

# KEYENCE

Digital CMOS Laser Sensor  
GV Series



Up to  
**1 m**  
Away



Stable detection of  
**metal** targets



Innovative solution for  
**black** targets

World's first **DATUM** Algorithm

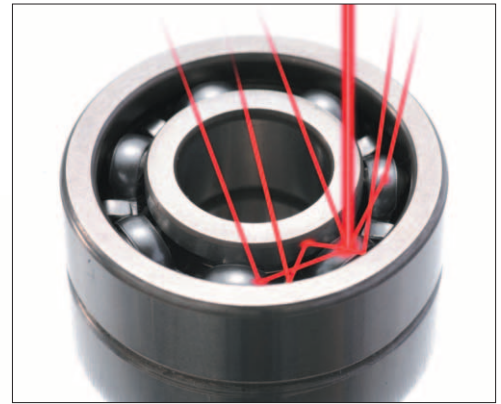
# *Conventional laser sensors have problems with...*

## **Metals**

Multiple reflection



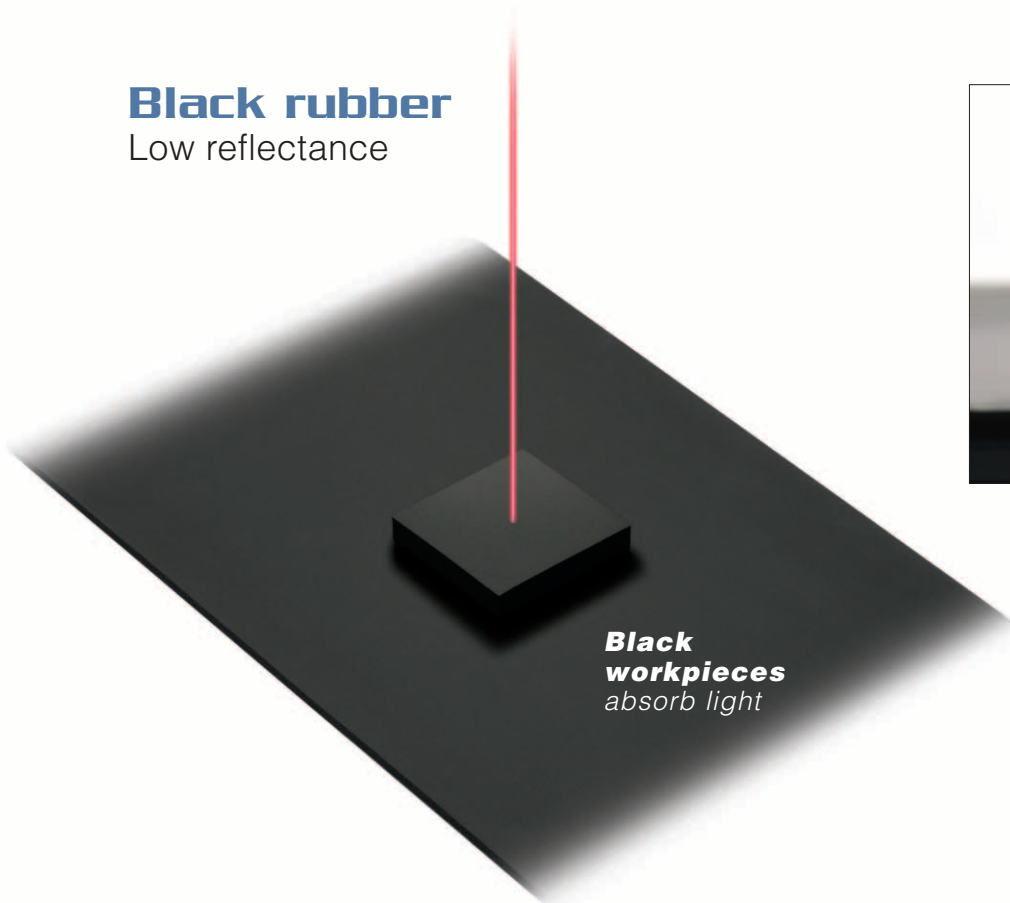
**Metal  
workpieces**  
*scatter the  
laser light*



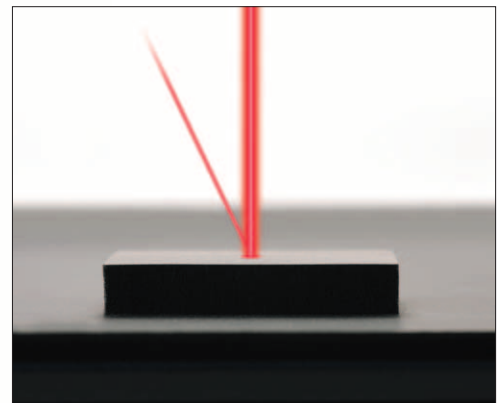
The correct valve  
cannot be detected due to  
multiple reflections

## **Black rubber**

Low reflectance



**Black  
workpieces**  
*absorb light*

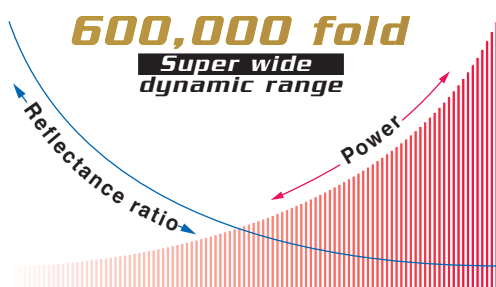
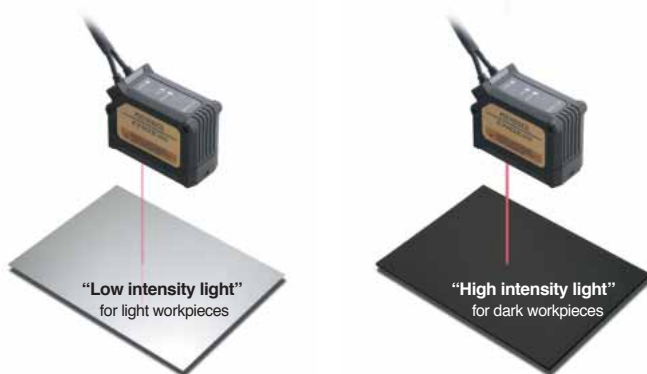


The detection is  
unstable due  
to the low reflectance

The latest light intensity control system reliably detects any colours.

**Best in the class 600,000 fold Super wide dynamic range**

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**

Item	Lowest detection range	Highest detection range*
Laser power	1	Two fold
Light emitting time	1	3,926 fold
Gain	1	77 fold
Total	1	approximately 600,000 fold

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

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



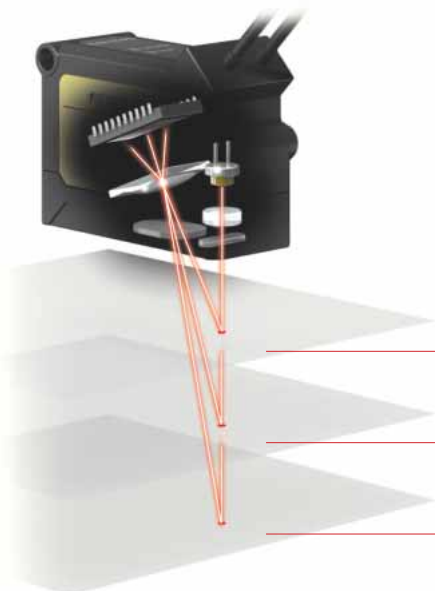
Amplifier unit  
GV-21/21P  
GV-22/22P

**DATUM**  
function

**Newly developed  
GV CMOS**

**Stable detection and high-speed response**

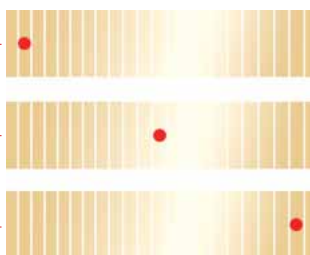
The size per pixel of this CMOS is larger than that of the conventional one to receive a larger amount of light than before. This provides stable detection and high-speed response.



**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

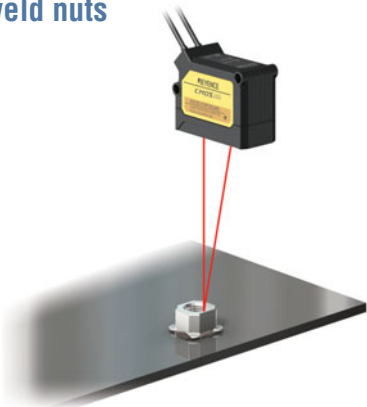


GV CMOS

\* A CMOS is a device with multiple light receiving elements aligned.

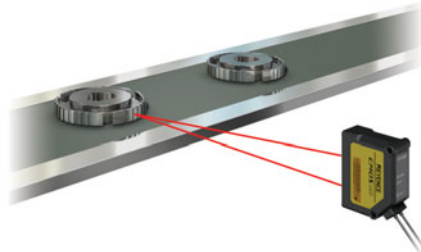
# Applications

## 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



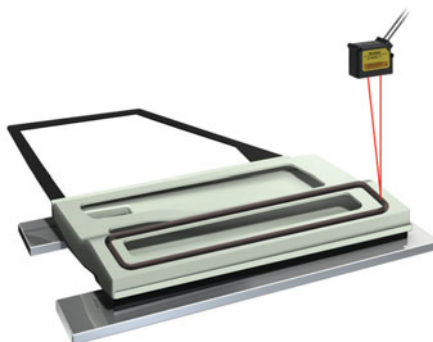
- Unaffected by polished, metallic surface

## Checking processed grooves of pipe material



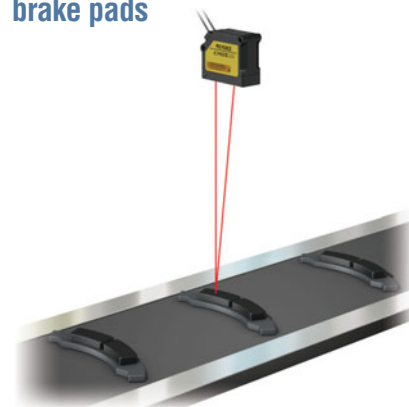
- Ignores scattered light and focuses only on the groove

## Checking application of adhesive



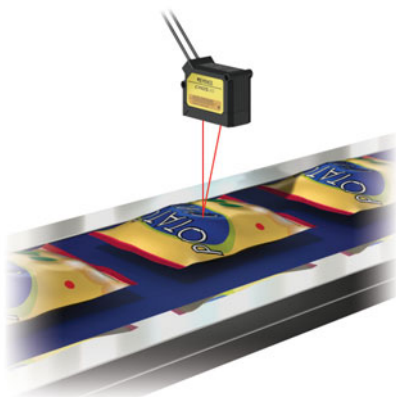
- Long distance detection of dark, glossy surfaces

## Detecting presence/absence of brake pads



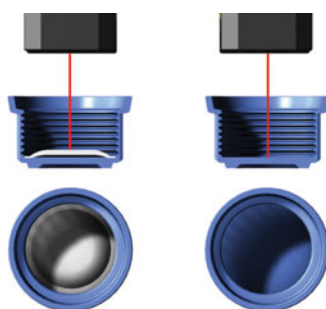
- Long distance detection of dark and irregular shaped targets

## Detecting snack packages



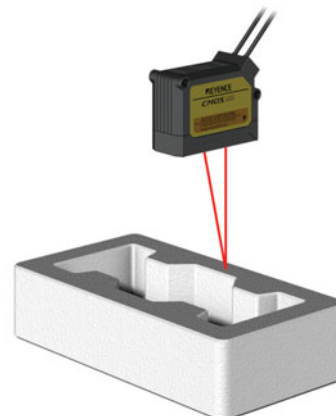
- Stable detection of shiny, wrinkled plastic or foil

## 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.



### Washable sensor head (head only) <IP67>

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

# 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 +, -).



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

### 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.

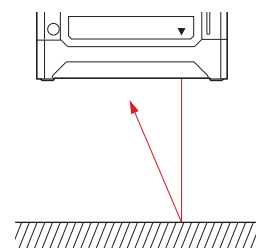
#### No multiple reflection



Head side



Amplifier side



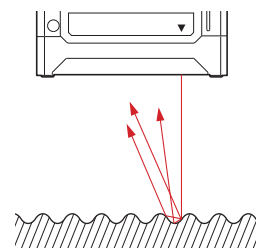
#### There is a multiple reflection



Head side



Amplifier side



### 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

# World's first **DATUM** Algorithm <Patent pending>

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

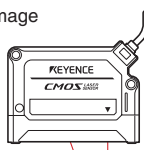
## DATUM ALGORITHM

- Based on:
- Distance
  - Received light pattern

### <<< DATUM tuning >>>

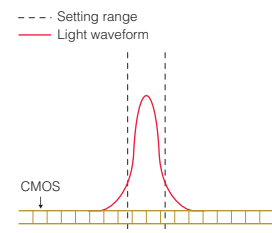
Easy tuning just by pressing the [SET] button with a target on a conveyor

Detection image



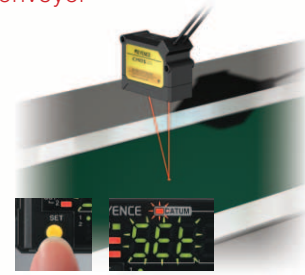
CONVEYOR

CMOS light received image



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.

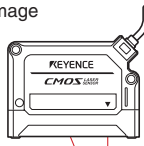
“Output OFF”



### <<< Detection example 1 >>>

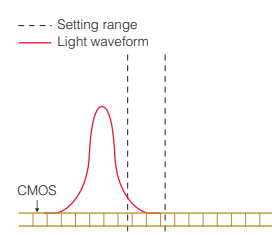
Flat workpiece

Detection image



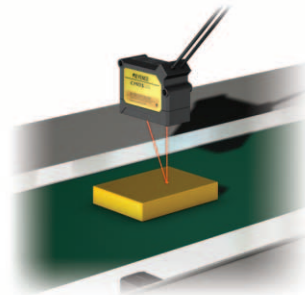
CONVEYOR

CMOS light received image



The CMOS light receiving position changes  
↓  
The distance changes  
↓  
The workpiece is judged as present

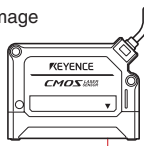
“Output ON”



### <<< Detection example 2 >>>

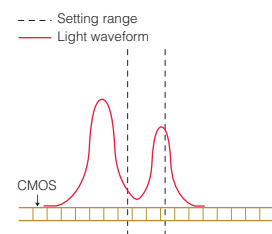
Rough workpiece

Detection image



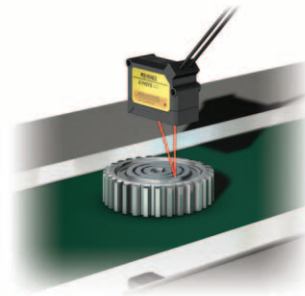
CONVEYOR

CMOS light received image



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

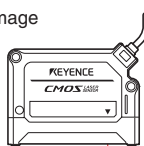
“Output ON”



### <<< Detection example 3 >>>

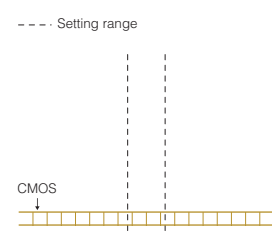
Round workpiece

Detection image



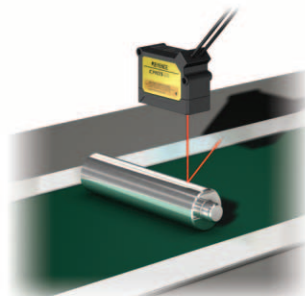
CONVEYOR

CMOS light received image



The light is not reflected properly  
↓  
The distance changes  
↓  
The workpiece is judged as present

“Output ON”





Other convenient sensing algorithms

<<< Edge hold mode >>> <Patent pending>  
With an unstable background

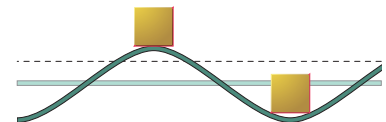
**Edge Hold**  
Detection of a workpiece on a conveyor

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.

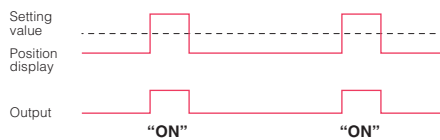
Normal state



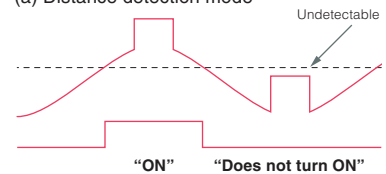
With an unstable background



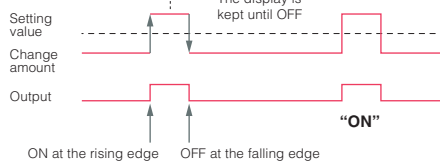
(a) Distance detection mode



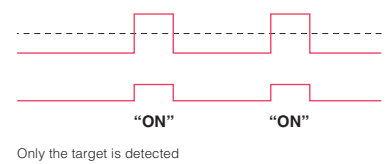
(a) Distance detection mode



(b) Edge hold mode

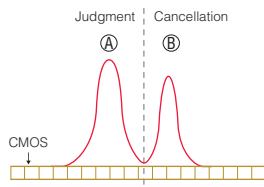
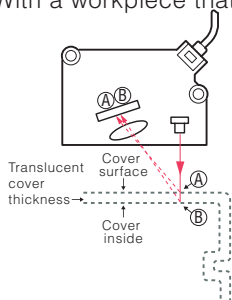


(b) Edge hold mode

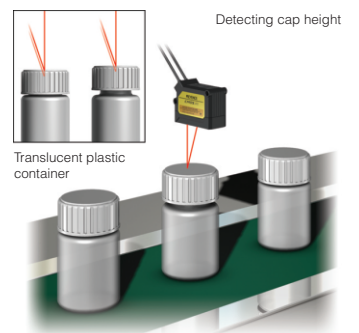


<<< Surface detection mode >>>

With a workpiece that has a dual reflection

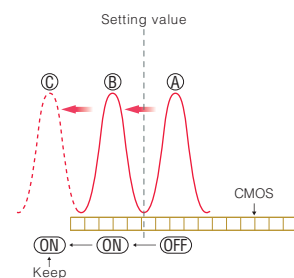
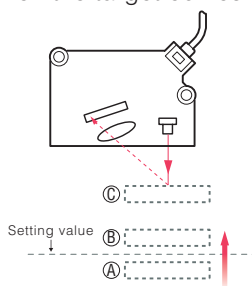


Some workpieces reflect the light from both top and bottom surfaces, making detection difficult. The surface detection mode ignores all other reflections and detects only the nearest surface.

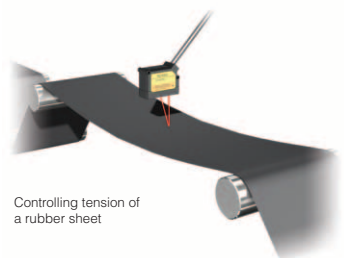


<<< Clamp function >>>

When the target comes too close to the sensor head

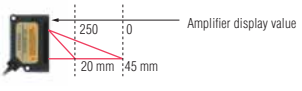
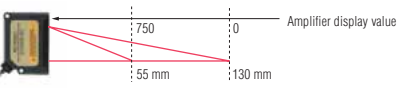
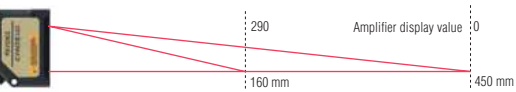
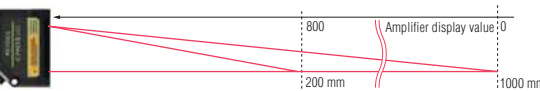


Even when the target comes too close to the sensor head and does not enter the detecting area, this function keeps the previous ON/OFF state.




# Lineup






## SENSOR HEAD

Model	Type	Configuration	Detection distance	Display	Display resolution	Detectable step change
GV-H45/ GV-H45L	Short-range		20 to 45 mm	250 to 0	1 digit (Approx. 0.1 mm)	0.5 mm
GV-H130/ GV-H130L	Middle-range		55 to 130 mm	750 to 0	2 digits (Approx. 0.2 mm)	1 mm
GV-H450/ GV-H450L	Long-range		160 to 450 mm	290 to 0	1 digit (Approx. 1 mm)	3 mm
GV-H1000/ GV-H1000L	Ultra long-range type		200 to 1000 mm	800 to 0	5 digit (Approx. 5 mm)	20 mm (Detection distance 200 to 800 mm) 30 mm (Detection distance 800 to 1000 mm)

## SENSOR AMPLIFIER

Model	Type	Configuration	Main/ expansion unit	Output mode
GV-21	DIN mounting		Main unit	NPN
GV-22			Expansion unit	
GV-21P			Main unit	PNP
GV-22P			Expansion unit	

## OPTIONAL (sold separately)

				
Rear mounting bracket for GV-H45(L)	Rear mounting bracket for GV-H130(L)	Rear mounting bracket for GV-H450(L)/GV-H1000(L)	Fixture for fastening the DIN amplifier	End unit (2 units in a set)
<b>GV-B01</b>	<b>GV-B02</b>	<b>GV-B03</b>	<b>OP-76877</b>	<b>OP-26751</b>

# Specifications

## SENSOR HEAD



Sensor type		Short-range type		Middle-range type		Long-range type		Ultra long-range type	
Model		GV-H45	GV-H45L	GV-H130	GV-H130L	GV-H450	GV-H450L	GV-H1000	GV-H1000L
Light source		Visible semiconductor laser Wavelength: 655 nm							
Laser class	FDA laser class	Class II (Max. 560 µW)	Class 1 <sup>5</sup> (Max. 220 µW)	Class II (Max. 560 µW)	Class 1 <sup>5</sup> (Max. 220 µW)	Class II (Max. 56 µW)	Class 1 <sup>5</sup> (Max. 220 µW)	Class II (Max. 560 µW)	Class 1 <sup>5</sup> (Max. 220 µW)
	IEC class	Class 2 (Max. 560 µW)	Class 1 (Max. 220 µW)	Class 2 (Max. 560 µW)	Class 1 (Max. 220 µW)	Class 2 (Max. 560 µW)	Class 1 (Max. 220 µW)	Class 2 (Max. 560 µW)	Class 1 (Max. 220 µW)
Detection distance (Amplifier range <sup>1</sup> )		20 to 45 mm (250 to 0)		55 to 130 mm (750 to 0)		160 to 450 mm (290 to 0)		200 to 1000 mm (800 to 0)	
Displayable range		259 to -34		768 to -98		295 to -50		810 to -175	
Standard detection deviation		0.5 mm		1 mm		3 mm		20 mm (Detection distance 200 to 800 mm) 30 mm (Detection distance 800 to 1000 mm)	
Spot diameter		Approx. ø0.1 mm (Detection distance 45 mm)		Approx. ø0.3 mm (Detection distance 130 mm)		Approx. ø0.8 mm (Detection distance 450 mm)		Approx. ø1.8 mm (Detection distance 1000 mm)	
Operation status indicators		Control output: Red LED / Laser radiation emission indicator: Green LED / Other: Green LED							
Environmental resistance	Enclosure rating	IP67							
	Ambient temperature	-10 to +50°C (No freezing)							
	Relative humidity	35 to 85% (No condensation)							
	Ambient light	Incandescent lamp: 10000 lux / Sunlight: 20000 lux	Incandescent lamp: 5000 lux / Sunlight: 10000 lux	Incandescent lamp: 10000 lux / Sunlight: 20000 lux	Incandescent lamp: 5000 lux / Sunlight: 10000 lux	Incandescent lamp: 5000 lux / Sunlight: 10000 lux	Incandescent lamp: 2500 lux / Sunlight: 5000 lux	Incandescent lamp: 5000 lux / Sunlight: 10000 lux <sup>2</sup>	Incandescent lamp: 2500 lux / Sunlight: 5000 lux <sup>3</sup>
Material		Housing material: PBT Display: Polyarylate Metal: SUS304 Lens cover: Glass Cable: PVC							
Weight <sup>4</sup>		Approx. 120 g		Approx. 130 g		Approx. 190 g		Approx. 210 g	

- General guideline for amplifier display values relative to detection distance (when distance display mode is set to normal).
- Incandescent lamp: 5000 lux, Sunlight: 3000 lux for GV-H1000 (When the response time is set to 10 ms or faster)
- Incandescent lamp: 2500 lux, Sunlight: 1500 lux for GV-H1000L (When the response time is set to 10 ms or faster)
- Including 2 m connector cable (3 m cable for GV-H1000)
- The laser classification for FDA (CDRH) is implemented based on IEC 60825-1 in accordance with the requirements of Laser Notice No. 50.

## AMPLIFIER UNIT

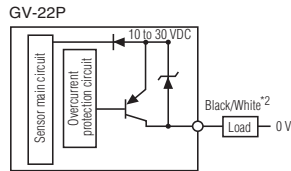
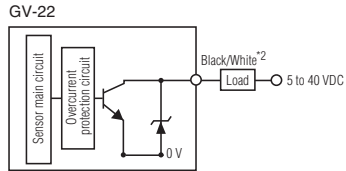
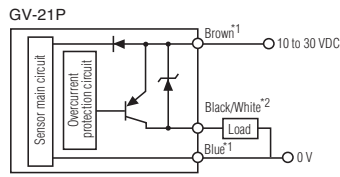
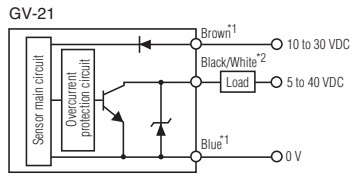
Model	Amplifier Type	Main unit	Expansion unit
	NPN output PNP output	GV-21 GV-21P	GV-22 GV-22P
Power voltage		10 to 30 VDC, Ripple (P-P): 10% max, Class 2	
Power consumption	Normal	2200 mW max. (at 30 V: 73.3 mA max.)	
	Eco-Half	1700 mW max. (at 30 V: 56.7 mA max.)	
	Eco-All	1600 mW max. (at 30 V: 53.3 mA max.)	
Display indicator		Dual 7-segment display (Current Value: 3-digit red LED indicator, Preset Value: 3-digit green LED indicator) + 2-colour 13-level Bar LED (Red, Green)	
Operation status indicators		Control output: Red LED x 2 Channel display: Green LED x 2 Laser radiation emission indicator Green LED Other: Green LED x 2/Red LED x 3	
Control output		NPN (PNP) open collector x 2ch, 40 V (30 V) DC max. / Max. 100 mA, residual voltage 1 V max.	
Control input		Purple: Laser emission stop Pink (selectable from menu): Bank switch, shift, timing	
Response time		1.5/3/10/20/50 ms	
Environmental resistance	Ambient temperature	-10 to +55°C (No freezing)	
	Relative humidity	35 to 85% (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, display cover: Polycarbonate Key Top: Polyacetal Cable: PVC	
Weight <sup>1</sup>		Approx. 110 g	

- Including the cable (2 m).



# I/O Circuit Diagram

## Output circuit



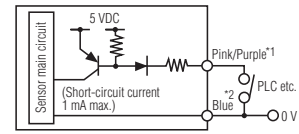
\*1 The power lines (brown and blue) of the expansion unit are common inside through the connector.  
 \*2 Black: Control output 1/White: Control output 2

\*1 The power lines (brown and blue) of the main unit and those of the expansion unit are common inside through the connector.  
 \*2 Black: Control output 1/White: Control output 2

## Input circuit

Emission stop input, Bank switching input, Shift input, Timing input

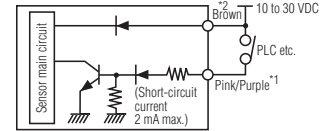
### GV-21/22



\*1 Pink: Bank switching input/Shift input/Timing input, Purple: Emission stop input

\*2 The power line (blue) of the main unit and that of the expansion unit are common inside through the connector.

### GV-21P/22P

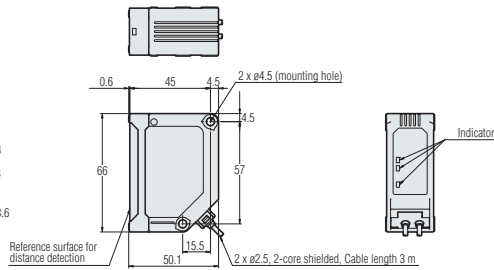
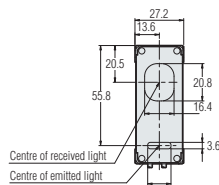


\*1 Pink: Bank switching input/Shift input/Timing input, Purple: Emission stop input

\*2 The power line (brown) of the main unit and that of the expansion unit are common inside through the connector.

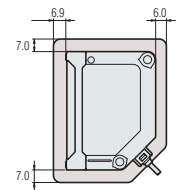
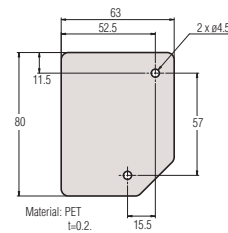
# Dimensions

## SENSOR HEAD GV-H1000/GV-H1000L

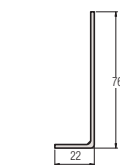


### Insulation sheet (accessory)

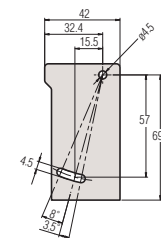
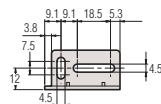
### When the insulation sheet is attached



### Mounting bracket (accessory)

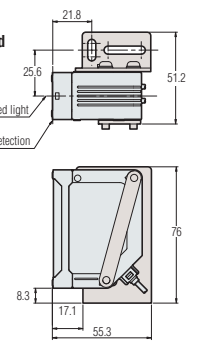
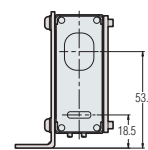


Material: SUS304  
 t=2.0  
 Supplied screw (2 pcs.) M3, P=0.5, L=30, Material: SUS



Material: SUS304  
 t=2.0

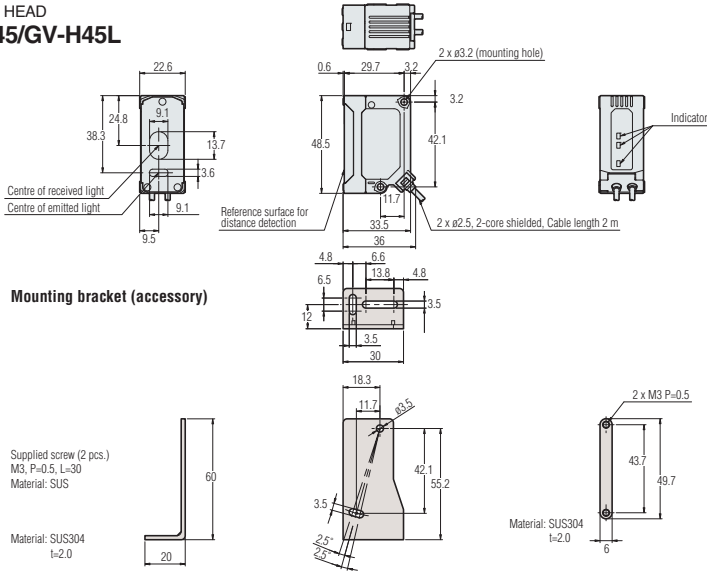
### When the mounting bracket is attached



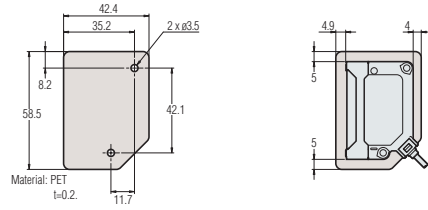
Unit:mm

# Dimensions

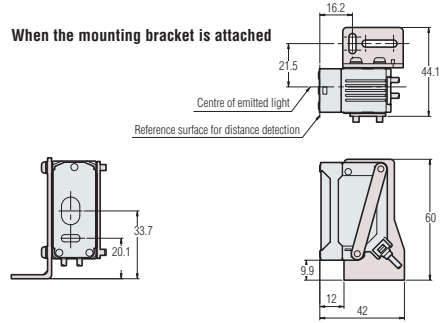
## SENSOR HEAD GV-H45/GV-H45L



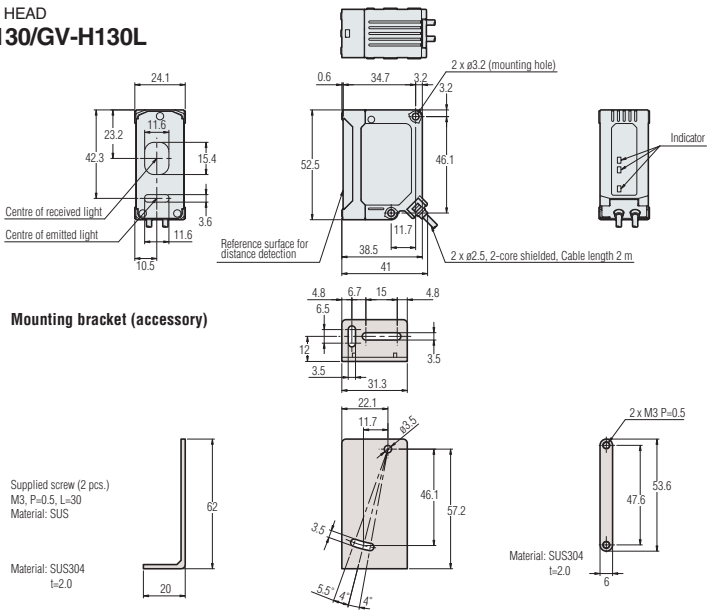
### Insulation sheet (accessory) When the insulation sheet is attached



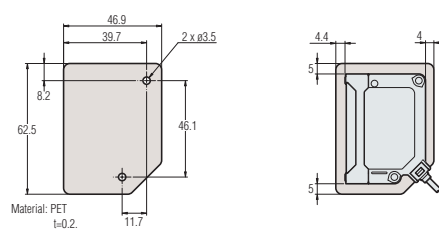
### When the mounting bracket is attached



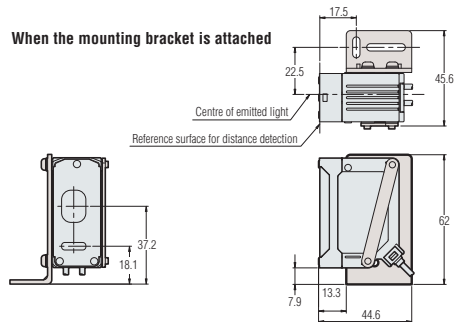
## SENSOR HEAD GV-H130/GV-H130L



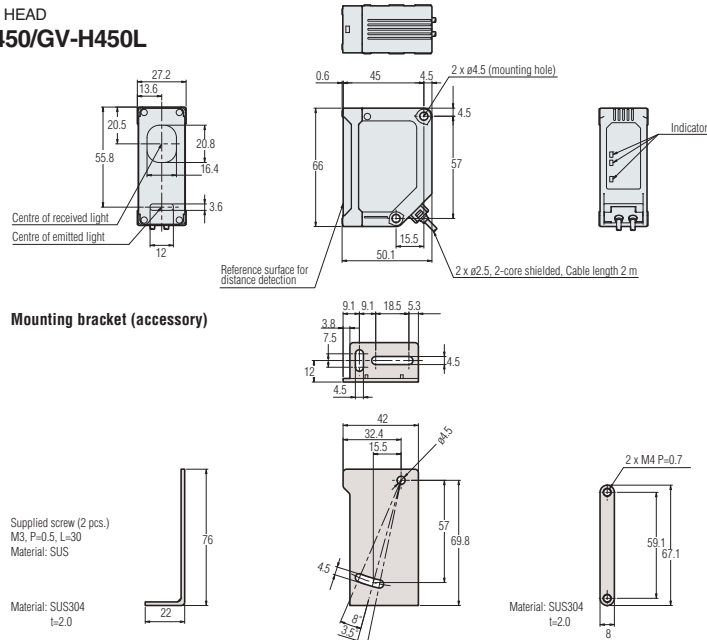
### Insulation sheet (accessory) When the insulation sheet is attached



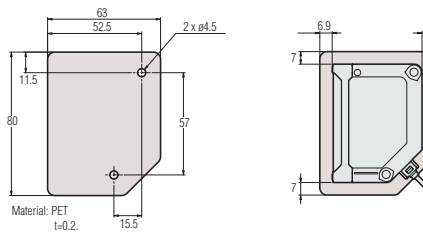
### When the mounting bracket is attached



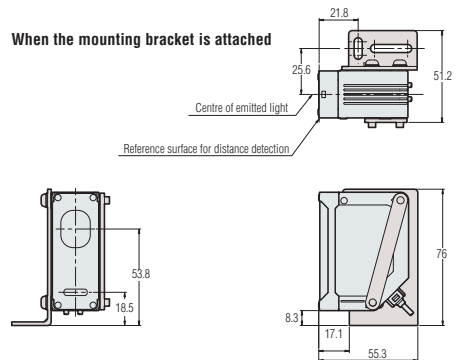
## SENSOR HEAD GV-H450/GV-H450L



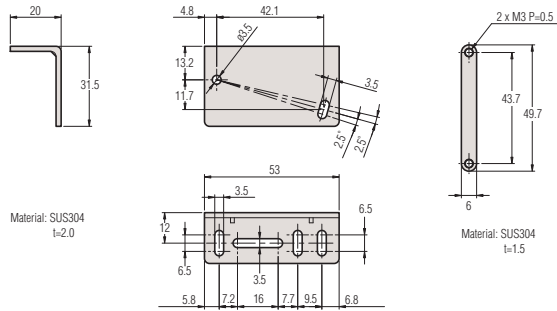
### Insulation sheet (accessory) When the insulation sheet is attached



### When the mounting bracket is attached

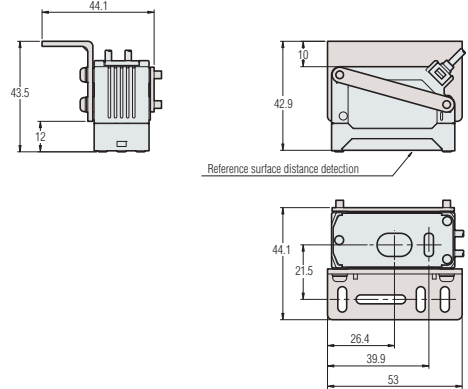


Rear mounting bracket for GV-H45/GV-H45L (optional) **GV-B01**

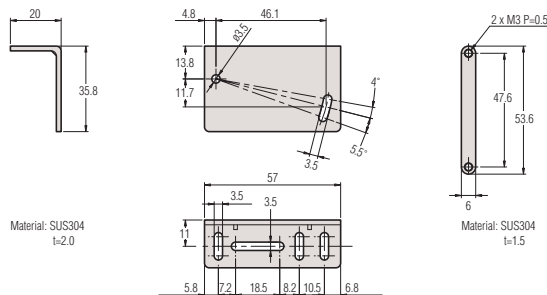


Supplied screw (2 pcs.) M3, P=0.5, L=30, Material: SUS

When the mounting bracket is attached

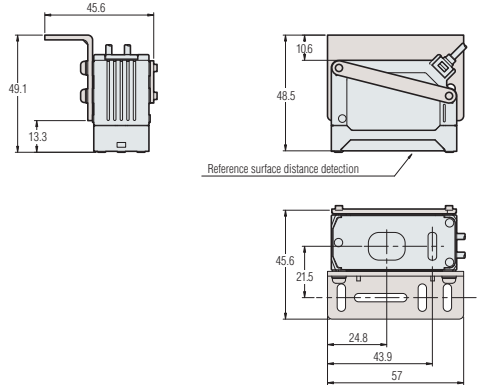


Rear mounting bracket for GV-H130/GV-H130L (optional) **GV-B02**

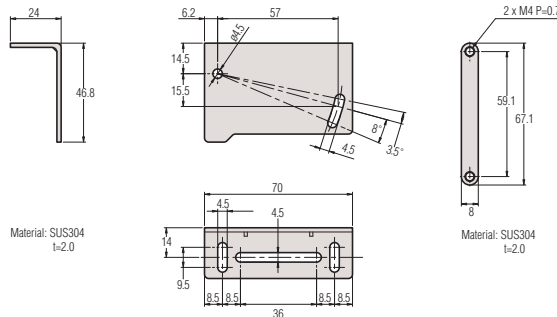


Supplied screw (2 pcs.) M3, P=0.5, L=30, Material: SUS

When the mounting bracket is attached

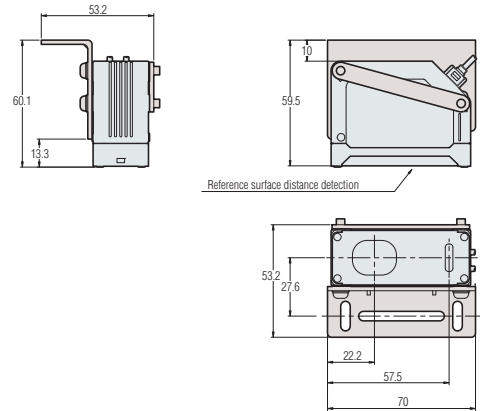


Rear mounting bracket for GV-H450/GV-H450L GV-H1000/GV-H1000L (optional) **GV-B03**

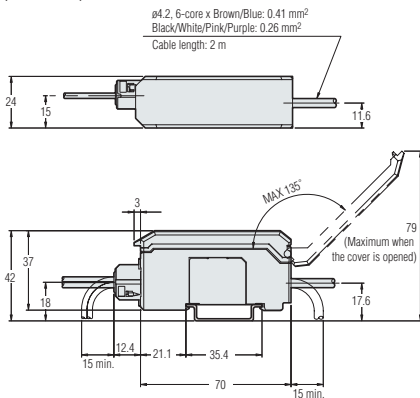


Supplied screw (2 pcs.) M3, P=0.5, L=30, Material: SUS

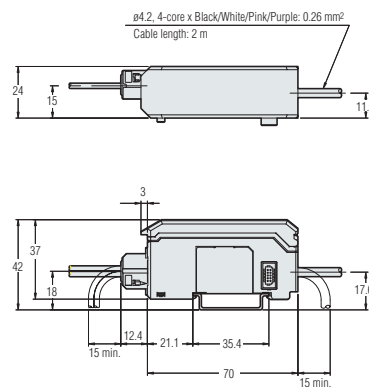
When the mounting bracket is attached



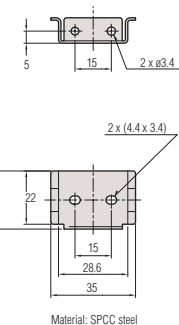
SENSOR AMPLIFIER **GV-21/21P** (Main unit)



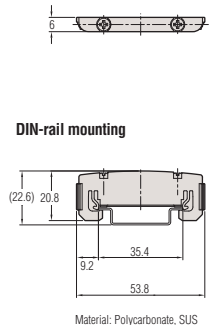
**GV-22/22P** (Expansion unit)



Fixture for fastening the DIN amplifier **OP-76877** (optional)



End unit **OP-26751** (optional)



DIN-rail mounting

# SENSOR VARIATIONS

## AMPLIFIERS

FIBRE OPTIC SENSOR

FS-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



# KEYENCE

Please visit: [www.keyence.com](http://www.keyence.com)



### SAFETY INFORMATION

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

### KEYENCE GLOBAL HEADQUARTERS

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