Ultra High-Accuracy Laser Displacement Sensor

CDX series

New models added

World’s No. 1 Linearity

OPTEX FA CO., LTD.
A fusion of ultra high-accuracy and ease-of-use

We have accumulated decades of know-how since our first laser displacement sensor was introduced to market, all which have been utilized to achieve the World’s No. 1 measurement accuracy. We arrived at a simple configuration by examining various user needs and are able to provide operability by way of a built-in Web server, a new concept for displacement sensors. Featuring a fusion of ultra high-accuracy and ease-of-use, these laser displacement sensors feature an extremely high level of perfection.

In order to enable ultra high-accuracy measurements to be performed, a specially-designed optical system and rigid body with an independent base unit structure have been adopted. Featuring advanced levels of both accuracy and high speed, causes of errors have been successfully shut out.

Linearity has been successfully restrained through use of a newly-developed original measurement algorithm. By performing a thorough review of our algorithm, ultra high-accuracy measurements have been achieved.

Featuring unprecedented linearity thanks to an advanced optical system and highly-rigid body structure.

Advanced Opto-technology &
High-rigidity design

New algorithm

Light receiving element

ATMOS

Receiving part

Neo LD lens

A CDX specially-designed lens featuring a 4-group-4-element structure. High linearity has been realized thanks to a new optical design with low-aberration.

Emitting part

Cylindrical lens

Employed for wide spot type.

High rigidity is ensured by providing an independent base unit only to the optical system.

Highly-rigid body structure

*Example with the diffuse-reflective type

Ultra High-Accuracy Laser Displacement Sensor

* For triangulation method diffuse-reflective type displacement sensors.

Optex FA examination performed November 2016.

0.015 F.S.%

World’s No. 1 Linearity

Series

CDX

Neo LD lens

The light receiving lens has been customized to enable light reflected from the measurement target to be focused with high accuracy on the light receiving element. Error-causing spot distortions that arise due to lens aberration have been decreased significantly.

Neo LD: Neo Low Dispersion

Linearity comparison

* Workpiece angle: +/-0°, diffuse mode.

Refer to P. 10 for measurement conditions.

Featuring the World’s No. 1 linearity that easily satisfies the [+/-0.015% F.S.] catalog specification, CDX series models realize measurements with significantly higher levels of accuracy than the conventional model.

Linearity (%FS)

<table>
<thead>
<tr>
<th></th>
<th>Conventional model</th>
<th>CDX-W85A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>-0.03</td>
<td>-0.02</td>
</tr>
<tr>
<td>70</td>
<td>-0.02</td>
<td>-0.01</td>
</tr>
<tr>
<td>75</td>
<td>-0.01</td>
<td>0</td>
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<tr>
<td>80</td>
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<td>90</td>
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<tr>
<td>95</td>
<td>0.04</td>
<td>0.04</td>
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<tr>
<td>100</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>105</td>
<td>0.06</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Distance (mm)

+/-
A fusion of ultra high-accuracy and ease-of-use

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Featuring a fusion of ultra high-accuracy and ease-of-use, these laser displacement sensors feature an extremely high level of perfection.

In order to enable ultra high-accuracy measurements to be performed, a specially-designed optical system and rigid body with an independent base unit structure have been adopted. Featuring advanced levels of both accuracy and high speed, causes of errors have been successfully shut out.

Featuring unprecedented linearity thanks to an advanced optical system and highly-rigid body

A CDX specially-designed lens featuring a 4-group-4-element structure. High linearity has been realized thanks to a new optical design with low-aberration.

Light receiving lens has been customized to enable light reflected from the measurement target to be focused with high accuracy on the light receiving element. Error-causing spot distortions that arise due to lens aberration have been decreased significantly.

Neo LD: Neo Low Dispersion

For triangulation method diffuse-reflective type displacement sensors.

Optex FA examination performed November 2016.

Ultra High-Accuracy Laser Displacement Sensor

CDX Series

World’s No. 1 Linearity

+/-0.015% F.S.

* Workpiece angle: +/-0°, diffuse mode.

Refer to P. 10 for measurement conditions.

New algorithm

Linearity has been successfully restrained through use of a newly-developed original measurement algorithm. By performing a thorough review of our algorithm, ultra high-accuracy measurements have been achieved.
Newly Developed Image Sensor for Highly Accurate, High-speed, and Stable Measurements

Newly developed image sensor: ATMOS

In order to achieve the World’s No. 1 Linearity, ATMOS image sensors were newly developed with a light receiving element featuring a CDX specialized design. By applying the latest technology, accuracy has been increased by 3.3 times* that of the conventional model.

ATMOS: Auto Tuning cMOS

*Comparison between the CDX-W85 and conventional equivalent model

Feedback-free high-speed shutter

With conventional image sensors, feedback control to the shutter could not keep up with sudden changes in receiving light levels caused by changes in workpiece colors, momentary inabilities to perform measurements would be caused, resulting in response delays. With newly developed ATMOS image sensors, measurements can be performed without the need for feedback control thanks to an industry-first algorithm. Because momentary inabilities to perform measurements and response delays have been eliminated, real-time measurements are now possible.

Stable measurements even with Class 1 lasers

With ATMOS image sensors, stable measurements are possible even with a Class 1 laser thanks to their high level of sensitivity. Even when measuring black workpieces such as tires, highly accurate measurements can be performed without using a high output laser. Stable measurement of black workpieces is possible while ensuring the safety of worker’s eyes.

High-speed measurement: Max. sampling period of 12.5 μs (Measuring frequency: 80 kHz)

With highly sensitive ATMOS image sensors, ultra high-speed shutter speeds are possible as the required exposure time is minimized. Because sampling periods have been reduced to 12.5 μs, 1/8th of the conventional model, these sensors can be utilized for application that require ultra high-speed measurements.

*Laser class 1: Designed to be inherently safe. Light is collected optically, ensuring a safe level even when the laser is emitted to the human body (eyes and skin).

*With a sampling period of 12.5 μs, the measurement range will be limited. For details, refer to P. 10.
LASER RADIATION
AVOID DIRECT EYE EXPOSURE
CLASS 3R LASER PRODUCT

Laser radiation is emitted from this aperture.

CLASS 3R LASER PRODUCT (IEC 60825-1:2001)
MAXIMUM OUTPUT: 5mW
PULSE DURATION: 6.4ms max.
WAVE LENGTH: 658nm
MEDIUM: SEMICONDUCTOR LASER

Automatic shutter release (light reception ends) when receiving light level saturation occurs means no feedback time

Appropriate receiving light level after one sampling period is as follows:

Black: Appropriate
Metal: Saturated

Saturation level

*With a sampling period of 12.5 μs, the measurement range will be limited. For details, refer to P. 10.

Conventional model CDX

12.5 μs

100 μs

Sampling period 1

8

10 μs

Large glass height measurement

High-speed measurement: Max. sampling period of 12.5 μs (Measuring frequency: 80 kHz)

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Applications

Shape measurement of cam shafts

Shape measurement of tires

Deflection measurement of large diameter drills

Flatness measurement of transmission parts

Height inspection of smartphone frames (specular reflection type)

Warpage measurement of glass substrates (specular reflection type)

Newly Developed Image Sensor for Highly Accurate, High-speed, and Stable Measurements

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ATMOS: Auto Tuning cMOS

*Comparison between the CDX-W85 and conventional equivalent model

NEW

Height inspection of smartphone frames (specular reflection type)

Flatness measurement of transmission parts

Shape measurement of tires

Deflection measurement of large diameter drills
Direct Network Connections are Possible without Use of a Controller

NEW

Direct Ethernet connection

Because an Ethernet serial interface is built-in to the sensor head, connection to a network is possible without use of a controller. Not only can the cost of a controller be eliminated, but any worries about securing space for controller installation can also be forgotten.

- No controller required. Simply add new sensors to the hub.

- Operation is possible by connecting directly to a PC LAN port

- Of course, connection to a PLC Ethernet port is also possible

When Analog/Control Output is Necessary

Displacement sensor amplifier unit CDA-M

The CDA-M amplifier unit is equipped with an organic EL display on which both Japanese characters and English lettering can be viewed with clarity. Control can be performed using either analog or control outputs, while thickness and height difference measurements can be performed using two sensor heads.

<table>
<thead>
<tr>
<th>Model</th>
<th>CDA-M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor head</td>
<td></td>
</tr>
<tr>
<td>(CDX series)</td>
<td>Max. 2 units</td>
</tr>
<tr>
<td>No. of connectable units</td>
<td>Amplifier side: M8, 4-pin connector</td>
</tr>
<tr>
<td>Connection type</td>
<td></td>
</tr>
<tr>
<td>Rating</td>
<td>Supply voltage: 12 to 24 VDC, +/-10%, including 10% ripple (p-p)</td>
</tr>
<tr>
<td>Current consumption</td>
<td>100 mA or less (at 12 V)</td>
</tr>
<tr>
<td>Display</td>
<td>Dot matrix display</td>
</tr>
<tr>
<td>Indicators</td>
<td>Power display: Red/Green, Output 1 to 3 display: Orange (Only output 1 display available)</td>
</tr>
<tr>
<td>Analog current output</td>
<td>4 to 20 mA/F.S., Load impedance 300 Ω or less</td>
</tr>
<tr>
<td>Control output</td>
<td>NPN/PNP open collector (selectable by setting) 3 outputs (Only output 1 available) max. 100 mA / 30 VDC, Residual voltage: 1.8 V or less</td>
</tr>
<tr>
<td>External input</td>
<td>2 inputs (Only 1 input available)</td>
</tr>
<tr>
<td>Connection type</td>
<td>Cable length: 2 m (diameter 6.8 mm)</td>
</tr>
<tr>
<td>Ambient temperature/humidity</td>
<td>-20 to +50°C / 35 to 85% RH (no freezing or condensation)</td>
</tr>
<tr>
<td>Storage temperature/humidity</td>
<td>-20 to +60°C / 35 to 85% RH (no freezing or condensation)</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 55 Hz; double amplitude 1.5 mm; 2 hours in each of the X, Y, and Z directions</td>
</tr>
<tr>
<td>Shock resistance</td>
<td>Approx. 50 G (500 mV/s²), 3 times in each of the X, Y, and Z directions</td>
</tr>
<tr>
<td>Protection circuit</td>
<td>Reverse connection protection</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IEC standard, IP50</td>
</tr>
<tr>
<td>Material</td>
<td>Polycarbonate</td>
</tr>
<tr>
<td>Weight</td>
<td>170 g</td>
</tr>
</tbody>
</table>

- If using an amplifier unit, some settings for the CDX series cannot be confirmed or changed. For details, see the CDX series user’s manual.
- On the CDX series, CH1 is the only output that can be set and used with an amplifier unit.
- The CDX series does not support CC-Link communication.
- The resolution of the analog outputs (shown below) will be lower than that when using Ethernet communication.
Equipped with a Web Server

Setup software is unnecessary

The CDX series features a new Web server. Using a web browser on the computer connected to the same network, browsing and controlling measured values and setup contents are possible. Use is possible without need for a dedicated computer software.

Supported browsers
Internet Explorer Ver.11 and above, Google Chrome 49 and above

Main functions

- Distance monitor
  Simultaneous display for 4 CHs

- Storage
  No data logger required

- Light distribution
  Masking of unnecessary areas

With the CDX series, judgment settings can be configured for channels 1 to 4. The measured values for each channel can be displayed at once on a graph, allowing for simple comparison of measurement data. Moreover, monitoring of speed and thickness of transparent objects in addition to displacement is possible simultaneously.

Measured values for up to 100,000 points can be stored. By operating using a browser, data can be viewed and CSV files can be downloaded.

By monitoring receiving light waveforms, receiving light levels and mounting angle can be confirmed. Thanks to a newly developed mask function, even if there are unnecessary objects or ambient light in the measurement range, those can be masked to enable measurements to be performed free of influence.

Other functions

- Measurement setting  ■  I/O setting  ■  Device setting  ■  Communication setting  ■  Product information etc.

* Internet Explorer and the Internet Explorer logo are trademarks or registered trademarks of Microsoft Corporation in the United States and other countries.
* Google Chrome and the Google Chrome logo are trademarks or registered trademarks of Google Inc. in the United States and other countries.
Regarding applicability of Export Trade Control Order enacted by Japanese government for the CDX series

CDX series sensor heads are products that are subject to “Export Trade Control Order Appended Table 1 2-(12) Measurement devices (including machine tools with a measurement function)”. Please inquire for details.

Additional information
There is no differentiation for the applicability of CDA series amplifier units and the resolution outputted from amplifiers connected to sensor heads is regulated as shown in the table to the left even if the average number of cycles is increased.

<table>
<thead>
<tr>
<th>Model</th>
<th>Measurement mode</th>
<th>Resolution</th>
<th>Additional</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDX-L15</td>
<td>Specular mode</td>
<td>0.01 μm</td>
<td></td>
</tr>
<tr>
<td>CDX-LW15</td>
<td>Specular mode</td>
<td>0.01 μm</td>
<td></td>
</tr>
<tr>
<td>CDX-30</td>
<td>Diffuse mode</td>
<td>0.05 μm</td>
<td></td>
</tr>
<tr>
<td>CDX-W30</td>
<td>Diffuse mode</td>
<td>0.05 μm</td>
<td></td>
</tr>
<tr>
<td>CDX-85</td>
<td>Diffuse mode</td>
<td>0.1 μm</td>
<td></td>
</tr>
<tr>
<td>CDX-W85</td>
<td>Diffuse mode</td>
<td>0.1 μm</td>
<td></td>
</tr>
<tr>
<td>CDX-150</td>
<td>Diffuse mode</td>
<td>0.1 μm</td>
<td></td>
</tr>
<tr>
<td>CDX-W150</td>
<td>Diffuse mode</td>
<td>0.2 μm</td>
<td></td>
</tr>
</tbody>
</table>
Options/Accessories

### Connectors/Connector Cables

<table>
<thead>
<tr>
<th>Type</th>
<th>Specifications</th>
<th>Cable length</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor head extension cable</td>
<td>Dedicated cable for extension between the sensor head and branch connector. Up to two extension cables can be connected and extended. Robot cable specifications. • Sensor side: M12, 8-pin socket • Branch connector side: M12, 8-pin plug</td>
<td>2 m</td>
<td>DSC-1208-G02MA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 m</td>
<td>DSC-1208-G05MA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 m</td>
<td>DSC-1208-G10MA</td>
</tr>
<tr>
<td>Ethernet cable</td>
<td>Dedicated cable for connecting from the branch connectors to the Ethernet port. Robot cable specifications. • Branch connector side: M12, 4-pin socket • Host side: RJ45 plug</td>
<td>2 m</td>
<td>SSL-2J04-G02ME-R</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 m</td>
<td>SSL-2J04-G05ME-R</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 m</td>
<td>SSL-2J04-G10ME-R</td>
</tr>
<tr>
<td>Power supply/external input cable</td>
<td>Power supply/external input cable for connecting to branch connector. • Branch connector side: M12, 4-pin socket • Power supply/external device side: discrete wire</td>
<td>2 m</td>
<td>DOL-1204-G02M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 m</td>
<td>DOL-1204-G05M</td>
</tr>
<tr>
<td>Branch connector</td>
<td>Branch connector for connecting sensor heads and various cables. Included with sensor head.</td>
<td>-</td>
<td>SYL-1208-G0M</td>
</tr>
</tbody>
</table>

### Amplifier unit, connector cables for amplifier unit

<table>
<thead>
<tr>
<th>Type</th>
<th>Specifications</th>
<th>Cable length</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amplifier unit</td>
<td>An amplifier unit to which up to two sensor heads can be connected. Control can be performed using either analog or control outputs, while thickness and height difference measurements can be performed using two sensor heads.</td>
<td>2 m</td>
<td>CDA-M</td>
</tr>
<tr>
<td>Sensor/amplifier connection cable</td>
<td>Connector cable for connecting branch connectors and amplifier units. • Branch connector side: M12, 5-pin socket • Amplifier unit side: M8, 4-pin plug</td>
<td>2 m</td>
<td>DSL-1204-G02M</td>
</tr>
<tr>
<td>Sensor-to-amplifier extension cable</td>
<td>Extension cable for connection to DSL-1204-G02M. Robot cable specifications. • Sensor/amplifier connection cable side: M8, 4-pin socket • Amplifier unit side: M8, 4-pin plug</td>
<td>2 m</td>
<td>DSL-0804-G02M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 m</td>
<td>DSL-0804-G05M</td>
</tr>
</tbody>
</table>

- Please ensure that the overall cable length when an amplifier unit is used is within 10 m (sensor head extension cable + sensor/amplifier connection cable + sensor-to-amplifier extension cable).
- If using an amplifier unit, some settings for the CDX series cannot be confirmed or changed. For details, see the CDX series user's manual.
- On the CDX series, CH1 is the only output that can be set and used with an amplifier unit.
- The CDX series does not support CC-Link communication.
- The resolution of the analog outputs (shown below) will be lower than that when using Ethernet communication.

<table>
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<tr>
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<td>Dedicated cable for extension between the sensor head and branch connector. Up to two extension cables can be connected and extended. Robot cable specifications. • Sensor side: M12, 8-pin socket • Branch connector side: M12, 8-pin plug</td>
<td>2 m</td>
<td>SSL-2J04-G02ME-R</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 m</td>
<td>SSL-2J04-G05ME-R</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 m</td>
<td>SSL-2J04-G10ME-R</td>
</tr>
<tr>
<td>Ethernet cable</td>
<td>Dedicated cable for connecting from the branch connectors to the Ethernet port. Robot cable specifications. • Branch connector side: M12, 4-pin socket • Host side: RJ45 plug</td>
<td>2 m</td>
<td>DOL-1204-G02M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 m</td>
<td>DOL-1204-G05M</td>
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<td>Power supply/external input cable</td>
<td>Power supply/external input cable for connecting to branch connector. • Branch connector side: M12, 4-pin socket • Power supply/external device side: discrete wire</td>
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<td>DOL-1204-G02M</td>
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<td>5 m</td>
<td>DOL-1204-G05M</td>
</tr>
<tr>
<td>Branch connector</td>
<td>Branch connector for connecting sensor heads and various cables. Included with sensor head.</td>
<td>-</td>
<td>SYL-1208-G0M</td>
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<td>SSL-2J04-G02ME-R</td>
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<tr>
<td></td>
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<td>DOL-1204-G02M</td>
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<td></td>
<td></td>
<td>5 m</td>
<td>DOL-1204-G05M</td>
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<tr>
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<td>Power supply/external input cable for connecting to branch connector. • Branch connector side: M12, 4-pin socket • Power supply/external device side: discrete wire</td>
<td>2 m</td>
<td>DOL-1204-G02M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 m</td>
<td>DOL-1204-G05M</td>
</tr>
<tr>
<td>Branch connector</td>
<td>Branch connector for connecting sensor heads and various cables. Included with sensor head.</td>
<td>-</td>
<td>SYL-1208-G0M</td>
</tr>
</tbody>
</table>
### Specifications

#### Sensor head (model based specifications)

<table>
<thead>
<tr>
<th>Model</th>
<th>CDX-L15A</th>
<th>CDX-LW15A</th>
<th>CDX-L30A</th>
<th>CDX-LW30A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical method</td>
<td>Specular reflection</td>
<td>Diffuse installation</td>
<td>Specular installation</td>
<td>Diffuse installation</td>
</tr>
<tr>
<td>Measurement range</td>
<td>15 +/-1 mm</td>
<td>30 +/-5 mm</td>
<td>25.5 +/-3.0 mm</td>
<td>25.5 +/-3.0 mm</td>
</tr>
<tr>
<td>Light source</td>
<td>Medium</td>
<td>Red semiconductor laser</td>
<td>665 nm</td>
<td>0.39 mW</td>
</tr>
<tr>
<td>Laser class</td>
<td>JIS/IEC</td>
<td>CLASS 1</td>
<td>FDA²</td>
<td>CLASS 1</td>
</tr>
<tr>
<td>Spot size</td>
<td>30 µm</td>
<td>30 x 1000 µm</td>
<td>30 x 1000 µm</td>
<td>30 x 1000 µm</td>
</tr>
<tr>
<td>Linearity</td>
<td>+/-0.05% of F.S. (+/-1 µm)</td>
<td>+/-0.03% of F.S. (+/-3 µm)</td>
<td>+/-0.04% of F.S. (+/-2.4 µm)</td>
<td>+/-0.015% of F.S. (+/-1.5 µm)</td>
</tr>
<tr>
<td>Resolution²</td>
<td>0.25 µm</td>
<td>0.25 µm</td>
<td>0.25 µm</td>
<td>0.25 µm</td>
</tr>
<tr>
<td>Repeat accuracy²</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sampling period</td>
<td>12.5 µs / 25 µs / 50 µs / 100 µs / 200 µs / 500 µs / 1 ms / Auto</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature drift</td>
<td>-10 to +40°C</td>
<td>+/-0.02% F.S./°C</td>
<td>+/-0.03% F.S./°C</td>
<td>+/-0.01% F.S./°C</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 300 g (including 500 mm connector cable)</td>
<td>Approx. 280 g (including 500 mm connector cable)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Measurement conditions

- **Ambient temperature**: 25°C (normal temperature), Supply voltage: 24 VDC, Sampling period: 50 μs, Moving average performed: 256, Median filter: 31, Center of measurement range, Meas. range 65 to 85 mm: +/-0.03% of F.S. (+/-3 µm), Meas. range 85 to 105 mm: +/-0.008% of F.S. (+/-7.2 µm)
- **Reference**: Medium, Meas. range 65 to 85 mm: +/-0.03% of F.S. (+/-3 µm), Meas. range 85 to 105 mm: +/-0.008% of F.S. (+/-7.2 µm)
- **Measurement range**: 85 +/-20 mm, 81.5 +/-10.0 mm, 85 +/-20 mm, 81.5 +/-10.0 mm, 150 +/-40 mm
- **Noise level**: 30 ±10 dB
- **Shock resistance**: 30 g, 2 ms
- **Vibration resistance**: 3.9 g, 2 ms
- **Storage temperature/humidity**: -20 to +60°C / 35 to 85% RH (no condensation or freezing)
- **Ambient temperature/humidity**: -10 to +50°C / 35 to 85% RH (no condensation or freezing)
- **Degree of protection**: IP67
- **Indicators**: Internal circuit, Analog output, Load, Black: Output, Yellow: NC, Purple: NC, Pink: NC, Gray: External input, White: Analog output, Blue: 0V/Analog GND
- **Communication interface**: Ethernet (100BASE-TX) / Corresponding to IEEE1588
- **Current consumption**: 340 mA (at 12 VDC), 180 mA (at 24 VDC)
- **Supply voltage**: 12 to 24 VDC (+/-10%, including ripple)
- **Sensor head (common specifications)**

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² Excluding differences per Laser Notice No. 50.

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* The measurement range will become narrower when the sampling period is set to the maximum speed of 12.5 µs. Please use by selecting from Near/Center/Far below.

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² In accordance with the FDA provisions of Laser Notice No. 50, the laser is classified as Class 1 per the IEC 60825-1:2007 standard.

³ Defined with center strength 1/e² (13.5%) at the center of measurement range. There may be leak light other than the specified spot size.

⁴ The sensor may be affected when there is a highly reflective object close to the detection area.

⁵ The minimum step that can be identified when the distance between the sensor and target changes one step at a time (when performing moving average 65,536 times)

⁶ Peak-to-peak value of measured value when measuring in stationary state (when performing moving average 65,536 times)

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*: The measurement conditions are as follows unless otherwise designated:

- **Ambient temperature**: 25°C (normal temperature), Supplied voltage: 24 VDC, Sampling period: 50 µs, Moving average performed: 256, Median filter: 31, Center of measurement range.
- **Measurement target** (specular reflection: glass) for the 15 mm/30 mm type, (specular reflection: aluminum vapor deposition mirror) and (diffuse reflection: visible light shielding ceramic) for the 85 mm type) Furthermore, the sensor head is fixed in place with an aluminum jig when measurements are performed.

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*: The CDX series sensor heads mentioned above are products to which limits on resolution have been added to enable their non-applicability to "Export Trade Control Order" Appended Table 1 2-(12) Measurement devices." For applicable products with no limited resolution, refer to P.8.
■ Sensor head (common specifications)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>12 to 24 VDC (+/-10%, including ripple)</td>
</tr>
<tr>
<td>Current consumption</td>
<td>340 mA (at 12 VDC), 180 mA (at 24 VDC)</td>
</tr>
<tr>
<td>Communication interface</td>
<td>Ethernet (100BASE-TX) / Corresponding to IEEE1588</td>
</tr>
<tr>
<td>External input</td>
<td>Selectable from laser OFF, hold/reset, start storage, and offset</td>
</tr>
<tr>
<td>Indicators</td>
<td>Link indicator (green) / power indicator (orange/blue/red)</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP67 (including connector part)</td>
</tr>
<tr>
<td>Ambient temperature/humidity</td>
<td>-10 to +60°C / 35 to 85%RH (no condensation or freezing)</td>
</tr>
<tr>
<td>Storage temperature/humidity</td>
<td>-20 to +60°C / 35 to 85%RH (no condensation or freezing)</td>
</tr>
<tr>
<td>Ambient illuminance</td>
<td>Incandescent lamp: 3,000 lx or less, fluorescent lamp: 10,000 lx or less</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 55 Hz: double amplitude 1.5 mm; 2 hours in each of the X, Y, and Z directions</td>
</tr>
<tr>
<td>Shock resistance</td>
<td>50 G (500 m/s²), 3 times in each of the X, Y, and Z directions</td>
</tr>
<tr>
<td>Applicable regulations</td>
<td>EMC: RoHS directive (2011/65/EU), Battery directive (2006/66/EC), China RoHS (Directive No. 32)</td>
</tr>
<tr>
<td>Applicable standards</td>
<td>Safety: FDA regulations (21 CFR 1040.10 and 1040.11)³</td>
</tr>
<tr>
<td>Warm-up time</td>
<td>Approx. 30 minutes</td>
</tr>
<tr>
<td>Material</td>
<td>Housing: Aluminum die-cast, Optical window: Glass</td>
</tr>
</tbody>
</table>


I/O Circuit Diagram

■ Connection and Circuit Diagram of Power Supply/External Input Cable DOL-1204-G0xM

- Blue: 0V
- White: External input (NPN)
- Black: External input (PNP)
- Brown: 24V DC

- Brown: 12 to 24V DC
- Black: Output
- Yellow: NC
- Purple: NC
- Gray: External input
- Pink: NC
- White: Analog output
- Analog output evaluation equipment
- Blue: 0V/Analog GND

■ Connection and Circuit Diagram of Amplifier Unit CDA-M

- Brown: 12 to 24V DC
- Black: Output
- Yellow: NC
- Purple: NC
- Gray: External input
- Pink: NC
- White: Analog output
- Analog output evaluation equipment
- Blue: 0V/Analog GND
Dimensions

- **CDX-L15A/-LW15A**
  - Link indicator (green)
  - Power indicator (orange/green/blue/red)

- **CDX-30A/-W30A**
  - Link indicator (green)
  - Power indicator (orange/green/blue/red)

  (Diffuse installation)

- **CDX-85A/-W85A**
  - Link indicator (green)
  - Power indicator (orange/green/blue/red)

- **CDX-150A/-W150A**
  - Link indicator (green)
  - Power indicator (orange/green/blue/red)

  (Specular installation)

(Unit: mm)
CDX-85A/-W85A
(Diffuse installation)

CDX-150A/-W150A
(Specular installation)

CDX-15A/-LW15A
(Diffuse installation)

CDX-30A/-W30A
(Specular installation)

Link indicator  
(green)

Power indicator  
(orange/green/blue/red)

M12, 8-pin connector

Optical axis
of emitter

Optical axis
of receiver

Measurement range

Optical axis
of emitter

Optical axis
of receiver

Measurement range

(Unit: mm)
/ Dimensions

- CDA-M
  - Power indicator (Green/Red)
  - Display screen
  - B button
  - M8, 4P female connector
  - Output indicator (Orange)
  - Arrow buttons

- SYL-1208-G0M

/ Spot Size (Typical Characteristic Data)

- CDX-L15A
- CDX-LW15A
- CDX-30A
- CDX-W30A
- CDX-85A
- CDX-W85A
- CDX-150A
- CDX-W150A

(Spot Size and Distance Data are Illustrated)
System Configuration

If extending the cable
Sensor head extension cable

DSC-1208-G02MA
DSC-1208-G05MA
DSC-1208-G10MA

If using an amplifier
Sensor/amplifier connection cable

DOL-1204-G02M
DOL-1204-G05M
DSL-1204-G02M

If extending the cable
Sensor-to-amplifier extension cable

DSL-0804-G02M
DSL-0804-G05M

Amplifier unit

CDA-M

Sensor head
CDX-L15A/-LW15A
CDX-30A/-W30A
CDX-85A/-W85A
CDX-150A/-W150A

PC
PLC
Hub, router

Power supply/external input cable

SYL-1206-G0M

Ethernet cable
SSL-2J04-G02ME-R
SSL-2J04-G05ME-R
SSL-2J04-G10ME-R

Branch connector
(included with sensor head)

Ensure that the overall cable length from the power supply to the sensor head is within 30 m, and the number of Sensor Head Extension Cables to be connected must be up to two. Also ensure that the overall cable length when the CDA-M amplifier unit is used is within 10 m. (This length restriction does not apply to the Ethernet cable.)
Attention: Not to be Used for Personnel Protection.

Never use these products as sensing devices for personnel protection. Doing so could lead to serious injury or death. These sensors do not include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition. Please consult our distributors about safety products which meet OSHA, ANSI and IEC standards for personnel protection.

● Specifications are subject to change without prior notice.
● Specifications and technical information not mentioned here are written in Instruction Manual. Or visit our website for details.
● All the warnings and cautions to know prior to use are given in Instruction Manual.