher than the atmospheric pressure at 0 m.
8) When the sampling cycle of the controller is set to "standard sampling"

# SPECIFICATIONS

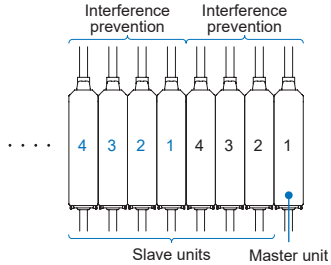
## Controller

| Item | | Type | Master unit | Slave unit | |
|---|---|---|---|---|---|
| | | | High performance type | High performance type | Wire-saving type |
| | Model No. | NPN output | **HG-TC101** | **HG-TC111** | **HG-TC113** |
| | | PNP output | **HG-TC101-P** | **HG-TC111-P** | |
| Applicable regulations | | | CE Marking (EMC Directive, RoHS Directive), UKCA Marking (EMC Regulations, RoHS Regulations) | | |
| Compatible sensor head | | | **HG-T1010**, **HG-T1110** | | |
| Number of connectable units | | | Up to 15 slave units can be connected to a master unit. (Note 2) | | |
| Supply voltage / Current consumption (Note 3) | | | 24 V DC ±10 %, including ripple 0.5 V (P-P) / 100 mA or less (when sensor head is connected) | | |
| Analog outputs (Switching type) (Note 4) | Analog voltage output | | • Voltage output range: 1 to 5 V/F.S. (default value)<br>• Linearity: ±0.05 % F.S. | • Output when alarm occurs: 5.2 V<br>• Output impedance: 100 Ω max. | — |
| | Analog current output | | • Current output range: 4 to 20 mA/F.S. (default value)<br>• Linearity: ±0.25 % F.S. | • Output when alarm occurs: 0 mA<br>• Load impedance: 250 Ω max. | — |
| Control outputs (Output 1, Output 2, Output 3) | | | <NPN output type><br>NPN open-collector transistor<br>• Maximum sink current: 50 mA (Note 5)<br>• Applied voltage: 30 V DC or less (between output and 0 V)<br>• Residual voltage: 1.5 V or less (at 50 mA sink current)<br>• Leakage current: 0.1 mA or less | <PNP output type><br>PNP open-collector transistor<br>• Maximum source current: 50 mA (Note 5)<br>• Applied voltage: 30 V DC or less (between output and +V)<br>• Residual voltage: 1.5 V or less (at 50 mA source current)<br>• Leakage current: 0.1 mA or less | — |
| | Short-circuit protection | | Incorporated (automatic reset type) | | |
| | Judgment output | | N.O. / N.C. switching type | | |
| | Alarm output | | Open when alarm occurs | | |
| External output switching | | | Output 1, Output 2, and Output 3 can be switched to 3-value, 2-value, Logic, and Logic 2. | | — |
| External inputs (Input 1, Input 2, Input 3) | | | <NPN output type><br>Non-contact input or NPN open-collector transistor<br>• Input conditions<br>Invalid: +8 V to +V DC or open<br>Valid: 0 to +1.2 V DC<br>• Input impedance: 10 kΩ approx. | <PNP output type><br>Non-contact input or PNP open-collector transistor<br>• Input conditions<br>Invalid: 0 to +0.6 V DC or open<br>Valid: +4 V to +V DC<br>• Input impedance: 10 kΩ approx. | — |
| | Input time | | • Trigger input: 2 ms or more (ON)<br>• Laser emission stop input, preset input, reset input, bank input A/B(Note 6): 20 ms or more (ON) | | |
| External input switching | | | Input 1, Input 2, and Input 3 can be switched to “Preset / Reset / Trigger”, “Bank Input A / Bank Input B / Select (Preset, Reset, Trigger)”, or “Laser emission stop”. | | — |
| Sampling cycle | | | 1 ms (standard sampling) / 0.5 ms (high-speed sampling) | | |
| Average count (response time) (Note 6) | | | 1 time (2 ms), 2 times (3 ms), 4 times (5 ms), 8 times (9 ms), 16 times (17 ms), 32 times (33 ms), 64 times (65 ms), 128 times (129 ms), 256 times (257 ms), 512 times (513 ms), and 1,024 times (1,025 ms) switching type | | |
| Display resolution | | | 1 µm 0.039 mil | | |
| Display range | | | -199.999 to 199.999 mm -7.874 to 7.874 in | | |
| Interference prevention function | | | Incorporated (Note 7) | — | |
| Pollution degree / Operating altitude | | | 2 / 2,000 m 6561.68 ft or less (Note 8) | | |
| Environmental resistance | Protection | | IP40 (IEC) | | |
| | Ambient temperature | | -10 to +50 °C +14 to +122 °F (No dew condensation or icing allowed) (Note 5), Storage: -20 to +60 °C -4 to +140 °F | | |
| | Ambient humidity | | 35 to 85 % RH, Storage: 35 to 85 % RH | | |
| | Voltage withstandability | | 1,000 V AC for one minute between all supply terminals connected together and enclosure | | |
| | Insulation resistance | | 20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure | | |
| | Vibration resistance | | 10 to 150 Hz frequency, 0.75 mm 0.030 in double amplitude (10 to 58 Hz), Maximum acceleration 49 m/s$^2$ (58 to 150 Hz) in X, Y and Z directions for two hours each | | |
| | Shock resistance | | 98 m/s$^2$ acceleration (10 G approx.) in X, Y and Z directions five times each | | |
| Material | | | Case: Polycarbonate, Cover: Polycarbonate, Switches: Polyacetal | | |
| Cable | | | 0.2 mm$^2$ 2-core (brown and blue lead wires) / 0.15 mm$^2$ 7-core composite cable, 2 m 6.562 ft long | 0.15 mm$^2$ 7-core composite cable, 2 m 6.562 ft long | — |
| Net weight | | | 140 g approx. | 140 g approx. | 60 g approx. |

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were as follows: supply voltage +24 V DC, ambient temperature +20 °C +68 °F.
2) When connected to a communication unit for digital displacement sensor, up to 14 slave units can be connected per master unit.
3) Current consumption does not include analog current output.
4) Linearity is a value calculated from digitally measured values at F.S. = 16 mA for current output or F.S. = 4 V for voltage output.
5) When slave units are connected to the master unit, the maximum sink current / source current of control output and ambient temperature vary depending on the number of connected slave units as shown below.

| Number of connected slave units | | Maximum sink current and source current of control output | Ambient temperature |
|---|---|---|---|
| | When communication unit is connected | | |
| 1 to 7 units | 1 to 6 units | 20 mA | -10 to +45 °C +14 to +113 °F |
| 8 to 15 units | 7 to 14 units | 10 mA | |

6) Average count (response time) is for when the sampling cycle is set to 1 ms (standard sampling). Response times differ when the sampling cycle is set to 0.5 ms (high-speed sampling).
7) This function operates for each set of 4 connected controllers.




8) Do not use or store in an environment that has been pressurized to an air pressure higher than the atmospheric pressure at 0 m.

# SPECIFICATIONS

## Communication unit for digital displacement sensors

| Item \ Designation | CC-Link IE Field communication unit |
|---|---|
| Model No. | **SC-HG1-CEF** |
| Applicable regulations | CE Marking (EMC Directive, RoHS Directive), UKCA Marking (EMC Regulations, RoHS Regulations) |
| Compatible controllers | **HG-TC□**, **HG-SC□** |
| Maximum number of connectable controllers | Maximum of 15 controllers (one master, 14 slaves) per **SC-HG1-CEF** unit |
| Supply voltage (Note 2) | 24 V DC ±10 %, including 0.5 V ripple (P-P) |
| Current consumption | 200 mA or less |
| Communication method | CC-Link IE Field |
| Remote station type | Remote device station |
| Network No. setting | 1 to 239 (decimal) [1 to EF (hex)] (0 and 240 or more: Error) (Note 3) |
| Cyclic transmission (Maximum number of links per station) | RX / RY:128 points each (128 bits), 16 bytes, RWr / RWw: 64 points each (64 words), 128 bytes |
| Transient transmission | Server function only, data size 1024 bytes |
| Station No. setting | 1 to 120 (decimal) (0 and 121 or more: Error) |
| Communication speed | 1 Gbps |
| Transmission line type | Line, star (mixing of line and star types is possible), ring |
| Maximum transmission distance | 100 m 328.084 ft |
| Maximum number of units connectable | 121 units (1 master station, 120 slave stations) |
| Cascade connection levels | Maximum 20 |
| Pollution degree | 2 |
| Operating altitude | 2,000 m 6561.68 ft or less (Note 4) |
| Environmental resistance: Protection | IP40 (IEC) |
| Environmental resistance: Ambient temperature | -10 to +45°C +14 to +113 °F (No dew condensation or icing allowed), Storage: -20 to +60°C -4 to +140°F |
| Environmental resistance: Ambient humidity | 35 to 85 % RH, Storage: 35 to 85 % RH |
| Environmental resistance: Voltage withstandability | 1,000 V AC for one min. between all supply terminals connected together and enclosure |
| Environmental resistance: Insulation resistance | 20 MΩ or more, with 250 V DC megger between all supply terminals connected together and enclosure |
| Environmental resistance: Vibration resistance | 10 to 150 Hz frequency, 0.75 mm 0.030 in double amplitude (10 to 58Hz), maximum acceleration 49 m/s$^2$ (58 to 150 Hz) in X, Y and Z directions for two hours each |
| Environmental resistance: Shock resistance | 98 m/s$^2$ acceleration (10 G approx.) in X, Y and Z directions five times each |
| Material | Enclosure: Polycarbonate |
| Communication cable | Ethernet cable that satisfies 1000BASE-T standard Category 5e or higher (Double-shielded / STP, straight cable) (Note 5) |
| Weight | Net weight: 100 g approx., Gross weight: 150 g approx. |

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were ambient temperature +20 °C +68 °F.
2) Power is supplied from a connected controller / master controller.
3) For the network number setting on this product, convert the network number to hex and set the hex value.
4) Do not use or store in an environment that has been pressurized to an air pressure higher than the atmospheric pressure at 0 m.
5) Use CC-Link Partner Association recommended cable.

| Item \ Designation | CC-Link communication unit | | | | |
|---|---|---|---|---|---|
| Model No. | **SC-HG1-C** | | | | |
| Applicable regulations | CE Marking [EMC Directive (Note 2), RoHS Directive], UKCA Marking [EMC Regulations (Note 2), RoHS Regulations] | | | | |
| Compatible controllers | **HG-TC□**, **HG-SC□** | | | | |
| Maximum number of connectable controllers | Maximum of 15 controllers (one master, 14 slaves) per **SC-HG1-C** unit | | | | |
| Supply voltage (Note 3) | 24 V DC ±10 %, including 0.5 V ripple (P-P) | | | | |
| Current consumption | 80 mA or less | | | | |
| Communication method | Switchable CC-Link Ver.1.10 or 2.00 | | | | |
| Remote station type | Remote device station | | | | |
| Number of occupied station | CC-Link Ver.1.10: 4 stations, CC-Link Ver.2.00: Switchable 2 or 4 stations | | | | |
| Station No. setting | 1 to 64 (0 and 65 or more: Error) | | | | |
| Communication speed | 10 Mbps | 5 Mbps | 2.5 Mbps | 625 kbps | 156 kbps |
| Maximum transmission distance | 100 m 328.084 ft | 160 m 524.934 ft | 400 m 1,312.336 ft | 900 m 2,952.756 ft | 1,200 m 3,937.008 ft |
| Pollution degree | 2 | | | | |
| Operating altitude | 2,000 m 6561.68 ft or less (Note 4) | | | | |
| Environmental resistance: Protection | IP40 (IEC) | | | | |
| Environmental resistance: Ambient temperature | -10 to +45°C +14 to +113 °F (No dew condensation or icing allowed), Storage: -20 to +60°C -4 to +140°F | | | | |
| Environmental resistance: Ambient humidity | 35 to 85 % RH, Storage: 35 to 85 % RH | | | | |
| Environmental resistance: Voltage withstandability | 1,000 V AC for one min. between all supply terminals connected together and enclosure | | | | |
| Environmental resistance: Insulation resistance | 20 MΩ or more, with 250 V DC megger between all supply terminals connected together and enclosure | | | | |
| Environmental resistance: Vibration resistance | 10 to 150 Hz frequency, 0.75 mm 0.030 in double amplitude (10 to 58 Hz), maximum acceleration 49 m/s$^2$ (58 to 150 Hz) in X, Y and Z directions for two hours each | | | | |
| Environmental resistance: Shock resistance | 98 m/s$^2$ acceleration (10 G approx.) in X, Y and Z directions five times each | | | | |
| Material | Enclosure: Polycarbonate | | | | |
| Communication cable | Specified cable (shielded twisted cable) (Note 5) | | | | |
| Weight | Net weight: 80 g approx., Gross weight: 130 g approx. | | | | |

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were ambient temperature +20 °C +68 °F.
2) If our product will be incorporated in a customer product that will comply with the EMC Directive and EMC Regulations, install our product in a conductive box in accordance with "PLC User's Manual [Published by Mitsubishi Electric Corporation]".
3) Power is supplied from a connected controller / master controller.
4) Do not use or store in an environment that has been pressurized to an air pressure higher than the atmospheric pressure at 0 m.
5) Use only a special-use communication cable that is approved by the CC-Link Partner Association.

| Item \ Designation | EtherCAT communication unit |
|---|---|
| Model No. | **SC-HG1-ETC** |
| Applicable regulations | CE Marking (EMC Directive, RoHS Directive), UKCA Marking (EMC Regulations, RoHS Regulations) |
| Compatible controllers | **HG-TC□**, **HG-SC□** |
| Maximum number of connectable controllers | Maximum of 15 controllers (one master, 14 slaves) per **SC-HG1-ETC** unit |
| Supply voltage (Note 2) | 24 V DC ±10 %, including ripple 0.5 V (P-P) |
| Current consumption | 100 mA or less |
| Communication protocol | EtherCAT |
| Compliance | IEEE 802.3u (100BASE-TX) |
| Communication speed | 100 Mbps (100BASE-TX) |
| Communication connector | RJ-45 × 2 |
| Node-to-node distance | 100 m 328.084 ft or less |
| Supported functions | Process data object communication (cyclic communication)<br>Mailbox communication (message communication) CoE Explicit Device Identification<br>Station Alias |
| Pollution degree | 2 |
| Operating altitude (Note 3) | 2,000 m 6,561.68 ft or less |
| Environmental resistance: Ambient temperature | -10 to +45 °C +14 to +113 °F (No dew condensation or icing allowed), Storage: -20 to +60 °C -4 to +140 °F |
| Environmental resistance: Ambient humidity | 35 to 85 % RH, Storage: 35 to 85 % RH |
| Environmental resistance: Voltage withstandability | 1,000 V AC for one min. between all supply terminals connected together and enclosure |
| Environmental resistance: Insulation resistance | 20 MΩ or higher, using 250 V DC megger between all supply terminals connected together and enclosure |
| Environmental resistance: Vibration resistance | 10 to 150 Hz frequency, 0.75 mm 0.030 in double amplitude (10 to 58Hz), maximum acceleration 49 m/s$^2$ (58 to 150 Hz) in X, Y and Z directions for two hours each |
| Environmental resistance: Shock resistance | 98 m/s$^2$ (10 G approx.) acceleration in X, Y, and Z directions five times each |
| Grounding method | Casing: Floating type |
| Material | Enclosure: Polycarbonate |
| Communication cable | Category 5e (shielded twisted pair cable recommended) |
| Weight | Net weight: 90 g approx., Gross weight: 150 g appox. |

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +20 °C +68 °F.
2) Power is supplied from a connected controller / master controller.
3) Do not use or store in an environment that has been pressurized to an air pressure higher than the atmospheric pressure at 0 m.

# SPECIFICATIONS

| Item \ Designation / Model No. | | RS-485 communication unit |
|---|---|---|
| | | **SC-HG1-485** |
| Applicable regulations | | CE Marking (EMC Directive, RoHS Directive), UKCA Marking (EMC Regulations, RoHS Regulations) |
| Compatible controllers | | **HG-TC□**, **HG-SC□** |
| Supply voltage (Note 2) | | 24 V DC ±10 %, Ripple (P-P) 10 % or less (Within specified power supply voltage range) |
| Current consumption | | 40 mA or less |
| Communication method | | Two-wire half duplex communication |
| Synchronization method | | Start-stop synchronization |
| Communication protocol | | MODBUS (RTU / ASCII) / MEWTOCOL-COM |
| Communication speed | | 1.2 kbps / 2.4 kbps / 4.8 kbps / 9.6 kbps / 19.2 kbps / 38.4 kbps / 57.6 kbps / 115.2 kbps |
| Electrical characteristics | | Complies with EIA RS-485 |
| Number of connectable units | Host (RS-485) | 1 to 99 units when MODBUS (RTU / ASCII) is used, 1 to 64 units when MEWTOCOL-COM is used |
| | Controllers | Maximum of 15 controllers (one master, 14 slaves) per **SC-HG1-485** unit |
| Stop bit length | | 1 bit / 2 bits |
| Parity check | | Even / Odd / None |
| Data bit length | | 8 bits (RTU) / 7 bits (ASCII) |
| Pollution degree | | 2 |
| Operating altitude | | 2,000 m 6561.68 ft or less (Note 3) |
| Environmental resistance | Protection | IP40 (IEC) |
| | Ambient temperature | -10 to +45 °C +14 to +113 °F (No dew condensation or icing allowed), Storage: -20 to +60 °C -4 to +140 °F |
| | Ambient humidity | 35 to 85 % RH, Storage: 35 to 85 % RH |
| | Voltage withstandability | 1,000 V AC for one min. between all supply terminals connected together and enclosure |
| | Insulation resistance | 20 MΩ or more, with 250 V DC megger between all supply terminals connected together and enclosure |
| | Vibration resistance | 10 to 150 Hz frequency, 0.75 mm 0.030 in double amplitude (10 to 58Hz), maximum acceleration 49 m/s$^2$ (58 to 150 Hz) in X, Y and Z directions for two hours each |
| | Shock resistance | 98 m/s$^2$ acceleration (10 G approx.) in X, Y and Z directions five times each |
| Material | | Enclosure: Polycarbonate |
| Total extension distance | | Communication cable: 1,200 m 3,937.008 ft or less between **SC-HG1-485** (terminal) and PLC |
| Weight | | Net weight: 75 g approx., Gross weight: 120 g approx. |
| Accessories | | Termination resistor switching jumper pin: 1 pc. |

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were ambient temperature +20 °C +68 °F.
2) Power is supplied from a connected controller / master controller.
3) Do not use or store in an environment that has been pressurized to an air pressure higher than the atmospheric pressure at 0 m.

| Item \ Designation / Model No. | | USB communication unit |
|---|---|---|
| | | **SC-HG1-USB** |
| Applicable regulations | | CE Marking (EMC Directive, RoHS Directive), UKCA Marking (EMC Regulations, RoHS Regulations) |
| Compatible controllers | | **HG-TC□** |
| Maximum number of connectable controllers | | Maximum of 15 controllers (one master, 14 slaves) per **SC-HG1-USB** unit |
| Supply voltage (Note 2) | | 24 V DC ±10 %, Ripple (P-P) 10 % or less (Within specified power supply voltage range) |
| Current consumption | | 50 mA or less |
| Communication method | | USB 2.0 Full Speed (Note 3) |
| Communication protocol | | Our dedicated protocol |
| USB port | | USB Mini-B (1 port) (Note 4) |
| Pollution degree | | 2 |
| Operating altitude | | 2,000 m 6561.680 ft or less (Note 5) |
| Environmental resistance | Protection | IP40 (IEC) |
| | Ambient temperature | -10 to +45 °C +14 to +113 °F (No dew condensation or icing allowed), Storage: -20 to +60 °C -4 to +140 °F |
| | Ambient humidity | 35 to 85 % RH, Storage: 35 to 85 % RH |
| | Voltage withstandability | 1,000 V AC for one min. between all supply terminals connected together and enclosure |
| | Insulation resistance | 20 MΩ or more, with 250 V DC megger |
| | Vibration resistance | 10 to 150 Hz frequency, 0.75 mm 0.030 in double amplitude (10 to 58 Hz), Maximum acceleration 49 m/s$^2$ (58 to 150 Hz) in X, Y and Z directions for two hours each |
| | Shock resistance | 98 m/s$^2$ acceleration (10 G approx.) in X, Y and Z directions five times each |
| Material | | Enclosure: Polycarbonate |
| Weight | | Net weight: 35 g approx., Gross weight: 95 g approx |

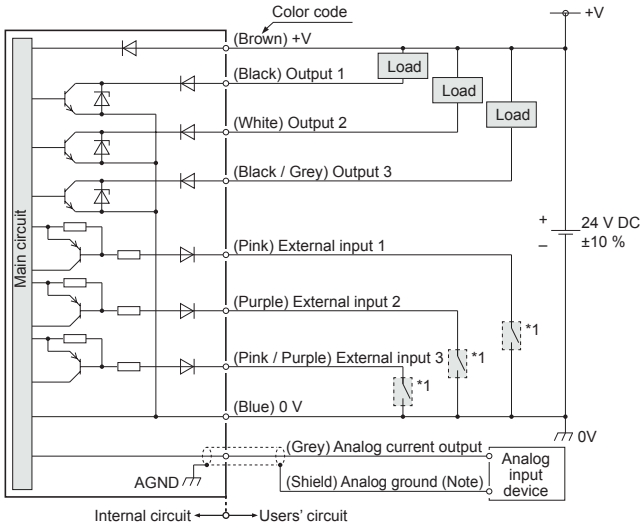
Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +20 °C +68 °F.
2) Power is supplied from a connected controller / master unit.
3) Dependent on PC environment.
4) USB 2.0 (Mini-B) cable for the connection of a PC is not provided with the product. Please purchase a USB 2.0 (Mini-B) cable.
5) Do not use or store in an environment that has been pressurized to an air pressure higher than the atmospheric pressure at 0 m.

# I/O CIRCUIT DIAGRAMS

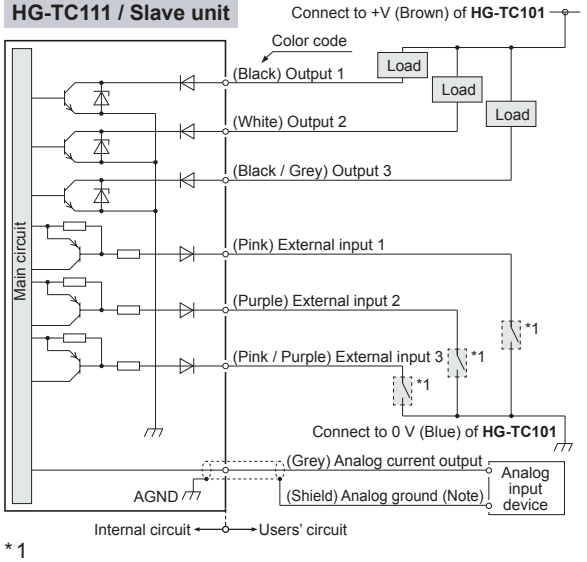
For communication unit for digital displacement sensors, refer to the instruction manual.
The instruction manual can be downloaded from our website.

## NPN output type

### HG-TC101 / Master unit

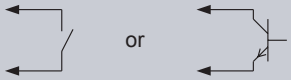



### HG-TC111 / Slave unit




*1

Non-voltage contact or NPN open collector transistor

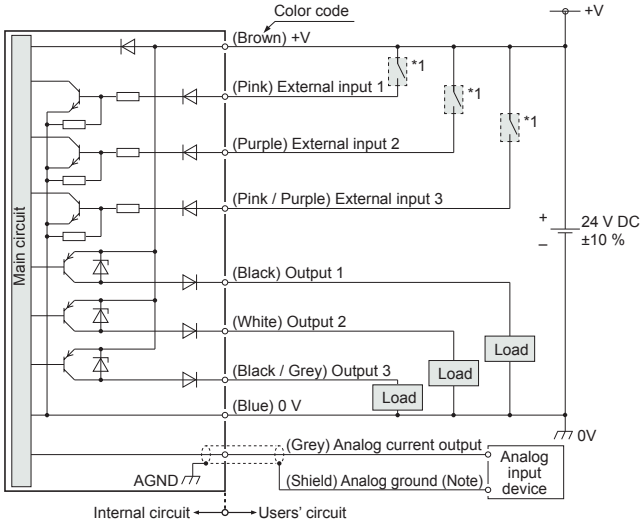



0 to +1.2 V DC: Effective
+8 V to +V DC or open: Ineffective

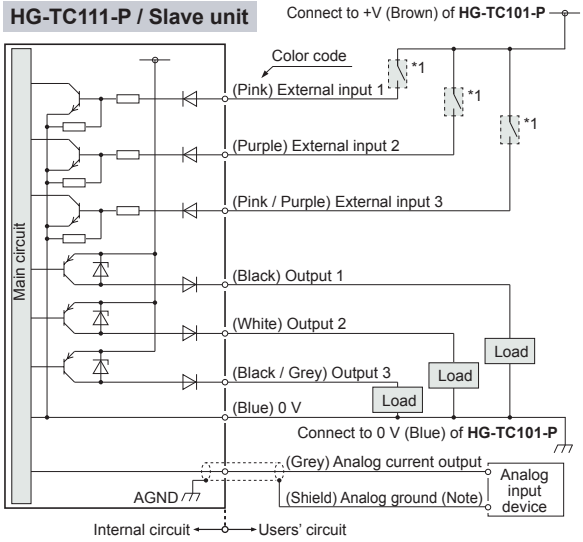
Note: Use shielded wire for the analog output.

## PNP output type

### HG-TC101-P / Master unit

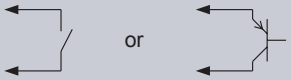



### HG-TC111-P / Slave unit




*1

Non-voltage contact or PNP open collector transistor




+4 V to +V DC: Effective
0 to +0.6 V DC or open: Ineffective

Note: Use shielded wire for the analog output.

# PRECAUTIONS FOR PROPER USE

Refer to the instruction manual for details.
The instruction manual can be downloaded from our website.

- This catalog is a guide to select a suitable product. Be sure to read instruction manual attached to the product prior to its use.

- Never use this product as a sensing device for personnel protection.
- When using sensing devices for personnel protection, use products that meet the laws and standards for personnel protection that apply in each region or country, such as OSHA, ANSI and IEC.

### User's Manual available for download

The **HG-T** series User's Manual is available for download from our website.

### Cautions for laser beams

- This product is classified as a Class 1 Laser Product in IEC / EN / JIS / GB / KS standards and in FDA* regulations. Do not look at the laser beam through optical system such as a lens.
- The explanation label and the FDA certificate / identification label are attached to the product. Handle the product according to the instruction given on the label.

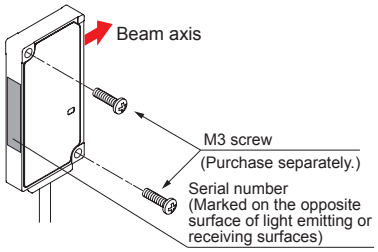
* This product complies with the FDA regulations (FDA 21 CFR 1040.10 and 1040.11) in accordance with FDA Laser Notice No. 56, except for complying with IEC 60825-1 Ed. 3.

## Sensor head

### Mounting

- The light emitting and receiving surfaces of the sensor head must be free of water, oil, fingerprints, and other substances that refract light as well as dust, grit, and other objects that intercept light.
- Do not allow ambient light such as sunlight to directly hit the light receiving section of the sensor head. In particular, if precision is required, use this product by mounting a douser (or similar material) on the sensor head.
- A serial number is marked on each opposite surface of the light emitting and receiving surfaces of the sensor head. Use a pair of emitter and receiver that have the same serial number.

- For the installation of sensor heads, use M3 screws and tighten to the torque of 0.5 N·m. M3 screws are not provided with the product.

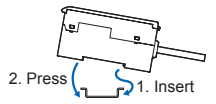



## Controller

### Mounting

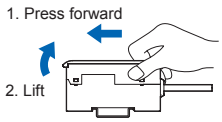
#### Mounting

1. Insert the rear of the mounting part into the DIN rail.
2. While pressing down on the rear of the mounting part, insert the front of the mounting part into the DIN rail.




#### Removal method

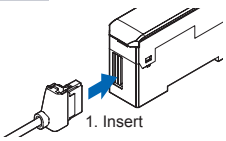
1. Grasp the product and push forward.
2. Lift the front to remove.




#### Attaching the sensor head connection cable

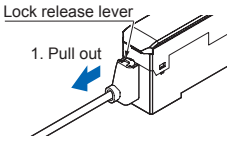
##### Mounting

1. Insert the sensor head connection cable into the connector for the sensor head connection cable on the controller.




##### Removal method

1. Grasp the controller, and while pressing on the lock release lever on the connector of the sensor head connection cable, pull toward you to disconnect.




Note: If you attempt to disconnect the cable by pulling it without pressing the lock release lever, cable wire breakage and connector damage may occur.

### Connection

- Always shut off the power before connecting a slave unit to or disconnecting a slave unit from the master unit. Risk of controller damage if you attempt connection with the power on.
- Insert the male connector firmly into the female connector. Risk of controller damage if not completely connected.
- When connecting slave units to a master unit, connect only NPN output types, or only PNP output types. Dissimilar output types cannot be connected together.
- To connect units, the units must be mounted on a DIN rail. Attach end plates **MS-DIN-E** (optional) so as to enclose the connected units at the ends.

- If the **HG-TC**□ controller is used together with the **HG-SC**□ controller for contact-type digital displacement sensor **HG-S** series, make sure to use the **HG-SC**□ controller manufactured in or after February, 2019. Furthermore, connect the slaves units of the same series to the side closer to the master unit and the slave units of the other series to the far side.

## Common

### Wiring

- The product is designed to fulfill the specifications when combined with the **HG-T**□ sensor head and **HG-TC**□ controller. If the product is used in combination with other products, it not only fails to meet the specifications but also generates a malfunction in some cases.
- For the controller DC power supply, only use a power supply that is isolated by means of an isolation transformer or otherwise.
- Risk of short-circuiting and damage to the controller or power supply if a transformer such as an auto transformer is used. Risk of short-circuiting and damage to the controller or power supply if incorrectly mounted or connected.

- Make sure that the power supply is off while performing wiring or expansion work.
- After you have completed wiring work, check the wiring carefully before switching on the power.
- 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.
- Make sure that stress by forcible bend or pulling is not applied directly to the sensor cable joint.

### Others

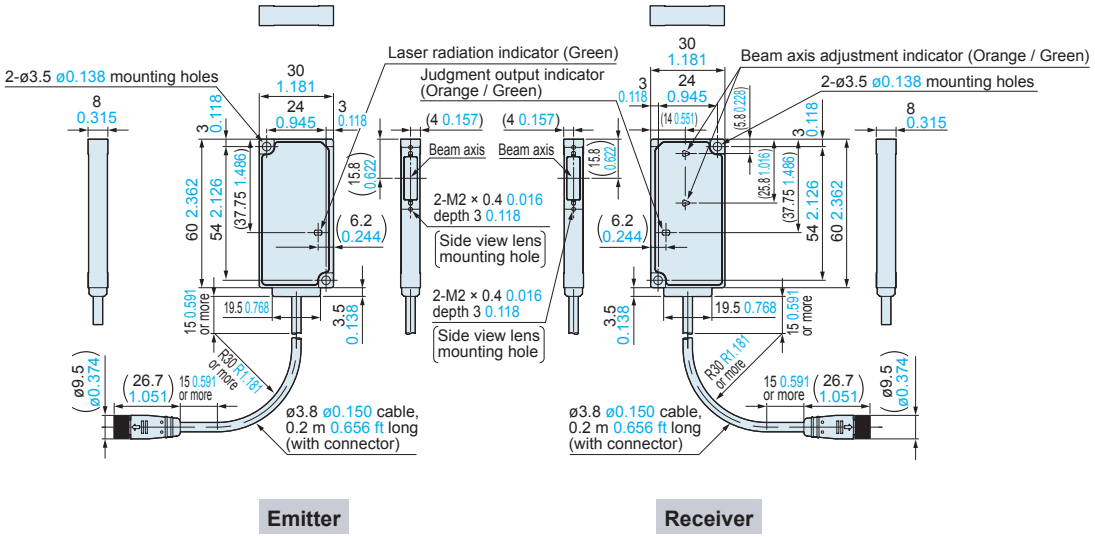
- This device has been developed / produced for industrial use only.
- Do not use this product outside the range of the specifications. Risk of an accident and product damage. There is also a risk of a noticeable reduction of service life.
- Do not use during the initial transient time after the power supply is switched on.
- To ensure performance, use the product at least 30 minutes (warm-up time) after the power is turned ON.
- This product (controller and sensor head receiver) uses an EEPROM. The EEPROM has a service life of one million setting operations.
- This product is suitable for indoor use only.
- Avoid dust, dirt, and steam.
- Take care that the product does not come in direct contact with organic solvents such as thinner.
- Take care that the product does not come in direct contact with strong acid or alkaline.
- Take care that the product does not come in direct contact with oil or grease.
- Do not use in an environment containing inflammable or explosive gases.
- Performance may not be satisfactory in a strong electromagnetic field.
- The sensor head is watertight, but the connector is not dustproof, waterproofing, or corrosion-resistant due to its structural reasons, so measurements cannot be taken under the water or in the rain. Pay attention to the environment where the product is used.
- This product is a precision device. Do not drop or otherwise subject to shock. Risk of product damage.
- Never attempt to disassemble, repair, or modify the product.

## DIMENSIONS (Unit: mm in)

The CAD data can be downloaded from our website.

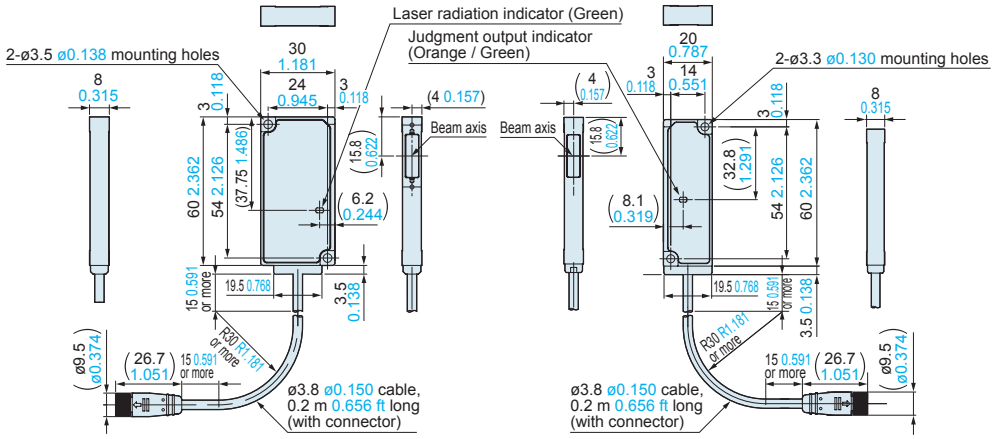
### HG-T1010

Sensor head (Standard type)



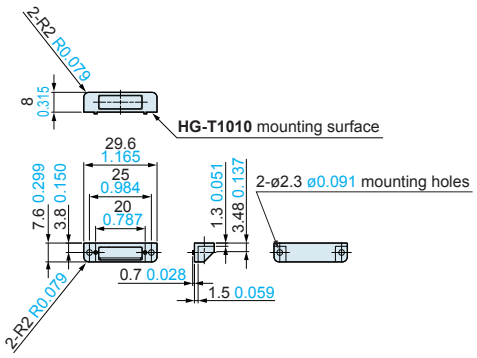

### HG-T1110

Sensor head (Slim type)




### HG-TSV10

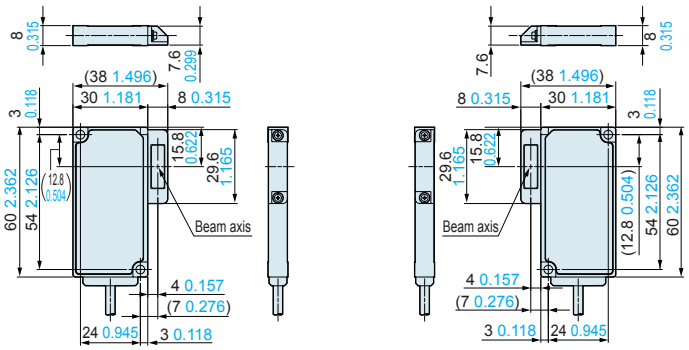
Side view attachment (Optional)




Two M2 (length 4 mm 0.157 in) screws with washers are attached.

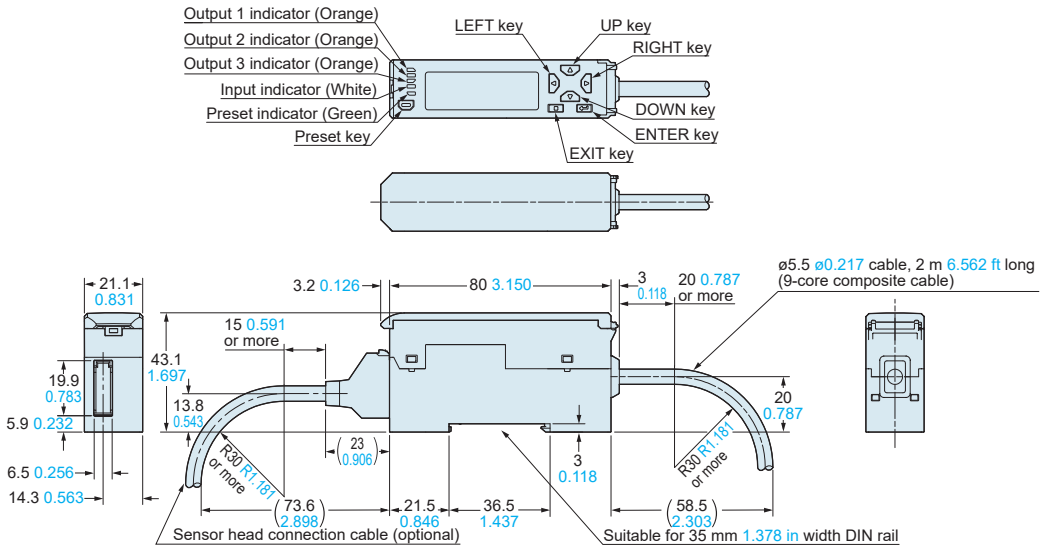
#### Assembly dimensions

The diagram shows the attachment mounted on the receiver of the standard type sensor head **HG-T1010**.
Can be installed in either direction.

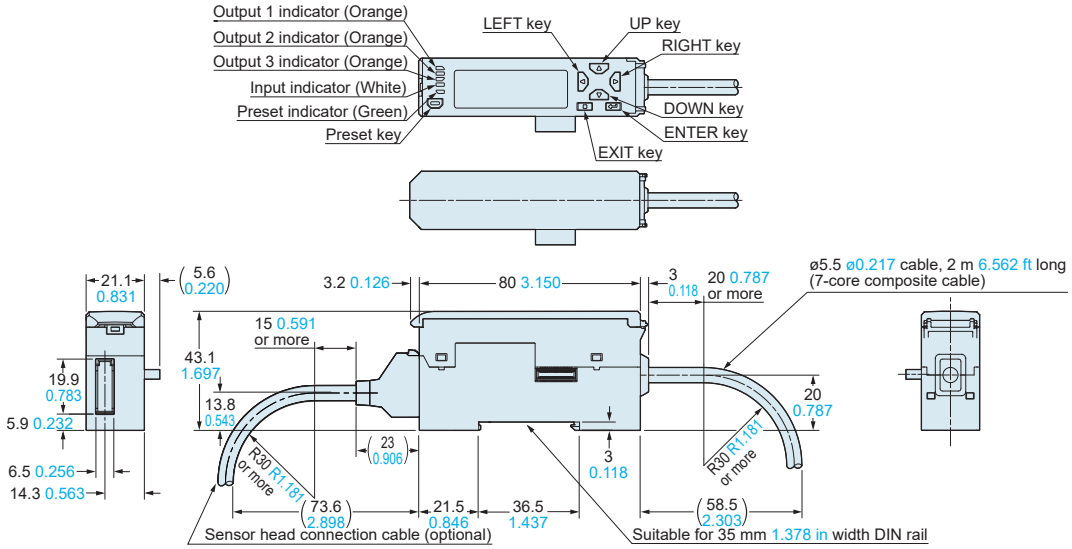



Notes: 1) The attachment cannot be installed to the slim type sensor head **HG-T1110**.
2) Be sure to confirm proper detection using actual equipment in advance when using the attachment.

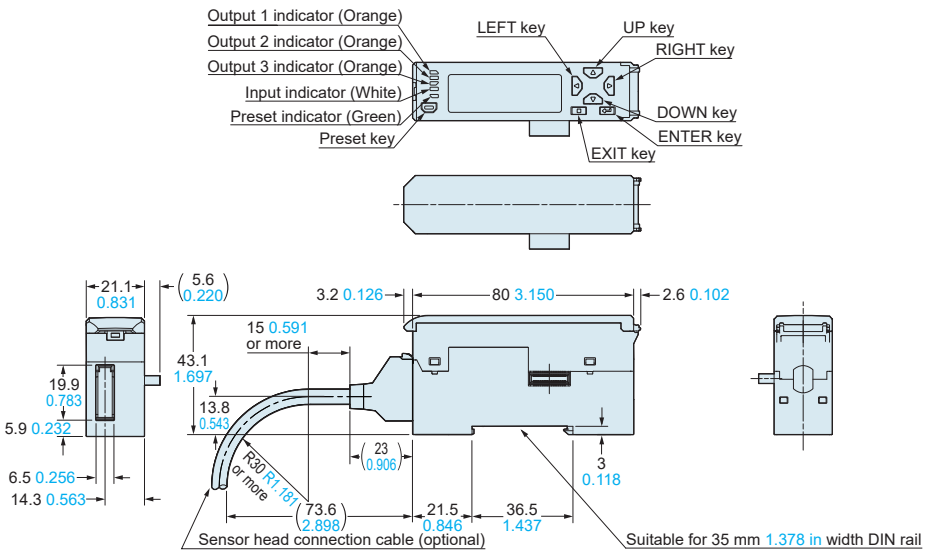
## HG-TC101 HG-TC101-P — Controller (Master unit)




## HG-TC111 HG-TC111-P — Controller (Slave unit)



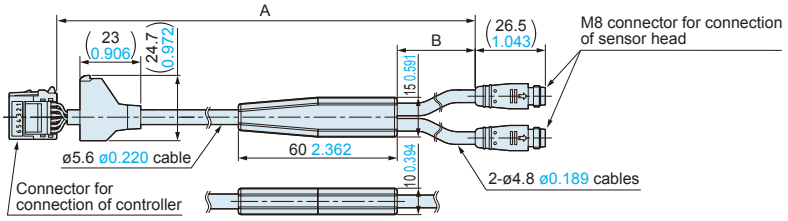

## HG-TC113 — Controller (Slave unit)



## DIMENSIONS (Unit: mm in)

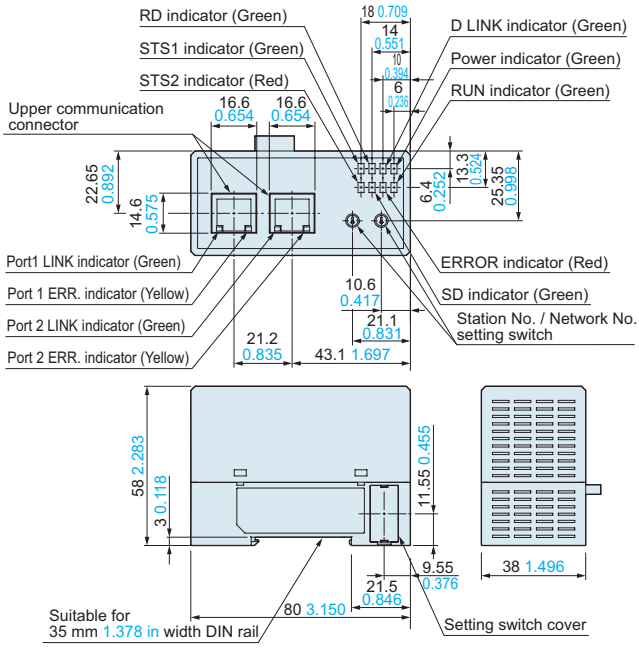
The CAD data can be downloaded from our website.

### CN-HT-C□ Sensor head connection cable

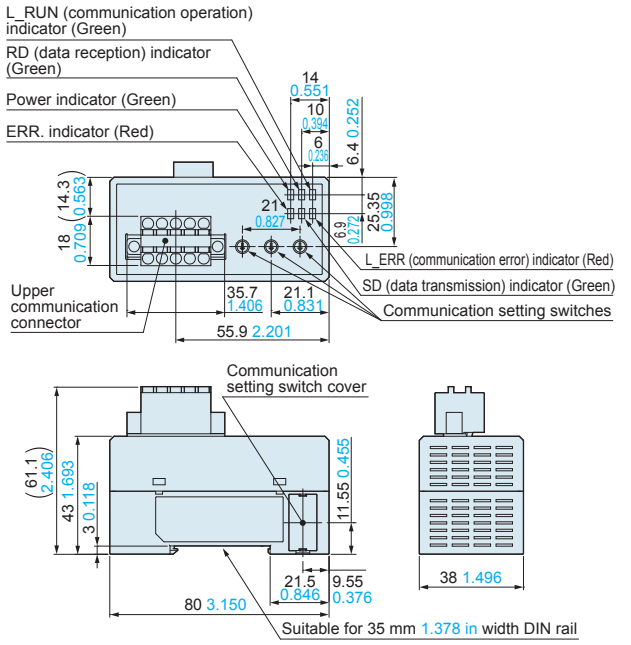



| Model | A | B |
|---|---|---|
| CN-HT-C2 | 2,000<br>78.740 | 500<br>19.685 |
| CN-HT-C5 | 5,000<br>196.850 | 500<br>19.685 |
| CN-HT-C10 | 10,000<br>393.701 | 1,000<br>39.370 |
| CN-HT-C20 | 20,000<br>787.402 | 1,000<br>39.370 |

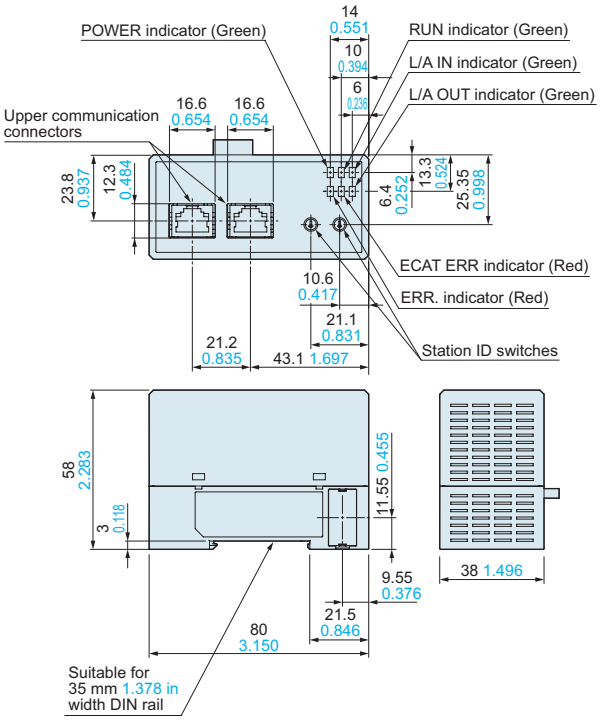
### SC-HG1-CEF CC-Link IE Field communication unit



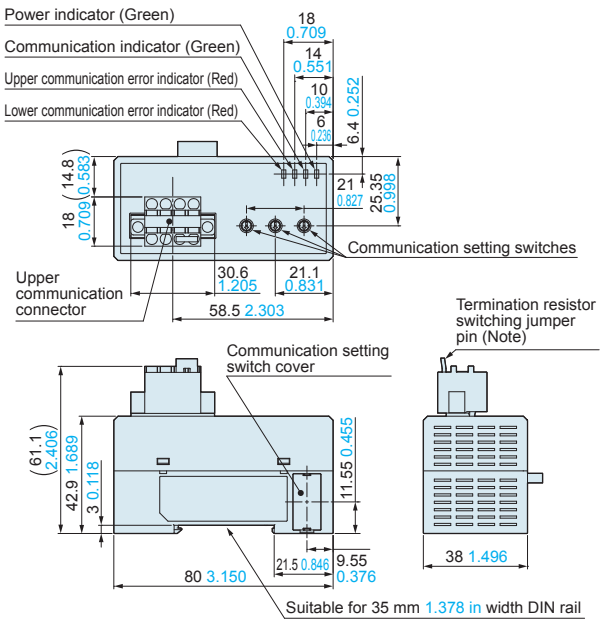

### SC-HG1-C CC-Link communication unit




### SC-HG1-ETC EtherCAT communication unit

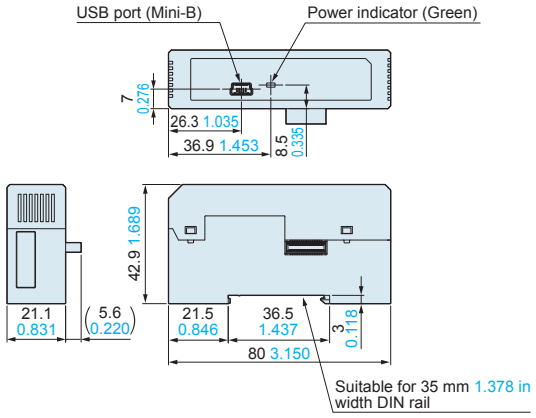



### SC-HG1-485 RS-485 communication unit

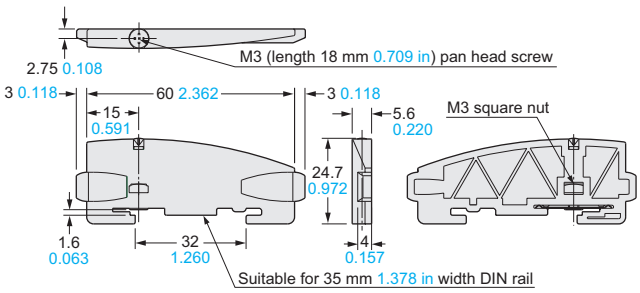



Note: The termination resistor switching jumper pin is not attached to the product at the factory. Attach the termination resistor switching jumper pin to the unit at the terminating end. Make sure that the termination resistor switching jumper pin have been removed from all units except the one at the terminating end.

## SC-HG1-USB USB communication unit




## MS-DIN-E End plate




Material: Polycarbonate

# Contact-type digital displacement sensor

Self-Monitoring Sensor

## Contact-type digital displacement sensor HG-S SERIES

**The optical absolute method eliminates “value skipping” and “unset zero point”!**

### Sensor head

- Tip deviation amount of 35 µm 1.378 mil or less (typical value) *1
- Plain bearings with 2-point support structure offering high lateral load resistance
- Hot-swappable
- Bending-resistant cable

*1: Calculated based on the upper and lower plain bearing clearances in the 10-mm type product.


| 10 mm 0.394 in type | 10 mm 0.394 in type | 32 mm 1.260 in type | 50 mm 1.969 in type |
|---|---|---|---|
| Air-driven type | Regular type | | |

**Development target:**

## Slim & Robust

- **The 10 mm 0.394 in type has a slim 11 × 18 × 84.5 mm 0.433 × 0.709 × 3.327 in body, for easy adjacent installation**
- **Class-top robustness in the industry**

Lateral load resistance No. 1* in class

Vibration / impact resistance No. 1* in class

* As of October 2023, in-company survey.

**Development goal:**

## Highest Resolution in Class

- **Resolution of 0.1 µm 0.004 mil* and indication accuracy of 1.0 µm 0.039 mil or less***
- **Absolute value scale reading for elimination of “value skipping” and “unset zero point”**

Resolution No. 1* in class

Optical absolute method

* In the case of high-precision sensor heads (**HG-S1110**□). As of October 2023, in-company survey.

### Controller

**Development focus:**

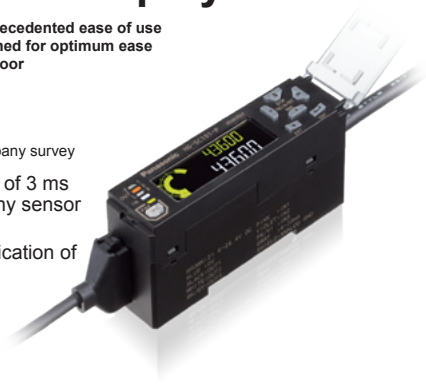
## Intuitive Dual Display

- **2-line digital display for unprecedented ease of use**
- **Full-fledged functions designed for optimum ease of operation on production floor**

Industry’s first*

* As of September 2015, in-company survey

- High-speed response of 3 ms in combination with any sensor head
- Alarm setting for notification of upward thrust



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