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KEYENCE

96M12277

High-speed, High-accuracy
Laser Displacement Sensor

LK-G5000 Series

User's Manual

Read this manual before use.
Keep this manual in a safe place for future reference.



Introduction

This manual describes the basic operations and hardware functions of the LK-G5000 Series. Before using the LK-G5000 Series, read this manual carefully to ensure complete understanding so that you can take full advantage of this product's performance and functions.
Keep this manual in a safe place for future reference.
Please deliver this manual to the end users of this product.

Symbols

The following symbols alert you to important messages concerning the prevention of human injury and product damage.

⚠DANGER
Failure to follow the instructions may lead to death or severe injury.

⚠WARNING
Failure to follow the instructions may lead to injury (such as electric shock or burn).

⚠CAUTION
Failure to follow the instructions may lead to property damage or product breakdown.

▶NOTE
Provides additional information on proper operation.

Reference
Provides reference information or useful information about operation.

Safety Precautions

General Precautions

- At startup and during operation, be sure to monitor the functions and performance of the LK-G5000 Series.
- It is recommended that you take substantial safety measures to avoid any damage in case of product failure.
- Do not modify the LK-G5000 Series or use it in any way other than as described in the specifications. The warranty will be voided in such cases.
- When the LK-G5000 Series is used in combination with other devices, functions and performance may be degraded depending on the operating conditions and surrounding environment.
- Do not use this product for the purpose to protect a human body or part of a human body.
- This product is not intended for use as an explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.
- Do not allow the temperature to change sharply around the LK-G5000 Series, including the accessories. Otherwise, condensation may lead to a malfunction.

⚠ WARNING

Ensuring safe operation

- Use the proper power supply voltage as specified. Failure to do so may cause a fire, electric shock, or malfunction.
- Do not attempt to disassemble or modify the unit. Doing so may cause a fire, electric shock or unit malfunction.

Handling abnormal conditions

Turn off the power immediately in the following cases. Using the LK-G5000 Series in an abnormal condition could cause product breakdown.
Contact your nearest KEYENCE office for repair.

- If liquid or foreign matter enters the unit.
- If the unit is dropped or the housing is damaged.
- If smoke or an abnormal odor is emitted from the controller.

⚠ CAUTION

Ensuring safe operation

- Be sure to turn off the power to the LK-G5000 Series and connected devices when you connect/disconnect the cable to/from them. Failure to do so may result in product damage.
- Do not turn off the power while any item is being set. Part or all of the settings may be lost.
- Do not block the vent holes on the unit. The rise in the internal temperature may cause product failure.

Installation environment

To use the LK-G5000 Series properly and safely, avoid installing it in the following locations. Doing so may lead to product breakdown.

- Location that is humid, dusty or poorly ventilated
- Location where the temperature becomes high, such as a place exposed to direct sunlight
- Location where there are flammable or corrosive gases
- Location where the product may be directly subjected to vibration or impact
- Location where water, oil or chemicals may splash onto the product
- Location where static electricity is readily generated

Noise control

When the LK-G5000 Series is installed near a noise source such as a power source or high-voltage lines, noise may cause a malfunction or failure of the unit. Take corrective actions against noise by using noise filters, laying cables in a separate conduit, and/or providing insulation when installing the controller and sensor head. Use a single core shielded cable for the analog output cable.

Influence of ambient temperature

Changes in the ambient temperature may cause the measurement to fluctuate. Be sure to keep the temperature constant at all times. When the ambient temperature changes by 10°C, it takes about 60 minutes until the temperature inside the unit is uniformly distributed.

Ambient light

Do not use the LK-G5000 Series near a lighting system that repeatedly turns on and off rapidly. If it is unavoidable to use the unit in such a place, install a light shielding board or a similar object so that the light will not affect the measurement.

Warming up

After turning on the power, wait approximately 30 minutes before using the LK-G5000 Series. Since the circuit is not stable immediately after the power is turned on, the measured value may gradually change during this period.

Influence of dust or dirt

The measurement may be incorrect when dirt, dust or fluid such as water or oil interferes with measurement in the following ways.

- Adhesion on the protective glass: Blow the dirt off with clean air. If dirt persists, wipe the glass surface gently using a soft cloth moistened with alcohol.
- Adhesion on the surface of the measurement target: Blow the dirt off with clean air or wipe it off.
- Intrusion of floating dust or splash of fluid into the light-axis range: Take corrective action such as installing a protective cover or air purge.

Other considerations

Influence of vibration

When the measurement target is vibrating, the measured value may fluctuate. In this case, increase the number of averaging measurements to ensure more accurate measurement.

Measurement target

The measured value may be incorrect if the shape or surface condition of the target varies with individual targets. In this case, measure a known target and use the calibration function to correct the error.

Handling

Do not wipe the unit with a wet cloth, benzene, or thinner. This may cause discoloration or deformation of the housing. If the unit becomes dirty, wipe it off with a cloth moistened with a mild detergent and then wipe with a soft dry cloth.

Effect of atmospheric motions

Slow atmospheric motions may affect the measurement and result in fluctuation of the measured value.
In such a case, take the following countermeasures:

- Enclose the sensor head in an appropriate enclosure.

Precautions on CE Marking

The LK-G5000 Series conforms to the CE Marking under the conditions that the following requirements are satisfied. In order to use the LK-G5000 Series be sure that the following requirements have already been satisfied beforehand.
The applicable standards (EMC Directive) are listed below:
EN61326-1, Class A
Limit the length of the power supply cable and all input/output cables that are connected to the terminal panel of the controller to 30 m or less.

▶NOTE

For the USB cable connected to the terminal panel of the controller, wind two turns of the cable around the ferrite core of the following model at a distance of 200 mm or less from the USB connector of the controller.
Model: ZCAT3035-1330 (Manufactured by TDK)

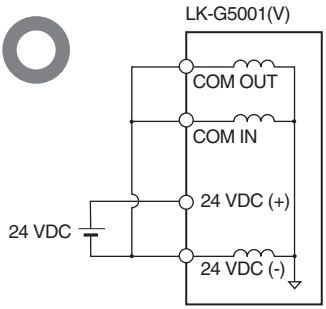
⚠ Precautions on wiring

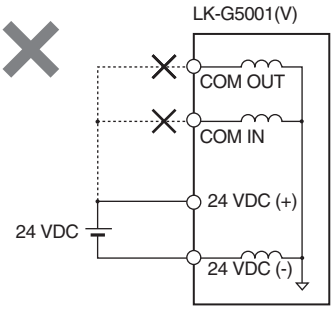
Part of the input/output circuit of the LK-G5000 Series is internally common. Be careful that no potential difference is generated between the internally common terminals due to the potential difference between the cables/external devices. Such a potential difference may cause a breakdown of the product or external devices.

Wiring example

LK-G5001V/LK-G5001 (NPN type)

The 24 VDC (-), COM OUT (COM for output), and COM IN (COM for input) terminals are common through choke coils respectively. They are also common with COM OUT and COM IN of the expansion connector through choke coils.

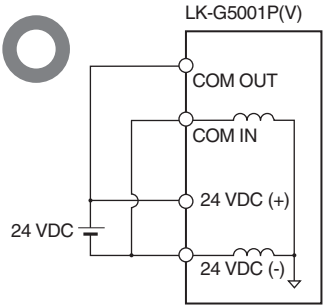


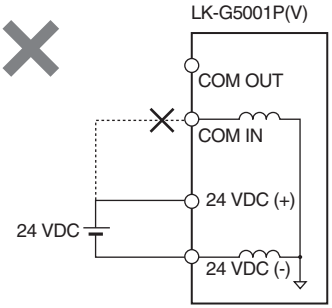


The power supply terminal (24 VDC) is short-circuited through the COM terminals, resulting in product failure.

LK-G5001PV/LK-G5001P (PNP type)

The 24 VDC (-) and COM IN terminals are common through choke coils. They are also common with COM IN of the expansion connector through choke coils.





The power supply terminal (24 VDC) is short-circuited through the COM terminals, resulting in product failure.

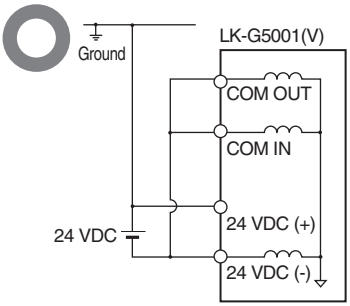
Caution for all types

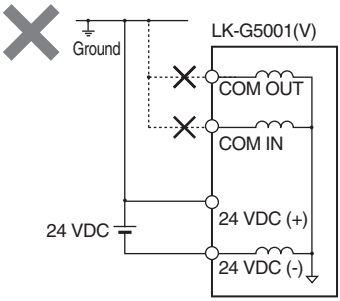
The 24 VDC (-) terminal, SG (GND) of the USB port, and SG (GND) of the RS-232C connector are common through choke coils. Be careful that no potential difference is generated between these terminals and the external devices such as a PC or PLC. If any potential difference exists, isolate the I/O terminals of the LK-G5000 Series except for those used for the power supply, RS-232C and USB.

Precautions on use in a positive ground environment

When using the LK-G5000 Series in a positive ground environment, be careful of a short circuit caused through the COM terminals.

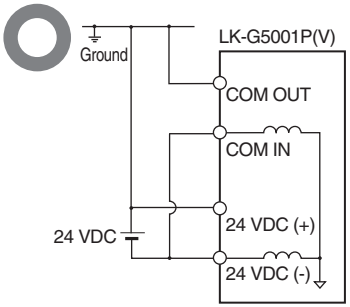
LK-G5001V/LK-G5001 (NPN type)

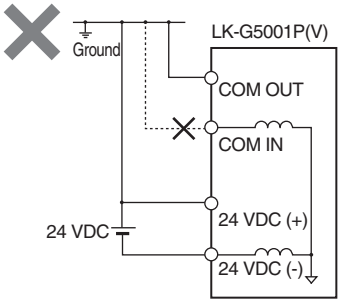




The power supply terminal (24 VDC) is short-circuited through the COM terminals, resulting in product failure.

LK-G5001PV/LK-G5001P (PNP type)



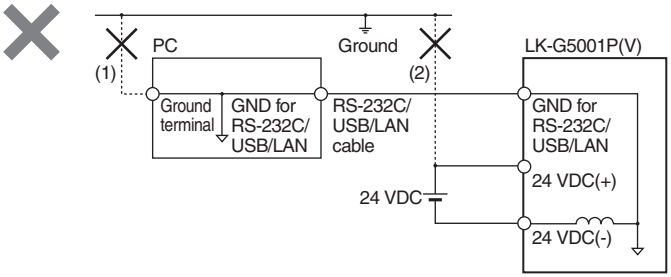


The power supply terminal (24 VDC) is short-circuited through the COM terminals, resulting in product failure.

Precautions on connection with a PC or other external device

In a positive ground environment, when the LK-Navigator 2 software is used by connecting a PC through USB or LAN, or when RS-232C communication is used with a PC, be careful of a short circuit created between the internal components of the PC and the SG (GND) terminal of the LK-G5000.

The 24 VDC (-) terminal, SG (GND) of the USB port, SG (GND) and 24 VDC (-) of the RS-232C connector, and SG (GND) of the Ethernet port are common through choke coils respectively. Be careful that no potential difference is generated between these terminals and the external device such as a PC or PLC. If any potential difference exists, isolate the external device or the I/O terminals of the LK-G5000 Series except for those used for the power supply, RS-232C, USB and LAN.



If the power supply terminal (24 VDC) is short-circuited through the internal component of the PC and the SG (GND) terminal of the LK-G5000 Series, a product breakdown may occur. If this is the case, isolate either the PC (1) or the LK-G5000 Series (2).

▶NOTE

The internal wiring of a PC or PLC varies depending on the device. Refer to the instruction manual of the device for details.

Safety precautions on laser products

The models of the LK-G5000 Series are classified as follows in terms of laser class:

Model		LK-H008/ LK-H008W	LK-H022/LK-H027/ LK-H022K/LK-H027K/ LK-H052/LK-H057/ LK-H052K/LK-H057K/ LK-H082/LK-H087/ LK-H152/LK-H157	LK-H020/LK-H025/ LK-H050/LK-H055 LK-H080/LK-H085/ LK-H150/LK-H155	LK-H023/ LK-H028/ LK-H053/ LK-H058
Wavelength		655 nm	655 nm	655 nm	690 nm
FDA (CDRH) Part 1040.10	Output	0.3mW	0.95 mW	4.8 mW	50 mW
	Laser class	Class II	Class II	Class IIIa	Class IIIb
IEC60825-1	Output	0.3mW	0.95 mW	4.8 mW	50 mW
	Laser class	Class 1	Class 2	Class 3R	Class 3B

⚠WARNING
Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Precautions on class IIIb/3B laser products

MPE (maximum permissible exposure): 2.5 mW/cm^2
NOHD (nominal ocular hazard distance): 68 cm (LK-H023),101 cm (LK-H028), 143 cm (LK-H053), 280 cm (LK-H058) from the transmitter

Follow the instructions mentioned in this manual. Otherwise, injury to the human body (eyes and skin) may result.

- Do not directly look at or touch the laser beam and its reflection from a mirror-like surface.
- Do not direct the beam at other people or into areas where other people unconnected with the laser work might be present.
- Prevent the diffusion of the laser beam.
  Make the laser path as short as possible and be sure to terminate it with a diffusion reflector or diffusion absorber which has proper reflectance and thermal characteristic. (It is recommended that you install a protective enclosure.)
- Install the laser product carefully so that the laser beam is not unintentionally directed at mirror-like surfaces.
- Wear protective eye goggles appropriate for the laser beam wavelength.
- Do not disassemble this product. Laser emission from this product is not automatically stopped when it is disassembled.
- Clean the aperture regulary. In addition, stop the emission of the laser beam when cleaning.
- Use an interlock function to block laser radiation in an emergency.

- Prevent prohibited laser radiation use by providing a key-operated switch or other control on the control panel.
- Install the products so that the path of the laser beam is not as the same height as that of human eye.

Precautions on class IIIa/3R laser products

Follow the instructions mentioned in this manual. Otherwise, injury to the human body (eyes and skin) may result.

- Do not direct the beam at other people or into areas where other people unconnected with the laser work might be present.
- Never look at the laser beam through optical instruments such as a microscope or a telescope.
- Prevent the diffusion of the laser beam.
  Make the laser path as short as possible and be sure to terminate it with a diffusion reflector or diffusion absorber which has proper reflectance and thermal characteristic. (It is recommended that you install a protective enclosure.)
- Install the products so that the path of the laser beam is not as the same height as that of human eye.
- Install the laser product carefully so that the laser beam is not unintentionally directed at mirror-like surfaces.
- It is recommended that you wear protective eye goggles.
- Do not disassemble this product. Laser emission from this product is not automatically stopped when it is disassembled.
- Do not directly look at or touch the laser beam and its reflection from a mirror-like surface.

Precautions on class II/2 laser products

Follow the instructions mentioned in this manual. Otherwise, injury to the human body (eyes and skin) may result.

- Do not stare into the beam.
- Do not direct the beam at other people or into areas where other people unconnected with the laser work might be present.
- 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 products so that the path of the laser beam is not as the same height as that of human eye.
- Do not disassemble this product. Laser emission from this product is not automatically stopped when it is disassembled.

Precautions on Class 1 Laser Products

Follow the instructions mentioned in this manual. Otherwise, injury to the human body (eyes and skin) may result.

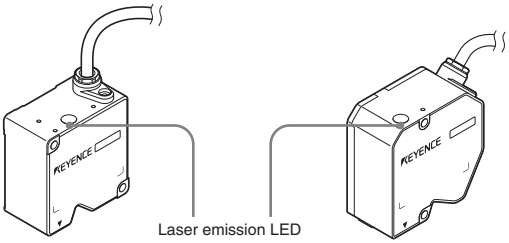
- Do not stare into the beam.
- Do not disassemble this product. Laser emission from this product is not automatically stopped when it is disassembled.

Safety features of the laser product

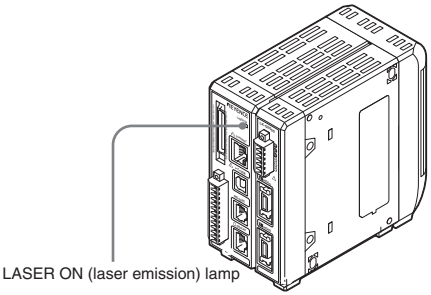
The LK-G5000 Series is equipped with the following safety features.

■ Laser radiation emission indicator

Lights or flashes while the LK-G5000 Series is in operation.

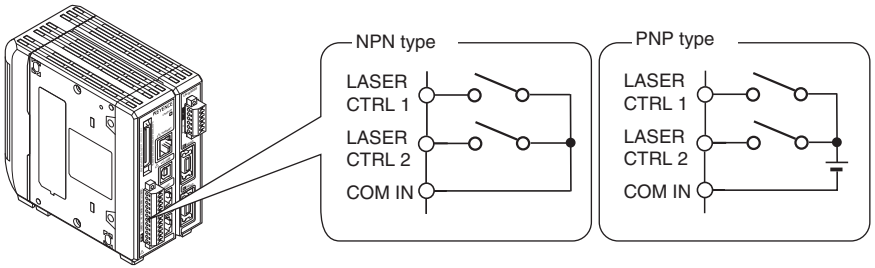


Lights or flashes while the LK-G5000 Series is in operation.



■ LASER CTRL terminals

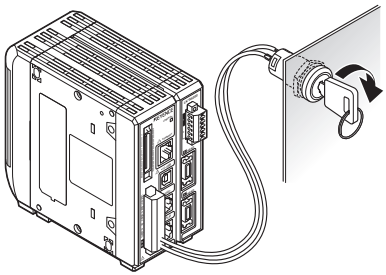
The operation is different between the laser class 3B sensor head (LK-H023/LK-H028/LK-H053/LK-H058) and the laser class 1, 2 or 3R sensor head.



Refer to "12-pin terminal block" (page 4-2) for details about the connecting terminals.

When a laser class 3B sensor head (LK-H023/LK-H028/LK-H053/LK-H058) is used
Provide a key-operated switch between the LASER CTRL1/LASER CTRL2 terminal and the COM IN terminal. Use a key-operated switch which can be removed only when the laser emission is off.

- NPN output type:Laser beam emission starts when the key-operated switch is operated to turn ON (close) the circuit between the LASER CTRL1/LASER CTRL2 terminal and the COM IN terminal.
- PNP output type:Laser beam emission starts when the key-operated switch is operated to turn ON (apply voltage to) the circuit between the LASER CTRL1/LASER CTRL2 terminal and the COM IN terminal.



▶NOTE

Control with a key-operated switch is required when at least one class 3B sensor head is connected.

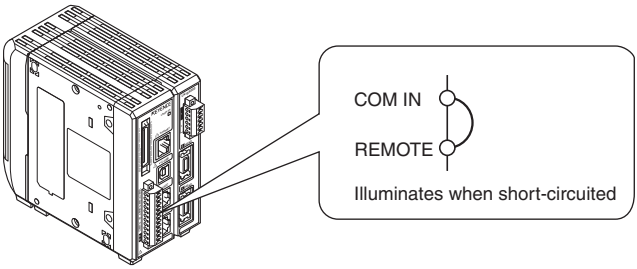
Example of applicable key-operated switch
CK-M12BFS1 keylock switch manufactured by Nihon Kaiheiki
Use a key-operated switch which can be removed only when the laser emission is off.

When only a laser class 1, 2 or 3R sensor head is used

- NPN output type: Laser beam emission stops when the circuit between the LASER CTRL1/LASER CTRL2 terminal and COM IN terminal is short-circuited.
- PNP output type: Laser beam emission stops when voltage is applied to the circuit between the LASER CTRL1/LASER CTRL2 terminal and COM IN terminal.

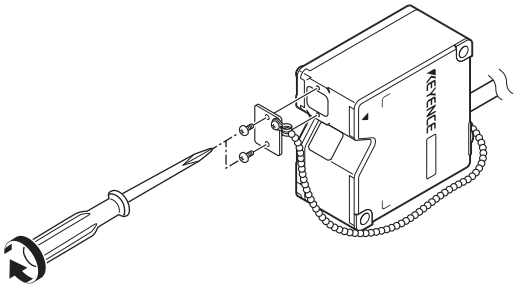
■ REMOTE terminal

Laser beam emission can be stopped by opening the circuit between the REMOTE terminal and COM IN terminal.
Refer to "12-pin terminal block" (page 4-2) for details about the connecting terminals.

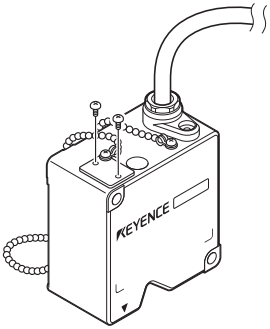


■ Shutter

- You can prevent the laser beam emission by closing the shutter.
- The shutter is provided for the following sensor head models:
  LK-H023/LK-H028/LK-H053/LK-H058
- To block the laser beam, attach the shutter to cover the lens surface with the supplied M1.6 screws.



- When the shutter is unnecessary, secure it next to the warning indicator.



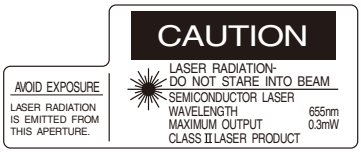
Warning labels

The description on the warning labels attached to the LK-G5000 Series and the label locations are described below.
The FDA (CDRH) warning labels are attached to the unit when the product is shipped from the factory. Labels other than the FDA (CDRH) label are supplied with the product. Attach the other label(s) to the locations as shown in the figures on page 19 according to the destination of the product. Warning labels are not attached with LK-H008/LK-H008W, because these models are Class 1 Laser Product according to IEC60825-1.

■ Label description

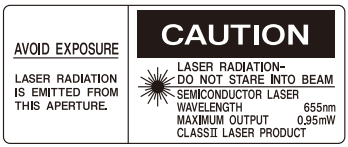
LK-H008/LK-H008W

FDA (CDRH)

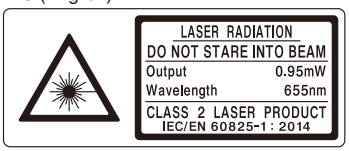


LK-H022/LK-H027/LK-H022K/LK-H027K/LK-H052/LK-H057/LK-H052K/ LK-H057K/LK-H082/LK-H087/LK-H152/LK-H157

FDA (CDRH)



IEC (English)



DIN (German)



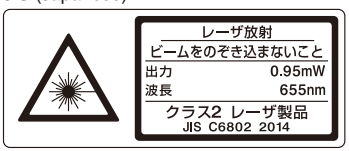
IEC (French)



CEI (Italian)



JIS (Japanese)

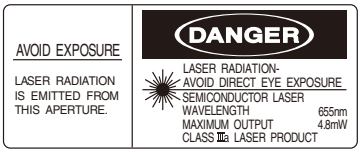


GB (Simplified Chinese)

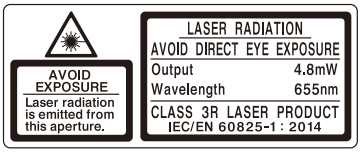


LK-H020/LK-H025/LK-H050/LK-H055/LK-H080/LK-H085/LK-H150/LK-H155

FDA (CDRH)



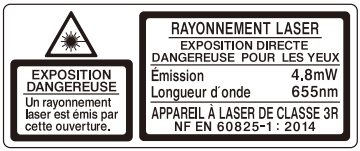
IEC (English)



DIN (German)



IEC (French)



CEI (Italian)



JIS (Japanese)

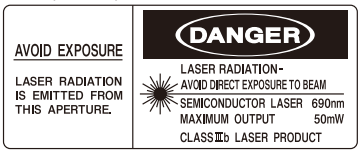


GB (Simplified Chinese)

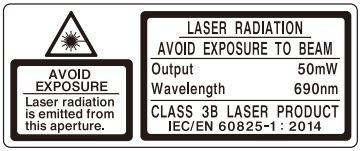


LK-H023/LK-H028/LK-H053/LK-H058

FDA (CDRH)



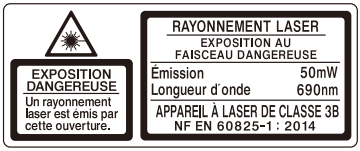
IEC (English)



DIN (German)



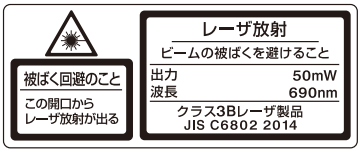
IEC (French)



CEI (Italian)



JIS (Japanese)

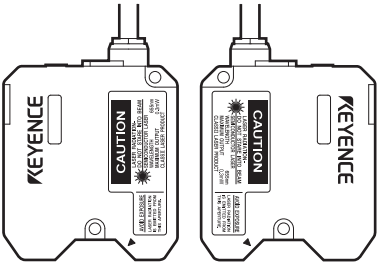


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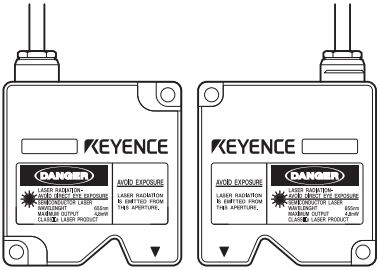


■ Label attachment locations

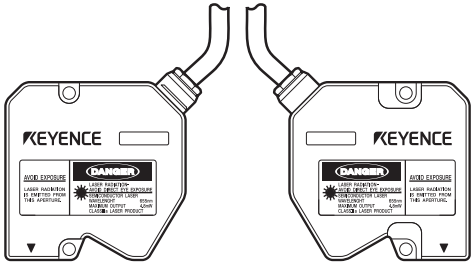
LK-H008/LK-H008W



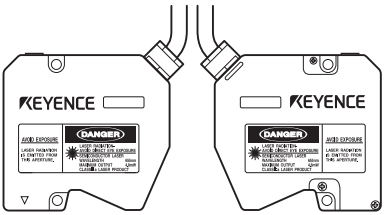
LK-H020/LK-H025/LK-H022/
LK-H027/LK-H023/LK-H028/
LK-H022K/LK-H027K



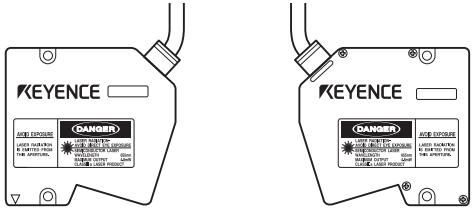
LK-H050/LK-H055/LK-H052/
LK-H057/LK-H053/LK-H058/
LK-H052K/LK-H057K



LK-H080/LK-H085/LK-H082/
LK-H087



LK-H150/LK-H155/LK-H152/
LK-H157



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Before Use

1

This chapter describes the configuration of the LK-G5000 Series, the operational precautions and the preparations required before using it. Be sure to read this chapter thoroughly before using the LK-G5000 Series.

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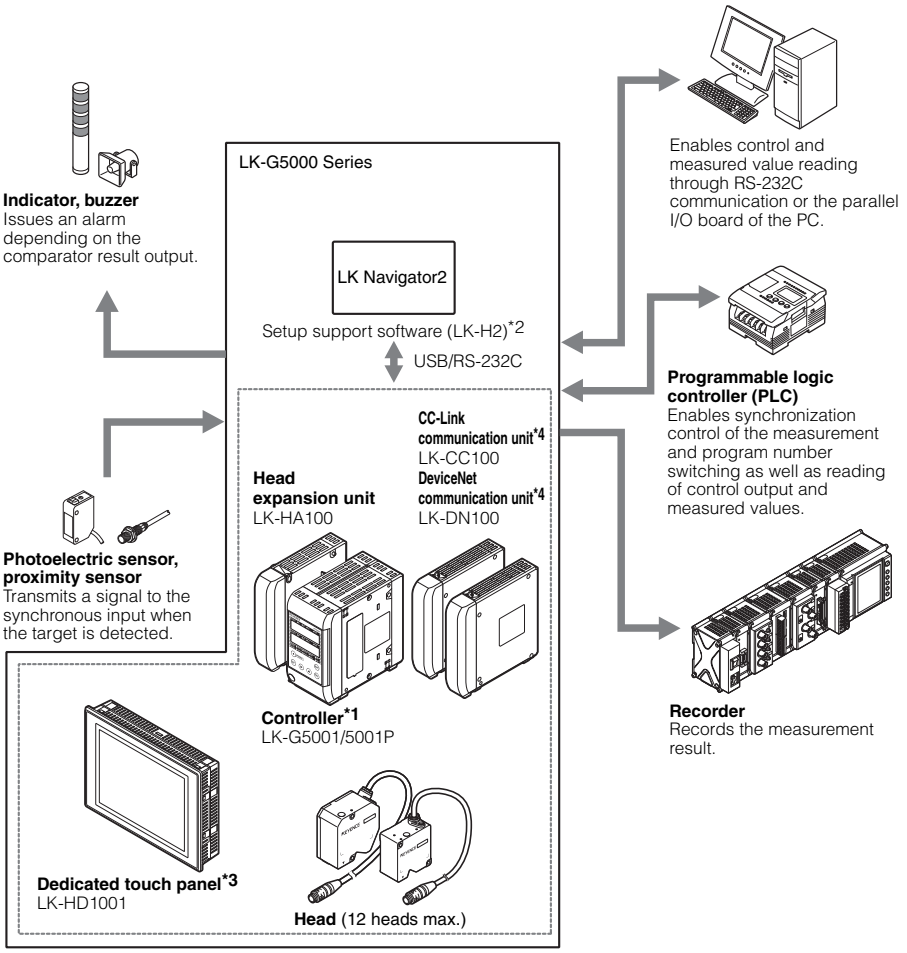
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System Configuration

The LK-G5000 Series can be used along with commercially-available devices for various purposes.



*1: The single unit type controller (LK-G5001V/LK-G5001PV) can be separated into the display panel and controller unit. They can also be purchased separately.
The single unit type controller is labeled as LK-HD500 on the display panel side and as LK-G5001 or LK-G5001P on the terminal panel side.

*2: For details about the LK-Navigator 2 setup support software (LK-H2), refer to the "LK-Navigator 2 User's Manual" (provided as a PDF file on the CD-ROM).

*3: For details on the dedicated touch panel (LK-HD1000), refer to the LK-HD1000 User's Manual.

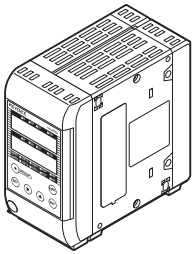
*4: For details on the CC-Link communication unit (LK-CC100) and the DeviceNet communication unit (LK-DN100), refer to the LK-CC100/LK-DN100 User's Manual.

Checking the Package Contents

The LK-G5000 Series consists of the following models. Ensure that all the components and accessories listed below are included in the package of the model you purchased before using the unit.

LK-G5001V/LK-G5001PV (Single unit type controller)

Controller
LK-G5001V/
LK-G5001PV: 1



User's
Manual
(This manual): 1

Screwdriver: 1



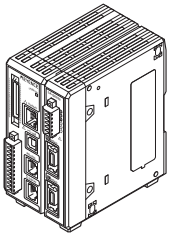
Packaged separately
LK-H2 (CD-ROM)



- Setup support software
  LK-Navigator 2
- Setup support software
  User's Manual (PDF file)

LK-G5001/LK-G5001P (Separate type controller)

Controller
LK-G5001/
LK-G5001P: 1



User's
Manual
(This manual): 1

Screwdriver: 1



Packaged separately
LK-H2 (CD-ROM)

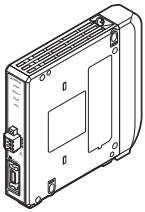


- Setup support software
  LK-Navigator 2
- Setup support software
  User's Manual (PDF file)

LK-HA100 (Head expansion unit)

Head expansion unit
LK-HA100: 1

Instruction
Manual: 1

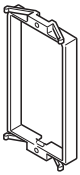


LK-HD500 (Separate type display panel)

Display panel
LK-HD500: 1



Display panel
attachment ring: 1

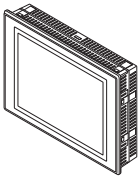


▶NOTE

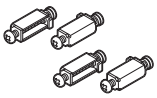
The cable connecting the controller is sold separately (page A-7).

LK-HD1001 (Touch panel)

Touch panel
LK-HD1001: 1



Mounting bracket: 4



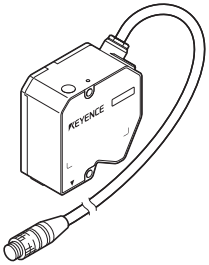
User's
Manual: 1

▶NOTE

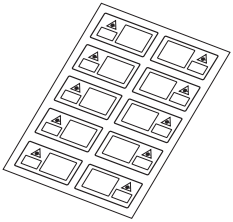
The cable connecting the controller is sold separately (page A-7).

Sensor head

Sensor head: 1



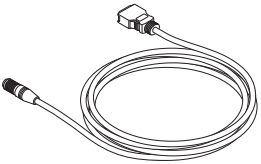
Laser label sheet: 1



The Laser label sheet is not attached with LK-H008/LK-H008W.

CB-A07/CB-A2/CB-A5/CB-A10/CB-A20/CB-A30

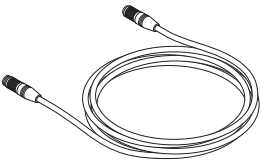
Head-to-controller cable: 1



- CB-A07: 0.7 m cable
- CB-A2: 2 m cable
- CB-A5: 5 m cable
- CB-A10: 10 m cable
- CB-A20: 20 m cable
- CB-A30: 30 m cable

CB-A5E/CB-A10E

Head-to-controller extension cable: 1



- CB-A5E: 5 m extension cable
- CB-A10E: 10 m extension cable

▶NOTE

- For each sensor head connection, use only one head-to-controller extension cable and limit the total length to 30 m at maximum.
- You cannot connect the CB-A∗∗E to the CB-A30.
- You cannot connect two CB-A10E cables to the CB-A10.

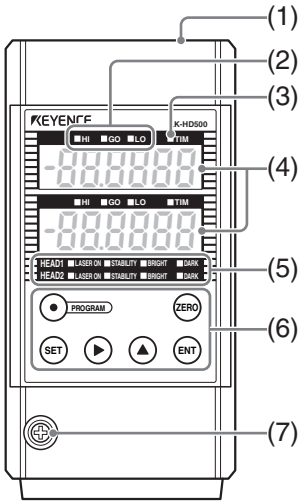
The package contents have been carefully inspected; however, if any component is defective or damaged, contact your nearest KEYENCE office (address listed at the end of this manual).
For the optional products, refer to "List of Optional Accessories" (page A-7).

Part Names and Functions

This section describes the name and functions of each component.

Controller

Display panel



(1) Display panel housing

(2) Comparator output indicators

Lights during the comparator output (HI, GO, or LO).

(3) TIM (synchronous input) indicator

Lights when the synchronous signal is being input.

(4) Measured value display

Displays the measured value, tolerance comparator value, or the setting items during setting.

Green: Within the tolerance limits Red: Outside the tolerance limits

(5) Sensor head status indicators

Display the laser emission status or the measurement status.

LASER ON	Laser emission LED. Lights while the LK-G5000 Series is in operation.
STABILITY	Lights in green or orange when the result is within the measurement range. Lights in red when the result is outside the measurement range, when an alarm is issued, or when the laser is off.
BRIGHT	Lights when the excessive light intensity alarm is triggered.
DARK	Lights when the insufficient light intensity alarm is triggered.

(6) Operation keys

Refer to "Operation keys" (page 1-7).

(7) Display panel fixing screw

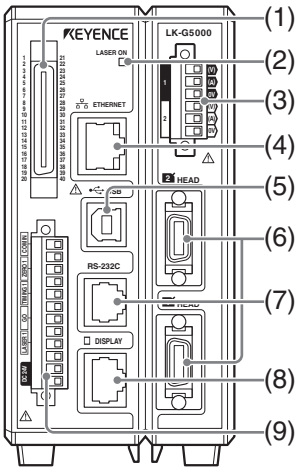
Items shown on the measured value display and their meanings

Display	Description
Numerical value (±999999)	The measurement result is displayed as a numerical value. The display unit, decimal point position, and minimum display unit vary depending on the settings.
FFFFFF (HI output: ON, Monitor output: +10.8 V)	Displayed when the result exceeds the display range.
-FFFFFF (LO output: ON, Monitor output: -10.8 V)	Displayed when the result is below the display range. This is also displayed while in alarm status (HI/LO output: ON).
- - - - - - (HI, GO, and LO output: OFF, Monitor output: -10.8 V)	Displayed while in comparator standby status.

Operation keys

Key	Function
PROGRAM	• When this key is pressed during measurement, the Program switching mode is invoked.
SET	• When this key is pressed during measurement, the Tolerance setting mode is invoked. When it is pressed for one second, the Operation setting mode is invoked. • When this key is pressed during setting, the setting is canceled and the operation returns to the previous step.
ENT	• When this key is pressed during measurement, the OUT display setting mode is invoked. • When it is pressed during setting, the setting is accepted.
ZERO	• When this key is pressed during measurement, the measured value is set to zero. When it is pressed for three seconds, the auto-zero setting is canceled. • When this key is pressed for three seconds during numerical value input, the value and selected item are initialized.
▶	• When this key is pressed during setting, the display is switched to the next setting item. • When it is pressed during numerical value input, the current digit shifts to the right by one. When it is pressed for one second or more, the digits shift continuously.
▲	• When this key is pressed during measurement, the display is changed in the order of upper window only, lower window only, dual display, and repeats. • When it is pressed during setting, the setting item is changed. When it is pressed during numerical value input, symbols are switched or a numerical value is set. When it is pressed for one second or more, the values change continuously.

Terminal panel



(1) Expansion connector (page 4-5)

(2) LASER ON (laser emission) lamp

Lights while the LK-G5000 Series is in operation.

(3) 6-pin terminal block (page 4-4)

(4) Ethernet connector

Used to connect a PC through Ethernet. Refer to "LK-Navigator 2 User's Manual" for details.

(5) USB connector

Used to connect a PC through USB. Refer to "LK-Navigator 2 User's Manual" for details.

(6) HEAD connector

(7) RS-232C connector (page 5-2)

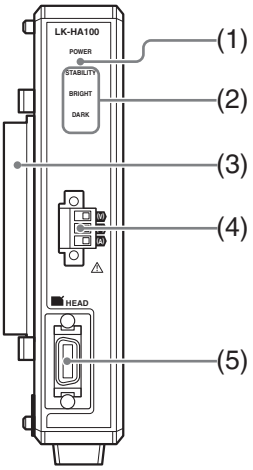
Used for communication with a PC or PLC.

(8) DISPLAY (display panel) connector

Connects the communication cable to the display panel (LK-HD500) or to the dedicated touch panel (LK-HD1001).

(9) 12-pin terminal block (page 4-2)

LK-HA100 head expansion unit



(1) POWER lamp

Lights when the power is on.

(2) Sensor head status indicator

Displays the laser emission status or the measurement status.

STABILITY	Lights in green or orange when the result is within the measurement range. Lights in red when the result is outside the measurement range, when an alarm is issued, or when the laser is off.
BRIGHT	Lights when the excessive light intensity alarm is triggered.
DARK	Lights when the insufficient light intensity alarm is triggered.

(3) Connector

(4) Terminal block

Used for analog monitor output.

OUT (V)	Analog voltage output Outputs the displayed value as voltage within the range of ±10.5 V.
OUT (A)	Analog current output Outputs the displayed value as a current within the range of 3.6 mA to 20.4 mA.
OUT 0 V	0 V terminal for OUT

The 6-pin terminal block of the controller corresponds to analog outputs CH01 and CH02. The terminal blocks of the head expansion units correspond to analog outputs CH03 to CH12 respectively from the controller side.
For details about the analog output channel assignment, refer to "Assigning OUT to the analog output channel (Analog output)" (page 3-67).

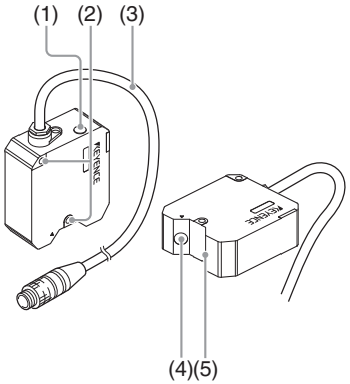
(5) HEAD connector

Sensor head

(1) Laser emission LED

Lights or flashes while the LK-G5000 Series is in operation.

Status	LED
Target is at the center of the measurement range.	Lights in green
Target is within the measurement range.	Lights in orange
Target is outside the measurement range. Alarm Laser off	Flashes in orange



(2) Mounting holes

(3) Connecting cable

Connected to the head-to-controller cable.

(4) Sensor (transmitter)

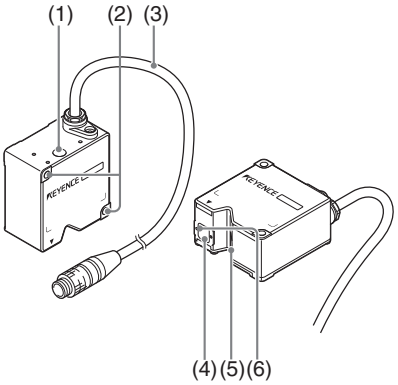
Emits the laser beam for measurement. This part is protected with a glass cover.

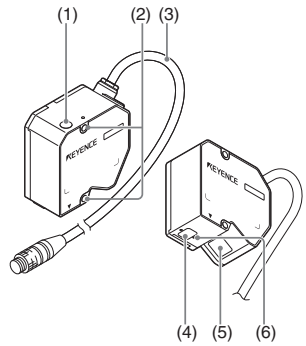
(5) Sensor (receiver)

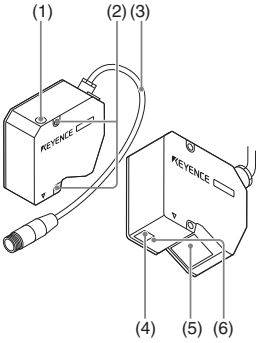
Receives the laser beam for measurement. This part is protected with a glass cover.

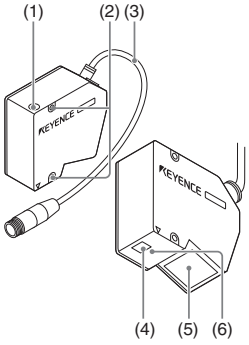
(6) Laser attenuator (shutter) mounting holes

Used to attach the laser attenuator for the laser class 3B sensor head.







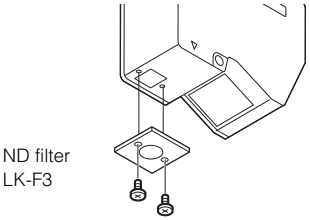


Mounting/Connecting the Units

Attaching the ND Filter (Option)

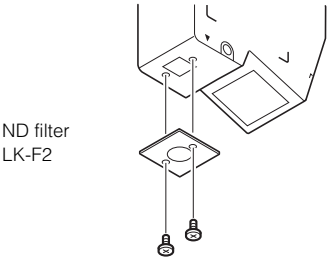
If the head is installed for specular reflection and the measurement target is a shiny mirror or glass surface, the received light intensity may saturate. In such a case, by attaching the ND filter (LK-F2/LK-F3) saturation can be avoided, thus enabling accurate measurements to be taken.

- LK-H085/LK-H087



Mounting screw x 2
(M1.6 x 3 countersink-head screw)

- LK-H155/LK-H157



Mounting screw x 2
(M1.6 x 3 countersink-head screw)

Mounting the sensor head

Determine the distance between the sensor head and the measurement target, and secure the head using screws through the two mounting holes.

▶NOTE

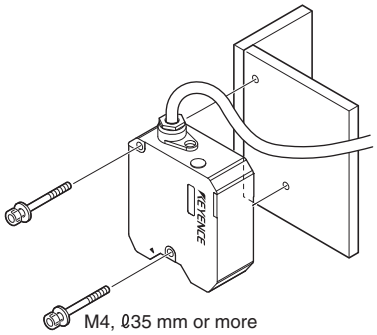
It is recommended that you provide insulation when the LK-G5000 Series is used in a positive ground environment.

■ Ambient temperature for the sensor head

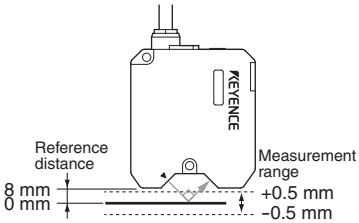
When the sensor head is mounted onto a plastic object, limit the ambient temperature to 45°C or lower.

LK-H008/LK-H008W

■ Mounting method



■ Measurement range



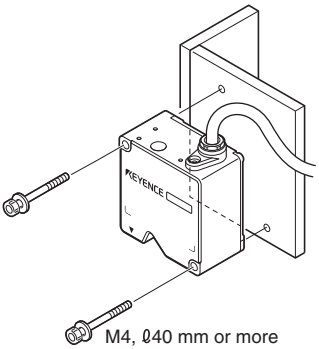
Reference

- The laser emission LED lights in green within approximately ±0.025 mm of the reference position, and lights in orange in any other position within the measurement range.
- The following table shows the measurement ranges for the sampling cycle between 2.55 µs and 10 µs.

Range setting	Center	Far
2.55 µs	±40 µm	-420 to -500 µm
5 µs	±180 µm	-140 to -500 µm
10 µs	±460 µm	+420 to -500 µm

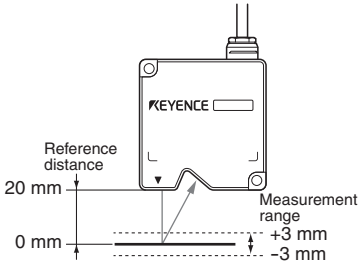
LK-H020/LK-H025/LK-H022/LK-H027/LK-H023/LK-H028/LK-H022K/LK-H027K

■ Mounting method

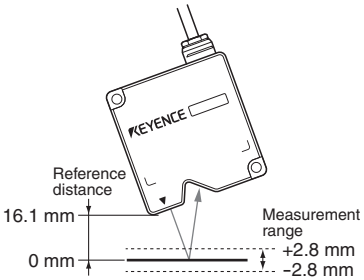


■ Measurement range

• Diffuse reflection mounting



• Specular reflection mounting



Reference

- For both diffuse reflection mounting and specular reflection mounting, the laser emission LED lights in green when the target is within approximately ±0.15 mm of the reference position, and lights in orange when it is in any other position within the measurement range.
- Select the mounting mode according to the mounting method (page 3-15).
- The following table shows the measurement ranges for the sampling cycle between 2.55 µs and 10 µs.

LK-H02x

Range setting	Center	Far
2.55 µs	±0.3 mm (±0.2 mm)	-2.6 to -3.0 mm (-2.6 to -2.8 mm)
5 µs	±1.2 mm (±1.0 mm)	-0.6 to -3.0 mm (-0.6 to -2.8 mm)
10 µs	±2.5 mm (±2.2 mm)	2.0 to -3.0 mm (1.8 to -2.8 mm)

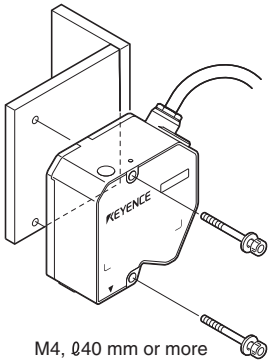
LK-H02xK

Range setting	Center	Far
2.55 µs	±0.2 mm (±0.2 mm)	-2.6 to -2.8 mm (-2.6 to -2.8 mm)
5 µs	±1.0 mm (±1.0 mm)	-0.6 to -2.8 mm (-0.6 to -2.8 mm)
10 µs	±2.2 mm (±2.2 mm)	1.8 to -2.8 mm (1.8 to -2.8 mm)

The values in parentheses are for specular reflection mounting.

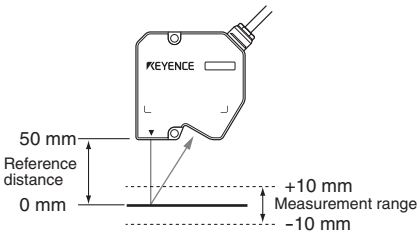
LK-H050/LK-H055/LK-H052/LK-H057/LK-H053/LK-H058/LK-H052K/LK-H057K

■ Mounting method

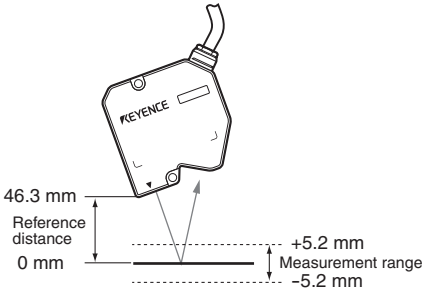


■ Measurement range

• Diffuse reflection mounting



• Specular reflection mounting



Reference

- For both diffuse reflection mounting and specular reflection mounting, the laser emission LED lights in green when the target is within approximately ±0.5 mm of the reference position, and lights in orange when it is in any other position within the measurement range.
- Select the mounting mode according to the mounting type (page 3-15).
- The following table shows the measurement ranges for the sampling cycle between 2.55 µs and 10 µs.

LK-H05x

Range setting	Center	Far
2.55 µs	±0.7 mm (±0.4 mm)	-7.6 to -10.0 mm (-7.6 to -9.6 mm)
5 µs	±2.0 mm (±1.6 mm)	-4.0 to -10.0 mm (-4.0 to -9.6 mm)
10 µs	±4 mm (±3.6 mm)	2.0 to -10.0 mm (1.6 to -9.6 mm)

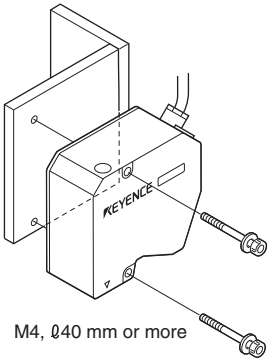
LK-H05xK

Range setting	Center	Far
2.55 µs	±0.4 mm (±0.4 mm)	-4.4 to -5.2 mm (-4.4 to -5.2 mm)
5 µs	±1.6 mm (±1.6 mm)	-2.0 to -5.2 mm (-2.0 to -5.2 mm)
10 µs	±3.6 mm (±3.6 mm)	3.2 to -5.2 mm (3.2 to -5.2 mm)

The values in parentheses are for specular reflection mounting.

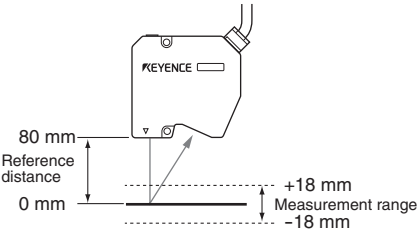
LK-H080/LK-H085/LK-H082/LK-H087

■ Mounting method

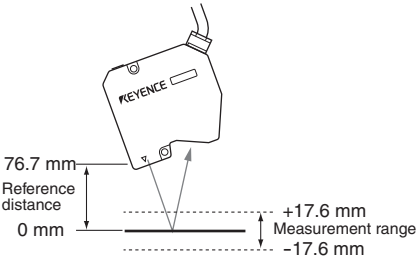


■ Measurement range

- Diffuse reflection mounting



- Specular reflection mounting



Reference

- For both diffuse reflection mounting and specular reflection mounting, the laser emission LED lights in green when the target is within approximately ±0.9 mm of the reference position, and lights in orange when it is in any other position within the measurement range.
- Select the mounting mode according to the mounting type (page 3-15).
- The following table shows the measurement ranges for the sampling cycle between 2.55 µs and 10 µs.

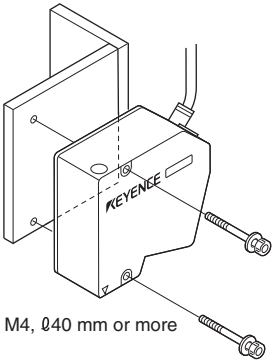
LK-H08x

Range setting	Center	Far
2.55 µs	±1.2 mm ±(1.1 mm)	-13.5 to -18.0 mm (-13.3 to -17.6 mm)
5 µs	±3.5 mm ±(3.4 mm)	-7.3 to -18.0 mm (-7.2 to -17.6 mm)
10 µs	±7.7 mm (±7.5 mm)	2.9 to -18.0 mm (2.8 to -17.6 mm)

The values in parentheses are for specular reflection mounting.

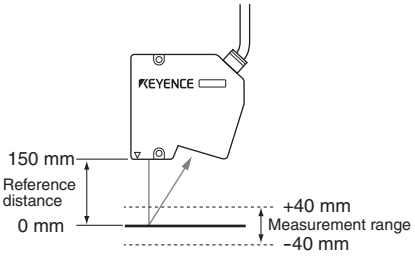
LK-H150/LK-H155/LK-H152/LK-H157

■ Mounting method

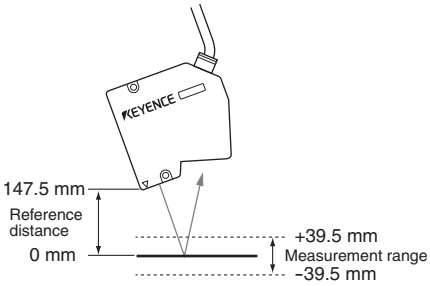


■ Measurement range

• Diffuse reflection mounting



• Specular reflection mounting



Reference

- For both diffuse reflection mounting and specular reflection mounting, the laser emission LED lights in green when the target is within approximately ±2 mm of the reference position, and lights in orange when it is in any other position within the measurement range.
- Select the mounting mode according to the mounting type (page 3-15).
- The following table shows the measurement ranges for the sampling cycle between 2.55 µs and 10 µs.

LK-H15x

Range setting	Center	Far
2.55 µs	±1.9 mm ±(1.8 mm)	-32.8 to -40.0 mm (-32.5 to -39.5mm)
5 µs	±7.6 mm ±(7.5 mm)	-16.9 to -40.0 mm (-16.8 to -39.5 mm)
10 µs	±17.7 mm (±17.5 mm)	7.2 to -40.0 mm (7.1 to -17.6 mm)

The values in parentheses are for specular reflection mounting.

Mounting the sensor head according to the measurement target

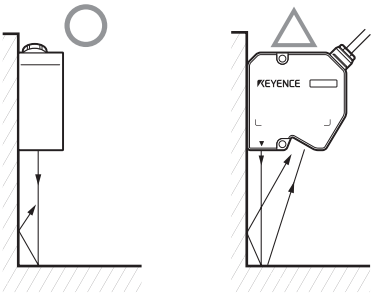
■ Measurement distance

Use the sensor head as close to the reference distance as possible. This ensures the most stable detection.

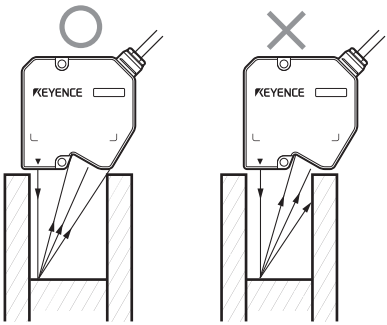
■ Target shape

It is recommended to mount the sensor head in the orientations indicated by the circles in the figures below.

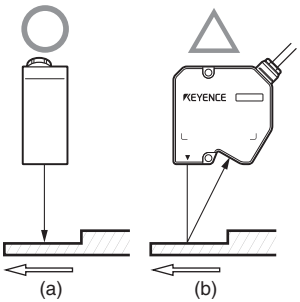
- Near a wall surface



- Displacement in a hole



- Height difference measurement

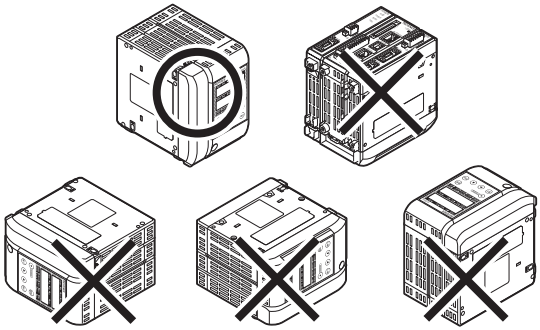


Mounting the controller

Mount the controller to the DIN rail, or secure it with screws.

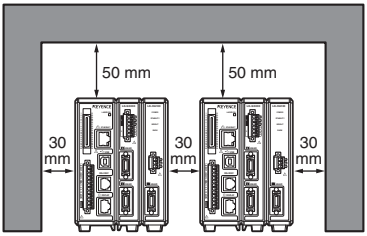
Caution on the orientation of the controller

Mount the controller only in the orientation shown with a circle in the following figures. Do not mount it upside down.



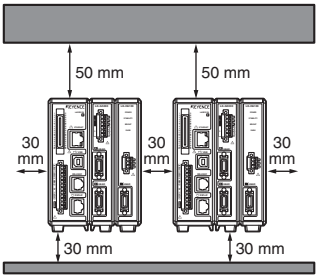
■ **To secure the controller with the screws on the bottom**

Provide clearance of 50 mm or more above, 30 mm or more on each side, and 30 mm or more at the rear of the controller for ventilation.
In addition, for ensuring the safety of the cable connection work, provide 65 mm or more space in front of the terminal panel of the controller.



■ **To mount the controller to the DIN rail**

Provide clearance of 30 mm or more between the controllers, 50 mm or more above and 30 mm or more below the controller.

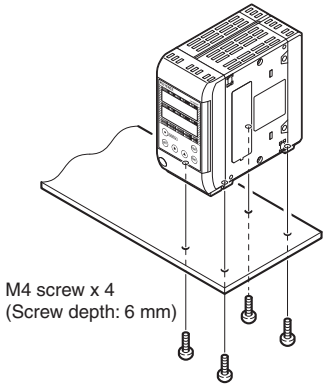


⚠CAUTION

- Do not block the ventilation holes on the top and bottom of the controller. The heat may stay inside and cause a malfunction.
- When the temperature inside the control panel exceeds the specified ambient temperature (50°C when one or less head expansion unit is connected, 40°C when two or more head expansion units are connected), decrease the temperature of the controller bottom to the specified ambient temperature or lower by using forced air cooling or by providing more clearance around the controller.

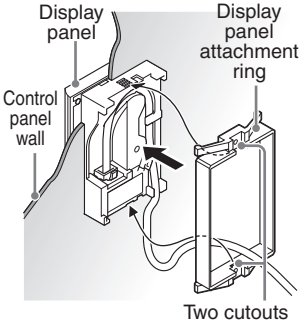
Mounting the LK-G5001V/LK-G5001PV (single unit type controller)

Mount the controller on its bottom surface.



Mounting the LK-G5001/LK-G5001P and LK-HD500 (separate type controller)

Display panel (LK-HD500)

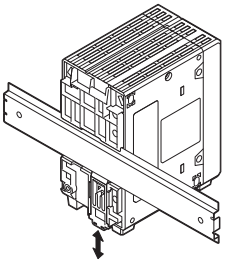


Insert the display panel from the front, and secure it with the display panel attachment ring from the rear.

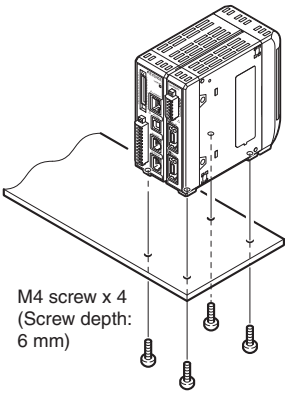
When removing the display panel, push the two cutouts of the attachment ring outward with a flat-blade screwdriver and then push out the display panel to the front.

Controller (LK-G5001/LK-G5001P)

- DIN-rail mounting



- Bottom mounting

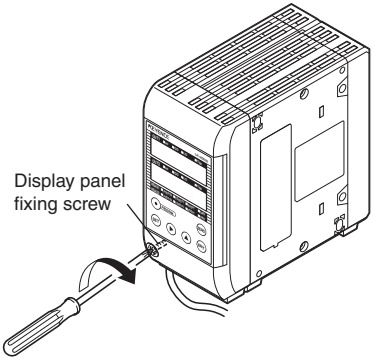


Separating the single unit type controller

1 **Disconnect the display panel cable from the display panel connector on the terminal panel of the controller.**

Also remove the display panel cable from the guide on the bottom of the controller.

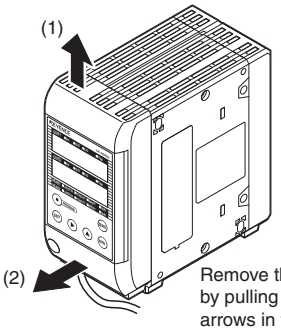
2 **Loosen the display panel fixing screw.**



Reference

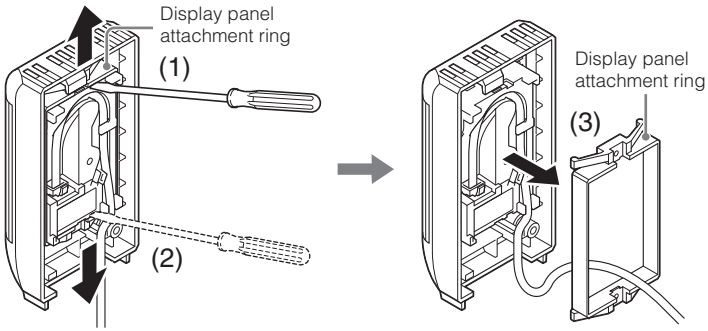
The display panel fixing screw stays on and does not detach from the display panel housing.

3 **Remove the display panel housing from the controller.**



Remove the display panel housing by pulling it in the directions of the arrows in the specified order.

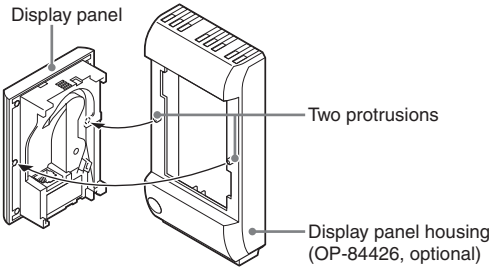
4 **Push (1) and (2) outward in this order with a flat-blade screwdriver, and then push the display panel to the front to remove the display panel attachment ring.**



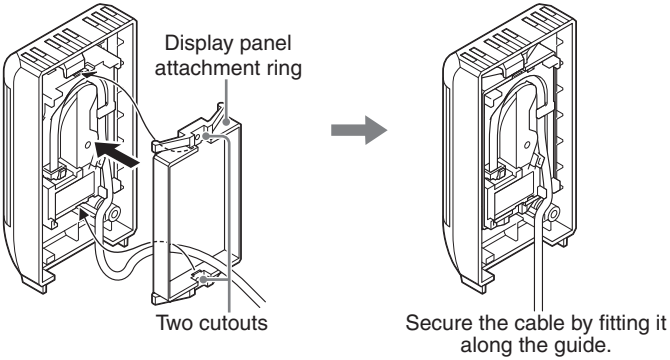
5 **Remove the display panel from the display panel housing.**

Combining the separate type controller

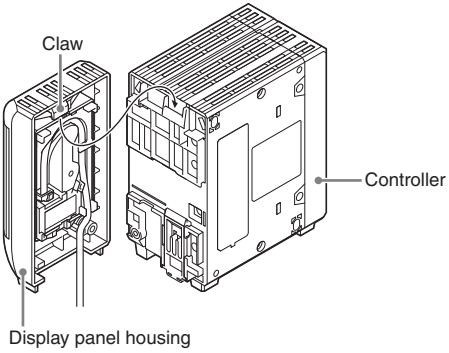
1 **Attach the display panel to the display panel housing by aligning the two protrusions on the housing with the display panel.**



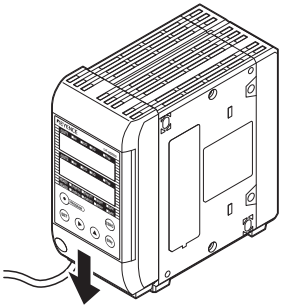
2 **Secure the display panel with the display panel attachment ring, and connect the 33 cm display panel cable (OP-84427, optional).**



3 **Align the claw of the display panel housing with the controller.**



4 **Attach the display panel housing by sliding it along the groove on the controller.**



Slide the front panel in the direction of the arrow.

⚠CAUTION

Be sure to check the orientation of the claw on the connector before attaching the display panel housing. Using the incorrect orientation may break the claw, causing a malfunction.

5 **Secure the display panel housing by tightening the display panel fixing screw.**

6 **Route the display panel cable along the guide, and connect it to the display panel connector on the terminal panel of the controller.**

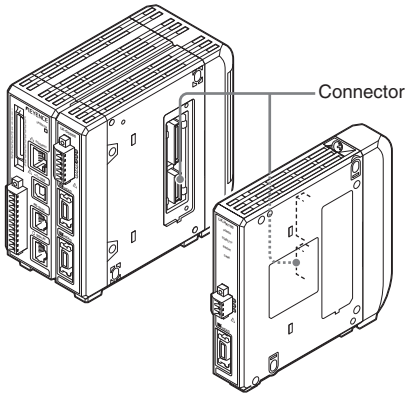
Connecting the head expansion unit

⚠CAUTION

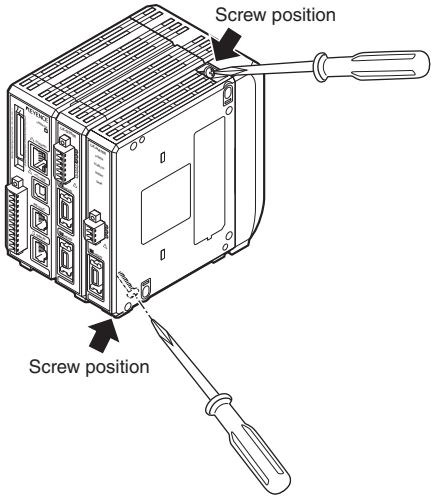
Turn off the power of the LK-G5000 Series before connecting the head expansion unit. Otherwise, you may suffer a shock or damage the unit.

1 **Connect the head expansion unit by aligning its connector to the connector on the left side of the controller.**

You need to remove the sticker attached to the left side of the controller beforehand.



2 **Secure the head expansion unit by tightening the two fixing screws.**



Tightening torque

Limit the tightening torque to 0.7 Nm or less.

3 **In the Environment settings, specify the active head count and active OUT count.**

Refer to "Setting the Operating Environment settings (ENV)" (page 3-69) for details.

▶NOTE

When you change the active head count or active OUT count in the Environment settings, all the settings of the LK-G5000 Series except for the Environment settings are reset. When you connect the LK-HA100 head expansion unit(s) and add a sensor head(s), be sure to set the active head count and active OUT count before changing the other measurement settings.

Connecting the communication unit

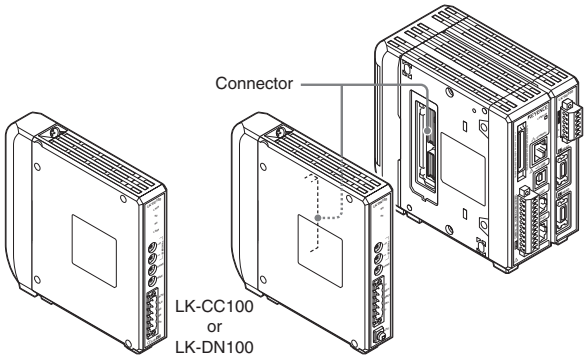
Connect the LK-CC100 CC-Link communication unit or the LK-DN100 DeviceNet communication unit to the controller.

⚠CAUTION

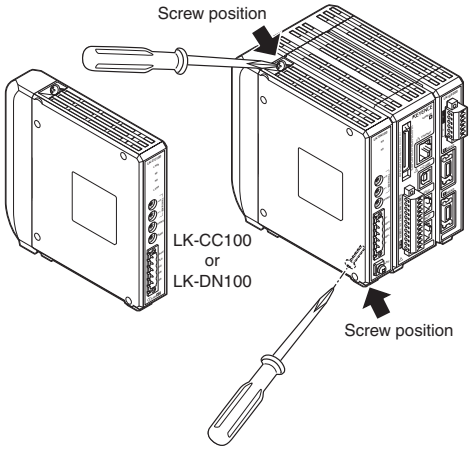
Turn off the power of the LK-G5000 Series before connecting the communication unit. Otherwise, you may suffer a shock or damage the unit.

1 **Connect the communication unit by aligning its connector to the connector on the right side of the controller.**

You need to remove the sticker attached to the right side of the connector beforehand.



2 **Secure the communication unit by tightening the two fixing screws.**



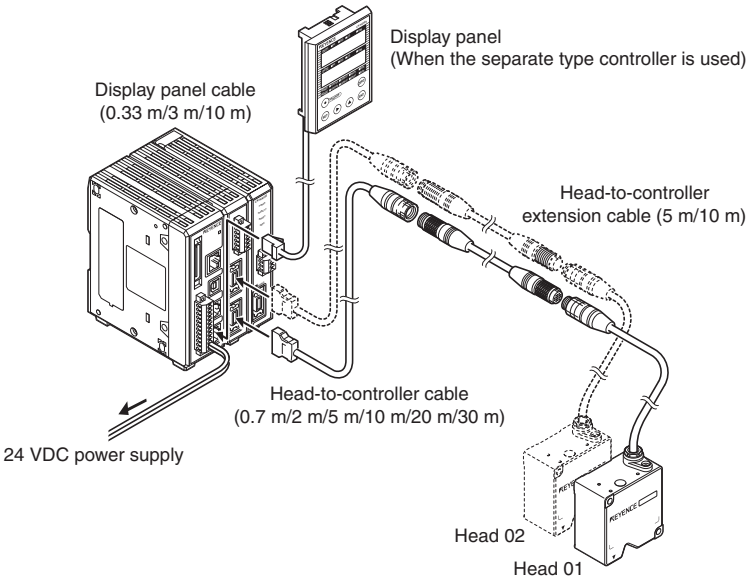
Tightening torque

Limit the tightening torque to 0.7 Nm or less.

Connecting the units

⚠CAUTION

- Be sure to turn off the power of the controller before connecting/disconnecting the cables. Failure to do so may cause product breakdown.
- Check the orientation of the connector before connecting it. Improper connection may break the connector pins, resulting in product breakdown.
- Part of the input/output circuit of the LK-G5000 Series is internally common. Be careful that no potential difference is generated between the internally common terminals due to the potential difference between the cables/external devices.
  Refer to "Precautions on wiring" (page 7) for details.



Connecting the sensor head

Connect the connector of the head-to-controller cable to the head connector 1 or 2 on the terminal panel of the controller. Ensure that a clicking sound is heard which indicates a secure connection. When disconnecting the cable, pull out the connector while holding down the buttons on both sides. Up to two sensor heads can be connected to the controller at the same time.

Reference

When the LK-HA100 head expansion units are used, up to 12 sensor heads can be connected.

▶NOTE

- For each sensor head connection, use only one head-to-controller extension cable and limit the total length to 30 m at maximum.
- You cannot connect the CB-A∗∗E to the CB-A30.
- You cannot connect two CB-A10E cables to the CB-A10.

Connecting the display panel

When using the separate type controller, connect the display panel cable between the display panel connector of the controller and the display panel.

Reference

The LK-G5000 Series can also be operated without the display panel. Moreover, you can use the LK-Navigator 2 software to operate the LK-G5000 Series from a PC or to display the measured value on a PC.

Connecting the power supply

Connect the 24 VDC power supply to terminals 1 and 2 of the 12-pin terminal block.

⚠CAUTION

Reference

Be sure to observe the following instructions. Otherwise, a connection failure may occur, causing a malfunction in the LK-G5000.

- For the power supply cable, use lead wires with a nominal cross-section area of 0.8 mm^2 to 1.3 mm^2 (AWG17 to 18).
- The unsheathed wire length should be approx. 9 mm.
- Do not use soldering (preliminary soldering) to connect the wires.
- Insert the wires into the innermost position of the terminal block securely.
- Connect the wires to the terminal block directly, without using a crimp terminal, etc.

Connection to the terminal block

The procedure to connect electrical wires to the terminal block are as follows:

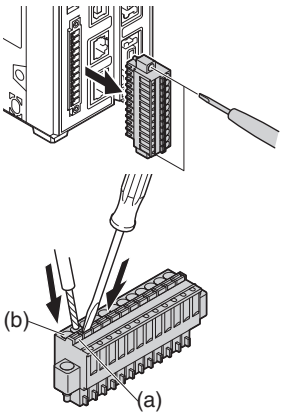
1 **Remove the terminal block from the controller.**

Loosen the two screws with a screwdriver and pull out the terminal block.

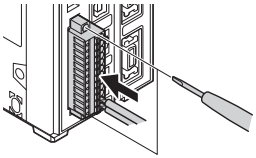
2 **Use a screwdriver to push in part (a) and insert a lead wire into part (b) as indicated.**

3 **Remove the screwdriver once the wire is fully inserted.**

Pull each lead wire gently to confirm that it is properly secured.



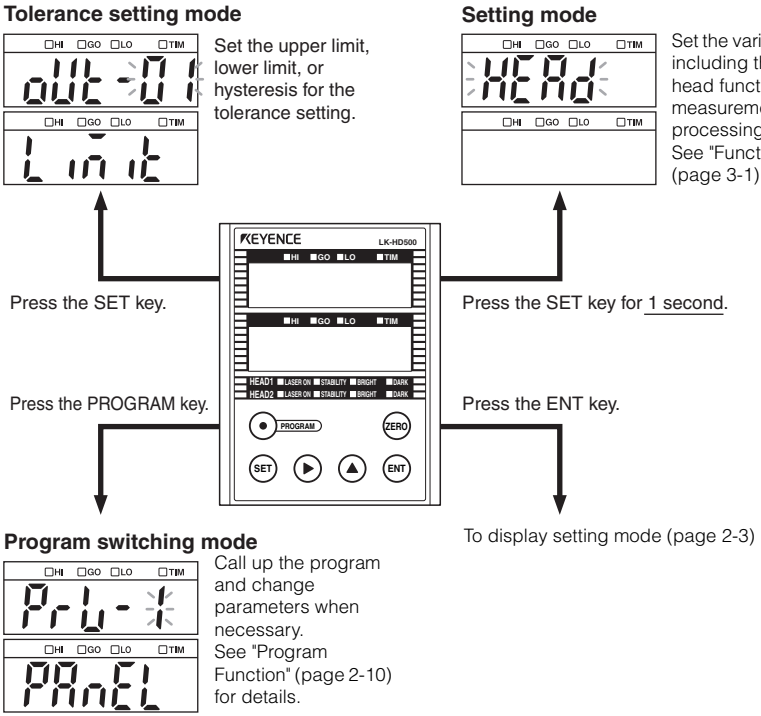
4 **Attach the terminal block to the controller.**



Outline of the Measurement and Settings

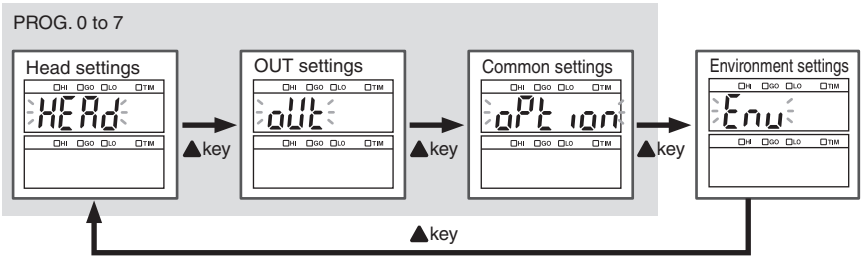
Mode selection

In addition to the measuring mode to perform measurement, the LK-G5000 Series has three other modes: the program switching mode to switch programs; the tolerance setting mode to set tolerances; and the setting mode to specify various functions.



Setting mode

In the Setting mode, every time the ▲ key is pressed, the setting category is switched in the order of Head Settings -> OUT Settings -> Common Settings -> Environment Settings.



PROG. 0 to 7	The LK-G5000 Series allows switching of eight programs assigned to Program Nos. 0 to 7. You can register a set of parameters as a program for a specific measurement process or target. When necessary, you can call up one of the programs and change the setting easily.
Head settings (page 3-3)	• Set the functions related to sensing ability to ensure stable detection. • Setting items: ABLE, measurement mode, alarm handling, ABLE calibration, mounting mode, mask setting, median, LASER CTRL group, range, base point
OUT settings (page 3-24)	• Set the functions related to data processing. • Setting items: Calculation method, scaling, filter, measurement mode, trigger, offset, minimum display unit, analog scaling, measurement type
Common settings (page 3-55)	• Set the functions common to the Head settings and OUT settings. • Setting items: Sampling cycle, mutual interference prevention, synchronization, comparator output form, strobe time, data storage, analog output, alarm output type
Environment settings (page 3-69)	• Set the operating environment of the devices. • Setting items: RS-232C, setting selection, program, panel lock, active OUT count, active head count, active analog channel count, LAN setting

Initializing the LK-G5000 Series to the Factory Default Settings

You can initialize all the specified settings for the LK-G5000 Series back to the default status when the unit was shipped from the factory.

1 **Hold down the ENT key and turn on the power.**

The measured value display shows "INIT" (INIT).

2 **When "OK" (OK) flashes in the lower window, press the ENT key again.**

The settings of the LK-G5000 Series are initialized to the factory default settings and the system enters the measuring status.

Refer to "Function Settings" (page 3-1) for details.

MEMO

Operations during Measurement and Their Functions

2

This chapter describes the operations that can be performed during displacement measurement and their functions.

Switching the Measurement Value Displays..... 2-2
Setting the Tolerance Comparator Value..... 2-4
Instantaneous Zero Setting (Auto-Zero)..... 2-7
Instantaneous Master Adjustment (Auto-offset)..... 2-9
Program Function..... 2-10
Switching Program Nos. 2-11
Storing Measured Values in the Memory (Data Storage Function)..... 2-12

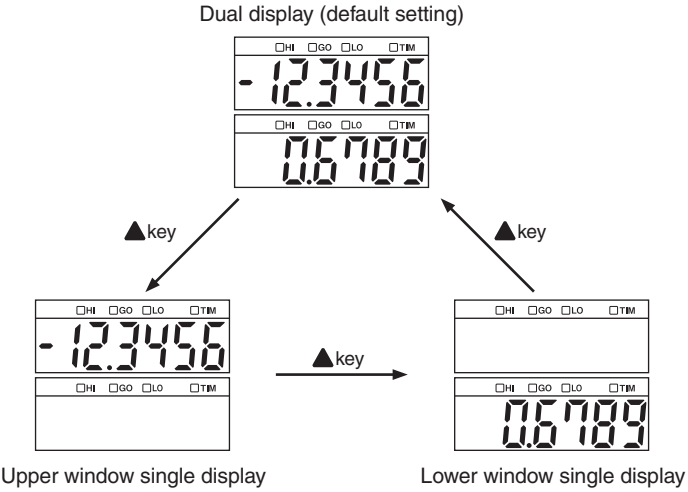
Switching the Measurement Value Displays

This section describes how to switch the measurement value displays.

Switching between the upper window display and lower window display

During measurement, you can switch the following three display types by pressing the ▲ key.

- Upper window single display
- Lower window single display
- Dual display



Reference

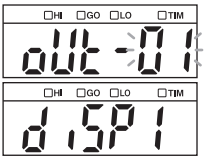
The selected display type is retained for each program No.

Assigning a desired OUT display to the upper/lower window (display setting)

1 **Press the ENT key.**

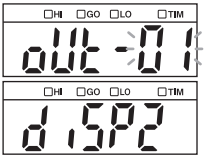
The system enters the display setting mode.

2 **Press the ▲ key to select the OUT No. to display in the upper window and then press the ENT key.**



3 **Press the ▲ key to select the OUT No. to display in the lower window and then press the ENT key.**

The display assignment is set.



Setting the Tolerance Comparator Value

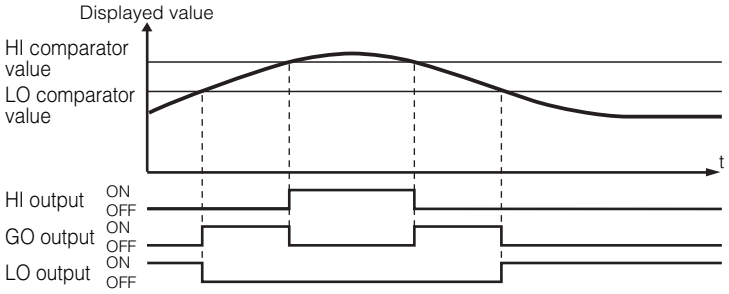
This section describes how to read the tolerance comparator display and how to set it.

The function of the tolerance comparator setting

You can set limit values (tolerance comparator values) used to decide whether the measured value is within the allowable range. The measured values are classified into three levels based on the limit: HI when the value exceeds the upper limit, LO when the value is below the lower limit, and GO when the value is within the allowable range. The result can be displayed or output.

Comparator status	Range	Display
HIGH	HI comparator value < Measured value	The "HI" LED lights and the measured value is displayed in red.
GO	LO comparator value ≤ Measured value ≤ HI comparator value	The "GO" LED lights and the measured value is displayed in green.
LOW	Measured value < LO comparator value	The "LO" LED lights and the measured value is displayed in red.
Comparator standby		No LED lights and the measured value display shows "- - - - - - - -".
Alarm		The "HI" and "LO" LEDs light simultaneously and the measured value display shows "-FFFFFF".

When the comparator output form (page 3-63) is set to "Normal", the comparator output is as follows.



Reference

- Refer to "Setting the output form of the tolerance comparator result (Comparator output form)" (page 3-63) for details of the comparator output form.
- The tolerance comparator result is output from the 12-pin terminal block and expansion connector on the terminal panel of the controller. Refer to "Function of the I/O terminals" (page 4-2) for details of the external output terminals.

▶NOTE

Measurement stops during the setting.

Setting the tolerance comparator value

1 **Press the SET key.**

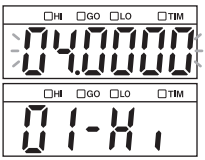
The system enters the tolerance setting mode.

2 **Press the ▲ key to select the OUT No. to set the tolerance comparator value and then press the ENT key.**



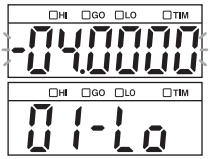
3 **Use the ▶ and ▲ keys to set the HI comparator value and then press the ENT key.**

In this example, the HI tolerance for OUT01 is set to 4.0000.



4 **Use the ▶ and ▲ keys to set the LO comparator value and then press the ENT key.**

In this example, the LO tolerance for OUT01 is set to -4.0000.
The specified tolerance comparator values are set.



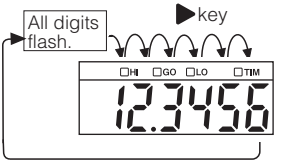
5 **Press the SET key.**

The system returns to the measuring status.

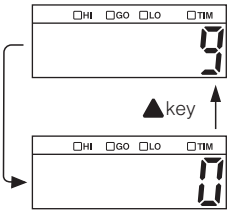
■ Entering numerical values

A numerical value can be set by the following key operations.

- You can set the digit of a flashing number.
- When all digits are flashing, you can set the sign.
- When the ▶ key is pressed, the digit that flashes after all the digits flash shifts to the right. When the key is pressed for one second or more, digits shift continuously.



- When the ▲ key is pressed, the value increments one at a time.
  When the key is pressed and held for one second or more, the value increments continuously.

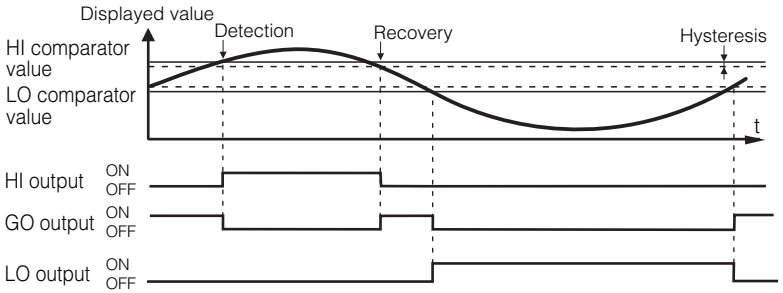


Reference

When the ZERO key is pressed and held for three seconds during the setting, the setting returns to the default value.

Hysteresis

If the measurement value is fluctuating around the tolerance comparator value, the comparator output may repeatedly turn on and off. By setting a hysteresis, an allowance can be made between the detected value and the return value of the tolerance comparator, preventing such a phenomenon. The diagram below shows the comparator output when the comparator output form is set to Normal. Hysteresis is disabled by default.



▶NOTE

Measurement stops during the setting.

Reference

Refer to "Setting the output form of the tolerance comparator result (Comparator output form)" (page 3-63) for details of the comparator output form.

Setting the hysteresis

1 **Press the SET key.**

The system enters the tolerance setting mode.

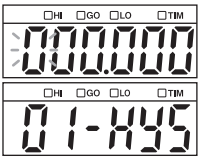
2 **Press the ▲ key to select the OUT No. to set the hysteresis and then press the ENT key.**



3 **Press the ENT key several times until "[Target OUT No.] -HYS" is displayed in the lower window.**

4 **Use the ▶ and ▲ keys to set the hysteresis and then press the ENT key.**

The specified hysteresis is set.



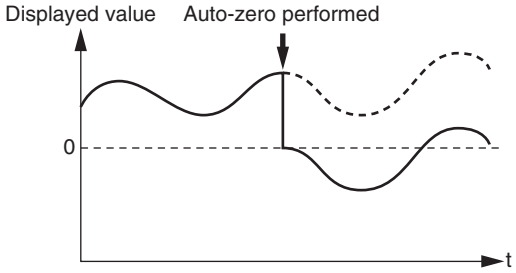
5 **Press the SET key.**

The system returns to the measuring status.

Instantaneous Zero Setting (Auto-Zero)

This section describes the auto-zero function which is used for reference zero point compensation.

The auto-zero function can be used to set a reference point at "0", for example, when the target is changed. You can instantaneously reset the currently displayed value to "0" by pressing the [ZERO] key or other operation. An increase or decrease in the displayed value relative to the zero point (reference point) can be displayed with the "+" or "-".



▶NOTE

The auto-zero cannot be set during the comparator standby status ("- - - - - - -" is displayed), over range status, or alarm status. (Canceling auto-zero is possible.)

Reference

- The auto-zero value is stored for each program No. and OUT No.
- The auto-zero value is retained even if the power is turned off.
- When the measurement mode is other than Normal, the system enters the comparator standby status ("------") after auto-zero is set.
- Master target adjustment using the offset function (auto-offset function)
  When the offset value has been set to the size of a master target, setting the auto-zero while the master target is being measured will set the displayed value to the size of the master target (offset value) (page 3-47).
- The auto-zero is applied to the measured value after it is processed with the measurement mode operation (page 3-37).

Setting the auto-zero from the display panel

1 **Measure the target to be used as a reference.**

In this example, assume that "12345" is displayed.



2 **Press the ZERO key.**

The measured value display shows zero.



▶NOTE

- To specify the auto-zero setting for either the upper or lower window only, use the up and down arrows to show only that display.
- To specify the same auto-zero setting for both the upper and lower windows, set the measured value display mode to the dual display. Refer to "Switching the Measurement Value Displays" (page 2-2) for the procedure for switching the measured value display.
- The auto-zero cannot be set to the OUT No. which is not being displayed.
- The measured value at the moment when the ZERO key is released is set to "0.0000".
- Pressing the ZERO key for three seconds cancels the auto-zero setting.

Auto-zero input from the ZERO terminal

When ZERO1 (Terminal 10) and COM for input (Terminal 12) of the 12-pin terminal block are turned ON, the auto-zero is set for all of the synchronized OUT.
When ZERO (Terminal 13) and COM for input (Terminal 1) of the expansion connector are turned ON while DEC_IN (Terminal 16) and COM for input (Terminal 1) of the expansion connector are turned ON, the auto-zero is set for the OUT selected with the B_IN terminal.
Limit the turn-on time for the terminals to less than two seconds.

- NPN type : OFF when opened/ON when short-circuited
- PNP type : OFF when opened/ON when voltage is applied

Reference

- When the synchronization is not set, the auto-zero is set to OUT01 when the ZERO1 terminal is turned ON.
- The measurement value at the instant when the terminal is turned on is set to "0.0000".
- If the ZERO1 or ZERO2 terminal is turned on for two seconds or more, the auto-zero is canceled.

Auto-zero input using the RS-232C interface

The auto-zero function can be set or canceled with the command sent from the external devices through the RS-232C interface ("RS-232C" (page 5-1)).

Instantaneous Master Adjustment (Auto-offset)

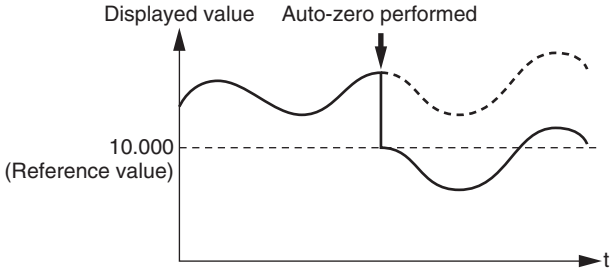
The auto-offset function can be used for master adjustment, when the target is changed.

Set the size of the master target as the offset value and then use the auto-zero function while measuring the master target. The size of the master target can be set as the master value (reference value).

Refer to "Auto-Zero" (page 2-7).
Refer to "Offset" (page 3-47).

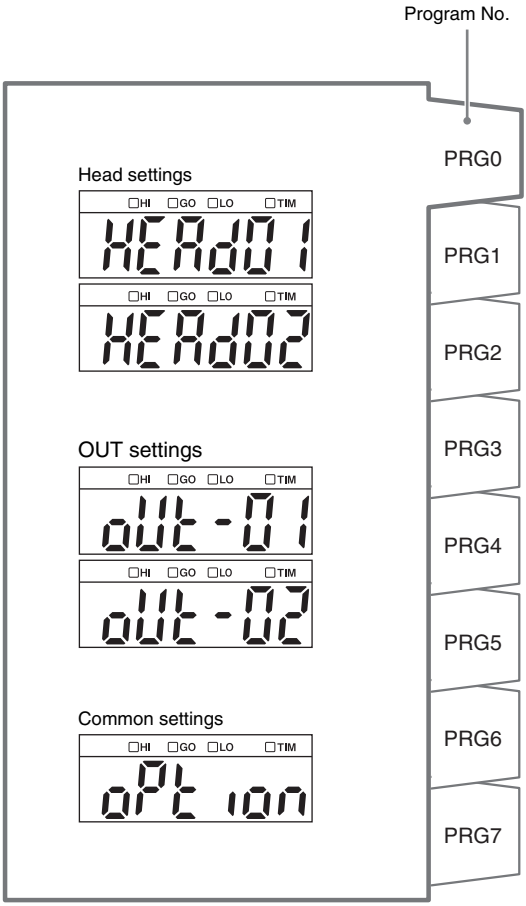
■ Example

To adjust the master target dimension at "10.000", perform the auto-zero function after setting an offset value of "10.000".



Program Function

The LK-G5000 Series allows switching of eight programs assigned to Program Nos. 0 to 7. You can register a set of parameters as a program for a specific measurement target. When necessary, you can call up one of the programs and change the setting easily.



▶NOTE

The Environment settings are common to all programs. These settings cannot be switched for each program.

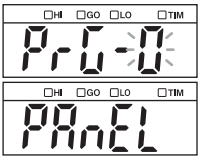
Switching Program Nos.

This section describes the Program No. switch function used to easily change the operation settings.

Using the display panel

1 **Press the PROGRAM key.**

The program selection screen appears.



2 **Press the ▲ key to select the desired program number and then press the ENT key.**

The program is switched and the system returns to the measuring status.

Using the external input terminal

The program number can be changed using the P1, P2, and P3 terminals of the expansion connector (page 4-5).

Using the RS-232C interface

The program numbers can be switched with the command sent from the external devices through the RS-232C interface (page 5-11).

▶NOTE

The method for switching the program numbers varies depending on the setting of "Setting the program switching method (Setting selection)" (page 3-73) in the Environment settings.

Function No.	Selection item	Possible operation
b-0	PAnEL	Panel operation/RS-232C interface
b-1	Ext	External terminal input

Reference

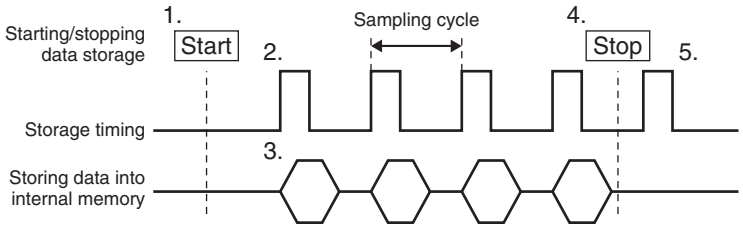
It is also possible to switch program numbers by using the LK-HD1001 dedicated touch panel or the LK-Navigator 2 setup support software.

Storing Measured Values in the Memory (Data Storage Function)

This function stores measured values of an arbitrary OUT No. in the controller's internal memory.

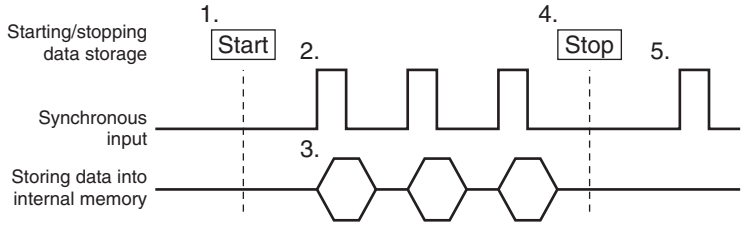
The LK-G5000 series can store data for up to a total of 1,200,000 measured data points in the internal memory, at each synchronous input, or in a storage cycle.
For the storage timing, "Synchronized with sampling cycle" or "Synchronized with synchronous input" can be selected.
To start and stop data storage, and to read data, use the RS-232C interface or the LK-Navigator2. (Refer to LK-Navigator2 User's Manual.)

■ **When storage cycle is "x1"**



1. The LK-G5000 starts storing data according to "Conditions to start storing data".
2. The measured value to be stored is determined in each "sampling cycle".
3. The measurement result is stored in the internal memory.
4. The LK-G5000 stops storing data according to "Conditions to stop storing data".
5. While the data storage function is stopped, measured values will not be stored.

■ **When storage cycle is "Synchronization input"**



1. The LK-G5000 starts storing data according to "Conditions to start storing data".
2. The measured value to be stored is determined according to "synchronous input". TIMING1 input, RS-232C interface input and LK-HD1000 timing buttons are available for "synchronous input".
3. The measurement result is stored in the internal memory.
4. The LK-G5000 stops storing data according to "Conditions to stop storing data".
5. While the data storage function is stopped, measured values will not be stored.

Storage timing

Storage timing is specified with "Storage cycle".
For details on storage cycle, refer to "Storage cycle selection" (page 3-65).

Storage cycle	Storage timing
x1	Stores all measurement data.
x2 to x1000	Samples measurement data, and stores sample data in the sampling cycle that are a multiple of the specified number.
Synchronization input	Stores data determined at each synchronous input.

Starting/stopping data storage and clearing data

Conditions to start storing data	• Start command from the RS-232C interface • Operation from the LK-Navigator 2 setup support software
Conditions to stop storing data	• Stop command from the RS-232C interface • Operation from the LK-Navigator 2 setup support software
Conditions to clear the stored data	Any of the following cases while the storing operation is stopped: • When the data for the specified number of measured values are stored • When the setting mode or communication mode is changed to the measuring mode • When the initialization command is sent through the RS-232C interface • When the initialization is ordered from the LK-Navigator 2 setup support software • When the power is turned off • When the program number is changed

Reading data

Data stored on the controller's internal memory can be read by the following method:

- Reading data via LK-Navigator2 (LK-Navigator2 User's Manual)
- Reading data with the read command via the RS-232C interface (page 5-12)

Function Settings

3

This chapter describes the functions of the LK-G5000 Series and how to set them.

Measurement, Data Flow and Functions..... 3-2

Setting the sensor head (HEAD) 3-3

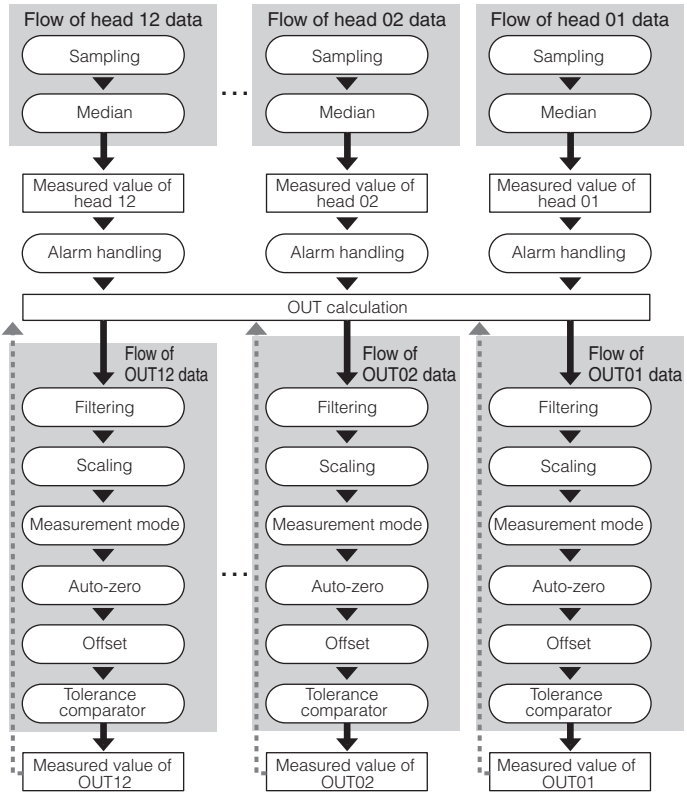
Setting the measurement value output conditions (OUT)... 3-24

Setting the Common Function (OPTION)..... 3-55

Setting the Operating Environment settings (ENV) 3-69

Measurement, Data Flow and Functions

The LK-G5000 Series can be connected with two sensor heads (12 heads max. when the expansion units are used). You can perform measurement using the individual sensor head or calculate the measurement values between the sensor heads.



Measured values of OUT01 through 12 can be used up to three times in the calculation.

The functions of the LK-G5000 Series can be categorized into the following four groups.

Head settings (page 3-3)	Set the functions related to sensing ability to ensure stable detection.
OUT settings (page 3-24)	Set the functions related to data processing.
Common settings (page 3-55)	Set the functions common to the Head settings and OUT settings.
Environment settings (page 3-69)	Set the operating environment of the devices.

Function symbol and function display



Setting the sensor head (HEAD)

This section describes the settings related to sensing ability to ensure stable detection.

▶NOTE

When you change the active head count or active OUT count in the Environment settings, all the settings of the LK-G5000 Series are reset. When you connect the LK-HA100 head expansion unit(s) and add a sensor head(s), be sure to specify the active head count and active OUT count before changing the other measurement settings.

List of functions and function Nos.

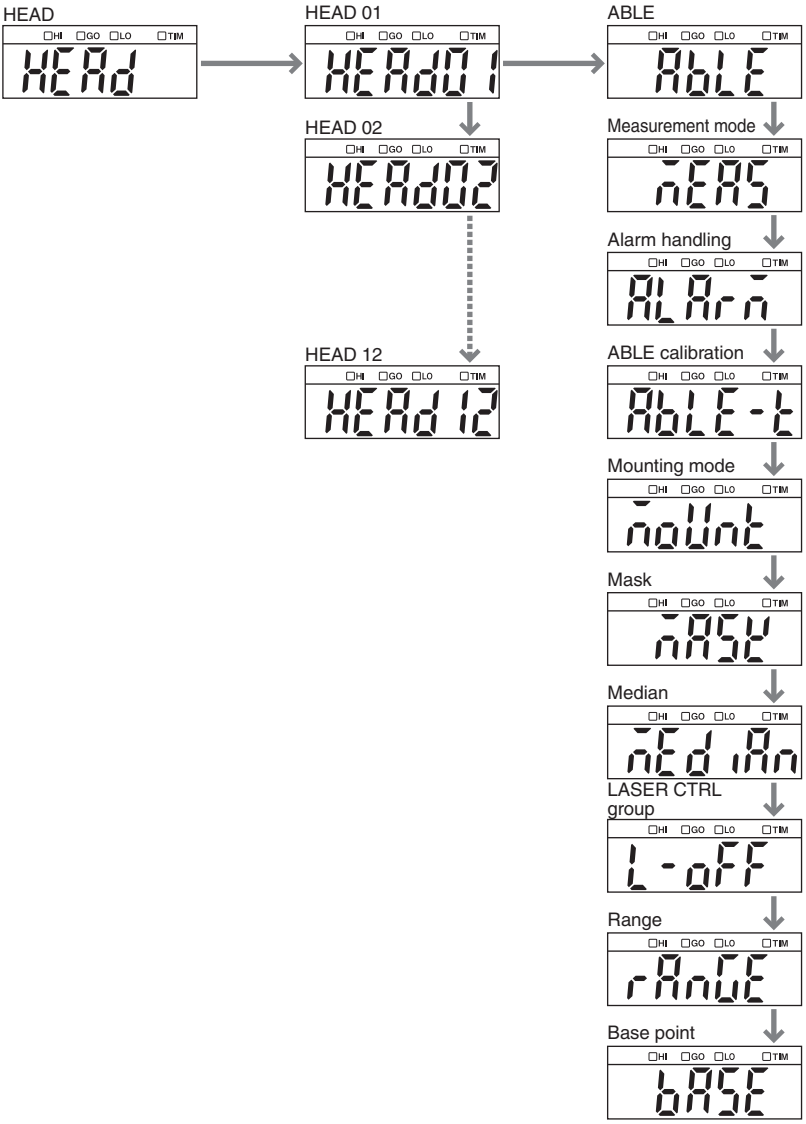
Function symbol	Function	Function No.					Reference page
	Function display	0	1	2	3	4	
A	ABLE	AUTO	MANUAL				page 3-6
	AbLE	AUto	mAnUAL				
b	Measurement mode	Normal	Translucent object	Transparent object	Transparent object 2	Semi opaque	page 3-8
	mEAS	norMAL	HALF-t	trAn-1	trAn-2	SEMi-o	
C	Alarm handling	• Process count (CoUnt1, 0 to 9999, initial value: 8) • Recovery count (CoUnt2, 0 to 9999, initial value: 0) • Level (LEvEL, 0 to 9, initial value:4)					page 3-10
	ALArm						
d	ABLE calibration	START/STOP					page 3-13
	AbLE-t	StArt/StoP					
E	Mounting mode	Diffuse reflection	Specular reflection				page 3-15
	mount	diFF-S	mirr-S				
F	Mask setting	OFF	ON				page 3-16
	MASK	oFF	on				
G	Median	OFF	7	15	31		page 3-18
	mEd iAn	oFF	7	15	31		
H	LASER CTRL group	LASER CTRL1	LASER CTRL2				page 3-20
	L-oFF	1	2				
I	Range	CENTER	FAR				page 3-21
	rAnGE	CEntEr	FAr				
J	Base point	NEAR	FAR				page 3-22
	bASE	nEAr	FAr				

* The shaded cells ( ) are set by default.

List of initial values and setting ranges

Function symbol	Item	Setting range	Initial value	Remark
A	ABLE	-	AUTO	
	Upper limit of control	1 to 99	99	Values smaller than the lower limit of control cannot be selected.
	Lower limit of control	1 to 99	1	Values larger than the upper limit of control cannot be selected.
b	Measurement mode	Normal/Translucent object/ Transparent object/ Transparent object 2/ Semi opaque	Normal	
C	Process count	0 to 9999	8	
	Recovery count	0 to 9999	0	
	Level	0 to 9	4	
d	ABLE calibration	START/STOP	-	
E	Mounting mode	Diffuse reflection/Specular reflection	Diffuse reflection	
F	Mask setting	OFF/ON	OFF	
	P-1	-9999.99 to 9999.99	0000.00	
	P-2	-9999.99 to 9999.99	0000.00	
G	Median	OFF/7/15/31	OFF	
H	LASER CTRL group	LASER CTRL1/LASER CTRL2	LASER CTRL1	
I	Range	CENTER/FAR	CENTER	
J	Base point	NEAR/FAR	NEAR	

List of the Head settings screens



Setting ABLE (ABLE)

The LK-G5000 Series measures the displacement of a target by measuring the laser beam reflected from the surface of the target. The ABLE function automatically adjusts the light intensity and sensitivity to their optimum levels according to the conditions of the target surface (color, luster, and material).

The following two types of settings are available for ABLE.

Function No.		Light intensity adjustment	Function
A-0	AUto	Auto	The light intensity is automatically adjusted to the optimum level. Select this option during normal operation.
A-1	MAnUAL	Manual	The light intensity and sensitivity can be adjusted by limiting the adjustment range for the light intensity and sensitivity to the desired range between 1 and 99. Select this option when the reflectance of the target changes greatly in a short cycle.

Setting ABLE (AUTO)

The following procedure changes the setting of head 01 as an example.

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Head setting (HEAd) and then press the ENT key.**

3 **Press the ▲ key to select the target sensor head (HEAd01) and then press the ENT key.**

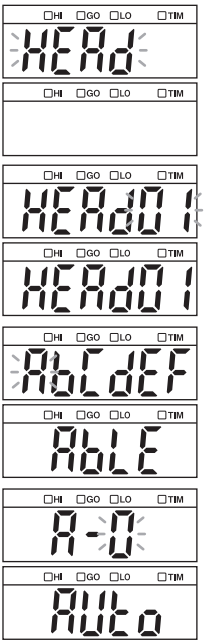
4 **Press the ▶ key to select function symbol A (ABLE, A) and then press the ENT key.**

5 **Press the ▲ key to select A-0 (AUTO, A-0) and then press the ENT key.**

The setting is saved.

6 **Press the SET key.**

The system returns to the measuring status.



Setting ABLE (MANUAL)

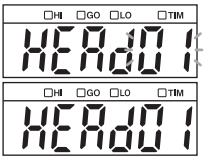
The following procedure changes the setting of head 01 as an example.

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Head settings (HEAd) and then press the ENT key.**



3 **Press the ▲ key to select the target sensor head (HEAD01, HEAd01) and then press the ENT key.**



4 **Press the ▶ key to select function symbol A (ABLE, A) and then press the ENT key.**

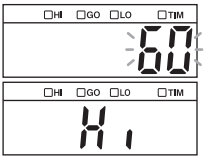


5 **Press the ▲ key to select A-1 (MANUAL, A-1) and then press the ENT key.**



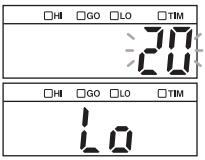
6 **Use the ▶ and ▲ keys to set the HI value and then press the ENT key.**

In this example, "60" is set.



7 **Use the ▶ and ▲ keys to set the LO value and then press the ENT key.**

In this example, "20" is set.
The setting is saved.



8 **Press the SET key.**

The system returns to the measuring status.

Setting the measurement mode according to the target (Measurement mode)

This function is used to ensure more stable detection by specifying the type of measurement target.

Function No.	Target	Description
b-0 nor̄AL	Normal	Select this option during normal operation.
b-1 HALF-t	Translucent object	Use this option for a target that absorbs light such as a translucent plastic.
b-2 trAn-1	Transparent object	Use this option to measure the displacement or thickness of a transparent object. This option is intended for the case where the reflectance values of the multiple surfaces of the transparent object are the same.
b-3 trAn-2	Transparent object 2	Use this option when the reflectance values of the multiple surfaces of the transparent object, such as the front side and back side, are different (four surfaces maximum).
b-4 SEn₁-o	Semi opaque	Use this option for a plastic target with a high gloss surface.

▶NOTE

- When "Transparent object 2" is selected, the sampling cycle is quadrupled at maximum in order to obtain optimum control over the detection of up to four surfaces.
- Using the "Transparent object 2" setting requires the K type sensor head.
- The relationship between the measurement mode of the sensor head, the sampling cycle, and the active OUT count is shown in the table below.

* If multiple measurement modes are set for each head, the measurement modes shown on the upper part of the following charts take priority.
(Priority High: Semi opaque → Transparent object → Transparent object 2 → Normal/Translucent object : Priority Low)

Measurement mode (page 3-8)	Number of OUTs (No calculation between OUTs)											
	1	2	3	4	5	6	7	8	9	10	11	12
Semi opaque	200	200	200	200	200	200	200	200	200	200	200	200
Transparent object	10	10	10	10	10	10	10	10	20	20	20	20
Transparent object 2	5	5	5	5	10	10	10	10	20	20	20	20
Normal/Translucent object	2.55	2.55	5	5	10	10	10	10	20	20	20	20

Sampling cycle [µs]

When ADD, SUB, P-P, MAX, MIN and AVE are used for calculation between OUTs, use the following chart.

Measurement mode	Number of OUTs (Calculation between OUTs)											
	1	2	3	4	5	6	7	8	9	10	11	12
Semi opaque	200	200	200	200	200	200	200	200	200	200	200	200
Transparent object	20	20	50	50	50	50	100	100	100	100	100	100
Transparent object 2	20	20	50	50	50	50	100	100	100	100	100	100
Normal/Translucent object	20	20	50	50	50	50	100	100	100	100	100	100

Sampling cycle [µs]

Setting the measurement mode

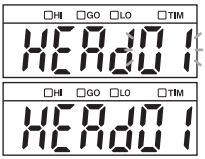
The following procedure changes the setting of head 01 as an example.

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Head settings (HEAd) and then press the ENT key.**



3 **Press the ▲ key to select the target sensor head (HEAD01, HEAd01) and then press the ENT key.**



4 **Press the ▶ key to select function symbol B (Measurement mode, b) and then press the ENT key.**



5 **Press the ▲ key to select B-2 (Transparent object, b-2) and then press the ENT key.**

The setting is saved.



6 **Press the SET key.**

The system returns to the measuring status.

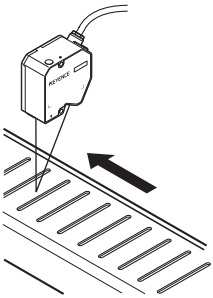
Specifying the action when measurement becomes impossible (Alarm handling)

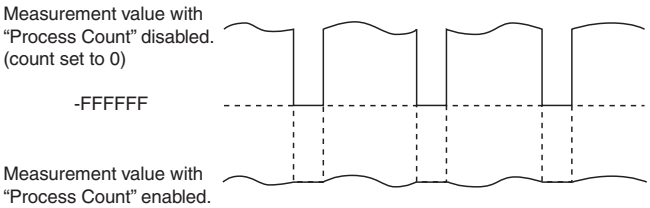
Measurement becomes impossible when the result is out of the measurement range or when the received light intensity is excessive/insufficient. The alarm handling function is used to specify how to process data in these situations.

Setting	Function
Process count CoUnt 1	Specifies the number of sampling times for which the last normal value is held after measurement becomes impossible. • Setting range: 0 to 9999 • If measurement is still impossible after the number of sampling times exceeds this value, the measured value is displayed as "-FFFFFF". • Holding is released when the system recovers to the measuring status within the specified process count. • When the process count is set to "9999", the normal value is continuously held until measurement becomes possible. • If the alarm occurs immediately after the power is turned on and there is no measured value, "-------" is held.
Recovery count CoUnt2	After measurement becomes impossible and an alarm is issued (-FFFFFF is displayed), if the number of valid measured values reaches the specified recovery count, the system recovers from the alarm. • Setting range: 0 to 9999 • If another alarm is issued before the number of valid measured values reaches the specified recovery count, the count is reset.
Level LEvEL	Sets the threshold level of the received light status below which a peak is judged as invalid. • Setting range: 0 to 9 • "0" is the least sensitive to the alarm and "9" is the most sensitive.

Process count and recovery count

■ Process count



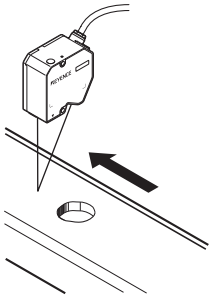


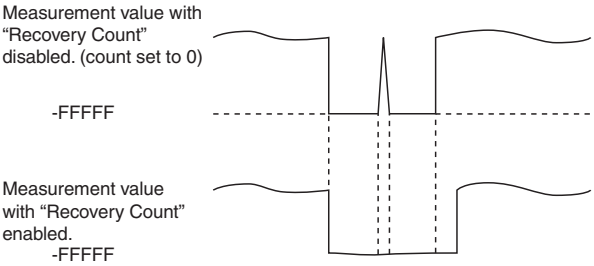
This setting can cancel the status when the measurement becomes impossible temporarily due to holes or other causes.

Reference

This setting does not hold the statuses of the sensor head status indicator on the display panel and the laser emission LED on the sensor head.

■ Recovery count





This setting can cancel irregular values resulting from stray light or other causes.

Setting the alarm handling

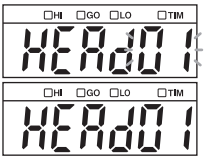
The following procedure changes the setting of head 01 as an example.

1 **Hold down the SET key.**

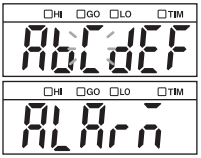
2 **Press the ▲ key to select the Head settings (HEAd) and then press the ENT key.**



3 **Press the ▲ key to select the target sensor head (HEAD01, HEAd01) and then press the ENT key.**



4 **Press the ▶ key to select function symbol C (Alarm handling, C) and then press the ENT key.**



5 **Use the ▶ and ▲ keys to specify the number of sampling times to hold the last normal value (CoUnt1) and then press the ENT key.**

In this example, "500" is set.



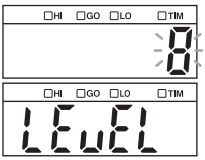
6 **Use the ▶ and ▲ keys to specify the number of sampling times to count the valid values to recover (CoUnt2) and then press the ENT key.**

In this example, "500" is set.



7 **Press the ▲ key to specify the level of light-receiving status to determine that the measurement is impossible (LEvEL) and then press the ENT key.**

In this example, "8" is set.
The setting is saved.



8 **Press the SET key.**

The system returns to the measuring status.

Automatically adjusting the ABLE adjustment range according to the target (ABLE calibration)

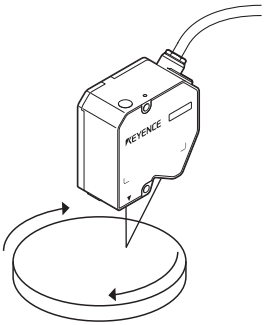
The ABLE calibration function optimizes the adjustment range for ABLE based on the actual measurement of the target. This function is useful when the reflectance of the target changes greatly in a short cycle.

▶NOTE

- The ABLE calibration must be conducted after the completion of the OUT settings and Common settings.
- Note that the ABLE calibration fails in the following cases:
  - The target sensor head for the ABLE calibration is not assigned to any OUT.
  - The target sensor head for the ABLE calibration is set to "AB-ON" but assigned to group "C" in the mutual interference prevention setting.
  - The input to the REMOTE terminal or LASER CTRL1/LASER CTRL2 terminal for the target sensor head for the ABLE calibration is turned off.

Operation flow of the ABLE calibration

1 **Measure an actual target as shown in the figure.**



2 **Start the ABLE calibration (page 3-14).**

The data collection starts.

3 **Move the target slowly.**

4 **Stop the ABLE calibration.**

The data collection finishes and the optimum range for ABLE is set.

Reference

- When the ABLE calibration is performed, the ABLE setting for function symbol A (page 3-6) is set to MANUAL, and the upper and lower limits of control are set to the adjusted values.
- By slowly moving the target, you can optimize the adjustment range for ABLE. Such optimization of the adjustment range improves the response when the reflectance of the target changes greatly in a short cycle.

Performing the ABLE calibration

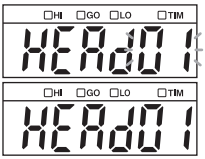
The following procedure changes the setting of head 01 as an example.

1 **Hold down the SET key.**

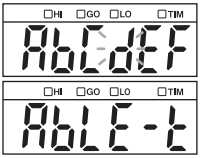
2 **Press the ▲ key to select the Head settings (HEAd) and then press the ENT key.**



3 **Press the ▲ key to select the target sensor head (HEAD01, HEAd01) and then press the ENT key.**



4 **Press the ▶ key to select function symbol D (ABLE calibration, d) and then press the ENT key.**

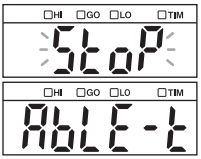


"StArt" is displayed.



5 **Press the ENT key.**

"StoP" is displayed and the measurement starts.
The measurement continues while "StoP" is displayed.



6 **Press the ENT key.**

The setting is saved.

7 **Press the SET key.**

The system returns to the measuring status.

Setting the mounting mode according to the sensor head mounting method (Mounting mode)

The LK-G5000 Series measures the displacement of a target by measuring the laser beam reflected from the surface of the target. When the target surface is flat, such as a mirror or glass plate, the specular reflection component of the reflected light increases. In such a case, use the specular reflection mounting so that the sensor head receives the specular reflection light properly.
The following two types of mounting modes are available.

Function No.	Mounting mode	Function
E-0 diFF-S	Diffuse reflection	Set the diffuse reflection mounting. Select this option during normal operation.
E-1 Mirr-S	Specular reflection	Set the specular reflection mounting. Select this option when the target is a mirror, a glass plate, or other similar object. The displayed value is corrected for the specular reflection mounting.

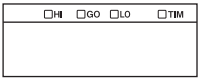
Setting the mounting mode

The following procedure changes the setting of head 01 as an example.

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Head settings (HEAd) and then press the ENT key.**





3 **Press the ▲ key to select the target sensor head (HEAD01, HEAd01) and then press the ENT key.**





4 **Press the ▶ key to select function symbol E (Mounting mode, E) and then press the ENT key.**





5 **Press the ▲ key to select E-0 (Diffuse reflection, E-0) and then press the ENT key.**

The setting is saved.



6 **Press the SET key.**

The system returns to the measuring status.



▶NOTE

The K type sensor head is always set to the specular reflection mode regardless of the mounting mode setting.

Specifying two points in the measurement range to exclude a certain area from the measurement (Mask setting)

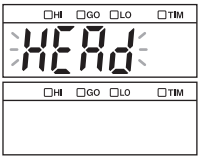
The mask setting function is used to specify two points in the measurement range to mask a certain area. By setting the mask, you can exclude the area within or outside of the area between the points from the measurement.

Setting the mask

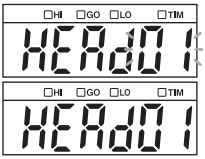
The following procedure changes the setting of head 01 as an example.

1 **Hold down the SET key.**

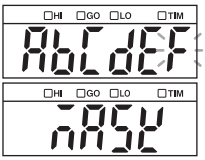
2 **Press the ▲ key to select the Head settings (HEAd) and then press the ENT key.**



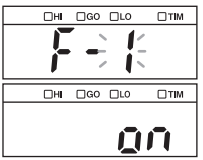
3 **Press the ▲ key to select the target sensor head (HEAD01, HEAd01) and then press the ENT key.**



4 **Press the ▶ key to select function symbol F (Mask setting, F) and then press the ENT key.**



5 **Press the ▲ key to select F-1 (Mask setting: ON, F-1) and then press the ENT key.**



6 **Use the ▶ and ▲ keys to set the mask starting point (P-1) and then press the ENT key.**



Reference

The starting and ending points for the Mask setting can be specified in the unit of 0.01 mm.
Values smaller than 0.01 mm are automatically processed inside the system.

7 **Use the ▶ and ▲ keys to set the mask ending point (P-2) and then press the ENT key.**

The setting is saved.



8 **Press the SET key.**

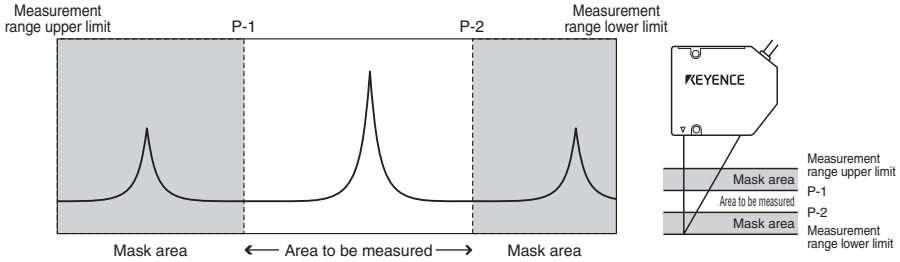
The system returns to the measuring status.

Area masked with the mask setting

The area to be masked depends on the values of the starting point (P-1) and ending point (P-2).

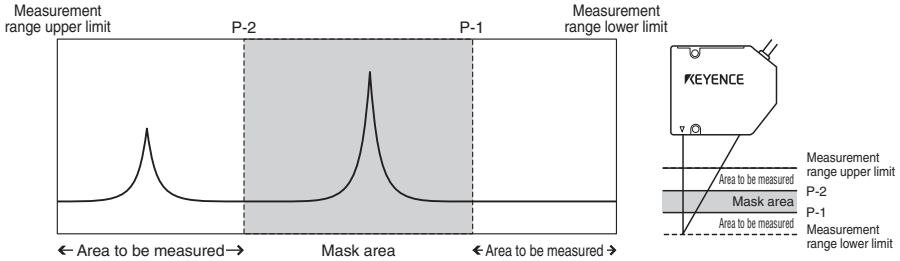
■ When the starting point (P-1) is larger than the ending point (P-2)

The mask is set to the area outside the area between these points.



■ When the starting point (P-1) is smaller than the ending point (P-2)

The mask is set to the area inside the area between these points.



■ When the starting point (P-1) equals the ending point (P-2)

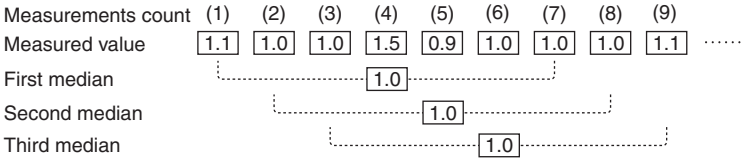
The entire measurement range is measured (no mask is set).

Preventing measurement fluctuations by ignoring sudden changes in the measured value (Median)

This function applies a 7-, 15-, or 31-point median filter to prevent measurement fluctuations by ignoring sudden changes in the measured value. This function is useful when the target moves fast.

■ Example when the 7-point median filter is used

Seven measured values are arranged in the order of magnitude and the value at the center is considered to be the measured value.



In the case of the first median, for example, the measured values (1) to (7) are sorted in the following order.
Consequently, the value at the center, 1.0, is the measured value.

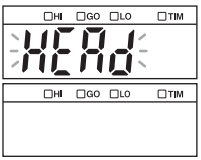
1.5 1.1 1.0 **1.0** 1.0 1.0 0.9

Setting the median

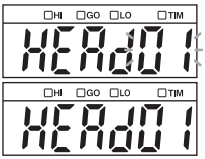
The following procedure changes the setting of head 01 as an example.

1 **Hold down the SET key.**

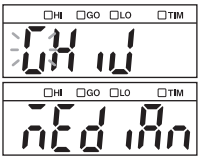
2 **Press the ▲ key to select the Head settings (HEAd) and then press the ENT key.**



3 **Press the ▲ key to select the target sensor head (HEAD01, HEAd01) and then press the ENT key.**

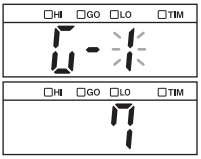


4 **Press the ▶ key to select function symbol G (Median, G) and then press the ENT key.**



5 **Press the ▲ key to select G-1 (Median: 7, G-1) and then press the ENT key.**

The setting is saved.



6 **Press the SET key.**

The system returns to the measuring status.

Grouping the laser control operation (LASER CTRL group)

This function is used to control laser operation such as turning on/off two or more sensor heads by grouping them into two groups. It is useful when sensor heads are used in different production lines.

Function No.	LASER CTRL group	Function
H-0 1	LASER CTRL1	Assign the currently selected sensor head to the LASER CTRL1 group.
H-1 2	LASER CTRL2	Assign the currently selected sensor head to the LASER CTRL2 group.

Setting the LASER CTRL group

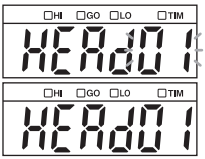
The following procedure changes the setting of head 01 as an example.

1 **Hold down the SET key.**

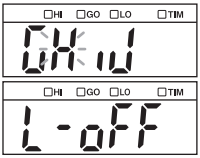
2 **Press the ▲ key to select the Head settings (HEAd) and then press the ENT key.**



3 **Press the ▲ key to select the target sensor head (HEAD01, HEAd01) and then press the ENT key.**

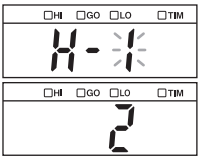


4 **Press the ▶ key to select function symbol H (LASER CTRL group, H) and then press the ENT key.**



5 **Press the ▲ key to select H-1 (LASER CTRL group2, H-1) and then press the ENT key.**

The setting is saved.



6 **Press the SET key.**

The system returns to the measuring status.

Setting the measurement position (Range)

This function is used to set the measurement range to either the reference position or the FAR side when the sampling cycle is between 2.55 µs and 10 µs.

Function No.	Range	Function
I-0 CEntEr	CENTER	Set the measurement range at the reference position.
I-1 FAr	FAR	Set the measurement range at the FAR side.

Setting the range

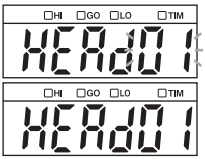
The following procedure changes the setting of head 01 as an example.

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Head settings (HEAd) and then press the ENT key.**



3 **Press the ▲ key to select the target sensor head (HEAD01, HEAd01) and then press the ENT key.**

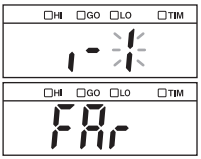


4 **Press the ▶ key to select function symbol I (Range, I) and then press the ENT key.**



5 **Press the ▲ key to select I-1 (FAR, I-1) and then press the ENT key.**

The setting is saved.



6 **Press the SET key.**

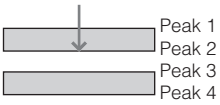
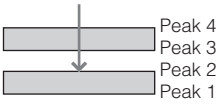
The system returns to the measuring status.

Reference

- For details about the relationship between the sampling cycle and measurement range, refer to page 1-12 (for the 20 mm type sensor head) or page 1-13 (for the 50 mm type sensor head).
- When the sampling cycle is 20 µs to 1 ms, the measurement range in the specification table is used regardless of the CENTER/FAR setting.

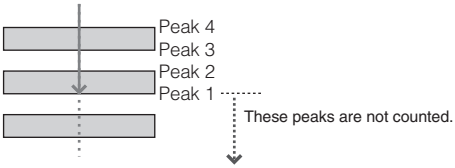
Setting the reference starting point for peak counting (Base point)

This function is used when the measurement mode is set to Transparent object and several peaks are detected within the measurement range. You can specify which peak will be used as a base point, either the one on the side nearest to the sensor head (NEAR) or the one on the side farthest from the sensor head (FAR).

Function No.	Base point	Function
J-0 nEAr	NEAR	Start counting from the peak nearest to the sensor head. Example when the measurement target is the second peak 
J-1 FAr	FAR	Start counting from the peak farthest from the sensor head. Example when the measurement target is the second peak 

▶NOTE

- When the Transparent object 2 mode is selected, the counting starts from the nearest peak regardless of the base point setting.
- Even when the Transparent object mode is selected and the base point is set to FAR, if the number of peaks exceeds four, the fourth peak from the NEAR side is counted as 1.



Setting the base point

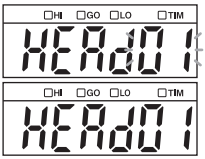
The following procedure changes the setting of head 01 as an example.

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Head settings (HEAd) and then press the ENT key.**



3 **Press the ▲ key to select the target sensor head (HEAD01, HEAd01) and then press the ENT key.**

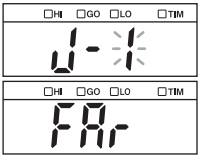


4 **Press the ▶ key to select function symbol J (Base point, J) and then press the ENT key.**



5 **Press the ▲ key to select J-1 (FAR, J-1) and then press the ENT key.**

The setting is saved.



6 **Press the SET key.**

The system returns to the measuring status.

Setting the measurement value output conditions (OUT)

This section describes the settings of the functions related to data processing.

▶NOTE

When you change the active head count or active OUT count in the Environment settings, all the settings of the LK-G5000 Series except for the Environment settings (ENV) are reset. When you connect the LK-HA100 head expansion unit(s) and add a sensor head(s), be sure to specify the active head count and active OUT count before changing the other measurement settings.

List of functions and function Nos.

Function symbol	Function / Function display	Function No. 0	1	2	3	4	5	6	7	Reference page
A	OUT calculation	Sensor head selection	OUT selection	Addition between OUT	Subtraction between OUT	Average of selected OUT	Peak-to-peak of selected OUT	Maximum value of selected OUT	Minimum value of selected OUT	page 3-28
	CALC	HEAd	oUt	Add	SUb	AvE	P-P	MAX	MIn	
b	Scaling									page 3-31
	SCAL									
C	Filter	Averaging	Low-pass filter	High-pass filter						page 3-33
	FiLtEr	AvG	LPF	HPF						
d	Measurement mode	Normal	Peak hold	Bottom hold	P-to-P hold	Sample hold	Average hold			page 3-37
	HoLd	norMAL	P-H	b-H	PP-H	SP-H	AvG-H			
E	Trigger	Trigger 1	Trigger 2							page 3-45
	trIG	t1n	t2n							
F	Offset									page 3-47
	oFFSEt									
G	Minimum display unit	In mm	In mm	In mm	In mm	In µm	In µm	In µm		page 3-48
	dECPt	0.01	0.001	0.0001	0.00001	0.1	0.01	0.001		
H	Analog scaling									page 3-50
	A-SCAL									
I	Measurement type	Displacement	Velocity	Acceleration						page 3-53
	APL	dIS	vEL	ACC						

* The shaded cells ( ) are set by default.

Functions A-0 and C require settings for the following sub-functions.

Sub-function symbol	Function	Function No.					
	Function display	0	1	2	3	4	5
A-Ht	Sensor head for transparent object detection	Surface 1	Surface 2	Surface 3	Surface 4	Surface 1 - 2	Surface 1 - 3
	trAn	1	2	3	4	1-2	1-3
C-0	Moving average	1 time	4 times	16 times	64 times	256 times	1024 times
	AvG	1	4	16	64	256	1024
C-1	Low-pass filter	3000 Hz	1000 Hz	300 Hz	100 Hz	30 Hz	10 Hz
	LPF	3000	1000	300	100	30	10
C-2	High-pass filter	3000 Hz	1000 Hz	300 Hz	100 Hz	30 Hz	10 Hz
	HPF	3000	1000	300	100	30	10

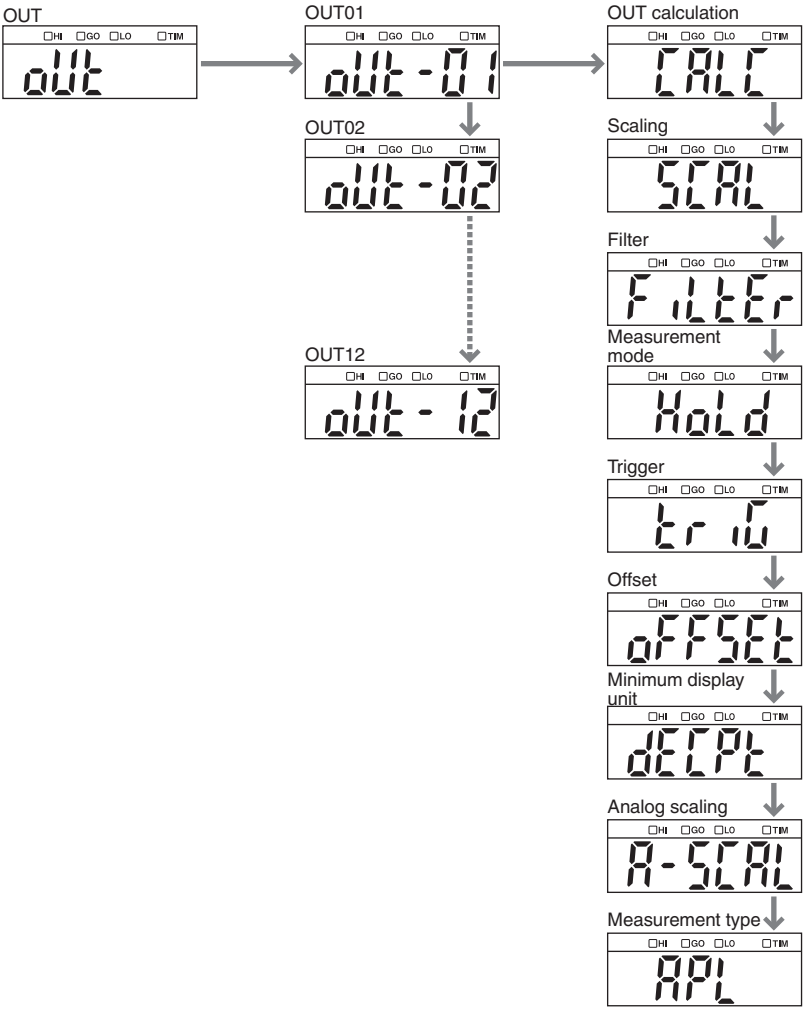
Sub-function symbol	Function	Function No.				Reference page
	Function display	6	7	8	9	
A-Ht	Sensor head for transparent object detection	Surface 1 - 4	Surface 2 - 3	Surface 2 - 4	Surface 3 - 4	page 3-28
	trAn	1-4	2-3	2-4	3-4	
C-0	Moving average	4096 times	16384 times	65536 times	262144 times	page 3-33
	AvG	4096	16384	65536	262144	
C-1	Low-pass filter	3 Hz	1 Hz	0.3 Hz	0.1 Hz	
	LPF	3	1	0.3	0.1	
C-2	High-pass filter	3 Hz	1 Hz	0.3 Hz	0.1 Hz	
	HPF	3	1	0.3	0.1	

* The shaded cells ( ) are set by default.

List of initial values and setting ranges

Function symbol	Item	Setting range	Initial value	Remark
A	Calculation method	HEAD/OUT/ADD/SUB/AVE/P-P/MAX/MIN	HEAD	
A-0	Sensor head	Head 01 to 12	01	
A-XE	Surface to be measured	1, 2, 3, 4, 1-2, 1-3, 1-4, 2-3. 2-4, 3-4	1	
A-1	OUT	OUT01 to 12	02	
A-2	ADD		02/02	
A-3	SUB			
A-4	AVE	ON/OFF of OUT01 to 12	OFF	
A-5	P-P			
A-6	MAX			
A-7	MIN			
b	Input value for the first point	-999999 to +999999	000.000	
	Display value for the first point	-999999 to +999999	000.000	
	Input value for the second point	-999999 to +999999	001.000	
	Display value for the second point	-999999 to +999999	001.000	
C	Number of moving average operations	1/4/16/64/256/1024/4096/16384/65536/262144	256	
	Cutoff frequency	3000/1000/300/100/30/10/3/1/0.3/0.1	100 Hz	Setting range is the same for both LPF and HPF.
d	Measurement mode	Normal/peak hold/bottom hold/peak-to-peak hold/average hold/sample hold	Normal	
E	Trigger	Trigger 1/Trigger 2	Trigger 1	
F	Offset	-999999 to +999999	000.000	
G	Minimum display unit	0.01 mm/0.001 mm/0.0001 mm/0.00001 mm/0.1 µm/0.01 µm/0.001 µm	0.001 mm	
H	Display value for the first point	-999999 to +999999	001.000	
	Output value for the first point	-10.5 V to +10.5 V	01.000	
	Display value for the second point	-999999 to +999999	-001.000	
	Output value for the second point	-10.5 V to +10.5 V	-01.000	
I	Measurement type	Displacement/velocity/acceleration	Displacement	
Tolerance	Upper tolerance limit	-999999 to +999999	005.000	
	Lower tolerance limit	-999999 to +999999	-005.000	
	Hysteresis width	0 to +999999	000.000	

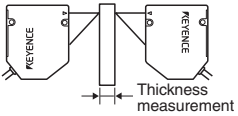
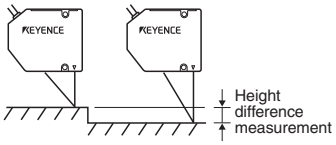
List of the OUT settings screens



Setting the OUT calculation (Calculation method)

This function is used to select the calculation method according to the target, whether to measure surface displacement, thickness, or height difference, based on the data obtained with the Head settings.

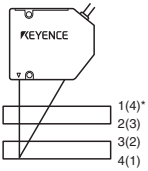
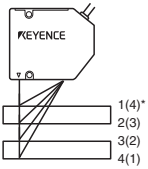
Function Nos. and measurement examples

Function No.	Calculation	Function
A-0	Sensor head	Measures surface displacement using the specified sensor head.
A-1	OUT	Specifies the measured value of the other sensor head to be input.
A-2	Addition	Measures thickness using head 01 and 02.* 
A-3	Subtraction	Measures height difference using head 01 and 02. 
A-4	AVE (Average among OUT)	Calculates the average of several OUT channels.
A-5	P-P (Peak-to-peak value)	Calculates the P-P value of several OUT channels.
A-6	MAX (Maximum value among OUT)	Calculates the maximum value of several OUT channels.
A-7	MIN (Minimum value among OUT)	Calculates the minimum value of several OUT channels.

* The auto-zero function is required.

Sub-functions and the surface to be measured

The following settings are used when the Transparent object or Transparent object 2 mode is selected.

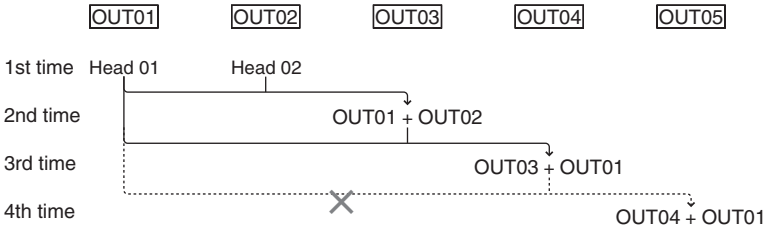
Sub-function symbol	Surface to be measured	Function
A-Ab0	1	Measures displacement of one surface. 
A-Ab1	2	
A-Ab2	3	
A-Ab3	4	
A-Ab4	1-2	Measures and calculates the relationship between two surfaces. When "4" is selected, the thickness of the first glass plate is measured. When "n" is selected, the gap between the first and second glass plates is measured. 
A-Ab5	1-3	
A-Ab6	1-4	
A-Ab7	2-3	
A-Ab8	2-4	
A-Ab9	3-4	

* The values in parentheses indicate the surface to be measured when the Transparent object mode is selected and the base point is set to FAR.

Using the output value of OUT in calculations more than once

The output value of OUT can be used in calculations up to two times as shown below.

Example when the output value of OUT01 is used repeatedly in calculations



- Output data of OUT01: Measured value of head 01
- Output data of OUT02: Measured value of head 02
- Output data of OUT03: Sum of OUT01 and OUT02 (Value calculated using the measured values of head 01 and head 02)
- Output data of OUT04: Sum of OUT03 and OUT01 (Value calculated using the measured values of head 01 and head 02 as well as using the measured value of head 01)

▶NOTE

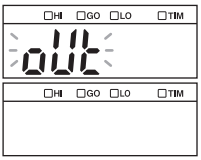
The measured value of one sensor head cannot be used four times or more. (Refer to the case of the 4th time in the figure above.)

Setting the calculation among OUT

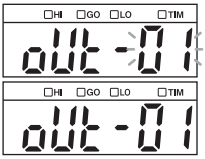
The following procedure changes the setting of OUT01 as an example.

1 **Hold down the SET key.**

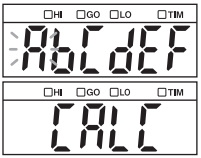
2 **Press the ▲ key to select the OUT settings (oUt) and then press the ENT key.**



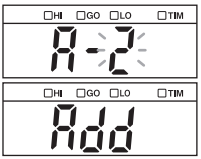
3 **Press the ▲ key to select the target OUT (OUT01, oUt-01) and then press the ENT key.**



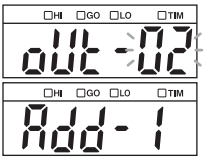
4 **Press the ▶ key to select function symbol A (Calculation among OUT, A) and then press the ENT key.**



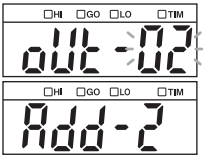
5 **Press the ▲ key to select A-2 (Addition, A-2) and then press the ENT key.**



6 **Press the ▲ key to select the target OUT to assign as Add-1 and then press the ENT key.**



7 **Press the ▲ key to select the target OUT to assign as Add-2 and then press the ENT key.**



8 **Press the SET key.**

The system returns to the measuring status.

▶NOTE

- When the Transparent object 2 mode (page 3-8) is set, select the surface on which the measurement target actually exists.
- The OUT data obtained with the velocity or acceleration measurement cannot be specified as calculation data for the other OUT.

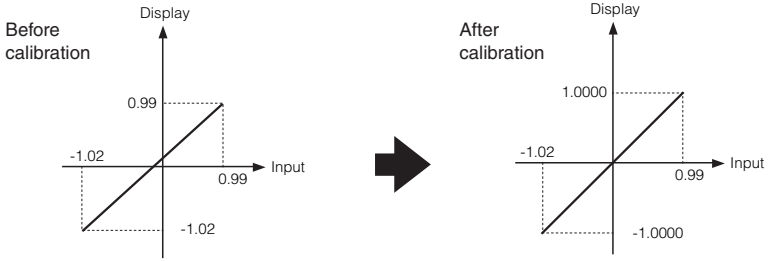
Calibrating the displayed value based on the measured value (Scaling)

This function is used to calibrate the value displayed for each OUT based on the measured value.
You need to select two points and specify values to be displayed for them respectively as a result of the calibration.

Setting the scaling

This section describes the setting procedure for the following calibration as an example.

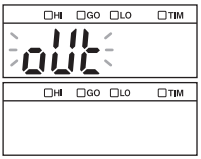
Setting item		Setting value	Display
Point 1	Original input value 1	-1.0200	inPt
	Calibrated displayed value 1	-1.0000	diSP
Point 2	Original input value 2	0.9900	inPt
	Calibrated displayed value 2	1.0000	diSP



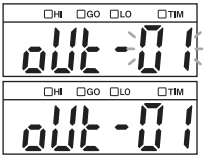
The following procedure changes the setting of OUT01 as an example.

1 **Hold down the SET key.**

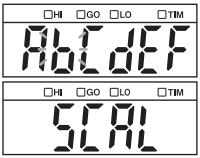
2 **Press the ▲ key to select the OUT settings (oUt) and then press the ENT key.**



3 **Press the ▲ key to select the target OUT (OUT01, oUt-01) and then press the ENT key.**



4 **Press the ▶ key to select function symbol B (Scaling, b) and then press the ENT key.**

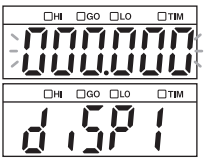


5 **Use the ▶ and ▲ keys to set the input value 1 for point 1 for OUT01 and then press the ENT key.**

The current measured value can be loaded by pressing the ZERO key.

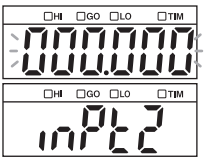


6 **Use the ▶ and ▲ keys to set the displayed value 1 for point 1 for OUT01 and then press the ENT key.**



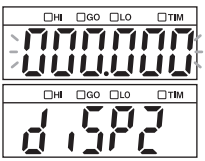
7 **Use the ▶ and ▲ keys to set the input value 2 for point 2 for OUT01 and then press the ENT key.**

The current measured value can be loaded by pressing the ZERO key.



8 **Use the ▶ and ▲ keys to set the displayed value 2 for point 2 for OUT01 and then press the ENT key.**

The setting is saved.



9 **Press the SET key.**

The system returns to the measuring status.

▶NOTE

When the following conditions are not satisfied, "Err-68" is displayed and the setting is disabled. Press the ENT key to cancel the error and then set the scaling again.

(1) Input value 1 - Input value 2 ≠ 0

(2) $\left| \dfrac{\text{Displayed value 2 - Displayed value 1}}{\text{Input value 2 - Input value 1}} \right| \leq 2$

Reference

If the ZERO key is pressed during the value input step, the current measured value is used as an input value. If this key is pressed and held for three seconds, the initial value is input.

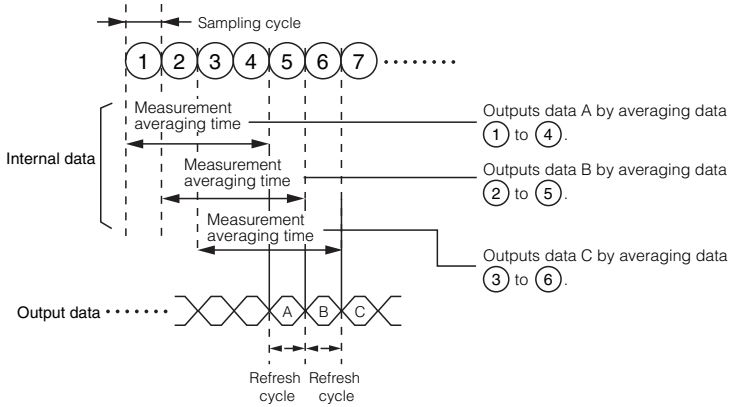
Apply a filter to ensure stable measurement (Filter)

The LK-G5000 Series offers the following three types of filter operations.

Function No.	Filter name	Function
C-0 AvG	Averaging	The moving average of the measured values is calculated. Set the number of averaging measurements.
C-1 LPF	Low-pass filter	Abrupt changes are ignored and only moderate changes are detected. Set the cutoff frequency.
C-2 HPF	High-pass filter	Moderate changes are ignored and only abrupt changes are detected. Set the cutoff frequency.

Setting the averaging filter

The averaging filter calculates the moving average of the measured values within the range of 1 to 262144 times.
The following is an example of the process when the number of averaging measurements is set to four.



Reference

The sampling cycle, measurement averaging time, and refresh cycle vary depending on the settings. Refer to "Response delay time" (page 6-14) for details.

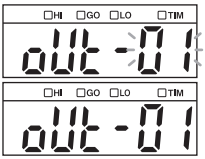
The following procedure sets the averaging filter to OUT01 as an example.

1 **Hold down the SET key.**

2 **Press the ▲ key to select the OUT settings (oUt) and then press the ENT key.**



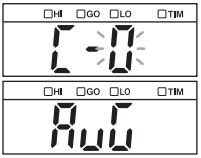
3 **Press the ▲ key to select the target OUT (OUT01, oUt-01) and then press the ENT key.**



4 **Press the ▶ key to select function symbol C (Filter, C) and then press the ENT key.**

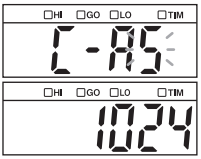


5 **Press the ▲ key to select C-0 (Averaging, C-0) and then press the ENT key.**



6 **Press the ▲ key to set the number of averaging measurements and then press the ENT key.**

In this example, "1024" is set.
The setting is saved.

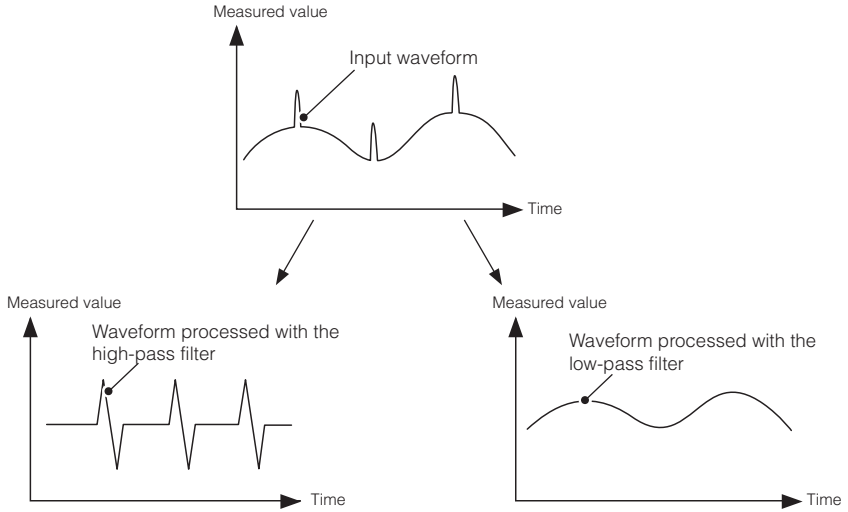


7 **Press the SET key.**

The system returns to the measuring status.

Setting the low-pass filter/high-pass filter

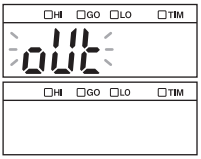
Each of these filters requires a cutoff frequency to be set.
When the filter is set, the data is processed as follows:



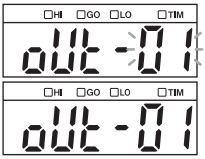
The following procedure sets the low-pass filter to OUT01 as an example.

1 **Hold down the SET key.**

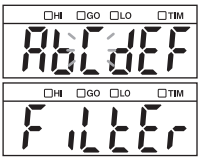
2 **Press the ▲ key to select the OUT settings (oUt) and then press the ENT key.**



3 **Press the ▲ key to select the target OUT (OUT01, oUt-01) and then press the ENT key.**

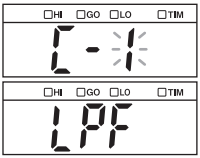


4 **Press the ▶ key to select function symbol C (Filter, C) and then press the ENT key.**



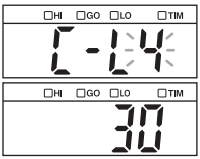
5 **Press the ▲ key to select C-1 (Low-pass filter, C-1) and then press the ENT key.**

To set the high-pass filter, select C-2.



6 **Press the ▲ key to select C-L4 (30 Hz, C-L4) and then press the ENT key.**

The setting is saved.



7 **Press the SET key.**

The system returns to the measuring status.

3

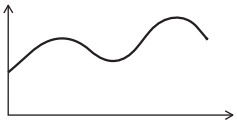
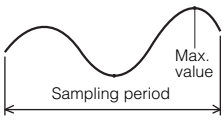
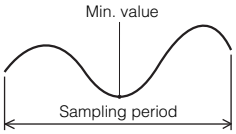
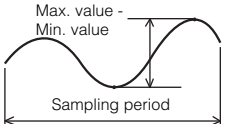
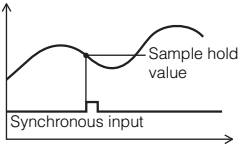
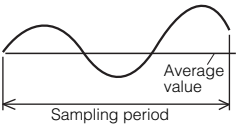
Reference

The cutoff frequency setting is restricted as follows by the sampling cycle (page 3-58) setting.

- When the sampling cycle is set to 1000 µs or 500 µs: Even if the cutoff frequency is set to 3000 Hz, 1000 Hz, or 300 Hz, the setting of 100 Hz is used.
- When the sampling cycle is set to 200 µs: Even if the cutoff frequency is set to 3000 Hz or 1000 Hz, the setting of 300 Hz is used.
- When the sampling cycle is set to 50 µs or 100 µs: Even if the cutoff frequency is set to 3000 Hz, the setting of 1000 Hz is used.
- When the sampling cycle is set to 5.0 µs or 10 µs: Even if the cutoff frequency is set to 0.1 Hz, the setting of 0.3 Hz is used.
- When the sampling cycle is set to 2.55 µs: Even if the cutoff frequency is set to 0.1 Hz or 0.3 Hz, the setting of 1 Hz is used.

Using the Hold function (Measurement mode)

The LK-G5000 Series offers six types of measurement modes.
The following table describes the operations of these measurement modes.

Function No.	Mode name	Description	Reference page
d-0 nornAL	Normal	 The measurement result can be displayed/output constantly.	page 3-39
d-1 P-H	Peak hold	 The maximum value during the specified period can be measured.	page 3-40
d-2 b-H	Bottom hold	 The minimum value during the specified period can be measured.	page 3-40
d-3 PP-H	Peak-to-peak hold	 The "maximum value - minimum value" during the specified period can be measured.	page 3-40
d-4 SP-H	Sample hold	 The value at the specified moment can be measured.	page 3-42, page 3-43
d-5 AvG-H	Average hold	 The average value during the specified period can be measured.	page 3-40

There are two sampling period types which are determined by the trigger condition settings Trigger 1 and Trigger 2 (page 3-45).

Setting the measurement mode

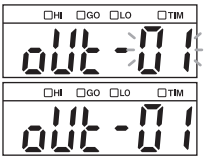
The following procedure sets the peak hold to OUT01 as an example.

1 **Hold down the SET key.**

2 **Press the ▲ key to select the OUT settings (oUt) and then press the ENT key.**



3 **Press the ▲ key to select the target OUT (OUT01, oUt-01) and then press the ENT key.**

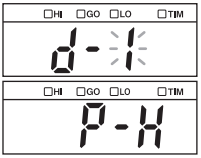


4 **Press the ▶ key to select function symbol D (Hold, d) and then press the ENT key.**



5 **Press the ▲ key to select D-1 (Peak hold, d-1) and then press the ENT key.**

The setting is saved.

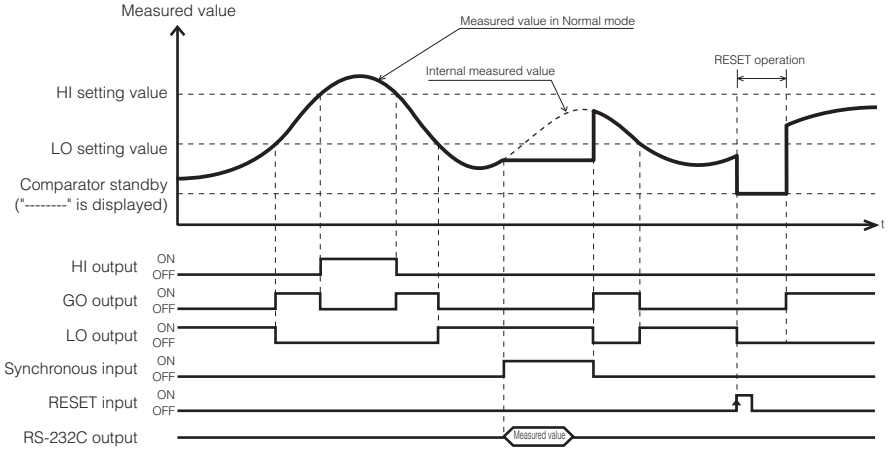


6 **Press the SET key.**

The system returns to the measuring status.

Normal

Measurement is performed continuously and the measured value is displayed/output constantly.



- The ON state of each output indicates that the NPN or PNP open-collector output is turned on.
- The ON state of each input indicates the following: For NPN type, the corresponding terminal and the COM terminal are short-circuited; and for PNP type, the voltage is applied between the corresponding terminal and the COM terminal.
- The RS-232C output is synchronized with the input to the TIMING1 terminal when "Automatic transmission" in the Environment settings is set to ON (page 3-72).
- Refer to "Functions of the I/O Signals" (page 4-8) for details about binary output.
- If an alarm occurs for the internal measured value during the sampling period, the measurement result is displayed differently depending on the alarm handling setting as follows:
  Process count set to 9999: The measurement result is output using the last held value.
  Process count set to 0 to 9998: When the alarm continues for longer than the specified process count during the sampling period, an alarm value (-FFFFFF) is output as the measurement result.

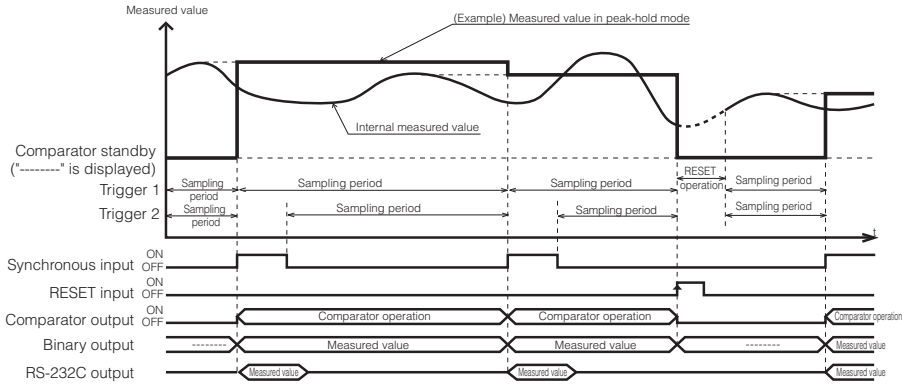
Reference

- If the reset input is turned ON while the synchronous input is on, the comparator standby status (the display shows "- - - - - - ") continues until the synchronous input turns off.
- The synchronous input and reset input can be controlled using the RS-232C (5-9 and page 5-11).
- The operation is the same regardless of the setting of Trigger 1 or Trigger 2.

Peak hold/bottom hold/peak-to-peak hold/average hold

Measurement is performed within the period of time specified with the external synchronous input (sampling period), and the displayed/output value is retained. The sampling period differs between the Trigger 1 and Trigger 2 settings.

Peak hold	Measures the maximum value within the specified period of time (sampling period).
Bottom hold	Measures the minimum value within the specified period of time (sampling period).
Peak-to-peak hold	Measures the "maximum value - minimum value" within the specified period of time (sampling period).
Average hold	Measures the average value within the specified period of time (sampling period).



- When Trigger 1 is selected (page 3-45), the sampling period is the period between the instant when the synchronous input turns on and the instant when the next synchronous input turns on. When the synchronous input turns on, the measured value for the preceding sampling period is output.
  The RESET operation is not performed when the synchronous input is turned on.
- When Trigger 2 is selected (page 3-45), the sampling period is the period when the synchronous input is turned off. When the synchronous input turns on, the measured value for the preceding sampling period is output.
  The RESET operation for the internal measured value is performed when the synchronous input turns off.
- In the following cases, the comparator standby status (the display shows "- - - - - -") continues until the first measured value is determined:
  When the power is turned on, when a setting is changed, when a program number is changed, when RESET is input, or when auto-zero is input.
- The comparator output is provided according to the measured value.
- The ON state of each output indicates that the NPN or PNP open-collector output is turned on.
- The ON state of each input indicates the following: For NPN type, the corresponding terminal and the COM terminal are short-circuited; and for PNP type, the voltage is applied between the corresponding terminal and the COM terminal.
- The RS-232C output is synchronized with the input to the TIMING1 terminal when "Automatic transmission" in the Environment settings is set to ON (page 3-72).

- Refer to "Functions of the I/O Signals" (page 4-8) for details about binary output.
- If the synchronous input turns on during the RESET operation, the comparator standby status (the display shows "------") starts.
- If an alarm occurs for the internal measured value during the sampling period, the measurement result is displayed differently depending on the alarm handling setting as follows:
  Process count set to 9999:The measurement result is output using the last held value.
  Process count set to 0 to 9998:When the alarm continues for longer than the specified process count during the sampling period, an alarm value (-FFFFFF) is output as the measurement result.

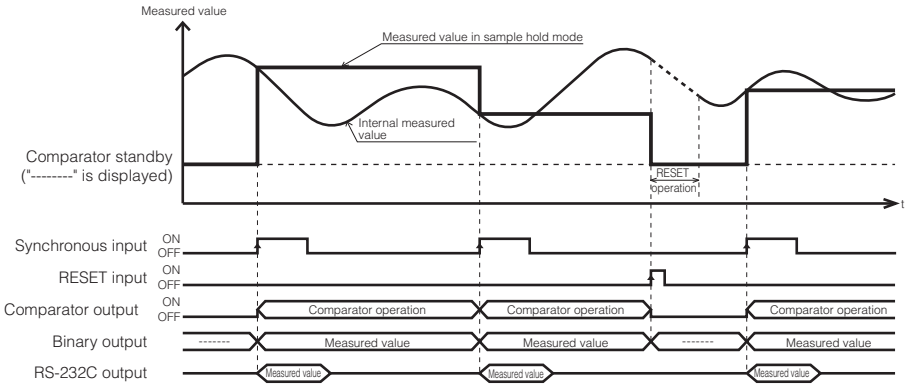
Reference

- The synchronous input and reset input can be controlled using the RS-232C (page 5-9 and page 5-11).
- The strobe output time can also be changed. Refer to "Setting the strobe output time (Strobe time)" (page 3-64) for details.

▶NOTE

When the average hold is selected for the measurement mode, set the filter function to the averaging filter with the number of averaging measurements set to one.

Sample hold (Trigger 1)

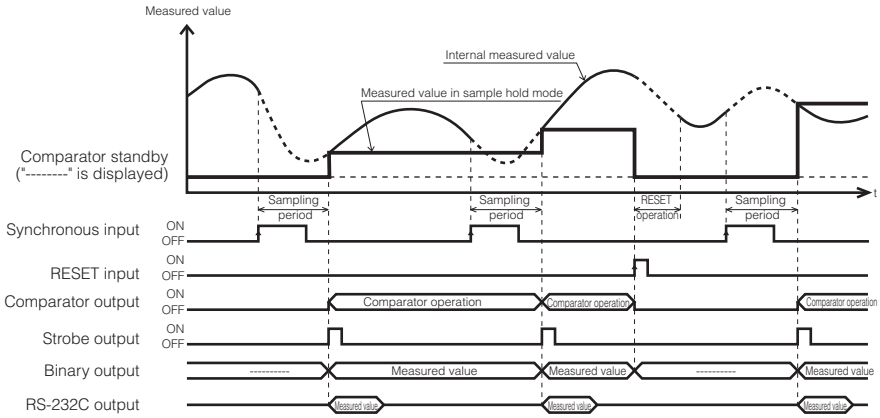


- The internal measured value when the synchronous input turns on is held and output.
- In the following cases, the comparator standby status (the display shows "- - - - - - -") continues until the first measured value is determined:
  When the power is turned on, when the mode is changed, when a program number is changed, when RESET is input, or when auto-zero is input.
- The comparator output is provided according to the measured value.
- The ON state of each output indicates that the NPN or PNP open-collector output is turned on.
- The ON state of each input indicates the following: For NPN type, the corresponding terminal and the COM terminal are short-circuited; and for PNP type, the voltage is applied between the corresponding terminal and the COM terminal.
- The RS-232C output is synchronized with the input to the TIMING1 terminal when "Automatic transmission" in the Environment settings is set to ON (page 3-72).
- If an alarm occurs for the internal measured value during the sampling period, the measurement result is displayed differently depending on the alarm handling setting as follows:
  Process count set to 9999: The measurement result is output using the last held value.
  Process count set to 0 to 9998: When the alarm continues for longer than the specified process count during the sampling period, an alarm value (-FFFFFF) is output as the measurement result.

Reference

- The synchronous input and reset input can be controlled using the RS-232C (5-9 and page 5-11).
- The strobe output time can also be changed. Refer to "Setting the strobe output time (Strobe time)" (page 3-64) for details.

Sample hold (Trigger 2)



- When the synchronous input turns on, the internal measurement value, which is determined by sampling the data from the specified number of averaging measurements obtained since the synchronous input, is held and output.
- In the following cases, the comparator standby status (the display shows "- - - - - -") continues until the first measured value is determined:
  When the power is turned on, when the mode is changed, when a program number is changed, when RESET is input, or when auto-zero is input.
- The comparator output is provided according to the measured value.
- The ON state of each output indicates that the NPN or PNP open-collector output is turned on.
- The ON state of each input indicates the following: For NPN type, the corresponding terminal and the COM terminal are short-circuited; and for PNP type, the voltage is applied between the corresponding terminal and the COM terminal.
- The RS-232C output is synchronized with the input to the TIMING1 terminal when "Automatic transmission" in the Environment settings is set to ON (page 3-72).
- If the synchronous input turns on during the RESET operation, the system stops the RESET operation and starts sampling.
- If an alarm occurs for the internal measured value during the sampling period, the measurement result is displayed differently depending on the alarm handling setting as follows:
  Process count set to 9999: The measurement result is output using the last held value.
  Process count set to 0 to 9998: When the alarm continues for longer than the specified process count during the sampling period, an alarm value (-FFFFFF) is output as the measurement result.
- If the RESET input or ZERO input is turned on during the sampling period, the sampling stops and the comparator standby status starts.

Reference

- The synchronous input and reset input can be controlled using the RS-232C (page 5-9 and page 5-11).
- The strobe output time can be changed. Refer to "Setting the strobe output time (Strobe time)" (page 3-64) for details.

▶NOTE

The filter function should be set to "Averaging" (page 3-33). The number of averaging measurements can be set as desired.

Setting the trigger condition (Trigger)

The Trigger 1 and Trigger 2 settings determine the sampling period during which the measured value is held for the specified measurement mode operation. For the differences in the timing, refer to "Using the Hold function (Measurement mode)" (page 3-37).

Function No.	Trigger	Function		
		Normal	Peak hold/ bottom hold/ peak-to-peak hold/ average hold	Sample hold
E-0 tim	Trigger 1	Holds the internal measured value at the rising edge of the synchronous signal for the period while the signal is turned ON.	Sets the sampling period from the rising edge of the synchronous signal to the next rising edge.	Holds the internal measured value at the rising edge of the synchronous signal.
E-1 tim2	Trigger 2		Sets the sampling period from the falling edge of the synchronous signal to the next rising edge.	When the synchronous input rises (turns on), it holds the internal measurement value which is determined by sampling the data of the specified number of averaging measurements obtained since the synchronous input.

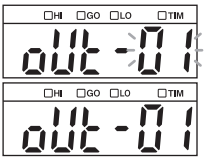
The following procedure sets Trigger 2 to OUT01 as an example.

1 **Hold down the SET key.**

2 **Press the ▲ key to select the OUT settings (out) and then press the ENT key.**



3 **Press the ▲ key to select the target OUT (OUT01, out-01) and then press the ENT key.**

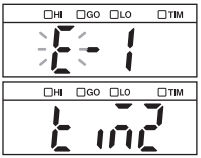


4 **Press the ▶ key to select function symbol E (Trigger, E) and then press the ENT key.**



5 **Press the ▲ key to select E-1 (Trigger 2, E-1) and then press the ENT key.**

The setting is saved.



6 **Press the SET key.**

The system returns to the measuring status.

Using offset in the measurement (Offset)

The offset function is used to add or subtract a desired value to or from the displayed value. By setting the offset value in advance, you can display that value when performing the auto-zero operation.
The offset value is applied to the measured value after it is processed with the specified measurement mode and auto-zero operations. Refer to "List of initial values and setting ranges" (page 3-26) for the setting range and restrictions of the offset function.

Reference

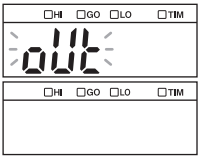
The offset value can also be used for master adjustment by using the auto-zero function (auto-offset function).
Set the size of the master target as the offset value and then use the auto-zero function while measuring the master target. The size of the master target can be set as the master value (reference value).

Setting the offset value

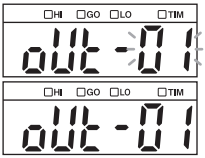
The following procedure sets the offset to OUT01 as an example.

1 **Hold down the SET key.**

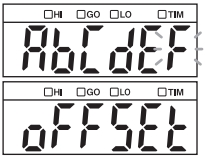
2 **Press the ▲ key to select the OUT settings (oUt) and then press the ENT key.**



3 **Press the ▲ key to select the target OUT (OUT01, oUt-01) and then press the ENT key.**

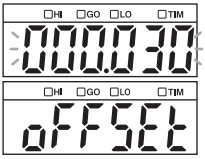


4 **Press the ▶ key to select function symbol F (Offset, F) and then press the ENT key.**



5 **Use the ▶ and ▲ keys to set the offset value and then press the ENT key.**

In this example, "0.03" is set.
The setting is saved.



6 **Press the SET key.**

The system returns to the measuring status.

Setting the unit and minimum display unit (Minimum display unit)

With the LK-G5000 Series, the display unit and minimum display unit can be selected from the six options listed in the tables below.
The factory default setting is "G-1".

■ When "Displacement" is selected for the measurement type (page 3-53)

Function No.	Minimum display unit	Unit	Display range
G-0 0.01	0.01	mm	-9999.99 to +9999.99
G-1 0.001	0.001	mm	-999.999 to +999.999
G-2 0.0001	0.0001	mm	-99.9999 to +99.9999
d-3 0.00001	0.00001	mm	-9.99999 to +9.99999
G-4 0.1	0.1	µm	-99999.9 to +99999.9
G-5 0.01	0.01	µm	-9999.99 to +9999.99
G-6 0.001	0.001	µm	-999.999 to +999.999

■ When "Velocity" is selected for the measurement type (page 3-53)

Function No.	Minimum display unit	Unit	Display range
G-0 0.1	0.1	m/s	-99999.9 to +99999.9
G-1 0.01	0.01	m/s	-9999.99 to +9999.99
G-2 0.001	0.001	m/s	-999.999 to +999.999
d-3 0.1	0.1	mm/s	-99999.9 to +99999.9
G-4 0.01	0.01	mm/s	-9999.99 to +9999.99
G-5 0.001	0.001	mm/s	-999.999 to +999.999
G-6 0.0001	0.0001	mm/s	-99.9999 to +99.9999

■ When "Acceleration" is selected for the measurement type (page 3-53)

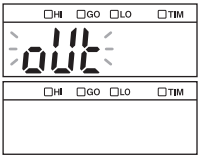
Function No.	Minimum display unit	Unit	Display range
G-0 0.1	0.1	km/s^2	-99999.9 to +99999.9
G-1 0.01	0.01	km/s^2	-9999.99 to +9999.99
G-2 0.001	0.001	km/s^2	-999.999 to +999.999
d-3 0.1	0.1	m/s^2	-99999.9 to +99999.9
G-4 0.01	0.01	m/s^2	-9999.99 to +9999.99
G-5 0.001	0.001	m/s^2	-999.999 to +999.999
G-6 0.0001	0.0001	m/s^2	-99.9999 to +99.9999

Setting the unit and minimum display unit

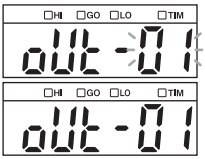
The following procedure sets OUT01 as an example.

1 **Hold down the SET key.**

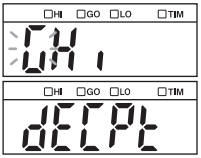
2 **Press the ▲ key to select the OUT settings (oUt) and then press the ENT key.**



3 **Press the ▲ key to select the target OUT (OUT01, oUt-01) and then press the ENT key.**

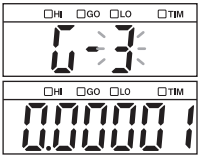


4 **Press the ▶ key to select function symbol G (Minimum display unit, G) and then press the ENT key.**



5 **Press the ▲ key to select G-3 (Unit: mm, Minimum display unit: 0.00001, G-3) and then press the ENT key.**

The setting is saved.



6 **Press the SET key.**

The system returns to the measuring status.

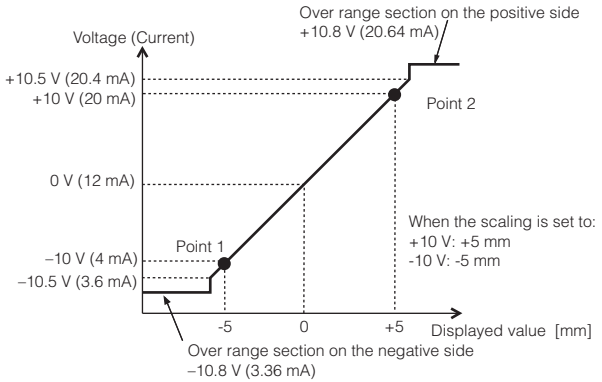
▶NOTE

If the unit and minimum display unit are changed, the settings related to the numerical value display for the same OUT of the same program number (tolerance, scaling, offset, and analog output scaling) as well as the auto-zero setting value are initialized.

Scaling the analog output (Analog scaling)

The analog voltage output can be scaled into a desired output voltage value within the range of ±10.5 V.
To set the scaling, select two displayed values and specify analog output values respectively.
To set the scaling of the analog current output (4 to 20 mA), use a voltage value which is converted from the current value using the following formula:

Voltage value (V) = (Current value [mA] - 12 mA)/0.8



▶NOTE

When the following conditions are not satisfied, "Err-69" is displayed and the setting is disabled. Press the ENT key to cancel the error and then set the scaling again.

(1) Displayed value 1 - Displayed value 2 ≠ 0

(2) $\left| \dfrac{\text{Output voltage value 2 - Output voltage value 1}}{\text{Displayed value 2 - Displayed value 1}} \right| \leq 10$

- Output voltages are calculated in units of mV.
  Example: When the setting value is 5.000 V, the calculation formula uses 5000.
- The calculation method for the displayed value differs depending on the minimum display unit.
  Example: When the input value is 0.500 mm, the following contents are used for calculation.

Minimum display unit	0.01	0.001	0.0001	0.00001
Unit	mm	mm	mm	mm
Value in the calculation formula	50	500	5000	50000

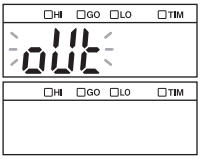
Setting the analog output scaling

The following procedure sets the following analog scaling to OUT01 as an example.

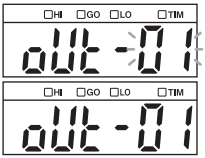
Measurement details		Measured value	Display
Point 1	Displayed value 1	-5.000	1-d.SP
	Analog output voltage value 1	-10.000	1-oUt
Point 2	Displayed value 2	5.000	2-d.SP
	Analog output voltage value 2	10.000	2-oUt

1 **Hold down the SET key.**

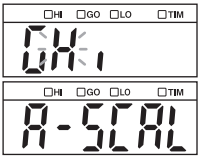
2 **Press the ▲ key to select the OUT settings (oUt) and then press the ENT key.**



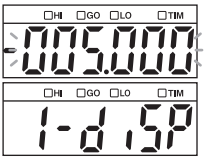
3 **Press the ▲ key to select the target OUT (OUT01, oUt-01) and then press the ENT key.**



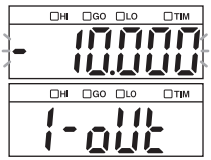
4 **Press the ▶ key to select function symbol H (Analog scaling, H) and then press the ENT key.**



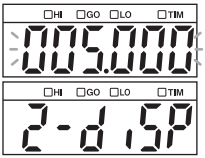
5 **Use the ▶ and ▲ keys to set the displayed value 1 for point 1 and then press the ENT key.**



6 **Use the ▶ and ▲ keys to set the analog output voltage value 1 for point 1 and then press the ENT key.**

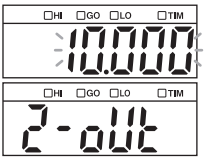


7 **Use the ▶ and ▲ keys to set the displayed value 2 for point 2 and then press the ENT key.**



8 **Use the ▶ and ▲ keys to set the analog output voltage value 2 for point 2 and then press the ENT key.**

The setting is saved.



9 **Press the SET key.**

The system returns to the measuring status.

3

Setting the type of measurement (Measurement type)

This function is used to set the measurement type according to the required measurement.

Function No.	Measurement type	Measurement
i-0 diS	Displacement	Measures displacement.
i-1 vEL	Velocity	Calculates the velocity based on the displacement in the sampling cycle.
i-2 ACC	Acceleration	Calculates the acceleration based on the displacement in the sampling cycle.

▶NOTE

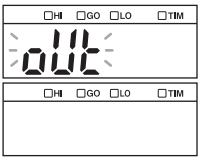
- The velocity and acceleration which can be calculated vary depending on the sampling cycle. Refer to "Relationship Between the Sampling Cycle and Velocity/Acceleration Measurement Range" (page A-11) for details.
- The OUT data obtained with the velocity or acceleration measurement cannot be specified as calculation data for another OUT.
- The number of OUT which can be set to the velocity/acceleration measurement varies depending on the sampling cycle as follows: 2.55 µs: 1, 5 µs: 2, 10 µs: 4, and 20 µs or longer: 12. (When the number of OUT exceeds the limitation, an alarm value is output for the exceeding OUT.)
- When the sensor head measurement mode used for the measurement is Transparent object or Transparent object 2, the velocity/acceleration is always calculated for the first peak.

Setting the measurement type

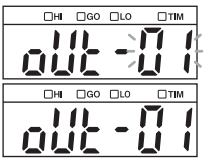
The following procedure sets OUT01 as an example.

1 **Hold down the SET key.**

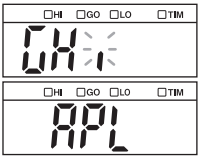
2 **Press the ▲ key to select the OUT settings (oUt) and then press the ENT key.**



3 **Press the ▲ key to select the target OUT (OUT01, oUt-01) and then press the ENT key.**

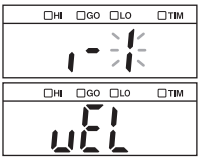


4 **Press the ▶ key to select function symbol I (Measurement type,) and then press the ENT key.**



5 **Press the ▲ key to select I-1 (Displacement,) and then press the ENT key.**

The setting is saved.



6 **Press the SET key.**

The system returns to the measuring status.

Setting the Common Function (OPTION)

This section describes the functions common to all program numbers.

List of functions and function Nos.

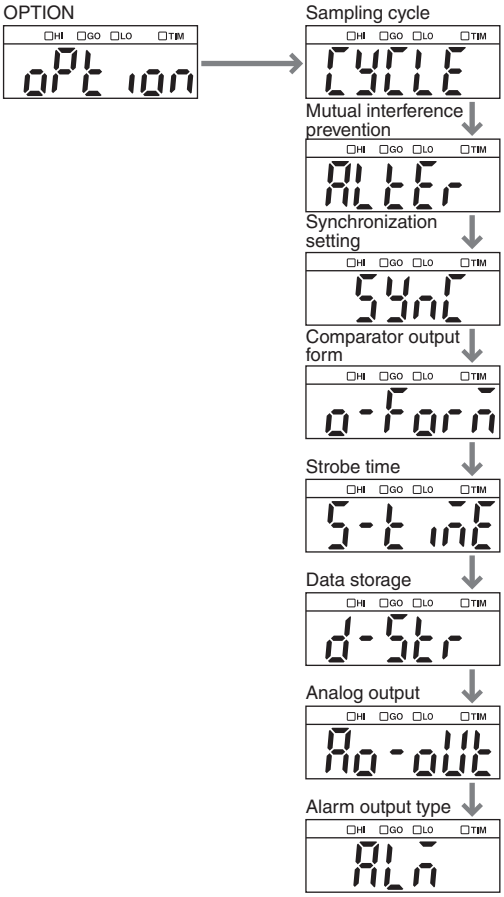
Function symbol	Function / Function display	Function No. 0	1	2	3	4	5	6	7	8	Reference page
A	Sampling cycle	2.55 µs	5 µs	10 µs	20 µs	50 µs	100 µs	200 µs	500 µs	1000 µs	page 3-58
	CYCLE	255	5	10	20	50	100	200	500	1000	
b	Mutual interference prevention	OFF	2 groups	3 groups							page 3-60
	ALtEr	oFF	Ab-on	AbC-on							
C	Synchronization setting	SYNC01 to 12 Set to ON/OFF									page 3-62
	SynC										
d	Comparator output form	Normal	Hold	Off-delay							page 3-63
	o-Forn	nornAL	HoLd	dELAY							
E	Strobe time	2 ms	5 ms	10 ms	20 ms						page 3-64
	S-t inE	2	5	10	20						
F	Data storage										page 3-65
	d-Str										
G	Analog output	CH01 to CH12									page 3-67
	Ao-oUt										
H	Alarm output type	System alarm	Measured value alarm	Both							page 3-68
	ALn	SYSALn	oUtALn	ALL							

- The shaded cells ( ) are set by default.
- Function "F" requires the sub-function settings of the number of data and storage cycle (page 3-65).

List of initial values and setting ranges

Function symbol	Item	Setting range	Initial value	Remark
A	Sampling cycle	2.55/5/10/20/50/100/200/500/1000 µs	200 µs	
b	Mutual interference prevention	OFF/AB-ON/ABC-ON	OFF	
C	Synchronization setting	ON/OFF for OUT01 to 12	All OFF	
d	Comparator output form	Normal/Hold/Off-delay	Normal	
E	Strobe time	2/5/10/20 ms	2 ms	
F	Number of data	1 to 1200000 (depends on the number of OUT for which data is stored)	100000	
	Storage cycle	1/2/5/10/20/50/100/200/500/1000/TIM	1	
G	Analog output	CH01 to 12	CH01 = OUT01, CH02 = OUT02	
H	Alarm output type	System alarm/measured value alarm/ both	System alarm	

List of the common function settings screens



Setting the sampling cycle for the measurement (Sampling cycle)

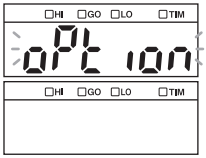
This function is used to set the sampling cycle for the measurement. Use the initial value during normal operation. If you want the sampling to be performed more quickly, change it to shorter values. If the received light intensity is extremely low, change it to longer values.

Function No.	Function (sampling cycle)
A-0 255	2.55 µs
A-1 5	5 µs
A-2 10	10 µs
A-3 20	20 µs
A-4 50	50 µs
A-5 100	100 µs
A-6 200	200 µs
A-7 500	500 µs
A-8 1000	1000 µs

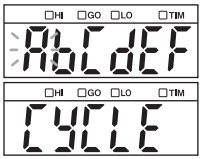
The following procedure sets the sampling cycle to 500 µs as an example.

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Common settings (oPt ion) and then press the ENT key.**

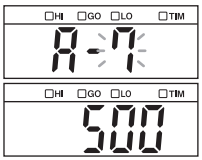


3 **Press the ▶ key to select function symbol A (Sampling cycle, A) and then press the ENT key.**



4 **Press the ▲ key to select A-7 (500 µs, A-7) and then press the ENT key.**

The setting is saved.



5 **Press the SET key.**

The system returns to the measuring status.

▶NOTE

- The relationship between the measurement mode of the sensor head, the sampling cycle, and the active OUT count is shown in the table below.

* If multiple measurement modes are set for each head, the measurement modes shown on the upper part of the following charts take priority.
(Priority High: Semi opaque → Transparent object → Transparent object 2 → Normal/Translucent object : Priority Low)

Measurement mode (page 3-8)	Number of OUTs (No calculation between OUTs)											
	1	2	3	4	5	6	7	8	9	10	11	12
Semi opaque	200	200	200	200	200	200	200	200	200	200	200	200
Transparent object	10	10	10	10	10	10	10	10	20	20	20	20
Transparent object 2	5	5	5	5	10	10	10	10	20	20	20	20
Normal/Translucent object	2.55	2.55	5	5	10	10	10	10	20	20	20	20

Sampling cycle [µs]

When ADD, SUB, P-P, MAX, MIN and AVE are used for calculation between OUTs, use the following chart.

Measurement mode	Number of OUTs (Calculation between OUTs)											
	1	2	3	4	5	6	7	8	9	10	11	12
Semi opaque	200	200	200	200	200	200	200	200	200	200	200	200
Transparent object	20	20	50	50	50	50	100	100	100	100	100	100
Transparent object 2	20	20	50	50	50	50	100	100	100	100	100	100
Normal/Translucent object	20	20	50	50	50	50	100	100	100	100	100	100

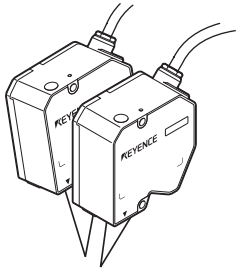
Sampling cycle [µs]

- The number of OUT which can be set to the velocity/acceleration measurement varies depending on the sampling cycle as follows: 2.55 µs: 1, 5 µs: 2, 10 µs: 4, and 20 µs or longer: 12. (When the number of OUT exceeds the limitation, an alarm value is output for the exceeding OUT.)

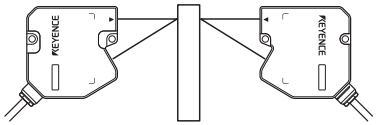
Setting the mutual interference prevention function (Mutual interference prevention)

When more than one sensor head are connected and mounted in close proximity, they may receive the light emitted from the other sensor head, resulting in a measurement error. The mutual interference prevention function assigns the sensor heads to three groups at maximum, A to C, to allow these groups to emit light alternately. This prevents interference with the sensor heads in the other group.

When the measurement points are close



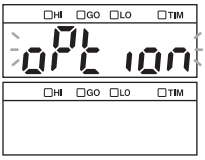
When the thickness of a transparent object is measured



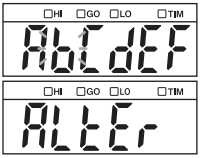
The following procedure enables the mutual interference prevention function for groups A and B as an example.

1 **Hold down the SET key.**

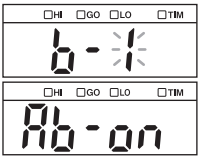
2 **Press the ▲ key to select the Common settings (oPt ion) and then press the ENT key.**



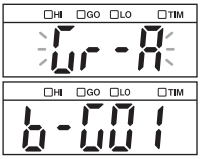
3 **Press the ▶ key to select function symbol B (Mutual interference prevention, b) and then press the ENT key.**



4 **Press the ▲ key to select B-1 (AB-ON, b-1) and then press the ENT key.**



5 **Press the ▲ key to select the group to which head 01 is assigned and then press the ENT key.**



The setting is saved.
Repeat this step for all sensor heads specified with the active head count (page 3-79).

6 **Press the SET key.**

The system returns to the measuring status.

▶NOTE

The sampling cycle is double the specified value when the mutual interference prevention function is set to AB-ON; and is tripled when the function is set to ABC-ON.

Setting the external synchronous input (Synchronization setting)

This function is used to set whether to use synchronous input control for each OUT. The following two operations can be selected.

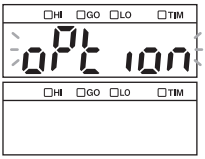
Function No.	Synchronization	Function
SYnC □ oFF	Asynchronous	Disables synchronization control using TIMING1, ZERO1, and RESET1, as well as automatic transmission through RS-232C.
SYnC □ on	Synchronous	Enables synchronization control using TIMING1, ZERO1, and RESET1, automatic transmission through RS-232C, and synchronization of storage operation.

* □ represents OUT No. (01 to 12)

Setting the synchronization

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Common settings (oPt ion) and then press the ENT key.**

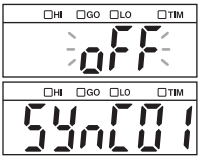


3 **Press the ▶ key to select function symbol C (Synchronization, C) and then press the ENT key.**



4 **Press the ▲ key to select Asynchronous (oFF) or Synchronous (on) and then press the ENT key.**

The setting is saved.
Repeat this step for all OUT specified with the active OUT count (page 3-78).



5 **Press the SET key.**

The system returns to the measuring status.

Reference

Also refer to "I/O terminals" (page 4-1).

Setting the output form of the tolerance comparator result (Comparator output form)

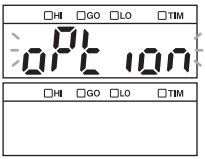
This function is used to set the output form of the tolerance comparator result. The following three types are available.

Function No.	Output form	Function
d-0 nor̃AL	Normal	Produces outputs according to the tolerance comparator result.
d-1 HoLd	Hold	Holds the output that is turned on. The hold is released when the measured value is reset.
d-2 dELAY	Off-delay	Applies off-delay of 60 ms to the normal output. The hold is released when the measured value is reset.

Setting the output form of the tolerance comparator result

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Common settings (oPt ion) and then press the ENT key.**

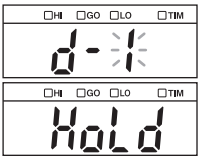


3 **Press the ▶ key to select function symbol D (Comparator output form, d) and then press the ENT key.**



4 **Press the ▲ key to select D-1 (Hold, d-1) and then press the ENT key.**

The setting is saved.



5 **Press the SET key.**

The system returns to the measuring status.

Setting the strobe output time (Strobe time)

This function is used to set the period of time for the strobe output to turn ON (one-shot output time).
The pulse width can be selected from the following four types.

Function No.	Function (Strobe output time)
E-0 2	2 ms
E-1 5	5 ms
E-2 10	10 ms
E-3 20	20 ms

Reference

- Refer to "Timing diagrams" (page 4-16) for details about the timing diagram.
- Refer to "Binary output" (page 4-20) for details about binary output timing.

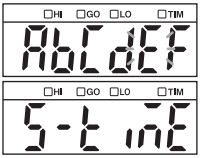
Setting the pulse width of the strobe signal

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Common settings (oPt ion) and then press the ENT key.**

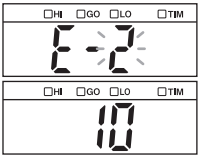


3 **Press the ▶ key to select function symbol E (Strobe time, E) and then press the ENT key.**



4 **Press the ▲ key to select E-2 (Pulse width: 10 ms, E-2) and then press the ENT key.**

The setting is saved.



5 **Press the SET key.**

The system returns to the measuring status.

▶NOTE

This setting is ignored when the measurement mode (page 3-37) is "Normal".

Storing the measured values in the memory (Data storage function)

The LK-G5000 Series can store up to 1,200,000 measured values (1,200,000 is a total and the available number for each Out Channel depends on the number of Out Channels to store data) in the internal memory using the external synchronous input or in every storage cycle. The stored data can be read and checked by using the RS-232C interface or the LK-Navigator 2 software.

The settings of the function numbers and sub-functions are as follows.

Sub-function symbol	Storage cycle selection
F-F00 1	x 1 (of the sampling cycle)
F-F01 2	x 2
F-F02 5	x 5
F-F03 10	x 10
F-F04 20	x 20
F-F05 50	x 50

Sub-function symbol	Storage cycle selection
F-F06 100	x 100
F-F07 200	x 200
F-F08 500	x 500
F-F09 1000	x 1000
F-F10 Ext	Synchronization input

Reference

- The data to be stored is the measured value of the Out Channel after it is processed with the specified measurement mode and other operations (page 3-2).
- The "storage cycle" is specified as the multiple of the sampling cycle. When the storage cycle is set to "Synchronization input", the data is stored in synchronization with the TIMING1 input, the LK-Navigator 2 operation, or the simultaneous timing button of the LK-HD1001.
- The storing operation stops when the number of stored data exceeds the specified number.
- The storage time can be calculated as "Sampling cycle x Storage cycle x Number of data".
- Even when the refresh cycle, which is determined with the number of averaging measurements, is longer than the sampling cycle, the data is stored based on the sampling cycle. In this case, the same measured value is stored until the measured value is updated.
- Even if "auto-zero" or "RESET" is input during data storage operation, the storage continues without clearing the stored data.
- When this function is started and stopped repeatedly, the new data is stored after the old data.
- From the display panel (HD500), the number of stored data can be set to only 999,999 at maximum.

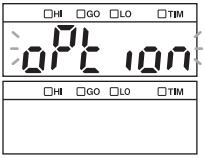
Starting/stopping data storage and clearing data

Conditions to start storing data	• Start command from the RS-232C interface • Operation from the LK-Navigator 2 setup support software
Conditions to stop storing data	• Stop command from the RS-232C interface • Operation from the LK-Navigator 2 setup support software
Conditions to clear the stored data	Any of the following cases while the storing operation is stopped: • When the data for the specified number of measured values are stored • When the setting mode or communication mode is changed to the measuring mode • When the initialization command is sent through the RS-232C interface • When the initialization is ordered from the LK-Navigator 2 setup support software • When the power is turned off • When the program number is changed

Setting the data storage method

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Common settings (oPt ion) and then press the ENT key.**



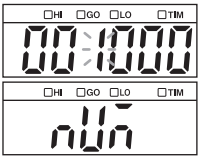
3

3 **Press the ▶ key to select function symbol F (Data storage, F) and then press the ENT key.**



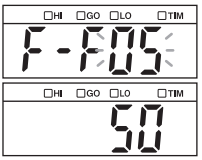
4 **Use the ▶ and ▲ keys to set the number of data to be stored and then press the ENT key.**

In this example, "1000" is set.



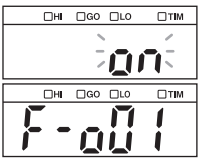
5 **Press the ▲ key to select the storage cycle and then press the ENT key.**

In this example, "50x" is set.



6 **Press the ▲ key to select whether to include the currently displayed OUT value in the stored data (on) or not (oFF) and then press the ENT key.**

The setting is saved.
Repeat this step for all OUT specified with the active OUT count (page 3-78).



7 **Press the SET key.**

The system returns to the measuring status.

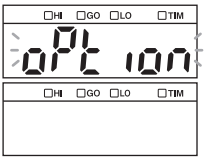
Assigning OUT to the analog output channel (Analog output)

Assigning "OUT" as Analog Output Channel. The number of analog outputs which can be used are two for the controller unit and one for each head expansion unit.

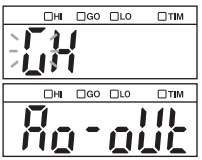
Setting the analog output

1 **Hold down the SET key.**

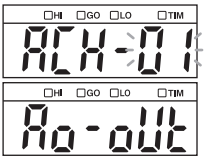
2 **Press the ▲ key to select the Common settings (oPt ion) and then press the ENT key.**



3 **Press the ▶ key to select function symbol G (Analog output, G) and then press the ENT key.**

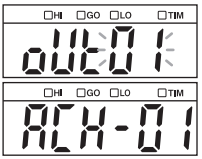


4 **Press the ▲ key to select the analog output channel to which OUT is assigned and then press the ENT key.**



5 **Press the ▲ to select OUT to be assigned to the analog output channel selected in step 4 and then press the ENT key.**

The setting is saved.
Repeat steps 4 to 5 for all OUT specified with the active OUT count (page 3-78).



6 **Press the SET key.**

The system returns to the measuring status.

Setting the type of alarm output (Alarm output type)

This function is used to select the type of alarm to be output from a system alarm, a measured value alarm, or both.

Function No.	Alarm output type	Function
H-0 SYSALn	System alarm	Outputs an alarm when a system alarm occurred. Once the alarm is output, the ON state is retained until the power is turned off.
H-1 oUtALn	Measured value alarm	Outputs an alarm when the received light intensity is insufficient or excessive.
H-2 ALL	Both	Outputs both system alarm and measured value alarm.

▶NOTE

The output uses an N.C. (normally closed) contact. The contact is short-circuited when it is OFF and is open when it is ON.

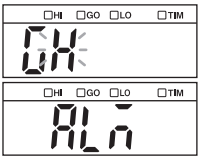
Setting the alarm output type

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Common settings (oPt ion) and then press the ENT key.**



3 **Press the ▶ key to select function symbol H (Alarm output type, H) and then press the ENT key.**



4 **Press the ▲ key to select H-1 (Measured value alarm, H-1) and then press the ENT key.**

The setting is saved.



5 **Press the SET key.**

The system returns to the measuring status.

Setting the Operating Environment settings (ENV)

This section describes how to set the device operations.

List of functions and function Nos.

The following five settings are available for the Environment settings. The functions and setting values are shown below.

Function symbol	Function	Function No.					Reference page
	Function display	0	1	2	3	4	
A	RS-232C	Baud rate					page 3-72
	rS232	9600	19200	38400	57600	115200	
		Parity					
		EuEn	odd	non			
		Automatic transmission					
		oFF	on				
b	Setting selection	Panel	Terminal input				page 3-73
	CHAnGE	PAnEL	Ext				
C	Program	Copy	Initialization				page 3-74
	PrG	CoPy	ErASE				
d	Panel lock	OFF	ON				page 3-76
	LoCK	oFF	on				
E	Active OUT count	2 (E-00) to 12 (E-10)					page 3-78
	o-Cnt						
F	Active head count	2 (F-00) to 12 (F-10)					page 3-79
	H-Cnt						
G	Active analog output channel count	2 (G-00) to 12 (G-10)					page 3-80
	Ao-Cnt						
H	LAN setting	The initial values are as follows: IP address: 192.168.10.10 Subnet mask: 255.255.255.0 Default gateway: 0.0.0.0					page 3-81
	LAn						

* The shaded cells ( ) are set by default.

List of initial values and setting ranges

The function settings at the time of shipment (initial values) and the available setting ranges are as follows.

Function symbol	Item	Setting range	Initial value	Remark
A	Baud rate	9600/19200/38400/57600/115200 bps	9600 bps	
	Parity	NON/EVEN/ODD	NON	
	Automatic transmission	OFF/ON	OFF	
b	Setting selection	Panel operation/external terminal	Panel operation	
C	Program	Copy/initialization		
d	Panel lock	ON/OFF	OFF	
E	Active OUT count	2 to 12	2	
F	Active head count	2 to 12	2	
G	Active analog output channel count	2 to 12	2	
H	LAN setting	Address setting range: 000.000.000.000 to 255.255.255.255 The initial values are as follows: • IP address:192.168.10.10 • Subnet mask:255.255.255.0 • Default gateway:0.0.0.0		

List of the Environment settings screens



Setting the RS-232C communication parameters (RS-232C)

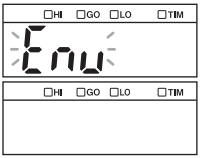
This function is used to set the communication parameters and output operations of the RS-232C interface.
Refer to "RS-232C" (page 5-1) for details of the RS-232C communication of the LK-G5000 Series.

Function No.	Setting item	Selection item	Remark
A-60 to A-64	Set the data communication speed.	9600/19200/38400/57600/ 115200	Unit: bps
A-P0 to A-P2	Set the type of parity.	None (NON)/Even (EVEN)/Odd (ODD)	
A-50 to A-51	Set the automatic transmission.	OFF/ON	

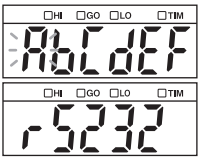
Changing the RS-232C communication settings

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Environment settings (Env) and then press the ENT key.**



3 **Press the ▶ key to select function symbol A (RS-232C, A) and then press the ENT key.**



4 **Press the ▲ key to select A-B2 (Baud rate: 38400 bps, A-62) and then press the ENT key.**

The setting is saved.



5 **Set the parity type and automatic transmission using the same procedure.**

6 **Press the SET key.**

The system returns to the measuring status.

Setting the program switching method (Setting selection)

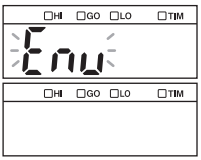
This function is used to select whether to switch program numbers from the display panel or from an external terminal input.

Function No.	Setting selection	Function
b-0 PAnEL	Panel	Panel operation/LK-Navigator 2/RS-232C/ Expansion unit (CC-Link or DeviceNet)
b-1 Ext	Terminal input	External terminal input

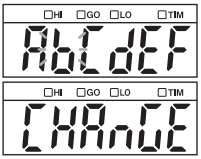
Setting the program switching method

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Environment settings (Env) and then press the ENT key.**

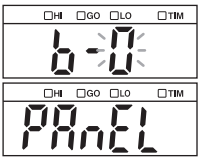


3 **Press the ▶ key to select function symbol B (Setting selection, b) and then press the ENT key.**



4 **Press the ▲ key to select B-0 (Panel, b-0) and then press the ENT key.**

The setting is saved.



5 **Press the SET key.**

The system returns to the measuring status.

▶NOTE

To switch program numbers by using the command for the RS-232C interface, CC-Link, or DeviceNet, set this setting to "Panel operation".

Copying/initializing the program (Program)

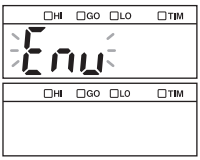
This function is used to copy or initialize a program.

Function No.	Operation	Function
C-0 CoPY	Copy	Copy a program by specifying the source program number and destination program number.
C-1 ErASE	Initialization	Initialize a program by specifying the program number of the program.

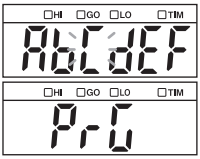
Copying a program

1 **Hold down the SET key.**

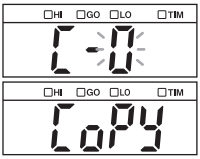
2 **Press the ▲ key to select the Environment settings (Env) and then press the ENT key.**



3 **Press the ▶ key to select function symbol C (Program, C) and then press the ENT key.**

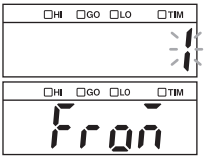


4 **Press the ▲ key to select C-0 (Copy, C-0) and then press the ENT key.**



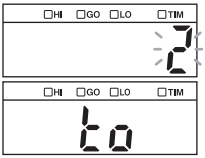
5 **Press the ▲ key to select the source program number and then press the ENT key.**

In this example, Program No. 1 is specified as the source program.



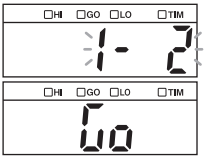
6 **Press the ▲ key to select the destination program number and then press the ENT key.**

In this example, Program No. 2 is specified as the destination program.



7 **Confirm the source and destination program numbers and then press the ENT key.**

The program is copied.
To cancel copying, press the SET key instead.



8 **Press the SET key.**

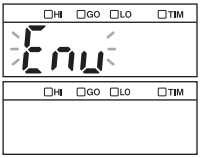
The system returns to the measuring status.

Initializing a program

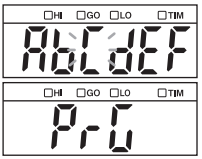
1 **Select the program number to be initialized.**

2 **Hold down the SET key.**

3 **Press the ▲ key to select the Environment settings (Env) and then press the ENT key.**



4 **Press the ▶ key to select function symbol C (Program, C) and then press the ENT key.**



5 **Press the ▶ key to select C-1 (Initialization, C-1) and then press the ENT key.**

In this example, Program No. 3 is specified as the program to be initialized.



6 **Confirm the program number and then press the ENT key.**

The program is initialized.
To cancel the initialization, press the SET key instead.



7 **Press the SET key.**

The system returns to the measuring status.

Preventing erroneous panel operation (Panel lock)

This function is used to prohibit operations from the display panel. Erroneous operations can be prevented even if an operation key is accidentally touched.

Function No.	Panel lock	Function
d-0 oFF	OFF	Enables key operations from the display panel.
d-1 on	ON	Disables key operations from the display panel.

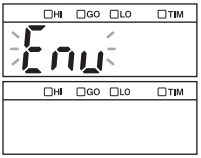
▶NOTE

When the panel is locked, all operations other than canceling the panel lock function are disabled.

Setting the panel lock

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Environment settings (Env) and then press the ENT key.**

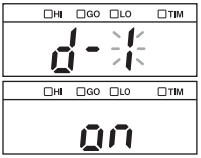


3 **Press the ▶ key to select function symbol D (Panel lock, d) and then press the ENT key.**



4 **Press the ▲ key to select D-1 (ON, d-1) and then press the ENT key.**

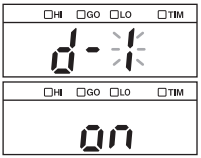
The setting is saved.



Canceling the panel lock

1 **Press and hold the SET key for two seconds or more.**

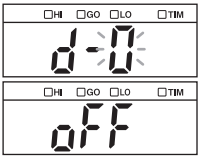
The panel lock setting screen is displayed.



2 **Press the ▲ key to select D-0 (OFF, d-0) and then press the ENT key.**

3 **Press the SET key.**

The panel lock is canceled and the system returns to the measuring status.



Specifying the number of OUT to be used (Active OUT count)

This function is used to set the number of OUT to be used.

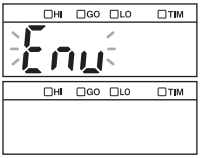
▶NOTE

When you change the active head count or active OUT count in the Environment settings, all the settings of the LK-G5000 Series except for the Environment settings are reset. When you connect the LK-HA100 head expansion unit(s) and add a sensor head(s), be sure to specify the active head count and active OUT count before changing the other measurement settings.

Changing the value of the active OUT count

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Environment settings (Env) and then press the ENT key.**

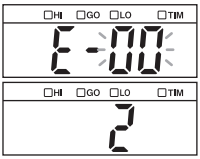


3 **Press the ▶ key to select function symbol E (Active OUT count, E) and then press the ENT key.**



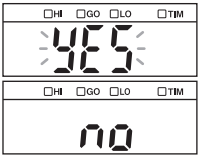
4 **Press the ▲ key to select the value of the active OUT count and then press the ENT key.**

A confirmation screen is displayed.



5 **To change the value of the active OUT count to this value, press the ▲ key, select "YES", and then press the ENT key.**

The setting is saved.
To cancel the change, select "no".



6 **Press the SET key.**

The system returns to the measuring status.

Specifying the number of sensor heads to be used (Active head count)

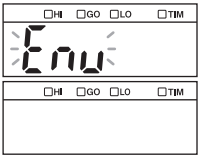
This function is used to set the number of sensor heads to be used.

> **NOTE**
> When you change the active head count or active OUT count in the Environment settings, all the settings of the LK-G5000 Series except for the Environment settings are reset. When you connect the LK-HA100 head expansion unit(s) and add a sensor head(s), be sure to specify the active head count and active OUT count before changing the other measurement settings.

Changing the value of the active head count

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Environment settings (Env) and then press the ENT key.**

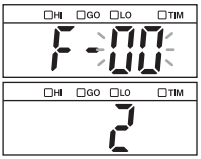


3 **Press the ▶ key to select function symbol F (Active head count, F) and then press the ENT key.**



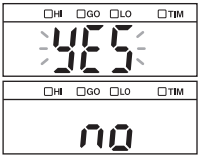
4 **Press the ▲ key to select the value of the active head count and then press the ENT key.**

A confirmation screen is displayed.



5 **To change the value of the active head count to this value, press the ▲ key, select "YES", and then press the ENT key.**

The setting is saved.
To cancel the change, select "no".



6 **Press the SET key.**

The system returns to the measuring status.

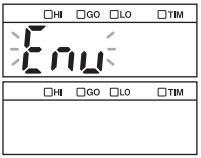
Specifying the number of analog output channels (Active analog output channel count)

This function is used to set the number of analog output channels to be used.

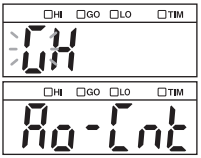
Changing the value of the active analog output channel count

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Environment settings (Env) and then press the ENT key.**

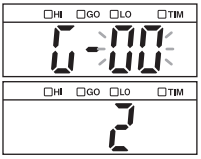


3 **Press the ▶ key to select function symbol G (Active analog output channel count, G) and then press the ENT key.**



4 **Press the ▲ key to select the value of the active analog output channel count and then press the ENT key.**

The setting is saved.



5 **Press the SET key.**

The system returns to the measuring status.

Setting the necessary information to connect to a network (LAN setting)

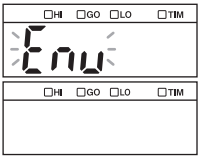
This function is used to set the necessary information to connect to a PC through Ethernet (such as the IP address, subnet mask, and default gateway of the LK-G5000 Series).

Function No.	LAN setting	Function
H-0 iPAdr A-Fld0 to A-Fld3	IP address	Specify the IP address of the LK-G5000 Series using the four fields of field 0 to field 3. The format of "[Field 0].[Field 1].[Field 2].[Field 3]" should be used.
H-1 S-mASK n-Fld0 to n-Fld3	Subnet mask	Specify the subnet mask of the LK-G5000 Series using the four fields of field 0 to field 3.
H-2 GAtEwY G-Fld0 to G-Fld3	Default gateway	Specify the default gateway of the LK-G5000 Series using the four fields of field 0 to field 3.

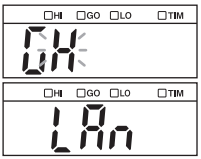
Setting the network information

1 **Hold down the SET key.**

2 **Press the ▲ key to select the Environment settings (Env) and then press the ENT key.**



3 **Press the ▶ key to select function symbol H (LAN setting, H) and then press the ENT key.**



4 **Press the ▲ key to select H-0 (IP address, H-0) and then press the ENT key.**

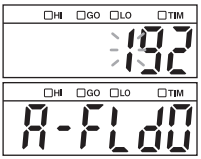
The input screen for field 0 is displayed.



5 **Use the ▶ and ▲ keys to set field 0 of the IP address to be assigned to the LK-G5000 Series and then press the ENT key.**

6 **Set fields 1 to 3 in the same manner and then press the ENT key.**

The setting is saved.



7 **Set the subnet mask (X-1) and default gateway (X-2) in the same manner as in steps 4 to 6.**

8 **Press the SET key.**

The system returns to the measuring status.

I/O terminals

4

This chapter describes the I/O terminal specifications and timing diagrams.

Names and functions of the I/O terminals 4-2
Timing diagrams 4-16

Names and functions of the I/O terminals

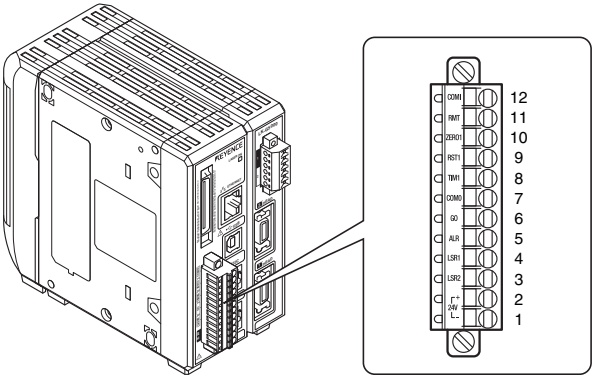
This section describes the names and functions of the I/O (input/output) terminals of the LK-G5000 Series provided in the 12-pin terminal block, 6-pin terminal block, and expansion connector.

Function of the I/O terminals

This section includes an overview and functions of the I/O terminals.

12-pin terminal block

The 12-pin terminal block is used for the general comparator output and control input. Applicable cable specification: AWG 16 to 26 Cable preparation: The cable should be stripped to 9 mm from the end (Use AWG 17 or 18 for power supply).



Terminal No.	Signal name	Description	
12	COM_IN	COM for input	
11	REMOTE	Laser remote interlock input	Non-voltage input
10	ZERO1	Auto-zero (synchronous) input	Non-voltage input (NPN type) Voltage input (PNP type)
9	RESET1	Reset (synchronous) input	
8	TIMING1	TIMING (synchronous) input	Non-voltage input 2 (NPN type) Voltage input 2 (PNP type)
7	COM_OUT	COM for output	
6	GO	General comparator output	NPN open-collector output (NPN type) PNP open-collector output (PNP type)
5	ALARM	System alarm or measured value alarm	
4	LASER_CTRL1	Laser control input 1	Non-voltage input (NPN type)*1 Voltage input (PNP type)*1
3	LASER_CTRL2	Laser control input 2	
2	24 VDC (+)	24 VDC input for power supply	
1	24 VDC (-)	0 V input for power supply	

*1 When the laser class 3B sensor head is connected, the laser emission is activated when this terminal is short-circuited. When the laser class 1, 2 or 3R sensor head is connected, the laser emission is activated when this terminal is opened.

⚠CAUTION

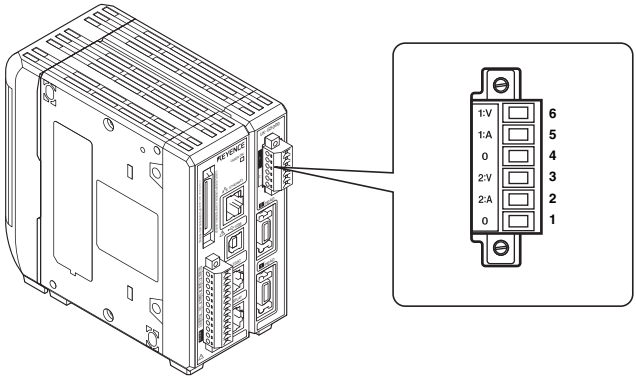
- Precautions on wiring:
  Parts of the input/output circuits of the LK-G5000 Series are common internally. Be careful that no potential difference is generated between the internally common terminals due to the potential difference between the cables/external devices. Refer to "Precautions on wiring" (page -7) for details.
- NPN type:
  The 24 VDC (-), COM OUT, and COM IN terminals are common through choke coils. They are also common with 0 V of the 6-pin terminal block and COM of the expansion connector through choke coils. Be careful of the potential difference being generated among these terminals.
- PNP type:
  The 24 VDC (-) and COM IN terminals are common through choke coils. These terminals are also common with 0 V of the 6-pin terminal block and COM IN of the expansion connector through choke coils. Be careful of the potential difference being generated among these terminals. The COM OUT terminals of the 12-pin terminal block and the expansion connector are common.
- The 24 VDC (-) terminal and the SG (GND) terminal of the RS-232C connector are common through choke coils.
  Be careful of the potential difference being generated among these terminals.

Reference

- Refer to "Electrical specifications for the NPN type models" (page 4-12) for details about the electrical specifications.
- Refer to "Timing diagrams" (page 4-16) for details about the timing diagram.

6-pin terminal block

The 6-pin terminal block is used for analog monitor output.
Applicable cable specification: AWG 28 to 16, Cable preparation: The cable should be stripped to 6.5 mm from the end.



Terminal No.	Signal name	Description
6	OUT01 (V)	Analog voltage output of OUT01 Voltage output within the range of ±10.5 V proportional to the displayed value
5	OUT01 (A)	Analog current output of OUT01 Current output within the range of 3.6 mA to 20.4 mA proportional to the displayed value
4	OUT01 0 V	0 V terminal of OUT01
3	OUT02 (V)	Analog voltage output of OUT02 Voltage output within the range of ±10.5 V proportional to the displayed value
2	OUT02 (A)	Analog current output of OUT02 Current output within the range of 3.6 mA to 20.4 mA proportional to the displayed value
1	OUT02 0 V	0 V terminal of OUT02

*The 0 V terminals No. 1 and No. 4 are common.

▶NOTE

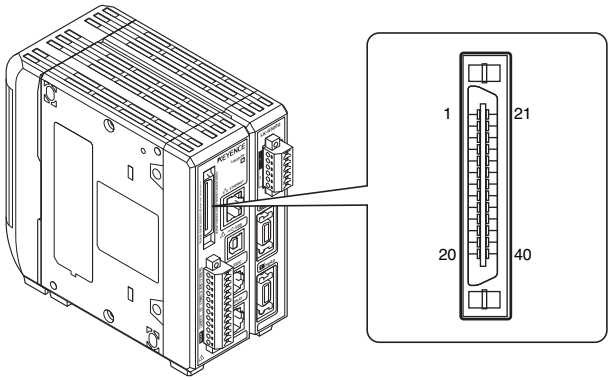
The 0 V terminal of the 6-pin terminal block and 24 VDC (-) terminal of the 12-pin terminal block are common through choke coils. Be careful of the potential difference being generated among these terminals.

Reference

- Refer to "Electrical specifications for the NPN type models" (page 4-12) for details about the electrical specifications.
- Refer to "Scaling the analog output (Analog scaling)" (page 3-50) for details about the analog output scaling.

Expansion connector

The expansion connector is used for the comparator output for OUT02, control input, and binary output.
Applicable connector: FX2B Series (HIROSE Electric Co., Ltd.)
A 3-m expansion connector cable (OP-51657) is available ("List of Optional Accessories" (page A-7)).



Terminal No.	Signal name	Description			Cable color
		Comparator output	Binary value output	Circuit (page 4-12)	
1	COM_IN	COM for input			Brown
2	P1	Program No. switch input		Non-voltage input (NPN type) Voltage input (PNP type)	Red
3	P2				Orange
4	P3				Yellow
5	B_IN1	Binary selection input			Green
6	B_IN2				Blue
7	B_IN3				Purple
8	B_IN4				Gray
9	B_OUT1	Binary selection output		NPN open-collector output (NPN type) PNP open-collector output (PNP type)	White
10	B_OUT2				Black
11	B_OUT3				Brown
12	B_OUT4				Red
13	ZERO	Auto-zero input (binary selection)		Non-voltage input (NPN type) Voltage input (PNP type)	Orange
14	RESET	RESET input (binary selection)			Yellow
15	TIMING	TIMING input (binary selection)		Non-voltage input 2 (NPN type) Voltage input 2 (PNP type)	Green
16	DEC_IN	Binary selection confirmation input		Non-voltage input (NPN type) Voltage input (PNP type)	Blue

Terminal No.	Signal name	Description				Cable color
		Comparator output		Binary value output	Circuit (page 4-12)	
17	DEC_OUT	Binary selection confirmation output			NPN open-collector output (NPN type) PNP open-collector output (PNP type)	Purple
18	COM_OUT	COM for output				Gray
19	STROBE	Strobe output			NPN open-collector output (NPN type) PNP open-collector output (PNP type)	White
20	OUT1 (8) HI/binary (0) (LSB)	OUT1 comparator HI output	OUT8 comparator HI output	Binary (0) output (LSB)		Black
21	OUT1 (8) GO/ binary (1)	OUT1 comparator GO output	OUT8 comparator GO output	Binary (1) output		Brown
22	OUT1 (8) LO/binary (2)	OUT1 comparator LO output	OUT8 comparator LO output	Binary (2) output		Red
23	OUT2 (9) HI/binary (3)	OUT2 comparator HI output	OUT9 comparator HI output	Binary (3) output		Orange
24	OUT2 (9) GO/ binary (4)	OUT2 comparator GO output	OUT9 comparator GO output	Binary (4) output		Yellow
25	OUT2 (9) LO/binary (5)	OUT2 comparator LO output	OUT9 comparator LO output	Binary (5) output		Green
26	OUT3 (10) HI/ binary (6)	OUT3 comparator HI output	OUT10 comparator HI output	Binary (6) output		Blue
27	OUT3 (10) GO/ binary (7)	OUT3 comparator GO output	OUT10 comparator GO output	Binary (7) output		Purple
28	OUT3 (10) LO/ binary (8)	OUT3 comparator LO output	OUT10 comparator LO output	Binary (8) output		Gray
29	OUT4 (11) HI/ binary (9)	OUT4 comparator HI output	OUT11 comparator HI output	Binary (9) output		White
30	OUT4 (11) GO/ binary (10)	OUT4 comparator GO output	OUT11 comparator GO output	Binary (10) output		Black
31	OUT4 (11) LO/ binary (11)	OUT4 comparator LO output	OUT11 comparator LO output	Binary (11) output		Brown
32	OUT5 (12) HI/ binary (12)	OUT5 comparator HI output	OUT12 comparator HI output	Binary (12) output		Red
33	OUT5 (12) GO/ binary (13)	OUT5 comparator GO output	OUT12 comparator GO output	Binary (13) output		Orange

Terminal No.	Signal name	Description				Cable color
		Comparator output		Binary value output	Circuit (page 4-12)	
34	OUT5 (12) LO/ binary (14)	OUT5 comparator LO output	OUT12 comparator LO output	Binary (14) output	NPN open-collector output (NPN type) PNP open-collector output (PNP type)	Yellow
35	OUT6 HI/ binary (15)	OUT6 comparator HI output	Not used (OFF)	Binary (15) output		Green
36	OUT6 GO/ binary (16)	OUT6 comparator GO output	Not used (OFF)	Binary (16) output		Blue
37	OUT6 LO/ binary (17)	OUT6 comparator LO output	Not used (OFF)	Binary (17) output		Purple
38	OUT7 HI/ binary (18)	OUT7 comparator HI output	Not used (OFF)	Binary (18) output		Gray
39	OUT7 GO/ binary (19)	OUT7 comparator GO output	Not used (OFF)	Binary (19) output		White
40	OUT7 LO/ binary (20) (MSB)	OUT7 comparator LO output	Not used (OFF)	Binary (20) output (MSB)		Black

- The cable colors represent the wire colors of the expansion connector cable (OP-51657).
- The signal functions of terminal numbers 20 to 40 vary depending on the binary selection input through terminal numbers 5 to 8.

⚠ CAUTION

- Precautions on wiring:
  Parts of the input/output circuits of the LK-G5000 Series are common internally. Be careful that no potential difference is generated between the internally common terminals due to the potential difference between the cables/external devices. Refer to "Precautions on wiring" (page -7) for details.
- NPN type:
  The COM OUT and COM IN terminals are common through choke coils. They are also common with the 24 VDC (-), COM OUT and COM IN terminals of the 12-pin terminal block through choke coils. Be careful of the potential difference being generated among these terminals.
- PNP type:
  The COM IN and 24 VDC (-) terminals are common through choke coils. They are also common with the 24 VDC (-) and COM IN terminals of the 12-pin terminal block through choke coils. Be careful of the potential difference being generated among these terminals. The COM OUT terminals of the expansion connector and 12-pin terminal block are common.

Functions of the I/O Signals

This section describes the functions of the I/O (input/output) signals. Refer to "Names and functions of the I/O terminals" (page 4-2) for details about the layout of the individual terminals.

Comparator output

Name	Description	Reference page
Tolerance comparator output (OUT HI, OUT GO, OUT LO)	Outputs the tolerance comparator result of the corresponding OUT when the binary selection input is set to select the comparator output.	-

Alarm output

Name	Description	Reference page
Alarm (N.C.) output (ALARM)	Outputs an alarm of the type specified with the "Alarm output type" (system alarm or measured value alarm).	page 3-68

Measurement control input/output

Name	Description	Reference page
TIMING input (TIMING)	Inputs a synchronous signal to the OUT selected with the binary selection input. *1	-
RESET input (RESET)	Resets the measured value of the OUT selected with the binary selection input. *1	-
TIMING1 input (TIMING1)	Inputs a synchronous signal to the synchronized OUT.	-
RESET1 input (RESET1)	Resets the measured value of the synchronized OUT.	-

*1 This input is valid when the binary selection input is set to select the binary output and the binary selection confirmation input is turned on. The input is not accepted when the binary selection input is set to select the comparator output or the binary selection confirmation input is turned off.

Auto-zero input

Name	Description	Reference page
ZERO input (ZERO)	Sets the current measured value of the OUT selected with the binary selection input to 0 (zero). *1	-
ZERO1 input (ZERO1)	Sets the current measured value of the synchronized OUT to 0.	-

*1 This input is valid when the binary selection input is set to select the binary output and the binary selection confirmation input is turned on. The input is not accepted when the binary selection input is set to select the comparator output or the binary selection confirmation input is turned off.

General comparator output

Name	Description	Reference page
General comparator output (GO)	Outputs a signal when GO output is the result for all OUTs specified with the available OUT count which are not in the comparator standby status.	-

Program No. switch input

Name	Description	Reference page
P1, P2, P3	Changes the program No. from an external device.	page 4-5

The relationship between the program numbers and the statuses of the P1 to P3 terminals is as follows.

Program No.	P3	P2	P1
0	OFF	OFF	OFF
1	OFF	OFF	ON
2	OFF	ON	OFF
3	OFF	ON	ON
4	ON	OFF	OFF
5	ON	OFF	ON
6	ON	ON	OFF
7	ON	ON	ON

Status	NPN type	PNP type
ON	Short-circuited with the COM terminal	Voltage being applied
OFF	Open	Open

Reference

To change the program number with the I/O terminals, you need to change the "Setting selection" of the Environment settings to "Terminal input" (page 3-73).

Binary selection input/output

Name	Description	Reference page
Binary selection input (B_IN1 to B_IN4)	Changes the range of the comparator output or the OUT No. for the binary output.	-
Binary selection output (B_OUT1 to B_OUT4)	Outputs the data provided from the comparator/binary output terminal.	-
Binary selection confirmation input (DEC_IN)	When turned on, applies the TIMING input, RESET input, and ZERO input to the selected OUT.	-
Binary selection confirmation output (DEC_OUT)	Outputs a signal when the binary selection confirmation input is turned on.	-

The statuses of the binary selection input/output (B_IN1 to B_IN4) are as follows.

Output data	B_IN4 B_OUT4	B_IN3 B_OUT3	B_IN2 B_OUT2	B_IN1 B_OUT1
Comparator output OUT1 to OUT7	OFF	OFF	OFF	OFF
OUT1 binary output	OFF	OFF	OFF	ON
OUT2 binary output	OFF	OFF	ON	OFF
OUT3 binary output	OFF	OFF	ON	ON
OUT4 binary output	OFF	ON	OFF	OFF
OUT5 binary output	OFF	ON	OFF	ON
OUT6 binary output	OFF	ON	ON	OFF
OUT7 binary output	OFF	ON	ON	ON
OUT8 binary output	ON	OFF	OFF	OFF
OUT9 binary output	ON	OFF	OFF	ON
OUT10 binary output	ON	OFF	ON	OFF
OUT11 binary output	ON	OFF	ON	ON
OUT12 binary output	ON	ON	OFF	OFF
Comparator output OUT1 to OUT7	ON	ON	OFF	ON
Comparator output OUT1 to OUT7	ON	ON	ON	OFF
Comparator output OUT8 to OUT12	ON	ON	ON	ON

Binary output

Name	Description	Reference page
Binary output	Outputs the measured value as binary data (21 bits). A negative value is represented as a two's complement number. Negative logic is used ("1" when the NPN or PNP open-collector output is turned on). Comparator standby status (All digits are shown with "-"): 0 x 100000 Over range on the positive side: 0 x 0FFFFF Over range on the negative side: 0 x 100000 Alarm: 0x100000	page 4-5 page 4-12
STROBE output	Strobe output for binary output	page 4-5

■ Binary output indication

The LK-G5000 Series outputs the measured value as a binary number (two's complement) of 21 bits. The decimal point is ignored.

- Example 1: When the measured value is "+134.97"
  13497 (decimal) → 0 0000 0011 0100 1011 1001 (binary)
- Example 2: When the measured value is "-134.97"
  -13497 (decimal) → 1 1111 1100 1011 0100 0111 (binary)

LASER CTRL input

Name	Description		Reference page
LASER CTRL input	Controls the lasers for each group specified as LASER CTRL group. The operation depends on the laser class of the sensor head. "LASER CTRL1" controls LASER CTRL group 1, and "LASER CTRL2" controls LASER CTRL group 2.		page 3-20 page 4-2 page 4-12 page A-11
	When only the laser class 1, 2 or 3R sensor head is used	When the laser class 3B sensor head (LK-H023/LK-H028/LK-H053/LK-H058) is used	
	• NPN output type: The laser beam emission stops when the LASER CTRL1/2 and COM IN terminals are short-circuited. • PNP output type: The laser beam emission stops when voltage is applied to the section between the LASER CTRL1/2 and COM IN terminals.	• NPN output type: The laser beam emission starts when the LASER CTRL1/2 and COM IN terminals are short-circuited with the key-operated switch. • PNP output type: The laser beam emission starts when voltage is applied to the section between the LASER CTRL1/2 and COM IN terminals with the key-operated switch.	

Laser remote interlock input

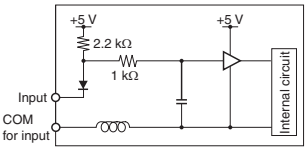
Name	Description	Reference page
REMOTE	This is the laser remote interlock terminal. The laser beam is emitted when this terminal is short-circuited with COM. The emission is stopped when this terminal is open. This terminal is common to sensor heads A and B. This input overrides the LASER OFF input.	page 4-2

Electrical specifications for the NPN type models

⚠CAUTION

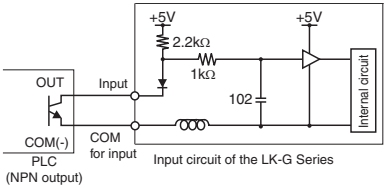
Be sure to read "Precautions on wiring" (page -7) before wiring.

■ Non-voltage input

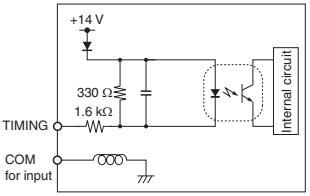


ON voltage	1 V max.
OFF current	0.6 mA max.
Short-circuit current (Typical)	2 mA

Connection example when an NPN output type PLC is connected to the non-voltage input of the LK-G Series



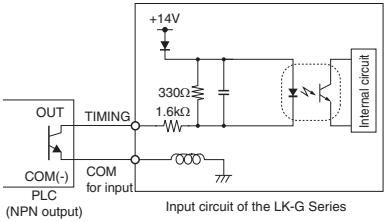
■ Non-voltage input 2 (TIMING/TIMING1)



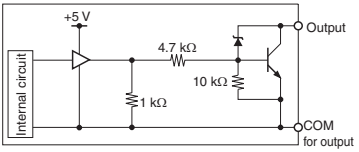
ON voltage	5 V or less
OFF current	1 mA max.
Short-circuit current (Typical)	8 mA

Compatible with the DC 2-wire model of the Keyence EV Series proximity

Connection example when an NPN output type PLC is connected to the non-voltage input of the LK-G Series

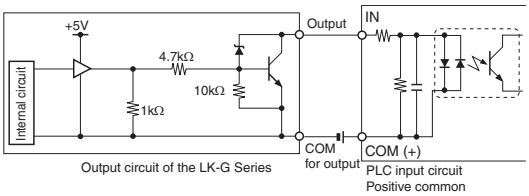


■ NPN open-collector output

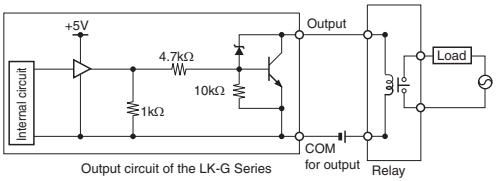


Maximum applied voltage	40 V
Maximum sink current	50 mA
Residual voltage	0.5 V max.
Leakage current	0.1 mA max.

Connection example when the NPN output of the LK-G Series is input to a PLC with positive common wiring



Connection example when the NPN output of the LK-G Series is input to a relay

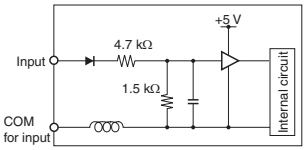


Electrical specifications for the PNP type models

⚠CAUTION

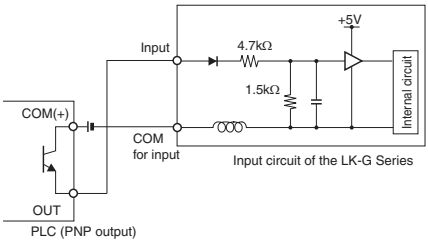
Be sure to read "Precautions on wiring" (page 7) before wiring.

■ **Voltage input**

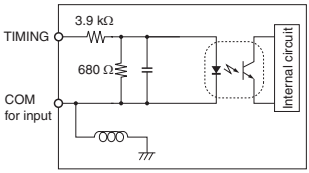


Maximum input voltage rating	26.4 V
ON voltage	10.8 V min.
OFF current	0.6 mA max.
Short-circuit current (Typical)	2 mA

Connection example when a PNP output type PLC is connected to the voltage input of the LK-G Series

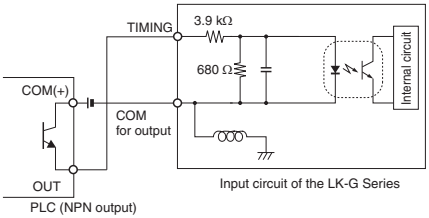


■ **Voltage input 2 (TIMING/TIMING1)**

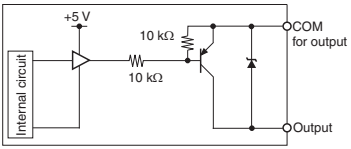


Maximum input voltage rating	26.4 V
ON voltage	10.8 V min.
ON current (Typical)	3 mA
OFF voltage	5 V max.
OFF current	1 mA max.

Connection example when a PNP output type PLC is connected to the voltage input of the LK-G Series

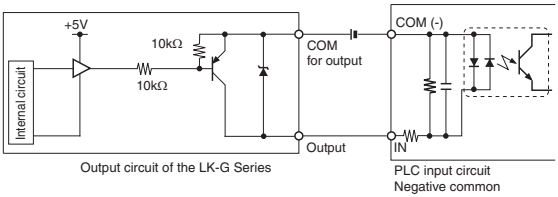


■ **PNP open-collector output**

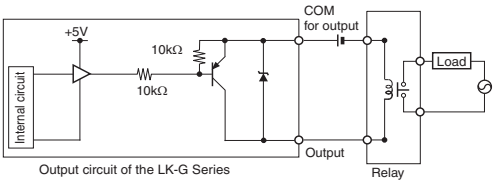


Maximum applied voltage	30 V
Maximum source current	50 mA
Residual voltage	0.5 V max.
Leakage current	0.1 mA max.

Connection example when the PNP output of the LK-G Series is input to a PLC with negative common wiring

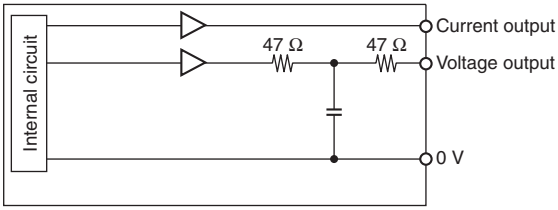


Connection example when the PNP output of the LK-G Series is input to a relay



Electrical specifications common to the NPN and PNP type models

■ Analog voltage output/analog current output



Voltage output

Output range	±10.8 V (Measured data: ±10.5 V)
Resolution	2 mV
Accuracy	±0.05% of F.S. (F.S. = 20 V, accuracy with reference to the displayed value)
Output impedance	Approx. 100 Ω
Response delay time	Approx. 1.5 µs (after the measured value is updated)

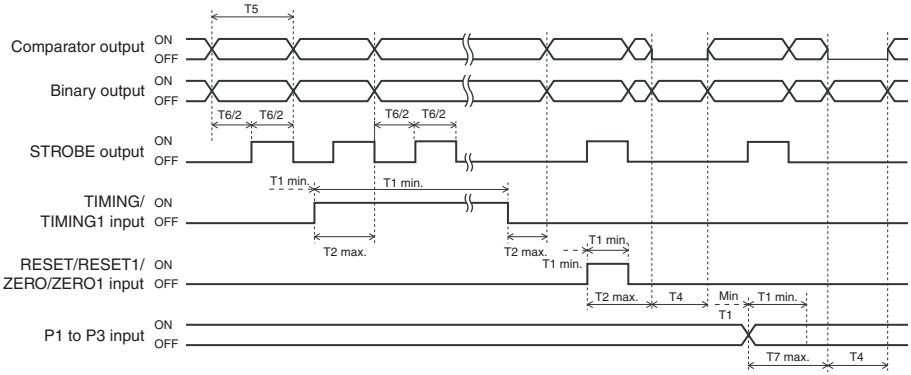
Current output

Output range	3.36 to 20.64 mA (Measured data: 3.6 to 20.4 mA)
Resolution	40 µA
Accuracy	±0.25% of F.S. (F.S. = 16 mA, accuracy with reference to the displayed value)
Applicable load	350 Ω max.
Response delay time	Approx. 10 µs (after the measured value is updated)

Timing diagrams

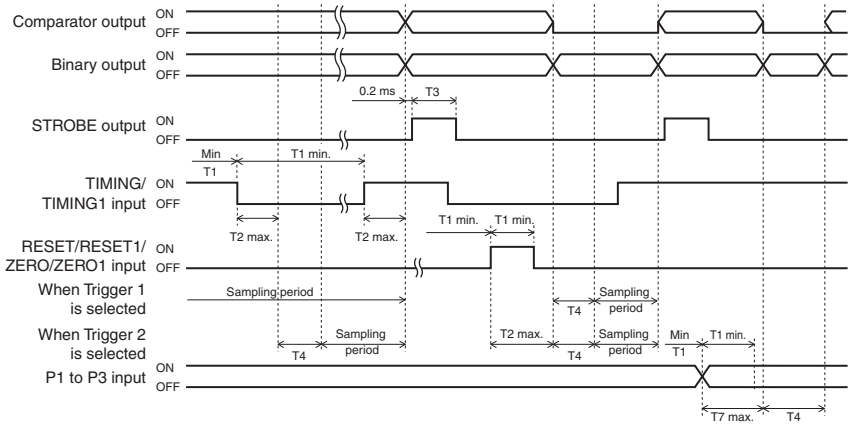
This section describes the timing of the I/O signal operations.

Normal



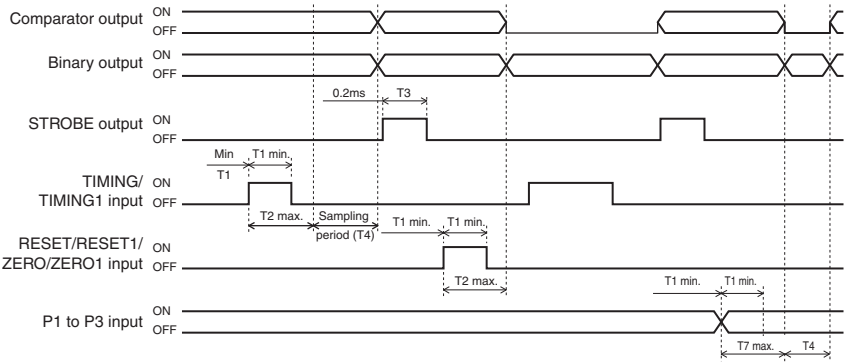
- The minimum input time (T1), input response time (T2), RESET time (T4), refresh cycle (T5), sampling cycle (T6), and program No. change time (T7) vary depending on the settings (page 4-27).
- When the sampling cycle (T6) is 20 µs or less, the STROBE output's T6 is fixed to 20 µs.
- Auto-zero is canceled when the ZERO input is turned on for two seconds or more.

Peak hold/bottom hold/peak-to-peak hold/average hold/sample hold (Trigger 1)



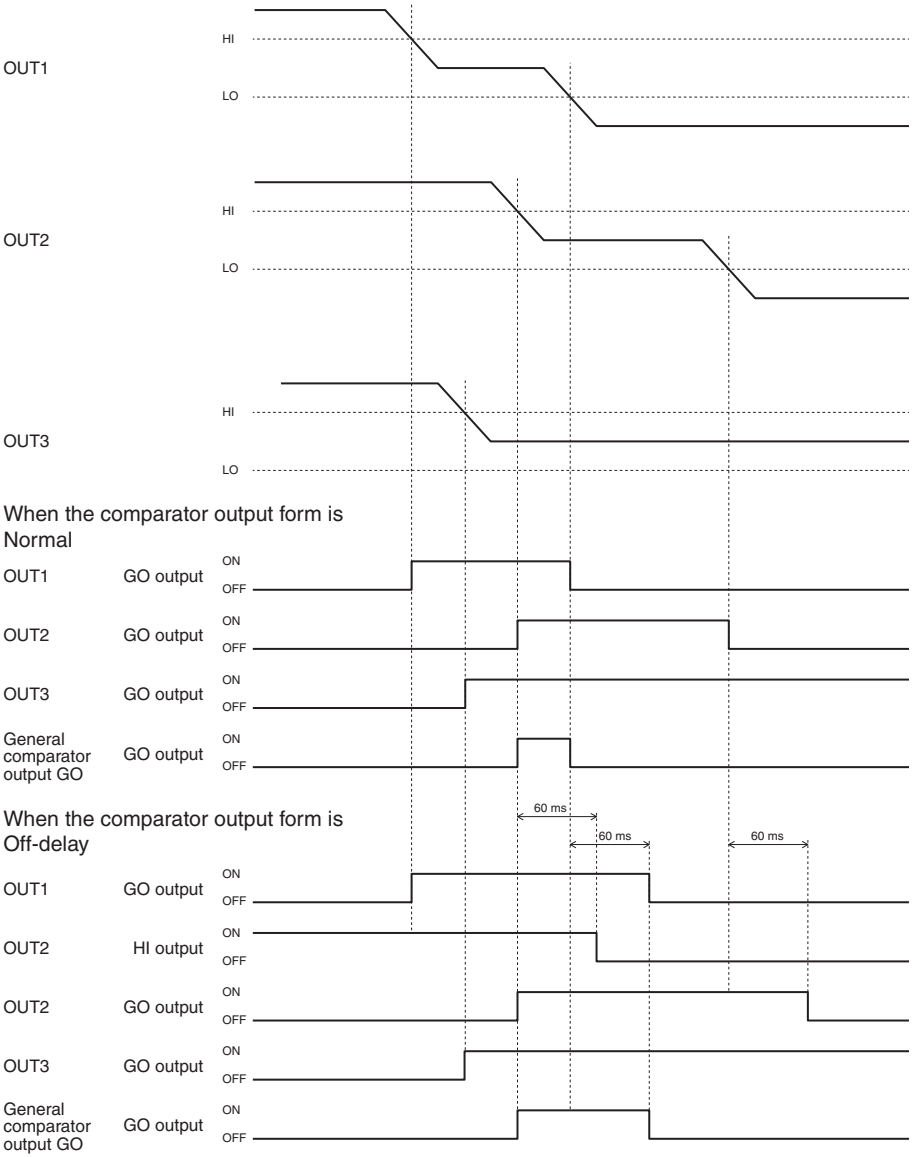
- The minimum input time (T1), input response time (T2), RESET time (T4), and program No. change time (T7) vary depending on the settings (page 4-27).
- The STROBE time (T3) can be changed (page 3-64).
- Auto-zero is canceled when the ZERO input is turned on for two seconds or more.
- The internal measured value of the RESET input is determined after the RESET time (T4) has elapsed.

Sample hold (Trigger 2)



- The TIMING input ON signal is used as a trigger and the measured value is determined after the sampling period (T4) has elapsed.
- The minimum input time (T1), input response time (T2), sampling period (T4), and program No. change time (T7) vary depending on the settings (page 4-27).
- The STROBE time (T3) can be changed (page 3-64).
- Auto-zero is canceled when the ZERO input is turned on for two seconds or more.
- If the RESET input or ZERO input is turned on during the sampling period, the sampling stops and the comparator standby status starts.

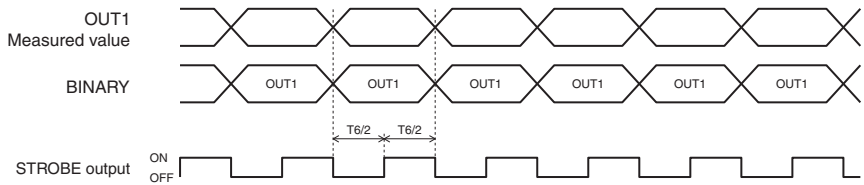
General comparator output GO



- The general comparator output GO turns on when GO outputs are turned ON for all OUTs which are not in the comparator standby status.
- Since the output is affected by the comparator output form setting, the general comparator output GO may be output when the HI or LO output is turned on for some OUT (page 3-63).

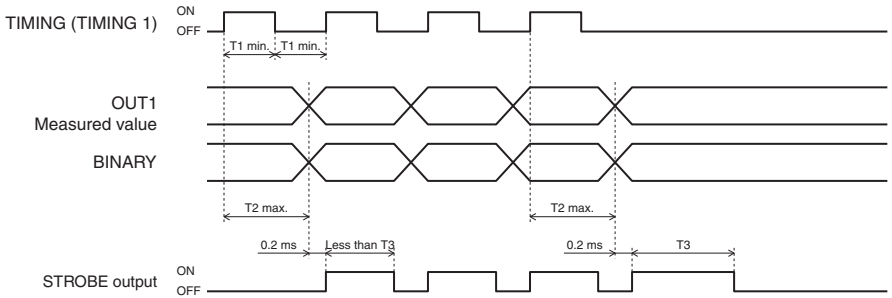
Binary output

■ BINARY (Normal mode)

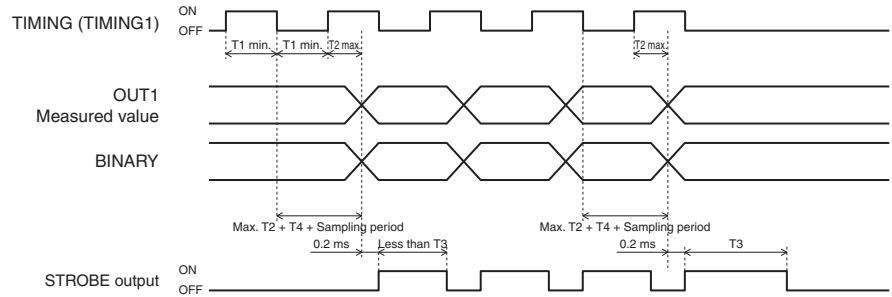


- When the sampling cycle (T6) is 20 µs or less, the STROBE output's T6 is fixed to 20 µs.

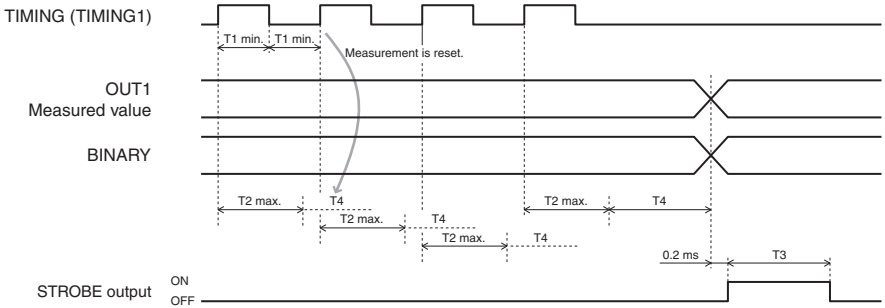
■ BINARY (Measurement mode with Trigger 1 selected)



■ BINARY (Measurement mode other than the sample hold with Trigger 2 selected)

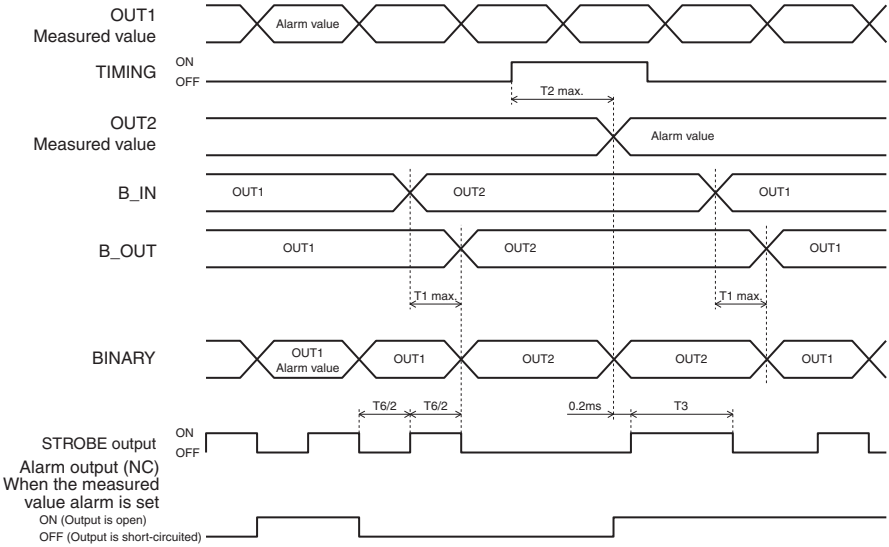


■ **BINARY (Sample hold with Trigger 2 selected)**



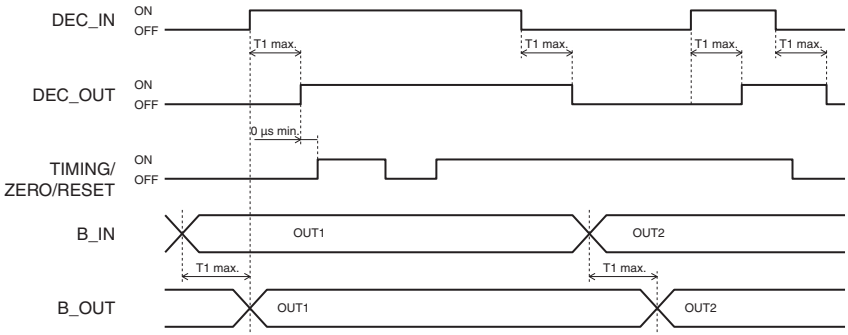
- After the synchronous signal turns ON and before the strobe output is turned on, if the synchronous input turns ON again, the internal measured value will be reset, and the strobe signal will turn ON after a period of "MaxT2 + T4 + 0.2 ms" has elapsed.

■ B_IN, B_OUT



- This timing diagram shows an example for settings other than OUT1: Normal, OUT2: Normal, or Sample hold with Trigger 2 selected.
- The OUT which is set with the B_IN input can be selected for binary output.
- The OUT No. which is providing the current binary output can be checked with the B_OUT output.
- The binary data should be imported in synchronization with the strobe signal being turned on.
- The minimum input time (T1), input response time (T2) and refresh cycle (T5) vary depending on the settings.
- The STROBE time (T3) can be changed.
- When the sampling cycle (T6) is 20 µs or less, the STROBE output's T6 is fixed to 20 µs.
- In any of the measurement modes, when the BINARY output is switched while strobe output is turned on, the binary output is turned off even in less than T3.
- In the normal mode, the BINARY output is switched at the timing when strobe output is turned off.
- The alarm output uses a normally-closed contact.

■ **DEC_IN**

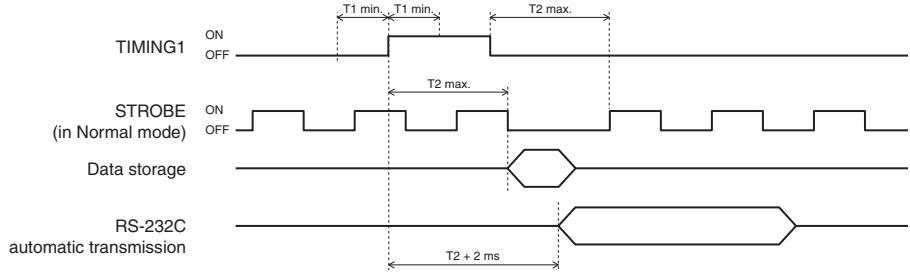


- When DEC_OUT is off, TIMING/ZERO/RESET is ignored.
- When B_IN specifies the comparator output, TIMING/ZERO/RESET is ignored.
- When synchronized OUT is selected, ZERO/RESET can be input but TIMING is not accepted.
- To switch the B_IN signal, turn OFF the DEC_IN signal, then switch the B_IN signal, and then turn DEC_IN ON again after confirming that B_OUT has been switched.
- When DEC_IN is turned on while TIMING (ZERO/RESET) is on, this input is applied to the OUT specified after DEC_IN is turned on.

■ External synchronization for data storage, RS-232C automatic transmission

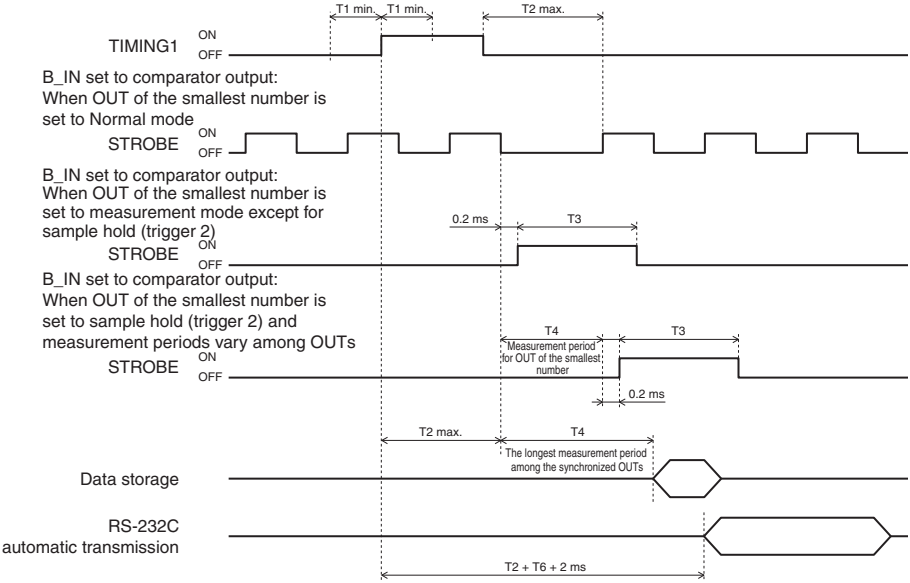
The STROBE output type depends on the synchronization setting.

- When the measurement mode for synchronized OUT is not sample hold (Trigger 2):

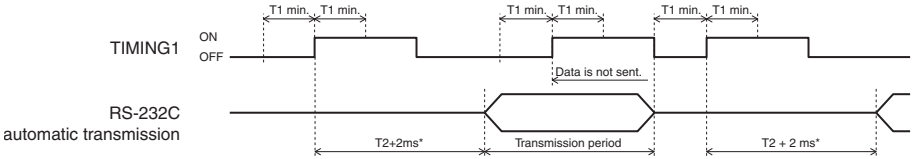


After TIMING1 is input and the input response time (T2) has elapsed, data storage (RS-232C automatic transmission) is performed.

- When the sample hold (Trigger 2) is selected as the measurement mode for some of the synchronized OUTs:
  - The STROBE output method is decided by the smallest OUT No. among the OUTs selected for synchronization control. (For example, when all of OUT1 to OUT12 are set for synchronization control and comparator outputs 8 to 12 are selected with B_IN, the smallest OUT No. is "OUT1", regardless of the B_IN input.)
  - If comparator output is selected with B_IN and synchronization control is not set, STROBE output is disabled.



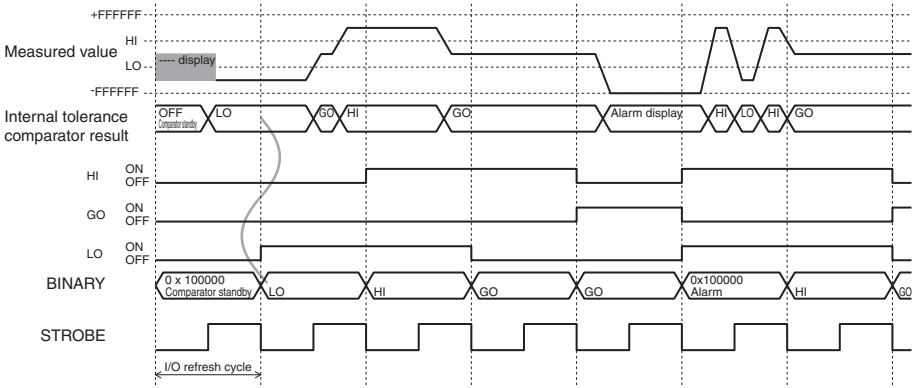
■ TIMING signal interval for the RS-232C automatic transmission



* This period will be T2 + T4 + 2 ms when the "sample hold (Trigger 2)" is selected as the measurement mode for some of the synchronized OUTs.

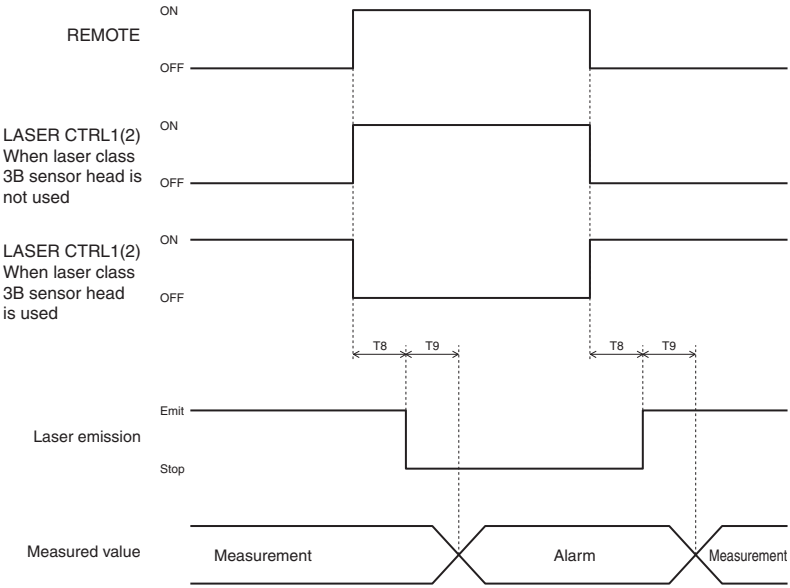
- Even when the next data is determined during the automatic transmission, the data is not sent.

■ Refresh timing during high-speed sampling



- The operations when the sampling cycle is shorter than the I/O refresh cycle are as follows:
  - If all comparator results are GO in one refresh cycle, GO turns on at the next refresh.
  - If at least one comparator result is HI (LO) in one refresh cycle, HI (LO) turns on at the next refresh.
  - If both HI and LO exist in one refresh cycle, both HI and LO turn on at the next refresh.
  - Binary output is updated to the latest value in every refresh cycle.
- The I/O refresh cycle depends on the sampling cycle and mutual interference prevention setting.

LASER REMOTE/LASER CTRL1/2



- T8 is the laser control emission response time and T9 is the laser control measurement response time (page 4-27).
- The REMOTE input turns on when opened and turns off when short-circuited.
- The status of LASER CTRL 1/2 is operated as follows:

Status	NPN type	PNP type
ON	Short-circuited with the COM terminal	Voltage applied
OFF	Open	Open

Timing details

■ Minimum input time (T1), input response time (T2), and refresh cycle (T5)

<table>
<tr><th rowspan="2">Sampling cycle (T6)</th><th rowspan="2">Minimum input time (T1)</th><th rowspan="2">Input response time (T2)</th><th rowspan="2">Laser control emission response time (T8)</th><th rowspan="2">Laser control measurement response time (T9)</th><th colspan="2">I/O refresh cycle</th></tr>
<tr><th>Mutual interference prevention function: OFF</th><th>Mutual interference prevention function: AB-ON/ABC-ON</th></tr>
<tr><td>2.55 µs</td><td rowspan="5">1000 µs</td><td>1000 µs + T6 x 131</td><td rowspan="5">1000 µs</td><td>T6 x 139 + 50 µs</td><td>T6 x 8</td><td>T6 x 4</td></tr>
<tr><td>5 µs</td><td>1000 µs + T6 x 67</td><td>T6 x 75 + 50 µs</td><td>T6 x 4</td><td>T6 x 2</td></tr>
<tr><td>10 µs</td><td>1000 µs + T6 x 35</td><td>T6 x 43 + 50 µs</td><td>T6 x 2</td><td rowspan="7">T6 x 1
For the sampling cycles longer than 10 µs: Same as the value for 10 µs</td></tr>
<tr><td>20 µs</td><td>1000 µs + T6 x 19</td><td>T6 x 27 + 50 µs</td><td rowspan="5">T6 x 1
For the sampling cycles longer than 20 µs: Same as the value for 20 µs</td></tr>
<tr><td>50 µs</td><td>1000 µs + T6 x 11</td><td>T6 x 19 + 50 µs</td></tr>
<tr><td>100 µs</td><td rowspan="4">1000 µs + T6</td><td rowspan="4">1000 µs + T6 x 6 +100 µs</td><td rowspan="4">1000 µs + T6</td><td rowspan="4">T6 x 13 + 100 µs</td></tr>
<tr><td>200 µs</td></tr>
<tr><td>500 µs</td></tr>
<tr><td>1000 µs</td></tr>
</table>

- The sampling cycle can be changed (15).
- When the sampling cycle is changed, the measurement response time, measurement averaging time, RESET time, and refresh cycle also change accordingly.
- When the mutual interference prevention function is used, the sampling cycle T6 is calculated as T6 x 2 (for AB_ON) or T6 x 3 (for ABC_ON).
- When "Velocity" is selected for the measurement type, T4 is calculated as T4 + T6; when "Acceleration" is selected, T4 is calculated as T4 + 2 x T6.

■ Measurement averaging time and RESET time (T4)

Filter		Measurement averaging time	RESET time (T4)
No. of averaging measurements	1	T6 x 1	T6 x 1
	4	T6 x 4	T6 x 4
	16	T6 x 16	T6 x 16
	64	T6 x 64	T6 x 64
	256	T6 x 256	T6 x 256
	1024	T6 x 1024	T6 x 1024
	4096	T6 x 4096	T6 x 4096
	16384	T6 x 16384	T6 x 16384
	65536	T6 x 65536	T6 x 65536
	262144	T6 x 262144	T6 x 262144
Low-pass filter		T6 x 12	T6 x 12
High-pass filter		T6 x 12	T6 x 12

- When the mutual interference prevention function is used, the sampling cycle T6 is calculated as T6 x 2 (for AB_ON) or T6 x 3 (for ABC_ON).
- When "Velocity" is selected for the measurement type, T4 is calculated as T4 + T6; when "Acceleration" is selected, T4 is calculated as T4 + 2 x T6.

■ Program No. change time (T7)

Program No. change time (T7) = Number of sensor heads connected to the controller x 50 ms
+ Number of sensor heads connected to the head expansion unit x 110 ms + 5 ms

RS-232C

5

This chapter describes how to connect external devices and the communication functions used for external control.

Specifications 5-2

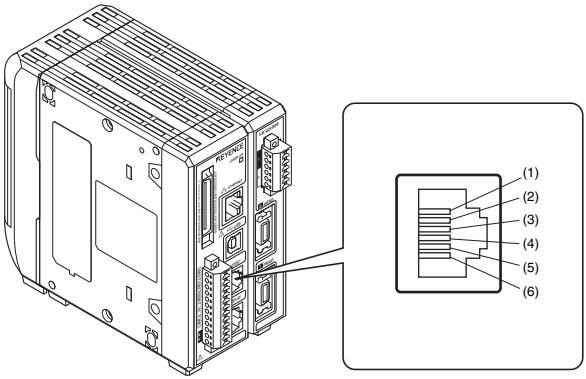
Measured Value Output and Changing Settings through Commands 5-4

Data Storage Function..... 5-36

Measured Value Output through External Synchronization 5-38

Specifications

Pin assignment



Applicable connector specifications: 6-pin modular plug connector

Terminal No.	Terminal name	Description
1	(Not used)	-
2	(Not used)	-
3	SD (TXD)	Signal reception from an external device (input)
4	SG (GND)	GND
5	RD (RXD)	Signal transmission to an external device (output)
6	(Not used)	-

* Do not use the terminals indicated as "Not used". Using these terminals may lead to product breakdown.

▶NOTE

- The SG (GND) and 24 VDC (-) terminals are common through choke coils. Be careful of the potential difference being generated among these terminals.
- Be sure to read "Precautions on wiring" (page 7) before starting wiring.

Communication parameters

EIA RS-232C compliant (Modem definition)

Transmission method	Full duplex
Synchronization	Start-stop
Transmission code	ASCII
Data length	8 bits
Stop bit length	1 bit
Parity check*	None/even/odd
Baud rate*	9600/19200/38400/57600/115200 bps
Data delimiter	CR
Flow control	None

Refer to "Setting the RS-232C communication parameters (RS-232C)" (page 3-72) for the setting of the communication parameters.

Communication operations for the measuring status and communication mode

General mode	During measurement	The measurement control commands are accepted. Commands such as writing/reading setting values are not accepted.
	During tolerance/ function setting	Communication is not accepted. The measurement stops.
Communication mode		• When the command "Q" "0" "CR" is received, the mode changes to the communication mode, and the setting values are written/read. • The measurement stops during the communication mode.

▶NOTE

You need to complete a sequence of command inputs/outputs before shifting from the measuring status to the tolerance/function setting status.

Setting outline according to external devices

Set the automatic transmission function (page 3-72) as described in the table below according to the external device to be connected.

External device	Automatic transmission	Reference page
Non-procedure communication with a PC or a PLC link unit (Communication commands are required.)	OFF	"Measured Value Output and Changing Settings through Commands" (page 5-4)
Communication with a PC or a PLC link unit (Measured values are output in synchronization with the external synchronous input.)	ON	"Measured Value Output through External Synchronization" (page 5-38)

*The operations described in "Measured Value Output and Changing Settings through Commands" are also valid when the automatic transmission is set to ON.

Measured Value Output and Changing Settings through Commands

You can import measured values and change parameter settings by connecting the LK-G5000 Series to a PC or a PLC link unit.

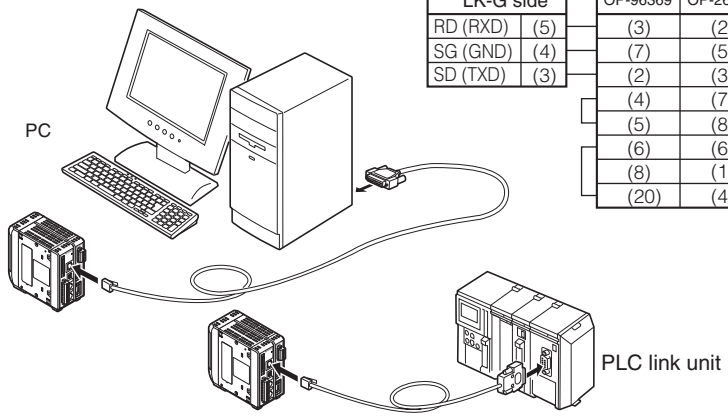
Connecting a PC/PLC link unit

The connection requires the OP-96368 dedicated cable (2.5-m straight cable) and either the OP-26401 (D-sub 9-pin) or OP-96369 (D-sub 25-pin) conversion adapter.

Reference

Also refer to the instruction manual for the PC or PLC link unit before starting connection.

Connection diagram



LK-G side		PC side		
		OP-96369	OP-26401	Signal name
RD (RXD)	(5)	(3)	(2)	RD (RXD)
SG (GND)	(4)	(7)	(5)	SG (GND)
SD (TXD)	(3)	(2)	(3)	SD (TXD)
		(4)	(7)	RS (RTS)
		(5)	(8)	CS (CTS)
		(6)	(6)	DR (DSR)
		(8)	(1)	CD (DCD)
		(20)	(4)	ER (DTR)

▶NOTE

Be sure to read "Precautions on wiring" (page 7) before starting wiring.

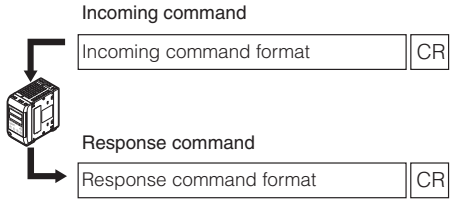
Environment settings parameters

Change the following parameters according to the PC or PLC link unit to be connected (page 3-72).

Item	Setting value	Remark
Baud rate	9600/19200/38400/57600/115200	Set the appropriate parameter according to the external device to be connected.
Parity check	None/even/odd	

Outline of the command format

The LK-G5000 Series controls operation based on the incoming command received from the external device, and then sends back the response command to the external device. CR is used to delimit each piece of data in the incoming/response command format.



▶NOTE

When creating a control program, build it so that you confirm the reception of the response command from the LK-G5000 Series before sending the next command.

Reference

Both upper-case and lower-case characters can be used in the command.
The presence or absence of the section enclosed with brackets ([ ]) in the command format depends on the condition.

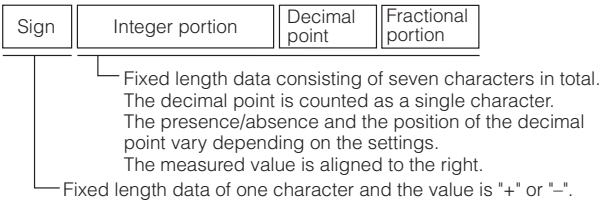
■ Error response command format

The table below lists the major error codes. Refer to "Error Codes" (page A-5) for details.

Response	ER, (Issued command), (Error code) CR
Error code	• 50: Command error • 51: Status error • 60: Command length error • 61: Parameter count error • 62: Parameter range error • 88: Timeout error • 99: Other error

Measured value format (hhhhhhhh)

A measured value is output in the format shown below.



The following table provides format examples.

Displayed value	Output format
12345	+01.2345
-00120	-00.0120
123456	+1234.56
-12	-00001.2
0000	+000.000
-------	XXXXXXXX
FFFFFF	+FFFFFFF
-FFFFFF	-FFFFFFF

5

Setting value format (fffffff)

■ Setting change format

Fixed length format that consists of one sign and six-digit numerical values. No decimal point is included.

■ Setting confirmation format

Fixed length format that consists of one sign, six-digit numerical value and one decimal point.

Mode change command

This section describes the command format used to switch between the "General mode" and "Communication mode".

Reference

Refer to "Communication operations for the measuring status and communication mode" (page 5-3) for details about the general mode and communication mode.

■ Changing to the communication mode

The mode is changed to the communication mode.

Incoming command	Q0 CR
Response command	Q0 CR
Parameter description	-
Error code	Err-51: Command Q0 was sent when the unit was in the communication mode.

■ Changing to the general mode

The mode is changed to the general mode.

Incoming command	R0 CR
Response command	R0 CR
Parameter description	-
Error code	Err-51: Command R0 was sent when the unit was in the general mode. Err-63: The repeated use of an OUT value in calculation exceeds the limit. Err-65: The calculation method parameter does not satisfy the requirements of the setting list. (OUT for velocity/acceleration was set for OUT calculation; or an item other than the sensor head was specified for calculation of OUT for velocity/acceleration.) Err-66: The calculation method parameter does not satisfy the requirements of the setting list. (No OUT was specified for AVE, MAX, MIN, or P-P calculation.)

Measurement control command format

This section describes the command format used to control the measurement. The incoming command is a command that the LK-G5000 Series can receive during the measurement and the response command is a command that is sent after the incoming command is processed properly.

The following subsections include details about the incoming commands and details about the response commands that are sent after the incoming commands are processed properly.

Refer to "Outline of the command format" (page 5-5) for the error response commands and refer to "Timing diagrams" (page 5-35) for the response delay time.

▶NOTE

These commands are accepted only when the controller is in the "General mode".

■ Measured value output (single)

Incoming command	MS,aa CR
Response command	MS,aa,hhhhhhhh CR
Parameter description	• Only the measured value for the specified OUT No. is output. • aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • hhhhhhhh: Measured value format
Error code	-

■ Measured value output (multiple)

Incoming command	MM,iiiiiiiiiiii CR
Response command	MM,iiiiiiiiiiii,hhhhhhhh[,hhhhhhhh...,hhhhhhhh] CR
Parameter description	• Any number of OUT can be selected from 12 OUTs to output their measured values. • iiiiiiiiiii: Sequence of numbers specifying 1 (output) or 0 (no output) for each OUT (Example when OUT02 and OUT05 are specified: 010010000000) • hhhhhhhh: Measured value format
Error code	• Err-62: All OUTs are specified with 0. • Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Measured value output (ALL)

Incoming command	MA CR
Response command	MA,hhhhhhhh[,hhhhhhhh...,hhhhhhhh] CR
Parameter description	• The measured values for all OUT Nos. being used are output according to "Active OUT count" in the Environment settings. (Example: When the "active OUT count" is four, the measured values for OUT01 to OUT04 are output.) • hhhhhhhh: Measured value format
Error code	-

■ Timing ON/OFF (single)

Incoming command	TS,p,aa CR
Response command	TS,p,aa CR
Parameter description	• p: ON/OFF setting (0: OFF, 1: ON) • aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12)
Error code	• Err-62: Synchronized OUT was specified. • Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Timing ON/OFF (multiple)

Incoming command	TM,p,iiiiiiiiiiii CR
Response command	TM,p,iiiiiiiiiiii CR
Parameter description	• p: ON/OFF setting (0: OFF, 1: ON) • iiiiiiiiiii: Sequence of numbers specifying 1 (output) or 0 (no output) for each OUT (Example when OUT02 and OUT05 are specified: 010010000000)
Error code	• Err-62: Synchronized OUT was specified. • Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Timing ON/OFF (synchronous)

Incoming command	TP CR
Response command	TP CR
Parameter description	• This command is applied to all of the synchronized OUT. • p: ON/OFF setting (0: OFF, 1: ON)
Error code	Err-62: Synchronized OUT does not exist.

■ Auto-zero ON (single)

Incoming command	VS,aa CR
Response command	VS,aa CR
Parameter description	aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Auto-zero ON (multiple)

Incoming command	VM,iiiiiiiiiiii CR
Response command	VM,iiiiiiiiiiii CR
Parameter description	iiiiiiiiiii: Sequence of numbers specifying 1 (output) or 0 (no output) for each OUT (Example when OUT02 and OUT05 are specified: 010010000000)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Auto-zero ON (synchronous)

Incoming command	VA CR
Response command	VA CR
Parameter description	This command is applied to all of the synchronized OUT.
Error code	Err-62: Synchronized OUT does not exist.

■ Auto-zero OFF (single)

Incoming command	WS,aa CR
Response command	WS,aa CR
Parameter description	aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Auto-zero OFF (multiple)

Incoming command	WM,iiiiiiiiiiii CR
Response command	WM,iiiiiiiiiiii CR
Parameter description	iiiiiiiiiii: Sequence of numbers specifying 1 (output) or 0 (no output) for each OUT (Example when OUT02 and OUT05 are specified: 010010000000)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Auto-zero OFF (synchronous)

Incoming command	WA CR
Response command	WA CR
Parameter description	This command is applied to all of the synchronized OUT channels.
Error code	Err-62: Synchronized OUT does not exist.

■ Reset (single)

Incoming command	DS,aa CR
Response command	DS CR
Parameter description	aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Reset (multiple)

Incoming command	DM,iiiiiiiiiiii CR
Response command	DM CR
Parameter description	iiiiiiiiiii: Sequence of numbers specifying 1 (output) or 0 (no output) for each OUT (Example when OUT02 and OUT05 are specified: 010010000000)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Reset (synchronous)

Incoming command	DA CR
Response command	DA CR
Parameter description	This command is applied to all of the synchronized OUT channels.
Error code	Err-62: Synchronized OUT does not exist.

■ Panel lock

Incoming command	KL,p CR
Response command	KL CR
Parameter description	p: ON/OFF setting (0: OFF, 1: ON)
Error code	Err-62: The specified parameter is out of the parameter definition.

■ Program switching

Incoming command	PW,o CR
Response command	PW CR
Parameter description	o: Program No. (0 to 7)
Error code	Err-62: The specified parameter is out of the parameter definition.

■ Program confirmation

Incoming command	PR CR
Response command	PR,o CR
Parameter description	o: Program No. (0 to 7)
Error code	Err-51: Status error

■ Data storage start

Incoming command	AS CR
Response command	AS CR
Parameter description	-
Error code	Err-51: The command was executed in a mode other than the Run mode.

■ Data storage stop

Incoming command	AP CR
Response command	AP CR
Parameter description	-
Error code	Err-51: Status error

■ Data storage initialization

Incoming command	AQ CR
Response command	AQ CR
Parameter description	-
Error code	Err-51: Status error

■ Data storage data output

Incoming command	AO,aa CR
Response command	AO,hhhhhhhh...,hhhhhhhh CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • hhhhhhhh: Measured value format
Error code	Err-51: The specified OUT was not the OUT for which data is stored.

■ Data storage status output

Incoming command	AN CR
Response command	AN,s,ddddddd[,ddddddd...ddddddd] CR
Parameter description	• s: Storage status (0: Data storage stopped, 1: Data being stored) • ddddddd: Number of actually stored data (1200000 max. depending on the number of specified OUT). As many values are output as the number of OUT being used in the order of OUT01, OUT02, etc.
Error code	-

Setting change command

The following subsections include details about the incoming commands and details about the response commands that are sent after the incoming commands are processed properly.
Refer to "Outline of the command format" (page 5-5) for the error response commands and refer to "Timing diagrams" (page 5-35) for the response delay time.

▶NOTE

These commands are accepted only when the controller is in the "Communication mode".

■ Measurement display switching

Incoming command	DC,bb,bb CR
Response command	DC CR
Parameter description	bb: OUT No. to display data (01: OUT01, 02: OUT02,...12: OUT12, 00: No display) Values should be specified in the order of the upper window and lower window.
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Tolerance setting

Incoming command	SW,LM,aa,fffffff,fffffff,fffffff CR
Response command	SW,LM CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • fffffff: Setting value format (Effective digits: 6). Values should be specified in the order of the upper limit, lower limit, and hysteresis. The most significant digit for the hysteresis is not a sign but 0.
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

Head settings

■ ABLE

Incoming command	SW,HA,M,qq,m CR
Response command	SW,HA CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • m: Mode (0: AUTO, 1: MANUAL)
Error code	Err-64: A head No. which exceeds the active head count was specified.

■ ABLE control range

Incoming command	SW,HA,R,qq,xx,xx CR
Response command	SW,HA CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • xx: Control range data (01 to 99). Values should be specified in the order of the upper limit and lower limit.
Error code	• Err-62: The condition of "Upper limit ≥ Lower limit" was not satisfied. • Err-64: A head No. which exceeds the active head count was specified.

■ Measurement mode

Incoming command	SW,HB,M,qq,c CR
Response command	SW,HB CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: Normal, 1: Translucent object, 2: Transparent object, 3: Transparent object 2, 4: Semi opaque)
Error code	• Err-62: "c" is out of range. • Err-64: A head No. which exceeds the active head count was specified.

■ Base point

Incoming command	SW,HB,B,qq,c CR
Response command	SW,HB CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: NEAR, 1: FAR)
Error code	• Err-62: "c" is out of range. • Err-64: A head No. which exceeds the active head count was specified.

■ Alarm handling

Incoming command	SW,HC,N,qq,nnnn,nnnn CR
Response command	SW,HC CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • nnnn: Numerical value without a sign (0000 to 9999). Values should be specified in the order of the process count and recovery count.
Error code	• Err-62: "nnnn" is out of range. • Err-64: A head No. which exceeds the active head count was specified.

■ Alarm level

Incoming command	SW,HC,L,qq,c CR
Response command	SW,HC CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Alarm level (0 to 9)
Error code	• Err-62: "c" is out of range. • Err-64: A head No. which exceeds the active head count was specified.

■ ABLE calibration start

Incoming command	SW,HD,S,qq CR
Response command	SW,HD CR
Parameter description	qq: Head No. (Numerical value from 01 to 12)
Error code	• Err-51: Unconnected sensor head was specified for the ABLE calibration. • Err-64: A head No. which exceeds the active head count was specified.

■ ABLE calibration finish

Incoming command	SW,HD,P CR
Response command	SW,HD CR
Parameter description	-
Error code	Err-51: The command was executed when the ABLE calibration was not being performed.

■ ABLE calibration stop

Incoming command	SW,HD,C CR
Response command	SW,HD CR
Parameter description	The sensor head being calibrated is automatically specified.
Error code	Err-51: The command was executed when the ABLE calibration was not being performed.

■ Mounting mode

Incoming command	SW,HE,qq,c CR
Response command	SW,HE CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: Diffuse reflection, 1: Specular reflection)
Error code	• Err-62: "c" is out of range. • Err-64: A head No. which exceeds the active head count was specified.

■ Mask setting

Incoming command	SW,HF,qq,c,fffffff,fffffff CR
Response command	SW,HF CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: OFF, 1: ON) • fffffff: Setting value format (Effective digits: 6). Values should be specified in the order of point 1 and point 2.
Error code	• Err-62: "c" or "fffffff" is out of range. • Err-64: A head No. which exceeds the active head count was specified.

■ Median

Incoming command	SW,HG,qq,c CR
Response command	SW,HG CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: OFF, 1: 7-point, 2: 15-point, 3: 31-point)
Error code	• Err-62: "c" is out of range. • Err-64: A head No. which exceeds the active head count was specified.

■ LASER CTRL group

Incoming command	SW,HH,qq,c CR
Response command	SW,HH,qq CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: LASER_CTRL1, 1: LASER_CTRL2)
Error code	• Err-62: "c" is out of range. • Err-64: A head No. which exceeds the active head count was specified.

■ Range setting

Incoming command	SW,HI,qq,c CR
Response command	SW,HI CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: CENTER, 1: FAR)
Error code	• Err-62: "c" is out of range. • Err-64: A head No. which exceeds the active head count was specified.

■ Mutual interference prevention group

Incoming command	SW,HJ,qq,c CR
Response command	SW,HJ CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: OFF, 1: AB-ON, 2: ABC-ON)
Error code	• Err-62: "c" is out of range. • Err-64: A head No. which exceeds the active head count was specified.

OUT settings

■ Calculation method

Incoming command	SW,OA,H,aa,ggg CR
Response command	SW,OA,aa CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • ggg: Head No. (H01 to H12) or OUT No. (O01 to O12), Calculation method (C01: ADD, C02: SUB, C03: AVE, C04: MAX, C05: MIN, C06: P-P)
Error code	• Err-64: An OUT No. which exceeds the active OUT count was specified. • Err-66: "ggg" does not conform to the specification described in the setting list.

■ Surface to be measured

Incoming command	SW,OA,T,aa,c CR
Response command	SW,OA,aa CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. (0: 1, 1: 2, 2: 3, 3: 4, 4: 1-2, 5: 1-3, 6: 1-4, 7: 2-3, 8: 2-4, 9: 3-4)
Error code	• Err-62: "c" is out of range. • Err-64: An OUT No. which exceeds the active OUT count was specified.

■ OUT to be calculated (ADD, SUB)

Incoming command	SW,OA,C,aa,jj,jj CR
Response command	SW,OA,aa CR
Parameter description	• The specified values are retained even after the "calculation method" is changed. • aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • jj: OUT to be calculated (Numerical value from 01 to 12). When the calculation is "OUT01 + OUT02", for example, these two "jj" values will be "01" and "02".
Error code	• Err-64: An OUT No. which exceeds the active OUT count was specified.

■ OUT to be calculated (AVE, MAX, MIN, P-P)

Incoming command	SW,OA,M,aa,iiiiiiiiiiii CR
Response command	SW,OA,aa CR
Parameter description	• This command is used when the selected calculation method is "AVE", "MAX", "MIN", or "P-P". • The specified values are retained even after the "calculation method" is changed. • iiiiiiiiiii: Format used to specify multiple OUT, HEAD, or analog output channel options. This is a sequence of numbers specifying 1 (output) or 0 (no output) for each OUT, HEAD, or analog output channel (Example when OUT02 and OUT05 are specified: 010010000000) • aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12)
Error code	• Err-64: An OUT No. which exceeds the active OUT count was specified. • Err-66: "iiiiiiiiiii" does not conform to the specification described in the setting list.

■ Scaling

Incoming command	SW,OB,aa,fffffff,fffffff,fffffff,fffffff CR
Response command	SW,OB CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • fffffff: Setting value format (Effective digits: 6). Values should be specified in the order of the measured value for point 1 (input value), displayed value for point 1, measured value for point 2 (input value), and displayed value for point 2.
Error code	• Err-64: An OUT No. which exceeds the active OUT count was specified. • Err-68: "fffffff" does not conform to the specification in the setting list.

■ Filter

Incoming command	SW,OC,aa,c,c CR
Response command	SW,OC CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. First c: Filter mode (0: Averaging, 1: Low-pass filter, 2: High-pass filter) Second c: Function No. for the filter mode selected with the first c (0: Averaging 1 time or 3000 Hz, 1: Averaging 4 times or 1000 Hz, 2: Averaging 16 times or 300 Hz, 3: Averaging 64 times or 100 Hz, 4: Averaging 256 times or 30 Hz, 5: Averaging 1024 times or 10 Hz, 6: Averaging 4096 times or 3 Hz, 7: Averaging 16384 times or 1 Hz, 8: Averaging 65536 times or 0.3 Hz, 9: Averaging 262144 times or 0.1 Hz)
Error code	• Err-62: "c" is out of range. • Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Measurement (Hold) mode

Incoming command	SW,OD,aa,c CR
Response command	SW,OD CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. (0: Normal, 1: Peak hold, 2: Bottom hold, 3: Peak-to-peak hold, 4: Sample hold, 5: Average hold)
Error code	• Err-62: "c" is out of range. • Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Trigger mode

Incoming command	SW,OE,M,aa,c CR
Response command	SW,OE CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. (0: Trigger 1, 1: Trigger 2)
Error code	• Err-62: "c" is out of range. • Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Offset

Incoming command	SW,OF,aa,fffffff CR
Response command	SW,OF CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • fffffff: Setting value format (Effective digits: 6)
Error code	• Err-62: "fffffff" is out of range. • Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Minimum display unit

Incoming command	SW,OG,aa,c CR
Response command	SW,OG CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. When "Displacement" is selected for the measurement type (0: 0.01 mm, 1: 0.001 mm, 2: 0.0001 mm, 3: 0.00001 mm, 4: 0.1 µm, 5: 0.01 µm, 6: 0.001 µm) When "Velocity" is selected for the measurement type (0: 0.1 m/s, 1: 0.01 m/s, 2: 0.001 m/s, 3: 0.1 mm/s, 4: 0.01 mm/s, 5: 0.001 mm/s, 6: 0.0001 mm/s) When "Acceleration" is selected for the measurement type (0: 0.1 km/s^2, 1: 0.01 km/s^2, 2: 0.001 km/s^2, 3: 0.1 m/s^2, 4: 0.01 m/s^2, 5: 0.001 m/s^2, 6: 0.0001 m/s^2)
Error code	• Err-62: "c" is out of range. • Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Analog output scaling

Incoming command	SW,OH,aa,fffffff,fffffff,fffffff,fffffff CR
Response command	SW,OH CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • fffffff: Setting value format (Effective digits: 6). Values should be specified in the order of the measured value for point 1, output value for point 1, measured value for point 2, and output value for point 2.
Error code	• Err-64: An OUT No. which exceeds the active OUT count was specified. • Err-69: "fffffff" does not conform to the specification in the setting list.

■ Measurement type

Incoming command	SW,OI,aa,c CR
Response command	SW,OI CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. (0: Displacement, 1: Velocity, 2: Acceleration)
Error code	• Err-62: "c" is out of range. • Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Synchronization setting

Incoming command	SW,OJ,aa,c CR
Response command	SW,OJ CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. (0: OFF, 1: ON)
Error code	• Err-62: "c" is out of range. • Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Storage (OUT No. specification)

Incoming command	SW,OK,aa,c CR
Response command	SW,OK CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. (0: OFF, 1: ON)
Error code	• Err-62: "c" is out of range. • Err-64: An OUT No. which exceeds the active OUT count was specified.

Common settings

■ Sampling cycle

Incoming command	SW,CA,c CR
Response command	SW,CA CR
Parameter description	c: Function No. (0: 2.55 µs, 1: 5 µs, 2: 10 µs, 3: 20 µs, 4: 50 µs, 5: 100 µs, 6: 200 µs, 7: 500 µs, 8: 1000 µs)
Error code	Err-62: "c" is out of range.

■ Mutual interference prevention

Incoming command	SW,CB,c CR
Response command	SW,CB CR
Parameter description	c: Function No. (0: OFF, 1: AB-ON, 2: ABC-ON)
Error code	Err-62: "c" is out of range.

■ Comparator output form

Incoming command	SW,CD,c CR
Response command	SW,CD CR
Parameter description	c: Function No. (0: Normal, 1: Hold, 2: Off-delay)
Error code	Err-62: "c" is out of range.

■ Strobe time

Incoming command	SW,CE,c CR
Response command	SW,CE CR
Parameter description	c: Function No. (0: 2 ms, 1: 5 ms, 2: 10 ms, 3: 20 ms)
Error code	Err-62: "c" is out of range.

■ Data storage

Incoming command	SW,CF,ddddddd,ll CR
Response command	SW,CF CR
Parameter description	• ddddddd: Number of data to be stored (0000000 to 1200000) • ll: Storage cycle (0: 1x, 1: 2x, 2: 5x, 3: 10x, 4: 20x, 5: 50x, 6: 100x, 7: 200x, 8: 500x, 9: 1000x, 10: Synchronous input)
Error code	Err-62: "ddddddd" or "ll" is out of range.

■ Analog output channel

Incoming command	SW,CG,ee,bb CR
Response command	SW,CG CR
Parameter description	• ee: Analog output channel No. (Numerical value from 01 to 12) • bb: OUT No. to output data (01: OUT01, 02: OUT02,...12: OUT12, 00: No output)
Error code	• Err-62: "ee" exceeds the active analog output channel count. • Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Alarm output type

Incoming command	SW,CH,c CR
Response command	SW,CH CR
Parameter description	c: Function No. (0: System alarm, 1: Measured value alarm, 2: Both)
Error code	Err-62: "c" is out of range.

Environment settings

■ Active OUT count

Incoming command	SW,EE,yy CR
Response command	SW,EE CR
Parameter description	yy: Active OUT/head count (02 to 12)
Error code	Err-62: "yy" is out of range.

■ Active head count

Incoming command	SW,EF,yy CR
Response command	SW,EF CR
Parameter description	yy: Active OUT/head count (02 to 12)
Error code	Err-62: "yy" is out of range.

■ Active analog output channel count

Incoming command	SW,EG,yy CR
Response command	SW,EG CR
Parameter description	yy: Active OUT/head count (02 to 12)
Error code	Err-62: "yy" is out of range.

■ IP address

Incoming command	SW,EH,I,zzzzzzzzzzzz CR
Response command	SW,EH CR
Parameter description	zzzzzzzzzzzz: IP address (Numerical values of zzz.zzz.zzz.zzz) Example: When the IP address is 10.10.1.9, specify "010010001009".
Error code	Err-62: "zzzzzzzzzzzz" is out of range.

■ Subnet mask

Incoming command	SW,EH,M,zzzzzzzzzzzz CR
Response command	SW,EH CR
Parameter description	zzzzzzzzzzzz: Subnet mask (Numerical values of zzz.zzz.zzz.zzz) Example: When the subnet mask is 255.255.0.0, specify "255255000000".
Error code	Err-62: "zzzzzzzzzzzz" is out of range.

■ Default gateway

Incoming command	SW,EH,G,zzzzzzzzzzzz CR
Response command	SW,EH CR
Parameter description	zzzzzzzzzzzz: IP address of default gateway (Numerical values of zzz.zzz.zzz.zzz) Example: When the IP address is 10.10.1.9, specify "010010001009".
Error code	Err-62: "zzzzzzzzzzzz" is out of range.

Setting confirmation command format

This section describes the format for the commands used to confirm the setting.

▶NOTE

These commands are accepted only when the controller is in the "Communication mode".

- The setting value format is returned including a decimal point.
- Refer to "Setting change command" (page 5-14) for details about each command.

■ Measurement display confirmation

Incoming command	DR CR
Response command	DR,bb,bb CR
Parameter description	bb: OUT No. to display/output data (01: OUT01, 02: OUT02,...12: OUT12, 00: No display/output). Values are returned in the order of the upper window and lower window.
Error code	-

■ Tolerance setting

Incoming command	SR,LM,aa CR
Response command	SR,LM,aa,ffffffff,ffffffff,ffffffff CR
Parameter description	• aa: OUT (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • ffffffff: Setting value format (Effective digits: 6). Values are returned in the order of the upper limit, lower limit, and hysteresis.
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

Head settings

■ ABLE

Incoming command	SR,HA,M,qq CR
Response command	SR,HA,M,qq,m CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • m: Mode (0: AUTO, 1: MANUAL)
Error code	Err-64: A head No. which exceeds the active head count was specified.

■ ABLE control range

Incoming command	SR,HA,R,qq CR
Response command	SR,HA,R,qq,xx,xx CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • xx: Control range data (01 to 99). Values are returned in the order of the upper limit and lower limit.
Error code	Err-64: A head No. which exceeds the active head count was specified.

■ Measurement mode

Incoming command	SR,HB,M,qq CR
Response command	SR,HB,M,qq,c CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: Normal, 1: Translucent object, 2: Transparent object, 3: Transparent object 2, 4: Semi opaque)
Error code	Err-64: A head No. which exceeds the active head count was specified.

■ Base point

Incoming command	SR,HB,B,qq CR
Response command	SR,HB,B,qq,c CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: NEAR, 1: FAR)
Error code	Err-64: A head No. which exceeds the active head count was specified.

■ Alarm handling

Incoming command	SR,HC,N,qq CR
Response command	SR,HC,N,qq,nnnn,nnnn CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • nnnn: Numerical value without a sign (0000 to 9999). Values are returned in the order of the process count and recovery count.
Error code	Err-64: A head No. which exceeds the active head count was specified.

■ Alarm level

Incoming command	SR,HC,L,qq CR
Response command	SR,HC,L,qq,c CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0 to 9)
Error code	Err-64: A head No. which exceeds the active head count was specified.

■ Mounting mode

Incoming command	SR,HE,qq CR
Response command	SR,HE,qq,c CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: Diffuse reflection, 1: Specular reflection)
Error code	Err-64: A head No. which exceeds the active head count was specified.

■ Mask setting

Incoming command	SR,HF,qq,c CR
Response command	SR,HF,qq,c,fffffff,fffffff CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: OFF, 1: ON) • fffffff: Setting value format (Effective digits: 6). Values are returned in the order of point 1 and point 2.
Error code	• Err-62: "c" is out of range. • Err-64: A head No. which exceeds the active head count was specified.

■ Median

Incoming command	SR,HG,qq CR
Response command	SR,HG,qq,c CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: OFF, 1: 7-point, 2: 15-point, 3: 31-point)
Error code	Err-64: A head No. which exceeds the active head count was specified.

■ LASER CTRL group

Incoming command	SR,HH,qq CR
Response command	SR,HH,qq,c CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: LASER CTRL1, 1: LASER CTRL2)
Error code	Err-64: A head No. which exceeds the active head count was specified.

■ Range setting

Incoming command	SR,HI,qq CR
Response command	SR,HI,qq,c CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: CENTER, 1: FAR)
Error code	Err-64: A head No. which exceeds the active head count was specified.

■ Mutual interference prevention group

Incoming command	SR,HJ,qq CR
Response command	SR,HJ,qq,c CR
Parameter description	• qq: Head No. (Numerical value from 01 to 12) • c: Function No. (0: OFF, 1: AB-ON, 2: ABC-ON)
Error code	Err-64: A head No. which exceeds the active head count was specified.

OUT settings

■ Calculation method

Incoming command	SR,OA,H,aa CR
Response command	SR,OA,H,aa,ggg CR
Parameter description	• aa: OUT/analog output channel No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • ggg: Head No. (H01 to H12) or OUT No. (O01 to O12), Calculation method (C01: ADD, C02: SUB, C03: AVE, C04: MAX, C05: MIN, C06: P-P)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Surface to be measured

Incoming command	SR,OA,T,aa CR
Response command	SR,OA,T,aa,c CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. (0: 1, 1: 2, 2: 3, 3: 4, 4: 1-2, 5: 1-3, 6: 1-4, 7: 2-3, 8: 2-4, 9: 3-4)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ OUT to be calculated (Add, Sub)

Incoming command	SR,OA,C,aa CR
Response command	SR,OA,C,aa,jj,jj CR
Parameter description	• The specified values are retained even after the "calculation method" is changed. • aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • jj: OUT to be calculated (Numerical value from 01 to 12). When the calculation is "OUT01 + OUT02", for example, these two "jj" values will be "01" and "02".
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ OUT to be calculated (AVE, MAX, MIN, P-P)

Incoming command	SR,OA,M,aa CR
Response command	SR,OA,M,aa,iiiiiiiiiii CR
Parameter description	• The specified values are retained even after the "calculation method" is changed. • aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • iiiiiiiiii: Format used to specify multiple OUT or HEAD.
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Scaling

Incoming command	SR,OB,aa CR
Response command	SR,OB,aa,fffffff,fffffff,fffffff,fffffff CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • fffffff: Setting value format (Effective digits: 6). Values are returned in the order of the measured value for point 1 (input value), displayed value for point 1, measured value for point 2 (input value), and displayed value for point 2.
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Filter

Incoming command	SR,OC,aa CR
Response command	SR,OC,aa,c,c CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. First c: Filter mode (0: Averaging, 1: Low-pass filter, 2: High-pass filter) Second c: Function No. for the filter mode selected with the first c (0: Averaging 1 time or 3000 Hz, 1: Averaging 4 times or 1000 Hz, 2: Averaging 16 times or 300 Hz, 3: Averaging 64 times or 100Hz, 4: Averaging 256 times or 30Hz, 5: Averaging 1024 times or 10Hz, 6: Averaging 4096 times or 3 Hz, 7: Averaging 16384 times or 1 Hz, 8: Averaging 65536 times or 0.3 Hz, 9: Averaging 262144 times or 0.1 Hz)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Measurement mode

Incoming command	SR,OD,aa CR
Response command	SR,OD,aa,c CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. (0: Normal, 1: Peak hold, 2: Bottom hold, 3: Peak-to-peak hold, 4: Sample hold, 5: Average hold)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Trigger mode

Incoming command	SR,OE,M,aa CR
Response command	SR,OE,M,aa,c CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. (0: Trigger 1, 1: Trigger 2)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Offset

Incoming command	SR,OF,aa CR
Response command	SR,OF,aa,fffffff CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • ffffff: Setting value format (Effective digits: 6)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Minimum display unit

Incoming command	SR,OG,aa CR
Response command	SR,OG,aa,c CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. When "Displacement" is selected for the measurement type (0: 0.01 mm, 1: 0.001 mm, 2: 0.0001 mm, 3: 0.00001 mm, 4: 0.1 µm, 5: 0.01 µm, 6: 0.001 µm) When "Velocity" is selected for the measurement type (0: 0.1 m/s, 1: 0.01 m/s, 2: 0.001 m/s, 3: 0.1 mm/s, 4: 0.01 mm/s, 5: 0.001 mm/s, 6: 0.0001 mm/s) When "Acceleration" is selected for the measurement type (0: 0.1 km/s^2, 1: 0.01 km/s^2, 2: 0.001 km/s^2, 3: 0.1 m/s^2, 4: 0.01 m/s^2, 5: 0.001 m/s^2, 6: 0.0001 m/s^2)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Analog output scaling

Incoming command	SR,OH,aa CR
Response command	SR,OH,aa,fffffff,fffffff,fffffff,fffffff CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • ffffff: Setting value format (Effective digits: 6). Values are returned in the order of the measured value for point 1, output value for point 1, measured value for point 2, and output value for point 2.
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Measurement type

Incoming command	SR,OI,aa CR
Response command	SR,OI,aa,c CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. (0: Displacement, 1: Velocity, 2: Acceleration)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Synchronization setting

Incoming command	SR,OJ,aa CR
Response command	SR,OJ,aa,c CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. (0: OFF, 1: ON)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

■ Storage (OUT No. setting)

Incoming command	SR,OK,aa CR
Response command	SR,OK,aa,c CR
Parameter description	• aa: OUT No. (Numerical value from 01 to 12, 01: OUT1, 02: OUT02,...12: OUT12) • c: Function No. (0: OFF, 1: ON)
Error code	Err-64: An OUT No. which exceeds the active OUT count was specified.

Common settings

■ Sampling cycle

Incoming command	SR,CA CR
Response command	SR,CA,c CR
Parameter description	c: Function No. (0: 2.55 µs, 1: 5 µs, 2: 10 µs, 3: 20 µs, 4: 50 µs, 5: 100 µs, 6: 200 µs, 7: 500 µs, 8: 1000 µs)
Error code	-

■ Mutual interference prevention

Incoming command	SR,CB CR
Response command	SR,CB,c CR
Parameter description	c: Function No. (0: OFF, 1: AB-ON, 2: ABC-ON)
Error code	-

■ Comparator output form

Incoming command	SR,CD CR
Response command	SR,CD,c CR
Parameter description	c: Function No. (0: Normal, 1: Hold, 2: Off-delay)
Error code	-

■ Strobe time

Incoming command	SR,CE CR
Response command	SR,CE,c CR
Parameter description	c: Function No. (0: 2 ms, 1: 5 ms, 2: 10 ms, 3: 20 ms)
Error code	-

■ Data storage

Incoming command	SR,CF CR
Response command	SR,CF,ddddddd,ll CR
Parameter description	• ddddddd: Number of data to be stored (0000000 to 1200000) • ll: Storage cycle (0: 1x, 1: 2x, 2: 5x, 3: 10x, 4: 20x, 5: 50x, 6: 100x, 7: 200x, 8: 500x, 9: 1000x, 10: Synchronous input)
Error code	-

■ Analog output channel

Incoming command	SR,CG,ee CR
Response command	SR,CG,ee,bb CR
Parameter description	• ee: Analog output channel No. (Numerical value from 01 to 12) • bb: OUT No. to output data (01: OUT01, 02: OUT02,...12: OUT12)
Error code	Err-69: "ee" exceeds the active analog output channel count.

■ Alarm output type

Incoming command	SR,CB CR
Response command	SR,CH,c CR
Parameter description	c: Function No. (0: System alarm, 1: Measured value alarm, 2: Both)
Error code	-

Environment settings

■ Active OUT count

Incoming command	SR,EE CR
Response command	SR,EE,yy CR
Parameter description	yy: Active OUT/head/analog output channel count (02 to 12)
Error code	-

■ Active head count

Incoming command	SR,EF CR
Response command	SR,EF,yy CR
Parameter description	yy: Active OUT/head/analog output channel count (02 to 12)
Error code	-

■ Active analog output channel count

Incoming command	SR,EG CR
Response command	SR,EE,yy CR
Parameter description	yy: Active OUT/head/analog output channel count (02 to 12)
Error code	-

■ IP address

Incoming command	SR,EH,I CR
Response command	SR,EH,I,zzzzzzzzzzzz CR
Parameter description	zzzzzzzzzzzz: IP address (Numerical values of zzz.zzz.zzz.zzz) Example: When the IP address is 10.10.1.9, specify "010010001009".
Error code	-

■ Subnet mask

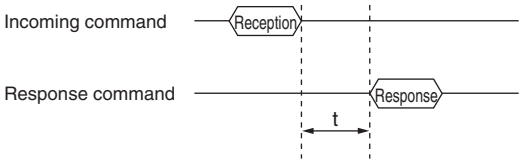
Incoming command	SR,EH,M CR
Response command	SR,EH,M,zzzzzzzzzzzz CR
Parameter description	zzzzzzzzzzzz: Subnet mask (Numerical values of zzz.zzz.zzz.zzz) Example: When the subnet mask is 255.255.0.0, specify "255255000000".
Error code	-

■ Default gateway

Incoming command	SR,EH,G CR
Response command	SR,EH,G,zzzzzzzzzzzz CR
Parameter description	zzzzzzzzzzzz: IP address of default gateway (Numerical values of zzz.zzz.zzz.zzz) Example: When the IP address is 10.10.1.9, specify "010010001009".
Error code	-

Timing diagrams

The timing diagram of the incoming and response commands is as follows.



The following table describes time t for each command.

Command		t
Measurement/control	PW	100 ms + Number of head expansion units x 100 ms
Setting/confirmation	SW,HD,S	600 ms + Number of head expansion units x 750 ms
	SW,HD,P	100 ms + Number of head expansion units x 10 ms
	SW,HD,C	100 ms + Number of head expansion units x 20 ms
	SW,EE	100 ms
	SW,EF	100 ms
Mode change	Q0	5 ms + Number of head expansion units x 10 ms
	R0	600 ms + Number of head expansion units x 750 ms
Other		5 ms

Reference

The response speed becomes slower than the figures in the table during communication with the LK-Navigator 2 setup support software or when the expansion unit is connected.

Data Storage Function

This section describes the data storage function using the RS-232C interface.

Reference

- For details on the data storage function, refer to page 2-11.
- For the procedure of operating the data storage function with LK-Navigator2, refer to LK-Navigator2 User's Manual.

Environmental settings

Item	Setting value	Remark
Baud rate	9600/19200/38400/57600/115200bps	The settings depend on the external device connected.
Parity	None/Even/Odd	

Command input/output procedure

The procedure for storing and reading measurement data is described below.

Reference

- The "data storage setting" and "storage (OUT)" commands can be received only when the controller is set in "Communication mode".
- The "data storage start", "data storage stop" and "data storage/data output" commands can be received only when the controller is set in "General mode".
- For switching between the "General mode" and the "Communication mode", refer to "Mode change command" (page 5-7) in this manual.
- Timing signal input methods are as described below.

Input method	Reference page
External terminal input (TIMING1) Input via RS-232C interface Input from dedicated touch panel LK-HD1000	page 4-2 page 5-9 LK-HD1000 User's Manual

■ **When the storage cycle is other than "Synchronization input"**

1. Specify the number of storage points and the storage cycle with the "data storage setting" command. (page 5-22)
2. Specify an OUT to be stored to with the "storage (OUT)" command. (page 5-21)
3. Start data storage with the "data storage start" command. (page 5-12)
4. Stop data storage with the "data storage stop" command. (page 5-12)
5. Output stored data with the "data storage/data output" command. (page 5-12)

■ **When storage cycle is "Synchronization input"**

1. Select an OUT to be stored to in synchronization with synchronous input in "Synchronization setting". (page 5-21)
2. Specify the number of storage points and the storage cycle with the "data storage setting" command. The storage cycle is set in "Synchronization input". (page 5-22)
3. Specify an OUT to be stored to with the "storage (OUT)" command. (page 5-21)
4. Start data storage with the "data storage start" command. (page 5-12)
5. Input a synchronous signal.
6. Stop data storage with the "data storage stop" command. (page 5-12)
7. Output stored data with the "data storage/data output" command. (page 5-12)

Measured Value Output through External Synchronization

This section describes how to output the measured value through the RS-232C interface in synchronization with the measurement triggered by the signal from the input terminal (TIMING1 input). Since no incoming command is used, this method is useful when you only need to import the measured value or when the LK-G5000 Series is connected to a device that cannot send commands such as a data logger. The OUT terminals which output the measured values with this method are the synchronized OUT only.

Reference

Commands for measured value output and for changing settings can be used even when the measured values are being output through the external synchronization (when the external trigger input is not OFF).

▶NOTE

Do not attempt to determine the next measured value while the current measured value is being output through the RS-232C interface. That next measured value will not be output.

Environment settings parameters

Set the environment settings as follows (page 3-72).

Item	Setting value	Remark
Baud rate	9600/19200/38400/57600/115200 bps	Set the appropriate parameter according to the external device to be connected.
Parity	None/even/odd	
Automatic transmission	ON/OFF	Select ON or OFF according to the output type.

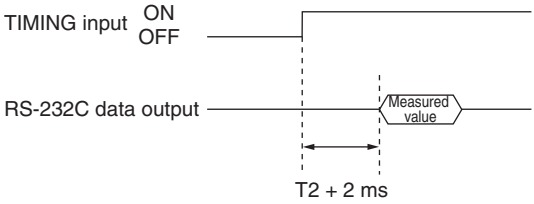
Output type

The measured value to be output is the value determined by the external synchronization (TIMING1 input).
The output is set as follows depending on the automatic transmission setting.

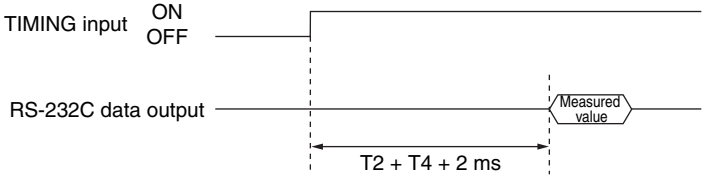
Automatic transmission	Output type
OFF	Disables the measured value output through the external synchronization.
ON	Enables the measured value output through the external synchronization.

Timing diagrams

■ **When the measurement mode is other than the sample hold (Trigger 2)**



■ **When the measurement mode is the sample hold (Trigger 2)**

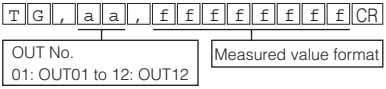


Reference

For details on T2 (input response time) and T4 (sampling period), refer to "Timing details" (page 4-27).

Output format

The following command format is used for the measured value output.
Regardless of the synchronization setting (synchronous/asynchronous), the measured value determined for each OUT No. is output in this format.



ASCII code table (Reference)

Low-order four bits \ High-order four bits	0	1	2	3	4	5	6	7
0	$^{N}U_{L}$	$^{D}L_{E}$	S_{P}	0	@	P	`	p
1	$^{S}O_{H}$	$^{D}C_{1}$	!	1	A	Q	a	q
2	$^{S}T_{X}$	$^{D}C_{2}$	”	2	B	R	b	r
3	$^{E}T_{X}$	$^{D}C_{3}$	#	3	C	S	c	s
4	$^{E}O_{T}$	$^{D}C_{4}$	$	4	D	T	d	t
5	$^{E}N_{Q}$	$^{N}A_{K}$	%	5	E	U	e	u
6	$^{A}C_{K}$	$^{S}Y_{N}$	&	6	F	V	f	v
7	$^{B}E_{L}$	$^{E}T_{B}$	'	7	G	W	g	w
8	B_{S}	$^{C}A_{N}$	(	8	H	X	h	x
9	H_{T}	E_{M}	)	9	I	Y	i	y
A	L_{F}	$^{S}U_{B}$	*	:	J	Z	j	z
B	V_{T}	$^{E}S_{C}$	+	;	K	[	k	{
C	F_{F}	→	,	<	L	¥	l	|
D	C_{R}	←	-	=	M	]	m	}
E	S_{O}	↑	.	>	N	^	n	~
F	S_{I}	↓	/	?	O	_	o	D_{T}

Specifications

6

This chapter includes the specifications of the controller and sensor head, the outer dimensions, and the characteristics such as the beam spot diameter.

Specifications 6-2

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Specifications

Controller

Model	Single unit type	LK-G5001V	LK-G5001PV	LK-HA100
	Separate type	LK-G5001/ LK-HD500	LK-G5001P/ LK-HD500	
Designation		Main controller		Head expansion unit
Sensor head compatibility		Compatible		
No. of connectable sensor heads		2		1
Display (LK-HD500)	Minimum display unit	0.001 µm		N/A
	Display range	±999.999 µm to ±9999.99 mm (7 settings selectable)		
	Display cycle	Approx. 10 times/sec.		
Display interface	DISPLAY port	Either the display unit (LK-HD500) or dedicated touch panel (LK-HD1001) can be connected		N/A
	LED indicator	LASER ON		POWER STABILITY BRIGHT DARK
Terminal block	Analog voltage output	±10 V output, Output impedance: 100 Ω		
	Analog current output	4 to 20 mA, Maximum load resistance: 350 Ω		
	No. of analog outputs	2		1
	TIMING1 input*1	Non-voltage input	Voltage input	N/A
	RESET1 input*1	Non-voltage input	Voltage input	
	Auto-zero1 input*1			
	Laser control input			
	Laser remote input*2	Non-voltage input		
	Alarm output	NPN open-collector output	PNP open-collector output	
	General comparator output			
Expansion connector	TIMING input	Non-voltage input	Voltage input	N/A
	RESET input	Non-voltage input	Voltage input	
	Auto-zero input			
	Program switch input			
	Binary selection input			
	Alarm output	NPN open-collector output	PNP open-collector output	
	Comparator output			
	Binary output			

Model	Single unit type	LK-G5001V	LK-G5001PV	LK-HA100
	Separate type	LK-G5001/ LK-HD500	LK-G5001P/ LK-HD500	
RS-232C interface		Baud rate: 9600 to 115200 bps Data length: 8 bits Stop bit length: 1 bit Parity: None/even/odd		N/A
USB interface		USB Revision 2.0 high speed compliant*3		
Ethernet interface*4		100Base-TX/10Base-T		
Head expansion unit connector		Up to 10 head expansion units can be connected to one main controller		
Expansion unit connector		Either of the CC-Link unit (LK-CC100) or DeviceNet unit (LK-DN100) can be connected		N/A
Power supply	Power supply voltage	24 VDC±10%		24 VDC±10% (Supplied from the controller)
	Maximum current consumption	3.5 A (when the maximum number of head expansion units are connected)		
Environment resistance	Ambient temperature	When one or less head expansion unit is connected: 0 to 50°C When two or more head expansion units are connected: 0 to 40°C		
	Relative humidity	35 to 85%RH (No condensation)		
Weight		600 g		300 g

*7 This input is applied to all of the synchronized OUT.

*8 When the laser class 3B sensor head is connected, a key-operated switch must be used for the input to this terminal. The laser is emitted only when the key-operated switch is set to the ON position. (Select a key which can be removed only when it is set to the OFF position.) When the laser class 1, 2/3R sensor head is connected, the laser turns on when this terminal is opened and turns off when it is short-circuited.

*9 When a PC supporting USB Revision 1.1 or USB Revision 2.0 full speed is connected, the data refresh cycle and other operations may slow down.

*10 The Ethernet connection should be used only for one-to-one connection with a PC or for local connection including only the PC and the LK-G5000 Series units.

- NPN open-collector output rating: 50 mA max. (40 V max.), Residual voltage: 0.5 V max.
- PNP open-collector output rating: 50 mA max. (30 V max.), Residual voltage: 0.5 V max.
- Non-voltage input rating: ON voltage: 1 V max., OFF current: 0.6 mA max.
- Voltage input rating: Maximum input rating: 26.4 V, ON voltage: 10.2 V, OFF current: 0.6 mA
- Parts of the input/output circuit of the LK-G5000 Series are internally common. Be careful that no potential difference is generated between the internally common terminals due to the potential difference between the cables/external devices. For details, refer to "Precautions on wiring" (page 7).

Sensor head

LK-H008/H008W

Model			LK-H008/ LK-H008W
Mounting mode			Specular reflection
Reference distance			8 mm
Measurement range*1			±0.5 mm
Light source			Red semiconductor laser
	Wavelength		655 nm
	Laser Class	IEC60825-1	Class II
		FDA(CDRH) Part 1040.10	Class 1
	Output		0.3 mW
Beam spot diameter (at reference distance)			ϕ20 µm 20 µm x 550 µm
Linearity*2			±0.05% of F.S. (F.S. = 1.0 mm)
Repeatability*3			0.005 µm (0.001 µm)
Sampling cycle			2.55/5/10/20/50/100/200/500/1000 µs (9 steps selectable)
Temperature fluctuation			0.02% of F.S./°C (F.S. = 1.0 mm)
Environment resistance	Enclosure rating		IP67
	Ambient light		Incandescent lamp or fluorescent lamp: 10000 lx max.
	Ambient temperature*4		0 to +50°C
	Relative humidity		35 to 85%RH (No condensation)
	Vibration		10 to 55 Hz, 1.5 mm double amplitude in X, Y, and Z directions, 2 hours respectively
Material			Aluminum die-cast
Weight (including cable)			Approx. 240 g

*1 Measurement range when the sampling cycle is 20 µs or more.
*2 This value is obtained when the KEYENCE standard target (metal mirror workpiece) is measured in the normal measurement mode.
*3 This value is obtained when the KEYENCE standard target (metal mirror workpiece) is measured at the reference distance with the number of averaging measurements set to 16384.
*4 When the ambient temperature rises to 40 °C or more, mount this on the metal plate for using.

LK-H020/H025/H023/H028/H022/H027/H022K/H027K

Model			LK-H020/ LK-H025	LK-H023/ LK-H028	LK-H022/ LK-H027	LK-H022K/ LK-H027K
Mounting mode			Diffuse reflection	Diffuse reflection	Diffuse reflection	Specular reflection
Reference distance			20 mm	20 mm	20 mm	16.1 mm
Measurement range*1			±3 mm	±3 mm	±3 mm	±2.8 mm
Light source			Red semiconductor laser			
	Wavelength		655 nm	690 nm	655 nm	655 nm
	Laser Class	IEC60825-1	Class 3R	Class 3B	Class 2	Class 2
		FDA(CDRH) Part 1040.10	Class IIIa	Class IIIb	Class II	Class II
	Output		4.8 mW	50 mW	0.95 mW	0.95 mW
Beam spot diameter (at reference distance)			ϕ25 µm (LK-H020/H023/H022/H022K)/ 25 µm x 1400 µm (LK-H025/H028/H027/H027K)			
Linearity*2			±0.02% of F.S. (F.S. = 6 mm)			
Repeatability*3			0.02 µm (0.01 µm)			
Sampling cycle			2.55/5/10/20/50/100/200/500/1000 µs (9 steps selectable)			
Temperature fluctuation			0.01% of F.S./°C (F.S. = 6 mm)			
Environment resistance	Enclosure rating		IP67			
	Ambient light		Incandescent lamp or fluorescent lamp: 10000 lx max.			
	Ambient temperature*4		0 to +50°C	0 to +45°C	0 to +50°C	
	Relative humidity		35 to 85%RH (No condensation)			
	Vibration		10 to 55 Hz, 1.5 mm double amplitude in X, Y, and Z directions, 2 hours respectively			
Material			Aluminum die-cast			
Weight (including cable)			Approx. 230 g			

*1 For details about the measurement range, refer to page 1-12 (for the sampling cycles between 2.55 and 10 µs).

*2 This value is obtained when the KEYENCE standard target (light-diffusive white object) is measured in the normal measurement mode.

*3 This value is obtained when the KEYENCE standard target (light-diffusive white object) is measured at the reference distance with the number of averaging measurements set to 16384.
The value in parentheses is a typical example of a measurement with the number of averaging measurements set to 65536.

*4 The LK-H023/H028 must be mounted on a metal plate when the ambient temperature rises to 40°C or more.

LK-H050/H055/H053/H058/H052/H057/H052K/H057K

Model			LK-H050/ LK-H055	LK-H053/ LK-H058	LK-H052/ LK-H057	LK-H052K/ LK-H057K
Mounting mode			Diffuse reflection	Diffuse reflection	Diffuse reflection	Specular reflection
Reference distance			50 mm	50 mm	50 mm	46.3 mm
Measurement range*1			±10 mm	±10 mm	±10 mm	±5.2 mm
Light source			Red semiconductor laser			
	Wavelength		655 nm	690 nm	655 nm	655 nm
	Laser Class	IEC60825-1	Class 3R	Class 3B	Class 2	Class 2
		FDA(CDRH) Part 1040.10	Class IIIa	Class IIIb	Class II	Class II
	Output		4.8 mW	50 mW	0.95 mW	0.95 mW
Beam spot diameter (at reference distance)			ϕ50 µm (LK-H050/H053/H052/H052K)/ 50 µm x 2000 µm (LK-H055/H058/H057/H057K)			
Linearity*2			±0.02% of F.S. (F.S. = 20 mm)			
Repeatability*3			0.025 µm			
Sampling cycle			2.55/5/10/20/50/100/200/500/1000 µs (9 steps selectable)			
Temperature fluctuation			0.01% of F.S./°C (F.S. = 20 mm)			
Environment resistance	Enclosure rating		IP67			
	Ambient light		Incandescent lamp or fluorescent lamp: 10000 lx max.			
	Ambient temperature		0 to +50°C			
	Relative humidity		35 to 85%RH (No condensation)			
	Vibration		10 to 55 Hz, 1.5 mm double amplitude in X, Y, and Z directions, 2 hours respectively			
Material			Aluminum die-cast			
Weight (including cable)			Approx. 260 g			

*1 For details about the measurement range, refer to page 1-13 (for the sampling cycles between 2.55 and 10 µs).

*2 This value is obtained when the KEYENCE standard target (light-diffusive white object) is measured in the normal measurement mode.

*3 This value is obtained when the KEYENCE standard target (light-diffusive white object) is measured at the reference distance with the number of averaging measurements set to 16384.

LK-H080/H085/H082/H087

Model			LK-H080/ LK-H085	LK-H082/ LK-H087
Mounting mode			Diffuse reflection	Diffuse reflection
Reference distance			80 mm	80 mm
Measurement range*1			±18 mm	±18 mm
Light source			Red semiconductor laser	
	Wavelength		655 nm	655 nm
	Laser Class	IEC60825-1	Class 3R	Class 2
		FDA(CDRH) Part 1040.10	Class IIIa	Class II
	Output		4.8 mW	0.95 mW
Beam spot diameter (at reference distance)			ϕ 70 µm (LK-H080/082) 70 µm x 2500 µm (LK-H085/087)	
Linearity*2			±0.02% of F.S. (F.S. = 36 mm)	
Repeatability*3			0.10 µm	
Sampling cycle			2.55/5/10/20/50/100/200/500/1000 µs (9 steps selectable)	
Temperature fluctuation			0.01% of F.S./°C (F.S. = 36 mm)	
Environment resistance	Enclosure rating		IP67	
	Ambient light		Incandescent lamp or fluorescent lamp: 10000 lx max.	
	Ambient temperature*4		0 to +50°C	
	Relative humidity		35 to 85%RH (No condensation)	
	Vibration		10 to 55 Hz, 1.5 mm double amplitude in X, Y, and Z directions, 2 hours respectively	
Material			Aluminum die-cast	
Weight (including cable)			Approx. 280 g	

*1 This measurement range is when the sampling cycle is over 20 µs.
*2 This value is obtained when the KEYENCE standard target (diffusive, white object) is measured whilst using the standard mode.
*3 This value is obtained when the KEYENCE standard target (light-diffusive white object) is measured at the reference distance with the number of averaging measurements set to 16384.
*4 Should the ambient temperature be above 40°C, a metal plate must be attached before use.

LK-H150/H155/H152/H157

Model			LK-H150/ LK-H155	LK-H152/ LK-H157
Mounting mode			Diffuse reflection	Diffuse reflection
Reference distance			150 mm	150 mm
Measurement range*1			±40 mm	±40 mm
Light source			Red semiconductor laser	
	Wavelength		655 nm	655 nm
	Laser Class	IEC60825-1	Class 3R	Class 2
		FDA(CDRH) Part 1040.10	Class IIIa	Class II
	Output		4.8 mW	0.95 mW
Beam spot diameter (at reference distance)			ϕ 120 µm (LK-H150/152) 120 µm x 4200 µm (LK-H155/157)	
Linearity*2			±0.02% of F.S. (F.S. = 80 mm)	
Repeatability*3			0.25 µm	
Sampling cycle			2.55/5/10/20/50/100/200/500/1000 µs (9 steps selectable)	
Temperature fluctuation			0.01% of F.S./°C (F.S. = 80 mm)	
Environment resistance	Enclosure rating		IP67	
	Ambient light		Incandescent lamp or fluorescent lamp: 10000 lx max.	Incandescent lamp or fluorescent lamp: 5000 lx max.
	Ambient temperature*4		0 to +50°C	
	Relative humidity		35 to 85%RH (No condensation)	
	Vibration		10 to 55 Hz, 1.5 mm double amplitude in X, Y, and Z directions, 2 hours respectively	
Material			Aluminum die-cast	
Weight (including cable)			Approx. 300 g	

*1 This measurement range is when the sampling cycle is over 20 µs.
*2 This value is obtained when the KEYENCE standard target (diffusive, white object) is measured whilst using the standard mode.
*3 This value is obtained when the KEYENCE standard target (light-diffusive white object) is measured at the reference distance with the number of averaging measurements set to 16384.
*4 Should the ambient temperature be above 40°C, a metal plate must be attached before use.

Expansion unit

LK-CC100 CC-Link unit

Model		LK-CC100
Designation		CC-Link communication unit dedicated to LK-G5000 Series
Network connection	Supported CC-Link*1 version	Ver. 1.10 (Extended cyclic setting: Single) Ver. 2.00 (Extended cyclic setting: Double or more)*2
	Master unit	CLPA-certified master unit (CC-Link Ver. 2.00/Ver. 1.10)
	No. of occupied stations	1 to 4
	Communication speed	156 kbps, 625 kbps, 2.5 Mbps, 5 Mbps, 10 Mbps
	Connecting cable	Dedicated CC-Link cable supporting Ver. 1.10 (Shielded 3-core twisted-pair cable: OP-79426, OP-79427)
	Maximum total cable extension length	156 kbps: 1200 m 625 kbps: 900 m 2.5 Mbps: 400 m 5 Mbps: 160 m 10 Mbps: 100 m
	Station type	Remote device station
Environment resistance	Ambient temperature	When one or less head expansion unit is connected: 0 to +50°C When two or more head expansion units are connected: 0 to +40°C
	Relative humidity	35 to 85%RH (No condensation)
Rated voltage		24 VDC±10% (supplied from controller)
Current consumption		200 mA max.
Weight		Approx. 300 g

*1 CC-Link is a registered trademark of Mitsubishi Electric Corporation.

*2 The LK-G5000 Series supports the "extended cyclic transmission" and "station-to-station cable length relaxation" of CC-Link Ver. 2.00.

LK-DN100 DeviceNet unit

Model		LK-DN100
Designation		DeviceNet communication unit dedicated to LK-G5000 Series
Network connection	Communication protocol	DeviceNet*1 compliant
	Master unit	ODVA-certified master unit
	Transmission speed	500 kbps, 250 kbps, 125 kbps
	Device type	Generic
	Transmission medium	Dedicated 5 cables (2 signal cables, 2 power supply cables, 1 shielding cable)
	Maximum trunk line cable length	Thick cable: 500 m (at transmission speed of 125 kbps) /250 m (at 250 kbps)/125 m (at 500 kbps) Thin cable: 100 m (at all transmission speed settings)
	Communication type	I/O communication (Poll) Explicit message communication
	Power supply	11 VDC to 25 VDC
	Current consumption	10 mA max. (when network power supply 24 V is applied)
Environment resistance	Ambient temperature	When one or less head expansion unit is connected: 0 to +50°C When two or more head expansion units are connected: 0 to +40°C
	Relative humidity	35 to 85%RH (No condensation)
Rated voltage		24 VDC±10% (supplied from controller)
Current consumption		200 mA max.
Weight		Approx. 300 g

*1 DeviceNet is a registered trademark of ODVA (Open DeviceNet Vendor Association).

Head-to-controller cable

Model	CB-A07	CB-A2	CB-A5	CB-A10	CB-A20	CB-A30
Cable length	0.7 m	2 m	5 m	10 m	20 m	30 m
Weight	Approx. 100 g	Approx. 200 g	Approx. 400 g	Approx. 750 g	Approx. 1400 g	Approx. 2000 g

Head-to-controller extension cable

Model	CB-A5E	CB-A10E
Cable length	5 m	10 m
Weight	Approx. 400 g	Approx. 750 g

Status table

			Display panel		Output			
			Measured value	**Comparator**	**Analog voltage (current)**	**ALARM (N.C.)**	**Comparator**	**Binary**
Measuring mode	Normal		Measured value	Comparator result	Voltage (current) with reference to the measured value	ON	Comparator result	Measured value
	Over range on the positive side		FFFFFF	HI	+10.8 V (20.64 mA)		HI	1048575 (0x0FFFFF)
	Over range on the negative side		-FFFFFF	LO	-10.8 V (3.36 mA)		LO	-1048576 (0x100000)
	Alarm	During hold	Hold			ON	Hold	
		During alarm	-FFFFFF	HI/LO ON simultaneously	-10.8 V (3.36 mA)	Varies depending on the alarm output type	HI/LO ON simultaneously	-1048576 (0x100000)
	Comparator standby		------	All OFF		ON	All OFF	
	During RESET operation							
	Dark/Bright			Alarm status		Varies depending on the alarm output type	Alarm status	
Setting mode			Setting item	Varies depending on the setting item	Hold	Hold	Hold	Hold
Communication mode	RS-232C communication		--COM-- (Communication mode indication)	OFF				
	USB communication							
	LAN							
System error			Error display		-10.8 V (3.36 mA)	Varies depending on the alarm output type	OFF	-1048576 (0x100000)
At power-on			------ (Starting up process is being checked)		Undefined value until measurement starts	OFF		0 (0x000000)

- "ON/OFF" indicates the ON/OFF status of the NPN or PNP open-collector output.
- "Hold" represents the status in which the last normal value is being held.
- "Setting mode" represents the setting changes using the display panel keys.
- "Communication mode" means the setting changes using the RS-232C/USB/LAN communication.
- The alarm output turns on when operation is normal and turns off when an error occurs.
- The RESET operation is performed after the mode is changed to the measuring mode, the program number is changed, the auto-zero operation is completed, and the RESET input is provided.
- If the RS-232C, USB, or LAN communication is used in the measuring mode, the response speed slows down.
- The RS-232C, USB, and LAN interfaces cannot be used simultaneously.
- When the LK-Navigator 2 setup support software is used, the change to the communication mode and return to the measuring mode are automatically controlled by the software.
- When the RS-232C communication is used with the LK-Navigator 2, the refresh rate becomes slow compared with the rate using the USB or LAN communication.

<table>
<tr><th colspan="2">Input</th><th rowspan="2">RS-232C</th><th rowspan="2">USB</th><th rowspan="2">LAN</th></tr>
<tr><th>TIMING/ RESET/ P1/P2/P3</th><th>ZERO</th></tr>
<tr><td rowspan="4">O</td><td>O</td><td rowspan="4">Measured value display, received light waveform display, data storage/ measurement control commands controlled by LK-Navigator 2</td><td colspan="2" rowspan="4">Measured value display, received light waveform display, data storage controlled by LK-Navigator 2</td></tr>
<tr><td>X (Canceling auto-zero is possible)</td></tr>
<tr><td>O</td></tr>
<tr><td>X (Canceling auto-zero is possible)</td></tr>
<tr><td colspan="5">Alarm status</td></tr>
<tr><td rowspan="5">X</td><td rowspan="5">X</td><td>Error</td><td colspan="2"></td></tr>
<tr><td>Setting transmission/ Setting change command</td><td colspan="2">Error</td></tr>
<tr><td rowspan="3">Error</td><td>Setting transmission</td><td>Error</td></tr>
<tr><td rowspan="2">Error</td><td>Setting transmission</td></tr>
<tr><td>Error</td></tr>
</table>

- "O" and "X" represent the statuses where input is possible and impossible respectively.
- "Setting mode" represents the setting changes using the display panel keys.
- "Communication mode" means the setting changes using the RS-232C/USB/LAN communication.
- The RESET operation is performed after the mode is changed to the measuring mode, the program number is changed, the auto-zero operation is completed, and the RESET input is provided.
- If the RS-232C, USB, or LAN communication is used in the measuring mode, the response speed slows down.
- The RS-232C, USB, and LAN interfaces cannot be used simultaneously.
- When the LK-Navigator 2 setup support software is used, the change to the communication mode and return to the measuring mode are automatically controlled by the software.
- When the RS-232C communication is used with the LK-Navigator 2, the refresh rate becomes slow compared with the rate using the USB or LAN communication.

Response delay time

■ Measurement response time

This is the period of time until the LK-G5000 Series recognizes the change in the target and outputs the signal. This is calculated by the following formula.

Sampling cycle (T6)	Measurement response time	
	Measurement modes other than semi opaque	Measurement mode of semi opaque
2.55 µs	T6 x 138 + T4 + 50 µs	-
5 µs	T6 x 74 + T4 + 50 µs	-
10 µs	T6 x 41 + T4 + 50 µs	-
20 µs	T6 x 25 + T4 + 50 µs	-
50 µs	T6 x 16 + T4 + 50 µs	-
100 µs	T6 x 10 + T4 + 100 µs	-
200 µs		T6 x 13 + T4 + 100 µs
500 µs		T6 x 13 + T4 + 100 µs
1000 µs		T6 x 11 + T4 + 100 µs

- For details about the sampling cycle (T6) and reset time (T4), refer to "Timing details" (page 4-27).
- When the mutual interference prevention function is used, the sampling cycle T6 is calculated as T6 x 2 (for AB_ON) or T6 x 3 (for ABC_ON).
- When "Velocity" is selected for the measurement type, T4 is calculated as T4 + T6; when "Acceleration" is selected, T4 is calculated as T4 + 2 x T6.

■ Power ON reset time

This is the period of time until measurement starts after the LK-G5000 Series is turned on.

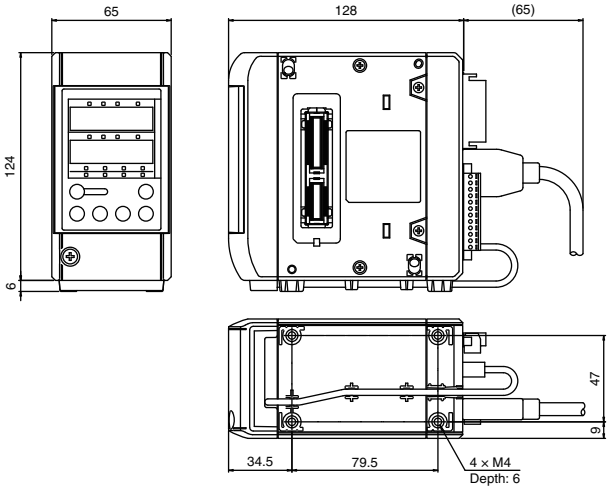
- Power ON reset time when only the controller is used: Approx. 7 seconds
- When 10 head expansion units are connected to the controller: Approx. 17 seconds

Dimensions

Controller

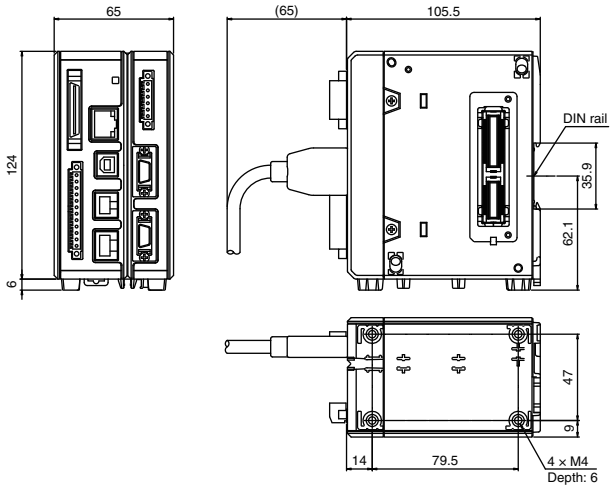
LK-G5001V/LK-G5001PV

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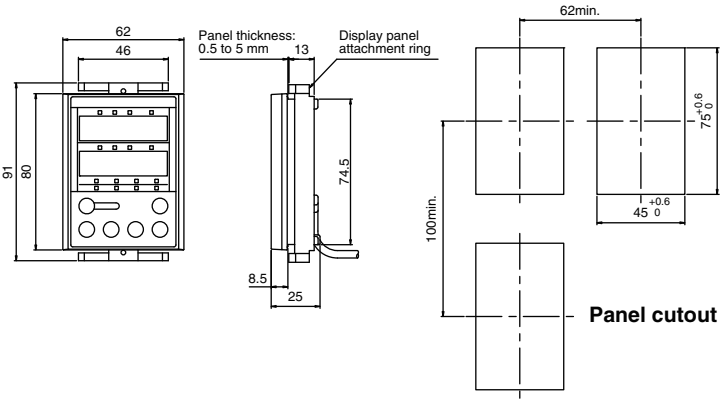


LK-G5001/LK-G5001P

<Unit: mm>



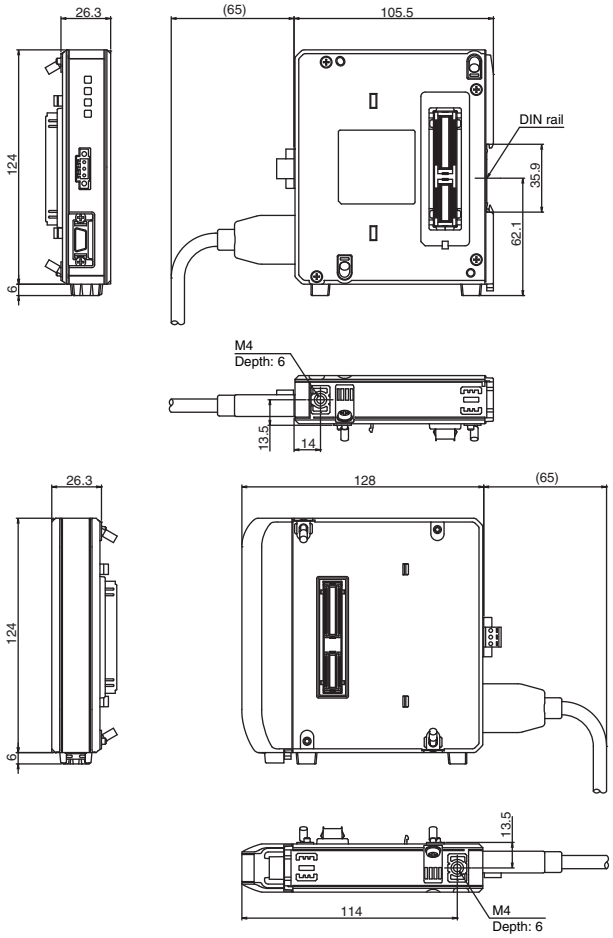
LK-HD500 <Unit: mm>



6

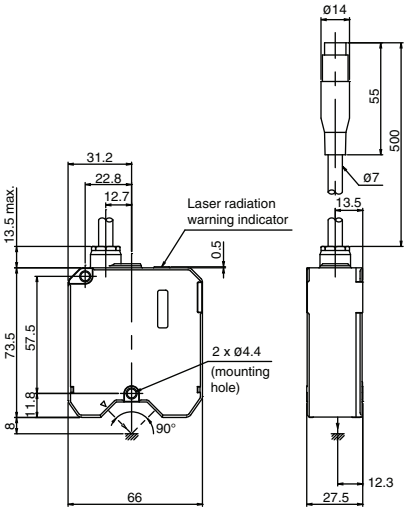
LK-HA100

<Unit: mm>

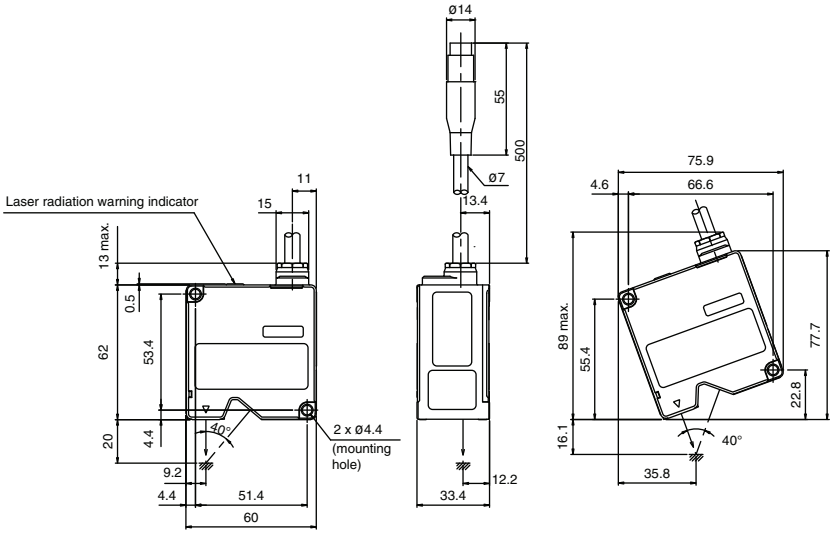


Sensor head

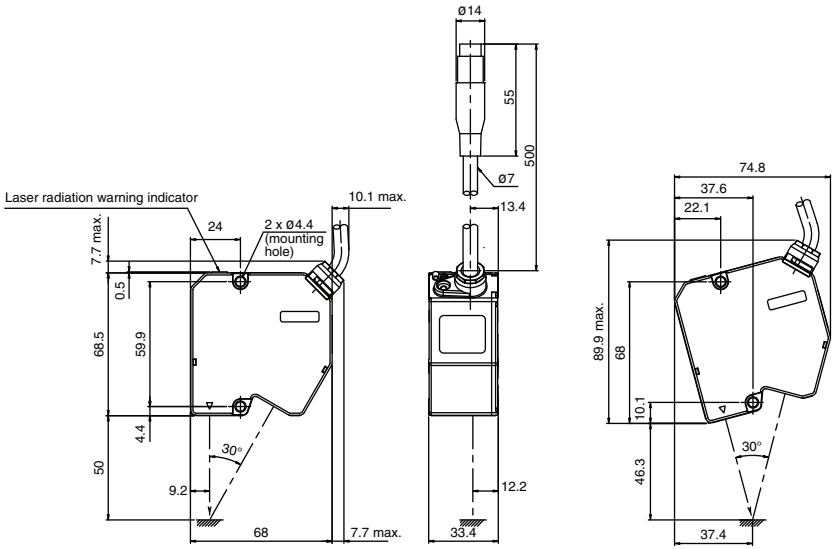
■ **LK-H008/H008W** <Unit: mm>



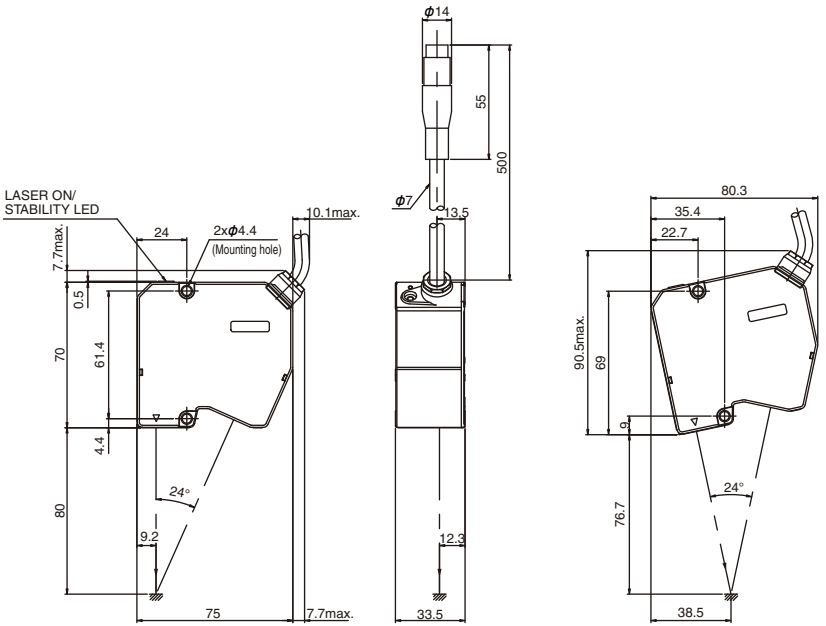
■ **LK-H020/H025/H023/H028/H022/H027/H022K/H027K** <Unit: mm>



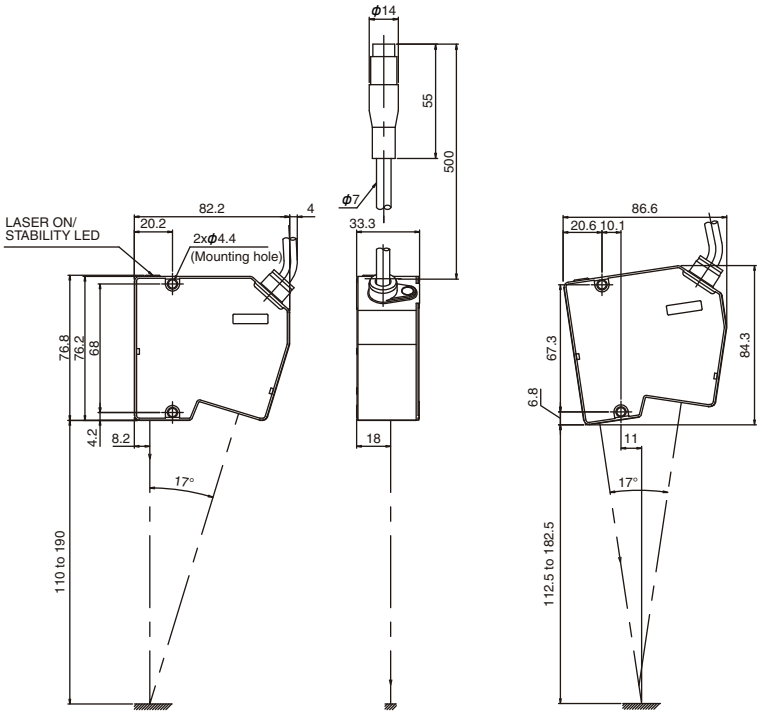
■ **LK-H050/H055/H053/H058/H052/H057/H052K/H057K** <Unit: mm>



■ **LK-H080/LK-H085/LK-H082/LK-H087** <Unit: mm>

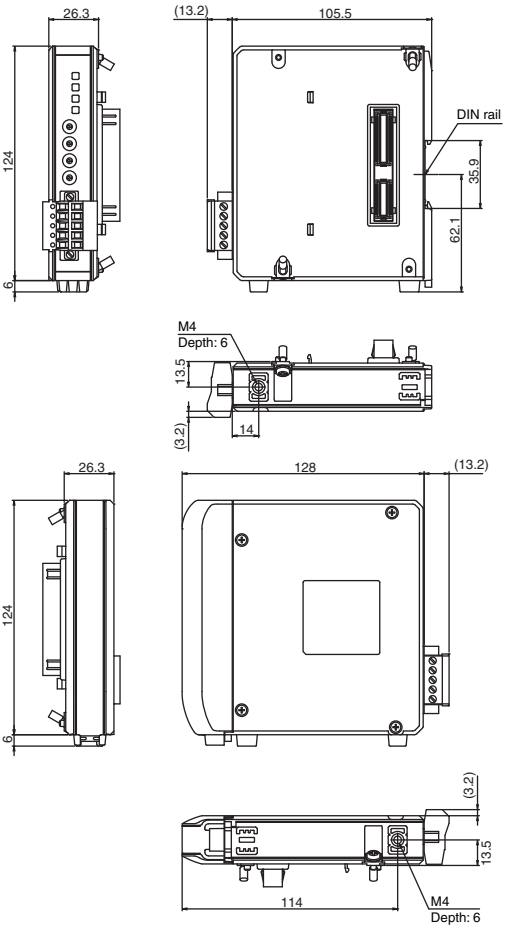


■ **LK-H150/LK-H155/LK-H152/LK-H157** <Unit: mm>



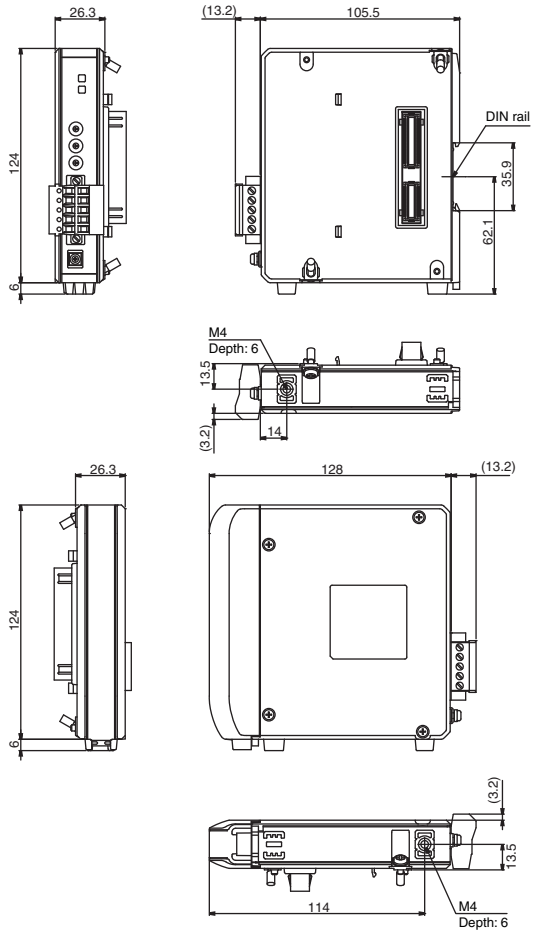
Expansion unit

■ **LK-CC100** <Unit: mm>



■ **LK-DN100**

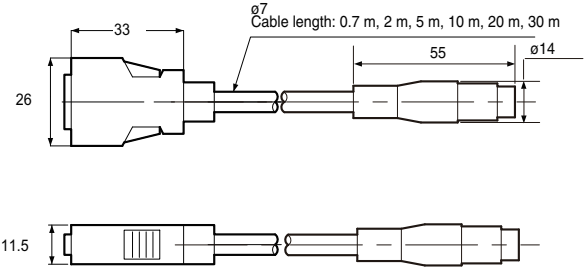
<Unit: mm>



Other accessory

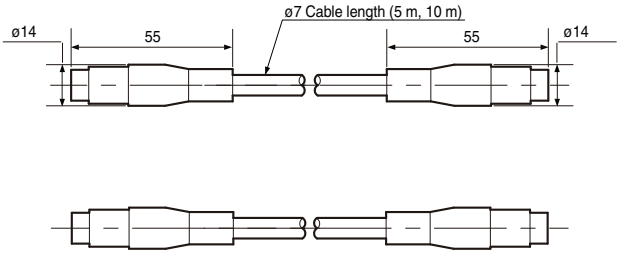
■ Head-to-controller cable CB-A07/CB-A2/CB-A5/CB-A10/CB-A20/CB-A30

<Unit: mm>



■ Head to controller extension cable CB-A5E/CB-A10E

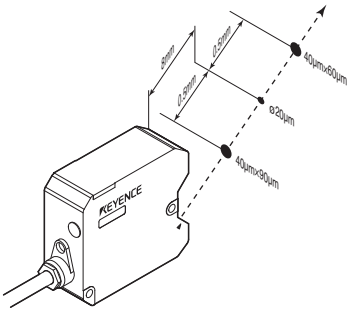
<Unit: mm>



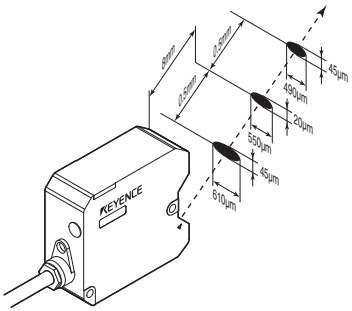
Characteristics

Beam spot diameter

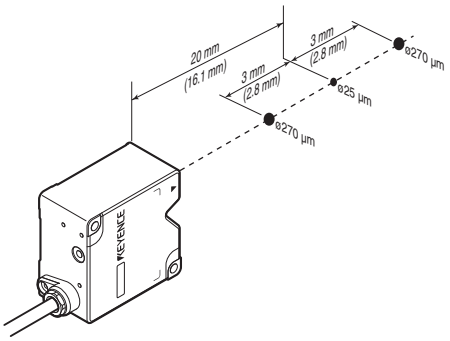
■ **LK-H008**



■ **LK-H008W**

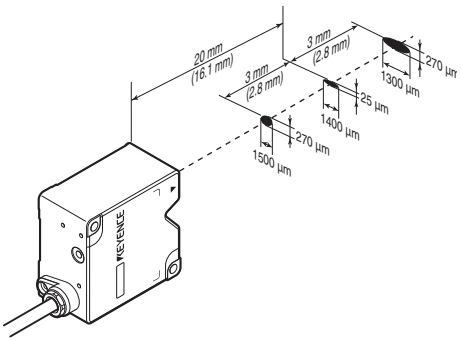


■ **LK-H020/LK-H023/LK-H022/LK-H022K**



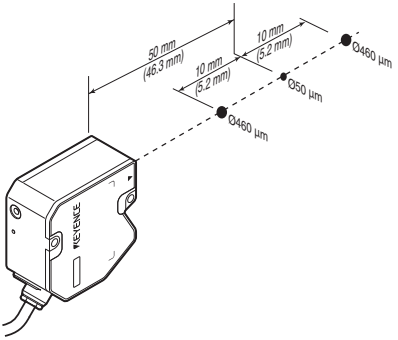
Dimensions in ( ) indicate the reference distance and measurement range for specular reflection mounting.

■ **LK-H025/LK-H027/LK-H027K/LK-H028**



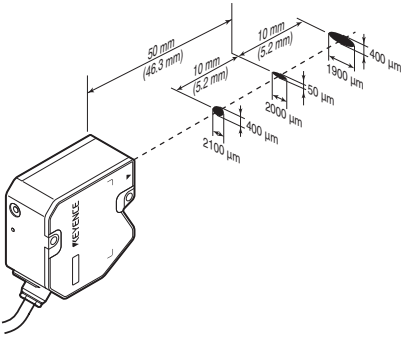
Dimensions in ( ) indicate the reference distance and measurement range for specular reflection mounting.

■ **LK-H050/LK-H052/LK-H053/LK-H052K**



Dimensions in ( ) indicate the reference distance and measurement range for specular reflection mounting.

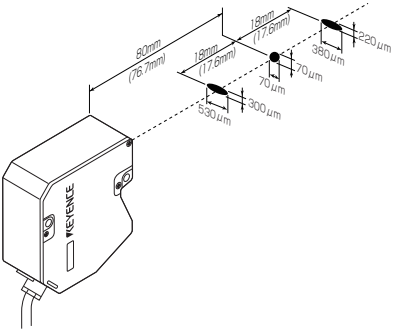
■ **LK-H055/LK-H057/LK-H058/LK-H057K**



Dimensions in ( ) indicate the reference distance and measurement range for specular reflection mounting.

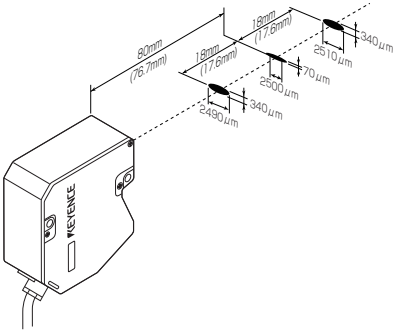
6

■ **LK-H080/LK-H082**



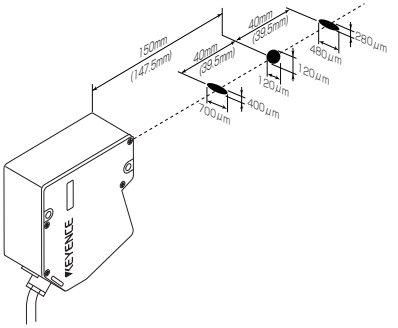
Dimensions in ( ) indicate the reference distance and measurement range for specular reflection mounting.

■ **LK-H085/LK-H087**



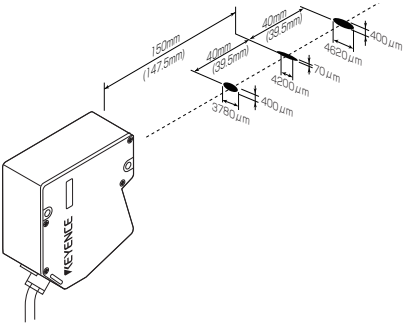
Dimensions in ( ) indicate the reference distance and measurement range for specular reflection mounting.

■ **LK-H150/LK-H152**



Dimensions in ( ) indicate the reference distance and measurement range for specular reflection mounting.

■ **LK-H155/LK-H157**



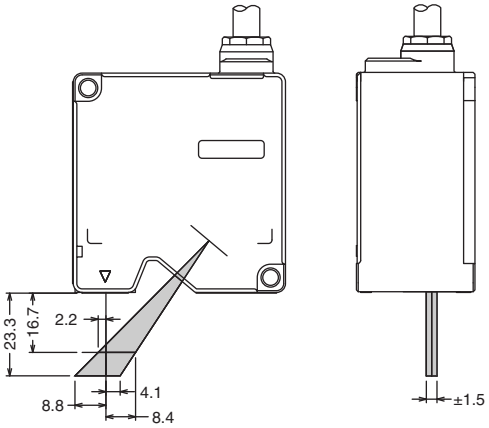
Dimensions in ( ) indicate the reference distance and measurement range for specular reflection mounting.

Mutual interference

No interference occurs if the beam spot of the other sensor is out of the shaded area in the figures (with white paper target).

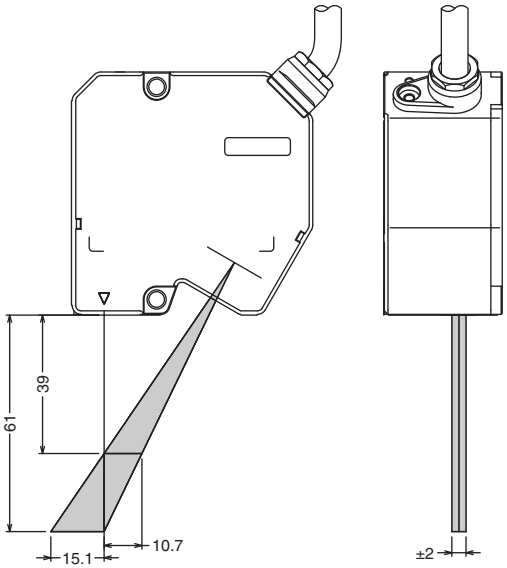
LK-H020/LK-H025/LK-H023/LK-H028/LK-H022/LK-H027/LK-H022K/LK-H027K

<Unit: mm>

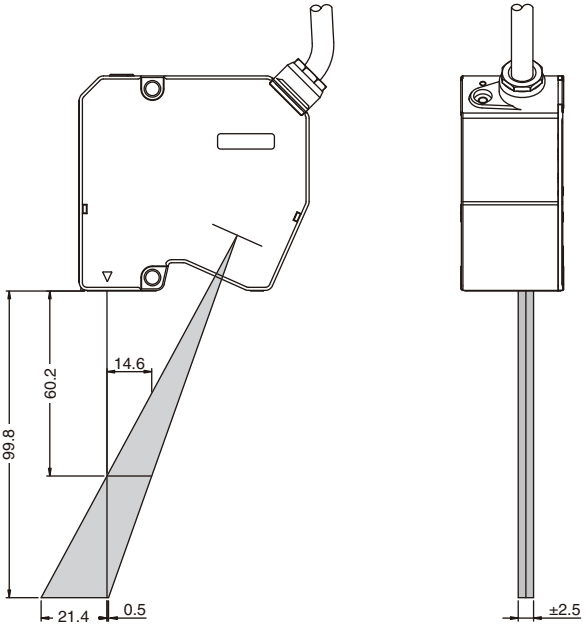


LK-H050/LK-H055/LK-H053/LK-H058/LK-H052/LK-H057/LK-H052K/LK-H057K

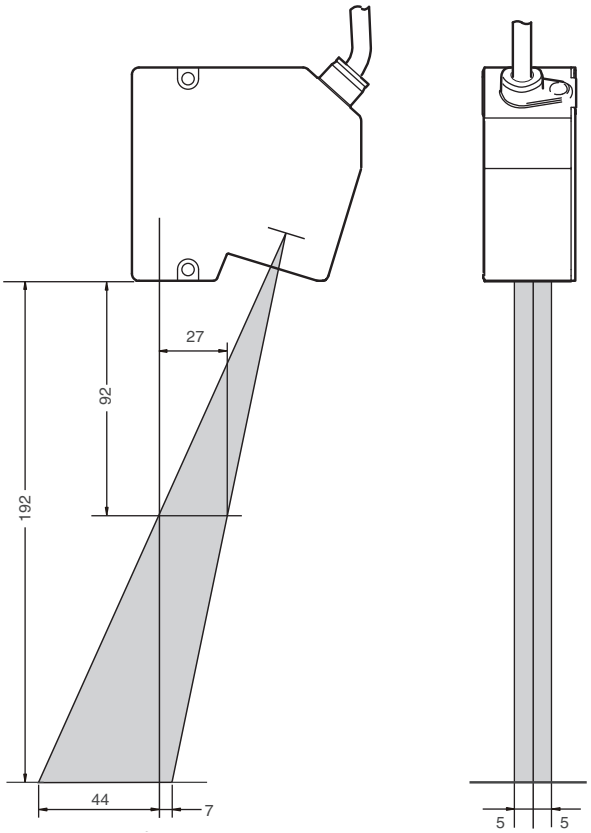
<Unit: mm>



LK-H080/LK-H085/LK-H082/LK-H087 <Unit: mm>



LK-H150/LK-H155/LK-H152/LK-H157 <Unit: mm>

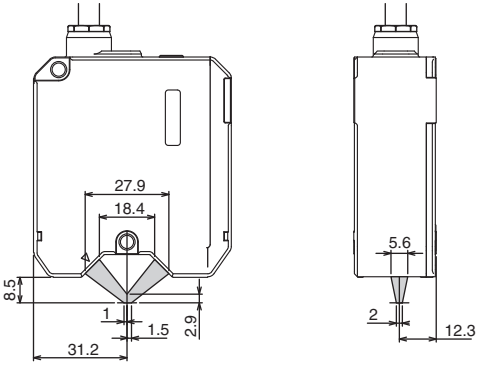


Optical axis range

The detection is not affected if an interfering object is out of the shaded area in the figures.

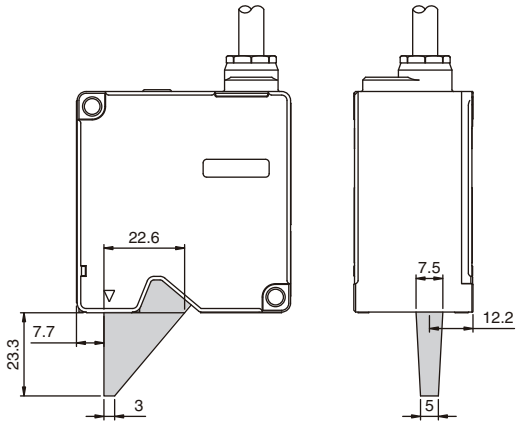
LK-H008/LK-H008W

<Unit: mm>



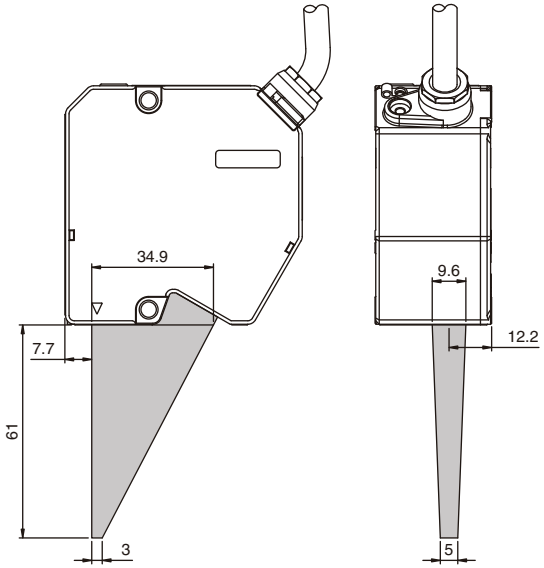
LK-H020/LK-H025/LK-H023/LK-H028/LK-H022/LK-H027/LK-H022K/LK-H027K

<Unit: mm>



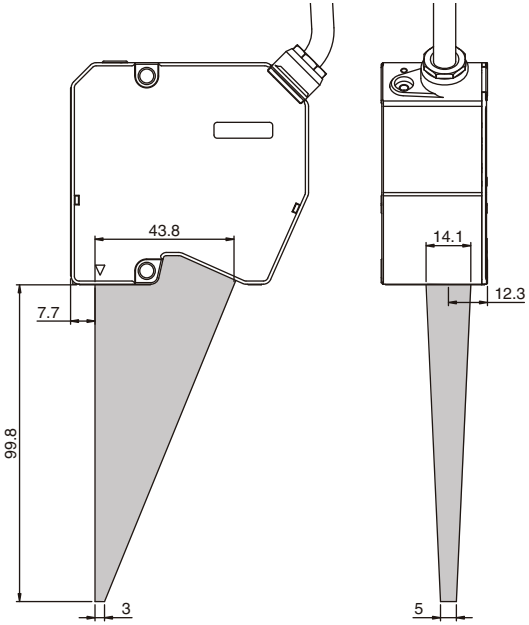
LK-H050/LK-H055/LK-H053/LK-H058/LK-H052/LK-H057/LK-H052K/LK-H057K

<Unit: mm>



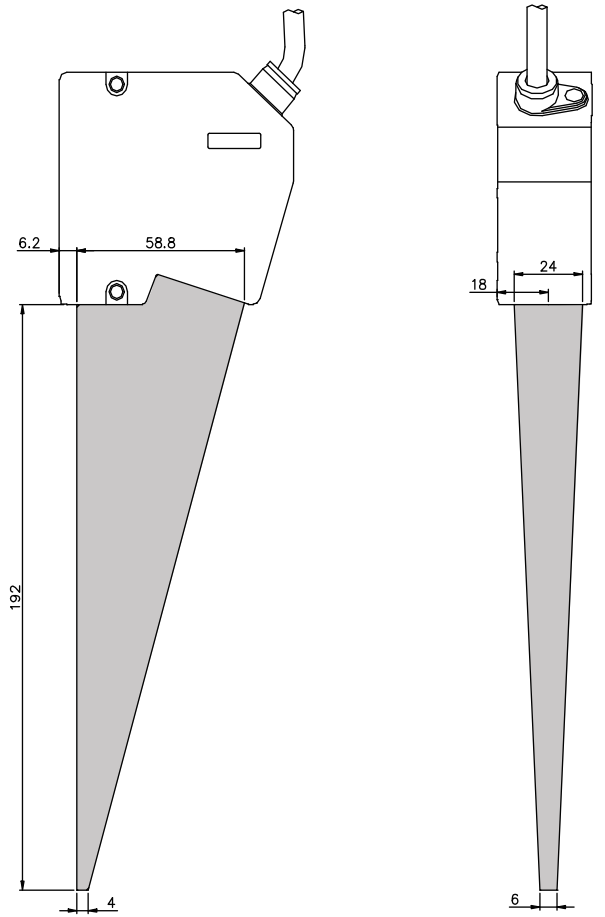
LK-H080/LK-H085/LK-H082/LK-H087

<Unit: mm>



LK-H150/LK-H155/LK-H152/LK-H157

<Unit: mm>



MEMO

Appendices

Troubleshooting A-2
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Relationship Between the Sampling Cycle and Velocity/
Acceleration Measurement Range..... A-11
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Troubleshooting

This section describes the countermeasures against errors or problems that may occur during the operation of the LK-G5000 Series.

Problem	Possible Cause	Countermeasure
Nothing is displayed on the display panel.	Is the display panel cable properly connected to the controller? Is the power supply cable properly connected?	Connect the power supply cable and display panel cable properly. (page 1-26)
An error code is displayed.	-	Address the problem by following the instruction provided for the displayed error code. (page A-5)
A measured value is not displayed.	Is the measurement target placed within the measurement range?	Place the measurement target properly within the measurement range.(page 1-12, page 1-13)
	Are the head settings properly set?	Adjust to the proper settings. (page 3-3)
	Is the glass cover dirty?	Remove the dust and dirt.
	Does the glass cover have any flaws or cracks?	The glass cover must be replaced. Because this replacement requires KEYENCE repair service, contact your nearest KEYENCE office.
	Is the synchronization control properly set according to the measurement mode?	Set the synchronization control according to the measurement mode. (page 3-62)
	Does condensation occur in the unit?	Check the installation environment. (page 1-3)
The laser beam is not emitted.	Is the head-to-controller cable properly connected? Is the power supply cable properly connected?	Connect the head-to-controller cable and the power supply cable properly. (page 1-26)
	Are the laser remote interlock input and the laser OFF input provided properly?	Provide these inputs properly. (page 1-10)
	Are the LASER CTRL terminal and LASER CTRL group set properly?	Adjust to the proper settings. (page 1-10, page 3-20)
	Is the active head count set properly?	Adjust to the proper setting. (page 3-79)
	Is the problematic sensor head assigned to any OUT?	Assign the sensor head to be used to a certain OUT. (page 3-28)
The laser beam is not emitted. (continued)	Is the problematic sensor head assigned to group C while the mutual interference prevention is set to AB-ON?	Change the setting to ABC-ON or assign the sensor head to group A or B. (page 3-60)
	Is the operation of the specified measurement mode possible with the specified sampling cycle setting?	Set the sampling cycle which allows the operation of the specified measurement mode. (page 3-58)

Problem	Possible Cause	Countermeasure
The measured value display fluctuates.	Is the number of averaging measurements properly set?	Set the number of averaging measurements properly. (page 3-33)
	Is the glass cover dirty?	Remove the dust and dirt.
	Does the glass cover have any flaws or cracks?	The glass cover must be replaced. Because this replacement requires KEYENCE repair service, contact your nearest KEYENCE office.
	Are there any water or oil splashes in the operating atmosphere?	Use air purge or another method to remove the splashes.
	Does mutual interference occur?	Use the mutual interference prevention function or the laser OFF function. (page 1-10, page 3-60) Change the mounting position of the sensor head.
	Is there strong ambient light?	Block the ambient light.
	Does the measurement target or sensor head vibrate?	Take appropriate countermeasures such as vibration isolation.
	Are the head settings properly set?	Adjust to the proper settings. (page 3-3)
The measured value display deviates.	Is the measurement target slanted or displaced?	Place the measurement target properly within the measurement range. (page 1-12, page 1-13)
	Is the LK-G5000 Series calibrated properly?	Calibrate the unit again. (page 3-31)
	Does the temperature in the operating environment change greatly?	Keep the ambient temperature constant. (page 1-10)
Program No. cannot be changed.	Is the setting selection properly set?	Set the setting selection according to the method to be used. (page 3-73)
	Is the panel lock set to ON?	Change the panel lock setting to OFF. (page 3-76)
	Is the LK-G5000 Series in either the setting mode or the communication mode?	Change the mode to the measuring mode.
The comparator output is not output properly.	Is the wiring correct?	Check the output circuit and wiring, and ensure proper connection.
	Is the tolerance properly set?	Set the tolerance again. (page 2-4)
	Is the comparator output form properly set?	Adjust to the proper setting. (page 3-63)
The analog output is not output properly.	Is the wiring correct?	Check the wiring and ensure proper connection.
	Does the voltage exceed +10.8 V or drop below -10.8 V?	Set the analog scaling properly according to the measured value. (page 3-50)
	Is an oscilloscope or a high-speed A/D board used?	The resolution may decrease when these devices are used. Change the analog scaling setting to minimize the influence.

Problem	Possible Cause	Countermeasure
The binary output is not output properly.	Is the wiring correct?	Check the output circuit and wiring, and ensure proper connection.
	Is the logic properly set?	The LK-G5000 Series uses negative logic for output.
	Is the import timing properly set?	Use strobe output to enable importing with proper timing. (page 4-16)
	Is the binary selection input provided properly?	Provide the input properly. (page 4-11)
The RS-232C communication is disabled.	Is the communication cable properly connected?	Connect the communication cable properly. (page 5-4)
	Is the communication cable connected according to the specifications?	Check the connection of the communication cable. (page 5-4)
	Are the communication parameters properly set?	Set the same communication parameters between the LK-G5000 Series and the external device. (page 5-4)
	Is the communication program correct?	Check that the commands and delimiters are sent and received properly. (page 5-5)
	Is the setting correct for the communication method and external device?	Set the automatic transmission properly. (page 3-72)
	Is any item being set?	The communication is disabled during setting.
The operation key does not work.	Is the display panel properly connected?	Connect the display panel properly. (page 1-26)
	Is the panel lock set to ON?	Set the panel lock to OFF. (page 3-76)
The LAN communication is disabled.	Are the IP address and subnet mask properly set?	Adjust to the proper settings. (page 3-81)
	Is a cross cable used when the LK-G5000 Series is directly connected with a PC?	Use a cross cable for direct connection with a PC.
	Is the PC connected using one-to-one connection or local connection?	To establish LAN connection with a PC, use one-to-one connection or local connection which includes only the PC and the LK-G5000 Series units.

Error Codes

This section lists the error codes displayed by the LK-G5000 Series and the countermeasures.

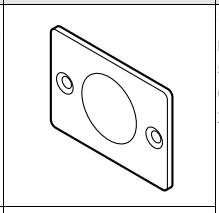
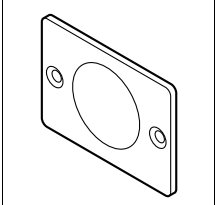
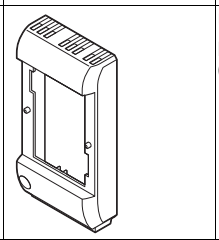
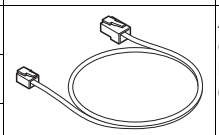
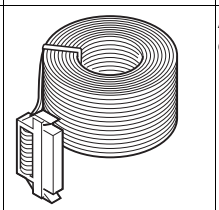
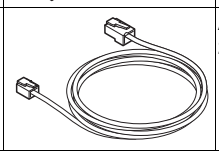
Display	System error	Error description	Countermeasure
Err-00	○	Head connection error	Check the sensor head connection. If there are errors with two or more sensor heads, the smallest error number among Err-01 to 12 is displayed.
Err-01 to 12	○	Head 01 to 12 error	
Err-13	○	Controller error	Turn off the power once and turn it on again. If the error continues, contact your nearest KEYENCE office.
Err-14	○	Display panel communication error	Check the connection with the display panel.
Err-15	○	Controller SRAM error	Turn off the power once and turn it on again, or initialize the settings. If the error continues, contact your nearest KEYENCE office.
Err-16	○	USB communication error	Turn off the power once and turn it on again. If the error continues, contact your nearest KEYENCE office.
Err-17	○	Ethernet communication error	Turn off the power once and turn it on again. If the error continues, contact your nearest KEYENCE office.
Err-18	○	Expansion unit error	Turn off the power once, disconnect the expansion unit and connect it again, and then turn on the power again. If the error continues, contact your nearest KEYENCE office.
Err-30 to 39	○	Head expansion unit error	Turn off the power once, disconnect the head expansion unit and connect it again, and then turn on the power again. If the error continues, contact your nearest KEYENCE office.
Err-50		Command error	The received command is not defined for the RS-232C communication. Check the command you sent.
Err-51		Status error	Operation through the RS-232C communication is not available (e.g., a measurement control command was received in the communication mode). Check the mode and the command you sent.
Err-60		Command length error	The command or parameter received through the RS-232C communication has an insufficient number of characters. Check the command you sent.
Err-61		Parameter count error	The command received through the RS-232C communication has insufficient parameters. Check the command you sent.

Display	System error	Error description	Countermeasure
Err-62		Parameter range error	The setting value received through the RS-232C communication is out of the possible setting range. Check the command you sent.
Err-63		Parameter range error (OUT calculation count limitation)	The repeated use of an OUT value in OUT calculation exceeds the limit. Check the command you sent.
Err-64		Parameter range error (OUT/Head No.)	The number of sensor heads or OUT being used exceeds the active head/OUT count. Check the setting.
Err-65		Parameter range error (Velocity/acceleration calculation method)	The OUT set to the measurement type of "Velocity" or "Acceleration" was set to OUT for another measurement type or to AVE/P-P/MAX or other calculation between OUT. Check the setting.
Err-66		Parameter range error (OUT specification)	The calculation range set for a certain OUT includes the OUT itself, or no target OUT has been set for the AVE/P-P/MIN/MAX calculation.
Err-67		Parameter range error (Sampling cycle)	The specified sampling cycle is faster than the fastest sampling cycle available based on the active OUT count, active head count, measurement mode, and calculation method. Select a slower sampling cycle or change other parameters.
Err-68		Parameter range error (Scaling)	The specified scaling parameters do not satisfy the following conditions: • Input value 1 - Input value 2 ≠ 0 • |(Displayed value 2 - Displayed value 1)/(Input value 2 - Input value 1)| ≤ 2
Err-69		Parameter range error (Analog output scaling)	The specified analog output scaling parameters do not satisfy the following conditions: • Input value 1 - Input value 2 ≠ 0 • |(Output voltage value 2 - Output voltage value 1)/(Displayed value 2 - Displayed value 1)| ≤ 10
Err-70		Parameter range error (Number of data to be stored)	The specified number of data to be stored exceeds the possible setting range.
Err-71		Parameter range error (OUT specified for data storage)	The number of OUT for which data is stored exceeds the active OUT count.
Err-88		Timeout error	No delimiter CR has been received for 30 seconds or more since the LK-G5000 Series started receiving commands through the RS-232C communication. Check the command you sent and the communication program.
Err-99		Other error	Contact your nearest KEYENCE office.

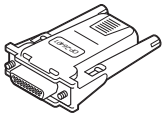
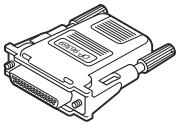
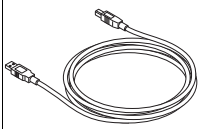
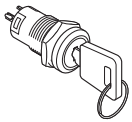
* If you cannot resume the LK-G5000 Series after taking the above countermeasures or if you encounter an error which is not listed in the table, contact your nearest KEYENCE office.

List of Optional Accessories

The following table lists the optional accessories supported by the LK-G5000 series.

Name		Model	Appearance	Description
Display panel housing		LK-F2 (LK-H150/155/152/157)		Used when the mirror surface is measured at a mirror reflection setup. (M1.6 x 3 countersink-head screw x 2)
		LK-F3 (LK-H80/85/82/87)		
Display panel housing		OP-84426		Used to combine the display panel (LK-HD500) and controller (LK-G5001/LK-G5001P).
Display panel cable	33 cm	OP-84427		A cable used to connect the display panel (LK-HD500/LK-HD1001) and controller (LK-G5001/LK-G5001P).
	3 m	OP-51655		
	10 m	OP-51656		
Expansion connector cable (3 m)		OP-51657		A cable for the expansion connector (3 m).
RS-232C cable		OP-96368		A communication cable for RS-232C (2.5 m).

A

Name	Model	Appearance	Description
RS-232C conversion adapter	OP-26401		A conversion adapter for a D-sub 9-pin connector. This connector is used in combination with the OP-96368.
RS-233C conversion adapter	OP-96369		A conversion adapter for a D-sub 25-pin connector. This connector is used in combination with the OP-96368.
USB cable	OP-66844		A cable for USB connection (2 m).
Key-operated switch	OP-86982		Key-operated switch for laser emission control
Ethernet cable	OP-66843		Cross cable (3m) for Ethernet communication

A

Type of Measurement and Sampling frequency

When the type of measurement is Velocity or Acceleration, the range to display the measured value is determined according to the settings of minimum display unit, sampling frequency and mutual intervention prevention function.

O: Possible to display measured values

- : Measured value displayed as -FFFFFF

■ When the Acceleration mode is selected

LK-H008 Series/LK-H02* Series

Sampling frequency [µs]	±99.9999 [m/s^2]	±999.999 [m/s^2]	±9999.99 [m/s^2]	±99999.9 [m/s^2]	±999.999 [km/s^2]	±9999.99 [km/s^2]	±99999.9 [km/s^2]	Remark
2.55	-	-	-	O	O	O	O	2.55µs Mutal intervention prevension function OFF
5	-	-	O	O	O	O	O	5µs Mutal intervention prevension function OFF
5.1	-	-	O	O	O	O	O	2.55µs Mutal intervention prevension function AB-ON
7.65	-	-	O	O	O	O	O	2.55µs Mutal intervention prevension function ABC-ON
10	-	-	O	O	O	O	O	10µs Mutal intervention prevension function OFF
15	-	O	O	O	O	O	-	5µs Mutal intervention prevension function AB-ON
20	-	O	O	O	O	O	-	20µs Mutal intervention prevension function OFF
30	-	O	O	O	O	O	-	10µs Mutal intervention prevension function ABC-ON
40	-	O	O	O	O	O	-	20µs Mutal intervention prevension function AB-ON
50	O	O	O	O	O	-	-	50µs Mutal intervention prevension function OFF
60	O	O	O	O	O	-	-	20µs Mutal intervention prevension function ABC-ON
100	O	O	O	O	O	-	-	100µs Mutal intervention prevension function OFF
150	O	O	O	O	O	-	-	50µs Mutal intervention prevension function ABC-ON
200	O	O	O	O	O	-	-	200µs Mutal intervention prevension function OFF
300	O	O	O	O	O	-	-	100µs Mutal intervention prevension function ABC-ON
400	O	O	O	O	O	-	-	200µs Mutal intervention prevension function AB-ON
500	O	O	O	O	O	-	-	500µs Mutal intervention prevension function OFF
600	O	O	O	O	O	-	-	200µs Mutal intervention prevension function ABC-ON
1000	O	O	O	O	O	-	-	1000µs Mutal intervention prevension function OFF
1500	O	O	O	O	O	-	-	500µs Mutal intervention prevension function ABC-ON
2000	O	O	O	O	O	-	-	1000µs Mutal intervention prevension function AB-ON
3000	O	O	O	O	O	-	-	1000µs Mutal intervention prevension function ABC-ON

LK-H05* Series/LK-H08* Series/LK-H15* Series

Sampling frequency [µs]	±99.9999 [m/s^2]	±999.999 [m/s^2]	±9999.99 [m/s^2]	±99999.9 [m/s^2]	±999.999 [km/s^2]	±9999.99 [km/s^2]	±99999.9 [km/s^2]	Remark
2.55	-	-	-	-	O	O	O	2.55µs Mutal intervention prevension function OFF
5	-	-	-	O	O	O	O	5µs Mutal intervention prevension function OFF
5.1	-	-	-	O	O	O	O	2.55µs Mutal intervention prevension function AB-ON
7.65	-	-	-	O	O	O	O	2.55µs Mutal intervention prevension function ABC-ON
10	-	-	-	O	O	O	O	10µs Mutal intervention prevension function OFF
15	-	-	O	O	O	O	O	5µs Mutal intervention prevension function AB-ON
20	-	-	O	O	O	O	O	20µs Mutal intervention prevension function OFF
30	-	-	O	O	O	O	O	10µs Mutal intervention prevension function ABC-ON
40	-	O	O	O	O	O	-	20µs Mutal intervention prevension function AB-ON
50	-	O	O	O	O	O	-	50µs Mutal intervention prevension function OFF
60	-	O	O	O	O	O	-	20µs Mutal intervention prevension function ABC-ON
100	-	O	O	O	O	O	-	100µs Mutal intervention prevension function OFF
150	-	O	O	O	O	O	-	50µs Mutal intervention prevension function ABC-ON
200	-	O	O	O	O	O	-	200µs Mutal intervention prevension function OFF
300	-	O	O	O	O	O	-	100µs Mutal intervention prevension function ABC-ON
400	-	O	O	O	O	O	-	200µs Mutal intervention prevension function AB-ON
500	-	O	O	O	O	O	-	500µs Mutal intervention prevension function OFF
600	-	O	O	O	O	O	-	200µs Mutal intervention prevension function ABC-ON
1000	-	O	O	O	O	O	-	1000µs Mutal intervention prevension function OFF
1500	-	O	O	O	O	O	-	500µs Mutal intervention prevension function ABC-ON
2000	-	O	O	O	O	O	-	1000µs Mutal intervention prevension function AB-ON
3000	-	O	O	O	O	-	-	1000µs Mutal intervention prevension function ABC-ON

A

■ When the Velocity mode is selected

LK-H008 Series/LK-H02* Series

Sampling frequency [µs]	±99.9999 [mm/s]	±999.999 [mm/s]	±9999.99 [mm/s]	±99999.9 [mm/s]	±999.999 [m/s]	±9999.99 [m/s]	±99999.9 [m/s]	Remark
2.55	-	-	○	○	○	○	○	2.55µs Mutal intervention prevension function OFF
5	-	-	○	○	○	○	○	5µs Mutal intervention prevension function OFF
5.1	-	-	○	○	○	○	○	2.55µs Mutal intervention prevension function AB-ON
7.65	-	-	○	○	○	○	○	2.55µs Mutal intervention prevension function ABC-ON
10	-	○	○	○	○	○	-	10µs Mutal intervention prevension function OFF
15	-	○	○	○	○	○	-	5µs Mutal intervention prevension function AB-ON
20	-	○	○	○	○	○	-	20µs Mutal intervention prevension function OFF
30	-	○	○	○	○	○	-	10µs Mutal intervention prevension function ABC-ON
40	-	○	○	○	○	○	-	20µs Mutal intervention prevension function AB-ON
50	-	○	○	○	○	○	-	50µs Mutal intervention prevension function OFF
60	-	○	○	○	○	○	-	20µs Mutal intervention prevension function ABC-ON
100	○	○	○	○	○	-	-	100µs Mutal intervention prevension function OFF
150	○	○	○	○	○	-	-	50µs Mutal intervention prevension function ABC-ON
200	○	○	○	○	○	-	-	200µs Mutal intervention prevension function OFF
300	○	○	○	○	○	-	-	100µs Mutal intervention prevension function ABC-ON
400	○	○	○	○	○	-	-	200µs Mutal intervention prevension function AB-ON
500	○	○	○	○	○	-	-	500µs Mutal intervention prevension function OFF
600	○	○	○	○	○	-	-	200µs Mutal intervention prevension function ABC-ON
1000	○	○	○	○	○	-	-	1000µs Mutal intervention prevension function OFF
1500	○	○	○	○	○	-	-	500µs Mutal intervention prevension function ABC-ON
2000	○	○	○	○	○	-	-	1000µs Mutal intervention prevension function AB-ON
3000	○	○	○	○	○	-	-	1000µs Mutal intervention prevension function ABC-ON

A

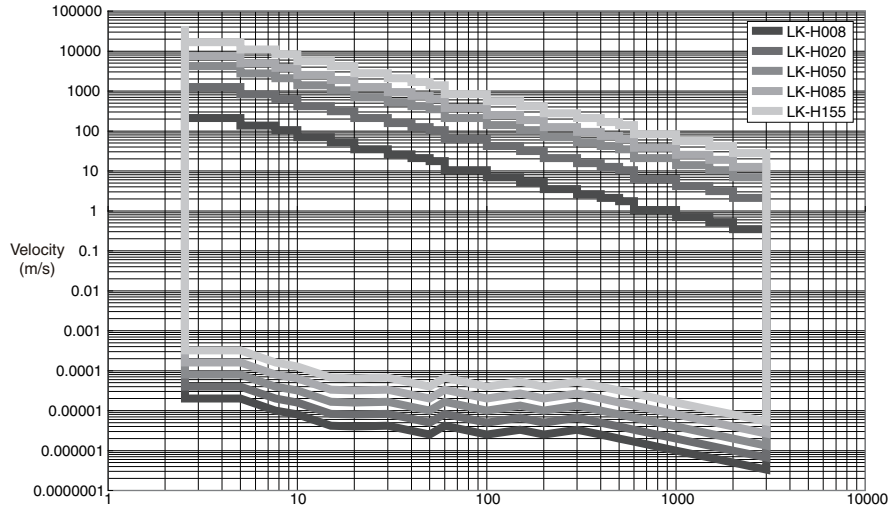
LK-H05* Series/LK-H08* Series/LK-H15* Series

Sampling frequency [µs]	±99.9999 [mm/s]	±999.999 [mm/s]	±9999.99 [mm/s]	±99999.9 [mm/s]	±999.999 [m/s]	±9999.99 [m/s]	±99999.9 [m/s]	Remark
2.55	-	-	○	○	○	○	○	2.55µs Mutal intervention prevension function OFF
5	-	-	○	○	○	○	○	5µs Mutal intervention prevension function OFF
5.1	-	-	○	○	○	○	○	2.55µs Mutal intervention prevension function AB-ON
7.65	-	-	○	○	○	○	○	2.55µs Mutal intervention prevension function ABC-ON
10	-	○	○	○	○	○	-	10µs Mutal intervention prevension function OFF
15	-	○	○	○	○	○	-	5µs Mutal intervention prevension function AB-ON
20	-	○	○	○	○	○	-	20µs Mutal intervention prevension function OFF
30	-	○	○	○	○	○	-	10µs Mutal intervention prevension function ABC-ON
40	-	○	○	○	○	○	-	20µs Mutal intervention prevension function AB-ON
50	-	○	○	○	○	○	-	50µs Mutal intervention prevension function OFF
60	-	○	○	○	○	○	-	20µs Mutal intervention prevension function ABC-ON
100	○	○	○	○	○	-	-	100µs Mutal intervention prevension function OFF
150	○	○	○	○	○	-	-	50µs Mutal intervention prevension function ABC-ON
200	○	○	○	○	○	-	-	200µs Mutal intervention prevension function OFF
300	○	○	○	○	○	-	-	100µs Mutal intervention prevension function ABC-ON
400	○	○	○	○	○	-	-	200µs Mutal intervention prevension function AB-ON
500	○	○	○	○	○	-	-	500µs Mutal intervention prevension function OFF
600	○	○	○	○	○	-	-	200µs Mutal intervention prevension function ABC-ON
1000	○	○	○	○	○	-	-	1000µs Mutal intervention prevension function OFF
1500	○	○	○	○	○	-	-	500µs Mutal intervention prevension function ABC-ON
2000	○	○	○	○	○	-	-	1000µs Mutal intervention prevension function AB-ON
3000	○	○	○	○	○	-	-	1000µs Mutal intervention prevension function ABC-ON

Relationship Between the Sampling Cycle and Velocity/Acceleration Measurement Range

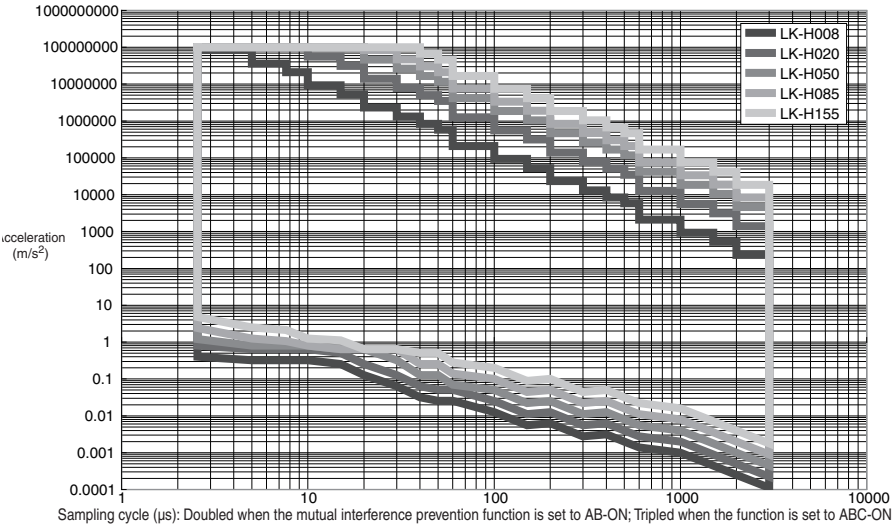
The following graphs show the relationship between the sampling cycle and velocity/acceleration in the velocity/acceleration measurement.

Velocity mode



Sampling cycle (µs): Doubled when the mutual interference prevention function is set to AB-ON; Tripled when the function is set to ABC-ON

Acceleration mode



Sampling cycle (µs): Doubled when the mutual interference prevention function is set to AB-ON; Tripled when the function is set to ABC-ON

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Revision History

Date of printing	Version	Revision details
March 2009	First edition	96M00415 0039-2
May 2009	Second edition	(96M00604 0059-1) P.1-24 Addition of notes regarding wiring.
October 2009	Third edition	STROBE output was added to pages 4-15, 4-19, and 4-21
November 2009	Second revision, first edition	LK-H008/H008W added
January 2010	Third revision, first edition	LK-H085/H087, LK-H155/H157 added
March 2010	Fourth revision, first edition	LK-H080/H082, LK-H150/H152 added
July 2011	Fourth revision, second edition	
November 2012	Fifth revision first edition	
March 2013	Fifth revision second edition	
December 2014	Fifth revision third edition	
February 2015	Fifth revision fourth edition	
October 2016	Fifth revision fifth edition	
November 2016	Fifth revision sixth edition	

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