

# HL-D3 SERIES

■ General terms and conditions..... F-3

■ Selection guide ..... P.1021~

## Related Information

■ Glossary of terms / General precautions ..... P.1587 / P.1595

■ About laser beam..... P.1593~

■ Korea's KC-mark ..... P.1602

Ver.2



[panasonic.net/id/pidsx/global](http://panasonic.net/id/pidsx/global)

CE

**FDA**  
Conforming to  
FDA regulations  
(HL-D301B/D301C only)



This product is classified as a Class 2 / Class 3R Laser Product in IEC / JIS standards and FDA\* regulations. Do not look at the laser beam directly or through optical devices such as a lens.

\* 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).

**High-precision laser with a resolution of 1  $\mu\text{m}$  0.039 mil**

**The functionality of 500 displacement sensors in just a 12.5 mm 0.492 in wide device!**

**High speed multi-point sensing and stable appearance measurement in one device**

The **HL-D3** series was developed based on a new concept of capturing the shape of objects with "points" instead of a "line." The new displacement sensors feature the following enhancements while not compromising the Z-axis resolution:

1 Faster measurement, achieved by selecting only the desired sensing points

2 Adjustable light intensity for each sensing point, which contributes to stable, precision detection

This is equivalent to the performance of 500 high-precision displacement sensors with a resolution of 1  $\mu\text{m}$  0.039 mil.

Measurement center distance and range (Z axis)

**50  $\pm$  10 mm 1.969  $\pm$  0.394 in**

Measurement range of width (X axis)

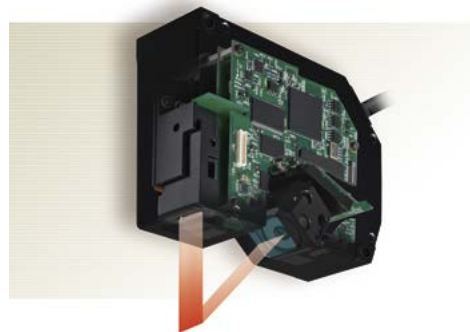
**12.5 mm 0.492 in**

Sampling rate

**Max. speed 80  $\mu\text{s}$   
(2-point specified)**

Resolution (Z axis)

**1  $\mu\text{m}$  0.039 mil  
(average number of samples: 64)**



Conventional model

**HL-D3**

**HL-D3** uses parallel beams made possible by the latest optical system. The reduced area of shadow that appears when the emitted light strikes the target object make it possible to accurately determine the shape of the object.



**Upgraded version with enhanced functionality Ver.2**

Upgraded version of the **HL-D3** series. Featuring added functions and a greater range of applications.

**Main added functions** \* Products produced from September 2013 have been upgraded to Ver. 2.

- X position correct function
- I/O terminal function

- OUT-OUT calculation

- Measurement area mask function

- Specular reflection coefficient setting

|                                           |
|-------------------------------------------|
| FIBER SENSORS                             |
| LASER SENSORS                             |
| PHOTOELECTRIC SENSORS                     |
| MICRO PHOTOELECTRIC SENSORS               |
| AREA SENSORS                              |
| SAFETY LIGHT CURTAINS / SAFETY COMPONENTS |
| PRESSURE / FLOW SENSORS                   |
| INDUCTIVE PROXIMITY SENSORS               |
| PARTICULAR USE SENSORS                    |
| SENSOR OPTIONS                            |
| SIMPLE WIRE-SAVING UNITS                  |
| WIRE-SAVING SYSTEMS                       |
| MEASUREMENT SENSORS                       |
| STATIC CONTROL DEVICES                    |
| LASER MARKERS                             |
| PLC                                       |
| HUMAN MACHINE INTERFACES                  |
| ENERGY MANAGEMENT SOLUTIONS               |
| FA COMPONENTS                             |
| MACHINE VISION SYSTEMS                    |
| UV CURING SYSTEMS                         |

|                                   |
|-----------------------------------|
| Selection Guide                   |
| Laser Displacement                |
| Magnetic Displacement             |
| Contact Displacement              |
| Collimated Beam Sensors           |
| Metal-sheet Double-feed Detection |
| Digital Panel Controller          |
| Other Products                    |

|       |
|-------|
| HL-G1 |
| HL-C2 |
| HL-D3 |

## Four modes for different measurement requirements

The **HL-D3** series is equipped with four sensing modes to enable to a variety of measurement needs, including in-line high-speed sensing and off-line high-precision detection.

### Multi-select displacement sensing mode **MSDS**

The displacement sensor senses up to 10 measurement points specified on the X axis (measurement range of width) and completes the judgment at extremely high speed.

Refer to p.1066 for more information.

### Multi-zone beam control measurement mode **MZBC**

High-precision sensing is achieved by segmenting the measurement range of width (X axis) to optimize light intensity. This mode is suitable for the sensing of objects with varied glossiness or color.

Refer to p.1068 for more information.

### Whole synchronized measurement mode

The displacement sensor performs sensing of all target objects with the same sensitivity adjustment throughout the entire measurement range of width (X axis). This mode is suitable for the sensing of fast-moving objects.

### Constant pitch measurement mode

Sensing is performed at even intervals by adjusting the sensitivity per the pitch specified along the measurement range of width (X axis). High-speed sensing is made possible by the reduced number of sensing points.

## Multiple shape calculation functions and two judgment outputs

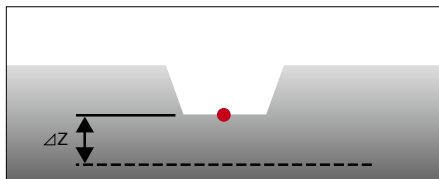
The **HL-D3** series calculates the shapes, including the height difference, width, and cross-sectional area, from the shape waveform based on the received light. At the same time, the displacement sensor uses these calculation results to instantaneously make Hi / Go / Lo judgments based on the present upper and lower limits.

(Only height calculation and step calculation in multi-select displacement sensing mode)

Thanks to the two sets of output, different shape calculations can be performed for each output or two sensor heads can be connected and used to output each judgment results.

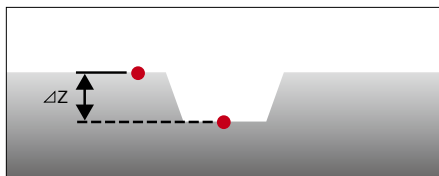
#### Height calculation

The height difference between the reference value and measured value is calculated.



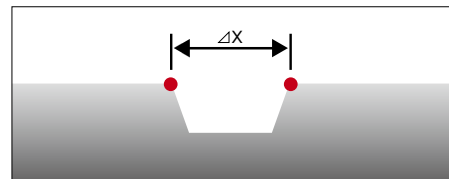
#### Step calculation

The height difference is calculated from 2 measured values.



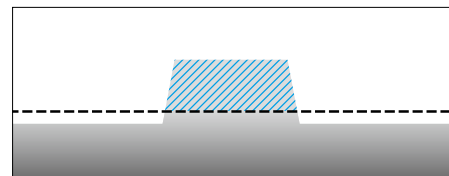
#### Width calculation

The width is calculated from 2 measured values.



#### Cross-sectional area calculation

**HL-D3** calculates the cross-sectional area defined by the reference value.



## Settings & monitoring software (HL-D3SMI) provided as standard

Conditions and the monitoring of measurements and judgment results can easily be set up by connecting to the **HL-D3C** controller and a PC pre-installed with **HL-D3SMI** using USB cables. The shape waveform based on the saved data can be reproduced on screen, which allows for it to be used as an analytical tool.

Refer to the columns on p.1066 and 1068.

### Operating environment

|                |                                                                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OS             | Microsoft Windows® 7 Professional 32-bit / 64-bit<br>Microsoft Windows® 8 Pro 32-bit / 64-bit<br>Microsoft Windows® 10 Pro 32-bit / 64-bit<br>(Japanese, English, Chinese) |
| CPU            | 1 GHz or higher                                                                                                                                                            |
| Memory         | 2 GB or higher                                                                                                                                                             |
| Screen display | SXGA (1,280 × 1,024 full colors) or more                                                                                                                                   |
| Hard disc      | 50 MB or more of available memory                                                                                                                                          |
| USB interface  | USB 2.0 Full Speed (USB 1.1 compatible) compliant                                                                                                                          |

\* A CD-ROM drive is required for installation.

\* Microsoft Windows is a registered trademarks of Microsoft Corporation in the United States and other countries.

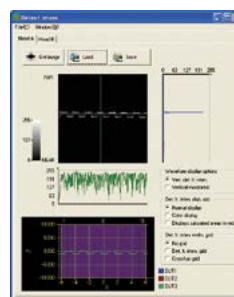
\* Pentium is a registered trademark of Intel Corporation.

### Main (Settings) screen



The main screen is where you set up the controller operations and the conditions for the sensor head and individual functions.

### Received light intensity image screen



On this screen, you can review the light receiving status of the 2D image sensor built into the sensor head, as well as the shape waveform of the measured values.

FIBER SENSORS  
LASER SENSORS  
PHOTOELECTRIC SENSORS  
MICRO PHOTOELECTRIC SENSORS  
AREA SENSORS  
SAFETY LIGHT CURTAINS / SAFETY COMPONENTS  
PRESSURE / FLOW SENSORS  
INDUCTIVE PROXIMITY SENSORS  
PARTICULAR USE SENSORS

SENSOR OPTIONS  
SIMPLE WIRE-SAVING UNITS  
WIRE-SAVING SYSTEMS  
MEASUREMENT SENSORS  
STATIC CONTROL DEVICES  
LASER MARKERS

PLC  
HUMAN MACHINE INTERFACES  
ENERGY MANAGEMENT SOLUTIONS  
FA COMPONENTS  
MACHINE VISION SYSTEMS  
UV CURING SYSTEMS

Selection Guide  
Laser Displacement  
Magnetic Displacement  
Contact Displacement  
Collimated Beam Sensors  
Metal-sheet Double-feed Detection  
Digital Panel Controller  
Other Products

**HL-G1**

**HL-C2**

**HL-D3**

FIBER  
SENSORSLASER  
SENSORSPHOTOELECTRIC  
SENSORSMICRO  
PHOTOELECTRIC  
SENSORSAREA  
SENSORSSAFETY LIGHT  
CURTAINS /  
SAFETY COMPONENTSPRESSURE /  
FLOW  
SENSORSINDUCTIVE  
PROXIMITY  
SENSORSPARTICULAR  
USE SENSORSSENSOR  
OPTIONSSIMPLE  
WIRE-SAVING  
UNITSWIRE-SAVING  
SYSTEMSMEASUREMENT  
SENSORSSTATIC  
CONTROL  
DEVICESLASER  
MARKERS

PLC

HUMAN MACHINE  
INTERFACESENERGY  
MANAGEMENT  
SOLUTIONS

FA COMPONENTS

MACHINE VISION  
SYSTEMSUV CURING  
SYSTEMSSelection  
GuideLaser  
DisplacementMagnetic  
DisplacementContact  
DisplacementCollimated  
Beam SensorsMetal-sheet  
Double-feed DetectionDigital Panel  
Controller

Other Products

HL-G1

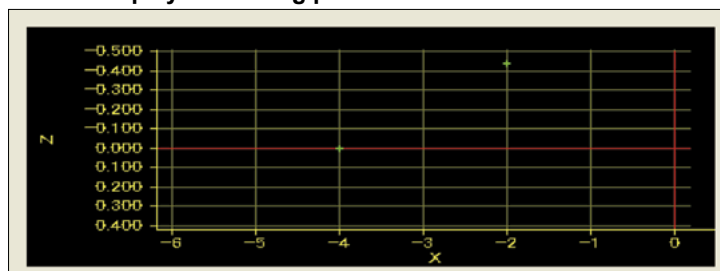
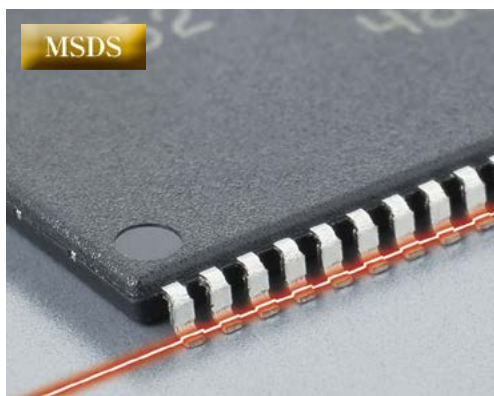
HL-C2

HL-D3

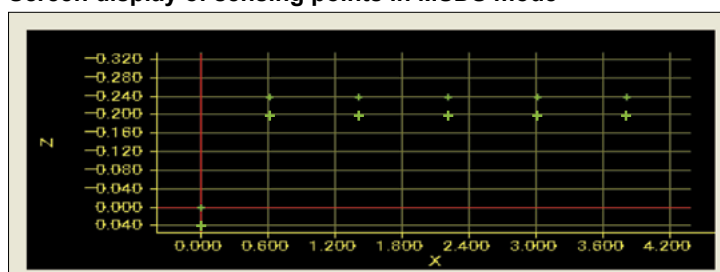
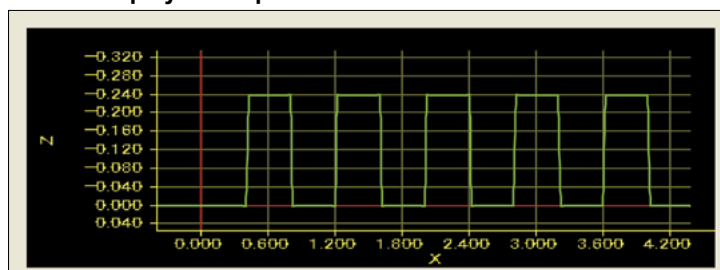
**Multi-select displacement sensing****Application** Checking for loose screws

Missing and loose screws can be detected by sensing the displacement of the screw head from the reference plane. **HL-D3** provides Hi / Go / Lo judgment based on the sensing results.

When two sensing points are used, in-line testing can be performed by virtue of the sensing performance that realizes a sampling rate of 80  $\mu$ s.

**Screen display of sensing points in MSDS mode****Screen display of calculated value and judgment****Application** Detecting misaligned pins on surface mounted components

**HL-D3** can even sense the tiny pins of surface mounting components. The measured values can be managed by setting the reference plane and pins as sensing points.

**Screen display of sensing points in MSDS mode****Screen display of shape waveform in MZBC mode**

**Multi-select displacement sensing****What is multi-select displacement sensing?** **MSDS**

Conventional 2D displacement sensors produced the measurements of the specified points after sensing the entire measurement range of width (X axis), which made them unsuitable for high-speed sensing.

The **HL-D3** series performs efficient internal processing by sensing only the displacements at the specified points. This feature enables super-fast measurement, from sensing to calculation and judgment. Sensitivity is also adjusted at each point to ensure optimized sensing in order to also achieve high precision.

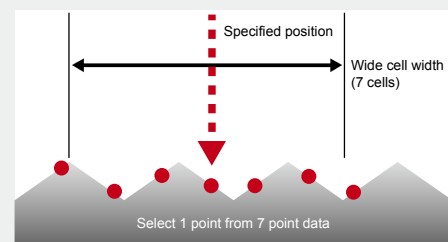
(MSDS: Multi-Select Displacement Sensing)

**[Features]**

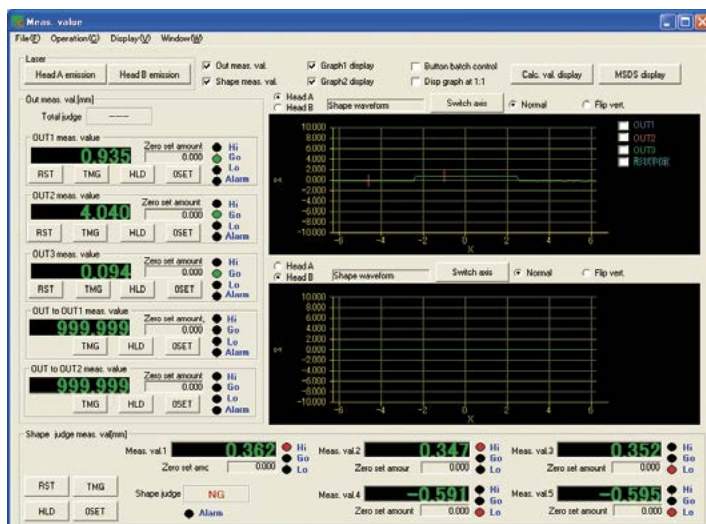
- High-speed sampling
  - Max. speed 80  $\mu$ s (for 2-point specified)
- Sensing points can be specified as desired
  - Up to 10 points
- Measurements of specified points can be buffered
- Height, step calculation, and judgment results can be output
- Wide-cell function

**[Wide-cell function]**

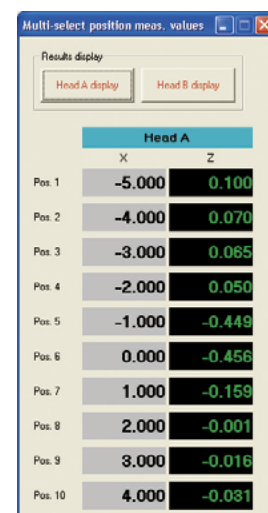
When the surface condition is rough, such as with cut metal, sensing of a single point will result in errors due to the uneven surface. The wide-cell function expands the sensing points for the light receiving side and obtains the mean value (or maximum or minimum value, depending on the setting) to improve the stability of the measurements.

**HL-D3SMI (monitoring software) can** **PART 1**

- Easily identify the sensed point based on the display of the displacement shape waveform obtained from the light intensity waveform
- Display the calculation area along with the displacement shape waveform in order to enable an instant understanding of the calculated point and area
- Display the calculated values of height difference, width, and cross-sectional area on the screen
- List the displacement value of each sensing point when operating in MSDS mode



Screen displaying measured values



Screen displaying multi-point displacement values

FIBER  
SENSORSLASER  
SENSORSPHOTOELECTRIC  
SENSORSMICRO  
PHOTOELECTRIC  
SENSORSAREA  
SENSORSSAFETY LIGHT  
CURTAINS /  
SAFETY COMPONENTSPRESSURE /  
FLOW  
SENSORSINDUCTIVE  
PROXIMITY  
SENSORSPARTICULAR  
USE SENSORSSENSOR  
OPTIONSSIMPLE  
WIRE-SAVING  
UNITSWIRE-SAVING  
SYSTEMSMEASUREMENT  
USE SENSORSSTATIC  
CONTROL  
DEVICESLASER  
MARKERS

PLC

HUMAN MACHINE  
INTERFACESENERGY  
MANAGEMENT  
SOLUTIONS

FA COMPONENTS

MACHINE VISION  
SYSTEMSUV CURING  
SYSTEMS

Selection  
Guide

Laser  
Displacement  
Magnetic  
Displacement  
Contact  
Displacement  
Collimated  
Beam Sensors  
Metal-sheet  
Double-feed Detection  
Digital Panel  
Controller  
Other Products

**HL-G1****HL-C2****HL-D3**



FIBER  
SENSORSLASER  
SENSORSPHOTOELECTRIC  
SENSORSMICRO  
PHOTOELECTRIC  
SENSORSAREA  
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CURTAINS /  
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USE SENSORSSENSOR  
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MANAGEMENT  
SOLUTIONS

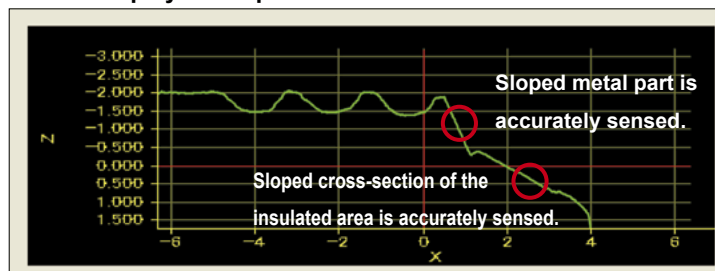
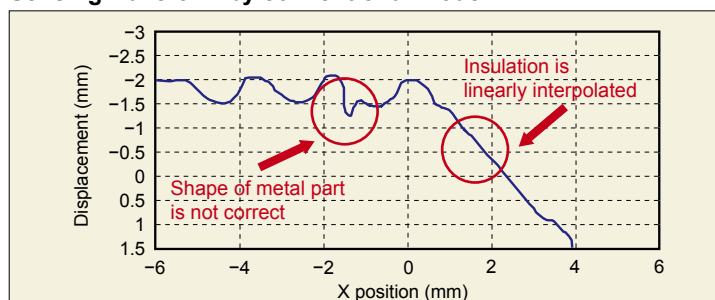
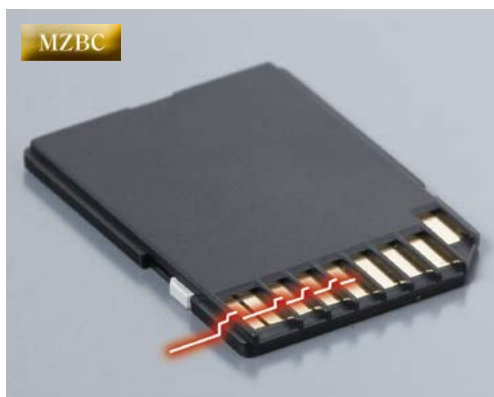
FA COMPONENTS

MACHINE VISION  
SYSTEMSUV CURING  
SYSTEMSSelection  
GuideLaser  
DisplacementMagnetic  
DisplacementContact  
DisplacementCollimated  
Beam SensorsMetal-sheet  
Double-feed DetectionDigital Panel  
Controller

Other Products

**HL-G1****HL-C2****HL-D3****Multi-zone beam control function****Application Sensing objects with sloped profile**

**HL-D3** can accurately sense the shapes of the thread and black insulation of a miniature bulb.

**Screen display of shape waveform****Sensing waveform by conventional model****Application Sensing objects using both gold plates and black resin**

The terminal part of an SD card has gold-plated pads, as well as resin walls and dented parts that separate them. **HL-D3** can accurately sense the two materials having different reflectance.

**Screen display of shape waveform****Close-up of sensed part**

**Multi-zone beam control function****What is multi-zone beam control?****MZBC**

Conventional 2D displacement sensors uniformly use the same light intensity adjustment for the entirety of the measurement range of width (X axis). When parts with significantly differing reflectance exist, the received light intensity becomes saturated or insufficient, preventing the acquisition of effective measurement results. The **HL-D3** series breaks down the measurement range of width (X axis) into small segments and adjusts the emission for each segmented unit (called "light intensity adjustment unit") for optimal sensitivity in order to achieve stable, high-precision sensing.

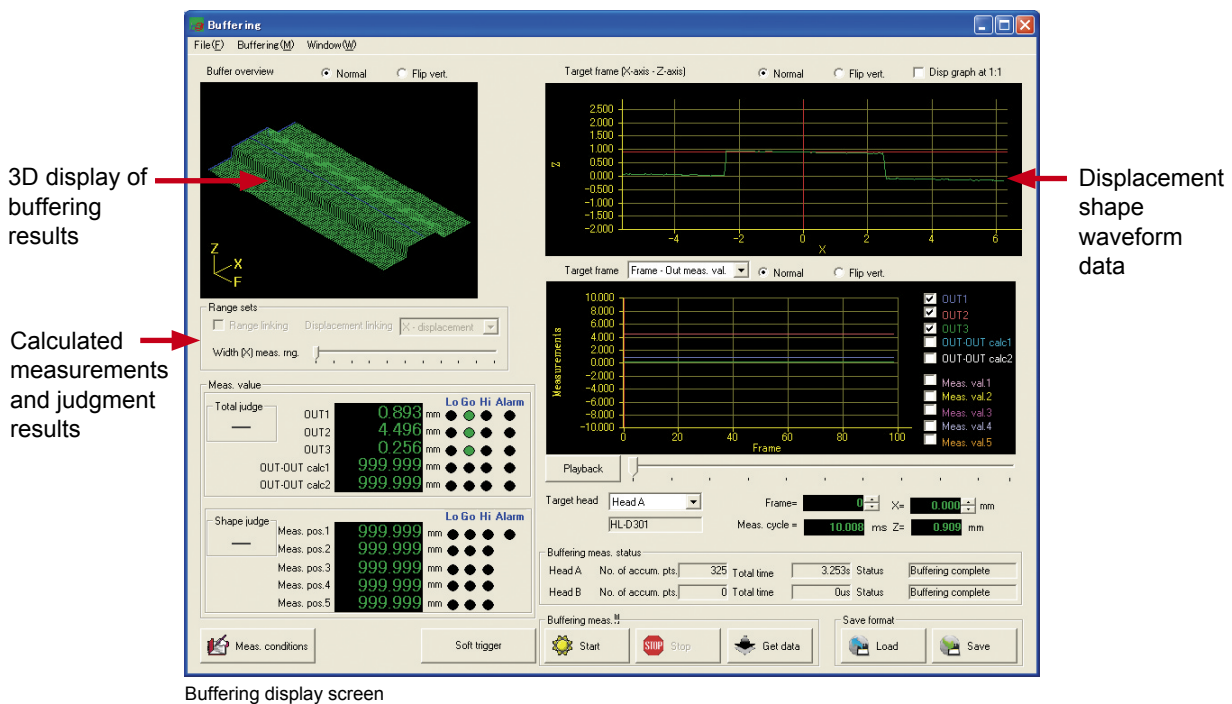
(MZBC: Multi-Zone Beam Control)

**[Features]**

- Stable sensing is possible even with objects of which reflectance is not consistent throughout the whole object
  - Both metal and resin parts exist
  - Profile consists of flat and sloped parts
- High-precision sensing
  - Resolution of 1  $\mu\text{m}$  **0.039 mil** (average number of samples: 64 with average height measurement)
- Calculation and judgment results of width, step, and cross-sectional area can be output

**HL-D3SMI (monitoring software) can****PART 2**

- Store displacement shape waveform data, calculated measured values, and judgment results on the memory built into the controller during continuous sensing.
- Provides a stereoscopic representation of the shape by a 3D display of stored data.
- Replay the stored data on the buffering screen at a later time, provided that the stored data is saved in the dedicated file format.
- Allow waveform display and analysis by means of spreadsheet software based on the data saved in CSV file format.

FIBER  
SENSORSLASER  
SENSORSPHOTOELECTRIC  
SENSORSMICRO  
PHOTOELECTRIC  
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SOLUTIONS

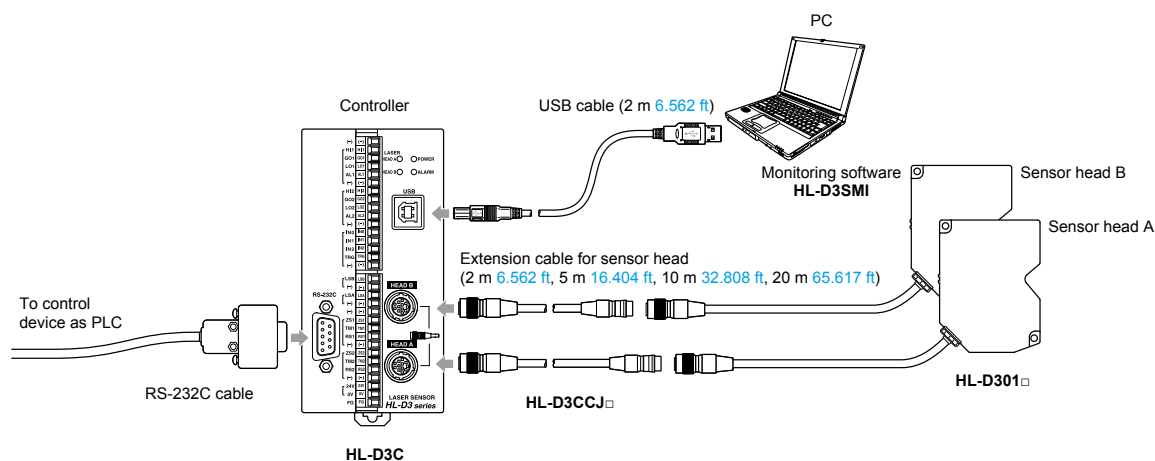
FA COMPONENTS

MACHINE VISION  
SYSTEMSUV CURING  
SYSTEMSSelection  
GuideLaser  
DisplacementMagnetic  
DisplacementContact  
DisplacementCollimated  
Beam SensorsMetal-sheet  
Double-feed DetectionDigital Panel  
Controller

Other Products

**HL-G1****HL-C2****HL-D3**

## SYSTEM CONFIGURATION



Set-up is performed based on the shape waveform obtained, which requires a computer pre-installed with the monitoring software (HL-D3SMI).

## ORDER GUIDE

### Sensor heads

| Type               | Appearance                                                                          | Measurement center distance and height (Z axis) measurement range | Measurement range of width (X axis)                       | Resolution (height direction) (Note 1) | Laser class                            | Model No.       |
|--------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------|----------------------------------------|----------------------------------------|-----------------|
| Diffuse reflection |  | 50 ±10 mm<br>1.969 ±0.394 in                                      | 12.5 mm<br>0.492 in<br>(with measurement center distance) | 1 μm<br>0.039 mil                      | Class 2<br>[IEC / JIS / FDA (Note 2)]  | <b>HL-D301B</b> |
|                    |                                                                                     |                                                                   |                                                           |                                        | Class 3R<br>[IEC / JIS / FDA (Note 2)] | <b>HL-D301C</b> |

Notes: 1) Value is the height mean value over the entire measurement range with the average number of samples being 64 and using measurement center distance.  
2) 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).

### Controller

| Appearance                                                                          | Model No.     | Output                                                       |
|-------------------------------------------------------------------------------------|---------------|--------------------------------------------------------------|
|  | <b>HL-D3C</b> | N-channel FET, open drain<br>(Judgment output, Alarm output) |

### Options

| Designation                 | Appearance                                                                          | Model No.  | Description               |                                                                                                                                          |
|-----------------------------|-------------------------------------------------------------------------------------|------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Sensor head extension cable |  | HL-D3CCJ2  | Length: 2 m<br>6.562 ft   | Cabyre cable with connector on both ends<br>Cable outer diameter: ø6.6 mm ø0.260 in<br>Connector outer diameter: ø14.7 mm ø0.579 in max. |
|                             |                                                                                     | HL-D3CCJ5  | Length: 5 m<br>16.404 ft  |                                                                                                                                          |
|                             |                                                                                     | HL-D3CCJ10 | Length: 10 m<br>32.808 ft |                                                                                                                                          |
|                             |                                                                                     | HL-D3CCJ20 | Length: 20 m<br>65.617 ft |                                                                                                                                          |

**SPECIFICATIONS****Sensor heads**

| Type                                |                      | Diffuse reflection type                                                                                                                                                                                                        |                                        |
|-------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| Item                                | Model No.            | HL-D301B                                                                                                                                                                                                                       | HL-D301C                               |
| CE marking directive compliance     |                      | EMC Directive, RoHS Directive                                                                                                                                                                                                  |                                        |
| Measurement center distance         |                      | 50 mm <b>1.969 in</b>                                                                                                                                                                                                          |                                        |
| Height (Z axis) measurement range   |                      | ±10 mm <b>0.394 in</b>                                                                                                                                                                                                         |                                        |
| Measurement range of width (X axis) | Near side            | 11.5 mm <b>0.453 in</b>                                                                                                                                                                                                        |                                        |
|                                     | Measurement center   | 12.5 mm <b>0.492 in</b>                                                                                                                                                                                                        |                                        |
|                                     | Far side             | 12.5 mm <b>0.492 in</b>                                                                                                                                                                                                        |                                        |
| Unit of measurement output          | Height (Z axis)      | 0.1 μm <b>0.004 mil</b>                                                                                                                                                                                                        |                                        |
|                                     | Width (X axis)       | 1 μm <b>0.039 mil</b> (Note 2)                                                                                                                                                                                                 |                                        |
| Resolution                          | Height (Z axis)      | 1 μm <b>0.039 mil</b> (Note 3)                                                                                                                                                                                                 |                                        |
|                                     | Width(X axis)        | 5 μm <b>0.197 mil</b> (Note 2, 4)                                                                                                                                                                                              |                                        |
| Linearity (Note 5)                  | Height (Z axis)      | ±0.1 % F.S.                                                                                                                                                                                                                    |                                        |
| Temperature characteristic          |                      | 0.02 % F.S./°C                                                                                                                                                                                                                 |                                        |
| Light source                        |                      | Red semiconductor laser (Peak wavelength 658 nm <b>0.026 mil</b> )                                                                                                                                                             |                                        |
|                                     | Output               | Max. output: 1 mW                                                                                                                                                                                                              | Max. output: 5 mW                      |
|                                     | Laser class          | Class 2<br>[IEC / JIS / FDA (Note 6)]                                                                                                                                                                                          | Class 3R<br>[IEC / JIS / FDA (Note 6)] |
| Beam size (Note 7)                  |                      | 50 μm × 15 mm <b>1.969 mil × 0.591 in</b>                                                                                                                                                                                      |                                        |
| Receiving element                   |                      | CMOS 2D image sensor                                                                                                                                                                                                           |                                        |
| Indicator                           | Laser emission       | Green LED (lights up during laser emission)                                                                                                                                                                                    |                                        |
|                                     | Measurement range    | Yellow LED<br>[ lights up when near the measurement center distance, blinks when within the measuring range, and lights out when outside of the measuring range. (at the measurement center position in the width direction) ] |                                        |
| Environmental resistance            | Protection           | IP67 (IEC) (excluding the connector)                                                                                                                                                                                           |                                        |
|                                     | Ambient temperature  | 0 to +45 °C <b>+32 to +113 °F</b> (No dew condensation allowed), Storage: -20 to +70 °C <b>-4 to +158 °F</b>                                                                                                                   |                                        |
|                                     | 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 (No direct sunlight or its reflection allowed)                                                                                                                |                                        |
|                                     | Vibration resistance | 10 to 55 Hz (period: 1 min.) frequency, 1.5 mm <b>0.059 in</b> double amplitude in X,Y and Z directions for two hours each                                                                                                     |                                        |
|                                     | Shock resistance     | 196 m/s <sup>2</sup> acceleration (20 G approx.) in X,Y and Z directions three times each                                                                                                                                      |                                        |
| Cable                               |                      | Cable type cable, 0.5 m <b>1.640 ft</b> long with connector                                                                                                                                                                    |                                        |
| Cable extension                     |                      | Extension up to total 20 m <b>65.617 ft</b> is possible, with optional cable.                                                                                                                                                  |                                        |
| Materials                           |                      | Enclosure: Die-cast aluminum, Case cover: Die-cast aluminum, Front cover: Glass                                                                                                                                                |                                        |
| Weight                              |                      | 500 g approx. (including cable)                                                                                                                                                                                                |                                        |
| Accessory                           |                      | Laser warning label: 1 set                                                                                                                                                                                                     |                                        |

- Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were as follows: (connected to the controller) supply voltage 24 V DC, ambient temperature +20 °C **+68 °F**, MZBC mode (adjustment unit: width of 100 μm **3.937 mil**), unit light receiving time 100 μs, average number of samples 64, measurement center distance, and target object is a white, light-diffusing object.
- 2) It is a value in which the sensor heads connected to a controller Ver. 2.00 or higher.
- 3) The value is the average of height measurement in full width at the measurement center distance.
- 4) This is the measurement value of a pin gauge rounded surface in the edge position measurement (start of falling edge) calculation setting. The measurement object: white ceramic pin gauge (ø10 mm **ø0.394 in**), unit light receiving time: 200 μs, measurement value extraction: base light intensity control, average number of samples: 64, width smoothing: ±4, all others are the initial settings.
- 5) Value represents the error in comparison with the ideal line of height measuring range (full scale) for the height measurement of the measurement center position in the width direction. The value in the specifications is the value within ±7.5 mm **0.295 in** of the height measuring range.
- 6) 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).
- 7) This size applies when using measurement center distance and is defined as 1/e<sup>2</sup> (13.5 % approx.) of the center light intensity. Leaked light occurs outside of the defined range; sensing performance may be affected when the reflectance around the detection point is higher than that detection point.

FIBER  
SENSORSLASER  
SENSORSPHOTO-  
ELECTRIC  
SENSORSMICRO  
PHOTO-  
ELECTRIC  
SENSORSAREA  
SENSORSSAFETY LIGHT  
CURTAINS /  
SAFETY  
COMPONENTSPRESSURE /  
FLOW  
SENSORSINDUCTIVE  
PROXIMITY  
SENSORSPARTICULAR  
USE  
SENSORSSENSOR  
OPTIONSSIMPLE  
WIRE-SAVING  
UNITSWIRE-SAVING  
SYSTEMSMEASURE-  
MENT  
SENSORSSTATIC  
CONTROL  
DEVICESLASER  
MARKERS

PLC

HUMAN  
MACHINE  
INTERFACESENERGY  
MANAGEMENT  
SOLUTIONSFA  
COMPONENTSMACHINE  
VISION  
SYSTEMSUV  
CURING  
SYSTEMSSelection  
GuideLaser  
DisplacementMagnetic  
DisplacementContact  
DisplacementCollimated  
Beam  
SensorsMetal-sheet  
Double-feed  
DetectionDigital Panel  
ControllerOther  
Products**HL-G1****HL-C2****HL-D3**



## SPECIFICATIONS

### Controller

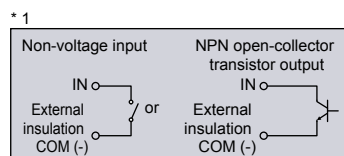
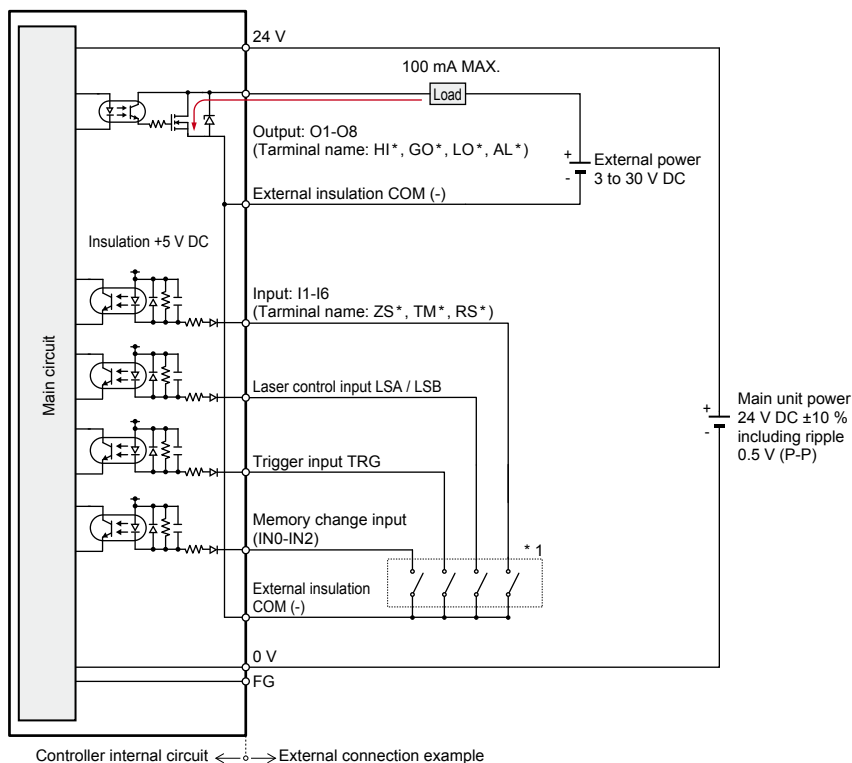
| Model No.                |                               | HL-D3C                                                                                                                                                                                                                                          |
|--------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Item                     |                               |                                                                                                                                                                                                                                                 |
| Applicable sensor heads  |                               | <b>HL-D301B, HL-D301C</b>                                                                                                                                                                                                                       |
| Connectable sensor heads |                               | Number of connectable units: Max. 2 units                                                                                                                                                                                                       |
| Supply voltage           |                               | 24 V DC $\pm 10\%$ including ripple 0.5 V (P-P)                                                                                                                                                                                                 |
| Current consumption      |                               | 1 A or less (when 2 sensor heads are connected)                                                                                                                                                                                                 |
| Sampling rate            |                               | Depends on the sensing mode and settings<br>Multi-zone beam control mode : Standard 12.2 ms (Note 2)<br>Whole synchronized measurement mode : Max. 2.5 ms (Note 3)<br>Multi-select displacement sensing mode : Max. 80 $\mu$ s (Note 4)         |
| Judgment output          |                               | N-channel FET, open drain<br>• Maximum sink current: 100 mA<br>• Applied voltage: 30 V DC or less (between output terminal and 0 V)<br>• ON-resistance: 5 $\Omega$ or less                                                                      |
| Output operation         |                               | Open during output operation (switchable)                                                                                                                                                                                                       |
| Short-circuit protection |                               | Incorporated                                                                                                                                                                                                                                    |
| Alarm output             |                               | N-channel FET, open drain<br>• Maximum sink current: 100 mA<br>• Applied voltage: 30 V DC or less (between output terminal and 0 V)<br>• ON-resistance: 5 $\Omega$ or less                                                                      |
| Output operation         |                               | Open when alarm is triggered (switchable)                                                                                                                                                                                                       |
| Short-circuit protection |                               | Incorporated                                                                                                                                                                                                                                    |
| External trigger input   |                               | Photocoupler insulation input                                                                                                                                                                                                                   |
| Input operation          |                               | ON: short-circuiting to external insulation COM (-) , OFF: when open                                                                                                                                                                            |
| Applied voltage          |                               | 30 V DC or less (leakage current: 0.1 mA or less)                                                                                                                                                                                               |
| Laser control input      |                               | Photocoupler insulation input                                                                                                                                                                                                                   |
| Input operation          |                               | Laser emission: short-circuiting to external insulation COM (-) , Laser emission OFF: when open                                                                                                                                                 |
| Applied voltage          |                               | 30 V DC or less (leakage current: 0.1 mA or less)                                                                                                                                                                                               |
| Zero set input           |                               | Photocoupler insulation input                                                                                                                                                                                                                   |
| Input operation          |                               | ON: short-circuiting to external insulation COM (-) , OFF: when open                                                                                                                                                                            |
| Applied voltage          |                               | 30 V DC or less (leakage current: 0.1 mA or less)                                                                                                                                                                                               |
| Timing input             |                               | Photocoupler insulation input                                                                                                                                                                                                                   |
| Input operation          |                               | ON: short-circuiting to external insulation COM (-) , OFF: when open                                                                                                                                                                            |
| Applied voltage          |                               | 30 V DC or less (leakage current: 0.1 mA or less)                                                                                                                                                                                               |
| Reset input              |                               | Photocoupler insulation input                                                                                                                                                                                                                   |
| Input operation          |                               | ON: short-circuiting to external insulation COM (-) , OFF: when open                                                                                                                                                                            |
| Applied voltage          |                               | 30 V DC or less (leakage current: 0.1 mA or less)                                                                                                                                                                                               |
| RS-232C interface        |                               | Baud rate: 9,600, 19,200, 38,400, 57,600, 115,200 bit/s (Note 5)                                                                                                                                                                                |
| USB interface            |                               | USB 2.0 full-speed (USB 1.1 compatible)                                                                                                                                                                                                         |
| Settings / Data display  |                               | <b>HL-D3SMI</b> (accessory) or dedicated API                                                                                                                                                                                                    |
| Indicator                | Power                         | Green LED<br>(lights up at power on)                                                                                                                                                                                                            |
|                          | Sensor head A Laser radiation | Green LED<br>[ During continuous sensing: lights up during laser emission, blinks twice when turning off<br>During sensing stop process: alternately lights up during laser emission (ON: 1 sec. / OFF: 1 sec.), blinks once when turning off ] |
|                          | Sensor head B Laser radiation | Green LED<br>[ During continuous sensing: lights up during laser emission, blinks twice when turning off<br>During sensing stop process: alternately lights up during laser emission (ON: 1 sec. / OFF: 1 sec.), blinks once when turning off ] |
|                          | Alarm                         | Red LED<br>(lights up when there is a sensing alarm or sensor head wire breakage)                                                                                                                                                               |

|                                           |
|-------------------------------------------|
| FIBER SENSORS                             |
| LASER SENSORS                             |
| PHOTO-ELECTRIC SENSORS                    |
| MICRO PHOTO-ELECTRIC SENSORS              |
| AREA SENSORS                              |
| SAFETY LIGHT CURTAINS / SAFETY COMPONENTS |
| PRESSURE / FLOW SENSORS                   |
| INDUCTIVE PROXIMITY SENSORS               |
| PARTICULAR USE SENSORS                    |
| SENSOR OPTIONS                            |
| SIMPLE WIRE-SAVING UNITS                  |
| WIRE-SAVING SYSTEMS                       |
| MEASURE-MENT SENSORS                      |
| STATIC CONTROL DEVICES                    |
| LASER MARKERS                             |
| PLC                                       |
| HUMAN MACHINE INTERFACES                  |
| ENERGY MANAGEMENT SOLUTIONS               |
| FA COMPONENTS                             |
| MACHINE VISION SYSTEMS                    |
| UV CURING SYSTEMS                         |
| Selection Guide                           |
| Laser Displacement                        |
| Magnetic Displacement                     |
| Contact Displacement                      |
| Collimated Beam Sensors                   |
| Metal-sheet Double-feed Detection         |
| Digital Panel Controller                  |
| Other Products                            |
| HL-G1                                     |
| HL-C2                                     |
| HL-D3                                     |

**SPECIFICATIONS****Controller**

| Model No.                |                      | <b>HL-D3C</b>                                                                                                                   |
|--------------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Item                     |                      |                                                                                                                                 |
| Environmental resistance | Ambient temperature  | 0 to +50 °C <b>+32 to +122 °F</b> (No dew condensation or icing allowed), Storage: -20 to +70 °C <b>-4 to +158 °F</b>           |
|                          | Ambient humidity     | 35 to 85 % RH , Storage: 35 to 85 % RH                                                                                          |
|                          | Vibration resistance | 10 to 55 Hz frequency (period: 1 min) , 0.75 mm <b>0.030 in</b> double amplitude in X, Y, and Z directions for 30 min. each     |
|                          | Shock resistance     | 196 m/s <sup>2</sup> acceleration (20G approx.) in X, Y, and Z directions three times each                                      |
| Material                 |                      | Enclosure: Aluminum                                                                                                             |
| Weight                   |                      | 300 g approx.                                                                                                                   |
| Accessories              |                      | <b>HL-D3</b> set-up CD-ROM, (including <b>HL-D3SMI</b> and User's Manual), Instruction manual, USB cable (2 m <b>6.562 ft</b> ) |

- Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were as follows: (connected to the sensor head) supply voltage 24 V DC, ambient temperature +20 °C **+68 °F**, MZBC mode (adjustment unit: width of 100 µm **3.937 mil**), unit light receiving time 100 µs, average number of samples 64, measurement center distance, and target object is a white, light-diffusing object.
- 2) Value for using two judgment outputs with 1 sensor head in MZBC mode, with each measuring range set to Max. and light intensity not adjusted (continuous sensing).
- 3) Value for obtaining displacement shape waveform data using buffering and 2 sensor heads in whole synchronized measurement mode, with each measuring range set to Min. (no OUT calculation).
- 4) Value for using 2 judgment outputs with 1 sensor head in MSDS mode, with the unit light receiving time set to 40 µs, light intensity not adjusted (continuous), and 2 points selected (without wide cell function).
- 5) Products produced from September 2013 (Ver. 2) are also compatible with 9,600, 19,200 and 38,400 bit/s.

**I/O CIRCUIT DIAGRAMS**

Note: External insulation COM (-) is insulated from internal 0 V. Always connect to an external power supply of 0 V.

FIBER  
SENSORSLASER  
SENSORSPHOTO-  
ELECTRIC  
SENSORSMICRO  
PHOTO-  
ELECTRIC  
SENSORSAREA  
SENSORSSAFETY LIGHT  
CURTAINS /  
SAFETY  
COMPONENTSPRESSURE /  
FLOW  
SENSORSINDUCTIVE  
PROXIMITY  
SENSORSPARTICULAR  
USE  
SENSORSSENSOR  
OPTIONSSIMPLE  
WIRE-SAVING  
UNITSWIRE-SAVING  
SYSTEMSMEASURE-  
MENT  
SENSORSSTATIC  
CONTROL  
DEVICESLASER  
MARKERS

PLC

HUMAN  
MACHINE  
INTERFACESENERGY  
MANAGEMENT  
SOLUTIONSFA  
COMPONENTSMACHINE  
VISION  
SYSTEMSUV  
CURING  
SYSTEMSSelection  
GuideLaser  
DisplacementMagnetic  
DisplacementContact  
DisplacementCollimated  
Beam  
SensorsMetal-sheet  
Double-feed  
DetectionDigital Panel  
ControllerOther  
Products**HL-G1****HL-C2****HL-D3**

**PRECAUTIONS FOR PROPER USE**

Refer to p.1595 for general precautions and p.1593~ for information about laser beam.

- This catalog has been prepared to aid selection of appropriate products. When using the product, be sure to read the User's Manual.



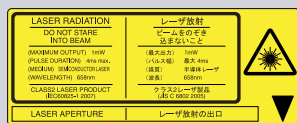
- Never use this product as a sensing device for personnel protection.
- This product is intended to detect the objects and does not have the control function to ensure safety such as accident prevention.
- When using sensing devices for personnel protection, use products that meet the laws and standards for personnel protection that apply in each region or country, such as OSHA, ANSI and IEC.



- 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.

**HL-D301B**

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

**HL-D301C**

- This product is classified as a Class 3R Laser Product in IEC / JIS standards and FDA\* regulations. Never directly look at or touch the laser beam or 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).

**Safety standards for laser beam products**

- A laser beam can harm human being's eyes, skin, etc., because of its high energy density. IEC has classified laser products according to the degree of hazard and the stipulated safety requirements. (Refer to p.1593~ for information about laser beam.)

**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. (Refer to p.1593~ for information about laser beam.)

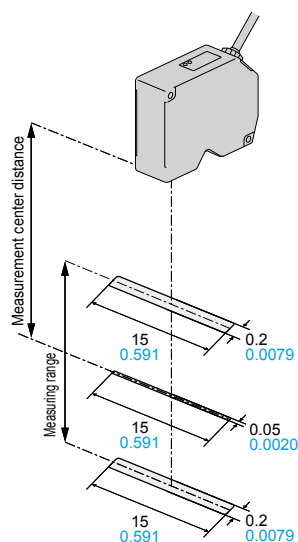
**Combining new and old versions**

- Combined operation of new and old versions of sensor heads and controllers are as follows.

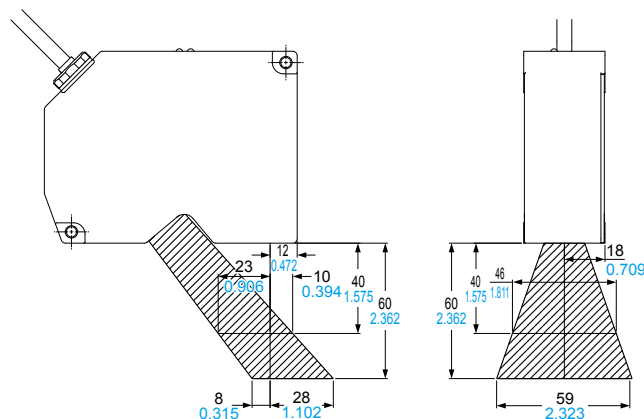
|            |           | Sensor head                                    |                                                                  |
|------------|-----------|------------------------------------------------|------------------------------------------------------------------|
|            |           | Ver. 1.10                                      | Ver. 2.00                                                        |
| Controller | Ver. 1.20 | Operation                                      | Controller operates as Ver. 1.20 (New features are unavailable.) |
|            | Ver. 2.01 | Cannot use (Note)<br>(alarm output, always ON) | Operation                                                        |

Note: While the controller may seem to be usable, the controller cannot be used as operations for existing functions are unavailable.

\* Products produced from September 2013 have been upgraded to Ver. 2.

**Beam size** (Unit: mm in)**HL-D301B, HL-D301C****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 of the sensor head in the figure below.

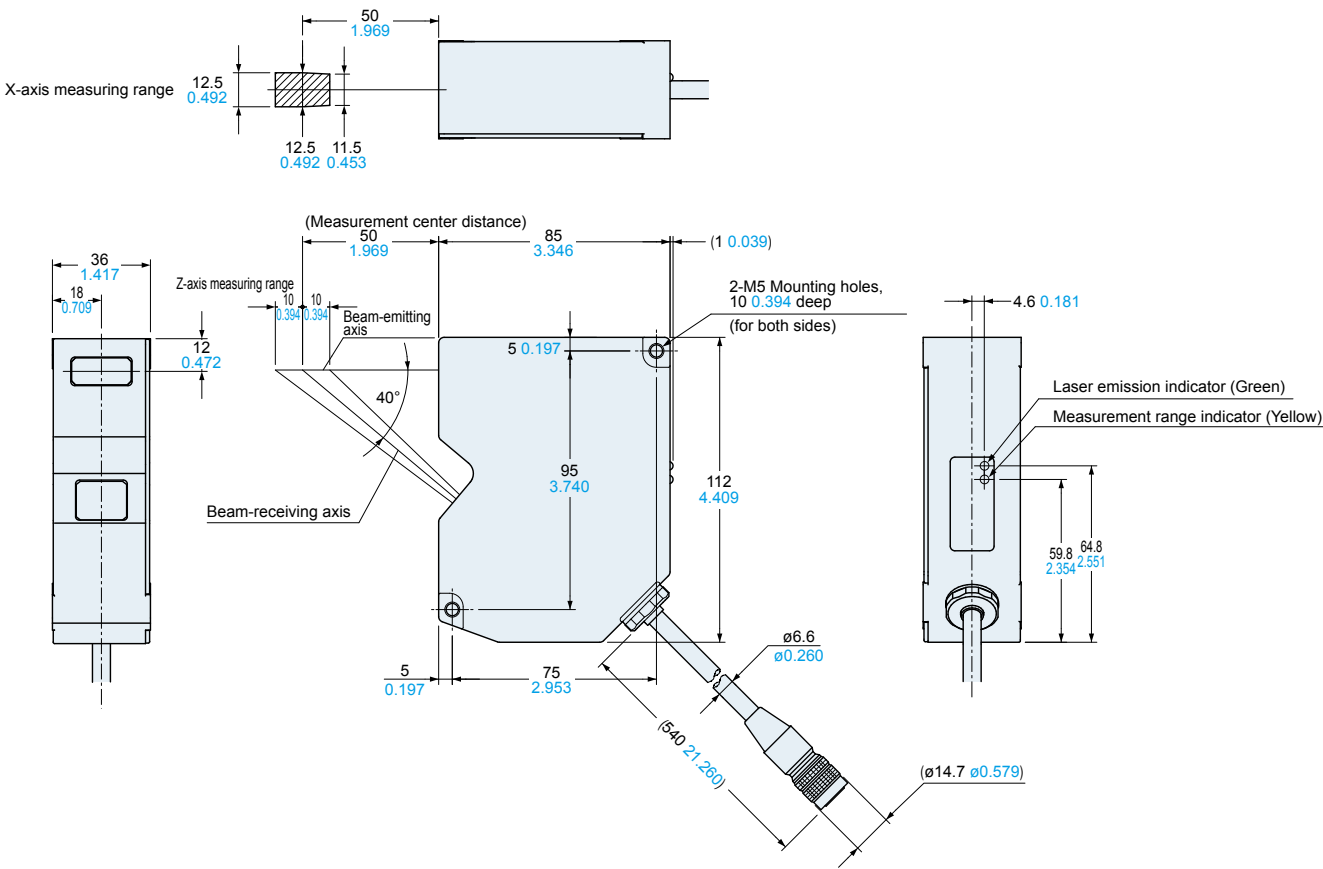
**HL-D301B, HL-D301C**

DIMENSIONS (Unit: mm in)

The CAD data can be download from our website.

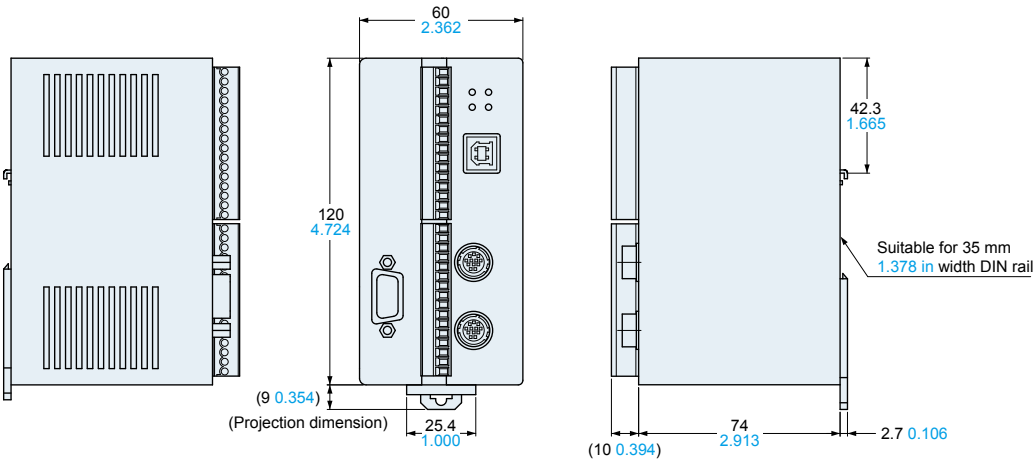
HL-D301B HL-D301C

Sensor head



HL-D3C

Controller



FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

SAFETY LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MINI SENSORS

STATIC CONTROL DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY MANAGEMENT SOLUTIONS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Laser Displacement

Magnetic Displacement

Contact Displacement

Collimated Beam Sensors

Metal-sheet Double-feed Detection

Digital Panel Controller

Other Products

HL-G1

HL-C2

HL-D3