


Ultra High-speed High-precision Laser Displacement Sensor

HL-C2 SERIES



HL-C2 SERIES



 This product is classified as a Class 1 / Class 2 / Class 3R Laser Product in IEC / JIS standards and a Class 1* / Class II / Class 2* / Class IIIa / Class 3R* Laser Product in FDA regulations. Never look at or touch the direct laser beam and its reflection.

* This product complies with 21 CFR 1040.10 and 1040.11 Laser Notice No. 50, dated June 24, 2007, issued by CDRH (Center for Devices and Radiological Health) under the FDA (Food and Drug Administration).

The No.1* industry leader in application compatibility with 34 different sensor head variations

* As of May 2017, in-company survey

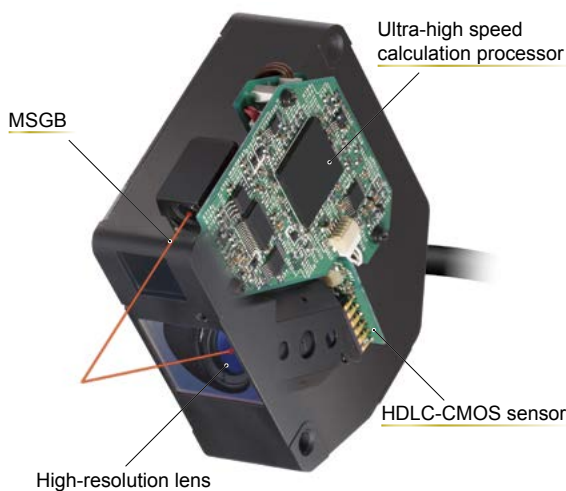
Combining our accumulated and the latest technologies to accomplished* functionality

* As of May 2017, in-company survey

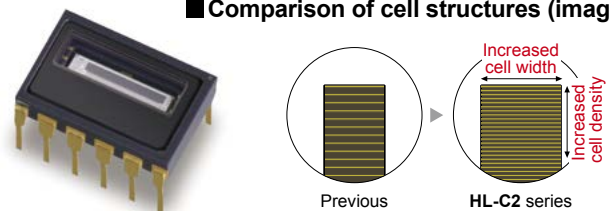
Our proprietary measurement CMOS, the “HDLC-CMOS Sensor”

The HDLC-CMOS sensors have been developed specially for the HL-C2 series. High density light-receiving cells and a processing speed close to the maximum limit result in high resolutions and high speeds which exceed all expectations for laser displacement sensors.

HDLC: High Density Linear Cell



Comparison of cell structures (image)

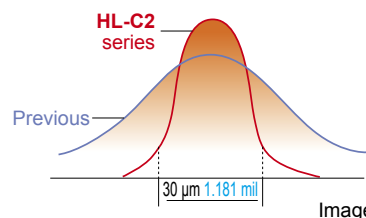


“MSGB” laser with sharp and fine projection

We have created the ideal laser using our proprietary optical technologies and aperture construction. Furthermore, emission adjustment algorithms have been redesigned to maintain ideal emission conditions.

MSGB: Micro Spot Gaussian Beam

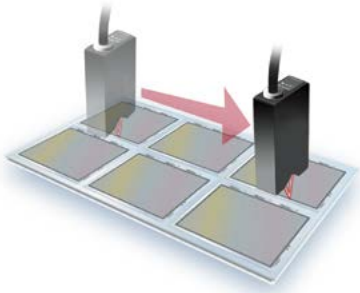
Comparison of beam diameter



- HL-C201A**
ø20 μm ø0.787 mil approx.
- HL-C203B**
ø30 μm ø1.181 mil approx.
- HL-C205B**
ø70 μm ø2.756 mil approx.
- HL-C208B**
ø100 μm ø3.937 mil approx.
- HL-C211B**
ø80 μm ø3.150 mil approx.
- HL-C235BE**
ø250 μm ø9.843 mil approx.
- (HL-C235CE-W**
ø400 μm ø15.748 mil approx.)

APPLICATIONS

Measurement of the flatness of patterned glass



Detection of deformed narrow pitch connector leg pins



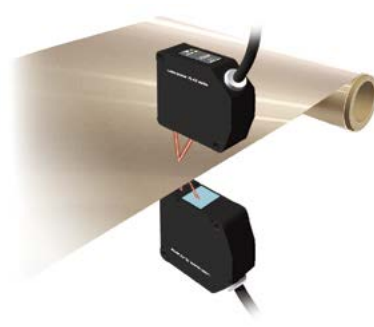
Measurement of HDD surface variations



Measurement of the shape of a camshaft



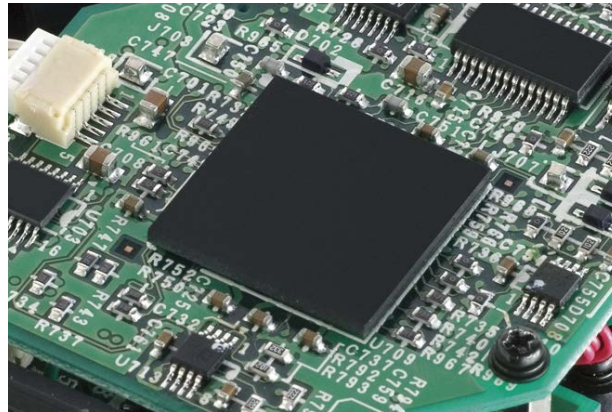
Thickness measurement of copper-clad laminate



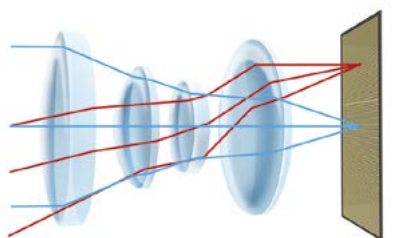
Controlling the height of a dispenser

**Ultra high-speed calculation processor**

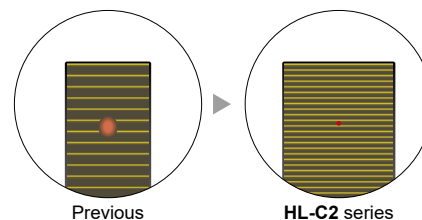
Using our specialized proprietary IC and custom algorithms for high-speed processing, information is digitally transmitted between the sensor head and controller. Both high-speed transmission and stability are realized for measurement values.

**“High-resolution lens” for realizing stable optical path lengths**

We designed a new high-resolution lens to reduce lens aberration as much as possible. Light entering from any angle can be gathered at a minimum point to realize even higher precision.



Image

Comparison of beam quality (Image)

Previous

HL-C2 series

A diverse array of sensor heads for your application needs

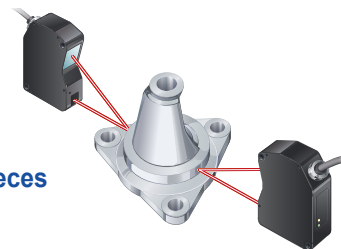
For automobile and vehicle parts measurement

Automobile and vehicle parts production facilities

Measurement mode setting

Long-range sensor head

Linear beam spot type



The measurement mode setting is compatible with a variety of workpieces

Select the optimal digital processing for the object to be measured.



Penetration

- Translucent objects
- Translucent plastics

Diffuse [Standard]

- Non-mirrored surfaces or opaque objects
- Metal, plastic, rubber, ceramic, etc.

Metal 1

- Metal with hairlines
- Extruded materials, rolled materials, etc.

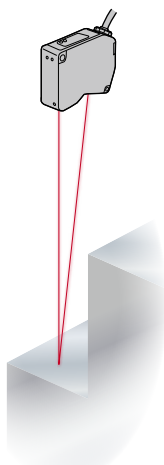
Metal 2

- Metal with strong hairlines
- Objects with fine scratches, cutting marks, or ground surfaces

Long-range sensor heads

Our lineup includes long-range sensor heads with measurement center distances of 110 mm **4.331 in** and 350 mm **13.780 in**. By keeping distance from the workpiece, the risk of sensor damage from contact with the workpiece can be reduced.

- Measurement center distance: 110 ±15 mm
HL-C211B(-MK) **4.331 ±0.591 in**
HL-C211C(-MK)
- Measurement center distance: 350 ±50 mm
HL-C235BE(-MK) **13.780 ±1.969 in**
HL-C235CE(-MK)
- Measurement center distance: 350 ±200 mm
HL-C235CE-W(MK) **13.780 ±7.874 in**



Linear beam spot type sensor heads

We offer linear beam spot type sensor heads with various measurement center distances that are not easily distorted by roughly-finished metal surfaces.

Small beam spot type optical waveform

Linear beam spot type optical waveform

Even surfaces that appear to be flat have minor surface variations when viewed under magnification. These variations can cause errors in measurement. Linear beam spot type sensors average out the influence of these variations, allowing for stable measurement of roughly-finished workpieces.

For measurement of glass height and thickness

FPD and solar panel production facilities

Measurement mode setting

Emission adjustment area specification

The measurement mode setting is compatible with a variety of workpieces

A specular reflection installation is required for measurement of transparent and mirrored-surface objects. Select the digital processing for the measurement application.



Specular [Standard]

- Mirrored surfaces or transparent objects
- Glass front and back surfaces

Glass

- Gaps between glass, glass thickness

Glass Pattern

- Patterned glass

Surface 1

Surface 2

Surface 3

Surface 4

Near point

Transparent / glass

Gap (empty space)

Transparent / glass

Far point

Emission adjustment area specification allows for measurement of glass surfaces

Glass surfaces can be accurately measured by combining the “Emission Adjustment” that determines the optimal emission amounts with the “Emission Adjustment Area Specification” that identifies the specific area to measure the emission.

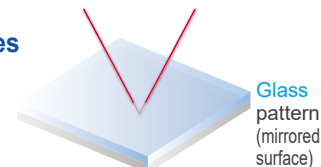
Glass surface

Oversaturation from the high reflection rate of the mirrored surface

When emission adjustment is performed...

Reducing emission to avoid oversaturation results in a reduction of the originally-targeted waveform

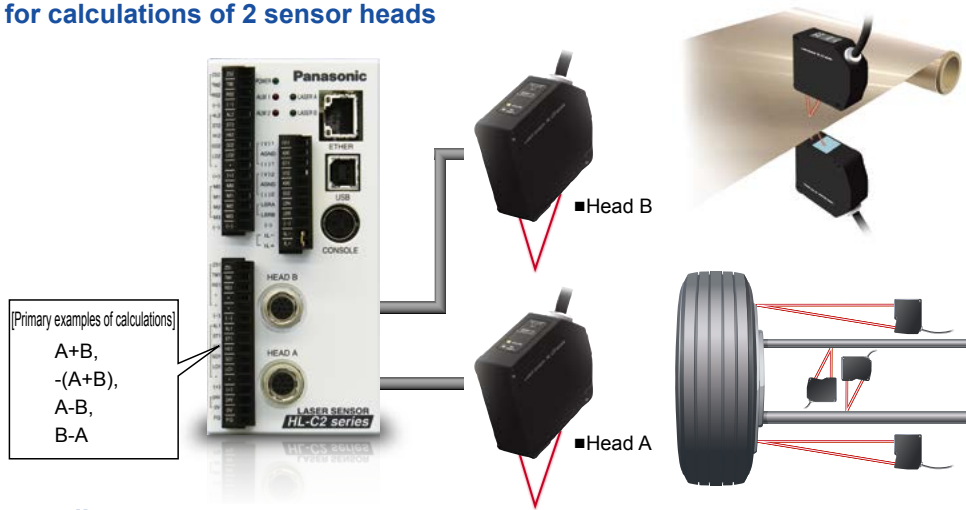
Emission adjustment area specification selects the area for more accurate measurement



Controllers that provide both convenience and improved product quality

On-board processing for calculations of 2 sensor heads

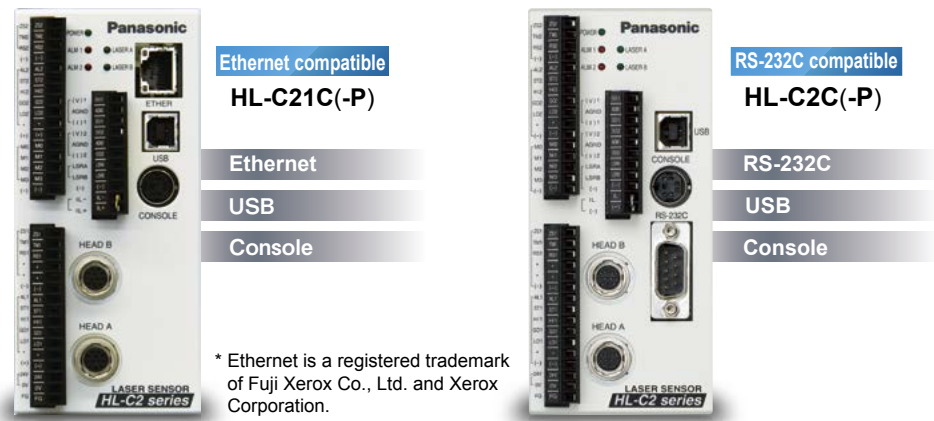
The controller is equipped to perform basic calculations and output results for applications such as thickness measurement for sandwiched layers and 2-point gap measurement. This can reduce computational burdens for host controllers (such as PLCs).



Connectivity to host controllers

Our controller lineup offers Ethernet, USB, and RS-232C connections. The controllers can connect to devices such as PCs and PLCs.

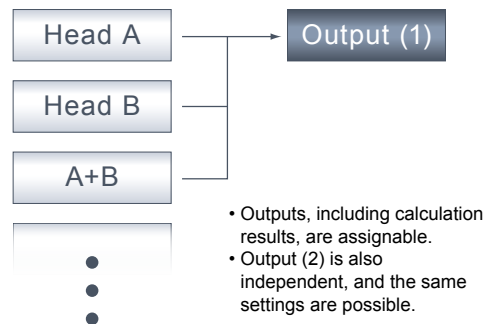
* An API (Application Programming Interface) and sample programs can be downloaded for free from our web site for operating the controller using a PC connected by USB.



* Ethernet is a registered trademark of Fuji Xerox Co., Ltd. and Xerox Corporation.

A full range of output ports allows output in line with your needs

Both Output (1) and Output (2) mounted on the controller provide independent analog outputs, various output signals (judgment, alarm, etc.), and various input signals (laser emission stop, zero set, etc.).



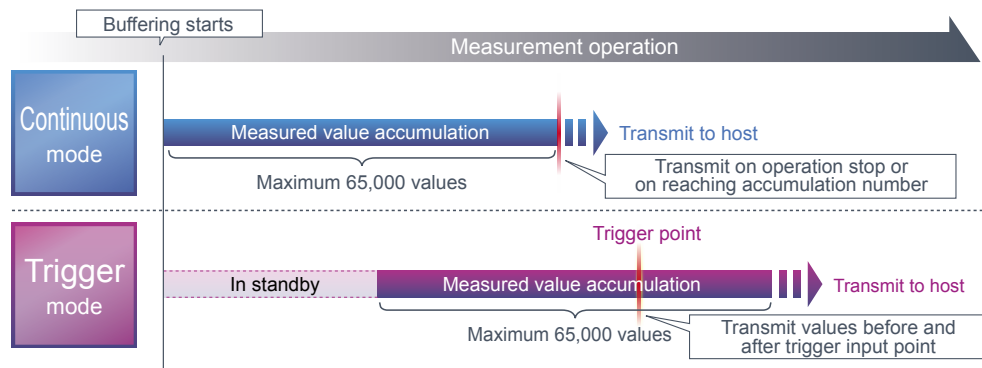
	o: Available	Output (1)	Output (2)
Output circuit	Analog voltage	o	o
	Analog current	o	o
	Hi / Go / Low judgment	o	o
	Alarm	o	o
	Strobe	o	o
Input circuit	Zero set	o	o
	Timing	o	o
	Reset	o	o

* Other functions such as laser control (emission stop) input and memory change are also on-board.

Buffering function allows for temporary accumulation of measured values

The buffering function allows measurement values acquired from high-speed sampling (10 μs) to temporarily accumulate in the controller, which are then transmitted to the host. A maximum of 65,000 values can be accumulated. The accumulation of shape data can contribute to traceability and other activities.

Furthermore, in trigger mode, by sending a trigger input when there is an error, measured values before and after the error can be acquired to help determine the cause of the error.

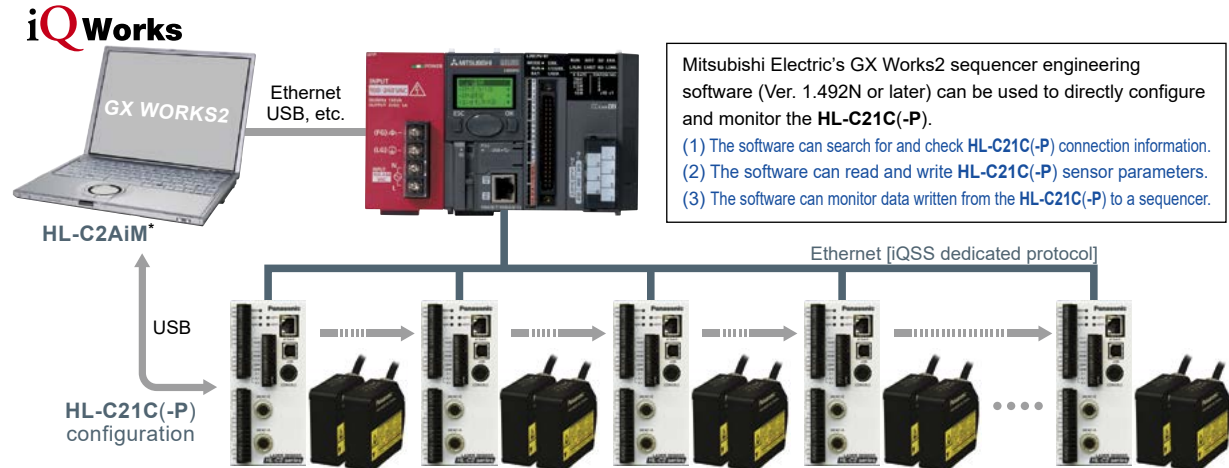


Providing increased connectivity and compatibility with host devices

Measurement status can be acquired with a programmable controller easily and without any need for programming

The **HL-C21C(-P)** supports the MEWTOCOL protocol (used by our programmable controllers), the MC protocol (used by Mitsubishi Electric's MELSEC-Q and MELSEC-L series) as well as the iQSS dedicated protocol (used by Mitsubishi Electric's MELSEC-L series), allowing measured values and other information to be written automatically to the data registers of programmable controllers without any need for programming.

* iQSS is an abbreviation for Mitsubishi Electric's iQ Sensor Solution. * iQSS and iQ Works are registered trademarks of Mitsubishi Electric Corporation.

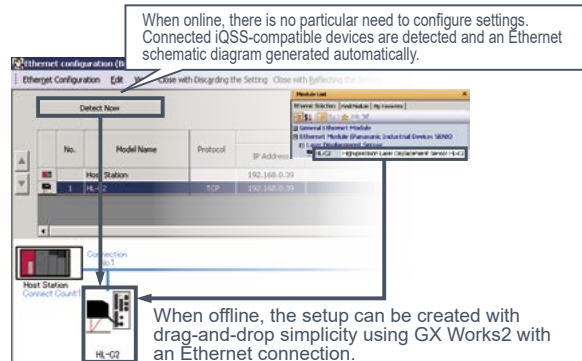


* **HL-C2AiM**: **HL-C2** dedicated intelligent monitor (available for download free of charge on our website)

Easy setup

HL-C21C(-P) connection settings can be set up using automatic detection of connected devices and drag-and-drop simplicity.

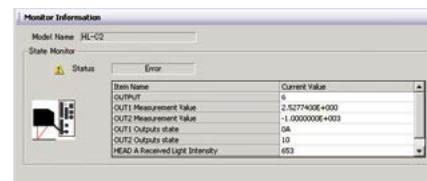
➔ Reduces development man-hours.



* Use Mitsubishi Electric's GX Works2 sequencer engineering software (Ver. 1.492N or later).

Sensor monitoring

The **HL-C21C(-P)**'s measurement status can be easily monitored.

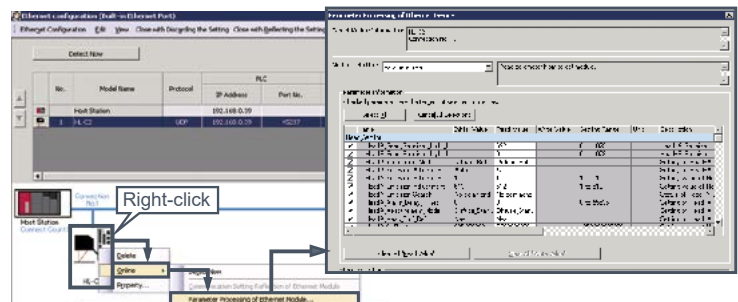


Reading and writing of sensor parameters

HL-C21C(-P) sensor parameters can be read and written easily.

* The **HL-C21C(-P)**'s Ethernet communications settings must be configured using **Configurator WD** (Ver. 1.62 or later of our Ethernet communications configuration tool). (This software is available for download free of charge from our website.)

* The MC protocol is supported for the MELSEC-Q series, and sensors can be monitored.



Interfaces for convenient setup and setting changes

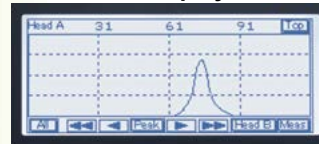
By combining the **GT12** programmable display with our software tools accessed from a PC (**HL-C2AiM** Intelligent Monitor), received light intensity waveforms and other information can be displayed in addition to the display of measured-value data.

GT12 Programmable Display Simple touch panel operation and easy-to-read display

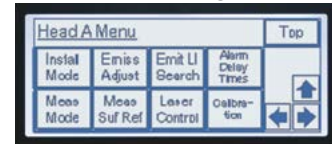


By installing screen application (provided free of charge) onto the **GT12** programmable display, it can be used as a dedicated console for viewing waveforms and setting operation conditions. (A proprietary connection cable is required.)

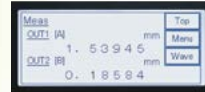
• Received light intensity in waveform display



• Condition setting function



• Measurement value data display function



Intelligent Monitor HL-C2AiM Waveform monitoring and function setting by computer is easy to do

* This software is available for download free of charge from our website.

OS (Note 1)	Microsoft® Windows® 7 Professional 32-bit / 64-bit Microsoft® Windows® 8 Pro 32-bit / 64-bit Microsoft® Windows® 10 Pro 32-bit / 64-bit (Japanese / English / Korean / Chinese)
CPU	1 GHz or above (Note 2)
Memory	2 GB or more (Note 2)
Hard disk	50 MB or more of usable space
Display screen	SXGA (1,280 × 1,024 full color) or above
Serial port	RS-232C compliant, transmission speed 115.2 kbps
USB port	USB 2.0 full speed (USB 1.1 compatible)

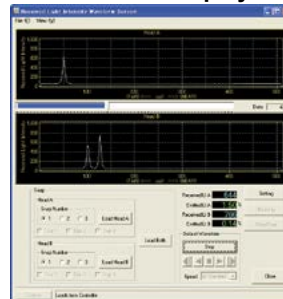
Notes: 1) Windows 7 / 8 / 10 are trademarks or registered trademarks of Microsoft Corporation in the United State and other countries.

2) Depends on the OS operation environment.

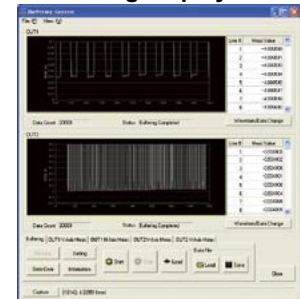
• Measurement value display



• Light receiving intensity in waveform display








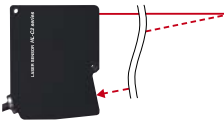



• Buffering display



* Microsoft and Windows are registered trademarks or trademarks of Microsoft Corporation in the United States and other countries.

ORDER GUIDE**Sensor heads**



Type	Appearance	Measurement center distance and measuring range	Resolution (Note)	Beam size	Model No. (Note)		
					IEC/JIS conformed type	FDA conformed type	
Small beam spot type		10 ±1 mm 0.394 ±0.039 in	0.01 μm 0.0004 mil (0.25 μm 0.010 mil)	ø20 μm ø0.787 mil approx.	HL-C201A * (HL-C201AE *)	HL-C201F (HL-C201FE)	
Linear beam spot type				20 × 700 μm 0.787 × 27.559 mil approx.	HL-C201A-MK * (HL-C201AE-MK *)	HL-C201F-MK (HL-C201FE-MK)	
Small beam spot type		8 ±0.8 mm 0.315 ±0.031 in	0.01 μm 0.0004 mil (0.25 μm 0.010 mil)	ø20 μm ø0.787 mil approx.	HL-C201A-SP2 (HL-C201AE-SP2)	————	
Linear beam spot type				20 × 700 μm 0.787 × 27.559 mil approx.	HL-C201A-SP2M (HL-C201AE-SP2M)	————	
Small beam spot type		15 ±1 mm 0.591 ±0.039 in	0.01 μm 0.0004 mil (0.25 μm 0.010 mil)	ø30 μm ø1.181 mil approx.	HL-C201A-SP3 (HL-C201AE-SP3)	————	
Linear beam spot type				30 × 1,400 μm 1.181 × 55.118 mil approx.	HL-C201A-SP3M (HL-C201AE-SP3M)	————	
Small beam spot type		At diffuse reflection mode 30 ±5 mm 1.181 ±0.197 in	0.025 μm 0.001 mil (0.25 μm 0.010 mil)	ø30 μm ø1.181 mil approx.	HL-C203B * (HL-C203BE *)	HL-C203F (HL-C203FE)	
Linear beam spot type				30 × 1,200 μm 1.181 × 47.244 mil approx.	HL-C203B-MK * (HL-C203BE-MK *)	HL-C203F-MK (HL-C203FE-MK)	
Small beam spot type		At diffuse reflection mode 50 ±5 mm 1.969 ±0.197 in	0.05 μm 0.002 mil (0.25 μm 0.010 mil)	ø70 μm ø2.756 mil approx.	HL-C205B (HL-C205BE)		
Linear beam spot type				70 × 1,000 μm 2.756 × 39.370 mil approx.	HL-C205B-MK (HL-C205BE-MK)		
Small beam spot type				ø70 μm ø2.756 mil approx.	HL-C205C (HL-C205CE)		
Linear beam spot type				70 × 1,000 μm 2.756 × 39.370 mil approx.	HL-C205C-MK (HL-C205CE-MK)		
Small beam spot type		At diffuse reflection mode 85 ±20 mm 3.346 ±0.787 in	0.15 μm 0.006 mil (0.25 μm 0.010 mil)	ø100 μm ø3.937 mil approx.	HL-C208B (HL-C208BE)		
Linear beam spot type				100 × 1,200 μm 3.937 × 47.244 mil approx.	HL-C208B-MK (HL-C208BE-MK)		
Small beam spot type				ø100 μm ø3.937 mil approx.	HL-C208C (HL-C208CE)		
Linear beam spot type				100 × 1,200 μm 3.937 × 47.244 mil approx.	HL-C208C-MK (HL-C208CE-MK)		
Small beam spot type		At diffuse reflection mode 110 ±15 mm 4.331 ±0.591 in	0.1 μm 0.004 mil (0.25 μm 0.010 mil)	ø80 μm ø3.150 mil approx.	HL-C211B * (HL-C211BE *)	HL-C211F (HL-C211FE)	
Linear beam spot type				80 × 1,700 μm 3.150 × 66.929 mil approx.	HL-C211B-MK * (HL-C211BE-MK *)	HL-C211F-MK (HL-C211FE-MK)	
					HL-C211C * (HL-C211CE *)	HL-C211F5 (HL-C211F5FE)	
					HL-C211C-MK * (HL-C211CE-MK *)	HL-C211F5-MK (HL-C211F5FE-MK)	
Small beam spot type		At diffuse reflection mode 350 ±50 mm 13.780 ±1.969 in	0.5 μm 0.020 mil	ø250 μm ø9.843 mil approx.	HL-C235BE *	————	
						HL-C235CE *	————
Linear beam spot type				250 × 3,500 μm 9.843 × 137.795 mil approx.	HL-C235BE-MK *	————	
						HL-C235CE-MK *	————
Small beam spot type		At diffuse reflection mode 350 ±200 mm 13.780 ±7.874 in	2 μm 0.079 mil	ø400 μm ø15.748 mil approx.	HL-C235CE-W		
Linear beam spot type				400 × 6,500 μm 15.748 × 255.905 mil approx.	HL-C235CE-WMK		

Note: Exports of models with a minimum resolution of under 0.25 μm 0.010 mil fall under Japanese Export Control defined by "Foreign Exchange and Foreign Trade Act." However, export control does not apply to the models shown in parentheses on the condition that they are used in combination with a controller (e.g. **HL-C2CE**) to which the export control defined by "Foreign Exchange and Foreign Trade Act" does not apply. In such cases, the minimum resolution is 0.25 μm 0.010 mil. Please contact us for further details.

* The product has acquired Korean S Mark certification.

ORDER GUIDE

Controllers

Type		Appearance	Model No. (Note)
RS-232C-compatible	NPN output		HL-C2C * (HL-C2CE *)
	PNP output		HL-C2C-P * (HL-C2CE-P *)
Ethernet-compatible	NPN output		HL-C21C (HL-C21CE)
	PNP output		HL-C21C-P (HL-C21CE-P)



Note: These products have been restricted for export in accordance with the "Foreign Exchange and Foreign Trade Act". However, by combining the parts listed in parentheses with sensor heads which are not restricted for export under the "Foreign Exchange and Foreign Trade Act", products for which the act does not restrict export can be provided. Please contact us for further details.

* The product has acquired Korean S Mark certification.

OPTIONS

Programmable display

It is possible to use the programmable display as an exclusive console which enables waveform display and condition setting by installing it in the screen data (free of charge) for **HL-C2**.

Product name	Appearance	Part No.	LCD	Screen size	Power source	Communication port	Front panel color	SD memory card slot
GT12		AIG12MQ02D	TFT monochrome LCD (white backlight) (Note 4)	4.6 inch	24 V DC	RS-232C	Pure black	_____
		AIG12MQ03D					Hairline silver	_____
		AIG12GQ02D	TFT monochrome LCD (green backlight) (Note 4)				Pure black	_____
		AIG12GQ03D					Hairline silver	_____

Notes: 1) The screen data differs depending on the language. Please download as necessary.




2) To install the screen data in the display, prepare a PC and a USB cable (A ↔ mini-B connector type) separately.

3) The provided console screen application has no function to write the data into or download the data from an SD memory card.

4) The backlight color becomes fixed upon the installation of provided screen application.

5) For details of programmable display **GT12**, refer to our website.

Others

Designation	Appearance	Model No.	Description
ND filter		HL-C2F01	When the amount of reflected light is large at the time that a specular reflective sensor is installed, reducing the amount of laser light to an appropriate level enables a higher precision measurement. (Light detection rate: 98 %) (Cannot be used with HL-C201 □.)
Sensor head extension cable		HL-C2CCJ2	Length: 2 m 6.562 ft , Weight: 0.2 kg approx.
		HL-C2CCJ5	Length: 5 m 16.404 ft , Weight: 0.4 kg approx.
		HL-C2CCJ10	Length: 10 m 32.808 ft , Weight: 0.7 kg approx.
		HL-C2CCJ20	Length: 20 m 65.617 ft , Weight: 1.4 kg approx.
		HL-C2CCJ30	Length: 30 m 98.425 ft , Weight: 2.0 kg approx.
GT series connector cable for HL-C2		HL-C2GT-C3	Length: 3 m 9.843 ft Cable to connect the programmable display GT12 and HL-C2 series controller

SPECIFICATIONS

Sensor heads

Item	Model No.	Type	Small beam spot type														
		IEC / JIS conformed type	HL-C201A(E)	HL-C201A(E)-SP2	HL-C201A(E)-SP3	HL-C203B(E)	HL-C205B(E)	HL-C205C(E)	HL-C208B(E)	HL-C208C(E)							
		FDA conformed type	HL-C201F(E)	—	—	HL-C203F(E)	—	—	—	—	—	—	—				
CE marking directive compliance			EMC Directive, RoHS Directive														
Setup mode (Note 2)			Specular reflection			Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection				
Measurement center distance			10 mm 0.394 in	8 mm 0.315 in	15 mm 0.591 in	30 mm 1.181 in	26.4 mm 1.039 in	50 mm 1.969 in	46 mm 1.811 in	50 mm 1.969 in	46 mm 1.811 in	85 mm 3.346 in	81.4 mm 3.205 in	85 mm 3.346 in	81.4 mm 3.205 in		
Measuring range (Note 3)			±1 mm ±0.039 in	±0.8 mm ±0.031 in	±1 mm ±0.039 in	±5 mm ±0.197 in	±4.6 mm ±0.181 in	±5 mm ±0.197 in	±5 mm ±0.197 in	±5 mm ±0.197 in	±5 mm ±0.197 in	±20 mm ±0.787 in	±6 mm ±0.236 in	±20 mm ±0.787 in	±6 mm ±0.236 in		
Resolution [Average number of samples] (Note 4, 5)			HL-C201A / HL-C201A-SP2 / HL-C201A-SP3 / HL-C201F: 0.04 μm 0.002 mil [256], 0.01 μm 0.0004 mil [4,096]			HL-C203B / HL-C203F: 0.1 μm 0.004 mil [256], 0.025 μm 0.001 mil [4,096]		HL-C205B / HL-C205C: 0.05 μm 0.002 mil [4,096]			HL-C205BE / HL-C205CE: 0.25 μm 0.010 mil [256]		HL-C208B / HL-C208C: 0.6 μm 0.024 mil [256], 0.15 μm 0.006 mil [4,096]			HL-C208BE / HL-C208CE: 0.6 μm 0.024 mil [256], 0.25 μm 0.010 mil [4,096]	
Linearity (Note 6)			±0.02 % F.S. (HL-C201FE: ±0.025 % F.S.)			±0.03 % F.S.			±0.03 % F.S.		±0.03 % F.S.	±0.1 % F.S.	±0.03 % F.S.	±0.1 % F.S.			
Temperature characteristics			0.01 % F.S./°C (HL-C201FE: 0.013 % F.S./°C)	0.02 % F.S./°C			0.01 % F.S./°C										
Light source			Red semiconductor laser (Peak emission wavelength: 658 nm 0.026 mil)														
			Max. output: 0.1 mW		Max. output: 0.3 mW	Max. output: 1 mW	Max. output: 1 mW	Max. output: 5 mW	Max. output: 1 mW	Max. output: 5 mW	Max. output: 1 mW	Max. output: 5 mW					
IEC / JIS conformed type			Class 1 (IEC / JIS)			Class 2 (IEC / JIS)	Class 2 (IEC / JIS)	Class 3R (IEC / JIS)	Class 2 (IEC / JIS)	Class 3R (IEC / JIS)	Class 2 (IEC / JIS)	Class 3R (IEC / JIS)					
FDA conformed type			Class 1 [FDA (Note 7) / IEC / JIS]		—	—	Class II (FDA), Class 2 (IEC / JIS)	Class 2 [FDA (Note 7) / IEC / JIS]	Class 3R [FDA (Note 7) / IEC / JIS]	Class 2 [FDA (Note 7) / IEC / JIS]	Class 3R [FDA (Note 7) / IEC / JIS]						
Beam size (Note 8)			ø20 μm ø0.787 mil approx.		ø30 μm ø1.181 mil approx.	ø70 μm ø2.756 mil approx.			ø100 μm ø3.937 mil approx.								
Receiving element			Linear image sensor														
Indicator			Green LED (lights up during laser emission)														
Measuring range			Yellow LED (lights up when near the measurement center distance, blinks when within the measuring range, and lights out when outside of the measuring range.)														
Protection			IP67 (IEC) (excluding the connector)														
Ambient temperature			0 to +45 °C +32 to +113 °F (No dew condensation or icing allowed), Storage: -20 to +70 °C -4 to +158 °F														
Ambient humidity			35 to 85 % RH, Storage: 35 to 85 % RH														
Ambient illuminance			Incandescent light: 3,000 lx or less at the light-receiving face (Note 9)														
Vibration resistance			10 to 55 Hz (period: 1 min.) 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 (20 G approx.) in X,Y and Z directions three times each														
Cable			Cable type cable, 0.5 m 1.640 ft long with connector														
Cable extension			Extension up to total 30 m 98.425 ft is possible, with optional cable.														
Material			Enclosure: Die-cast aluminum, Case cover: Die-cast aluminum, Front cover: Glass														
Weight			250 g approx. (including cable)					300 g approx. (including cable)									
Accessory			Laser warning labels (for applicable standards and regulations): 1 set														

Notes: 1) Measuring conditions are as follows unless otherwise specified: connection with controller, supply voltage: 24 V DC, ambient temperature: +20 °C +68 °F, sampling cycle: 40 μs, average number of samples: 256 times, measurement center distance, measurement object: white ceramic [aluminum vapor deposition surface reflection mirror for HL-C201A(E) / HL-C201A(E)-SP2 / HL-C201F(E), clear glass for HL-C201A(E)-SP3], and digital measurement value.

- 2) Use the external ND filter (optional) HL-C2F01 in case the amount of reflected beam is too large on Specular Reflection installation. (Cannot be used with HL-C201□.)
- 3) Measuring range at sampling periods of 20 μs and 10 μs is as follows.

Model No.	HL-C201□	HL-C201□-SP2	HL-C201□-SP3	HL-C203□		HL-C205□		HL-C208□		
Setup mode	Specular reflection	Specular reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	
Sampling	20 μs	+0.1 to +1.0 mm +0.004 to +0.039 in	+0.1 to +0.8 mm +0.004 to +0.031 in	+0.1 to +1.0 mm +0.004 to +0.039 in	0 to +5.0 mm 0 to +0.197 in	0 to +4.6 mm 0 to +0.181 in	+0.5 to +5.0 mm +0.020 to +0.197 in	+0.5 to +5.0 mm +0.020 to +0.197 in	0 to +20 mm 0 to +0.787 in	0 to +6.0 mm 0 to +0.236 in
	10 μs	+0.8 to +1.0 mm +0.031 to +0.039 in	+0.7 to +0.8 mm +0.028 to +0.031 in	+0.8 to +1.0 mm +0.031 to +0.039 in	+3.8 to +5.0 mm +0.150 in to +0.197 in	+3.6 to +4.6 mm +0.142 to 0.181 in	+4.7 to +5.0 mm +0.185 to +0.197 in	+4.6 to +5.0 mm +0.181 to +0.197 in	+18 to +20 mm +0.709 to +0.787 in	Measurement not possible

- 4) The P-P value for the deviation in the digital measurement values at the measurement center distance has been converted for the measurement center distance.
- 5) Exports of models with a minimum resolution of under 0.25 μm 0.010 mil fall under Japanese Export Control defined by "Foreign Exchange and Foreign Trade Act." These products are introduced to limited countries only. Please refer to "PRECAUTIONS FOR PROPER USE" (p.20).
- 6) Indicates error with respect to the ideal linear values for digital displacement output when standard objects were measured by our company. It may vary depending on the types of objects being measured.
- 7) FDA regulatory compliance is attained following the stipulations of Laser Notice No. 50 (June 24, 2007) of FDA regulations (21 CFR 1040.10 and 1040.11).
- 8) This beam diameter is the size at the measurement center distance. These values were defined by using 1/e² (13.5 % approx.) of the center light intensity. If there is a slight leakage of light outside the normal spot diameter and if the periphery surrounding the sensing point has a higher reflectivity than the sensing point itself, then the results may be affected.
- 9) Variance is ±0.03 % F.S. or less depending on the ambient illuminance.

SPECIFICATIONS

Sensor heads

Item	Model No.	Type	Small beam spot type								
		IEC / JIS conformed type	HL-C211B(E)	HL-C211C(E)	HL-C235BE	HL-C235CE	HL-C235CE-W				
		FDA conformed type	HL-C211F(E)	HL-C211F5(E)					HL-C235CE-W		
CE marking directive compliance			EMC Directive, RoHS Directive								
Setup mode (Note 2)		Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection	
Measurement center distance		110 mm 4.331 in	106.7 mm 4.201 in	110 mm 4.331 in	106.7 mm 4.201 in	350 mm 13.780 in	348 mm 13.701 in	350 mm 13.780 in	348 mm 13.701 in	350 mm 13.780 in	
Measuring range (Note 3)		±15 mm ±0.591 in	±14.5 mm ±0.571 in	±15 mm ±0.591 in	±14.5 mm ±0.571 in	±50 mm ±1.969 in	±42 mm ±1.654 in	±50 mm ±1.969 in	±42 mm ±1.654 in	±200 mm ±7.874 in	
Resolution [Average number of samples] (Note 4, 5)		HL-C211B / HL-C211C / HL-C211F / HL-C211F5: 0.4 μm 0.016 mil [256], 0.1 μm 0.004 mil [4,096] HL-C211BE / HL-C211CE / HL-C211FE / HL-C211F5E: 0.4 μm 0.016 mil [256], 0.25 μm 0.010 mil [4,096]				2.0 μm 0.079 mil [256], 0.5 μm 0.020 mil [4,096]			8 μm 0.315 mil [256], 2 μm 0.079 mil [4,096]		
Linearity (Note 6)		±0.03 % F.S.							±0.04 % F.S. (-200 to 0 mm -7.874 to 0 in), ±0.08 % F.S. (0 to +200 mm 0 to +7.874 in), (F.S. = ±200 mm ±7.874 in)		
Temperature characteristics		0.01 % F.S./°C									
Light source		Red semiconductor laser (Peak emission wavelength: 658 nm 0.026 mil)									
		Max. output: 1 mW		Max. output: 5 mW		Max. output: 1 mW		Max. output: 5 mW		Max. output: 5 mW	
		IEC / JIS conformed type		Class 2 (IEC / JIS)		Class 3R (IEC / JIS)		Class 2 (IEC / JIS)		Class 3R (IEC / JIS)	
		FDA conformed type		Class II (FDA), Class 2 (IEC / JIS)		Class IIIa (FDA), Class 3R (IEC / JIS)					Class 3R (FDA (Note 7) / IEC / JIS)
Beam size (Note 8)		ø80 μm ø3.150 mil approx.				ø250 μm ø9.843 mil approx.			ø400 μm ø15.748 mil approx.		
Receiving element		Linear image sensor									
Indicator	Laser emission		Green LED (lights up during laser emission)								
	Measuring range		Yellow LED (lights up when near the measurement center distance, blinks when within the measuring range, and lights out when outside of the measuring range.)								
Environmental resistance	Protection		IP67 (IEC) (excluding the connector)								
	Ambient temperature		0 to +45 °C +32 to +113 °F (No dew condensation or icing allowed), Storage: -20 to +70 °C -4 to +158 °F								
	Ambient humidity		35 to 85 % RH, Storage: 35 to 85 % RH								
	Ambient illuminance		Incandescent light: 3,000 lx or less at the light-receiving face (Note 9)								
	Vibration resistance		10 to 55 Hz (period: 1 min.) 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 (20 G approx.) in X,Y and Z directions three times each								
Cable		Cable type, 0.5 m 1.640 ft long with connector									
Cable extension		Extension up to total 30 m 98.425 ft is possible, with optional cable.									
Material		Enclosure: Die-cast aluminum, Case cover: Die-cast aluminum, Front cover: Glass									
Weight		300 g approx. (including cable)			450 g approx. (including cable)			300 g approx. (including cable)			
Accessory		Laser warning label: 1 set									

Notes: 1) Measuring conditions are as follows unless otherwise specified: connection with controller, supply voltage: 24 V DC, ambient temperature: +20 °C **+68 °F**, sampling cycle: 40 μs, average number of samples: 256 times, measurement center distance, measurement object: white ceramic, and digital measurement value.

2) Use the external ND filter (optional) **HL-C2F01** in case the amount of reflected beam is too large on Specular Reflection installation.

3) Measuring range at sampling periods of 20 μs and 10 μs is as follows.

Model No.		HL-C211□		HL-C235□		HL-C235CE-W
Setup mode		Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection
Sampling	20 μs	+0.5 to +15.0 mm +0.020 to +0.591 in	+0.5 to +14.5 mm +0.020 to +0.571 in	0 to +50 mm 0 to +1.969 in	0 to +42 mm 0 to +1.654 in	-70 to +200 mm -2.756 to +7.874 in
	10 μs	+12.5 to +15.0 mm +0.492 to +0.591 in	+12.5 to +14.5 mm +0.492 to +0.571 in	+36 to +50 mm +1.417 to +1.969 in	+36 to +42 mm +1.417 to +1.654 in	+100 to +200 mm +3.937 to +7.874 in

4) The P-P value for the deviation in the digital measurement values at the measurement center distance has been converted for the measurement center distance.

5) Exports of models with a minimum resolution of under 0.25 μm **0.010 mil** fall under Japanese Export Control defined by "Foreign Exchange and Foreign Trade Act." These products are introduced to limited countries only. Please refer to "**PRECAUTIONS FOR PROPER USE**" (p.20).

6) Indicates error with respect to the ideal linear values for digital displacement output when standard objects were measured by our company. It may vary depending on the types of objects being measured.

7) FDA regulatory compliance is attained following the stipulations of Laser Notice No. 50 (June 24, 2007) of FDA regulations (21 CFR 1040.10 and 1040.11).

8) This beam diameter is the size at the measurement center distance. These values were defined by using 1/e² (13.5 % approx.) of the center light intensity. If there is a slight leakage of light outside the normal spot diameter and if the periphery surrounding the sensing point has a higher reflectivity than the sensing point itself, then the results may be affected.

9) Variance is ±0.03 % F.S. or less (±0.08 % F.S. or less for **HL-C235CE-W**) depending on the ambient illuminance.

SPECIFICATIONS

Sensor heads

Item	Model No.	Type	Linear beam spot type										
		IEC / JIS conformed type	HL-C201A(E)-MK	HL-C201A(E)-SP2M	HL-C201A(E)-SP3M	HL-C203B(E)-MK	HL-C205B(E)-MK	HL-C205C(E)-MK	HL-C208B(E)-MK	HL-C208C(E)-MK			
		FDA conformed type	HL-C201F(E)-MK	—	—	HL-C203F(E)-MK	—	—	—	—	—	—	
CE marking directive compliance		EMC Directive, RoHS Directive											
Setup mode (Note 2)		Specular reflection			Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	
Measurement center distance		10 mm 0.394 in	8 mm 0.315 in	15 mm 0.591 in	30 mm 1.181 in	26.4 mm 1.039 in	50 mm 1.969 in	46 mm 1.811 in	50 mm 1.969 in	46 mm 1.811 in	85 mm 3.346 in	81.4 mm 3.205 in	
Measuring range (Note 3)		±1 mm ±0.039 in	±0.8 mm ±0.031 in	±1 mm ±0.039 in	±5 mm ±0.197 in	±4.6 mm ±0.181 in	±5 mm ±0.197 in	±5 mm ±0.197 in	±5 mm ±0.197 in	±5 mm ±0.197 in	±20 mm ±0.787 in	±6 mm ±0.236 in	
Resolution [Average number of samples] (Note 4, 5)		HL-C201A-MK / HL-C201A-SP2M / HL-C201A-SP3M / HL-C201F-MK: 0.04 μm 0.002 mil [256], 0.01 μm 0.0004 mil [4,096]			HL-C203B-MK / HL-C203F-MK: 0.1 μm 0.004 mil [256], 0.025 μm 0.001 mil [4,096]		HL-C205B-MK / HL-C205C-MK: 0.2 μm 0.008 mil [256], 0.05 μm 0.002 mil [4,096]			HL-C208B-MK / HL-C208C-MK: 0.6 μm 0.024 mil [256], 0.15 μm 0.006 mil [4,096]			
Linearity (Note 6)		±0.02 % F.S. (HL-201FE-MK: ±0.025 % F.S.)			±0.03 % F.S.			±0.03 % F.S.		±0.03 % F.S.	±0.1 % F.S.	±0.03 % F.S.	±0.1 % F.S.
Temperature characteristics		0.01 % F.S./°C (HL-201FE-MK) 0.013 % F.S./°C	0.02 % F.S./°C			0.01 % F.S./°C							
Light source		Red semiconductor laser (Peak emission wavelength: 658 nm 0.026 mil)											
		Max. output: 0.1 mW		Max. output: 0.3 mW		Max. output: 1 mW		Max. output: 1 mW		Max. output: 5 mW		Max. output: 1 mW	
		Class 1 (IEC / JIS)		Class 1 (IEC / JIS)		Class 2 (IEC / JIS)		Class 2 (IEC / JIS)		Class 3R (IEC / JIS)		Class 2 (IEC / JIS)	
		Class 1 [FDA (Note 7) / IEC / JIS]		—		Class II (FDA), Class 2 (IEC / JIS)		Class 2 [FDA (Note 7) / IEC / JIS]		Class 3R [FDA (Note 7) / IEC / JIS]		Class 2 [FDA (Note 7) / IEC / JIS]	
Beam size (Note 8)		20 × 700 μm 0.787 × 27.559 mil approx.		30 × 1,400 μm 1.181 × 55.118 mil approx.		30 × 1,200 μm 1.181 × 47.244 mil approx.		70 × 1,000 μm 2.756 × 39.370 mil approx.		100 × 1,200 μm 3.937 × 47.244 mil approx.			
Receiving element		Linear image sensor											
Indicator		Green LED (lights up during laser emission)											
		Yellow LED (lights up when near the measurement center distance, blinks when within the measuring range, and lights out when outside of the measuring range.)											
Environmental resistance		IP67 (IEC) (excluding the connector)											
		0 to +45 °C +32 to +113 °F (No dew condensation or icing allowed), Storage: -20 to +70 °C -4 to +158 °F											
		35 to 85 % RH, Storage: 35 to 85 % RH											
		Incandescent light: 3,000 lx or less at the light-receiving face (Note 9)											
		10 to 55 Hz (period: 1 min.) frequency, 1.5 mm 0.059 in double amplitude in X,Y and Z directions for two hours each											
		196 m/s ² acceleration (20 G approx.) in X,Y and Z directions three times each											
Cable		Cable type, 0.5 m 1.640 ft long with connector											
Cable extension		Extension up to total 30 m 98.425 ft is possible, with optional cable.											
Material		Enclosure: Die-cast aluminum, Case cover: Die-cast aluminum, Front cover: Glass											
Weight		250 g approx. (including cable)					300 g approx. (including cable)						
Accessory		Laser warning labels (for applicable standards and regulations): 1 set											

Notes: 1) Measuring conditions are as follows unless otherwise specified: connection with controller, supply voltage: 24 V DC, ambient temperature: +20 °C +68 °F, sampling cycle: 40 μs, average number of samples: 256 times, measurement center distance, measurement object: white ceramic [aluminum vapor deposition surface reflection mirror for HL-C201A(E)-MK / HL-C201A(E)-SP2M / HL-C201F(E)-MK, clear glass for HL-C201A(E)-SP3M], and digital measurement value.
 2) Use the external ND filter (optional) HL-C2F01 in case the amount of reflected beam is too large on Specular Reflection installation. (Cannot be used with HL-C201□.)
 3) Measuring range at sampling periods of 20 μs and 10 μs is as follows.

Model No.	HL-C201□-MK	HL-C201□-SP2M	HL-C201□-SP3M	HL-C203□-MK		HL-C205□-MK		HL-C208□-MK		
Setup mode	Specular reflection	Specular reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	
Sampling	20 μs	+0.1 to +1.0 mm +0.004 to +0.039 in	+0.1 to +0.8 mm +0.004 to +0.031 in	+0.1 to +1.0 mm +0.004 to +0.039 in	0 to +5.0 mm 0 to +0.197 in	0 to +4.6 mm 0 to +0.181 in	+0.5 to +5.0 mm +0.020 to +0.197 in	+0.5 to +5.0 mm +0.020 to +0.197 in	0 to +20 mm 0 to +0.787 in	0 to +6.0 mm 0 to +0.236 in
	10 μs	+0.8 to +1.0 mm +0.031 to +0.039 in	+0.7 to +0.8 mm +0.028 to +0.031 in	+0.8 to +1.0 mm +0.031 to +0.039 in	+3.8 to +5.0 mm +0.150 in to +0.197 in	+3.6 to +4.6 mm +0.142 to 0.181 in	+4.7 to +5.0 mm +0.185 to +0.197 in	+4.6 to +5.0 mm +0.181 to +0.197 in	+18 to +20 mm +0.709 to +0.787 in	Measurement not possible

- The P-P value for the deviation in the digital measurement values at the measurement center distance has been converted for the measurement center distance.
- Exports of models with a minimum resolution of under 0.25 μm 0.010 mil fall under Japanese Export Control defined by "Foreign Exchange and Foreign Trade Act." These products are introduced to limited countries only. Please refer to "PRECAUTIONS FOR PROPER USE" (p. 20).
- Indicates error with respect to the ideal linear values for digital displacement output when standard objects were measured by our company. It may vary depending on the types of objects being measured.
- FDA regulatory compliance is attained following the stipulations of Laser Notice No. 50 (June 24, 2007) of FDA regulations (21 CFR 1040.10 and 1040.11).
- This beam diameter is the size at the measurement center distance. These values were defined by using 1/e² (13.5 % approx.) of the center light intensity. If there is a slight leakage of light outside the normal spot diameter and if the periphery surrounding the sensing point has a higher reflectivity than the sensing point itself, then the results may be affected.
- Variance is ±0.03 % F.S. or less depending on the ambient illuminance.

SPECIFICATIONS

Sensor heads

Item	Model No.	Type	Linear beam spot type					
		IEC / JIS conformed type	HL-C211B(E)-MK	HL-C211C(E)-MK	HL-C235BE-MK	HL-C235CE-MK	HL-C235CE-WMK	
		FDA conformed type	HL-C211F(E)-MK	HL-C211F5(E)-MK	—	—	—	
CE marking directive compliance		EMC Directive, RoHS Directive						
Setup mode (Note 2)		Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection
Measurement center distance		110 mm 4.331 in	106.7 mm 4.201 in	110 mm 4.331 in	106.7 mm 4.201 in	350 mm 13.780 in	348 mm 13.701 in	350 mm 13.780 in
Measuring range (Note 3)		±15 mm ±0.591 in	±14.5 mm ±0.571 in	±15 mm ±0.591 in	±14.5 mm ±0.571 in	±50 mm ±1.969 in	±42 mm ±1.654 in	±50 mm ±1.969 in
Resolution [Average number of samples] (Note 4, 5)		HL-C211B-MK / HL-C211C-MK / HL-C211F-MK / HL-C211F5-MK: 0.4 μm 0.016 mil [256], 0.1 μm 0.004 mil [4,096] HL-C211BE-MK / HL-C211CE-MK / HL-C211FE-MK / HL-C211F5E-MK: 0.4 μm 0.016 mil [256], 0.25 μm 0.010 mil [4,096]			2.0 μm 0.079 mil [256], 0.5 μm 0.020 mil [4,096]		8 μm 0.315 mil [256], 2 μm 0.079 mil [4,096]	
Linearity (Note 6)		±0.03 % F.S.						±0.04 % F.S. (-200 to 0 mm -7.874 to 0 in), ±0.08 % F.S. (0 to +200 mm 0 to +7.874 in), (F.S. = ±200 mm ±7.874 in)
Temperature characteristics		0.01 % F.S./°C						
Light source		Red semiconductor laser (Peak emission wavelength: 658 nm 0.026 mil)						
		Max. output: 1 mW	Max. output: 5 mW	Max. output: 1 mW	Max. output: 5 mW	Max. output: 1 mW	Max. output: 5 mW	Max. output: 5 mW
IEC / JIS conformed type		Class 2 (IEC / JIS)	Class 3R (IEC / JIS)	Class 2 (IEC / JIS)	Class 3R (IEC / JIS)	Class 2 (IEC / JIS)	Class 3R (IEC / JIS)	Class 3R (IEC / JIS)
FDA conformed type		Class II (FDA), Class 2 (IEC / JIS)	Class IIIa (FDA), Class 3R (IEC / JIS)	—	—	—	—	Class 3R [FDA (Note 7) / IEC / JIS]
Beam size (Note 8)		80 × 1,700 μm 3.150 × 66.929 mil approx.			250 × 3,500 μm 9.843 × 137.795 mil approx.		400 × 6,500 μm 15.748 × 255.905 mil approx.	
Receiving element		Linear image sensor						
Indicator	Laser emission	Green LED (lights up during laser emission)						
	Measuring range	Yellow LED (lights up when near the measurement center distance, blinks when within the measuring range, and lights out when outside of the measuring range.)						
Environmental resistance	Protection	IP67 (IEC) (excluding the connector)						
	Ambient temperature	0 to +45 °C +32 to +113 °F (No dew condensation or icing allowed), Storage: -20 to +70 °C -4 to +158 °F						
	Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH						
	Ambient illuminance	Incandescent light: 3,000 lx or less at the light-receiving face (Note 9)						
	Vibration resistance	10 to 55 Hz (period: 1 min.) 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 (20 G approx.) in X,Y and Z directions three times each							
Cable		Cabletyre cable, 0.5 m 1.640 ft long with connector						
Cable extension		Extension up to total 30 m 98.425 ft is possible, with optional cable.						
Material		Enclosure: Die-cast aluminum, Case cover: Die-cast aluminum, Front cover: Glass						
Weight		300 g approx. (including cable)		450 g approx. (including cable)			300 g approx. (including cable)	
Accessory		Laser warning labels (for applicable standards and regulations): 1 set						

Notes: 1) Measuring conditions are as follows unless otherwise specified: connection with controller, supply voltage: 24 V DC, ambient temperature: +20 °C **+68 °F**, sampling cycle: 40 μs, average number of samples: 256 times, measurement center distance, measurement object: white ceramic, and digital measurement value.

2) Use the external ND filter (optional) **HL-C2F01** in case the amount of reflected beam is too large on Specular Reflection installation.

3) Measuring range at sampling periods of 20 μs and 10 μs is as follows.

Model No.		HL-C211□-MK		HL-C235□-MK		HL-C235CE-WMK
Setup mode		Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection
Sampling	20 μs	+0.5 to +15.0 mm +0.020 to +0.591 in	+0.5 to +14.5 mm +0.020 to +0.571 in	0 to +50 mm 0 to +1.969 in	0 to +42 mm 0 to +1.654 in	-70 to +200 mm -2.756 to +7.874 in
	10 μs	+12.5 to +15.0 mm +0.492 to +0.591 in	+12.5 to +14.5 mm +0.492 to +0.571 in	+36 to +50 mm +1.417 to +1.969 in	+36 to +42 mm +1.417 to +1.654 in	+100 to +200 mm +3.937 to +7.874 in

4) The P-P value for the deviation in the digital measurement values at the measurement center distance has been converted for the measurement center distance.

5) Exports of models with a minimum resolution of under 0.25 μm **0.010 mil** fall under Japanese Export Control defined by "Foreign Exchange and Foreign Trade Act." These products are introduced to limited countries only. Please refer to "**PRECAUTIONS FOR PROPER USE**" (p. 20).

6) Indicates error with respect to the ideal linear values for digital displacement output when standard objects were measured by our company. It may vary depending on the types of objects being measured.

7) FDA regulatory compliance is attained following the stipulations of Laser Notice No. 50 (June 24, 2007) of FDA regulations (21 CFR 1040.10 and 1040.11).

8) This beam diameter is the size at the measurement center distance. These values were defined by using 1/e² (13.5 % approx.) of the center light intensity. If there is a slight leakage of light outside the normal spot diameter and if the periphery surrounding the sensing point has a higher reflectivity than the sensing point itself, then the results may be affected.

9) Variance is ±0.03 % F.S. or less (±0.08 % F.S. or less for **HL-C235CE-WMK**) depending on the ambient illuminance.

SPECIFICATIONS

Controllers

Item	Model No.	Type	RS-232C-compatible	Ethernet-compatible
		NPN output type	HL-C2C(E)	HL-C21C(E)
		PNP output type	HL-C2C(E)-P	HL-C21C(E)-P
CE marking directive compliance		EMC Directive, RoHS Directive		
Connectable sensor head		Number of connectable units: Max. 2 units		
Supply voltage		24 V DC $\pm 10\%$ including ripple 0.5 V (P-P)		
Current consumption		500 mA approx. at 2 sensor heads connected, 350 mA approx. at 1 sensor head connected		
Sampling cycle		10 μ s, 20 μ s, 40 μ s, 100 μ s, 200 μ s, 400 μ s, 1 ms, 2 ms		
Analog output	Voltage (Note 2)	Voltage output scale: -5 to $+5$ V/F.S. (initial value) Output range during normal status: -10.0 to $+10.0$ V Output at abnormal status: -10.8 V or $+10.8$ V Resolution: 2 mV, Linearity: $\pm 0.05\%$ F.S. Max. 2 mA, output impedance 50 Ω , Response delay time: 1.5 μ s/V approx.		
	Current (Note 3)	Current output scale: 4 to 20 mA/F.S. (initial value) Output range during normal status: 2 to 24 mA Output at abnormal status: 1 mA or 25 mA Resolution: 3 μ A, Linearity: $\pm 0.05\%$ F.S. Load impedance: 250 Ω max., Response delay time: 10 μ s approx.		
Alarm output	<NPN output type> NPN open-collector transistor • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less [between alarm output and Common (-)] • Residual voltage: 1 V or less (at 100 mA sink current)		<PNP output type> PNP open-collector transistor • Maximum source current: 100 mA • Applied voltage: 30 V DC or less (between alarm output and +V) • Residual voltage: 1 V or less (at 100 mA source current)	
	Output operation	Opened when the amount of light is insufficient		
	Short-circuit protection	Incorporated		
Judgment output (HI, GO, LO)	<NPN output type> NPN open-collector transistor • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less [between judgment output to Common (-)] • Residual voltage: 1 V or less (at 100 mA sink current)		<PNP output type> PNP open-collector transistor • Maximum source current: 100 mA • Applied voltage: 30 V DC or less (between judgment output to +V) • Residual voltage: 1 V or less (at 100 mA source current)	
	Output operation	Opened at output operation		
	Short-circuit protection	Incorporated		
Strobe output	<NPN output type> NPN open-collector transistor • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less [between strobe output to Common (-)] • Residual voltage: 1 V or less (at 100 mA sink current)		<PNP output type> PNP open-collector transistor • Maximum source current: 100 mA • Applied voltage: 30 V DC or less (between strobe output to +V) • Residual voltage: 1 V or less (at 100 mA source current)	
	Output operation	Opened at data determination		
	Short-circuit protection	Incorporated		
Remote interlock input	<NPN output type> Laser emission is delayed when connected to Common (-). Laser emission stop at open Applied voltage: 30 V DC or less (Leak current: 0.1 mA or less)		<PNP output type> Laser emission is delayed when connected to IL (+). Laser emission stop at open Applied voltage: 30 V DC or less (Leak current: 0.1 mA or less)	
Laser control input	<NPN output type> Laser emission is stopped when connected to Common (-). Laser is emitted immediately after opened. Applied voltage: 30 V DC or less (Leak current: 0.1 mA or less)		<PNP output type> Laser emission is stopped when connected to external power (+). Laser is emitted immediately after opened. Applied voltage: 30 V DC or less (Leak current: 0.1 mA or less)	
Zero set input	<NPN output type> Zero set is ON when connected with Common (-). Zero set turns to OFF after continuously connected to Common (-) for one second. Applied voltage: 30 V DC or less (Leak current: 0.1 mA or less)		<PNP output type> Zero set is ON when connected with external power (+). Zero set turns to OFF after continuously connected to external power (+) for one second. Applied voltage: 30 V DC or less (Leak current: 0.1 mA or less)	
Timing input	<NPN output type> ON at/during connection to Common (-) (depending on analysis mode) Applied voltage: 30 V DC or less (Leak current: 0.1 mA or less)		<PNP output type> ON at/during connection to external power (+) (depending on analysis mode) Applied voltage: 30 V DC or less (Leak current: 0.1 mA or less)	
Reset input	<NPN output type> Reset is done when connected to Common (-). Applied voltage: 30 V DC or less (Leak current: 0.1 mA or less)		<PNP output type> Reset is done when connected to external power (+). Applied voltage: 30 V DC or less (Leak current: 0.1 mA or less)	
Memory change input	<NPN output type> Memory is specified when connected to Common (-). Applied voltage: 30 V DC or less (Leak current: 0.1 mA or less)		<PNP output type> Memory is specified when connected to external power (+). Applied voltage: 30 V DC or less (Leak current: 0.1 mA or less)	
RS-232C interface	Baud rate 9,600, 19,200, 38,400, 115,200 bit/s		—————	
Ethernet interface (Note 4)	—————		IEEE802.3u, 10BASE-T/100BASE-TX RJ45 Compatible protocols: iQSS-compatible proprietary protocol, MC protocol, MEWTOCOL	
USB interface	USB 2.0 full speed (USB 1.1 compatible) compliant			
Setting / Data Display	GT12 Programmable Display (optional)			

SPECIFICATIONS

Controllers

Item	Model No.	Type	RS-232C-compatible	Ethernet-compatible
		NPN output type	HL-C2C(E)	HL-C21C(E)
		PNP output type	HL-C2C(E)-P	HL-C21C(E)-P
Indicator	Power	Green LED (lights up at power on)		
	Sensor head A Laser radiation	Green LED (lights up during or immediately before laser emission of sensor head A)		
	Sensor head B Laser radiation	Green LED (lights up during or immediately before laser emission of sensor head B)		
	Alarm 1	Red LED (lights up when OUT1 can not be measured due to insufficient amount of light)		
	Alarm 2	Red LED (lights up when OUT2 can not be measured due to insufficient amount of light)		
Environmental resistance	Ambient temperature	0 to +50 °C +32 to +122 °F (No dew condensation or icing allowed), Storage: -20 to +70 °C -4 to +158 °F		
	Ambient humidity	35 to 85 %RH		
	Vibration resistance	10 to 55 Hz frequency (period: 1 min.), 0.75 mm 0.030 in double amplitude in X, Y and Z directions for 30 min. each		
	Shock resistance	196 m/s ² acceleration (20 G approx.) in X, Y, and Z directions three times each		
Material		Case: Polycarbonate, Connector cap: PE	Case: Polycarbonate	
Weight		450 g approx.		
Accessories		USB cable (2 m 6.562 ft long): 1 pc., Short bracket: 1 pc.	USB cable (2 m 6.562 ft long): 1 pc., Short bracket: 1 pc. Ferrite core (E04SR200935A made by Seiwa Electric Mfg. Co.): 3 cores	

Notes: 1) **HL-C2C(-P) / HL-C21C(-P)** are restricted for export in accordance with the "Foreign Exchange and Foreign Trade Law". These products are introduced to limited countries only. Please refer to "**PRECAUTIONS FOR PROPER USE**" (p.20).

2) The linearity is F.S.=20 V to digital measurement value. Response delay time is the period after update of measurement value.

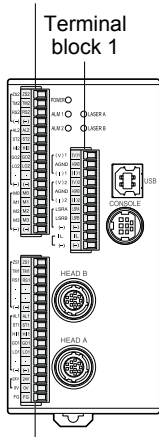
3) The linearity is F.S.=16 mA to digital measurement value. Response delay time is the period after update of measurement value.

4) For Ethernet communication settings of **HL-C21C(E) (-P)**, **Configurator WD** (Ethernet communication setting tool, Ver. 1.62 or later) is required. Please download it from our website for use.

I/O CIRCUIT AND WIRING DIAGRAMS

Terminal arrangement

Terminal block 2



Terminal block 3

Terminal block 1

Terminal	Function
NPN PNP	
(V)1	Analog voltage output (for OUT1)
AGND	Analog ground
(I)1	Analog current output (for OUT1)
(V)2	Analog voltage output (for OUT2)
AGND	Analog ground
(I)2	Analog current output (for OUT2)
LSRA	Laser control input (for Head A) Laser stop during short circuit
LSRB	Laser control input (for Head B) Laser stop during short circuit
(-)	Common (-)
IL IL-	Remote interlock Laser stop when opened.
(-) IL+	Remote interlock common

Terminal block 2

Terminal	Function
NPN PNP	
ZS2	Zero set input (for OUT2) ON during short circuit (Note 1)
TM2	Timing input (for OUT2) ON during short circuit
RS2	Reset input (for OUT2) ON during short circuit
(-)	Common (-)
AL2	Alarm output (for OUT2)
ST2	Strobe output (for OUT2)
HI2	Judgment HI output (for OUT2)
GO2	Judgment GO output (for OUT2)
LO2	Judgment LO output (for OUT2)
•	Reserved terminal (Note 2)
(-) (+)	Common (-) / Common (+)
M0	
M1	Memory change (16 ways)
M2	
M3	
(-)	Common (-)

Notes: 1) Turn off the terminal in case short circuit lasts for more than one second.

2) Do not connect anything to the reserved terminals.

Terminal block 3

Terminal	Function
NPN PNP	
ZS1	Zero set input (for OUT1) ON during short circuit (Note 1)
TM1	Timing input (for OUT1) ON during short circuit
RS1	Reset input (for OUT1) ON during short circuit
•	Reserved terminal (Note 2)
•	Reserved terminal (Note 2)
(-)	Common (-)
AL1	Alarm output (for OUT1)
ST1	Strobe output (for OUT1)
HI1	Judgment HI output (for OUT1)
GO1	Judgment GO output (for OUT1)
LO1	Judgment LO output (for OUT1)
•	Reserved terminal (Note 2)
(-) (+)	Common (-) / Common (+)
24 V	24 V DC input for power supply
0 V	Power supply ground 0 V
FG	Frame ground

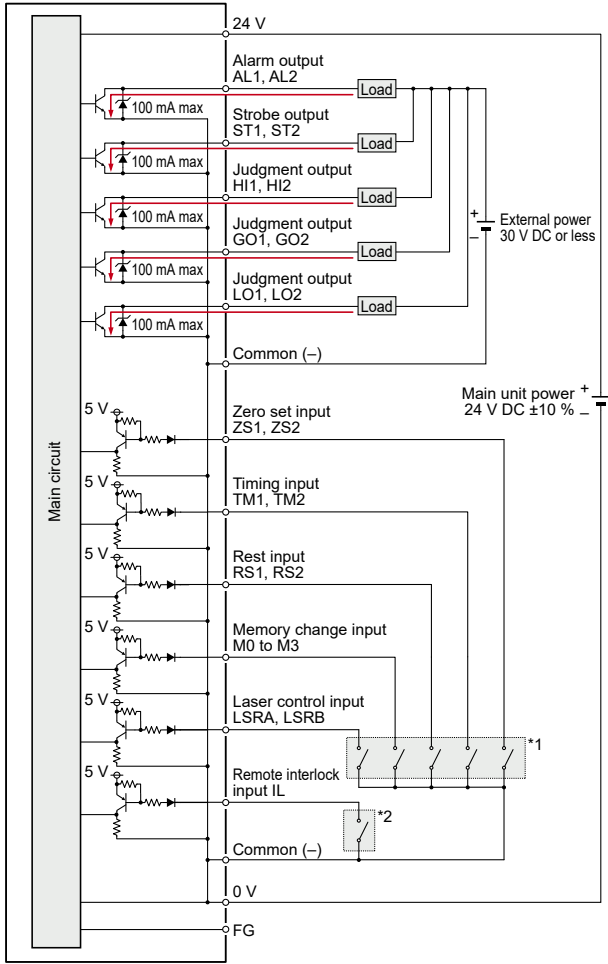
Notes: 1) Turn off the terminal in case short circuit lasts for more than one second.

2) Do not connect anything to the reserved terminals.

I/O CIRCUIT AND WIRING DIAGRAMS

NPN output type

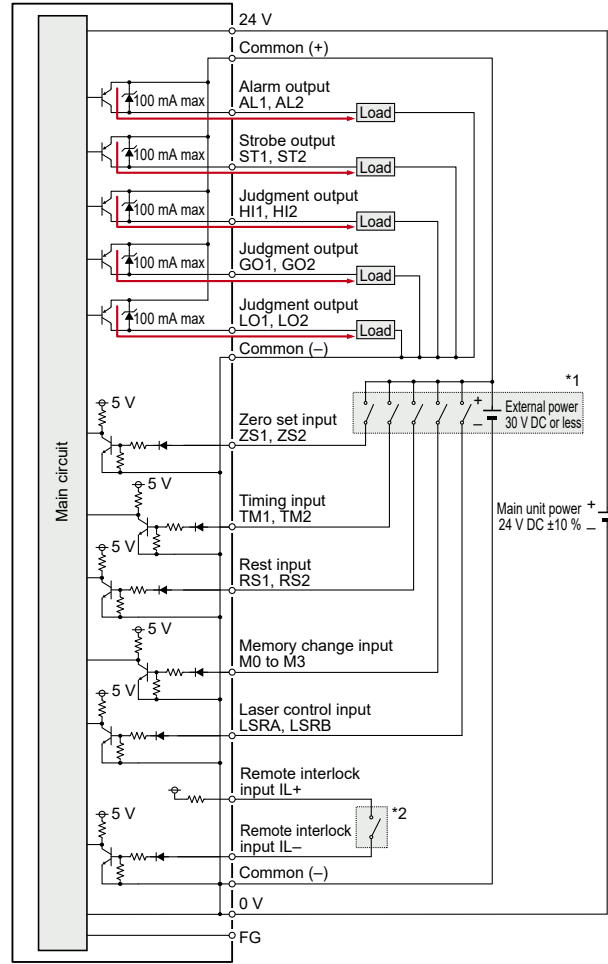
I/O circuit diagrams



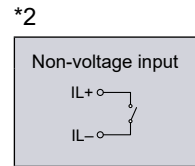
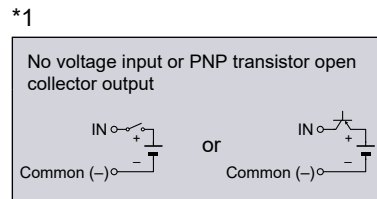
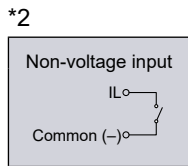
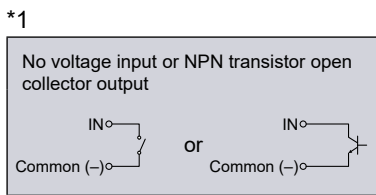
Controller internal circuit ← External connection example

PNP output type

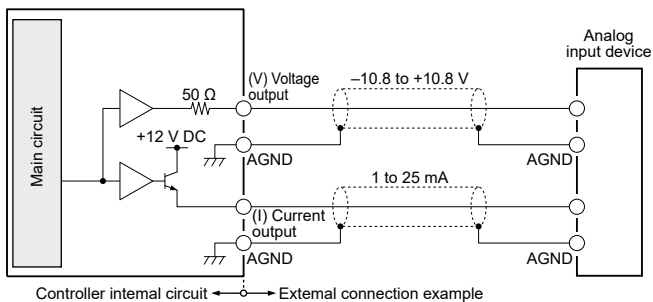
I/O circuit diagrams



Controller internal circuit ← External connection example



Analogue output (Common in NPN output type and PNP output type)



Controller internal circuit ← External connection example

Notes: 1) Do not short-circuit analogue output terminals or apply voltage to them.
2) Use shielded wires for analogue outputs.

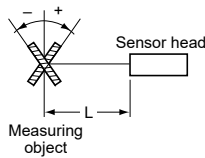
SENSING CHARACTERISTICS (TYPICAL)

HL-C201A HL-C201F

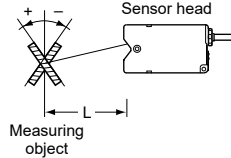
Correlation between measuring distance and error characteristics

Setup mode: Specular reflection

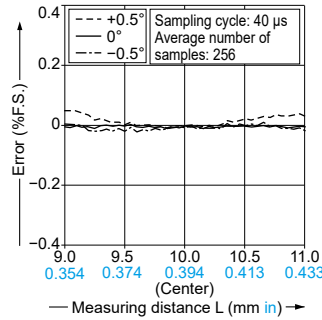
Aluminum vapor deposition surface reflection mirror (0°, ±0.5°)
Vertical orientation



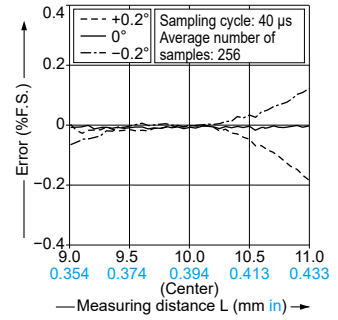
Aluminum vapor deposition surface reflection mirror (0°, ±0.2°)
Horizontal orientation



• Vertical orientation



• Horizontal orientation

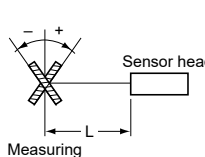


HL-C201A-SP2

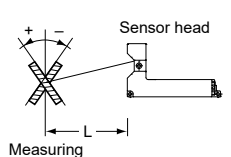
Correlation between measuring distance and error characteristics

Setup mode: Specular reflection

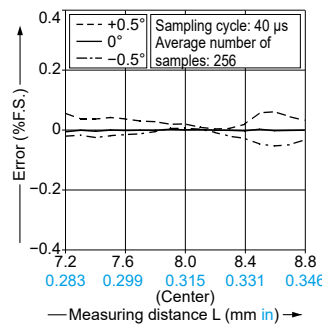
Aluminum vapor deposition surface reflection mirror (0°, ±0.5°)
Vertical orientation



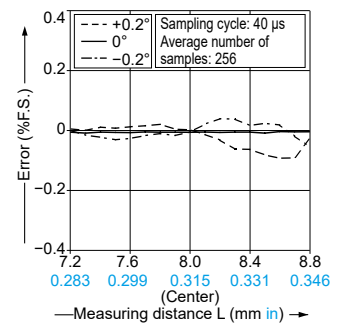
Aluminum vapor deposition surface reflection mirror (0°, ±0.2°)
Horizontal orientation



• Vertical orientation



• Horizontal orientation

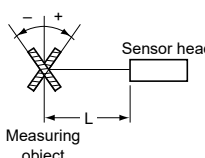


HL-C201A-SP3

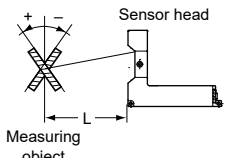
Correlation between measuring distance and error characteristics

Setup mode: Specular reflection

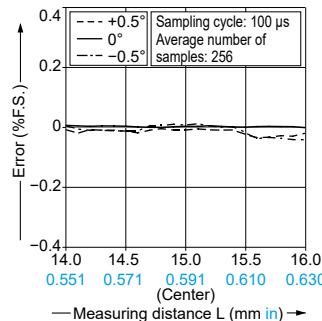
Glass (0°, ±0.5°)
Vertical orientation



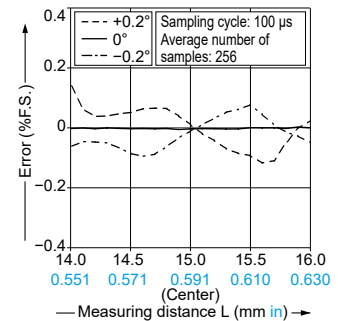
Glass (0°, ±0.2°)
Horizontal orientation



• Vertical orientation



• Horizontal orientation

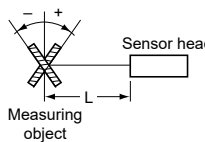


HL-C203B HL-C203F

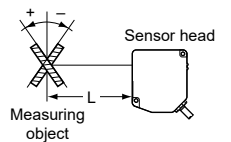
Correlation between measuring distance and error characteristics

Setup mode: Diffuse reflection

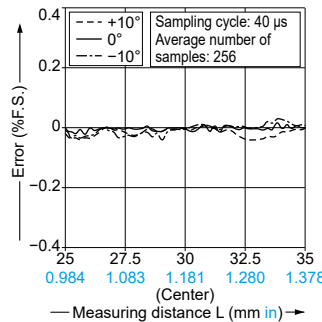
White ceramic (0°, ±10°)
Vertical orientation



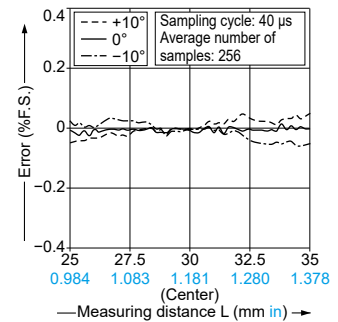
White ceramic (0°, ±10°)
Horizontal orientation



• Vertical orientation

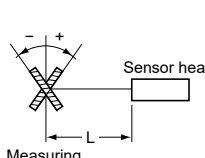


• Horizontal orientation

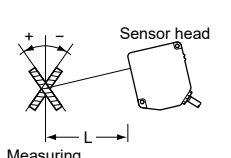


Setup mode: Specular reflection

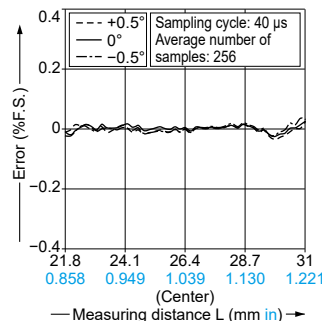
Aluminum vapor deposition surface reflection mirror (0°, ±0.5°)
Vertical orientation



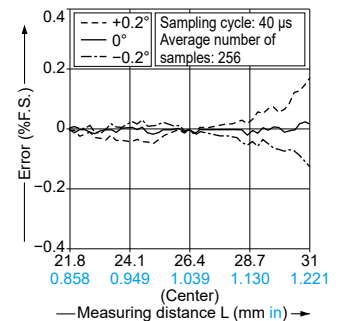
Aluminum vapor deposition surface reflection mirror (0°, ±0.2°)
Horizontal orientation



• Vertical orientation



• Horizontal orientation

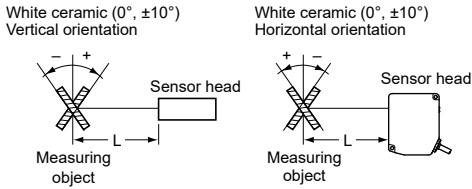


SENSING CHARACTERISTICS (TYPICAL)

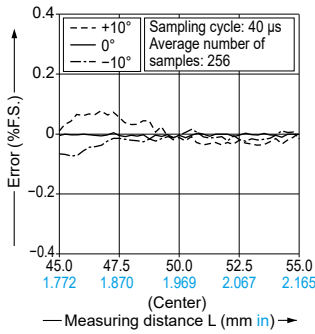
HL-C205B HL-C205C

Correlation between measuring distance and error characteristics

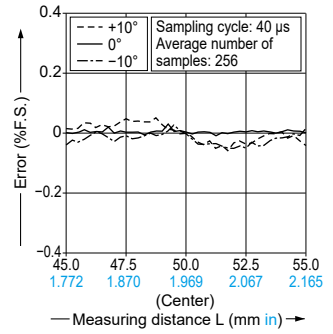
Setup mode: Diffuse reflection



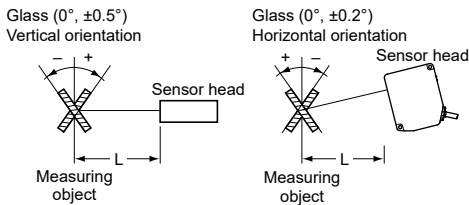
• Vertical orientation



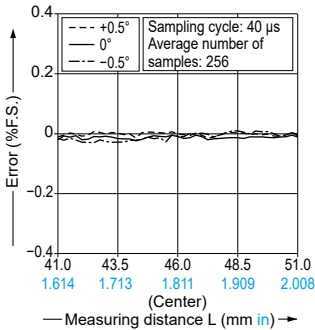
• Horizontal orientation



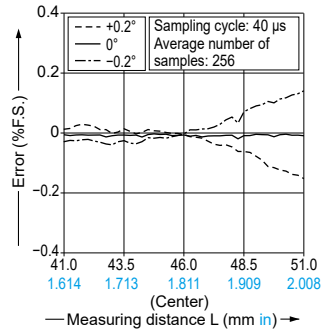
Setup mode: Specular reflection



• Vertical orientation



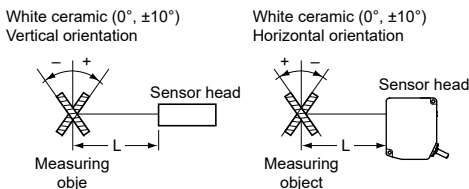
• Horizontal orientation



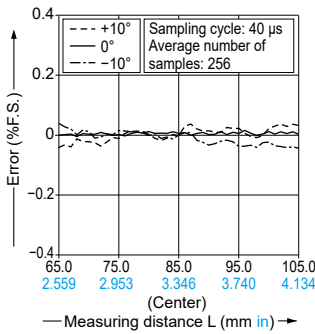
HL-C208B HL-C208C

Correlation between measuring distance and error characteristics

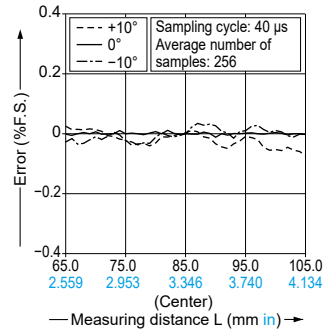
Setup mode: Diffuse reflection



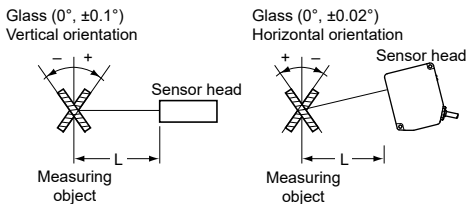
• Vertical orientation



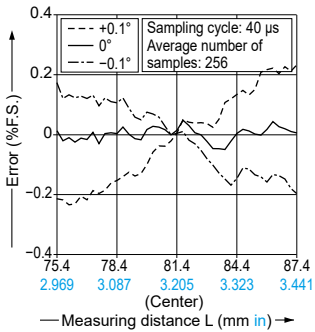
• Horizontal orientation



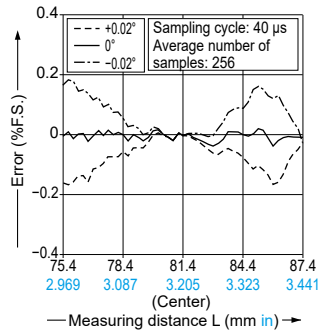
Setup mode: Specular reflection



• Vertical orientation



• Horizontal orientation

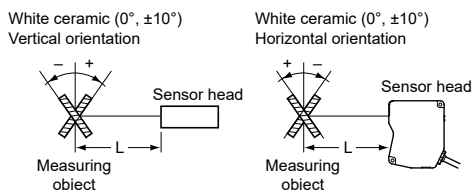


SENSING CHARACTERISTICS (TYPICAL)

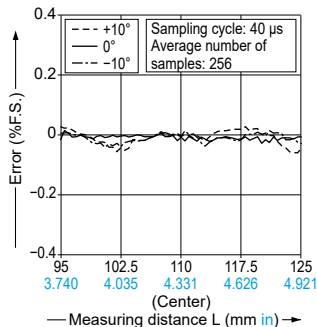
HL-C211B HL-C211C HL-C211F HL-C211F5

Correlation between measuring distance and error characteristics

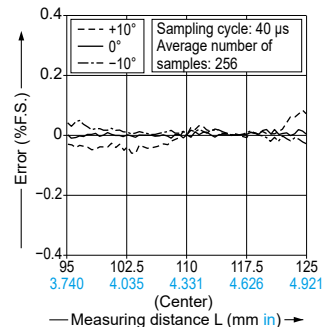
Setup mode: Diffuse reflection



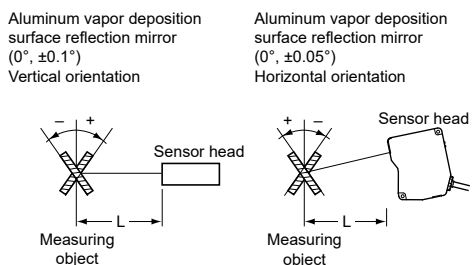
Vertical orientation



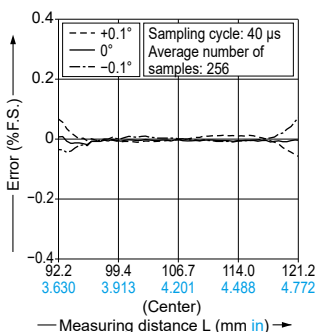
Horizontal orientation



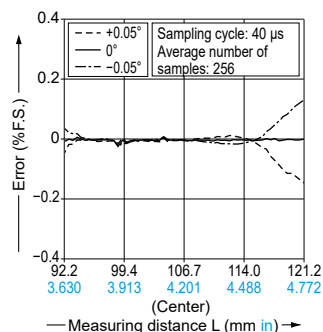
Setup mode: Specular reflection



Vertical orientation



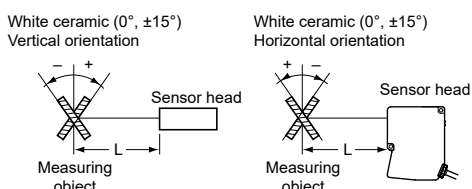
Horizontal orientation



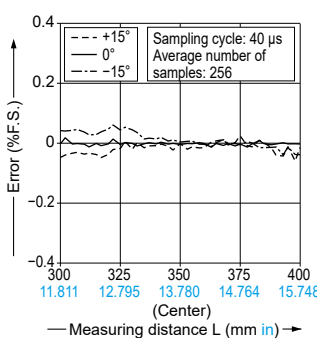
HL-C235BE HL-C235CE

Correlation between measuring distance and error characteristics

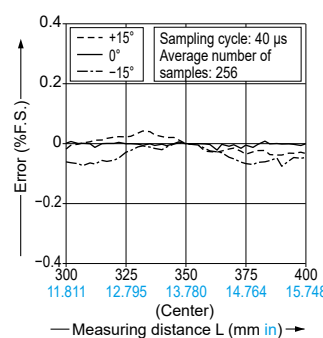
Setup mode: Diffuse reflection



Vertical orientation



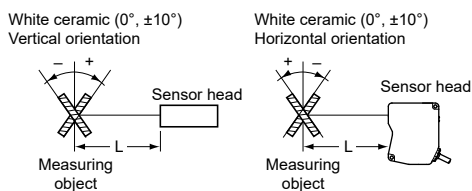
Horizontal orientation



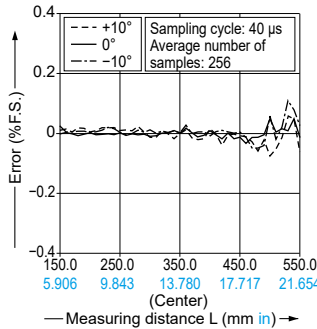
HL-C235CE-W

Correlation between measuring distance and error characteristics

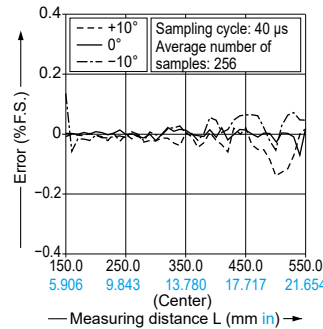
Setup mode: Diffuse reflection



Vertical orientation



Horizontal orientation



PRECAUTIONS FOR PROPER USE

Refer to the instruction manual for details. The instruction manual can be download 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.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.
- Do not use in environments with flammable gases. Usage may cause an explosion.



- Do not operate products using methods other than those described in the instruction manual included with each product. Control or adjustment through procedures other than those specified may cause hazardous laser radiation exposure.
- The following labels are attached to the products. Handle each product according to the instruction given on the warning label.
- Types which comply with FDA regulations have an English label applied based on those FDA regulations.

HL-C201A(E)(-MK) / HL-C201A(E)-SP2(M) / HL-C201A(E)-SP3(M)

- This product is classified as a Class 1 Laser Product in IEC / JIS standards. Do not look at the laser beam through optical devices such as a lens.



HL-C203B(E)(-MK) / HL-C205B(E)(-MK) / HL-C208B(E)(-MK) / HL-C211B(E)(-MK) / HL-C235BE(-MK)

- This product is classified as a Class 2 Laser Product in IEC / JIS standards. Do not look at the laser beam directly or through optical devices such as a lens.



HL-C205C(E)(-MK) / HL-C208C(E)(-MK) / HL-C211C(E)(-MK) / HL-C235CE(-MK) / HL-C235CE-W(-MK)

- This product is classified as a Class 3R Laser Product in IEC / JIS standards. Never directly look at or touch the laser beam or its reflection.



- Do not use outside of specification ranges for ratings, environmental conditions, etc. Abnormal heat or smoke generation may occur.
- Do not disassemble or modify these products. Electrical shock or smoke generation may occur.
- Connect electrical wires securely with terminal screws. Imperfect connections may cause abnormal heat or smoke generation.
- Do not touch the terminal while power is being supplied to the product. Electrical shock may occur.

- Exports of models with a minimum resolution of under 0.25 μm 0.010 mil fall under Japanese Export Control, which is defined by "Foreign Exchange and Foreign Trade Act".

Therefore, anyone who wishes to export or transfer these products outside of Japan is required to obtain the necessary license from the Ministry of Economy, Trade and Industry of Japan.

Also, these products fall under international export control regulations, such as Nuclear Suppliers Group (NSG) guidelines 1.B.3.b.1 and Wassenaar Arrangement (WA) 2.B.6.b.1.a, and are objects of the regulation. Please comply with the export control in each country.

Note: These products are introduced to limited countries only. Please contact our office for details.

Warming up time

- To ensure the performance of the product, before use allow at least 30 minutes of warming up after turning on the power.

Safety standards for laser beam products

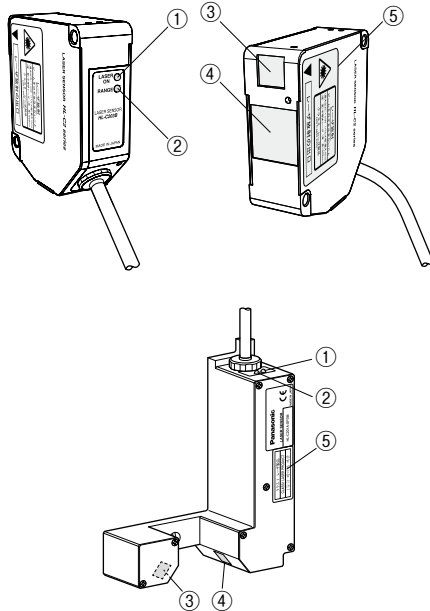
- A laser beam can harm human being's eyes, skin, etc., because of its high energy density. IEC and JIS have classified laser products according to the degree of hazard and the stipulated safety requirements.

Safe use of laser products

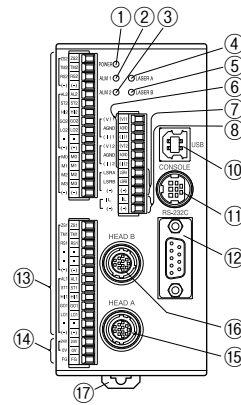
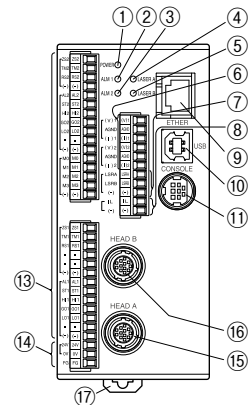
- For the purpose of preventing users from suffering injuries by laser products, IEC 60825-1(Safety of laser products). Please check the standards before use.

PRECAUTIONS FOR PROPER USE

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

Functional description**Sensor head**

	Description	Function
①	Laser emission indicator (Green LED)	Lights up during laser emission.
②	Measurement range indicator (Yellow LED)	Lights up when the target reaches the approximate center of the measurement. Blinks when the target enters within the measurement range. Turns off the light when the target goes out of the measurement range.
③	Light emitter	Emits the laser light.
④	Light receiver	Receives the laser specular light from a measurement target.
⑤	Warning label	Shows the laser emission position. Please read carefully before use.

Controller**<RS-232C-compatible>**
HL-C2C□**<Ethernet-compatible>**
HL-C21C□

	Description	Function
①	POWER indicator	Lights up in green when electricity is provided to the controller.
②	ALM1 (Alarm) indicator	Abnormal condition indicator for OUT1. Lights up in red during dark status (poor light intensity) of OUT1 or the sensor head is in unconnected status.
③	ALM2 (Alarm) indicator	Abnormal condition indicator for OUT2. Lights up in red during dark status (poor light intensity) of OUT2 or the sensor head is in unconnected status.
④	LASER A indicator	Lights up in green during the laser radiation of Head A.
⑤	LASER B indicator	Lights up in green during the laser radiation of Head B.
⑥	Analog output terminal	Terminal for analog data output.
⑦	Laser control terminal	Stops laser emission in case of short-circuiting.
⑧	Remote interlock terminal	Stops laser emission when it's opened.
⑨	Ethernet connector	Equipped on HL-C21C□ models. Used for Ethernet communication with controllers.
⑩	USB connector	Used for communication with PC using USB.
⑪	Console connection connector	Used for connecting the console.
⑫	RS-232C connector	Equipped on HL-C2C□ models. Used for RS-232C communication with controllers.
⑬	I/O terminal	Terminal for various I/O and memory change.
⑭	Power terminal	Terminal for power supply to the controller.
⑮	Sensor head A connection connector	Controller recognizes a sensor head which is connected to this connector as "Sensor head A" and starts operation.
⑯	Sensor head B connection connector	Controller recognizes a sensor head which is connected to this connector as "Sensor head B" and starts operation.
⑰	DIN rail mounting hook	Used for hooking / removing the sensor heads to / from the 35 mm 1.378 in width DIN rail with one-touch simple operation.

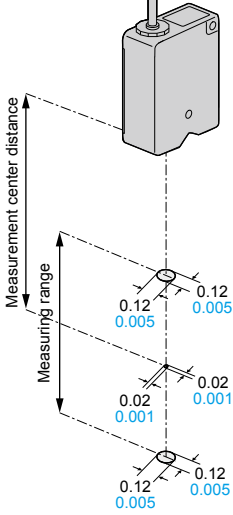
Note: In case of connecting one sensor head to the controller, be sure to connect the sensor head to ⑮ the sensor head A connection connector (HEAD A) side. If the sensor head is connected to ⑯ the sensor head B connection connector (HEAD B) side, the measurement cannot be performed.

PRECAUTIONS FOR PROPER USE

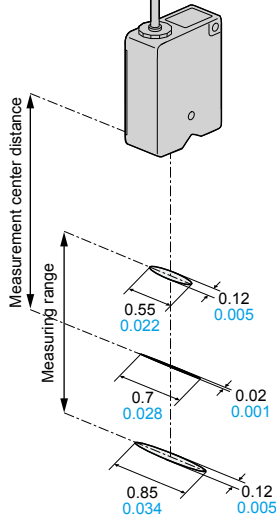
Refer to the instruction manual for details. The instruction manual can be download from our website.

Beam size (Unit: mm in)

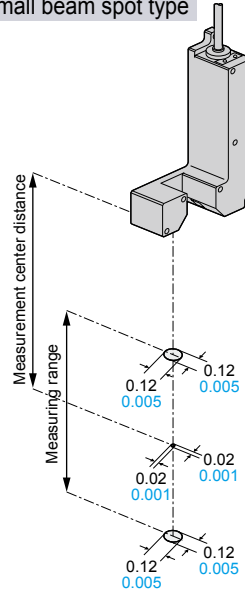
HL-C201□
Small beam spot type



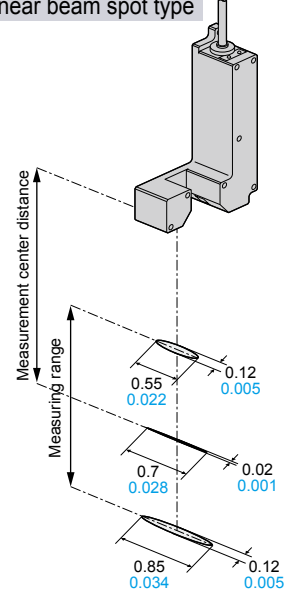
HL-C201□-MK
Linear beam spot type



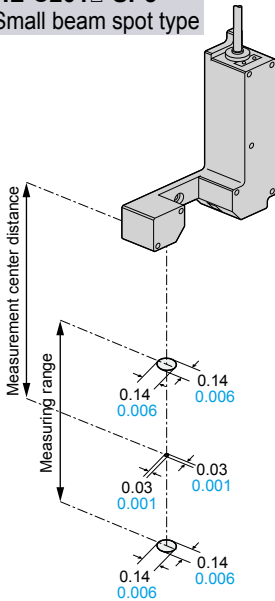
HL-C201□-SP2
Small beam spot type



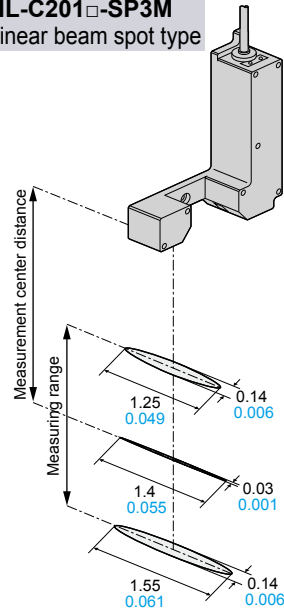
HL-C201□-SP2M
Linear beam spot type



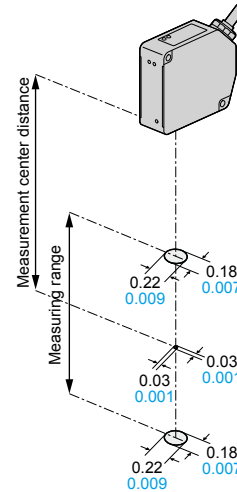
HL-C201□-SP3
Small beam spot type



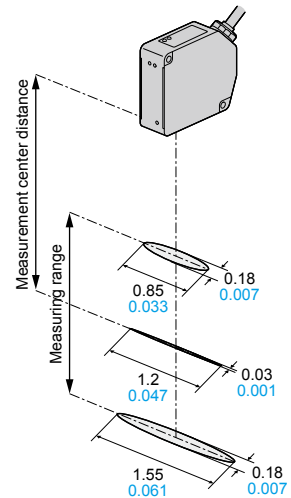
HL-C201□-SP3M
Linear beam spot type



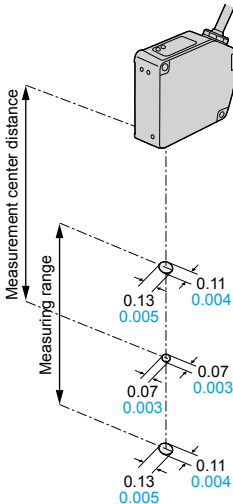
HL-C203□
Small beam spot type



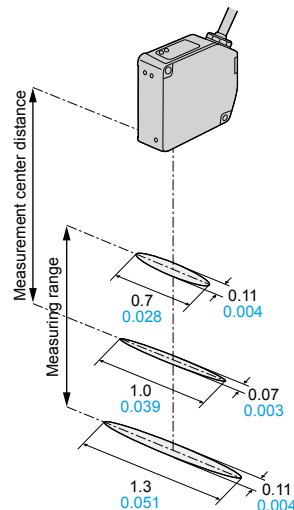
HL-C203□-MK
Linear beam spot type



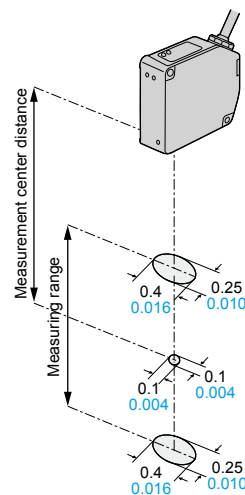
HL-C205□
Small beam spot type



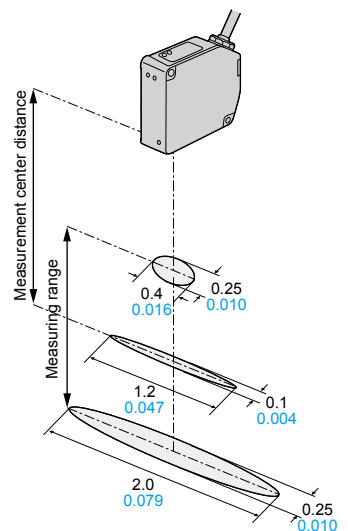
HL-C205□-MK
Linear beam spot type



HL-C208□
Small beam spot type



HL-C208□-MK
Linear beam spot type

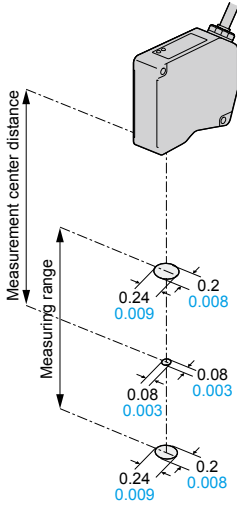


PRECAUTIONS FOR PROPER USE

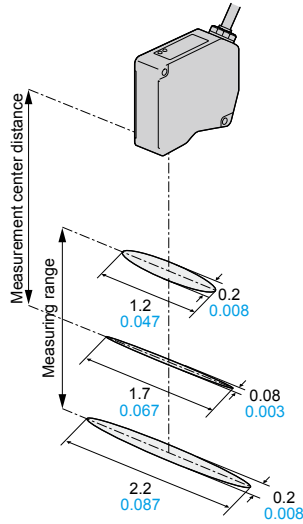
Refer to the instruction manual for details. The instruction manual can be download from our website.

Beam size (Unit: mm in)

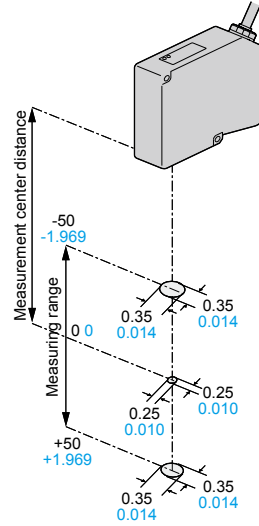
HL-C211□
Small beam spot type



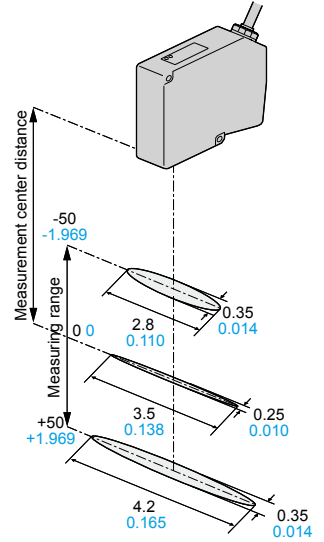
HL-C211□-MK
Linear beam spot type



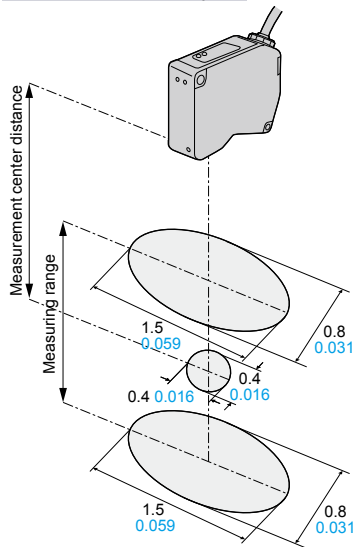
HL-C235□
Small beam spot type



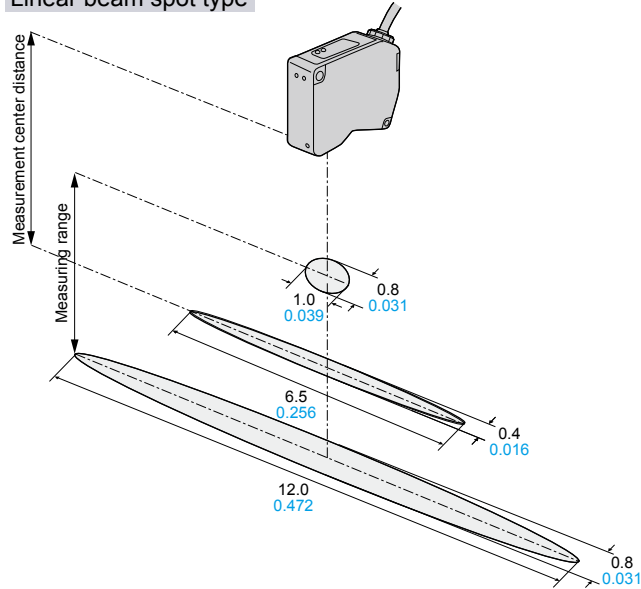
HL-C235□-MK
Linear beam spot type



HL-C235CE-W
Small beam spot type



HL-C235CE-WMK
Linear beam spot type



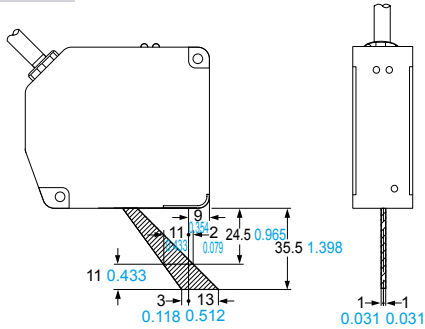
PRECAUTIONS FOR PROPER USE

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

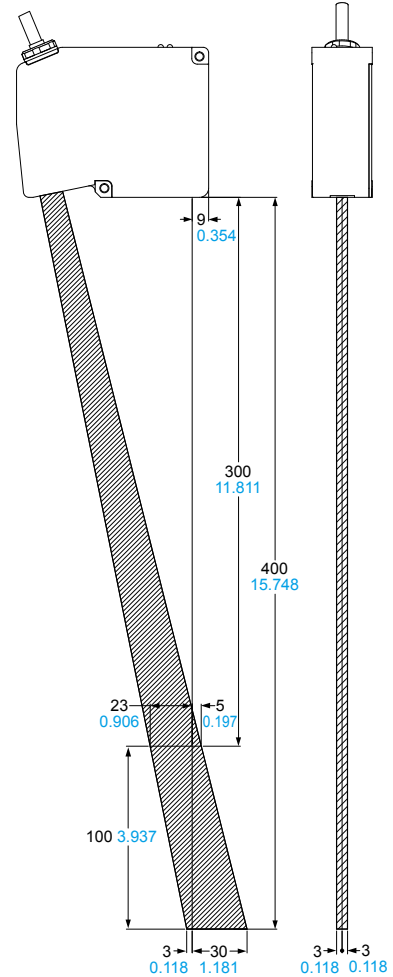
Mutual interference (Unit: mm in)

- When installing two or more sensor heads side by side, mutual interference will not occur if the laser spots from other sensor heads do not fall within the shaded areas in the figure below. When connecting two sensor heads to one controller, the mutual interference prevention function can be used. Therefore the measures shown below are not necessary in that case.

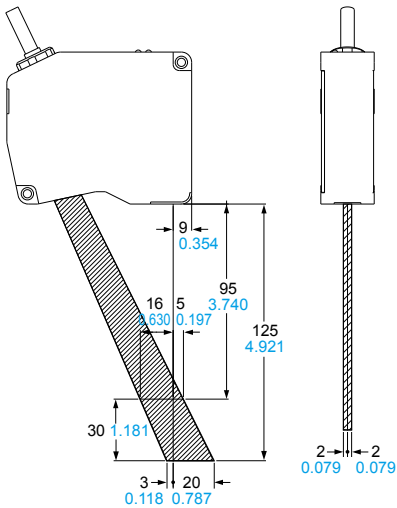
HL-C203□



HL-C235□



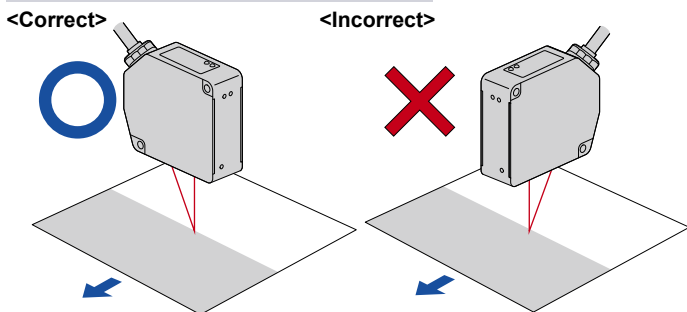
HL-C211□



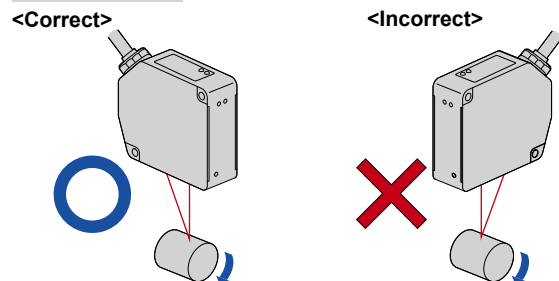
Sensor head mounting direction

- To obtain the greatest precision, the sensor head should be oriented facing the direction of movement of the object's surface, as shown in the figure below.

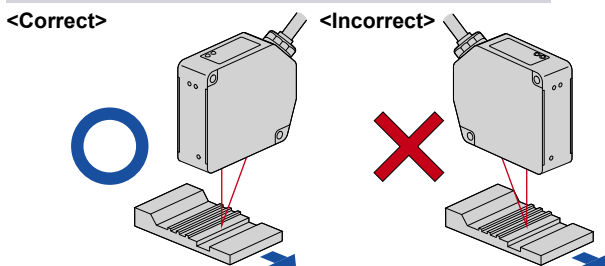
Object with variations in material or color



Rotating object



Object that has large differences in gaps and grooves

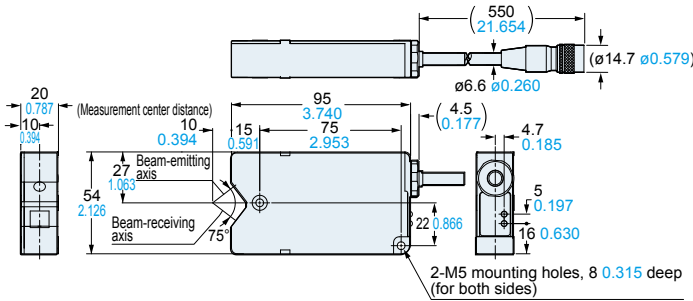


DIMENSIONS (Unit: mm in)

The CAD data can be downloaded from our website.

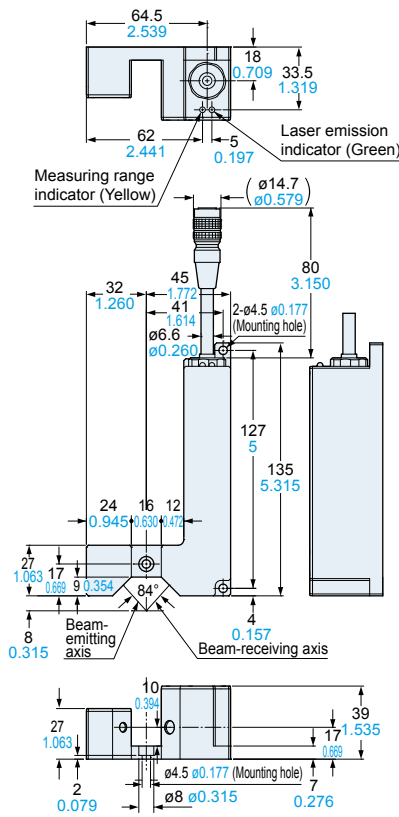
HL-C201 □ HL-C201 □-MK Sensor head

Setup mode: Specular reflection type



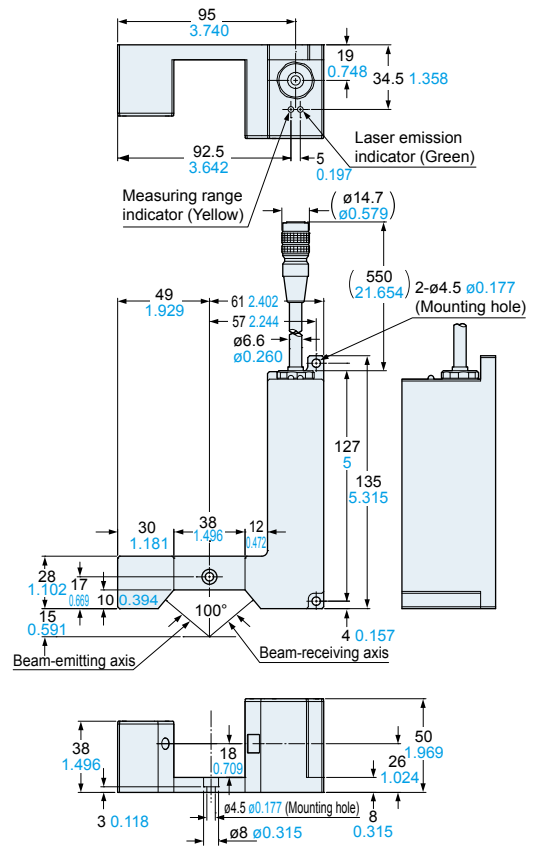
HL-C201 □-SP2 HL-C201 □-SP2M Sensor head

Setup mode: Specular reflection type



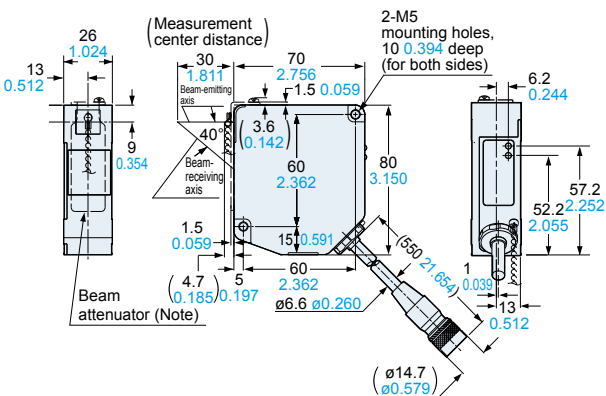
HL-C201 □-SP3 HL-C201 □-SP3M Sensor head

Setup mode: Specular reflection type

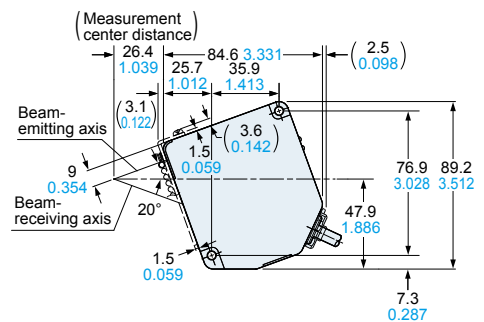


HL-C203 □ HL-C203 □-MK Sensor head

Setup mode: Diffuse reflection type



Setup mode: Specular reflection type



Note: A beam attenuator is not available for JIS / IEC conformed types.

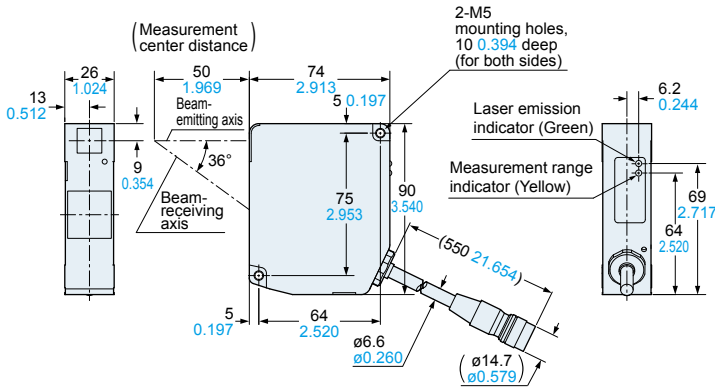
DIMENSIONS (Unit: mm in)

The CAD data can be downloaded from our website.

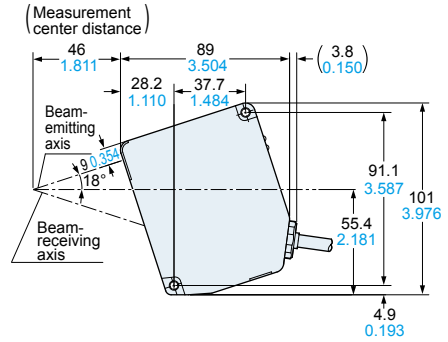
HL-C205 □ HL-C205 □-MK

Sensor head

Setup mode: Diffuse reflection type



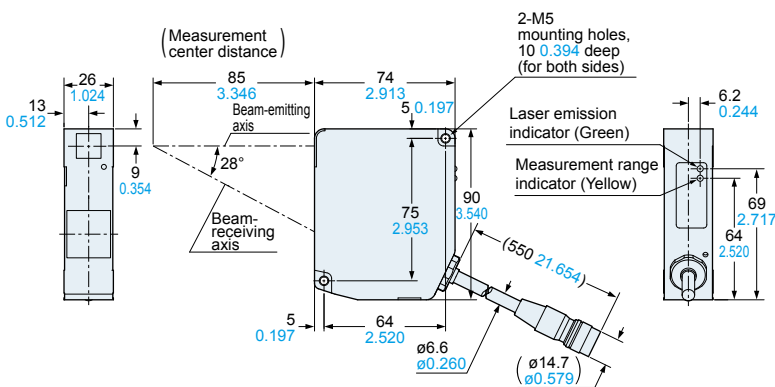
Setup mode: Specular reflection type



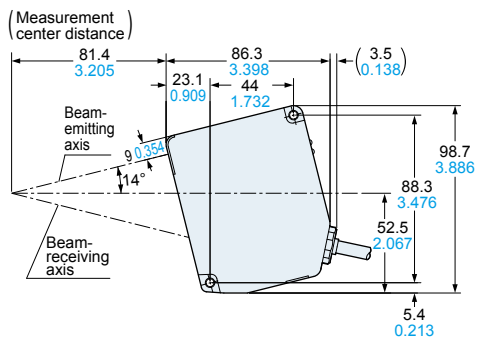
HL-C208 □ HL-C208 □-MK

Sensor head

Setup mode: Diffuse reflection type



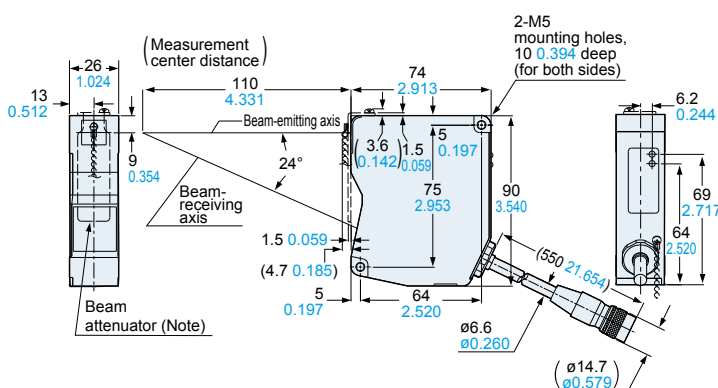
Setup mode: Specular reflection type



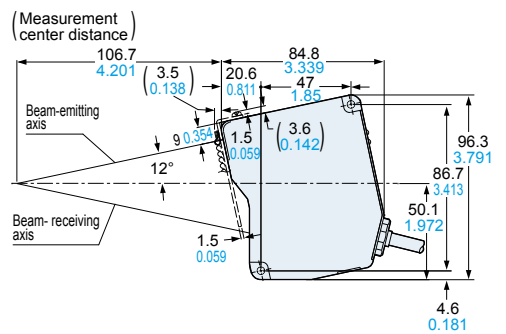
HL-C211 □ HL-C211 □-MK

Sensor head

Setup mode: Diffuse reflection type



Setup mode: Specular reflection type



Note: A beam attenuator is not available for IEC/JIS conformed types.

Disclaimer

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