A Wide Variety of Application Modes for Easy, High-Accuracy Measurements
Thrubeam Digital Laser Sensor with the Highest Level of Stability

REPEATABILITY OF 5 μm 0.20 Mil
LINEARITY OF ± 0.1% (IG-028)

The sensor provides a high level of stability with its multi-wavelength laser and parallel computing chip.

WIDE VARIETY OF APPLICATION MODES
- Edge control mode
- Outer diameter measurement mode
- Inner diameter/Gap measurement mode
- Edge detection of transparent targets
Large Distance between the Transmitter and Receiver
IG-028: Max. 1500 mm 59.06" IG-010: Max. 1000 mm 39.37"

L-CCD* Light-Receiving Element
The sensor recognizes the position of a target and is less sensitive to its environment, making it possible to achieve stable target measurement.

* L-CCD : Linearized-Charge Coupled Device

IP67 Protection
The enclosure is resistant to harsh environments and offers long-term durability.

Display Unit Options
There are two types of display units: panel mount and DIN-rail mount. When a display unit is connected to a communication unit, measurement data can be sent to external devices such as a PLC.
High stability and measurement accuracy are achieved with the newly developed optical system

Multi-Wavelength Laser + I-DSP

With conventional lasers, the transmission spot produces a patchy pattern (as shown in the figure to the right). This is a laser-specific interference problem caused by the laser having a single wavelength. The IG Series sensor overcomes this problem by using a multi-wavelength laser. Because shadows are formed on the CCD more clearly, the sensor remains highly stable, even with targets that are conventionally difficult to detect (e.g., transparent objects). With the I-DSP (a parallel computing chip) incorporated in the receiver, the sensor can perform data processing at high speed, reducing noise to a minimum.

Repeatability of 5 μm 0.20 Mil

Linearity of ±0.1%

STABLE DETECTION OF TRANSPARENT & MESH TARGETS

The L-CCD makes it possible to detect a target based on its position. Edge control and positioning of transparent and mesh targets can be performed stably.
Extremely easy to use due to the built-in position monitor

Determining the Part of a Target to be Measured

The position monitor on the IG Series sensors makes it possible to visually check how a target is detected. The user can prevent mounting or setting errors by observing the red lights that indicate the received light position and the green lights that indicate the measurement position.

Easier Optical Axis Alignment

The position monitor makes it easier to align the optical axis. Easily perform optical axis alignment by adjusting the sensor head so that all of the position monitor lights turn red.
Easy to maintain thanks to excellent environment resistance

Key Point: Less Sensitive to Dirt

Because it uses an L-CCD, the IG Series is less sensitive to materials such as dirt than a sensor that uses a photodiode (PD) as the light-receiving element.

IP67 Protection

The enclosure satisfies the IP67 rating based on the IEC standards and remains watertight even after being held at a depth of one meter for 30 minutes. The enclosure is resistant to adverse environments and offers long-term durability.

Flexible Free-Cut Cable

The sensor head cable is a robot cable that withstands repeated bending. The cable can be used safely in a position requiring repeated motion.

Edge Check Function

The user can check whether a measurement is performed correctly by verifying the number of edges in the field of view.

Example

- Prevent dust or oil from adhering to the measurement unit, which can cause an abnormal measurement value.
- Detect the intrusion of a different type of target.
- Check that a measurement target falls within the measurement range.
Three major application modes

Edge Control and Positioning Mode
The distance from the end of the measurement range to the edge of a target is measured.

Outer Diameter/Width Measurement Mode
The outer diameter or width of a target is measured.

Inner Diameter/Gap Measurement Mode
The inner diameter of a target or a gap between targets is measured.

Five dedicated modes can be selected according to the application

Edge Detection of Transparent Targets
The edges of transparent objects such as glass have low transparency which decreases the amount of light received. The IG Series detects edges exploiting this nature and automatically changes a measurement sensitivity appropriately to detect a transparent target.

Five dedicated modes
- Pin position measurement mode
- Pin pitch judgment mode
- Pin diameter judgment mode
- Specified edge-to-edge distance measurement mode
- Very parallel light + multi-wavelength
- Edge detection algorithm + glass edge mode
- Received-light waveform
- The measurement sensitivity is automatically changed
- The edge is enhanced
BUILT-IN CALCULATION FUNCTIONS ALLOW FOR AN EVEN WIDER VARIETY OF APPLICATIONS

**Edge Control and Positioning Mode**

- Feedback control using edge position control
- Positioning control of the angle of a wafer

**Glass Edge Mode**

- Positioning of a glass substrate
- Edge control of a transparent sheet

**Easy control when used with a servomotor (example)**

- Amplifier or communication unit
- Control device
- Outputs the edge position information to a control device. It is possible to send the information via an analog output, BCD output, or RS-232C output according to the type of the control device instead of using a PLC.

**Easy measurement with the calculation function**

- Main unit
- Expansion unit 1
- Expansion unit 2
- A-B: Misalignment measurement
- B-C: Y-axis position measurement
- C: X-axis position measurement

The main unit of the amplifier can communicate with the expansion units. When positioning an object such as a panel, it is possible to calculate a misalignment amount by calculating the data obtained by two sensor heads.
Outer Diameter/Width Measurement Mode + Calculation function

Abnormal diameters and deformations can be detected in real time by measuring a tube at two axes. The 980 µs high-speed sampling detects even tiny abnormalities.

Inner Diameter/Gap Measurement Mode + Calculation function

The thickness of a product can be controlled by measuring the gaps of the two sides between the rollers.
The configuration software, IG Configurator, allows for a wide range of settings to be made including the monitoring of the waveforms of received light and the measurement modes.

**Reading and Writing Settings**

The user can enter all settings including the measurement modes into a PC and then transfer them to the sensor. The management of setting data is simple and very convenient when two or more sensors are used.

**Monitoring Function**

Measurement conditions such as the waveforms of received light can be displayed in real time. The mounting and sensitivity settings can also be adjusted more precisely.

**Calculation Function**

**Addition mode** (if a measurement target is large)

**Subtraction mode** (to measure the difference in level or inclination)

**Setting Examples**

**Sensitivity Setting**

The set value used to judge whether light enters or is blocked, based on the amount of light received by the CCD, is called the binarization level. The amount of light received when the reference waveform is registered is regarded as the 100% level. The light is judged to be blocked if the amount of light is less than the specified binarization level. The IG Series initially sets a binarization level of 25% and the user can change the level according to the application.

**Zero Shift Function**

This function shifts an internal measurement value to 0 (to offset the value). When the target value is changed, this function can be used to shift an internal measurement value to the new target value.
DATA COMMUNICATION

Amplifier Function

**NPN/PNP Output Selection (judgment selection)**

Both NPN and PNP outputs are supported. The outputs are set the first time the user turns on the power. These settings can subsequently be changed. Judgments are output as HIGH, GO, or LOW.

**Bank Function**

The bank function can register up to four patterns of specific settings. For example, in response to a measurement target changeover, this function allows the user to easily switch between the patterns of registered settings.

*HIGH setting value, LOW setting value, binarization level, shift target value, etc.

Communication Unit

**Open field network communication units**

Achieving great wire-saving with the new open field network communication units

**DL Series**

<table>
<thead>
<tr>
<th>Model</th>
<th>Appearance</th>
<th>Communication method</th>
<th>Connection device</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEW DL-ES1A</td>
<td>[Image]</td>
<td>EtherCAT®</td>
<td>PLCs</td>
</tr>
<tr>
<td>DL-PN1</td>
<td>[Image]</td>
<td>PROFINET</td>
<td>PLCs</td>
</tr>
<tr>
<td>DL-EP1</td>
<td>[Image]</td>
<td>EtherNet/IP™</td>
<td>PLCs</td>
</tr>
<tr>
<td>DL-DN1</td>
<td>[Image]</td>
<td>DeviceNet™</td>
<td>PLCs</td>
</tr>
</tbody>
</table>

*EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

**Lineup**

**Sensor heads**

**IG-010**

- Measurement range: 10 mm
- Mounting distance: 0 to 1000 mm
- Repetition accuracy: 5 μm
- Linearity: ±28 μm ±1.10 Mil

**IG-028**

- Measurement range: 28 mm
- Mounting distance: 0 to 1500 mm
- Repetition accuracy: 5 μm
- Linearity: ±28 μm ±1.10 Mil

*1 For the detailed conditions, refer to "Specifications" (page 12).

**Display units (amplifiers)**

**DIN rail mount type**

- IG-1000 Main unit
- IG-1050 Expansion unit

**Panel mount type**

- IG-1500 Main unit
- IG-1550 Expansion unit

**Sensor head cables**

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Cable length</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Image]</td>
<td>2 m 0.56&quot;</td>
<td>OP-87056</td>
<td>Approx. 80 g</td>
</tr>
<tr>
<td></td>
<td>5 m 0.47&quot;</td>
<td>OP-87057</td>
<td>Approx. 190 g</td>
</tr>
<tr>
<td></td>
<td>10 m 0.80&quot;</td>
<td>OP-87058</td>
<td>Approx. 360 g</td>
</tr>
<tr>
<td></td>
<td>20 m 0.67&quot;</td>
<td>OP-87059</td>
<td>Approx. 680 g</td>
</tr>
</tbody>
</table>

*The cable is common to the transmitter and receiver, and can be used with either of them.
*2 Two cables are included with a sensor head.

Analog Output Selection

The following four types of analog outputs can be selected. The output is selected the first time the user turns on the power.

<table>
<thead>
<tr>
<th>Setting value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>No output</td>
</tr>
<tr>
<td>0-5V</td>
<td>Analog output after the judgment value is converted to the range from 0 to 5 V.</td>
</tr>
<tr>
<td>-5-5V</td>
<td>Analog output after the judgment value is converted to the range of ±5 V.</td>
</tr>
<tr>
<td>1-5V</td>
<td>Analog output after the judgment value is converted to the range from 1 to 5 V.</td>
</tr>
<tr>
<td>4-20mA</td>
<td>Analog output after the judgment value is converted to the range from 4 to 20 mA.</td>
</tr>
</tbody>
</table>

The setting can be changed.
**Specifications**

### Sensor heads

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Appearance</th>
<th>Description</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor heads</td>
<td>For IG-010</td>
<td>IG-TB01</td>
<td>–</td>
<td>Approx. 50 g</td>
</tr>
<tr>
<td></td>
<td>For IG-028</td>
<td>IG-TB02</td>
<td>–</td>
<td>Approx. 40 g</td>
</tr>
</tbody>
</table>

**End unit (Optional)**

* The mounting bracket is used when the expansion cable is used to connect to the end units to secure the display units on both ends. When connecting additional units, be sure to use the end units. (2 pcs.)

### Optional accessories for the display unit

<table>
<thead>
<tr>
<th>Model</th>
<th>Appearance</th>
<th>Description</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP-267S1</td>
<td>To connect an additional expansion unit, use the end units to secure the display units on both ends. When connecting additional units, be sure to use the end units. (2 pcs.)</td>
<td>Approx. 15 g</td>
<td></td>
</tr>
</tbody>
</table>

### Optional accessories for the communication unit

<table>
<thead>
<tr>
<th>Model</th>
<th>Appearance</th>
<th>Description</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP-5706</td>
<td>The panel front protection cover and panel mounting bracket are included in the panel mount type amplifier. If the supplied cover or bracket is lost or damaged, purchase a new one.</td>
<td>Approx. 6 g</td>
<td></td>
</tr>
</tbody>
</table>

### Optional

- Approx. 380 g Approx. 500 g Weight (including supplied items)
- Transmitter × 1, Receiver × 1, Sensor head cables (2 m 0.08") × 2 Supplied item

### Notes

- 1. The DL-R51A communication unit is required.
- 2. The screws for connecting the sensor head and bracket are included.
# Display unit (amplifier)

<table>
<thead>
<tr>
<th>Model</th>
<th>IG-1000</th>
<th>IG-1050</th>
<th>IG-1500</th>
<th>IG-1550</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appearance</strong></td>
<td><img src="244x688" alt="Image" /></td>
<td><img src="297x727" alt="Image" /></td>
<td><img src="329x690" alt="Image" /></td>
<td><img src="382x729" alt="Image" /></td>
</tr>
<tr>
<td>Amplifier type</td>
<td>DIN rail mount</td>
<td>Panel mount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main unit/Expansion unit</td>
<td>Main unit</td>
<td>Expansion unit</td>
<td>Main unit</td>
<td>Expansion unit</td>
</tr>
<tr>
<td>Analog output</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Power supply voltage</strong></td>
<td>10-30 VDC, Ripple (P-P): 10% included, Class 2 or LPS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption (including analog current output)</td>
<td>Normal: 2700 mW or less (at 30 V: 90 mA or less)</td>
<td>Normal: 2380 mW or less (at 30 V: 77 mA or less)</td>
<td>Power saving function (HALF): 2200 mW (at 30 V: 74 mA or less)</td>
<td></td>
</tr>
<tr>
<td><strong>Digital display method</strong></td>
<td>Dual 7-seg display</td>
<td>Upper level: Green, 5 digits</td>
<td>Lower level: Red/Green, 2 colors, 5 digits</td>
<td></td>
</tr>
<tr>
<td><strong>Display resolution</strong></td>
<td>1 μm 0.04 Mil, 10 μm 0.39 Mil, 100 μm 3.94 Mil, 1000 μm 39.37 Mil (selectable)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>Voltage output</td>
<td>Current output</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output range</td>
<td>±5 V (full scale 10 V)</td>
<td>4-20 mA (full scale 16 mA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output resistance</td>
<td>100 Ω</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load resistance</td>
<td>–</td>
<td>350 Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repetition accuracy</td>
<td>±0.05 % of F.S.</td>
<td>±0.5 % of F.S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display accuracy</td>
<td>±0.005 % of F.S./°C</td>
<td>±0.01 % of F.S./°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Environment resistance</strong></td>
<td>Ambient temperature</td>
<td>-10 to +50°C (14 to 122°F) (No freezing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>35 to 85%RH (No condensation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 55 Hz Double amplitude 1.5 mm 0.06” XYZ each axis: 2 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Material</strong></td>
<td>Main unit case/Front sheet: Polycarbonate, Key top: Polyacetal, Cable: PVC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Supplied item</strong></td>
<td>Main body × 1, Instruction manual × 1 (only for main unit)</td>
<td>Main body × 1, Panel mounting bracket × 1, Front protection cover × 1, Power supply and input/output cable (2 m 0.08”) × 1, Expansion cable (50 mm 1.97”) × 1 (only for expansion unit), Instruction manual × 1 (only for main unit)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weight (including supplied items)</strong></td>
<td>Approx. 150 g</td>
<td>Approx. 140 g</td>
<td>Approx. 170 g</td>
<td>Approx. 165 g</td>
</tr>
</tbody>
</table>

*1 When expansion units are added: Max. 20 mA/ch
*2 For more details, refer to the User's Manual.
*3 Delay time that occurs from the analog output circuit after the judgment is output.
### Sensor head

**IG-010**

- **Transmitter**
  - Transmission spot center
  - 2-M3 Valid screw depth 4
  - ø4.8 ø0.19"
  - ⅞-ø3.4 ø0.13"
  - Cable length 170
  - Mounting hole
  - ø8.5 ø0.33" Spot facing depth 4
  - ø8.5 ø0.33" Spot facing depth 4.16"

- **Receiver**
  - Transmission spot center
  - 2-M5 Valid screw depth 5.5
  - ø12 ø0.47"
  - ø12 ø0.47"

**IG-028**

- **Transmitter**
  - Transmission spot center
  - ø4.8 ø0.19"
  - ⅞-ø3.4 ø0.13"
  - ø8.5 ø0.33" Spot facing depth 4

- **Receiver**
  - Transmission spot center
  - ø8.5 ø0.33" Spot facing depth 4

**Sensor head mounting bracket**

**IG-TB01 + IG-010**

- 2-ø4.5 ø0.18" Drilled through hole
- ø8.5 ø0.33" Spot facing depth 4
- ø8.5 ø0.33" Spot facing depth 4.16"

**IG-TB02 + IG-028**

- 2-ø4.5 ø0.18" Drilled through hole
- ø8.5 ø0.33" Spot facing depth 4
- ø8.5 ø0.33" Spot facing depth 4.16"
Dimensions

Sensor amplifier (DIN rail mount type)

IG-1000/IG-1050

Sensor amplifier (Panel mount type)

IG-1500/IG-1550

End unit (Optional) (2 pcs.)

OP-26751

Wiring Diagram

Notes on connecting a panel mount type expansion unit

Place the main unit in the top position, and bring the expansion unit into contact with the main unit vertically. For horizontal connection of the panel mount type, the optional expansion cable OP-35361 (300 mm) 11.8" type is required.

Wiring Diagram

*1 The brown, blue, and light blue cables are not provided in a IG-1050/IG-1550 unit (expansion unit).
*2 The power is supplied to the expansion unit from the IG-1000/IG-1500 unit (main unit).
*3 For an external input, bank A input, bank B input, laser emission stop input, or OFF (not used) can also be selected.
For external input 4, gain input can also be selected.
For details, refer to the User’s Manual.
Specifications

**EtherCAT® Network communication unit DL-EC1A**

- **Model**: DL-EC1A
- **EtherCAT® Specifications**
  - Compatible functions: Process data object communication (cyclic communication), Mailbox communication (message communication), CoE compatible
- **Conformance**
  - Test: Complete with V2.0.42

**PROFINET Network communication unit DL-PN1**

- **Model**: DL-PN1
- **PROFINET specifications**
  - Device type: D9 UV Communication
  - Number of connections: 1
  - Update time: 2 to 512 ms
  - QoS/DL Version: Ver. 2.3
  - Conformance class: Conformance Class A
  - Compliant protocol: LLDP, DCP

**PROFIBUS DP Network communication unit DL-PD1**

- **Model**: DL-PD1
- **PROFIBUS DP specifications**
  - Device type: DP-VI Slave (D-sub 9 pin, Number of the ports: 1)
  - Communication speed: 9.6 kbps to 12 Mbps
  - Cable length: 187.5 kbps: 1000 m 3350 ft, 500 kbps: 400 m 1312 ft
  - Repeatability communication bandwidth for cyclic communication: 6000 pps
  - Conformance Test: Complies with V2.0.42

**EtherNet/IP™ Network communication unit DL-EP1**

- **Model**: DL-EP1
- **EtherNet/IP™ Specifications**
  - Compatible Functions: Cyclic Communication
  - Number of connections: 64
  - PPI (Transmission cycle): 0.5 to 10000 ms (0.5 ms unit)
  - Nominal bandwidth for cyclic communication: 6000 pps
  - Conformance Test: Compatible with Version A/

**DeviceNet™ Network communication unit DL-DN1**

- **Model**: DL-DN1
- **DeviceNet™ Specifications**
  - Communication speed: Automatic switching method
  - Communication Length: 100 m 328.1' (thick cable) 250 m 820.2' (thick cable) 500 m 1640.4' (thick cable)
  - Network power source: 11 to 25 VDC (DeviceNet™ provided from the communication power source)

**CC-Link Network communication unit DL-CL1**

- **Model**: DL-CL1
- **CC-Link specifications**
  - Number of occupied stations: 1/2/4 stations (selectable)
  - Type of station: Remote device station
  - Transmission rate: 100 kbps/5 Mbps/25 Mbps/10 Mbps
  - Setting of station numbers: 1 to 64

**TCP/IP Network communication unit DL-EN1**

- **Model**: DL-EN1
- **TCP/IP specifications**
  - Communication speed: 9.6/19.2/45.45/93.75 kbps: 1200 m 3937.0'
  - Message communication: 6000 pps
  - Remote device station: 1 to 64
  - Setting of station numbers: 1 to 64

**RS-232C Network communication unit DL-RS1A**

- **Model**: DL-RS1A
- **RS-232C specifications**
  - Communication Method: Full duplex
  - Synchronization Method: Start-stop
  - Communication Code: ASCII
  - Baud rate: 2400/4800/9600/19200 bps
  - Maximum cable length: 100 m 328.1' (thin cable)

**Berdnet communication unit DL-RB1A**

- **Model**: DL-RB1A
- **Berdnet Output Specifications**
  - Input/Output Terminal: 34 pin connector (MIL Standard)
  - BCD Output: 4 (1 column) × 6 columns, signal output, strobe output, alarm output
  - NPN Open collector: 40 V, 20 mA or less, residual voltage 1 V or less
  - Full duplex: Positive logic/Negative logic can be switched
  - Control Input: 40 Selection Input: 4, data request input
  - Max. voltage: 5 VDC, max. input time: 2 ms or more
  - Source: Non-voltage input, input time: 2 ms or more, short circuit current 1 mA

**Dimensions**

<table>
<thead>
<tr>
<th>Model</th>
<th>Unit: mm / inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>DL-EC1A</td>
<td></td>
</tr>
<tr>
<td>DL-PD1</td>
<td></td>
</tr>
<tr>
<td>DL-PN1/EP1/EN1</td>
<td></td>
</tr>
<tr>
<td>DL-DN1</td>
<td></td>
</tr>
<tr>
<td>DL-RS1A</td>
<td></td>
</tr>
<tr>
<td>DL-RB1A</td>
<td></td>
</tr>
</tbody>
</table>

**SAFETY INFORMATION**
Please read the instruction manual carefully in order to safely operate any KEYENCE product.

**GLOBAL NETWORK**
CONTACT YOUR NEAREST OFFICE FOR RELEASE STATUS.

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