High-precision measurement on any material or surface

ø26 mm (ø1.02")
(CL-L015)
Ultra-compact coaxial laser displacement sensors for any application in any location

High-precision measurement on all targets, with simple sensor head installation and program settings. CL-3000 Series ultra-compact coaxial laser displacement sensors address manufacturing challenges such as improving quality, preventing the shipment of defective parts and increasing production.
Cover a wide range of applications using the new standard in laser displacement sensors.

Confocal Displacement Sensor CL-3000 Series
No influence from heat or electrical noise
High-precision displacement sensors that perform to specifications

In the new multi-color confocal method displacement sensors, the light sources and other parts are all mounted in the optical unit. Since the lens is the only part inside the head, it is not impacted by heat, electrical noise or other error-producing sources not listed in the specifications. These are high accuracy displacement sensors that you can truly rely on in manufacturing environments.

Operation Indicator
Features an operation indicator with high visibility even from a distance.

Designed to be unaffected by external error sources
Structure designed with only the lens inside the head. Without electrical components, no noise or heat is generated.
The multi-color confocal method allows for performance not possible with conventional systems.

Ultra-compact and lightweight
Not only can the sensor head be installed in small and constrained spaces, it can be easily mounted on robots as well.

Effective on curved, uneven and rough surfaces
The wide angle lensing allows for high-accuracy measurement on a wide variety of target shapes, including curved or uneven surfaces, and surfaces with rough finishes.

High precision regardless of the material
Measures precisely on all targets, including transparent, mirrored, unfinished metal, ceramic and adhesive surfaces. Measures stably on targets that cast multiple reflections or absorb light.

Easy installation and high-accuracy measurement even for multi-point thickness measurements that used to be so troublesome
The adjustable fixture for thickness measurement and the optical axis alignment function make accurate set-up quick and easy, eliminating errors from mis-installation.
Ultra-compact and lightweight

With a diameter of just 8 mm (0.31"), non-contact measurement can be performed in tight spaces.

Run-out measurement of a roll coater

A cable enclosure rating that can withstand harsh manufacturing conditions

The flexible metal tubing around the cable protects the fragile fibers from tensile loads, shock, bending and lateral pressure. Cable length can be extended to a maximum of 30 m 98.4'.

6
Ultra-compact structure, with only the lens inside the head

Small form factor, at just 1/50th of the conventional size

Designed with only the lens inside the head, the sensor is reduced to 1/50th the size of conventional systems. Meeting the increasing need for miniaturization in manufacturing equipment, it offers easy installation while eliminating space restrictions.

Multiple sensors can be installed side-by-side

Due to the head size of conventional laser displacement sensors, targets needing multi-point measurement need to be moved with an XY stage, increasing equipment cost and complexity. The CL Series of ultra-compact heads can be installed in parallel even in cramped spaces, allowing users to keep equipment costs down.

Lightweight and easy to integrate with robots

At roughly 1/2 the weight of a conventional laser displacement sensor the CL series can be easily mounted on the end of a robot arm. Additionally, the lighter weight reduces the residual vibration when the robot arm is brought to a stop.
Multi-color confocal method

Sensor head

To sensor head

Transmitting
Transmits light at varying focal distances for each wavelength

Red
Short Range

Green
Medium Range

Blue
Long Range

Controller and optical unit

Receiving
Wavelengths of light that pass through the pinhole vary by refraction point. Only the light at wavelengths that best match the focal point passes through the pinhole.

Quad CMOS
A dynamic range 26 times greater than conventional units. Light is received by four high-resolution CMOSs allowing for high accuracy measurement on all kinds of materials.

To spectrometer

Light source unit
The ultra-high brightness LPD light source generates light stably at all wavelength bands.

Spectrometer
The received light is split by wavelength and focused onto the Quad CMOS.

Large area, high-accuracy measurement using an ultra-high brightness multi-color transmitter light source

Multi-color light is generated using a LPD light source that emits red and green light simultaneously. The emitted light is more stable and of higher brightness over a wider range of wavelength bands compared to typical white LEDs. This ensures there are sufficient light levels at all points in the measurement range, allowing for higher accuracy.

Typical white LED transmitter light source

Narrow wavelength band for high-brightness light emission

Low received light intensity at range edges

Multi-color transmitter light source

Wide wavelength band for high-brightness emission

Received light is sufficient at any position
High precision due to the multi-color confocal method

Larger measurement ranges and higher accuracy across the entire measurement range

Using an ultra-high brightness multi-color transmitter light source allows for a larger measurement range and higher accuracy across the entire measurement range compared with confocal displacement sensors using white LED light sources. This allows for increased stability and higher accuracy even when the measurement point changes due to target height variance or other reasons.

High-precision measurement even on transparent or mirrored targets with curved surfaces or oblique angles

The wide angle opening, combined with the coaxial multi-color confocal method, allow the CL Series to accurately measure curved or angled targets where only small amounts of light are reflected back from the target.

No dead angles on step heights or uneven surfaces

Measurements are not impacted by head installation direction or travel direction thanks to the coaxial multi-color confocal method.

Accurate measurement even on transparent and mirrored surfaces

Conventional laser displacement sensors need to be mounted at an angle to measure off of transparent or highly-reflective targets. As the height of the target changes, this mounting angle causes the measurement point on the target to change. The CL Series’ measurement is vertical for all targets, so the measurement point remains consistent.
High precision regardless of the material

High-precision measurement on any material without needing specialized heads

Measurement Image Charts

<table>
<thead>
<tr>
<th>Material</th>
<th>Conventional laser displacement sensor</th>
<th>CL Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td></td>
<td>CL Series</td>
</tr>
<tr>
<td>Black rubber</td>
<td></td>
<td>CL Series</td>
</tr>
<tr>
<td>Mirrored targets</td>
<td></td>
<td>CL Series</td>
</tr>
<tr>
<td>Glass</td>
<td></td>
<td>CL Series</td>
</tr>
<tr>
<td>Gel</td>
<td></td>
<td>CL Series</td>
</tr>
</tbody>
</table>

High-precision linearity on a wide variety of materials

Conventional laser displacement sensor (Typical)

CL-3000 Series

For CL-L015 / CL-L015N (Typical)
Stable, high-accuracy measurement even on difficult targets

Accurate measurement even on rough surfaces

The Quad Spot system directs light onto four points on the target. The light from each of these four points is received onto four separate CMOSs and measurements are determined for each point. The signal strength and reliability of each point is evaluated and the unique processing system determines the true measurement by removing the influence from irregular reflections.

Resistant against multiple reflections

Quad processing is not impacted by irregular or multi-reflection light. This makes it possible for the CL series to stably measure on reflective or angled surfaces such as those on the connector pins of IC chips.

Effective for transparent film measurement

Accurately differentiates reflected light from different surfaces to measure transparent films and coatings as thin as 15μm (0.0006”).

High-accuracy on translucent targets

Capable of high-accuracy measurement even on PCBs, translucent liquids and other targets that absorb light.
Easy installation and high-accuracy measurement, even for multi-point thickness

Easy installation with adjustable fixture and the optical-axis alignment function

With conventional laser measurement sensors, optical axis alignment, which is critical for achieving high-accuracy thickness measurement, is challenging to configure. With the CL Series, anyone can easily align the sensors using the optical-axis alignment function included in the PC software combined with the adjustable fixture for thickness measurement.
Optical-axis alignment function prevents installation errors

When taking thickness measurements from both sides of the target, major errors occur when the optical axes of both sensor heads do not align or when the target vibrates or tilts even slightly. The CL Series can align the optical axes accurately, enabling high-accuracy thickness measurement from both sides of the target.

Synchronized measurement between all sensor heads allows for measurement without positional misalignment

Synchronized measurement is possible since one controller operates all sensor heads. The accuracy of sheet thickness measurement is improved without the need for difficult PLC programming.

The sensor head design eliminates heat generation, enabling high-accuracy measurement

The heat generated by conventional laser displacement sensors causes thermal distortion of the fixture, making it susceptible to measurement errors resulting from optical axis misalignment. The CL Series is designed so that there are no electronic components generating heat inside the head. As a result there is no thermal distortion of the mounting jig. This is the ideal for high-accuracy measurement.
Accurate measurement of ultra-fine shapes
Profile Measurement Head **CL-PT010**

The profile measurement head can measure even very fine targets with its small beam spot

Capable of accurately tracing even target shapes with sharp angles.

Available encoder input

Enables measurement by synchronizing with the target's position. Uses a unitary design with a direct connection to the controller for simple synchronization.
Applications

Measurement of camera module stroke

![Image of camera module stroke measurement]
Enables high-accuracy inspection of stroke and behavior measurements on a camera module, VCM and more.

- **Ultra-high accuracy**
  Linearity from ±0.2 µm ±0.000008"
- **No heat generated**
  Measurement error eliminated
- **Effective on unfinished metal surfaces**
  Quad processing system

Measurement of coplanarity

![Image of coplanarity measurement]
Enables high-accuracy measurement of coplanarity on precision connectors and similar items.

- **Ultra-high accuracy**
  Linearity from ±0.2 µm ±0.000008"
- **No heat generated**
  Measurement error eliminated
- **No multiple reflection light**
  Raises inspection reliability

Glass thickness and flatness measurement

![Image of glass thickness and flatness measurement]
Measure glass thickness and warpage simultaneously. Effective even on tilted surfaces, enabling high-accuracy inspection.

- **Ultra-high accuracy**
  Linearity from ±0.2 µm ±0.000008"
- **No heat generated**
  Measurement error eliminated
- **No measurement misalignment**
  No errors caused by height variance

HDD motor run-out and head height measurement

![Image of HDD motor run-out and head height measurement]
All types of measurement are possible simultaneously with compact ø8 ø0.31” heads. Capable of measuring both mirrored and unfinished metal surfaces with the same sensor head.

- **Compact ø8 mm ø0.31” sensor head**
  Can be installed anywhere
- **Ultra-high accuracy**
  Linearity from ±0.2 µm ±0.000008"
- **No heat generated**
  Measurement error eliminated

Plate run-out measurement

![Image of plate run-out measurement]
Enables high accuracy run-out measurement even on targets with rough surfaces.

- **Ultra-high accuracy**
  Linearity from ±0.2 µm ±0.000008"
- **Effective on unfinished metal surfaces**
  Quad processing system
- **No heat generated**
  Measurement error eliminated

Metal plate thickness measurement

![Image of metal plate thickness measurement]
High-precision measurement of metal plate thickness.

- **Ultra-high accuracy**
  Linearity from ±0.2 µm ±0.000008"
- **No heat generated**
  Measurement error eliminated
- **Thickness measurement from both sides**
  Easy installation with an optical-axis alignment function

Meets IP67 dust and water-resistance standards allowing use in all manufacturing environments

Can be used without worries even in processing areas with frequent water spray, thanks to its high water-resistant performance.

* Measurement may become unstable due to light refraction if lens is fully covered by water or oil.
* CL-PT010 meets IP64 standard.
Easy Configuration / Data Collection

Dedicated PC Software: **CL-NavigatorN**

**Easy Configuration**

Intuitive and easy to configure menus allow for quick programming. Drop-down menus and icons make for simple operation, letting anyone configure the system easily.

**Program Switching**

Ability to switch between eight programs. It's easy to copy settings between programs or restore initial settings.

**OUT Switching**

Supports eight OUT settings. No difficult settings are required, and accurate measurement is possible with minimal settings.

**Measurement mode**

Intuitive operation allows users to perform the desired measurement with ease. No special programming skills required; just click the icons to configure settings.

**Multi-calculation function**

Measured values are calculated instantly across multiple sensor heads. Complex calculations previously carried out on a PLC or PC can now be processed simply within the controller.

**Warpage Measurement**
Calculates variance between reference point and all measurement points.

**Flatness Measurement**
Calculates variance between MIN and MAX values within measurement points.

**Step Measurement**
Calculates variance between all measurement points.

**Average Height Measurement**
Calculates average height of a surface based on the measurements from multiple points.
Trend Graph

Measurement values are displayed in real-time, in easy-to-understand format. Useful for initial startup at work sites. The display can be easily configured for optimal display for all applications.

Data Storage

The controller's internal memory can store a maximum of 1.6 million measured values. The data can be loaded to a PC via USB communication.

Analysis with CL-NavigatorN

Features a full array of functions, including numerical readings via cursor, as well as zoom in, zoom out and overlap functions.

Analysis with Excel

Data collected in CL-NavigatorN can be loaded into Excel by saving in CSV format.
Product Line-Up & Options

Device Configuration List

Sensor Heads
- Compact ø8 ø0.31" Model: CL-L007/CL-P007
- Ultra High-Accuracy Model: CL-L015/CL-P015
- High-Accuracy Model: CL-L030/CL-P030
- Mid-Range Model: CL-L070/CL-P070
- Profile Measurement Model: CL-PT010

- Position
- Thickness
- Height
- Run-out

Linewidth
- CL-L007: 3.5 µm (0.000138")
- CL-L015: 0.033 mm (0.0013")
- CL-L030: 0.015 mm (0.0006")
- CL-L070: 0.007 mm (0.0003")

- SPOT type
- CL-L007: 750 µm (0.029")
- CL-L015: 300 µm (0.012")
- CL-L030: 150 µm (0.006")
- CL-L070: 75 µm (0.003")

- CL-P007: 50 µm (0.002")
- CL-P015: 25 µm (0.001")
- CL-P030: 12.5 µm (0.000")
- CL-P070: 6.25 µm (0.000")
- CL-PT010: 3.5 µm (0.000138")

- CL-L007: ±0.2 µm (±0.00008")
- CL-L015: ±0.05 µm (±0.00002")
- CL-L030: ±0.05 µm (±0.00002")
- CL-L070: ±0.01 µm (±0.000004")

- CL-P007: ±0.2 µm (±0.00008")
- CL-P015: ±0.1 µm (±0.00004")
- CL-P030: ±0.05 µm (±0.00002")
- CL-P070: ±0.01 µm (±0.000004")

- CL-PT010: ±0.1 µm (±0.00004")

<table>
<thead>
<tr>
<th>Sensor heads</th>
<th>Spot type</th>
<th>Quad type</th>
<th>CL-L007</th>
<th>CL-L015</th>
<th>CL-L030</th>
<th>CL-L070</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL-L007/CL-P007</td>
<td>Spot type</td>
<td>Quad type</td>
<td>ø5.5 mm</td>
<td>ø13.7 mm</td>
<td>ø16.3 mm</td>
<td>ø26.3 mm</td>
</tr>
<tr>
<td>CL-L015/CL-P015</td>
<td>Spot type</td>
<td>Quad type</td>
<td>ø7 mm</td>
<td>ø15 mm</td>
<td>ø16.3 mm</td>
<td>ø26.3 mm</td>
</tr>
<tr>
<td>CL-L030/CL-P030</td>
<td>Spot type</td>
<td>Quad type</td>
<td>ø8.5 mm</td>
<td>ø10.9 mm</td>
<td>ø18.3 mm</td>
<td>ø28.3 mm</td>
</tr>
<tr>
<td>CL-L070/CL-P070</td>
<td>Spot type</td>
<td>Quad type</td>
<td>ø10 mm</td>
<td>ø15 mm</td>
<td>ø18.3 mm</td>
<td>ø28.3 mm</td>
</tr>
</tbody>
</table>

Head fixtures
- For CL-L015/030/070: OP-88283
- For CL-L007: OP-88353/OP-88354/OP-88355
- For CL-PT010: OP-88289

Adjustable fixture for thickness measurement

Display panel
- CL-D500
System Configuration

Sensor Head Connections: With Two Units

- PC
- Ethernet, USB
- PLC
- I/O, RS-232C, EtherNet/IP™, Ethernet
- Programmable Encoder
- Display Panel
- Controller CL-3000
- Encoder unit CL-E100
- Sensors, Other
- Head extension cable (5, 10, 30 m) (16.4', 32.8', 98.4') (max 30 m 98.4')
- Display Panel Cable (3 m, 10 m) (9.8', 32.8')
- Optical unit CL-L(P)xxxN
- Optical unit CL-L(P)xxxN
- Sensor head

Sensor Head Connections: With Six Units

- PC
- Ethernet, USB
- PLC
- I/O, RS-232C, EtherNet/IP™, Ethernet
- Programmable Encoder
- Display Panel
- Controller CL-3000
- Encoder unit CL-E100
- Sensors, Other
- Head extension cable (5, 10, 30 m) (16.4', 32.8', 98.4') (max 30 m 98.4')
- Display Panel Cable (3 m, 10 m) (9.8', 32.8')
- Optical unit CL-L(P)xxxN
- Optical unit CL-L(P)xxxN
- Expansion cable CL-AC1/CL-AC2
- Relay unit CL-H200
- Optical unit CL-L(P)xxxN
- Expansion unit CL-H100
- Optical unit CL-L(P)xxxN
- Optical unit CL-L(P)xxxN
- Sensor head
- Expansion cable CL-AC1/CL-AC2
### Specifications

#### Quad type

**Sensor Heads and Optical Units**

<table>
<thead>
<tr>
<th>Model</th>
<th>Head</th>
<th>Optical unit</th>
<th>CL-L007</th>
<th>CL-L015</th>
<th>CL-L030</th>
<th>CL-L070</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Reference distance</td>
<td>7 mm 0.28&quot;</td>
<td>15 mm 0.59&quot;</td>
<td>30 mm 1.18&quot;</td>
<td>70 mm 2.76&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reference measurement range</td>
<td>±1.5 mm ±0.06&quot;</td>
<td>±1.3 mm ±0.05&quot;</td>
<td>±3.7 mm ±0.15&quot;</td>
<td>±10 mm ±0.39&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Linearity</td>
<td>±2.1 µm ±0.000083&quot;</td>
<td>±0.49 µm ±0.00019&quot;</td>
<td>±0.94 µm ±0.000037&quot;</td>
<td>±2.2 µm ±0.000097&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High precision measurement range</td>
<td>±0.5 mm ±0.02&quot;</td>
<td>±0.5 mm ±0.02&quot;</td>
<td>±0.10 mm ±0.04&quot;</td>
<td>±0.30 mm ±0.12&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Linearity</td>
<td>±0.91 µm ±0.000036&quot;</td>
<td>±0.41 µm ±0.000016&quot;</td>
<td>±0.72 µm ±0.000028&quot;</td>
<td>±2.0 µm ±0.000079&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resolution</td>
<td>±0.25 µm ±0.00010&quot;</td>
<td>±0.25 µm ±0.00010&quot;</td>
<td>±0.25 µm ±0.00010&quot;</td>
<td>±0.25 µm ±0.00010&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spot diameter</td>
<td>±750 µm ±0.0259&quot;</td>
<td>±300 µm ±0.0118&quot;</td>
<td>±500 µm ±0.0157&quot;</td>
<td>±600 µm ±0.0236&quot;</td>
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<tr>
<td>Laser class</td>
<td>Optical unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sampling cycle</td>
<td></td>
<td></td>
<td>100/200/500/1000 µs (Adjustable 4-stage)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental resistance</td>
<td>Enclosure rating</td>
<td>Head</td>
<td>IP67 (IEC60529)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ambient operating illuminance</td>
<td></td>
<td>Target surface illuminance 30,000 lux (incandescent lamp)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Operating ambient temperature</td>
<td></td>
<td>0 to 50°C 32 to 122°F</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>Operating ambient humidity</td>
<td></td>
<td>20% RH to 85% RH (no condensation)</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Vibration resistance</td>
<td>Head</td>
<td>10 to 57 Hz, double amplitude 1.5 mm 0.06&quot;; 2 hours each for X, Y, and Z axes</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Optical unit</td>
<td></td>
<td>10 to 57 Hz, double amplitude 0.3 mm 0.01&quot;; 2 hours each for X, Y, and Z axes</td>
<td></td>
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<td></td>
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<tr>
<td>Shock resistance</td>
<td></td>
<td></td>
<td>15G 6 ms</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Temperature characteristic</td>
<td>Head</td>
<td></td>
<td>0.0005% of F.S. / °C</td>
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<tr>
<td></td>
<td>Optical unit</td>
<td></td>
<td>0.015% of F.S. / °C</td>
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<tr>
<td>Material</td>
<td>Head</td>
<td>SUS</td>
<td></td>
<td>Front: SUS Rear: Aluminum</td>
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<tr>
<td>Optical unit</td>
<td>Polycarbonate</td>
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<tr>
<td>Weight</td>
<td>Head</td>
<td>Approx. 140 g</td>
<td>Approx. 180 g</td>
<td>Approx. 200 g</td>
<td>Approx. 280 g</td>
<td></td>
</tr>
<tr>
<td>Optical unit</td>
<td>Approx. 1600 g</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

*1 Sensor head and optical unit are a matched pair. Not cross compatible.  *2 Value measured in displacement mode with KEYENCE reference workpiece (mirrored surface).

**Focused spot type**

<table>
<thead>
<tr>
<th>Model</th>
<th>Head</th>
<th>CL-P007</th>
<th>CL-P015</th>
<th>CL-P030</th>
<th>CL-P070</th>
<th>CL-PT010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Reference distance</td>
<td>7 mm 0.28&quot;</td>
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<td>70 mm 2.76&quot;</td>
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<tr>
<td></td>
<td></td>
<td>Reference measurement range</td>
<td>±1.5 mm ±0.06&quot;</td>
<td>±1.3 mm ±0.05&quot;</td>
<td>±3.7 mm ±0.15&quot;</td>
<td>±10 mm ±0.39&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Linearity</td>
<td>±0.96 µm ±0.000038&quot;</td>
<td>±0.49 µm ±0.000019&quot;</td>
<td>±0.94 µm ±0.000037&quot;</td>
<td>±2.2 µm ±0.000087&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High precision measurement range</td>
<td>±0.5 mm ±0.02&quot;</td>
<td>±0.5 mm ±0.02&quot;</td>
<td>±1.0 mm ±0.04&quot;</td>
<td>±3.0 mm ±0.12&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Linearity</td>
<td>±0.55 µm ±0.000022&quot;</td>
<td>±0.41 µm ±0.000016&quot;</td>
<td>±0.72 µm ±0.000028&quot;</td>
<td>±2.0 µm ±0.000079&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resolution</td>
<td>±0.25 µm ±0.00010&quot;</td>
<td>±0.25 µm ±0.00010&quot;</td>
<td>±0.38 µm ±0.00015&quot;</td>
<td>±0.50 µm ±0.00020&quot;</td>
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<td></td>
<td>Spot diameter</td>
<td>±50 µm ±0.00020&quot;</td>
<td>±25 µm ±0.00010&quot;</td>
<td>±38 µm ±0.00015&quot;</td>
<td>±50 µm ±0.00020&quot;</td>
</tr>
<tr>
<td>Laser class</td>
<td>Optical unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Ambient operating illuminance</td>
<td></td>
<td>Target surface illuminance 30,000 lux (incandescent lamp)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operating ambient temperature</td>
<td></td>
<td>0 to 50°C 32 to 122°F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operating ambient humidity</td>
<td></td>
<td>20% RH to 85% RH (no condensation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vibration resistance</td>
<td>Head</td>
<td>10 to 57 Hz, double amplitude 1.5 mm 0.06&quot;; 2 hours each for X, Y, and Z axes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Optical unit</td>
<td></td>
<td>10 to 57 Hz, double amplitude 0.3 mm 0.01&quot;; 2 hours each for X, Y, and Z axes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock resistance</td>
<td></td>
<td></td>
<td>15G 6 ms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature characteristic</td>
<td>Head</td>
<td></td>
<td>0.0005% of F.S. / °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Optical unit</td>
<td></td>
<td>0.1% of F.S. / °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Head</td>
<td>SUS</td>
<td></td>
<td>Front: SUS Rear: Aluminum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optical unit</td>
<td>Polycarbonate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Head</td>
<td>Approx. 140 g</td>
<td>Approx. 180 g</td>
<td>Approx. 200 g</td>
<td>Approx. 280 g</td>
<td>Approx. 1100 g</td>
</tr>
<tr>
<td>Optical unit</td>
<td>Approx. 1600 g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 Sensor head and optical unit are a matched pair. Not cross compatible.  *2 Value measured in displacement mode with KEYENCE reference workpiece (mirrored surface).

**Expansion cable**

<table>
<thead>
<tr>
<th>Model</th>
<th>CL-AC1</th>
<th>CL-AC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>1 m 3.3'</td>
<td>2 m 6.6'</td>
</tr>
<tr>
<td>Weight</td>
<td>200 g</td>
<td>400 g</td>
</tr>
</tbody>
</table>

**Sensor head extension cable**

<table>
<thead>
<tr>
<th>Model</th>
<th>CL-CS</th>
<th>CL-C10</th>
<th>CL-C30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>5 m 16.4'</td>
<td>10 m 32.8'</td>
<td>30 m 98.4'</td>
</tr>
<tr>
<td>Weight</td>
<td>450 g</td>
<td>850 g</td>
<td>2500 g</td>
</tr>
</tbody>
</table>
### Controller

<table>
<thead>
<tr>
<th>Model</th>
<th>CL-3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of optical unit connections</td>
<td>Controller only: 2 units; using expansion units/relay units: 6 units</td>
</tr>
</tbody>
</table>

#### Interface

<table>
<thead>
<tr>
<th>Interface</th>
<th>EtherNet/IP™</th>
<th>Supports cyclic communication and message communication; RPI: 1 to 10,000 ms (0.5 ms units) Maximum number of connections: 8, complies with Version.CT14 conformance test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ethernet</td>
<td>Allows for measurement data output and control I/O via no-protocol command communication with PCs and PLCs 100Base-TX, capable of communication with CL-NavigatorN</td>
</tr>
<tr>
<td></td>
<td>USB</td>
<td>Conforms to USB 2.0 HighSpeed, capable of communication with CL-NavigatorN</td>
</tr>
<tr>
<td></td>
<td>RS-232C</td>
<td>Allows for measurement data output and control I/O via no-protocol command communication with PCs and PLCs Baud rate: 9600 to 115,200 bps, data length: 8 bit, stop bit: 1 bit, parity: none/odd numbers/odd numbers</td>
</tr>
<tr>
<td>Terminal (IN)</td>
<td>13 (supports function switching via software)</td>
<td></td>
</tr>
<tr>
<td>Terminal (OUT)</td>
<td>11* (supports function switching via software)</td>
<td></td>
</tr>
</tbody>
</table>

#### Ratings

<table>
<thead>
<tr>
<th>Power voltage</th>
<th>24 VDC ±10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum current consumption</td>
<td>With 1 optical unit connected: 0.86 A, with 4 optical units connected: 3.3 A, with 6 optical units connected: 4.5 A</td>
</tr>
</tbody>
</table>

#### Environmental resistance

- Operating ambient temperature: 0 to 50°C 32 to 122°F
- Operating ambient humidity: 20% RH to 85% RH (no condensation)
- Vibration resistance: 10 to 57 Hz, double amplitude 0.5 mm 0.02"; 2 hours each for X, Y, and Z axes

#### Monitor/Setting support software

- CL-NavigatorN

#### Weight

- Approx. 600 g

*1 Positive common connection is supported for NPN input devices, and negative common connection for PNP input devices.

### Expansion Unit and Relay Unit

<table>
<thead>
<tr>
<th>Model</th>
<th>CL-H100</th>
<th>CL-H200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of optical unit connections</td>
<td>Supports two CL-H200 expansion units</td>
<td>Supports two optical unit connections</td>
</tr>
</tbody>
</table>

#### Environmental resistance

- Operating ambient temperature: 0 to 50°C 32 to 122°F
- Operating ambient humidity: 20% RH to 85% RH (no condensation)

#### Weight

- Approx. 300 g

### Display panel

<table>
<thead>
<tr>
<th>Model</th>
<th>CL-D500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum display unit</td>
<td>0.001 μm</td>
</tr>
<tr>
<td>Display range</td>
<td>±999.999 μm to ±9999.99 mm ±0.0394&quot; to ±393.70&quot;</td>
</tr>
<tr>
<td>Display cycle</td>
<td>Approximately 10 times/second</td>
</tr>
</tbody>
</table>

#### Environmental resistance

- Operating ambient temperature: 0 to 50°C 32 to 122°F
- Operating ambient humidity: 20% RH to 85% RH (no condensation)

#### Weight

- Approx. 100 g

### Encoder Unit

<table>
<thead>
<tr>
<th>Model</th>
<th>CL-E100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of encoder axes</td>
<td>Incremental method (A/B/Z phase)</td>
</tr>
<tr>
<td>Minimum encoder input time</td>
<td>100 ns to 20 μs</td>
</tr>
<tr>
<td>Maximum current consumption</td>
<td>0.18 A</td>
</tr>
<tr>
<td>Service power supply</td>
<td>5 VDC ±10%, maximum power supply 200 mA</td>
</tr>
<tr>
<td>Input terminal</td>
<td>Compatible with NPN/PNP open collector output (5 V/12 V/24 V). Compatible with line driver output</td>
</tr>
</tbody>
</table>

#### Environmental resistance

- Operating ambient temperature: 0 to 50°C 32 to 122°F
- Operating ambient humidity: 20% RH to 85% RH (no condensation)

#### Weight

- Approx. 300 g

### CL-NavigatorN OS environment

<table>
<thead>
<tr>
<th>Item</th>
<th>Required Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supported OS</td>
<td>Windows® 10 / Windows® 8.1 / Windows® 7*</td>
</tr>
<tr>
<td>CPU</td>
<td>Celeron Dualcore 1.7 GHz or higher</td>
</tr>
<tr>
<td>Memory capacity</td>
<td>4 GB or more</td>
</tr>
<tr>
<td>Required free space on hard disk</td>
<td>1 GB or more</td>
</tr>
<tr>
<td>Display resolution</td>
<td>XGA (1024x768 pixels) or higher</td>
</tr>
</tbody>
</table>

*1 Home, Pro and Enterprise Editions are supported. *2 Core, Pro and Enterprise Editions are supported. *3 Home Premium, Professional and Ultimate Editions are supported. Windows® 5 and Excel are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.