

Digital CMOS Laser Sensor GV Series

Instruction Manual

Read this manual before using the sensor in order to achieve maximum performance.
Keep this manual in a safe place after reading it so that it can be used at any time.

Note The displayed values indicate guidelines for distances and should not be used in exact measurement applications.

Safety Precautions on Laser Products



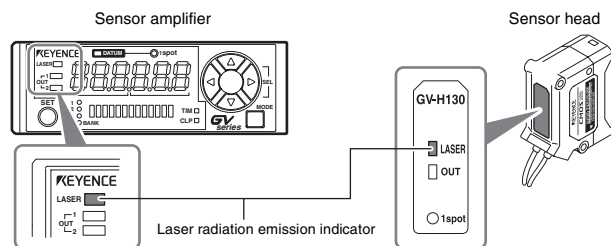
- The GV Series is intended for the detection of target objects. Do not apply the product to safety circuits for human protection.
- This product is not of explosion-proof construction. Do not use it in a location where any flammable gases, liquid, or powder exist.
- Control, adjustment, or performance of procedures other than those specified herein may result in hazardous radiation exposure.
- This product employs a semiconductor laser for its light source.
- Class 2 Laser Product
Do not look directly at laser light or reflected laser light from a mirrored surface. Otherwise, eye injury may result.
- Do not disassemble the GV Series.
This will result in harmful laser radiation exposure and possible eye injury.
- Be sure to stop the laser emission before cleaning the laser emission opening. Otherwise, exposure to the laser may cause eye injury.
- Be careful of the path of the laser beam.
If there is a danger that the operator may be exposed to the laser beam reflected by specular or diffuse reflection, block the beam by installing an enclosure with the appropriate reflectance. Install the GV Series so that the path of the laser beam is not at the same height as that of the human eye during operation.
- We recommend placing a protective enclosure around the GV Series to prevent any human access during operation.
- We recommend always wearing protective goggles when operating the GV Series.
- Do not use the GV Series in ways other than those described in this instruction manual. Otherwise, the laser beam may cause damage.

Item		Description
Model		GV-H45, GV-H130, GV-H450
Wavelength		655 nm
FDA	Class	II
	Maximum output	1 mW
JIS/IEC	Class	2
	Maximum output	1 mW

Safety measures for the laser

Laser radiation emission indicator

The laser radiation emission indicator lights up after turning on the power and while the laser beam is being emitted.



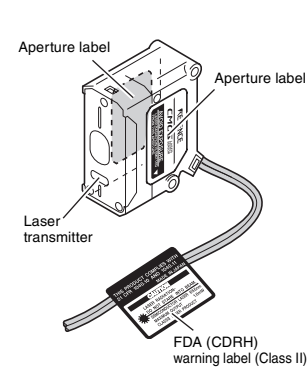
Laser emission stop input

Laser emission stops when a signal is input for 20ms or longer on the purple wire. Laser emission will begin approximately 20ms after the input has been removed. The control output functions according to the detection value even while the laser emission stop is being input.

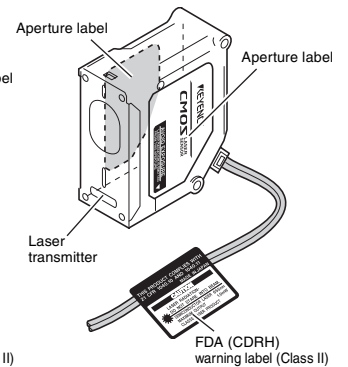
Laser warning labels

The following diagrams show the type and position of laser warning labels according to the GV Series.

GV-H45/H130



GV-H450



Aperture label



FDA (CDRH) warning label (CLASS II)



JIS/IEC warning label (CLASS 2)



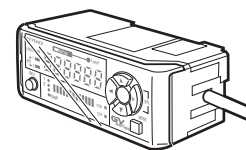
When using the GV Series within Japan, apply the warning labels in a clear position, such as by affixing the JIS warning label over the FDA (CDRH) warning label.

Checking the Package Contents

Check if the parts and equipment listed below are included in the package of the model you purchased before using the unit.

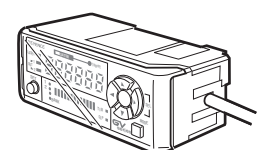
Sensor amplifier

GV-21/GV-21P (main unit)



Amplifier x1
Instruction manual x1

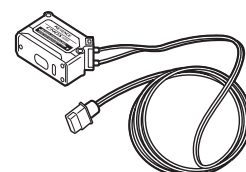
GV-22/GV-22P (expansion unit)



Amplifier x1

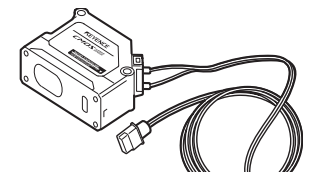
Sensor head

GV-H45/H130



Sensor head x1
Insulating sheet x1
Mounting bracket x1
Board nut x1
M3 x L30 screw x2
Laser warning sticker x1

GV-H450



Sensor head x1
Insulating sheet x1
Mounting bracket x1
Board nut x1
M4 x L35 screw x2
Laser warning sticker x1

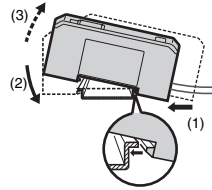
We have thoroughly inspected the package contents before shipment. However, in the event of defective or broken items, contact your nearest KEYENCE office.

Mounting and Wiring the Sensor Amplifier

Mounting the sensor amplifier

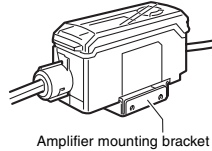
■ Mounting the GV-21/GV-21P (main unit)

- 1 Align the claw at the bottom of the main body with the DIN rail. While pushing the main body in the direction of the arrow 1, slant it in the direction of the arrow 2.



- 2 To dismount the sensor, raise the main body in the direction of the arrow 3 while pushing the main body in the direction of the arrow 1.

When using the amplifier mounting bracket (OP-76877) (sold separately), mount it as shown in the diagram to the right.



■ Mounting the GV-22/GV-22P (expansion unit)

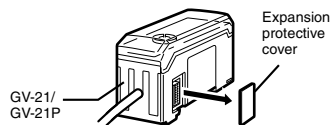
Several expansion units can be used in connection with the main unit. Up to three expansion units can be connected to one main unit.

CAUTION

- When connecting multiple amplifiers (expansion units), first check to make sure that the power is turned off to all of the main and expansion units. Connecting the units with the power turned on may cause damage to the units.
- Push the amplifiers (expansion units) as far as possible into the main unit. If they are connected at a slant or not inserted securely, the units may be damaged.
- Only GV Series amplifier can be connected. Connecting other amplifiers may cause damage to the units.

Note Expansion units with different output types (such as a PNP output main unit to an NPN output expansion unit) cannot be connected together.

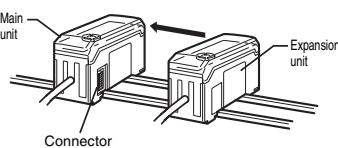
- 1 Remove the expansion protective cover from the GV-21/GV-21P (main unit)



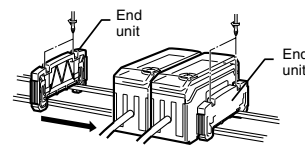
- 2 Install the amplifiers (expansion units) on the DIN rail.

For more information about mounting, see "Mounting the GV-21/GV-21P (main unit)".

- 3 Push the expansion unit into the main unit connector until a clicking sound can be heard.



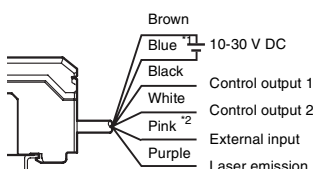
- 4 Install the end units (OP-26751: 2 units in a set) (sold separately) on either side of the amplifiers (main or expansion units). Secure the end units in place with screws on top (2 on each end unit).



The end units are mounted in the same way as the amplifiers.

Amplifier wiring

The following information shows the I/O cable.
For more information about the I/O circuit, see page 9 of this Instruction Manual.



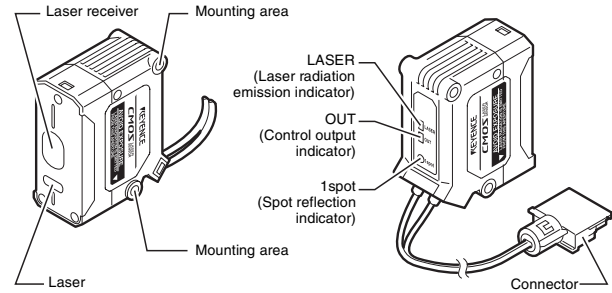
*1 GV-22/GV-22P (expansion unit) do not have brown or blue lines. Power is supplied to the expansion units through GV-21/GV-21P (main unit).

*2 The external input switches as shown below depending on the amplifier OPTIONAL settings.

- oFF Input off
- SFT External shift
- bnK Bank switching
- tim Timing input

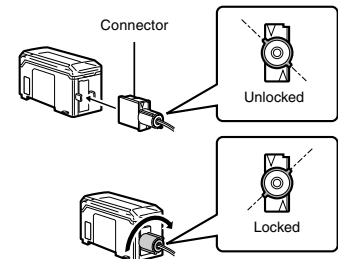
Connecting and Mounting the Sensor Head

Sensor head part names



Connecting the sensor head

- 1 Unlock the sensor head connector and insert it into back of the amplifier.

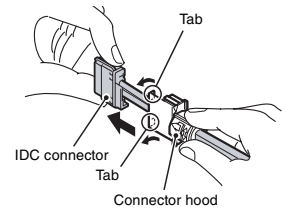


- 2 Turn the round part of the connector clockwise until a clicking sound is heard to lock it.

■ Shortening the sensor head cable

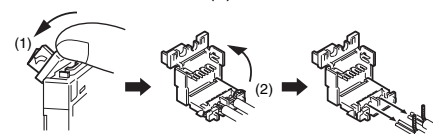
Note After changing the length of the sensor head cable, always check that the connection with the amplifier is working properly. If "ErH" appears on the amplifier, use pliers to re-crimp the connector. If that does not improve the connection, take the connector apart and reconfigure it.

- 1 Release the tabs on the connector hood and pull out the IDC connector in the direction of the arrow.



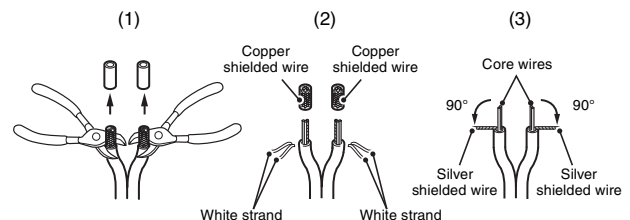
- 2 Hold the IDC connector so that the back side (side where the wires can be seen) is facing forward. Push the upper tab in the direction of arrow (1) and then open the back side in the direction of arrow (2).

Remove the cable and cut it to the required length.



- 3 Manipulate the end of the cables as shown in the following figure.

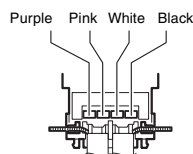
- (1) Strip at least 10 mm of insulation from the end of the cable (do not strip the core wire insulation).
- (2) Cleanly remove the copper shielded wire (remove the white strands at the same time).
- (3) Twist the base of the silver shielded wire at least five times so it does not unravel, and bend it 90° to the side.



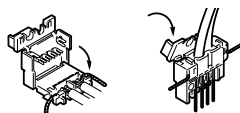
Note

- Be careful not to twist the core wires along with the shielded wire. If the wires become twisted, untwist them slightly and pull the core wires apart from the shielded wires.
- Do not strip the insulation of the core wires.

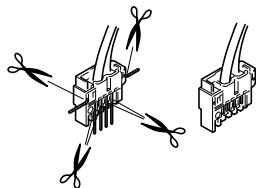
- 4 Insert the core wires into the connector as shown in the diagram, while twisting the shielded wires in the direction of the arrow and pulling them into the grooves.



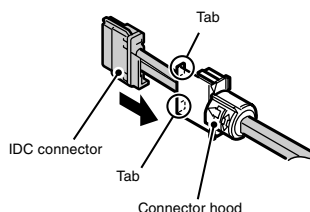
- 5 Close the connector, crimp it tight with pliers or a similar tool, and push down on the top to lock it shut.



- 6 Trim off the wires sticking out of the connector by using a wire cutter.



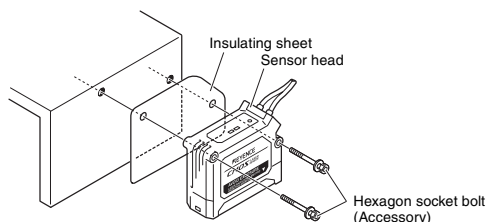
- 7 Firmly insert the IDC connector into the connector hood.



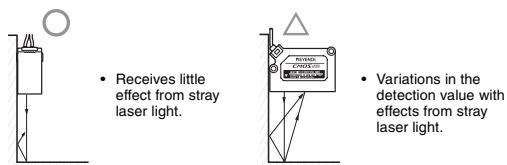
Note Do not install the connectors more than two times. If the connectors have been installed at least two times, purchase another OP-66850 separately.

Mounting the sensor head

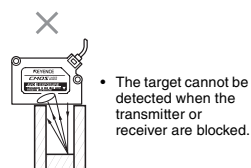
Use the dedicated mounting bracket to mount the sensor head. When not using the dedicated mounting bracket, the included insulating sheet must be inserted between the mounting surface and the sensor head as shown in the diagram. (When using the dedicated mounting bracket, the insulating sheet is not necessary.)



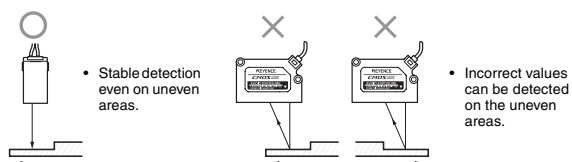
● Mounting when detecting targets close to a wall



● Mounting when detecting targets in a hole

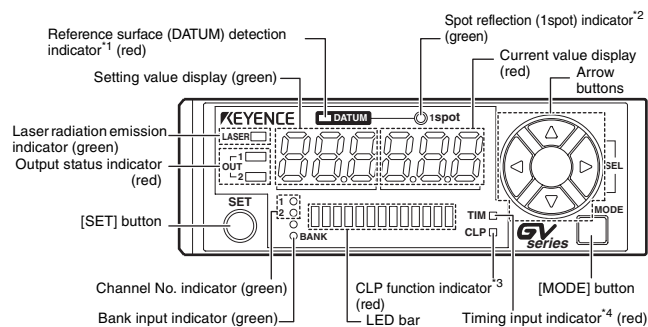


● When detecting uneven workpieces



Sensor Amplifier

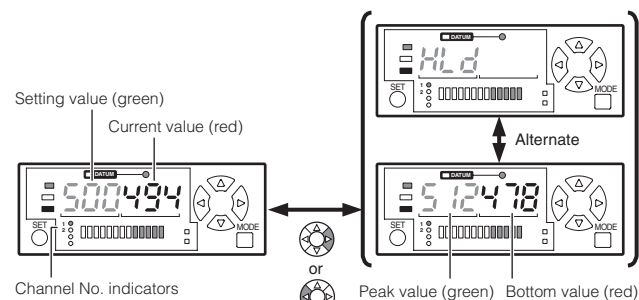
Sensor amplifier part names



- *1 The reference surface (DATUM) detection indicator lights up when performing reference surface detection. For more information, see "Reference surface detection (DATUM) method (Application)" on page 5 of this Instruction Manual.
- *2 The spot reflection indicator lights up during normal detection and turns off during multiple reflection (when multiple peaks of received light intensity occurs due to diffuse reflection), insufficient light intensity, and when the target is out of the detection range.
- *3 For more information about the CLP (clamp) function indicator, see *4. Clamp function setting" on page 8 of this Instruction Manual.
- *4 For more information about the timing input indicator, see "8. External input setting" on page 8 of this Instruction Manual.

Main screen

The main screen can be switched between "Current/setting value display" and "Peak/bottom value display". The main screen can be switched even during keylock.



Setting value/current value display
Pressing the [MODE] button switches the channels (channel No. indicators).

Peak value/bottom value display
Pressing the [UP] arrow button resets the peak and bottom values.

Pressing the [Up] and [Down] arrow buttons simultaneously on the main screen forces the current value (red) to 0.

- * With the default settings. For details, see "9. Shift target value setting" on page 9 of this Instruction Manual.

Note When the channel No. 1 indicator is lit, the control output 1 (black line) setting value is displayed. When the channel No. 2 indicator is lit, the control output 2 (white line) setting value is displayed. Operations are different in F-2 mode. (See page 5 of this Instruction Manual.)

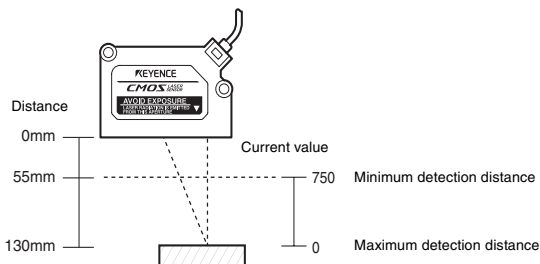
● Current value and display resolution

In the default state, the current value shows 0 when the workpiece is located at the maximum detection distance. Bringing the workpiece closer to the sensor head gradually increases the value and displays it up to the minimum detection distance.

Item	Current value		
	GV-H45	GV-H130	GV-H450
Detecting range (mm)	20.0 to 45.0	55.0 to 130.0	160 to 450
Digital display (initial)	250 to 0	750 to 0	290 to 0
Display resolution	1	2	1

Note The displayed values indicate guidelines for distances and should not be used in the actual applications for measurement.

Example When using sensor head GV-H130



For example, when using the defaults with the setting value (green) at 500, the comparator output turns on when the current value is 500 or greater and turns off when it is less than 500.

If multiple reflection (when multiple peaks of received light intensity occurs due to diffuse reflection) occurs during F-1, F-2, or A-1 modes, the value immediately before the current value is held.

- **Setting value**

The following table shows the default setting values for each channel.

Operation mode	Item	Default value		
		GV-H45	GV-H130	GV-H450
F-1, A-1, A-2	Control output 1 (black) (Channel 1 lit)	150	500	200
	Control output 2 (white) (Channel 2 lit)	125	400	150
F-2	Control output 1 (black) HIGH (Channel 1 lit)	150	500	200
	Control output 1 (black) LOW (Channel 2 lit)	100	300	100
	Control output 2 (white) HIGH (Channel 1 flashing)	125	400	150
	Control output 2 (white) LOW (Channel 2 flashing)	75	200	50

- **Peak/bottom values**

Peak value: Resets when the detection value exceeds the setting value and holds the maximum value (peak value) until the detection value falls below the setting value again.

Bottom value: Resets when the detection value falls below the setting value and holds the minimum value (bottom value) until the detection value exceeds the setting value again.

 The held peak and bottom values can be cleared by pressing and hold the [Up] arrow button.

Using Basic Operations

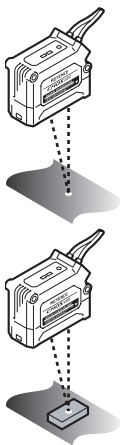
Configure the sensitivity setting in F-1 mode (with the default settings).

2-point calibration

The setting is automatically calculated as the mean value detected from two points: with the workpiece and without the workpiece.

- 1 Press the [SET] button once without a workpiece in place.

The current value without the workpiece is read.



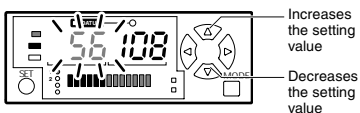
2 Place a workpiece in the detection position, and quickly press the [SET] button once again.

This concludes 2-point calibration and the sensor returns to the detection state.

Reference If there is very little difference between the values obtained in Step 1 and Step 2, then "—" flashes in the setting value display area after calibration is complete. The setting value is still updated.

Fine-tune setting value

Use the [Up] and [Down] arrow buttons to fine-tune the setting value.



Item	Setting range
Setting value fine-tuning	-199 to 999

Reference surface (DATUM) calibration

Use DATUM calibration when comparator output cannot be performed correctly during 2-point calibration (due to problems such as chattering from the surface of the workpiece).

3 Press the [SET] button once without a workpiece in place (reference surface).

4 Using the same conditions, press and hold the [SET] button again for at least three seconds (until the digital display (green) starts flashing).



Configuring the Sensitivity Setting and Operation Mode

Detection method

The GV Series has two types of detection methods: "Distance detection method" and "Reference surface (DATUM) detection method".
The reference surface (DATUM) detection method can only be used when performing reference surface calibration.

Note Control output 2 is fixed to distance detection method for all operation modes.

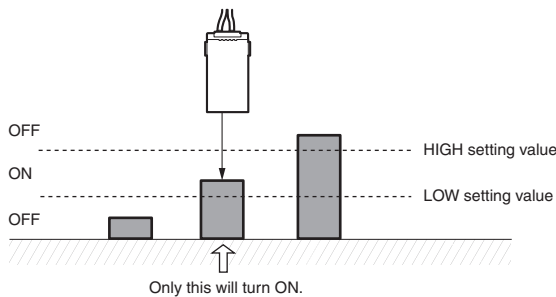
■ Distance detection method (Normal)

Detects the distance between the detection target and the sensor head, and then performs control output. The following table shows each operation mode and the auto calibration that can be used.

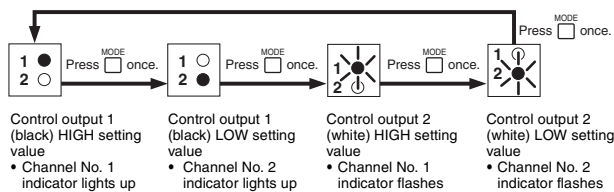
Operation mode		Description	Usable auto calibration
General	F-1	Normal detection mode The most general mode. ON/OFF judgment is performed based on one setting value.	2-point calibration Full auto calibration Maximum sensitivity setting
	F-2	Area detection mode On/OFF judgment is performed on an area based on two settings.	2-point area calibration 1-point area calibration
Special	A-1	Edge hold mode Detects the change in distance (derivation) to the target and holds the display.	2-point calibration Full auto calibration Maximum sensitivity setting
	A-2	Surface detection mode When multiple beams of light are reflected from the detection target, the closest reflected light is judged as the detection value.	2-point calibration Full auto calibration Maximum sensitivity setting

- **Area detection mode (F-2 mode)**

Operation image



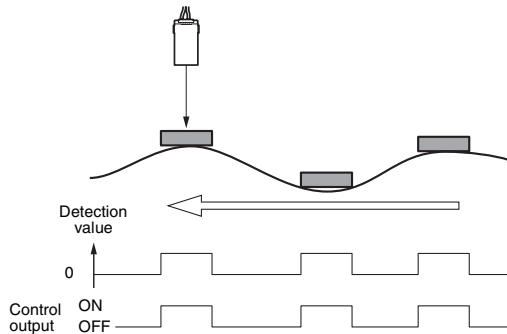
When using the F-2 mode, the channel No. indicator switches in the following order each time the [MODE] button is pressed.



● Edge hold mode (A-1 mode)

This operation mode is suitable for detecting workpieces on a conveyor or detecting workpieces with waving backgrounds. It ignores slow distance changes and only detects workpieces (sudden changes in height).

When height differences greater than the setting value are detected (low areas become high), the value at the detected time are held and displayed, and control output starts.
If the difference is small and does not exceed the setting value, the display stays as 0.
When height differences greater than the setting value are detected (high areas become low), detection value becomes 0 and control output is stopped.



Note

- When edge hold mode (A-1 mode) is selected, edge hold mode only operates on channel 1. Channel 2 operates under distance measurement mode (F-1 mode).
- If the edges are gentle (such as spherical or tilted workpieces), this mode may not be able to detect workpieces or may output the value incorrectly.
- Send the workpiece past the sensor head so that the area for detecting height differences is parallel to the sensor head. See "When detecting uneven workpieces" (page 3).

Reference

- When a detection value is being held, press and hold the [Up] and [Down] arrow buttons at the same time to set the current value to 0 (regardless of the shift target value) and to turn off output. The current value for channel 2 changes to 0 as well.
- If the external input function is set to "SFT" and the external input (pink line) is turned on, the control output turns off and the current value becomes 0. (When channel 2 is selected, the current value becomes 0 as well. Turning the laser emission stop input on and off performs a similar action, but it only changes the current value of the channel to 0.)

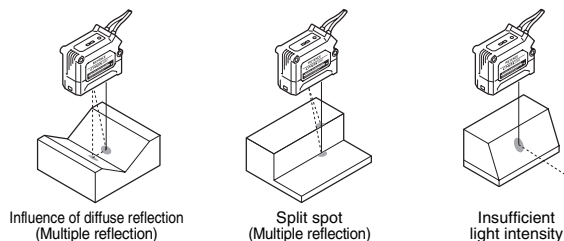
■ Reference surface detection (DATUM) method (Application)

This method memorizes the background (reference surface) and uses it to perform comparator output when there is a workpiece (when the state differs from the reference surface).

The reference surface detection (reference surface calibration) can only be used on Channel 1 of operation mode F-1/F-2.

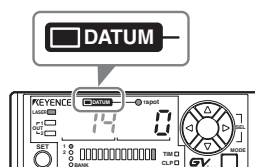
Operation mode	Description	Changes to the setting value
General F-1	Turns on control output when the detected surface is not the same as the memorized reference surface. The current value for the memorized surface is forcibly set to 0. (The display is common for channels 1 and 2.)	The setting value can be configured around 0. Individual setting values cannot be changed.
Special F-2		The setting value can be configured around 0. Individual setting values can be adjusted.

Use the reference surface (DATUM) detection method in the following situations:



During reference screen (DATUM) detection, the background is memorized as the reference. During the unstable situations noted above, a workpiece is judged as present when the detected surface is different from the background. This makes stable detection possible even when using workpieces with unstable shapes.

The reference surface (DATUM) detection indicator lights up when using reference surface detection after performing reference surface (DATUM) calibration.

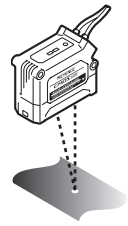


Configuring the sensitivity setting for distance detection method

■ 2-point calibration (operation modes: F-1, A-1, A-2)

1 Press the [SET] button once without a workpiece in place.

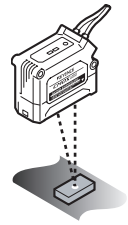
The current value without the workpiece is read.



2 Place a workpiece in the detection position, and quickly press the [SET] button once again.

The setting value is calculated as the mean value between the value obtained in step 1 and the value obtained in step 2.

This concludes 2-point calibration and the sensor returns to the detection state.



Reference

If there is very little difference between the values obtained in Step 1 and Step 2, then "----" flashes in the setting value display area after calibration is complete. The setting value is still updated.

■ Maximum sensitivity setting (operation modes: F-1, A-1, A-2)

1 Press and hold the [SET] button for at least three seconds without a workpiece in place.

2 Release the [SET] button when "Set" flashes on the display.

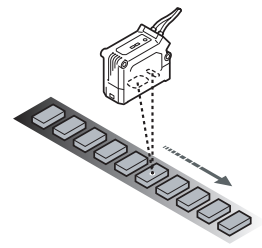
This concludes maximum sensitivity calibration and the sensor returns to the detection state.

■ Full auto calibration (operation modes: F-1, A-1, A-2)

This method performs calibration while the target is moving.

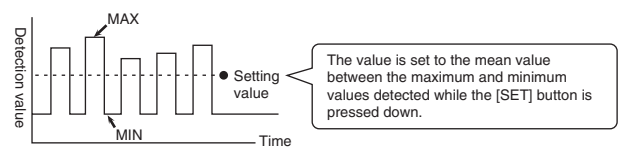
1 Press and hold the [SET] button for at least three seconds while the target workpiece is passing through the detection area for the sensor.

The sensitivity is set according to the detection value while the [SET] button is pressed.



2 Release the [SET] button when "Set" flashes on the display.

This concludes calibration and the sensor returns to the detection state.



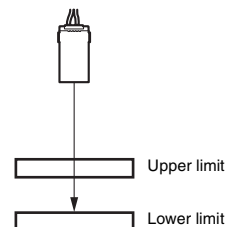
■ 2-point area calibration (operation mode: F-2)

1 Place a workpiece on the upper limit that you want the sensor to detect, and press the [SET] button once.

That upper limit becomes the HIGH setting value.

2 Place a workpiece on the lower limit that you want the sensor to detect, and press the [SET] button once.

That lower limit becomes the LOW setting value.

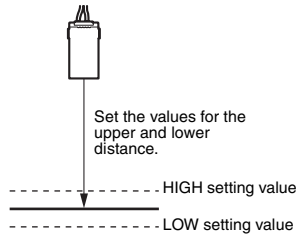


Reference

If there is very little difference between the values obtained in Step 1 and Step 2, then "----" flashes in the setting value display area after calibration is complete. The setting value is still updated.

1-point area calibration (operation mode: F-2)

- 1 Press and hold the [SET] button for at least three seconds with the workpiece that you want to detect in place.
- 2 Release the [SET] button when "SEt" flashes on the display.
1-point area calibration is complete. The sensor will now return to its detection state.

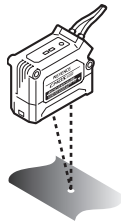


Configuring the sensitivity setting for reference surface (DATUM) detection method

Reference surface (DATUM) calibration (operation mode: F-1, F-2)

This method teaches the sensor to recognize the background or reference surface as one output state. Once a target is introduced into the beam, the output state will change.

- 1 Press the [SET] button once without a target in place.
- 2 Press and hold the [SET] button for at least three seconds without the target in place.



When performing reference surface calibration, the values are set slightly above and slightly below the reference surface. When the detection value falls within this range, comparator output is turned off. When it falls outside of this range, comparator output is turned on.

Operations during F-1 mode

The setting value can be adjusted by using the [Up] and [Down] arrow buttons, but the HIGH and LOW setting values cannot be adjusted individually.

Operations during F-2 mode

The HIGH and LOW setting values can be adjusted individually by using the [Up] and [Down] arrow buttons.

- Note**
- Reference surface calibration cannot be used during the following states. (Instead, 2-point calibration is performed.)
 - The spot reflection indicator (1spot) is flashing on the sensor head or sensor amplifier.
 - The setting is control output 2.
 - A mode other than F-1 mode or F-2 mode is being used.
 - Reference surface calibration can only be set when the operation mode is F-1 or F-2.
 - When performing reference surface calibration, the current value is set to 0.

Clearing reference surface (DATUM) detection method

When the reference surface (DATUM) detection indicator is lit, press and hold the [Up] and [Down] arrow buttons for at least three seconds. The reference surface (DATUM) detection indicator will turn off and the sensor will return to distance detection method. The value is canceled if a form of calibration other than reference surface calibration is performed.

Other Settings

Zero point positioning

Sets the current value to zero (shift target value).

- 1 Press the [Up] and [Down] arrow buttons simultaneously without a target in place.
The current value becomes "0" and zero point positioning is complete.

Note When the shift target value is set, performing zero point positioning does not make the current value "0". Instead, it becomes the set value for the shift target value. For more information about setting the shift target value, see page 9 of this Instruction Manual.

Reference Pressing the [Up] and [Down] arrow buttons simultaneously for at least three seconds cancels the zero point (shift target value).

Initial reset (initialization) and custom save function

Initial reset (initialization)

Returns all of the settings to the factory defaults.

- 1 While pressing the [MODE] button, press the [SET] button five times.
- 2 Press the [Down] arrow button to display "rSt no".
Reference When "rSt no" is displayed, pressing the [MODE] button returns to the main screen without initializing.
- 3 Press the [Up] or [Down] arrow button to select "rSt ini", and then press the [MODE] button to initialize.

Custom save (Saving the settings)

Saves all of the settings. The saved settings can be loaded at a later time.

- 1 While pressing the [MODE] button, press the [SET] button five times.
- 2 Press the [Left] or [Right] arrow button to display "SAv".
- 3 Press the [Down] arrow button to display "SAv no".
Reference When "SAv no" is displayed, pressing the [MODE] button returns to the main screen without saving the settings.
- 4 Press the [Up] or [Down] arrow button to select "SAv YES", and then press the [MODE] button to save the settings.

Note Performing custom save overwrites the settings from the previous custom save.

Custom reset (Loading the settings)

Loads the settings saved with custom save.

- 1 While pressing the [MODE] button, press the [SET] button five times.
- 2 Press the [Down] arrow button to display "rSt no".
Reference When "rSt no" is displayed, pressing the [MODE] button returns to the main screen without performing custom reset.
- 3 Press the [Up] or [Down] arrow button to select "rSt CSt", and then press the [MODE] button to load the settings.

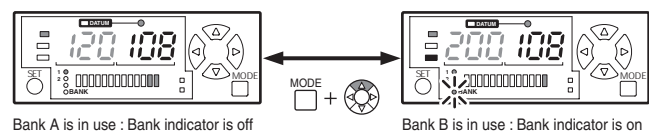
Note Performing custom reset erases the current settings.

Bank switching

The bank function allows two patterns of sensitivity settings to be saved in channels 1 and 2. (This is useful during operations such as switching the setup.)

- The bank switching function can only be used when the external input is set to "bnk" in the OPTIONAL settings.
- Hold down the [MODE] button while in the main screen and press the [Up] arrow button to switch banks. This allows the settings to be configured for each bank.
- During the keylock state, the banks are switched via an external input.

Note When the external input is off, bank A is used. When the external input is on, bank B is used.



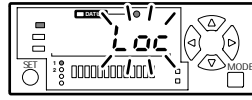
Keylock Function

The keylock function prevents accidental operation of the buttons during detection. While using the keylock function, operations other than switching the display for the main screen are prohibited.

Note The keylock settings can only be set in the main screen.

Setting/releasing keylock

While pressing the [MODE] button in the main screen, press and hold the [UP] or [Down] button for at least three seconds. This sets (or releases) keylock and returns the sensor to the main screen.



Interference protection function

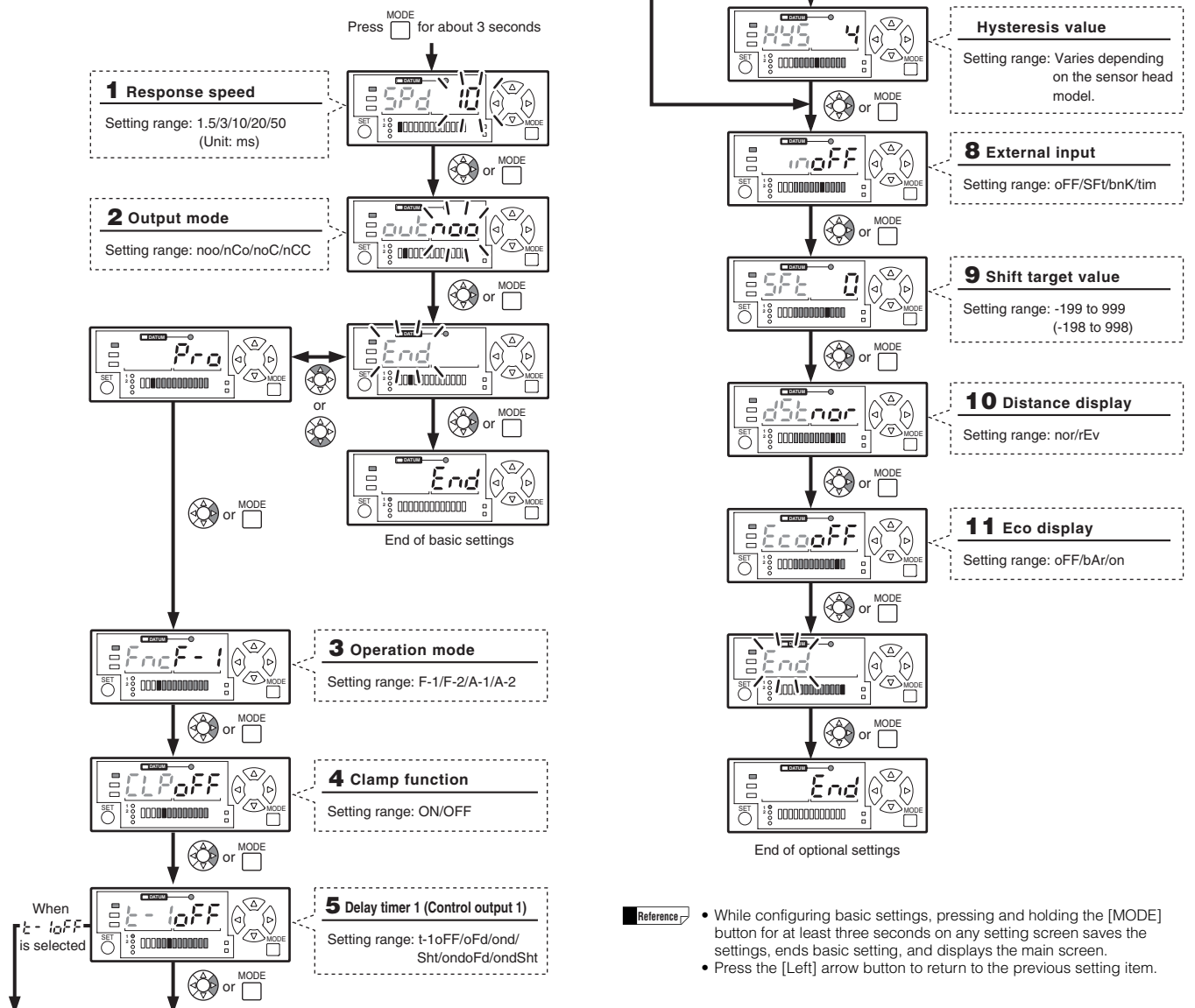
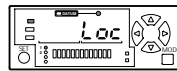
The GV Series can prevent mutual interference that may occur when connecting several expansion units. The interference protection function only works when the following conditions are met.

- Interference protection functions on up to two adjacent units.
- The main unit and expansion units use the same response speed.
- The response speed is set to 1.5, 3, or 10.

Setting Each Type of Function

Press and hold the [MODE] button for at least three seconds in the main screen (during detection) to change the settings.

Note The screen shown to the right is displayed during keylock and basic settings cannot be input.



1. Response speed setting

The response speed is the time from when the sensor head starts detection until the value at the detection position is established as a comparator value.

Item	Setting range	Default value
Response speed	1.5/3/10/20/50 (Unit: ms)	10

2. Output mode setting

Sets the control output mode for each control output.

Item	Description			Default value
Output mode	Settings	Control output 1	Control output 2	noo
	noo	N.O.	N.O.	
	nCo	N.C.	N.O.	
	noC	N.O.	N.C.	
	nCC	N.C.	N.C.	

Reference N.O. (normal open) and N.C. (normal close) operate in the following manner.

Output mode	During detection
N.O. (normal open)	ON
N.C. (normal close)	OFF

3. Operation mode selection

Sets the operation mode.

Operation mode	Description	Default value
F-1	General	Normal detection mode
F-2	Special	Area detection mode
A-1		Edge hold mode
A-2		Surface detection mode

4. Clamp function setting

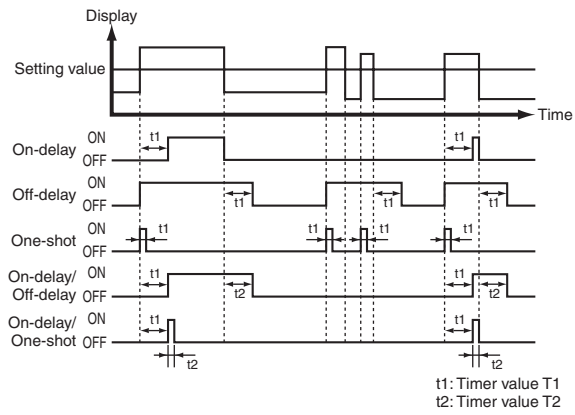
The clamp function holds that last detectable value when the target to be detected does not enter the detection range or when there is an insufficient light intensity.

Setting item	Description	Default value
on	The output activates along with the detection value if target was not detectable. The current value display and LED bar display are also saved. If distance detection can be performed, then the hold is released.	
oFF	When the distance detection cannot be performed and "---" is displayed, the comparator output operates in the same way as if a detection object appears at the farthest point of the detection range.	i

5. (6.) Delay timer setting

Individual delay timers can be set for channels 1 and 2.

Setting item	Description	Default value
oFF	Delay timer is not used	i
ond	On-delay	
oFd	Off-delay	
Sht	One-shot	
ondoFd	On-delay/off-delay	
ondSht	On-delay/one-shot	



7. Hysteresis setting

Sets the hysteresis for judgment with control outputs 1 and 2.

Setting item	Description	Default value
Std	Run with the default values.	i
Usr	Set custom values.	

The hysteresis setting range and default value are as follows when "Usr" is selected.

Head model	Setting range	Default value
GV-H45	0, 1 to 100	2
GV-H130	0, 2 to 100	4
GV-H450	0, 0.5, 1 to 100	0.5

8. External input function setting

Sets the function assigned to the external input (pink line).

Setting item	Description	Default value
oFF	Do not use external input (input off).	i
SfT	Used as "External shift input".	
bnK	Used as "Bank switching input".	
tim	Used as "Timing input".	

Reference The minimum external input time is 20 ms.

External shift input

When external input is activates the current value is shifted by the shift target value.
(For information about the shift target value, see "9. Shift target value setting".)

Bank switching input

With keylock active, the banks are switched via the external input.
(For more information about bank switching, see "Bank switching".)

Note When edge hold mode (A-1 mode) is set, switching banks with the external input resets the current value to 0.

Timing input

Output 1 will only activate accordingly while the timing input is active. The timing input indicator on the sensor amplifier lights up.

Reference Output 2 works independently of the timing input.

9. Setting the shift target value

Set this value to shift the current value by another amount.

Item	Setting range	Default value
Shift target value	-199 to 999	0

- Press the [Up] and [Down] arrow buttons simultaneously to shift the current value to the shift target value.
The shift status is retained even if the power is turned off.

Reference Press the [Up] and [Down] arrow buttons simultaneously and hold them to clear the shifted target value.

- The amplifier does not retain the amount of shift when shifting with external input. (It is cleared when the power is turned off.) To retain the amount of shift, press the [Up] and [Down] arrow buttons simultaneously and perform shift.
- When performing reference surface calibration while edge hold mode (A-1 mode) is set, the value is always shifted to 0.
- Shift is only effective on the selected bank.

10. Distance display setting

Setting item	Description	Default value
nor (Normal)	The display value increases as the target comes closer to the sensor head.	i
rEv (Reverse)	The display value decreases as the target comes closer to the sensor head.	

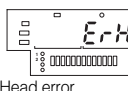
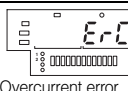
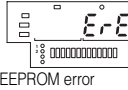
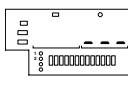
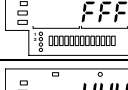
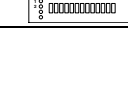
11. Eco display setting

Set this parameter to reduce the consumption current or to stop displaying specific values. When running in power saving (eco) mode, pressing any button returns the sensor to normal operations.

The main screen switches to eco mode if no operations take place for 30 seconds.

Setting item	Description	Default value
oFF	Turns off the eco display.	i
bAr	Turns off the digital display.	
on	The digital display (green) flashes in sequence. Bar display and channel No. indicators are turned off.	

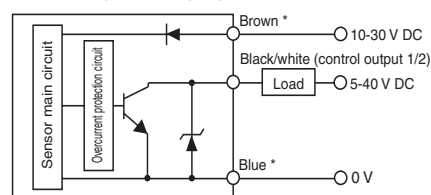
Error Displays and Corrective Actions

Error indication	Error contents	Remedy
 Head error	Sensor head is not connected. Head cable is broken. Sensor head is damaged	- Check that the sensor head is connected. - Check that the head cable is not broken. - Check the connection of the head cable to the connector. - After checking these points, turn on the power again.
 Overcurrent error	Overcurrent is flowing through the output wire	- Check the load and reduce the current to be within the rated range. - Check that the output wire does not touch another wire or a frame.
 EEPROM error	Data read/write error Data has been written in the EEPROM over 1 million times and can no longer be updated.	Perform initialization. If you need to write more data, replace the amplifier unit.
 No workpiece or background error	There is no workpiece or background within the detection distance range, or no light is entering the receiver.	Set a workpiece or background in the distance for detection from the sensor.
 Reading exceeds detection distance error	Reading exceeds the detection distance range.	Set a workpiece or background in the distance for detection from the sensor.
 Light intensity saturated error	Light intensity is saturated.	Tilt the sensor head so that specular reflection does not enter the sensor.

I/O Circuit Diagram

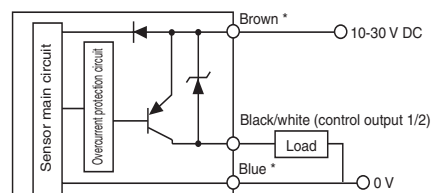
Output circuit

GV-21/22 (NPN output)



* GV-21 only

GV-21P/22P (PNP output)

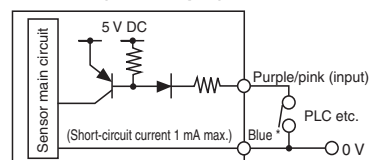


* GV-21P only

Power is supplied to the expansion unit GV-22(P) from the expansion connector on the back of the main unit GV-21(P). The power wires (brown and blue) of the main unit and those of the expansion unit are common inside through the connector.

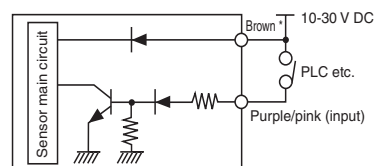
Input circuit

GV-21/22 (NPN output)



* GV-21 only

GV-21P/22P (PNP output)



* GV-21P only

Purple line Laser emission stop input
Pink line External input function

* The external input function can be set to one of the following.

- Not used
- Shift input
- Bank switching input
- Timing input

Specifications

Sensor head

Item		Specifications		
Model		GV-H45 (Short-range)	GV-H130 (Mid-range)	GV-H450 (Long-range)
Light source		Visible semiconductor laser Wavelength: 655 nm		
FDA laser class		Class II (Max. 1 mW)		
JIS/IEC class		Class 2 (Max. 1 mW)		
Detection distance		20 to 45 mm	55 to 130 mm	160 to 450 mm
Standard detection deviation		0.5 mm	1 mm	3 mm
Spot diameter		Approx. ϕ 0.1 mm (Detection distance 45 mm)	Approx. ϕ 0.3 mm (Detection distance 130 mm)	Approx. ϕ 0.8 mm (Detection distance 450 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% RH (No condensation)		
	Ambient light	Incandescent lamp: 10,000 lx Sunlight: 20,000 lx Incandescent lamp: 5,000 lx Sunlight: 10,000 lx		
	Vibration	10 to 55 Hz, 1.5 mm double amplitude in the X, Y, and Z directions, 2 hours respectively		
Material	Housing	Housing material: PBT Display: Polyarylate Metal part: SUS304		
	Lens cover	Glass		
	Cable	PVC		
Weight*		Approx. 120 g	Approx. 130 g	Approx. 190 g

* Including the connector cable (2 m).

Sensor amplifier

Item		Specifications	
Model	NPN output	GV-21	GV-22
	PNP output	GV-21P	GV-22P
Amplifier type		Main unit	Expansion unit
Power voltage		10-30 VDC, Ripple (P-P): 10% max, Class 2	
Power consumption		Normal: 2200 mW max. (at 30 V: 73.3 mA max.) Eco-bar: 1700 mW max. (at 30 V: 56.7 mA max.) Eco-all: 1600 mW max. (at 30 V: 53.3 mA max.)	
Response time		1.5/3/10/20/50 ms	
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 line:Laser emission stop input Pink line:Setting value bank switching input/shift input/timing input (selected with the settings)	
Environmental resistance	Ambient temperature	-10 to +55°C (No freezing)	
	Relative humidity	35 to 85% RH (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, front sheet: Polycarbonate Key top: Polyacetal Cable: PVC	
Weight*		Approx. 110 g	

* Including the cable (2 m).

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