A Wide Variety of Application Modes for Easy, High-Accuracy Measurements

LASER EDGE SENSOR

Intelligent Sensor

I-SERIES
Thrubeam Digital Laser Sensor with the Highest Level of Stability

**REPEATABILITY OF 5 μm**

**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  IG-010: Max. 1000 mm

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

* L-CCD : Linearised-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.

### Best in its class

- **Repeatability of 5 μm**
- **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.

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**Intelligent**

High accuracy was achieved by using the technology and functions developed for high-accuracy measuring instruments.

**Tough**

Developed for use in harsh environments, the IG Series was designed with a strong structure.

**Easy**

Excellent usability makes it possible to quickly and easily perform stable measurements without any difficult adjustments and settings.

The intelligent I-Series consists of a high-accuracy sensor lineup that realises low-cost high performance with only the most advanced functions for on-site operations.
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.

**Extremely easy to use due to the built-in position monitor**

**Determining the Part of a Target to be Measured**

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.

**Easier Optical Axis Alignment**
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 metre 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.

The measurement area is automatically specified simply by selecting the mode.

Pin position measurement mode
Pin pitch judgement mode
Pin diameter judgement mode
Specified edge-to-edge distance measurement mode
Feedback control using edge position control

Positioning control of the θ angle of a wafer

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

- Measures position information
- Amplifier or communication unit
- Analogue output
- BCD output
- RS-232C output
- Control device

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

**Glass Edge Mode + Calculation function**

Positioning of a glass substrate

Edge control of a transparent sheet

**Easy measurement with the calculation function**

- A
- B
- Main unit
- Expansion unit 1
- Expansion unit 2
- A-B: Misalignment measurement
- B: 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 + 

![Outer diameter/deformation measurement of an extrusion](image1)

![Outer diameter measurement of a part](image2)

**Easy measurement with the calculation function**

- A-B: Deformation measurement
- B: Outer diameter measurement

A-B≠0

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

Inner Diameter/Gap Measurement Mode + 

![Gap measurement between rollers](image3)

![Diameter check of press cutting](image4)

**Easy measurement with the calculation function**

A-B=0  A-B≠0

The thickness of a product can be controlled by measuring the gaps of the two sides between the rollers.
EVEN MORE USEFUL WHEN CONNECTED TO A PC

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 Example 1**

**Setting Example 2**

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 binarisation 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 binarisation level. The IG Series initially sets a binarisation 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 (judgement 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. Judgements are output as HIGH, GO, or LOW.

**Analogue Output Selection**

The following four types of analogue 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>Not output</td>
</tr>
<tr>
<td>0~5V</td>
<td>Analogue output after the judgement value is converted to the range from 0 to 5 V.</td>
</tr>
<tr>
<td>-5~5V</td>
<td>Analogue output after the judgement value is converted to the range of ±5 V.</td>
</tr>
<tr>
<td>1~5V</td>
<td>Analogue output after the judgement value is converted to the range from 1 to 5 V.</td>
</tr>
<tr>
<td>4~20mA</td>
<td>Analogue output after the judgement value is converted to the range from 4 to 20 mA.</td>
</tr>
</tbody>
</table>

The setting can be changed.

### Communication Unit

**NEW 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><em>NEW</em> DL-EPI</td>
<td></td>
<td>EtherNet/IP</td>
<td>PLCs</td>
</tr>
<tr>
<td><em>NEW</em> DL-DNI</td>
<td></td>
<td>DeviceNet</td>
<td>PLCs</td>
</tr>
</tbody>
</table>

#### 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, binarisation level, shift target value, etc.*

### Lineup

**Sensor heads**

**IG-010**

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

**IG-028**

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

*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>Model</th>
<th>Appearance</th>
<th>Cable length</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP-8756</td>
<td>2 m*²</td>
<td>Approx. 80 g</td>
<td></td>
</tr>
<tr>
<td>OP-8757</td>
<td>5 m</td>
<td>Approx. 190 g</td>
<td></td>
</tr>
<tr>
<td>OP-8758</td>
<td>10 m</td>
<td>Approx. 360 g</td>
<td></td>
</tr>
<tr>
<td>OP-8759</td>
<td>20 m</td>
<td>Approx. 680 g</td>
<td></td>
</tr>
</tbody>
</table>

This connector is required if the cable is cut.

*2 Cable included, can be used with either of them.

*3 Two cables are included with a sensor head.
Optional accessories
- PC software: *1 IG Configurator IG-H1
  - Approx. 80 g
- Sensor head mounting brackets: *2 For IG-010 IG-T801
  - Approx. 50 g
  For IG-028 IG-T802
  - Approx. 40 g
- End unit (Optional): OP-26751
  - Approx. 15 g
  - 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.)
- Panel front protection cover (included in panel mount type amplifier): DP-87876
  - Approx. 6 g
  - 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.
- Optional accessories for the display unit: OP-4122
  - Panel mounting bracket (included in panel mount type amplifier)
  - Approx. 7 g
- Expansion cable: OP-35361
  - Approx. 10 g
  - Although the DL Series is designed for the DIN-rail mount type only, the optional expansion cable (OP-35361, 300 mm) enables communication with the panel mount type display unit.
- Optional accessories for the communication unit: OP-60412
  - DIN-rail mounting bracket
  - Approx. 12 g
  - The mounting bracket is used when the expansion cable is used to connect to the panel mount type display unit, in which case a DIN rail is not provided.

Specifications

Sensor heads

Model
- IG-010
- IG-028

Appearance
- Operation principle: CCD method
- Light source: Visible light semiconductor laser (Wavelength: 660 nm)
  - FDA (CDRH) Part 1040.10 Class 1 Laser Product*
  - IEC60825-1 Class 1 Laser Product

Sensor heads

Model
- IG-010
- IG-028

Appearance
- Operation principle: CCD method

Light source
- FDB (CDRH) Part 1040.10 Class 1 Laser Product
- IEC60825-1 Class 1 Laser Product

Mounting distance
- 0 to 1000 mm
- 0 to 1500 mm

Sampling cycle
- 2880μs (When the number of times for averaging is set to [hsp]: 490μs)

Minimum detectable object
  - High sensitivity mode: ø0.2 mm (Setting distance: 40 mm), ø0.5 mm (Setting distance: 100 mm)
  - Standard mode: ø0.2 mm (Setting distance: 500 mm), ø0.5 mm (Setting distance: 1000 mm)

Repeatability
  - ±0.28 μm (Setting distance: 100 mm)
  - ±0.5 μm (Setting distance: 500 mm)

Linearity
  - ±0.03 % of F.S. (±3 μm/C)

Temperature characteristics
  - ±0.1 % of F.S. (±0.01% of F.S./°C)

Environmental resistance

Enclosure rating
- IP68

Ambient temperature
- -10 to +45°C (No freezing)
- 35 to 85% RH (No condensation)

Ambient light
- Incandescent lamp: 5000 lux Sunlight: 4000 lux

Pollution degree
- 2

Material
- Case: Zinc die-cast (Lower case), PBT (Upper case), Polyarylate (PAR) (Display part), SUS304 (Metallic part)
- Lens cover: Glass
- Cable: PVC

Supplied item
- Transmitter × 1, Receiver × 1, Sensor head cables (2 m) × 2

Weight (including supplied items)
- Approx. 380 g
- Approx. 500 g

*1 The DL-RSA1 communication unit is required.
*2 The screws for connecting the sensor head and bracket are included.
## Display unit (amplifier)

### Appearance

<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>DIN rail mount</td>
<td>Panel mount</td>
<td>DIN rail mount</td>
<td>Panel mount</td>
<td></td>
</tr>
</tbody>
</table>

### Amplifier type

<table>
<thead>
<tr>
<th>Main unit/Expansion unit</th>
<th>Main unit</th>
<th>Expansion unit</th>
<th>Main unit</th>
<th>Expansion unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analogue output</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

### Power supply voltage

- **Normal**: 2700 mW or less (at 30 V: 90 mA or less) 2300 mW (at 30 V: 77 mA or less)
- **Power saving function (HALF)**: 2200 mW (at 30 V: 74 mA or less)
- **Power saving function (ALL)**: 2200 mW (at 30 V: 74 mA or less)

### Power consumption

- **Voltage output**: 10-30 VDC, Ripple (P-P): 10% included, Class 2 or LPS
- **Power consumption**: 2700 mW or less (at 30 V: 90 mA or less) 2300 mW (at 30 V: 77 mA or less) 2200 mW (at 30 V: 74 mA or less)

### Digital display method

<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>Digital display method</td>
<td>Dual F-7 seg display</td>
<td>Dual F-7 seg display</td>
<td>Upper level: Red, 5 digits</td>
<td>Upper level: Red/Green, 2 colours, 5 digits</td>
</tr>
<tr>
<td>Response time (output range)</td>
<td>1.96 to 4031.72 ms</td>
<td>1.96 to 4031.72 ms</td>
<td>1.96 to 4031.72 ms</td>
<td>1.96 to 4031.72 ms</td>
</tr>
</tbody>
</table>

### Display range

-99.999 to +99.999, -99.99 to +99.99, -99.9 to +99 (selectable)

### Display resolution

Upper level: Red, 5 digits Lower level: Green, 5 digits

### Output

#### Analogue output (selectable among ±5V, 1-5V, 0-5V, 4-20mA)

<table>
<thead>
<tr>
<th>Voltage output</th>
<th>Current output</th>
</tr>
</thead>
<tbody>
<tr>
<td>±5 V (full scale ±5V)</td>
<td>4-20 mA (full scale 16 mA)</td>
</tr>
<tr>
<td>±0.05 % of F.S.</td>
<td>±0.25 % of F.S.</td>
</tr>
<tr>
<td>±0.005 % of F.S.</td>
<td>±0.01 % of F.S.</td>
</tr>
<tr>
<td>±0.005 % of F.S.</td>
<td>±0.01% of F.S.</td>
</tr>
<tr>
<td>±0.05 % of F.S.</td>
<td>±0.01 % of F.S.</td>
</tr>
</tbody>
</table>

#### Gain input

Input time: 20 ms or more. Response delay time: 120 ms or less

#### Reset input

Input time: 20 ms or more. Response delay time: 20 ms or less

#### Zero shift input

Input time: 20 ms or more. Response delay time: 20 ms or less

#### Bank A input/Bank B input

Input time: 20 ms or more. Response delay time: 20 ms or less

#### Laser emission stop input

Input time: 2 ms or more. Response delay time: 2 ms or less

#### Update cycle

Same as sensor head sampling cycle

#### Response time

Same as Response time (judgement output)

#### Time constant

10 μs (90 % response) 30 μs (90 % response)

### Environment resistance

<table>
<thead>
<tr>
<th>Ambient humidity</th>
<th>35 to 85%RH (No condensation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>-10 to +50°C (No freezing)</td>
</tr>
</tbody>
</table>

### Pollution degree

Pollution degree 2

### Material

Main unit case/Front sheet: Polycarbonate, Key top: Polyacetal, Cable: PVC

### Supplied item

- Main body × 1
- Instruction manual × 1 (only for main unit)
- Main body × 1, Panel mounting bracket × 1
- Front protection cover × 1
- Power supply and input/output cable (2 m) × 1
- Expansion cable (50 mm) × 1 (only for expansion unit)
- Instruction manual × 1 (only for main unit)

### Weight (including supplied items)

- Approx. 150 g
- Approx. 140 g
- Approx. 110 g
- Approx. 165 g

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**Note:**
- When expansion units are added: Max. 20 mA/ch
- For more details, refer to the User’s Manual.
- Delay time that occurs from the analogue output circuit after the judgement is output.
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) type is required.

*1 The brown, blue, and light blue cables are not provided in an IG-1050 unit (expansion unit).

*2 For an analogue output, OFF (not used), 0 to 5 V, ±5 V, 1 to 5 V, or 4 to 20 mA can be selected.

*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.

*4 The power is supplied to the expansion unit from the IG-1000/1500 unit (main unit).
Specifications

EtherNet/IP compatible communication unit

<table>
<thead>
<tr>
<th>Model</th>
<th>DL-EP1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatible functions</td>
<td>Cyclic communication</td>
</tr>
<tr>
<td>Number of connections</td>
<td>256</td>
</tr>
<tr>
<td>RPI (Transmission cycle)</td>
<td>0.5 to 10000 ms (0.5 ms unit)</td>
</tr>
<tr>
<td>Tolerable communication bandwidth for cyclic communication</td>
<td>6000 pps</td>
</tr>
</tbody>
</table>

DeviceNet supported communication unit

<table>
<thead>
<tr>
<th>Model</th>
<th>DL-DN1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatible functions</td>
<td>Compatible function input/output communication (poll)/ Explicit message communication</td>
</tr>
<tr>
<td>Address settings</td>
<td>0 to 63 (PGM compatible)</td>
</tr>
<tr>
<td>Communication speed (Automatic switching method)</td>
<td>500 kbps, 250 kbps, 125 kbps</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>100 m (thick cable), 250 m (thick cable), 500 m (thick cable), 100 m (thin cable), 100 m (thin cable)</td>
</tr>
<tr>
<td>Network power source</td>
<td>11 to 25 VDC (DeviceNet provided from the communication power source)</td>
</tr>
</tbody>
</table>

RS-232C communication unit

<table>
<thead>
<tr>
<th>Model</th>
<th>DL-RS1A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication method</td>
<td>Full duplex</td>
</tr>
<tr>
<td>Synchronisation method</td>
<td>Start-stop</td>
</tr>
<tr>
<td>Transmission code</td>
<td>ASCII</td>
</tr>
<tr>
<td>Baud rate</td>
<td>2400/4800/19200/38400 bps</td>
</tr>
</tbody>
</table>

BCD output unit

<table>
<thead>
<tr>
<th>Model</th>
<th>DL-RB1A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input/output terminal</td>
<td>34 pin connector (MIL Standard)</td>
</tr>
<tr>
<td>Control output</td>
<td>BCD output: 4 (1 column) x 6 columns, signal output, strobe output, alarm output RPN open collector 40 V, 20 mA or less, residual voltage 1 V or less Positive logic/Negative logic can be switched</td>
</tr>
<tr>
<td>Control input</td>
<td>IO selection input: 4 data request input Non-voltage input, input time 2 ms or more, short circuit current 1 mA</td>
</tr>
</tbody>
</table>

Common specifications for all models

<table>
<thead>
<tr>
<th>Model</th>
<th>DL-EP1</th>
<th>DL-DN1</th>
<th>DL-RS1A</th>
<th>DL-RB1A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power source voltage</td>
<td>20 to 30 VDC (including 10% supplied from the connected sensor amplifier)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (including the connector)</td>
<td>Approx. 70 g</td>
<td>Approx. 80 g</td>
<td>Approx. 53 g</td>
<td>Approx. 46 g</td>
</tr>
</tbody>
</table>

Dimensions

<table>
<thead>
<tr>
<th>Model</th>
<th>DL-EP1</th>
<th>DL-DN1</th>
<th>DL-RS1A</th>
<th>DL-RB1A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (including the connector)</td>
<td>Approx. 70 g</td>
<td>Approx. 80 g</td>
<td>Approx. 53 g</td>
<td>Approx. 46 g</td>
</tr>
</tbody>
</table>

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