Digital CMOS Laser Sensor
GV Series

Stable detection of metal targets

Innovative solution for black targets

Up to 1m Away

World’s first DATUM Algorithm
Conventional laser sensors have problems with...

Metals
Multiple reflection

Metal workpieces scatter the laser light

The correct valve cannot be detected due to multiple reflections

Black rubber
Low reflectance

Black workpieces absorb light

The detection is unstable due to the low reflectance
The latest light intensity control system reliably detects any colours.

**DATUM function of the GV Series eliminates these problems!!**

**Newly developed**

**GV CMOS**

Stable detection and high-speed response

The size per pixel of this CMOS is larger than that of the conventional one to receive a larger amount of light than before. This provides stable detection and high-speed response.

**Measurement principle**

The wider pixel size of the GV CMOS can receive more light than conventional CMOS imagers. The end result is:

- Stable detection
- High-speed response

---

**DATUM function**

The wider pixel size of the GV CMOS can receive more light than conventional CMOS imagers. The end result is:

- Stable detection
- High-speed response

---

**The advanced technology that responds to the 600,000 fold light intensity variation of workpieces.**

Dynamic range

Accommodates a wide variation of light intensity reflected from a workpiece without degrading the accuracy of distance detection.

The GV Series sets laser emitting time, power and gain optimally on a workpiece basis in real time. Targets with any colours can be reliably detected.

---

**Adjustment range approximately 600,000 fold**

<table>
<thead>
<tr>
<th>Item</th>
<th>Lowest detection range</th>
<th>Highest detection range*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser power</td>
<td>1</td>
<td>Two fold</td>
</tr>
<tr>
<td>Light emitting time</td>
<td>1</td>
<td>3,926 fold</td>
</tr>
<tr>
<td>Gain</td>
<td>1</td>
<td>77 fold</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>approximately 600,000 fold</td>
</tr>
</tbody>
</table>

*When the response time is set at 50 ms.
Applications

Detecting presence/absence of weld nuts
- Long distance
- Detects irregular shape and surface finishes

Detecting quenched parts
- Long distance allows mounting away from heat
- Detects parts with irregular shape
- Detects oil soaked parts

Detecting displacement of blank material
- Unaffected by polished, metallic surface

Checking processed grooves of pipe material
- Ignores scattered light and focuses only on the groove

Checking application of adhesive
- Long distance detection of dark, glossy surfaces

Detecting presence/absence of brake pads
- Long distance detection of dark and irregular shaped targets

Detecting snack packages
- Stable detection of shiny, wrinkled plastic or foil

Detecting presence/absence of cap seals
- Targets are detected by height
- Perfect for applications where colour changes frequently.

Detecting foam targets
- Reliable detection when light is dispersed by a target such as foam
Sensor Head

Four variations ranging from long-distance to high-accuracy detection.

- Short-range type GV-H45/GV-H45L
- Middle-range type GV-H130/GV-H130L
- Long-range type GV-H450/GV-H450L
- Ultra Long-range type GV-H1000/GV-H1000L

Amplifier unit

Wire-saving structure! Up to four units can be connected

The power is supplied through the side connector when connecting expansion units. This saves two wires per unit (power +, -).

Interference suppression function

When expansion units are connected, up to two adjacent units can operate in close proximity to each other with no interference.

- Those two units should be set for the same response time.
- This Interference suppression function is invalid for response times of 20 or 50 ms.

Bar LED

This bar LED shows you the detection state at a glance.

1 spot indicator

This indicator tells you from the reflection whether the target is at the optimal position for detection. Make sure that the 1 spot indicator is lit when you perform the DATUM tuning.

- No multiple reflection
- There is a multiple reflection

External input (selectable)

- External shift input-------- The current value can be shifted to any value.
- Bank switching input------ The bank switches two setting values with each other.
- Timing input------------- This input enables the output.

Timer function (selectable)

- Off-delay, On-delay, One-shot
- On-delay/Off-delay, On-delay/One-shot

Washable sensor head (head only) <IP67>

Rugged, IP67-rated sensor heads can be put to the test in harsh environments.

The GV Series' amplifiers should not be connected with those of other models.

Rugged, IP67-rated sensor heads can be put to the test in harsh environments.

Short-range type

GV-H45/GV-H45L

Middle-range type

GV-H130/GV-H130L

Long-range type

GV-H450/GV-H450L

Ultra Long-range type

GV-H1000/GV-H1000L
World's first DATUM Algorithm  

When the DATUM (background, reference surface) tuning is performed, workpieces can be correctly detected.

<<< DATUM tuning >>>  

Easy tuning just by pressing the [SET] button with a target on a conveyor

When performing the DATUM tuning (reference surface calibration) with a target on a conveyor (background), the values are set slightly above and slightly below the conveyor position. With no workpiece in place, the light waveform falls within this range.

"Output OFF"

<<< Detection example 1 >>>  

Flat workpiece

The CMOS light receiving position changes  
The distance changes  
The workpiece is judged as present  
"Output ON"

<<< Detection example 2 >>>  

Rough workpiece

2 peaks appear on the waveform  
The light receiving pattern changes  
The workpiece is judged as present  
"Output ON"

<<< Detection example 3 >>>  

Round workpiece

The light is not reflected properly  
The distance changes  
The workpiece is judged as present  
"Output ON"
Other convenient sensing algorithms

<<< Edge hold mode >>>

With an unstable background

Edge Hold
Detection of a workpiece on a conveyor

This operation mode ignores slow distance changes and detects only sudden changes in height (workpieces). The GV Series detects the change of the distance so the detection is not affected by the traveling speed of the workpieces.

(a) Distance detection mode
(b) Edge hold mode

<<< Surface detection mode >>>

With a workpiece that has a dual reflection

Some workpieces reflect the light from both top and bottom surfaces, making detection difficult. The surface detection mode ignores all other reflections and detects only the nearest surface.

<<< Clamp function >>>

When the target comes too close to the sensor head

Even when the target comes too close to the sensor head and does not enter the detecting area, this function keeps the previous ON/OFF state.
## Specifications

### SENSOR HEAD

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Configuration</th>
<th>Detection distance</th>
<th>Display</th>
<th>Display resolution</th>
<th>Detectable step change</th>
</tr>
</thead>
<tbody>
<tr>
<td>GV-H450/</td>
<td>Short-range type</td>
<td>Amplifier display value</td>
<td>20 to 45 mm</td>
<td>250 to 0</td>
<td>1 digit (Approx. 0.1 mm)</td>
<td>0.5 mm</td>
</tr>
<tr>
<td>GV-H450L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GV-H130/</td>
<td>Middle-range type</td>
<td>Amplifier display value</td>
<td>55 to 130 mm</td>
<td>750 to 0</td>
<td>2 digits (Approx. 0.2 mm)</td>
<td>1 mm</td>
</tr>
<tr>
<td>GV-H130L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GV-H450/</td>
<td>Long-range type</td>
<td>Amplifier display value</td>
<td>160 to 450 mm</td>
<td>250 to 0</td>
<td>1 digit (Approx. 1 mm)</td>
<td>3 mm</td>
</tr>
<tr>
<td>GV-H450L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GV-H1000/</td>
<td>Ultra long-range type</td>
<td>Amplifier display value</td>
<td>200 to 1000 mm</td>
<td>800 to 0</td>
<td>5 digits (Approx. 5 mm)</td>
<td>20 mm (Detection-distance 200 to 800 mm)</td>
</tr>
<tr>
<td>GV-H1000L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SENSOR AMPLIFIER

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Configuration</th>
<th>Main/ expansion unit</th>
<th>Output mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>GV-21</td>
<td>DIN mounting</td>
<td></td>
<td>Main unit</td>
<td>NPN</td>
</tr>
<tr>
<td>GV-22</td>
<td></td>
<td></td>
<td>Expansion unit</td>
<td></td>
</tr>
<tr>
<td>GV-21P</td>
<td></td>
<td></td>
<td>Main unit</td>
<td>PNP</td>
</tr>
<tr>
<td>GV-22P</td>
<td></td>
<td></td>
<td>Expansion unit</td>
<td></td>
</tr>
</tbody>
</table>

### AMPLIFIER UNIT

<table>
<thead>
<tr>
<th>Amplifier Type</th>
<th>Main unit</th>
<th>Expansion unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPN output</td>
<td>GV-21</td>
<td>GV-22</td>
</tr>
<tr>
<td>PNP output</td>
<td>GV-21P</td>
<td>GV-22P</td>
</tr>
</tbody>
</table>

### Power Supply

- **Power supply:**
  - 10 to 30 VDC, Ripple (P-P): 10% max.
  - 1 to 5 mA max.

### Control Indicator

- **Control indicator:**
  - NPN (PNP) open collector ±10 V DC max. / Max. 100 mA, residual voltage 1 V max.

### Control Input

- **Control input:**
  - Purple: Laser emission stop
  - Pink (selectable from menu): Bank switch, shift, timing

### Environmental Resistance

- **Ambient temperature:**
  - -10 to +50°C (No freezing)
  - -20°C to 85°C (No condensation)

- **Relative humidity:**
  - 26 to 85% (No condensation)
  - 20 to 80% (No condensation)

### Vibration

- 10 to 55 Hz, 1.5 mm double amplitude in the X, Y, and Z directions, 2 hours respectively

### Material

- Housing material: PBT
- Display: Polycarbonate
- Key: Polyacetal
- Cable: PVC

### Specifications Table

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Short-range type</th>
<th>Middle-range type</th>
<th>Long-range type</th>
<th>Ultra long-range type</th>
</tr>
</thead>
<tbody>
<tr>
<td>GV-H450/</td>
<td>Amplifier display value</td>
<td>20 to 45 mm</td>
<td>250 to 0</td>
<td>1 digit (Approx. 0.1 mm)</td>
</tr>
<tr>
<td>GV-H450L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GV-H130/</td>
<td>Amplifier display value</td>
<td>55 to 130 mm</td>
<td>750 to 0</td>
<td>2 digits (Approx. 0.2 mm)</td>
</tr>
<tr>
<td>GV-H130L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GV-H450/</td>
<td>Amplifier display value</td>
<td>160 to 450 mm</td>
<td>250 to 0</td>
<td>1 digit (Approx. 1 mm)</td>
</tr>
<tr>
<td>GV-H450L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GV-H1000/</td>
<td>Amplifier display value</td>
<td>200 to 1000 mm</td>
<td>800 to 0</td>
<td>5 digits (Approx. 5 mm)</td>
</tr>
<tr>
<td>GV-H1000L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

1. **General guideline for amplifier display values relative to detection distance (sensor display mode is set to normal).**
2. Incandescent lamp: 5000 lux, Sunlight: 3000 lux for GV-H1000L (When the response time is set to 10 ms or faster)
3. Incandescent lamp: 1000 lux, Sunlight: 500 lux for GV-H450L (When the response time is set to 10 ms or faster)
4. Including the cable (2 m).
5. The laser classification for FDA (CDRH) is implemented based on IEC 60825-1 in accordance with the requirements of Laser Notice No.50.
**I/O Circuit Diagram**

**Output circuit**
- **GV-21**: Pink: Bank switching input/Shift input/Timing input, Purple: Emission stop input
- **GV-21P**: Pink: Bank switching input/Shift input/Timing input, Purple: Emission stop input
- **GV-22**: Pink: Bank switching input/Shift input/Timing input, Purple: Emission stop input
- **GV-22P**: Pink: Bank switching input/Shift input/Timing input, Purple: Emission stop input

**GV-21/22**
- Emission stop input, Bank switching input, Shift input, Timing input

**GV-21P/22P**
- Emission stop input, Bank switching input, Shift input, Timing input

*1* Pink: Bank switching input/Shift input/Timing input, Purple: Emission stop input
*2* The power lines (brown and blue) of the main unit and those of the expansion unit are common inside through the connector.

**Dimensions**

**GV-H1000/GV-H1000L**

**Insulation sheet (accessory)**

**When the insulation sheet is attached**

**When the mounting bracket is attached**

**Unit:** mm

**Mounting bracket (accessory)**

Material: SUS304
Supplied screw (2 pcs.) M3, P=0.5, L=30, Material: SUS

**Dimensions**

**GV Series**
SENSOR VARIATIONS

AMPLIFIERS
FIBRE OPTIC SENSOR

F5-N Series
Mega Power Light Beam

COLOUR DETECTION SENSOR
CZ-V Series
4 Independent Outputs

HEAVY-DUTY SENSOR
PX Series
Oil-resistant, waterproof

LASER OPTIC SENSOR
LV-H/LV-S Series
Long distance & wide area

FIBRE OPTIC SENSORS

Tough & Durable

Environment-proof

Easy Installation

Space saving

Area detection

Laser beam

Please visit: www.keyence.com

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

The information in this publication is based on KEYENCE’s internal research/evaluation at the time of release and is subject to change without notice.

Copyright (c) 2008 KEYENCE CORPORATION. All rights reserved.