High-speed, High-accuracy
CCD Laser Displacement Sensor
LK-G Series
User’s Manual

Read this manual before using the system in order to achieve maximum performance.
Keep this manual in a safe place for future reference.
Introduction

This Instruction Manual describes the basic operations and hardware functions of the LK-G Series. Read this manual carefully to ensure the optimum performance and full function of the LK-G Series before use.

Keep this manual in a safe place for future reference. Be sure that the person who will finally operate this product receives this manual.

Symbols

These symbols alert you to matters concerning the prevention of human injury and product damage.

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

⚠️ WARNING
Failure to follow the instructions may lead to injury.

⚠️ CAUTION
Failure to follow the instructions may lead to product damage or failure of the product.

⚠️ Note
Provides additional information on proper operations that can be easily mistaken.

⚠️ Reference
Provides advanced and useful information for operation.

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Safety Precautions

General Cautions

• At startup and during operation, be sure to monitor the functions and performance of the LK-G Series.
• We recommend that you take substantial safety measures to avoid any damage in the event of a problem occurring.
• Do not attempt to open or modify the LK-G Series or use it in any way other than as described in the specifications. If the LK-G Series is modified or used other than as described, the warranty will be voided.
• When the LK-G 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 the LK-G Series for the purpose of protecting the human body.
• Do not allow the temperature to change sharply around the LK-G Series, including the accessories. Otherwise, condensation may lead to malfunction.

WARNING

Follow the safety precautions below to ensure safe operation

• Apply the correct power voltage. Failure to do so may cause fire, electric shock, or malfunction.
• Do not attempt to disassemble or modify the unit. Doing so may cause fire or electric shock.

Handling abnormalities

Turn off the power immediately in the following cases. Using the unit in an abnormal condition could cause fire, electric shock, or accident.

Contact the nearest KEYENCE office for repair.

• If liquid including water, chemicals or debris enters the unit.
• If the unit is dropped or the case is damaged.
• If abnormal smoke or odor is present.
CAUTION

Follow the safety precautions below to ensure safe operation

• Be sure to turn the power off when you plug/unplug the cable that leads to the unit and its accessories. Not following this caution may result in damage.
• Do not turn off the power while setting items. The data being set or all the data may be lost.
• Do not block the vent holes on the unit. Increase of internal temperature may cause failure.

Installation environment

To use the LK-G Series correctly and safely, avoid installing it in the following locations; doing so may lead to breakdown of the unit.

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

Corrective action for noise

Do not install the LK-G Series near a power source or high-voltage cable, otherwise noise may cause the LK-G Series to malfunction. Take corrective action for noise by using noise filters, laying cables separately, and/or installing insulation on the controller and the measuring unit. Use the single core shielded cable for the analog output cable.

Influence of ambient temperature

A change in the ambient temperature may cause the measurement to fluctuate. Be sure to keep it stabilized. When the ambient temperature changes by 10 °C, it takes 60 minutes for the distribution of internal temperature to equalize.

Operating ambient light intensity level

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

Warming up

Before using the LK-G Series, wait approximately 30 minutes after the power is turned on. Otherwise, the measured value may gradually fluctuate because the circuit is not immediately stable after the power is turned on.
Influence of dust or dirt

The measurement may fluctuate due to dirt, dust or fluid such as water or oil in the following cases:

• Adhesion on the protection 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 measuring target: Blow the dirt off with clean air or wipe it off.

• Intrusion of floating or sprinkled dust or dirt into the light-axis range: In this case, take corrective action with a protective cover or air purge.

Notes

Influence of vibration

When the measuring target is vibrating, the measured value may fluctuate. In this case, increase the average number of times of measurement to achieve a more accurate value.

Measuring target

The measured value may fluctuate if the shapes or surfaces of the measuring targets vary. In this case, use a known target and perform appropriate correction using the calibration function.

Handling

Do not wipe with a wet cloth, benzene, or thinner. Doing so may change the color or shape of the unit. If the unit has much dirt on it, wipe it off with a cloth moistened with a mild detergent, 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 measurement portion with an appropriate enclosure.

• Agitate the air between the measurement portion and the workpiece more strongly with a fan.

Precautions on CE Marking

The LK-G Series conforms to the EMC Directive subject to the conditions that the following requirements are satisfied. In order to use this equipment in the EU countries, be sure that the following requirements have already been satisfied beforehand.

The applicable standards are explained below.

EMI: EN61326, class A
EMS: EN61326
Length of the power cord that is connected to the Controller, and length of all input/output cords must be limited to shorter than 30 m.
Safety Precautions on Laser Products

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

- **LK-G15/LK-G10** is a class 1 laser product according to IEC60825-1.

**WARNING**

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

**Cautions on class 3a/3R/3A laser products**

Observe the following instructions. Otherwise, injury to the human body (eyes and skin) may result.

- Do not direct the laser beam at other persons.
- Never look at the laser beam through optical instruments such as a microscope, magnifier or telescope.
- Make the laser path as short as possible and be sure to terminate the laser path with a diffusion reflector or diffusion absorber so that the laser beam does not diffuse. (It is recommended to install the protection enclosure.)
- Install the laser product so that the laser beam be located well above or below eye level.
- Install the laser product carefully so that the laser beam is not unintentionally directed at mirror-like surfaces.
- It is recommended to wear protective eye goggles.
- Do not disassemble the LK-G Series.
- Do not look directly at the laser beam.

**Model LK-G35/LK-G30**

**Model LK-G85/LK-G80**

**Model LK-G155/LK-G150**

**Model LK-G405/LK-G400**

**Model LK-G505/LK-G500**

**Model LK-G37/LK-G32**

**Model LK-G87/LK-G82**

**Model LK-G157/LK-G152**

**Model LK-G407/LK-G402**

**Model LK-G507/LK-G502**

**Wavelength 650 nm**

**FDA (CDRH)**

**Part 1040.10**

**Maximum output** 4.8 mW 0.95 mW 0.3 mW

**Class**

- Class 3a
- Class 2
- Class 2
- Class 1


**JIS C6802:** 1997

**Maximum output** 4.8 mW 0.95 mW 0.3 mW

**Class**

- Class 3A
- Class 2
- Class 1
Cautions on Class 2 laser products

Observe the following instructions. Otherwise, injury to the human body (eyes and skin) may result.

• Do not direct the laser beam at other persons.
• Do not disassemble the LK-G Series.

Cautions on Class 1 laser products

• Do not look directly at the laser beam for an extended period of time.
• Do not disassemble the LK-G Series.
The LK-G Series is equipped with the following safety features based on IEC60825-1 and CDRH Part 1040.10 (Safety of laser products).

■ Laser radiation emission warning indicator
   Lights or flashes while the LK-G Series is in operation.

■ Laser remote interlock connector
   The laser beam stops radiation emission upon opening the circuit between the REMOTE terminal and the COM IN terminal.

■ Beam stop or attenuator
   The laser beam stops radiation emission by the following operations:
   • NPN type: Short-circuiting between the LASER OFF terminal and COM IN terminal.
   • PNP type: Apply the voltage between the LASER OFF terminal and COM IN terminal.

Refer to “12-pin I/O terminal block” (page 4-2) for connecting terminals.
Refer to “Expansion Connector” (page 4-5) for connecting terminals.

* The laser remote interlock connector is delivered with the wire for short-circuiting installed.
Warning labels

The contents of warning indications and locations for attaching warning labels are described below.

The FDA (CDRH) warning labels are attached to the unit when shipped from the factory. Labels other than the FDA (CDRH) label are supplied with the unit. Attach the other label(s) to the locations as shown in the figure on page 9 according to the destinations of the product.

Warning label are not supplied with LK-G15/LK-G10, because these models are IEC class 1 and JIS class 1 products.

Label contents

- FDA (CDRH) IEC (English)
- IEC (German) IEC (French)
- JIS (Japanese) GB (Simplified Chinese)
Label attachment locations

- LK-G35/LK-G30/LK-G37/LK-G32
- LK-G85/LK-G80/LK-G87/LK-G82
- LK-G155/LK-G150/LK-G157/LK-G152
- LK-G405/LK-G400/LK-G407/LK-G402
- LK-G505/LK-G500/LK-G507/LK-G502

AVOID EXPOSURE

LASER RADIATION IS EMITTED FROM THIS APERTURE.

LASER RADIATION - DO NOT STARE INTO BEAM

CAUTION

SEMICONDUCTOR LASER WAVELENGTH

MAXIMUM OUTPUT

CLASS 650nm LASER PRODUCT

0.3mW
Before Use
Operations and Functions
during Measurement
Input/Output Terminals
Function Settings
RS-232C Specifications
Appendices

Chapter 1
Chapter 2
Chapter 3
Chapter 4
Chapter 5
Chapter 6
Appendices

Organization of this Manual

Describes cautions and preparations before use.
Describes the operations that can be performed during displacement measurement and their functions.
Describes the functions and setting procedures of the Head settings, Output settings, Common settings, and Environment settings.
Describes the specifications of the input/output terminals and timing chart.
Describes the functions of the RS-232C interface and the setting procedures.
Describes the specifications of the controller and the head, outside dimensions, and characteristics.
Describes the troubleshooting methods, contents of error messages and optional products.
List of Default Values and Setting Ranges ..........................................3-15

List of the OUT Setting Screens ....3-16

Calculating Between the Heads....3-18

Setting the Scaling for Measurement (Calibration)...................................3-20

Stabilizing the Measurement by Filtering..........................................3-22

Using the Hold Function (Measurement Mode) ....................3-25

Setting the Trigger Condition ........3-31

Measuring with Offset....................3-32

Setting the Unit and the Minimum Display Unit ...................................3-33

Scaling the Analog Output ............3-34

Outputting the Analog Output Without Holding..........................................3-36

Setting the Common Function ............3-37

List of Functions and Function Nos. ......3-37

List of Default Values and Setting Ranges ..........................................3-37

List of the Common Function Setting Screens .........................................3-38

Setting the Sampling Rate of Measurement Value.......................3-39

Setting the Mutual Interference Prevention Function.......................3-40

Setting the External Timing Input...........3-41

Setting the Output Form of the Tolerance Comparator ...................................3-42

Setting the Strobe Output Time .....3-43

Accumulating the Measurement Value in the Memory (Data Storage Function)............... 3-44

Setting the Operations of the Equipment (Environment Settings) .......................3-46

List of Functions and Function Nos. ......3-46

List of Default Values and Setting Ranges ..........................................3-47

List of the Environment Setting Screens ............................3-48

Setting the Communication Specifications of the RS-232C...... 3-49

Setting the Program Switching Method......................... 3-50

Copying/Initializing the Program .. 3-51

Preventing Erroneous Operation on the Panel (Panel Lock) ....................... 3-53

Reducing the Power Consumption (Eco Mode)................................... 3-54

Chapter 4 Input/Output Terminals

Identifying Names and Functions of the Input/Output Terminals ........................ 4-2

Functions of the Input/Output Terminals ....................................... 4-2

Functions of the Input and Output Signals................................ 4-7

Timing Chart ...................................... 4-12

Chapter 5 RS-232C

Specifications ...................................... 5-2

Pin Layout....................................... 5-2

Communication Specifications....... 5-2

Communication Performance and Communication Mode in the Measurement State ........................ 5-3

Overview of the Settings According to External Devices............................. 5-3

Outputting Measurement Values and Changing Settings through Commands ...... 5-4

Connecting the PC or PLC Link Unit....... 5-4

Mode Change Command............... 5-7

Measurement Control Command Format ............................................ 5-8

Change Parameter Command ..... 5-13

Check Parameter Command Format...5-20

Timing Chart ................................. 5-21

Outputting Measurement Values in External Synchronization ................................. 5-22

Environment Settings Parameters 5-22

Output........................................... 5-22
Before Use

This chapter describes the configuration of the LK-G Series, cautions and required preparation before use. Be sure to read this section thoroughly before using the LK-G Series.

System Configuration ............................................................1-2
Checking the Package Contents ...........................................1-3
Identifying Part Names and Functions ..................................1-6
Installing and Connecting the Heads and Optional Parts ......1-9
Outline of Measurement and Settings .................................1-24
Returning the LK-Series to the Factory Default Settings.....1-26
Before Use

System Configuration

The LK-G Series can be used for various purposes in combination with commercially available devices.

*1: The controller (LK-G3001V/LK-G3001PV) can be separated into the display panel and the controller main unit. You can also purchase them separately.


Programmable controller

Enables timing control of the measurement and the switching of program No. as well as the control output and the measurement value acquisition.

PC

Enables control and acquisition of the measurement value from the RS-232C or the parallel I/O board.

Recorder

Records the measurement result.

Indicator light/Buzzer

Issues an alarm depending on the comparator result output.

Photoelectric/Proximity sensor

Transmits a signal to the TIMING input when the target is detected.

Head (two heads max.)

LK-G15/LK-G10
LK-G35/LK-G30
LK-G85/LK-G80
LK-G155/LK-G150
LK-G405/LK-G400
LK-G505/LK-G500

LK Navigator

Setup support software (LK-H1W) *2

LK-G Series

USB/RS-232C

Controller

LK-G3001V/LK-G3001PV
LK-G3001/LK-G3001P

*1
Before Use
Checking the Package Contents

The LK-G Series consists of the following models. Check if the parts and equipment listed below are included in the package of the model you purchased before using the unit.

**LK-G3001V/LK-G3001PV (Single Unit Type Controller)**
- Controller User’s Manual
- Screwdriver (Packed separately)
- LK-H1W (CD-ROM) (this manual): 1
- LK-G3001PV: 1

**LK-G3001/LK-G3001P (Separate Type Controller)**
- Controller User’s Manual
- Screwdriver (Packed separately)
- LK-G3001/ (this manual): 1
- LK-H1W (CD-ROM)
- LK-G3001P/: 1

- **Setup support software**
  - "LK-Navigator"
- **User’s Manual (PDF file)**
- **USB cable (3m)**

**Setup support software**
- "LK-Navigator"
- **User’s Manual (PDF file)**
- **USB cable (3m)**
Before Use

LK-GD500 (Separate Type Controller)

Display panel: 1
Panel attachment ring: 1

Head (LK-G15/LK-G10)

Head: 1

Head (Model other than LK-G15/LK-G10)

Head: 1
Laser sticker sheet: 1

The communication cable between the controller and the separate type display panel is sold separately. Refer to page A-6 for details.
Before Use

LK-GC2/GC5/GC10/GC30

Head-to-controller cable:

- LK-GC2: 2-m cable
- LK-GC5: 5-m cable
- LK-GC10: 10-m cable
- LK-GC30: 30-m cable

*We have thoroughly inspected the package contents before shipment. However, in the event of defective or broken items, contact your nearest KEYENCE office (address listed in the end of this manual).

For the optional products, refer to "List of Optional Products" (page A-6).
Before Use
Identifying Part Names and Functions

This section describes the name and function of each part.

Controller

Display panel

1 Display panel fixing case

2 Display panel fixing screw

3 Measurement value indicators

Display the measurement value, tolerance comparator value, and various statistical results. The setting items are displayed during setting.

Green: Within the tolerance    Red: Outside the tolerance

4 Comparator output indicator

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

5 Timing input indicator

Lights when the timing signal is being input.

6 Head status display indicator

Displays the laser emission status and the measurement status.

7 Operation keys

Displays and descriptions of the measurement value indication

LASER ON Laser emission LED. Lights while the LK-G Series is in operation.

STABILITY Lights in green or orange within the measurement range. Lights in red outside the measurement range, alarm, or laser-off.

BRIGHT Lights at the exceeding light intensity alarm.

DARK Lights at the light intensity shortage alarm.

Display

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numerical value (±999999)</td>
<td>Displays the measurement result in numerical value. The display unit, decimal point position, and minimum display unit vary depending on the settings.</td>
</tr>
<tr>
<td>FFFFFFF (HI output: ON. Monitor output: +10.8 V)</td>
<td>Displayed when the value exceeds the display range.</td>
</tr>
<tr>
<td>–FFFFFF (LO output: ON. Monitor output: –10.8 V)</td>
<td>Displayed when the value drops below the display range.</td>
</tr>
<tr>
<td>(HI, GO and LO outputs: OFF. Monitor output: –10.8 V)</td>
<td>Displayed during the comparator standby state.</td>
</tr>
</tbody>
</table>
Before Use

Operation keys

1 RS-232C connector
Establishes communication with a PC or a PLC.

2 USB connector
Used when connecting the PC via USB.
Refer to "LK-Navigator User's Manual" for details.

3 6-pin terminal block

4 Expansion connector

5 Head connectors

6 Laser emission LED.
Lights while the LK-G series operates.

7 Display panel connector
Connects the communication cable between the display panel and the controller.

8 12-pin terminal block

---

Key | Function
---|---
| • During measurement it calls the Program switch mode.
| • During measurement it calls the Tolerance setting mode.
| • When pressed for one second, it calls the Operation setting mode.
| • During setting it cancels the setting content and returns to the previous setting.
| • During measurement it calls the Statistics display mode.
| • During setting it determines the content.
| • During measurement it sets the measurement value to zero.
| • When pressed for three seconds it cancels auto-zero.
| • When pressed for three seconds while inputting the value, it initializes the selected item.
| • During setting it switches the display to the next setting item.
| • While inputting the value it shifts one digit right.
| • When pressed for one second or more it shifts in higher speed.
| • During measurement it changes the display for OUT1, OUT2 or both at the same time.
| • During setting it switches the setting content.
| • While inputting the value it switches symbols or sets numerical values.
| • When pressed for one second or more it shifts in higher speed.

---

Refer to "Pin Layout" (page 5-2).
Refer to "6-pin I/O terminal block" (page 4-4).
Refer to "Expansion connector" (page 4-5).
Refer to "12-pin I/O terminal block" (page 4-2).
1 Before Use

1 Sensor (emitter)
Emits the laser beam for measurement. It is protected with a glass cover.

2 Sensor (receiver)
Receives the laser beam for measurement. It is protected with a glass window.

3 Attachment holes for the ND filter
Used for attaching the ND filter (LK-F1/LK-F2).

4 Installation holes

5 Connecting cable
Connected to the head-to-controller cable.

6 Laser radiation emission LED
Lights or flashes while the LK-G Series is in operation.

Status LED
Center of the measurement range Lights in green
Within the measurement range Lights in orange
Outside the measurement range

Alarm Laser off
Flashes in orange
Before Use

Installing and Connecting the Heads and Optional Parts

Installing the Head

Adjust the distance between the head and the measuring target, and fix the head with the screws at the two installation holes.

- LK-G15/LK-G10

The measurement range is shown in the figure below.

* The value inside the parentheses ( ) is when the sampling rate is 20 µs.

- LK-G10

The laser emission LED at both diffuse reflection and specular reflection lights in green within ±0.05 mm of the reference position, and lights in orange in the other positions in the measurement range.

- Installation procedure

<table>
<thead>
<tr>
<th>Reference distance</th>
<th>Measurement range</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mm</td>
<td>–1 mm (–0.37 mm)</td>
</tr>
<tr>
<td>0 mm</td>
<td>+1 mm</td>
</tr>
</tbody>
</table>

- R4

- M4

r

35 mm or more
Before Use

- **LK-G35/LK-G30/LK-G37/LK-G32**

The measurement range is shown in the figure below.

*The value inside the parentheses ( ) is when the sampling rate is 20 µs.*

- Laser emission LED at both diffuse reflection and specular reflection lights in green within ±0.25 mm of the reference position, and lights in orange in the other positions in the measurement range.

### Installation procedure

- **Diffuse reflection setup**
- **Specular reflection setup**

### Reference distance

- **30 mm**
- **23.5 mm**
- **0 mm**

### Measurement range

- **40°**

+4.5 mm

Measurement range: –4.5 mm (–1.6 mm)

+5 mm

Measurement range: –5 mm (–1.8 mm)
Before Use

- **LK-G85/LK-G80/LK-G87/LK-G82**
  - The measurement range is shown in the figure below.
  - The value inside the parentheses ( ) is when the sampling rate is 20 µs. Note that the measurement range narrows, disabling measurements at the reference position.
  - The laser emission LED at both diffuse reflection and specular reflection lights in green within ±0.75 mm of the reference position, and lights in orange in the other positions in the measurement range.
  - Select the mounting mode (page 3-12) according to the installation conditions.
  - The measurement range when measuring a mirror surface or a glass surface at the time of specular reflection setup is between +14 (NEAR side) to –8.2 mm (FAR side). When the sampling rate is 20 µs, the value becomes +14 (NEAR side) to +8.7 mm (NEAR side).

- **LK-G85**
  - M4
  - Installation procedure
  - Diffuse reflection setup
  - Specular reflection setup
  - Reference distance: 80 mm
  - Reference distance: 0 mm
  - Measurement range: +14 mm
  - Measurement range: –14 mm
  - Reference distance: 75.2 mm
  - Reference distance: 0 mm
  - 17°

- **Note**
Before Use

■ LK-G155/LK-G150/LK-G157/LK-G152

The measurement range is shown in the figure below.

* The value inside the parentheses ( ) is when the sampling rate is 20 µs. Note that the measurement range narrows, disabling measurements at the reference position.

• The laser emission LED at both diffuse reflection and specular reflection lights in green within ±2 mm of the reference position, and lights in orange in the other positions in the measurement range.

• Select the mounting mode ( page 3-12) according to the installation conditions.

The measurement range when measuring a mirror surface or a glass surface at the time of specular reflection setup is between +39 (NEAR side) to –24 mm (FAR side). When the sampling rate is 20 µs, the value becomes +39 (NEAR side) to +22 mm (NEAR side).

Installation procedure

LK-G150

• Diffuse reflection setup • Specular reflection setup

Reference
distance
150 mm

Reference
distance
0 mm

Measurement range
+39 mm
–39 mm
(+22 mm)

Reference
distance
147.5 mm

Reference
distance
0 mm

17°

Note
Before Use

- **LK-G405/LK-G400/LK-G407/LK-G402**
  - The measurement range is shown in the figure below.
  - The value inside the parentheses ( ) is when the sampling rate is 20 µs. Note that the measurement range narrows, disabling measurements at the reference position.
  - The laser emission LED at both diffuse reflection and specular reflection lights in green within ±5 mm of the reference position, and lights in orange in the other positions in the measurement range.
  - Select the mounting mode (page 3-12) according to the installation conditions.
  - When using LK-G405/G400/G407/G402, select function No. G-1 or G-0 (page 3-3).
  - The measurement range when measuring a mirror surface or a glass surface at the time of specular reflection setup is between +72 (NEAR side) to –50 mm (FAR side). When the sampling rate is 20 µs, the value becomes +72 (NEAR side) to +70 mm (NEAR side).

---

Installation procedure

- LK-G405
  - Diffuse reflection setup
  - Specular reflection setup

<table>
<thead>
<tr>
<th>Reference distance</th>
<th>Measurement range</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 mm</td>
<td>–99 mm (–100 mm)</td>
</tr>
<tr>
<td>0 mm</td>
<td>+99 mm (+100 mm)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference distance</th>
<th>Measurement range</th>
</tr>
</thead>
<tbody>
<tr>
<td>398 mm</td>
<td>–17° (–20°)</td>
</tr>
</tbody>
</table>

---

Note
Before Use

■ LK-G505/LK-G500/LK-G507/LK-G502

The measurement range is shown in the figure below.

*1 The value inside the parentheses ( ) is when the sampling rate is 50 µs.
*2 The value inside the parentheses ( ) is when the sampling rate is 20 µs.

Note that the measurement range narrows in either case, disabling measurements at the reference position.

• The laser emission LED at both diffuse reflection and specular reflection lights in green within ±12.5 mm of the reference position, and lights in orange in the other positions in the measurement range.

• Select the mounting mode (page 3-12) according to the installation conditions.

When using LK-G505/G500/G507/G502, select function No. G-1 or G-0 (page 3-3).

The measurement range when measuring a mirror surface or a glass surface at the time of specular reflection setup is between +173 (NEAR side) to +49.5 mm (NEAR side). When the sampling rate is 50 µs, the value becomes +173 (NEAR side) to +125 mm (NEAR side). Note that the measurement is disabled when the sampling rate is 20 µs.

• Installation procedure

LK-G505

• Diffuse reflection setup • Specular reflection setup

Reference distance 500 mm

Reference distance 0 mm

+249 mm

Measurement range –498 mm (+125 mm)*1 (+230 mm)*2

+250 mm

Measurement range –500 mm (+125 mm)*1 (+230 mm)*2

Reference distance 497.5 mm

Reference distance 0 mm

17°

Note
Before Use

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 measurement accuracy may deteriorate. In such a case, attach the ND filter (LK-F1) to ensure accurate measurement.

- LK-G35/LK-G30/LK-G37/LK-G32
- LK-G85/LK-G80/LK-G87/LK-G82
- LK-G155/LK-G150/LK-G157/LK-G152
- LK-G405/LK-G400/LK-G407/LK-G402
- LK-G505/LK-G500/LK-G507/LK-G502

ND filter LK-F1

Mounting screw x 4 (M1.6 x 3 countersink-head screw)

ND filter LK-F2

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

Installations Depending on the Measurement Target

Measuring distance

Use the head as close to the reference distance as possible. Doing so stabilizes the detection.

Target shape

The installation of the head in the orientations indicated by the circle in the figures below is recommended.

Displacement in a hole

Near the wall surface

Height-difference measurement

(a)
Before Use

Installing the Controller

Install the controller to the DIN rail, or fix it with screws.

Caution on the orientation of the LK-G Series

Install the controller in the orientations shown in the following figures with a circle. Do not install it upside down.

Be sure to leave 30 mm of clearance or more above the controller, and 10 mm or more on each side. In addition, for ensuring the safe connection of the cord, leave 65 mm space or more in front of the terminal panel of the controller.

When installing the controllers side-by-side, make sure there is a clearance of 10 mm or more between the controllers and 30 mm or more of clearance above them.

CAUTION

• Do not cover the ventilation holes on the top and bottom of the controller. The heat may stay inside causing a malfunction.

• When the temperature in the controller panel rises to over 50 °C, decrease the ambient temperature below 50 °C by introducing forced cooling air or by securing more room around the system.
Before Use

Installing the LK-G3001V/LK-G3001PVLK-G3001PV (single unit type controller)

Install it on its bottom.

Installing the LK-G3001/LK-G3001P and LK-GD500 (separate type controller)

Display panel (LK-GD500) Controller (LK-G3001/LK-G3001P)

- Installing on a DIN rail
- Installing on its bottom

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

When removing the display panel, while pushing up the two cutouts of the attachment ring with a flat-head screwdriver and push out the display panel.

M4 screw x 4 (screw depth 6 mm)

Display panel
Control panel
Panel attachment ring
Two cutouts
M4 screw x 4 (screw depth 6 mm)
1-19
1 Before Use

Separating the single unit type controller

Disconnect the display panel cable from the display panel connector on the controller's terminal panel.

Remove the display panel cable from the guide on the bottom of the controller.

2 Loosen the display panel fixing screw.
The display panel fixing screw does not drop from the display panel fixing case.

3 Remove the display panel fixing case from the controller.

4 While pushing (1) and (2) outward in this order, push the display panel to remove the panel attachment ring.

5 Remove the display panel from the display panel fixing case.

Reference

1

2

Remove the display panel fixing case in the directions of the arrows.

(3)

1

(2)
1. Before Use

2. Installing the display panel by aligning it with the two protrusions on the display panel fixing case.

3. Fix the display panel with the panel attachment ring, and connect the 30-cm display cable (optional).

4. Align the three claws of the display panel fixing case with the controller.

Display Panel
- Two protrusions
- Display panel fixing case (optional)
- Panel attachment ring
- Two claws

Fix the cable by fitting it along the guide.

Display panel fixing case
- Controller
- Three claws
Before Use

4 Install the display panel fixing case along the groove on the controller.

CAUTION
Be sure to check the orientation of the claws on the connector side before installation. Otherwise, the claws break and cause malfunction.

5 Fix the display panel fixing case 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 rear of the controller.

Slide the front panel in the direction of the arrow.
Before Use

Connection

■ Connecting the head

Connect the connector of the head-to-controller cable to the head connector A or B on the controller's terminal panel. Check that a click sound is heard indicating that they are securely fixed. When removing it, pull it out while pressing the buttons on both sides of the connector. Up to two heads can be connected at the same time.

CAUTION

• Be sure to turn off the power of the controller before connecting/disconnecting cables. Failure to do so may cause malfunction.

• Ensure that the orientation of the connector is correct. Otherwise the pin could break and may lead to system malfunction.

Display panel cable (30 cm/3 m/10 m)  Head-to-controller cable (2 m/5 m/10 m/30 m)  Head B  Head A  24 VDC power supply  Display Panel (in the case of the separate type controllers)
Before Use

■ Connecting the display panel
In the case of the separate type controller, the display panel cable is used for connecting the controller to the display panel. The LK-G series can be operated without the display panel. In addition, the operation from a PC is possible by using the “LK-Navigator” software.

■ Connecting the power
Connect the 24V DC power to the terminals 1 and 2 of the 12-pin terminal block. KEYENCE CA-U2 is recommended for the 24V DC power supply.

■ Connecting the terminal block
The steps to connect the 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 it out.
2. Loosen the screws on the terminal with a screwdriver, and insert the lead wires into the terminal block. Approximately 6.5mm of the insulation should be stripped from both wires.
3. Tighten the lead wires with the screwdriver. After tightening them, pull the lead wires lightly to confirm that they are securely fixed.
4. Install the terminal block to the controller.

Reference
Reference
Before Use

Outline of Measurement and Settings

Switching Modes

The LK-G has the following modes:

- Program switch mode: Switches between stored programs
- Tolerance setting mode: Sets "Hi" and "Lo" limits
- Setting mode: Used for setup of various functions and settings
- Measurement mode: Performs measurement

Press the [SET] key for one second.

Chapter 3 "Function Settings" (page 3-1)

The parameters can easily be changed if necessary when calling up the program.

Chapter 2 "Operations and Functions during Measurement" - "Program Function" (page 2-8)

The upper limit, lower limit, or hysteresis can be set in the Tolerance setting mode.
## Before Use

### Setting Mode

In the Setting mode, every time the key is pressed, the setting content advances in this order: Head Setting → OUT Settings → Common Settings → Environment Settings.

<table>
<thead>
<tr>
<th>Program Nos.</th>
<th>Functions</th>
<th>Setting Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-7</td>
<td>Head setting</td>
<td>ABLE, Measurement mode, ALARM warning, ABLE calibration</td>
</tr>
<tr>
<td></td>
<td>OUT settings</td>
<td>Calculation method, Scaling, Filter, Measurement mode, Trigger, Offset, Minimum display unit, Analog scaling, Analog through</td>
</tr>
<tr>
<td></td>
<td>Common settings</td>
<td>Sampling rate, Mutual interference prevention, Timing synchronization, Comparator output format, Strobe time, Data storage</td>
</tr>
<tr>
<td></td>
<td>Environment settings</td>
<td>RS-232C, Setting selection, Program, Panel lock, Eco mode</td>
</tr>
</tbody>
</table>

### OUT1 Timer (TIM)

- **HI**: High level output
- **GO**: Go output
- **LO**: Low level output

### OUT2 Timer (TIM)

- **HI**: High level output
- **GO**: Go output
- **LO**: Low level output
Before Use

Returning the LK-Series to the Factory Default Settings

You can initialize the controller and return the settings to the default settings when shipped from the factory.

1. While pressing the [M] key, turn on the power.

   The measurement value indication shows "nt".

2. When you press the [M] key again, the settings are initialized and the measurement state is established.

   The settings return to the default setting when shipped from the factory.

Refer to "Chapter 3 Function Settings" (page 3-1).
Operations and Functions during Measurement

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

- Switching the Measurement Value Displays
- Setting the Tolerance Comparator Values
- Setting the Display Value Instantaneously to Zero (Auto-Zero)
- Program Function
  - Switching Program Nos.
  - Performing Statistical Computation with the Measurement Value
Operations and Functions during Measurement

This section describes how to switch the measurement value display contents.

During measurement, the following three types of display can be switched. Press the key to switch displays:

- OUT1 signal display
- OUT2 signal display
- OUT1/OUT2 dual display

The display type is retained for every program No.
Operations and Functions during Measurement

Setting the Tolerance Comparator Value

This section describes how to read the tolerance comparator display, and its setting procedure.

The Function of the Tolerance Settings

HIGH and LOW comparator tolerance values can be set. The measured value can be displayed and output in 3 steps: when exceeding the HI comparator value (HI), when the value drops below the LOW comparator value (LOW), and when the value is between the HI and LOW comparator values (GO).

When the comparator output format is normal, the comparator output is as follows. The comparator result of tolerance is outputted from the 12-pin I/O terminal block and the expansion connector on the controller's terminal panel.

<table>
<thead>
<tr>
<th>Comparator status</th>
<th>Range</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>HI comparator value &lt; Measurement value</td>
<td>HI LED lights, and the measurement value is displayed in red.</td>
</tr>
<tr>
<td>GO</td>
<td>LO comparator value &lt; HI comparator value</td>
<td>GO LED lights, and the measurement value is displayed in green.</td>
</tr>
<tr>
<td>LOW</td>
<td>Measurement value &lt; LO comparator value</td>
<td>LO LED lights, and the measurement value is displayed in red.</td>
</tr>
<tr>
<td>Comparator stand-by state</td>
<td></td>
<td>No LED lights, and the measurement value is displayed as ------.</td>
</tr>
</tbody>
</table>

Refer to “Setting the Output Form of the Tolerance Comparator” (page 3-42) for the comparator output form.

Refer to “Functions of the Input/Output Terminals” (page 4-2) for the external terminals.

<table>
<thead>
<tr>
<th>Display value</th>
<th>HI comparator value</th>
<th>LO comparator value</th>
<th>HI output</th>
<th>GO output</th>
<th>LO output</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
</tbody>
</table>

Reference
Operations and Functions during Measurement

Measurement stops while the setting is in progress.

1. Press the "GO" key.
   - Enters the tolerance setting mode.
2. For changing the OUT No. to be set, press the "GO" key.
3. Press the "GO" key, and set the value with the "HI" and "LO" keys.
   - As an example, the tolerance on the HI side of OUT1 is set to 4.0000.
4. Press the "GO" key, and set the value with the "HI" and "LO" keys.
   - As an example, the tolerance on the LO side of OUT1 is set to -4.0000.

Setting procedure of 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 symbols.
- When the "HI" key is pressed, the digit that flashes after all the digits flash shifts to the right. When pressed for one second or more it shifts in higher speed.
- When the "LO" key is pressed, the value increments. When pressed for one second or more, the value advances in higher speed.
- When the "TIM" key is pressed for three seconds, the setting returns to the default value.

Note
Operations and Functions during Measurement

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, a gap may be generated between the detected value and the return value of the tolerance comparator, thus avoiding this phenomenon. When the comparator output format is normal, the comparator output is as follows. Hysteresis is not set by default when shipped from the factory.

Measurement stops while the setting is in progress.

Setting procedures of hysteresis

1. Press the key.
   Enters the tolerance setting mode.

2. Pressing the key twice shows the Hysteresis setting screen.
   "kYS-1" sets OUT1, and "kYS-2" sets OUT2.

3. Press the key, and set the value with the and keys.
   In this example, the hysteresis of OUT1 is set to "0.1000".

4. Confirm the data by pressing the key, and press the key to return to the measurement state.

Refer to "Setting the Output Form of the Tolerance Comparator" (page 3-42) for the comparator output form.

<table>
<thead>
<tr>
<th>Display value</th>
<th>HI comparator value</th>
<th>HI output</th>
<th>LO comparator value</th>
<th>LO output</th>
<th>GO output</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI</td>
<td>ON</td>
<td>OFF</td>
<td>LO</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>Low</td>
<td>ON</td>
<td>OFF</td>
<td>GO</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>TIM</td>
<td>ON</td>
<td>OFF</td>
<td>TIM</td>
<td>ON</td>
<td>OFF</td>
</tr>
</tbody>
</table>

Note

OUT1
HI
GO
LO

OUT2 TIM

OUT1
HI
GO
LO

OUT2 TIM
Operations and Functions during Measurement

Setting the Display Value Instantaneously to Zero (Auto-Zero)

This section describes the auto-zero function, which is used for referencing zero-point position. Operation of the key or others resets the present displayed value to "0.0000". By considering this zero position as a reference, the increase and decrease are displayed in ± (positive/negative). This function can be used for reference zero-point positioning when a workpiece is changed.

The example below uses the auto-zero function by using the 150-µm target as a reference.

Auto-zero cannot be set at comparator standby state (displayed as "------") and over-range state. However, cancellation of auto-zero is possible.

• The auto-zero value is stored according to program No. and OUT.
• The auto-zero value is retained even if the power is turned off.
• When the measurement mode is other than normal, the comparator standby state ("---") is established after auto-zero is set.

- Adjusting a master workpiece by using the offset function (auto offset function)
  - When the offset value is set to the size of the master workpiece, enabling the auto-zero will set the numerical value to the size of the master workpiece (offset value).
- Auto-zero is set for the measurement value that underwent a measurement mode process (page 3-25).
  Refer to "Measuring with Offset" (page 3-32).
Operations and Functions during Measurement

■ Operations from the display panel

1. Measure the target to be used as a reference.
2. Assume that "1.2345" is displayed.

- Press the \textit{HI} key.
The measurement value display becomes zero.

- If you enable the auto-zero function for either OUT1 or OUT2 independently, the measurement value display mode must be set to the single display.
- If you enable the auto-zero function for both OUT1 or OUT2 at the same time, the measurement value display mode must be set to the dual display.
- The measurement value at the moment when the \textit{HI} key is released is set as "0.0000".
- Pressing the \textit{HI} key for three seconds cancels auto-zero.

■ Input from the ZERO terminal

Auto-zero is activated for OUT1 when ZERO1 (Terminal 10) on the 12-pin terminal block receives an input and for OUT2 when ZERO2 (Terminal 8) on the expansion connector receives an input. Ensure that the turn-on time does not exceed two seconds.

- NPN type: OFF when opened/ON when short-circuited with COM (No.12)
- PNP type: OFF when opened/ON when the voltage is applied

The measurement value at the turning-on moment is set as "0.0000".

- If the ZERO1 terminal or the ZERO2 terminal is turned on for two seconds or more, auto-zero is canceled.

■ RS-232C interface

You can send the command from the external devices by using the RS-232C interface to set or cancel the auto-zero function.

Refer to "Switching the Measurement Value Displays" (page 2-2) for switching the measurement value display.

Refer to "Chapter 5 RS-232C" (page 5-1).
# Operations and Functions during Measurement

Eight Programs can be switched among Program Nos. 0 to 7 in the LK-G Series. Register the setting contents that correspond to a measuring target as programs in advance. By calling up a program as desired, you can easily change between targets.

**Environment Settings** is not saved in the program.

<table>
<thead>
<tr>
<th>Program No.</th>
<th>Head Settings</th>
<th>OUT Settings</th>
<th>Common Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRG0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRG1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRG2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRG3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRG4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRG5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRG6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRG7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note**
Operations and Functions during Measurement

Switching Program Nos.

This section describes the Program No. switch function, which can easily change the operation settings.

**Display panel**
1. Press the P1 key.
2. The program selection screen appears.
3. Select a program No. by using the P2 key.
4. Press the P3 key to register it, and return to the measurement state.

**External input terminal**
Program No. can be changed by using the P1, P2, and P3 keys of the expansion connector.

**RS-232C interface**
You can send the command from the external devices by using the RS-232C interface to switch program Nos.

The method of switching the program Nos. varies depending on the setting of "Setting the Program Switching Method" (page 3-50) in the Environment settings. Refer to "Expansion Connector" (page 4-5) and "Chapter 5 RS-232C" (page 5-RS-232).
Performing Statistical Computation with the Measurement Value

Statistical computation with the measurement value can be performed. The data to be used for the statistical computation is the one held in each measurement mode. OUT1 and OUT2 can perform statistical computation independently.

Up to 90000 statistical data can be acquired. If the number exceeds 90000, the statistical computation stops.

The statistical computation is performed and the statistical data is updated continuously.

The statistical data is cleared under the following six conditions:

• When the key is pressed for three seconds
• When moving to the Measurement mode from the Setting mode, Tolerance Settings mode, Program Change mode, or Communication mode
• When the statistics clearing command is received via the RS-232C interface
• When the clearing operation is performed on “LK-Navigator” software
• When a program No. is switched
• When the power is turned off

The upper OUT1 display shows the name of the statistical data, and the lower OUT2 display shows the statistical data.

The statistical data consists of the following 11 items.

- M - Sk: Tolerance upper limit
- M - SLo: Tolerance lower limit
- M - AvG: Average value
- M - toP: Maximum value
- M - bot: Minimum value
- M - d F: Maximum value – minimum value
- M - Std: Standard deviation
- M - no: Number of all data
- M - H: Number of tolerance HI data
- M - Go: Number of tolerance GO data
- M - Lo: Number of tolerance LO data

Refer to “Using the Hold Function (Measurement Mode)” (page 3-25).

OUT1 display

<table>
<thead>
<tr>
<th>Name of statistical data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M - Sk</td>
<td>Tolerance upper limit</td>
</tr>
<tr>
<td>M - SLo</td>
<td>Tolerance lower limit</td>
</tr>
<tr>
<td>M - AvG</td>
<td>Average value</td>
</tr>
<tr>
<td>M - toP</td>
<td>Maximum value</td>
</tr>
<tr>
<td>M - bot</td>
<td>Minimum value</td>
</tr>
<tr>
<td>M - d F</td>
<td>Maximum value – minimum value</td>
</tr>
<tr>
<td>M - Std</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>M - no</td>
<td>Number of all data</td>
</tr>
<tr>
<td>M - H</td>
<td>Number of tolerance HI data</td>
</tr>
<tr>
<td>M - Go</td>
<td>Number of tolerance GO data</td>
</tr>
<tr>
<td>M - Lo</td>
<td>Number of tolerance LO data</td>
</tr>
</tbody>
</table>
Operations and Functions during Measurement

1. Press the key to change the screen to show the single display.
   Set the OUT No. of which statistical data is to be displayed.

2. Press the key.
   The screen changes to the statistical data display.
   The upper limit of the tolerance setting is displayed.

3. Press the key and check the statistical data in order.
   For details of the displaying order, refer to page 2-10.

4. Press the key to return to the measurement value display.

When displaying both OUT1 and OUT2 during measurement, the statistics cannot be displayed.

- The measurement and statistical computation are performed even when the statistical data are displayed.
- In the statistics display screen, if no key operation is performed for 60 seconds, the screen returns to the measurement state.
This chapter describes the functions of the LK-G Series and the setting procedures.

Measurement, Data Flow and Functions ................................ 3-2
Setting the Head .................................................................. 3-3
Setting the Conditions of the Measurement Value Output .... 3-13
Setting the Common Functions .......................................... 3-37
Setting the Operations of the Equipment (Environment Settings) .................................................. 3-48
Measurement, Data Flow and Functions

The LK-G Series can connect two heads. Each head can perform measurement individually, and the measurement values between the heads can be calculated.

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

- **Function and function display**
  - Head Settings: The functions related to stable detection are set.
  - OUT Settings: The functions related to data processing are set.
  - Common Settings: The common functions related to the Head settings and the OUT settings are set.
  - Environment Settings: The operating environment of the LK-G Series is set.
- **Measurement mode**
  - Data flow of the head A
  - Data flow of OUT 1 data
  - Data flow of OUT 2 data
  - Data flow of the head B
- **Calculation between the data of heads**
  - Sampling
  - Alarm processing
  - Scaling
  - Filtering
  - Tolerance comparator
  - Auto-zero

- **Head A measurement value**
  - Head B measurement value
  - OUT 1 measurement value
  - OUT 2 measurement value
  - OUT 1 HI
  - OUT 1 GO
  - OUT 1 LO
  - OUT 2 TIM
### Setting the Head

This section describes the settings related to the sensing for stable detection.

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3-5</td>
</tr>
<tr>
<td>B</td>
<td>3-7</td>
</tr>
<tr>
<td>C</td>
<td>3-8</td>
</tr>
<tr>
<td>D</td>
<td>3-10</td>
</tr>
<tr>
<td>E</td>
<td>3-12</td>
</tr>
</tbody>
</table>

#### List of Functions and Function Nos.

- **Function display**
- **Function Light intensity adjustment**
- **Function Measurement mode**
- **Function Alarm processing**
- **Function Calibration START/STOP**
- **Function Mounting mode**

#### List of Default Values and Setting Ranges

<table>
<thead>
<tr>
<th>Function</th>
<th>Item</th>
<th>Settable range</th>
<th>Default value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Function display**
- **Function Light intensity adjustment**
- **Function Measurement mode**
- **Function Alarm processing**
- **Function Calibration START/STOP**
- **Function Mounting mode**
Function Settings

List of the Head Setting Screens

OUT1

HI  GO  LO  TIM

OUT2 TIM

HI  GO  LO

OUT1

HI  GO  LO  TIM

OUT2 TIM

HI  GO  LO

Head Settings

Measurement mode

Auto  Manual

Normal

Translucent object  Transparent object

Transparent object 2

Alarm process

Multi-reflective object

Number of times of processing

ABLE calibration

Level

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

The following two types of setting are available for ABLE.

- Setting procedure of ABLE (AUTO)

1. Hold down the key, and select "kEAd-A" with the key. "Head A" is set in this example.
2. Press the key, and select the function "A" by the key.
3. Set ABLE.
4. Press the key to register the setting. Press the key to return to the measurement state.

Function No. Light intensity adjustment

- A-0 AUTO
  - Auto Automatically adjusts the light intensity to the optimum level.
  - Select this in normal cases.
- A-1 MANUAL
  - Manual The light intensity and sensitivity can be adjusted by limiting the adjustment range to the desired range between 1 and 99.
  - Select this when the reflective rate of the target changes rapidly and drastically, or when only detection of the target is required.
Function Settings

1. Hold down the key, and select "kEAd-A" with the key. "Head A" is set in this example.

2. Press the key, and select function "A" with the key. Set ABLE.

3. Press the key, and select "A-1" with the key. Select "ìmanual".

4. Press the key, and set the value for the higher limit with the and keys. "60" is set in this example.

5. Press the key, and set the value for the lower limit with the and keys. "20" is set in this example.

6. Press the key to register the setting. Press the key to return to the measurement state.
Function Settings

Setting the Measurement Mode According to the Measuring Target

Specifying the features of the measuring target stabilizes the detection. Select the corresponding type from the following list.

- To obtain optimal control over detection of the four surfaces, the sampling rate of [Transparent object 2] is quadrupled at maximum. Be sure to attach the ND filter (page 1-9).
- When selecting the transparent object, transparent object 2, or multi-reflective object, set the sampling rate (page 3-39) to other than 20 µs (other than 20 µs and 50 µs when transparent object 2 is selected in the LK-G85/G80/G87/G82/G155/G150/G157/G152/G405/G400/G407/G402, and other than 20 µs, 50 µs and 100 µs when transparent object 2 is selected in the LK-G505/G500/G507/G502).

Setting procedure of the measurement mode

1. Hold down the key, and select "kEAd-A" with the key. "Head A" is set in this example.
2. Press the key, and select function "b" with the key. Set the measurement mode.
3. Press the key, and select "b-2" with the key. "Transparent object" is selected in this example.
4. Press the key to register the setting. Press the key to return to the measurement state.

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Target workpiece</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>b-0</td>
<td>normal</td>
<td>Normal      Select this setting in normal cases.</td>
</tr>
<tr>
<td>b-1</td>
<td>kalf-t</td>
<td>Translucent object Used for a target that absorbs light such as a translucent resin.</td>
</tr>
<tr>
<td>b-2</td>
<td>tran-1</td>
<td>Transparent object Used for displacement measurement or thickness measurement of a transparent object. Used when the reflective ratio of multiple surfaces on a transparent object is the same.</td>
</tr>
<tr>
<td>b-3</td>
<td>tran-2</td>
<td>Transparent object 2 Used when the reflective ratio of the multiple surfaces (up to four phases) on the transparent object is different.</td>
</tr>
<tr>
<td>b-4</td>
<td>rs</td>
<td>Multi-reflective object Used to measure the bending of an IC or connector terminal.</td>
</tr>
</tbody>
</table>

Note

OUT1

HI

GO

LO

TIM

OUT2 TIM

OUT1

HI

GO

LO

TIM

OUT2 TIM

OUT1

HI

GO

LO

TIM

OUT2 TIM

OUT1

HI

GO

LO

TIM

OUT2 TIM

OUT1

HI

GO

LO

TIM

OUT2 TIM

OUT1

HI

GO

LO

TIM

OUT2 TIM

OUT1

HI

GO

LO

TIM

OUT2 TIM
Function Settings

Specifying the Process When Measurement is Not Possible (Alarm Process)

The measurement is disabled when measurement overrange occurs or the light intensity is not adequate. The alarm process specifies how to process the data in these situations.

The alarm process has the following two types.

1. **Measurement disabled state on a hole to other similar feature can be cancelled.**
2. **The head status display indicator on the display panel or the laser emission LED on the head will not be held.**

### Setting Count

**Specifies the number of samples the previous measured value is held for after measurement is disabled.**

- **Setting range:** 0 to 999
- **If the measurement remains disabled even after the number of times of processing exceeds the specified value, the measurement value is displayed as -FFFFFF.**
- **Holding is released when the system recovers to the measurement state within the specified number of times of processing.**
- **When the number of times of processing is set as “999”, the normal value continues to be retained until the measurement is enabled.**

### Setting Level

**Sets the threshold level of the received light status to be judged as not measurable.**

- **Setting range:** 0 to 9
- **“0” is the least sensitive to the alarm, and “9” is the most sensitive to it.**

---

**Normal measurement value without “hold” (when the “Count” is set to 0):**

- **-FFFFFF**

**Normal measurement value with “hold”:**

- **-FFFFFF**
Function Settings

1. Hold down the key, and select "kEAd-A" with the key. "Head A" is set in this example.

2. Press the key, and select function "[" with the key.

3. Press the key, and set the number of times with the and keys. "500" times is set in this example.

4. Press the key, and specify the level with the key. "8" is set in this example.

5. Press the key to register the measurement result. Press the key to return to the measurement state.
Function Settings

Automatically Teaching the Adjustment Range of ABLE According to the Target

The ABLE calibration function optimizes the adjustment range of ABLE by actually measuring the target. Use this function when the reflective ratio of the target changes drastically in a short cycle.

■ Procedure of the ABLE calibration

1. Measure an actual target as shown in the following figure.
2. Start the ABLE calibration. The data acquisition starts.
3. Move the target slowly.
4. Complete the ABLE calibration. The data acquisition is completed, and the optimum ABLE range is set.

When ABLE calibration is performed, ABLE of function "A" is set to MANUAL, and the upper and lower limits of control are set to the adjusted values. By slowly moving the target, the adjustment range of ABLE can be optimized. By optimizing the adjustment range, the responsiveness when the reflectivity drastically changes in rapid cycle can be enhanced.

Reference
3-11  Function Settings

■ Setting procedure of the ABLE calibration

1. Hold down the key, and select "kEAd-A" with the key. "Head A" is set in this example.

2. Press the key, and select function "d" with the key.

3. Press the key to display "StArt". Press the key again to start measurement. "StoP" indicates that the target is being measured.

4. Press the key to register the measurement result. Press the key to return to the measurement state.
Setting the Mounting Mode

The LK-G Series measures the displacement of the target by measuring the reflected laser beam. When much of the surface of the target is specular, such as a mirror or glass, the mirror-reflection component of the reflective light increases. In such a case, set the mirror reflection setup to receive the specular reflection light.

In such a case, mount the head for mirror reflection.

The following two types of mounting mode are available.

■ Setting procedure of the mounting mode

1. Hold down the \[\texttt{key}, \text{ and select } \texttt{ kEAd-A \} with the \texttt{key}. \]

   "Head A" is set in this example.

2. Press the \[\texttt{key}, \text{ and select function } \texttt{ e } with the \texttt{key}. \]

   Set the mounting mode.

3. Press the \[\texttt{key}, \text{ and select } \texttt{ e-0 \} with the \texttt{key}. \]

   Select the diffuse reflection mode.

4. Press the \[\texttt{key} \text{ to register the setting. Press the \texttt{key} \text{ to return to the measurement state.} \]

When the LK-G15/LK-G10 is connected, the setting of the mounting mode is invalid.

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Mounting mode</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-0</td>
<td>d FF-S</td>
<td>Diffuse reflection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sets head for diffuse reflection. Select this in normal cases.</td>
</tr>
<tr>
<td>E-1</td>
<td>rr-S</td>
<td>Mirror reflection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sets head for mirror reflection mode. Select this when the measurement target is a mirror, glass or other specular surfaces.</td>
</tr>
</tbody>
</table>

Note
### Function Settings

Setting the Conditions of the Measurement Value Output

The functions related to data processing are set.

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Display</th>
<th>Calculation method</th>
<th>Filter</th>
<th>Measurement mode</th>
<th>Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>Head A + Head B</td>
<td>Average Low-pass filter</td>
<td>Normal</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>Head A - Head B</td>
<td>High-pass filter</td>
<td>Peak hold</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>Transparent object A displacement / thickness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>Transparent object B displacement / thickness</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Add-Ab Sub-Ab Trans-A Trans-b Scaling Head A Head B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Average Low-pass filter</th>
<th>High-pass filter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Normal P-k</th>
<th>Bottom P-k</th>
<th>P-to-P PP-k</th>
<th>Sample-and-hold</th>
<th>Average-k</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Trigger 1</th>
<th>Trigger 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Display unit</th>
<th>Analog output scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Displayed in mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Displayed in µm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>0.01</th>
<th>0.001</th>
<th>0.0001</th>
<th>0.00001</th>
<th>0.1</th>
<th>0.01</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Analog-through OFF</th>
<th>Analog-through ON</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Off</td>
</tr>
</tbody>
</table>

- The shaded cells are set by default.
**Function Settings**

Functions "A" and "B" specify the following sub-functions.

<table>
<thead>
<tr>
<th>Sub-function</th>
<th>Function No.</th>
<th>Function display</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-4 Head-A</td>
<td>1 2 3 4</td>
<td>1 - 2 1 - 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>transparent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Surface 1 – Surface 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Surface 1 – Surface 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Surface 2 – Surface 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Surface 3 – Surface 4</td>
</tr>
</tbody>
</table>

| A-5 Head-B   | 1 2 3 4      | 1 - 2 1 - 3      |
|              |              | transparent      |

| -0 Moving-average | 1 4 16 64 256 1024 |
| AvG             | 1 4 16 64 256 1024 |
|                 | `-0 Moving-average |
|                 | AvG               |

| -1 Low-pass filter | 1 30 100 300 |
| LPF              | 1 30 100 300 |
| Low-pass filter   | 1 30 100 300 |

| -2 High-pass filter | 1 30 100 300 |
| HPF              | 1 30 100 300 |
| High-pass filter  | 1 30 100 300 |

<table>
<thead>
<tr>
<th>Sub-function</th>
<th>Function No.</th>
<th>Function display</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-4 Head-A</td>
<td>1 2 3 4</td>
<td>1 - 2 1 - 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>transparent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Surface 1 – Surface 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Surface 1 – Surface 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Surface 2 – Surface 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Surface 3 – Surface 4</td>
</tr>
</tbody>
</table>

| A-5 Head-B   | 1 2 3 4      | 1 - 2 1 - 3      |
|              |              | transparent      |

| -0 Moving-average | 4096 16384 65536 262144 |
| AvG             | 4096 16384 65536 262144 |
|                 | `-0 Moving-average |
|                 | AvG               |

| -1 Low-pass filter | 1 0.3 0.1 |
| LPF              | 1 0.3 0.1 |
| Low-pass filter   | 1 0.3 0.1 |

<p>| -2 High-pass filter | 1 0.3 0.1 |
| HPF              | 1 0.3 0.1 |
| High-pass filter  | 1 0.3 0.1 |</p>
<table>
<thead>
<tr>
<th>Function</th>
<th>Item</th>
<th>Settable range</th>
<th>Default value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Head A/Head B/Head A + Head B/Head A-Head B/Head A transparent object displacement-thickness/Head B transparent object displacement-thickness</td>
<td>1/2/3/4/1-2/1-3/1-4/2-3/2-4/3-4</td>
<td>1</td>
<td>When the transparent object displacement/thickness is selected for the calculation method</td>
</tr>
<tr>
<td>B</td>
<td>Input value of the first point</td>
<td>-99.9999 to +99.9999</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Display value of the first point</td>
<td>-99.9999 to +99.9999</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Input value of the second point</td>
<td>-99.9999 to +99.9999</td>
<td>+1.0000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display value of the second point</td>
<td>-99.9999 to +99.9999</td>
<td>+1.0000</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Number of times of moving average</td>
<td>1/4/16/64/256/1024/4096/16384/65536/262144</td>
<td>256</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cutoff frequency</td>
<td>1000/300/100/30/10/3/1/0.3/0.1</td>
<td>100 Hz</td>
<td>The LPF and HPF have the same settable range.</td>
</tr>
<tr>
<td></td>
<td>Measurement mode</td>
<td>Normal/peak hold/bottom hold/peak-to-peak hold/average hold/sample-hold</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trigger Trigger 1/Trigger 2</td>
<td>Trigger 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Offset</td>
<td>-99.9999 to +99.9999</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimum display unit</td>
<td>0.01/0.001/0.0001/0.00001/0.1/0.01</td>
<td>0.0001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display value of the first point</td>
<td>-99.9999 to +99.9999</td>
<td>+1.0000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Output value of the first point</td>
<td>-10.5 V to +10.5 V</td>
<td>+10.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display value of the second point</td>
<td>-99.9999 to +99.9999</td>
<td>-1.0000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Output value of the second point</td>
<td>-10.5 V to +10.5 V</td>
<td>-10.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analog-through</td>
<td>ON/OFF</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tolerance</td>
<td>Tolerance upper limit</td>
<td>-99.9999 to +99.9999</td>
<td>+5.0000</td>
</tr>
<tr>
<td></td>
<td>Tolerance lower limit</td>
<td>-99.9999 to +99.9999</td>
<td>-5.0000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hysteresis width</td>
<td>0 to +99.9999</td>
<td>+0.0000</td>
<td></td>
</tr>
</tbody>
</table>
### OUT Setting Screens

#### OUT1
- HI
- GO
- LO
- TIM

#### OUT2
- TIM
- HI
- GO
- LO

---

### OUT Settings Calculation method

**Head A**
- Scaling
- Filter

**Head B**
- Average
- Low-pass filter
- High-pass filter

**Transparent object A/B**
Calculating Between the Heads

The surface displacement, thickness, and height-difference measurements can be performed by calculating the data acquired from the setting of head A or head B according to the measurement target.

■ Function Nos. and measurement examples

* Used in combination with the auto offset function.

When transparent object is selected for the measurement mode of head setting, head A and head B perform surface measurement if Add-Ab or Sub-Ab is selected.

Sub-functions and measurement surfaces

*When trAn-A is selected: â4, when tran-b is selected: â5

Function No. | Calculation | Function
---|---|---
A-0 | a | Head A Surface displacement measurement using the head A or B
A-1 | a | Head B
A-2 | add-ab | Head A + B Thickness measurement using the head A and B
A-3 | sub-ab | Head A - B Height-difference measurement using the head A and B
A-4 | tran-a | Head-A transparent object
 | Performs the displacement measurement and thickness measurement of the transparent object.
The measurement surface is selected by the sub-function.
A-5 | tran-b | Head-B transparent object

Sub-function | Measurement surface | Function
---|---|---
a-| 1 | 1D isplacement measurement of one surface
| 2 | 2
| 3 | 3
| 4 | 1-2 | Measurement and calculation of two phases
 | By selecting "4", the thickness of the first sheet of glass can be measured.
 | By selecting "7", the gap between the first and the second sheets of glass can be measured.
| 5 | 1-3 | 1-3
| 6 | 1-4 | 1-4
| 7 | 2-3 | 2-3
| 8 | 2-4 | 2-4
| 9 | 3-4 | 3-4

Thickness measurement
Height difference measurement
3-19 LK-G-M-NO3-E

3 Function Settings

■ Setting procedure of the calculation between heads

1 Hold down the OUT1 key, and select "OUT-1" with the HI key.

2 Press the GO key, and select function "A" by the HI key. Select the calculation.

3 Press the OUT1 key, and select "A-2" with the HI key. The addition of head A and B is selected in the function.

4 Press the GO key to register the setting. Press the LO key to return to the measurement state.

■ Setting procedure for measuring thickness of transparent target

1, 2 follow steps 1 & 2 from the previous section.

3 Press the OUT1 key, and select "A-4" with the HI key. Head A's transparent object is set in this example.

4 Press the GO key, and select "A-44" with the HI key. Measurement between surface ends 1 - 2 is selected in this example.

5 Press the OUT1 key to register the setting. Press the LO key to return to the measurement state.

When [Transparent object 2] (3-7) is specified, select the measurement surface on which the object to be measured actually exists.
3-20
LK-G-M-NO3-E

Function Settings

Setting the Scaling for Measurement (Calibration)

The displayed value for the measurement value can be calibrated as desired.

Set the values to display for the desired two points to calibrate.

Head A and head B can be calibrated for each OUT1 and OUT2.

- Setting procedure of scaling

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

1. Hold down the key, and select "Out-1" with the key.
   - OUT1 is set in this example. Select "out-2" when setting OUT2.

2. Press the key, and select function "b" with the key.
   - Set the scaling.

3. Press the key, and select "b-0".
   - "Head A" is set in this example. Select "b-1" when setting head B.

- Setting content

<table>
<thead>
<tr>
<th>Setting value</th>
<th>Display value</th>
<th>Original input value</th>
<th>Calibrated displayed value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1.nPt</td>
<td></td>
<td>-1.0200</td>
<td>-1.0000</td>
</tr>
<tr>
<td>A2.nPt</td>
<td></td>
<td>0.9900</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Display value</th>
<th>Input value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before calibration</td>
<td>0.99</td>
</tr>
<tr>
<td>After calibration</td>
<td>1.0000</td>
</tr>
</tbody>
</table>
Function Settings

1. Press the \text{key} to set the input value 1 of the head A, point 1 by using the \text{and} \text{keys.} The current measurement value is loaded if the \text{key} is pressed.

2. Press the \text{key} to set the input value 1 of the head A, point 1 by using the \text{and} \text{keys.}

3. Press the \text{key} to set the input value 2 of the head A, point 2 by using the \text{and} \text{keys.} The current measurement value is loaded if the \text{key} is pressed.

4. Press the \text{key} to set the input value 2 of the head A, point 2 by using the \text{and} \text{keys.}

5. Press the \text{key} to register the setting result. Press the \text{key} to return to the measurement state.

When the following conditions are not satisfied, "Err-7" is displayed and the setting cannot be performed. Press the \text{key} to cancel the error, and set the scaling again.

1. Input value 1 - Input value 2 \leq 0

2. If the \text{key} is pressed while inputting the value, the current measurement value is inputted. If it is pressed for three seconds, the default value is inputted.

Note

Displayed value 2 - Displayed value 1 < 10

Input value 2 - Input value 1

Reference
The following three types of function can be set for the filter.

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Filter name</th>
<th>Function</th>
<th>Setting the number of times of averaging.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>LPF</td>
<td>Low-pass filter</td>
<td>Cuts extreme changes and only captures moderate fluctuations. Set the cutoff frequency.</td>
</tr>
<tr>
<td>-2</td>
<td>HPF</td>
<td>High-pass filter</td>
<td>Cuts moderate fluctuations and only captures extreme changes. Set the cutoff frequency.</td>
</tr>
</tbody>
</table>

Refer to "Response Delay Time" (6-23 page).
3-23

Function Settings

■ Functions of the low-pass filter and high-pass filter

Set the cutoff frequency for each of the filters.

The process when the filter is set is as follows.

■ Setting procedure of averaging

The setting procedure is described below for the case where the averaging is set to OUT1 as an example.

1. Hold down the key, and select “Out-1” with the key.

2. Press the key, and select function “[ ]” with the key.

Set the filter.

3. Press the key, and select “[ ]0” with the key.

Set “Moving average”.
3-24

3 Function Settings

4 Press the \( \text{GO} \) key, and specify the number of times of moving average with the \( \text{HI} \) key. “1024” times is selected in this example.

5 Press the \( \text{HI} \) key to register the setting. Press the \( \text{LO} \) key to return to the measurement state.

■ Setting procedure of the low-pass filter/high-pass filter

The setting procedure is described below for the case where the low-pass filter is set to OUT1 as an example.

1 Hold down the \( \text{TIM} \) key, and select “\( \text{OUT-1} \)” with the \( \text{HI} \) key.

2 Press the \( \text{HI} \) key, and select function “[\( -1 \)]” with the \( \text{LO} \) key. “LPF (low-pass filter)” is selected in this example. Select “[\( -2 \)]” to select “HPF (high-pass filter)”.

3 Press the \( \text{HI} \) key, and select “[\( -L3 \)]” with the \( \text{LO} \) key. Cutoff frequency is set as “30” Hz in this example.

4 Press the \( \text{HI} \) key to register the setting. Press the \( \text{LO} \) key to return to the measurement state.

When the sampling rate (page 3-39) is 1000 µs and 500 µs, and the cutoff frequency is set to 1000 Hz and 300 Hz, the operating frequency becomes 100 Hz. When the sampling rate is 200 µs, and the cutoff frequency is set as 1000 Hz, the operating frequency becomes 300 Hz.
### Function Settings

This section describes the six types of measurement modes.

The function of each measurement mode is as follows.

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Mode name</th>
<th>Description</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>d-0</td>
<td>nor</td>
<td>Normal The measured result can be displayed or outputted as required.</td>
<td>page 3-27</td>
</tr>
<tr>
<td>d-1</td>
<td>P-k</td>
<td>Peak hold The maximum value during the specified period can be measured.</td>
<td>page 3-28</td>
</tr>
<tr>
<td>d-2</td>
<td>b-k</td>
<td>Bottom hold The minimum value during the specified period can be measured.</td>
<td>page 3-28</td>
</tr>
<tr>
<td>d-3</td>
<td>PP-k</td>
<td>Peak-to-peak hold The differential value of the maximum and minimum values during the specified period can be measured.</td>
<td>page 3-28</td>
</tr>
<tr>
<td>d-4</td>
<td>SP-k</td>
<td>Sample-and-hold The value at the specified moment can be measured.</td>
<td>page 3-29, 3-30</td>
</tr>
<tr>
<td>d-5</td>
<td>AvG-k</td>
<td>Average hold The average value during the specified period can be measured.</td>
<td>page 3-28</td>
</tr>
</tbody>
</table>

Refer to “Setting the Trigger Condition” (page 3-31) for setting the trigger.

<table>
<thead>
<tr>
<th>Sampling period</th>
<th>Max. value</th>
<th>Sampling period</th>
<th>Min. value</th>
<th>Max. value - Min. value</th>
<th>Sampling period</th>
<th>Average value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIMING</td>
<td>input</td>
<td>Sample-and-hold value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Function Settings

Setting procedure of the measurement mode

The setting procedure is described below for the case where peak hold is set to OUT1 as an example.

1. Hold down the \( ^{\text{HI}} \) key, and select "OUT1" with the \( ^{\text{GO}} \) key.

2. Press the \( ^{\text{HI}} \) key, and select function "d" with the \( ^{\text{GO}} \) key. Select Hold.

3. Press the \( ^{\text{HI}} \) key, and select "d-1" with the \( ^{\text{GO}} \) key. "Peak hold" is selected in this example.

4. Press the \( ^{\text{HI}} \) key to register the setting. Press the \( ^{\text{GO}} \) key to return to the measurement state.
Function Settings

Timing Chart

■ Normal Measurement is performed consecutively, and the measurement value is displayed and outputted as required.

• The ON state of each output indicates the state where the NPN or PNP open-collector output is turned on.
• The ON state of each input indicates the state where it is short-circuited between the terminal and the COM terminal for NPN type, and the voltage is applied between the terminal and the COM terminal.
• The RS-232C output is synchronized with the timing input when "Auto transmission" in the Environment setting is set other than OFF. (page 3-49)

Refer to "Functions of the Input and Output Signals" (page 4-7) for details of binary output.

If the RESET input is set to ON when the TIMING input is ON, the comparator standby state (the display shows "------") is displayed until the TIMING input becomes OFF.

• The TIMING input and RESET input can be controlled using the RS-232C (page 5-8).
• There is no difference between the functions of Trigger 1 and Trigger 2.

Measurement value in Normal mode

Internal measurement value

ON
OFF
HI output

Comparator standby

(------ display)

HI set value

Measurement value

LO set value

ON
OFF
GO output

ON
OFF
LO output

ON
OFF
TIMING output

ON
OFF
RESET input

RS-232C output

Measurement value

RESET process

Reference
Function Settings

- Peak hold/bottom hold/peak-to-peak hold/average hold
  - The values within the period of time (sampling period) determined by the external TIMING input are measured, and the display and output are retained. The sampling period differs between Trigger 1 and 2.
  - For Trigger 1, the sampling period is between the rising edge of the TIMING input to the rising edge of the next TIMING input. When the TIMING input turns ON, the measurement value in the sampling period immediately before is outputted. The RESET process is not performed when the TIMING input is turned on.
  - For Trigger 2, the sampling period is between the falling edge of the TIMING input to the rising edge of the next TIMING input. When the TIMING input turns ON, the measurement value in the sampling period immediately before is output. The RESET process of the internal measurement value is performed when the timing input is turned off.
  - In the following cases, the comparator standby status (the display shows "------") is displayed until the first measurement value is fixed. When the power is turned on/when a setting is changed/when a program No. is changed/when RESET is inputted/when Auto-zero is inputted

- The comparator output is outputted according to the measurement value.
- The ON state of each output indicates the state where the NPN or PNP open-collector output is turned on.
- The ON state of each input indicates the state where it is short-circuited between the terminal and the COM terminal for NPN type, and the voltage is applied between the terminal and the COM terminal for PNP type.
- The RS-232C output is synchronized with the timing input when "Auto transmission" in the Environment setting is set other than OFF. (page 3-49)
- Refer to "Functions of the Input and Output Signals" (page 4-7) for details of binary output.
- If the TIMING input becomes ON during the RESET processing, the comparator standby status (the display shows "------") is displayed.
- When the internal measurement value becomes the alarm state, the measurement result varies depending on the settings of the alarm process.
  - With hold: The measurement result is outputted by using the value immediately before the retained value.
  - Without hold: The measurement value is outputted while ignoring the alarm state period at the time of peak hold. When the whole sampling period is in the alarm state, the alarm (-FFFFFF) becomes the measurement result. At the time of other than peak hold, the alarm (-FFFFFF) becomes the measurement result.
- The TIMING input and RESET input can be controlled using the RS-232C (page 5-8).

- Set the average filter (the number of times for averaging) to 1 if the measurement mode is set to average hold.
- When the mode is set without the alarm hold, and a large value is set for the average number of times, the measurement result may not trigger an alarm. Check the alarm output to ensure that the alarm state is properly recognized.

References:
- 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 differential value of the maximum and minimum values within the specified period of time (sampling period).
- Average hold: Measures the average value within the specified period of time (sampling period).
Sample-and-hold (Trigger 1)

- The internal measurement value when the TIMING input becomes ON is retained and outputted.
- In the following cases, the comparator standby status (“------” is indicated) is displayed until the first measured value is fixed.
  - When the power is turned on/
  - When the setting is changed/
  - When the program No. is changed/
  - When RESET is inputted/
  - When auto-zero is inputted

- The comparator output is outputted according to the measurement value.
- The ON state of each output indicates the state where the NPN or PNP open-collector output is turned on.
- The ON state of each input indicates the state where it is short-circuited between the terminal and the COM terminal for NPN type, and the voltage is applied between the terminal and the COM terminal for PNP type.
- The RS-232C output is synchronized with the timing input when “Auto transmission” in the Environment setting is set other than OFF. (page 3-49)

The TIMING input and RESET input can be controlled using the RS-232C (page 5-8).

When the mode is set without the alarm hold, and a large value is set for the average number of times, the measurement result may not trigger an alarm. Check the alarm output to ensure that the alarm state is properly recognized.
Function Settings

Sample-Hold (Trigger 2)

- When the TIMING input is turned on, the internal measurement value is retained and outputted. That value is fixed by sampling the data acquired in the same number of times of averaging since the TIMING input is on.
- In the following cases, the comparator standby status (the display shows "------") is displayed until the first measured value is fixed.
  - When the power is turned on
  - When the setting is changed
  - When the program No. is changed
  - When RESET is inputted
  - When auto-zero is inputted
- The comparator output is outputted according to the measurement value.
- The ON state of each output indicates the state where the NPN or PNP open-collector output is turned on.
- The ON state of each input indicates the state where it is short-circuited between the terminal and the COM terminal for NPN type, and the voltage is applied between the terminal and the COM terminal for PNP type.
- The RS-232C output is synchronized with the timing input when "Auto transmission" in the Environment settings is set to other than OFF.
- If the TIMING input is turned on during the RESET process, the system stops the RESET process and starts sampling.
- When the internal measurement value becomes the alarm state (measurement overrange or inadequate light intensity), the measurement result varies depending on the settings of the alarm process.
  - With hold: The measurement result is outputted by using the value immediately before the retained value.
  - Without hold: The alarm (-FFFFFF) becomes the measurement result.
- If you turn on the RESET input or the ZERO input during the sampling period, the sampling stops and the comparator standby state is established.
- The TIMING input and RESET input can be controlled via RS-232C (page 5-8).
- The Strobe output time can be changed. Refer to "Setting the Strobe Output Time" (3-44 page) for details.
- When the mode is set without the alarm hold, and a large value is set for the average number of times, the measurement result may not trigger an alarm. Check the alarm output to ensure that the alarm state is properly recognized.
- Set the filter to [Average]. [Count] can be set as desired. Refer to "Stabilizing the Measurement by Filtering" (3-22 page) for setting the filter.
Function Settings

Setting the Trigger Condition

Trigger 1 and trigger 2 differ in terms of the sampling period during which the measurement value is retained in the measurement mode. The offset value is set for the measurement value that underwent a measurement mode process and the auto-zero process. Refer to "Using the Hold Function (Measurement Mode)" (page 3-25) for the details of the timing difference.

1. Hold down the [key], and select "OUT-1" with the [key].
2. Press the [key], and select the function "E" with the [key].
3. Press the [key], and select "E-1" with the [key]. "Trigger 2" is selected in this example.
4. Press the [key] to register the setting. Press the [key] to return to the measurement state.
Function Settings
Measuring with Offset
You can add or subtract any value to or from the displayed value. When the offset value is set, it can be displayed when the auto-zero is performed.
The offset value is set for the measurement value that underwent a measurement mode process and the auto-zero process.

Adjusting the master workpiece by using the auto-zero function (auto offset function)
The size of the master workpiece can be set as the master value (reference value), if you set the size of the master workpiece as the offset value, and then use the auto-zero function while measuring the master workpiece.

Setting procedure of the offset value
The setting procedure is described below for the case where offset is set for OUT1 as an example.

1. Hold down the key, and select "OUT1" with the key.
   OUT1 is chosen for this example.
2. Press the key, and select function "F" with the key.
   Set the offset.
3. Press the key, and set the offset value with the and keys.
   "0.03" is set in this example.
4. Press the key to register the setting. Press the key to return to the measurement state.

Refer to "List of Default Values and Setting Ranges" (3-15 page) for the setting range and its restriction.

Reference
OUT1
HI
GO
LO
TIM
OUT2 TIM
OUT1
HI
GO
LO
TIM
OUT2 TIM
OUT1
HI
GO
LO
TIM
OUT2 TIM
Setting the Unit and the Minimum Display Unit

The display unit and the minimum display unit can be selected from the following six types of units.
The factory default setting is "G-2". When using LK-G405/G400/G407/G402/G505/G500/G507/G502, select function No. G-1 or G-0.

### Setting procedure of the number of digits to be displayed and the position of the decimal point

1. Hold down the key, and select "Out-1" with the key.
   OUT 1 is set in this example.

2. Press the key, and select function "G" with the key.
   Set the display unit and the minimum display unit.

3. Press the key, and select "G-3" with the key.
   Set the unit to mm and the minimum display unit to 0.00001.

4. Press the key to register the setting. Press the key to return to the measurement state.

If the unit and the minimum display unit are changed, the setting content related to the numerical value display within the same OUT in the same program No. and the auto-zero setting value is initialized.

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Minimum display unit</th>
<th>Unit</th>
<th>Displayable range</th>
</tr>
</thead>
<tbody>
<tr>
<td>g-0</td>
<td>0.01</td>
<td>mm</td>
<td>0.01 mm – 9999.99 to + 9999.99</td>
</tr>
<tr>
<td>g-1</td>
<td>0.001</td>
<td>mm</td>
<td>0.001 mm – 999.999 to + 999.999</td>
</tr>
<tr>
<td>g-2</td>
<td>0.0001</td>
<td>mm</td>
<td>0.0001 mm – 99.9999 to + 99.9999</td>
</tr>
<tr>
<td>g-3</td>
<td>0.00001</td>
<td>mm</td>
<td>0.00001 mm – 9.99999 to + 9.99999</td>
</tr>
<tr>
<td>g-4</td>
<td>0.1</td>
<td>µm</td>
<td>0.1 µm – 99999.9 to + 99999.9</td>
</tr>
<tr>
<td>g-5</td>
<td>0.01</td>
<td>µm</td>
<td>0.01 µm – 9999.99 to + 9999.99</td>
</tr>
</tbody>
</table>

**Note**
3-34

3  Function Settings

Scaling the Analog Output

The analog voltage output can be scaled into the output voltage value within the range of ±10.5 V.

When setting the scaling, specify the analog output values for the display value of the desired two points.

The scaling of the analog current output (4 to 20 mA) is set by calculating the electric current value to the voltage value by using the following formula.

\[
\text{Voltage value (V)} = \frac{\text{Electric current value (mA)} - 12 \text{ mA}}{0.8}
\]

When the following conditions are not satisfied, "Err-7" is displayed and the setting cannot be performed. Press the key to cancel the error, and set the scaling again.

1. Input value 1 - Input value 2 ≥ 0

The output voltage is calculated by 1 mV, and the displayed value by 0.01 µm regardless of the specified unit and the minimum display unit.

■ Setting procedure of the monitor output

The following settings are performed.

<table>
<thead>
<tr>
<th>Measurement content</th>
<th>Measurement value</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point 1</td>
<td>Displayed value 1</td>
<td>-5.0000</td>
</tr>
<tr>
<td>Analog output voltage value 1</td>
<td>-10.000</td>
<td>1-Out</td>
</tr>
<tr>
<td>Point 2</td>
<td>Displayed value 2</td>
<td>5.0000</td>
</tr>
<tr>
<td>Analog output voltage value 2</td>
<td>10.000</td>
<td>2-Out</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Voltage (Current)</th>
<th>Range above at the positive side</th>
<th>Range above at the negative side</th>
</tr>
</thead>
<tbody>
<tr>
<td>–10V</td>
<td>–5 +50</td>
<td>–10.5V (3.6mA)</td>
</tr>
<tr>
<td>–10.5V (20.4mA)</td>
<td>–10.8V (3.36mA)</td>
<td></td>
</tr>
<tr>
<td>+10V</td>
<td>+5mm</td>
<td>+10V : +5mm</td>
</tr>
</tbody>
</table>

Note

Output voltage value 2 - Output voltage value 1

Displayed value 2 - Displayed value 1
1. Hold down the key, and select "OUT-1" with the key. OUT1 is set in this example.

2. Press the key, and select function "k" with the key. Set the scaling of the analog output.

3. Press the key, and set the display value of point 1 by using the and keys.

4. Press the key, and set the output value of point 1 by using the and keys.

5. Press the key to register the setting. Press the key to return to the measurement state.

6. Press the key, and set the display value of point 2 by using the and keys.

7. Press the key, and set the output value of point 2 by using the and keys.
Function Settings

Outputting the Analog Output Without Holding

The internal measurement value before being retained is outputted when the analog-through is set to ON while the measurement value is retained in the measurement mode.

Setting procedure of the analog-through

1. Hold down the key, and select "OUt-1" with the key. OUT1 is set in this example.
2. Press the key, and select function " " with the key. Set the analog-through.
3. Press the key, and select "-1" with the key. The analog output is output by through.
4. Press the key to register the setting. Press the key to return to the measurement state.

If analog-through is set to ON, the offset value or the auto-zero value will not be reflected to the analog output.

Note
### Setting the Common Function

This section describes the functions common to each program No.

#### List of Functions and Function Nos.

- The shaded cells are set by default.
- Function *F* sets the number of data and accumulation rate as a sub-function.

#### List of Default Values and Setting Ranges

<table>
<thead>
<tr>
<th>Function</th>
<th>Function No.</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function display</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sampling rate</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Function No.</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>page</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Function Item

<table>
<thead>
<tr>
<th>Item</th>
<th>Settable range</th>
<th>Default value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Sampling rate</td>
<td>20/50/100/200/500/1000 µs</td>
<td>200 µs</td>
<td></td>
</tr>
<tr>
<td>b: Mutual interference prevention</td>
<td>ON/OFF</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>c: Timing synchronization</td>
<td>Synchronous/asynchronous</td>
<td>Asynchronous</td>
<td></td>
</tr>
<tr>
<td>d: Comparator output format</td>
<td>Normal/hold/delay</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td>E: Strobe time</td>
<td>2/5/10/20 ms</td>
<td>2 ms</td>
<td></td>
</tr>
<tr>
<td>F: Data selection</td>
<td>OFF/OUT1/OUT2/OUT1.2</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>Number of data</td>
<td>1 to 65536</td>
<td>65536</td>
<td></td>
</tr>
<tr>
<td>Accumulation rate</td>
<td>1/2/5/10/20/50/100/200/500/1000 x 20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Refer to "Accumulating the Measurement Value in the Memory (Data Storage Function)" (page 3-54).
<table>
<thead>
<tr>
<th>Function Settings</th>
<th>IN1</th>
<th>OUT1</th>
<th>COMMON FUNCTION SETTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HI</td>
<td>GO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LO</td>
<td>TIM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HI</td>
<td>GO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LO</td>
<td>TIM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HI</td>
<td>GO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LO</td>
<td>TIM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HI</td>
<td>GO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LO</td>
<td>TIM</td>
<td></td>
</tr>
</tbody>
</table>

- **Common Sampling Rate**
- **Mutual Interference Prevention**
- **Timing Cycle**
- **Comparator Output Format**
  - Asynchronous
  - Normal
  - HOLD
- **Strobe Time**
- **Data Storage**
  - Synchronous
Function Settings

Setting the Sampling Rate of Measurement Value

This section describes how to set the measurement sampling cycle. If you want the sampling to be performed more quickly, modify it to perform faster or when the received light is extremely dim, modify it to perform more slowly.

■ Setting procedure of the sampling rate

1. Hold down the key, and select "oPt on" with the key.
   - Set the common settings.

2. Press the key, and select function "A" by the key.
   - Set the sampling cycle.

3. Press the key, and select "A-4" with the key.
   - The sampling rate is set as "500" µs in this example.

4. Press the key to register the setting. Press the key to return to the measurement state.

- The sampling rate will be doubled when two heads are connected and the sampling rate is set as 20 µs.
- Set the sampling rate to other than 20 µs (other than 20 µs and 50 µs when transparent object 2 is selected in the LK-G85/G80/G87/G82/G155/G150/G157/G152/G405/G400/G407/G402, and other than 20 µs, 50 µs and 100 µs when transparent object 2 is selected in the LK-G505/G500/G507/G502) when one of the items from transparent object, transparent object 2, and multi-reflective object is selected in the measurement mode of the head (page 3-7).
- The sampling rate will be up to four times slower when the transparent object 2 is selected.
- Do not use the measurement value display or received light waveform display of the setup support software "LK-Navigator" when setting the sampling rate to 20 µs.

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Function (sampling rate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-0</td>
<td>20 µs</td>
</tr>
<tr>
<td>A-1</td>
<td>50 µs</td>
</tr>
<tr>
<td>A-2</td>
<td>100 µs</td>
</tr>
<tr>
<td>A-3</td>
<td>200 µs</td>
</tr>
<tr>
<td>A-4</td>
<td>500 µs</td>
</tr>
<tr>
<td>A-5</td>
<td>1000 µs</td>
</tr>
</tbody>
</table>
Function Settings

Setting the Mutual Interference Prevention Function

When two heads are connected and a little distance is left between them, a measurement error may occur by receiving the light emitted from the other head. The mutual interference prevention function is used in such a case.

When the mutual interference prevention function is set to ON, the two heads emit the laser beam alternately to evade the interference from the other.

■ Setting procedure of the mutual interference prevention function

1. Hold down the   key, and select "Opt on" with the    key.
2. Set the common settings.
3. Press the    key, and select function "b" with the    key.
4. Set the mutual interference prevention function.
   - Press the    key, and select "b-1" with the    key.
   - The mutual interference prevention function is set to "ON" in this example.
5. Press the    key to register the setting. Press the    key to return to the measurement state.

The sampling rate is doubled when the mutual interference prevention function is set to ON.

When measuring the thickness of the transparent object

Note
### Setting the External Timing Input

The control method for the timing inputs of OUT1 and OUT2 can be set. The following functions can be specified by the settings.

#### Setting the timing synchronization

1. Hold down the **5** key, and select "○p on" with the **2** key.
2. Press the **1** key, and select function "[-n-Syn]" with the **6** key.
3. Press the **1** key, and select "[-Synchronous]" with the **6** key.
4. Press the **1** key to register the setting. Press the **2** key to return to the measurement state.

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Timing</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[-0]</td>
<td>Asynchronous</td>
<td>Controls OUT1 and OUT2 asynchronously. Assigns independent input terminals for each of OUT1 and OUT2.</td>
</tr>
<tr>
<td>[-1]</td>
<td>Synchronous</td>
<td>Controls OUT1 and OUT2 synchronously. No. 8 of the 12-pin I/O terminal triggers OUT1 &amp; OUT2, and No. 6 of the expansion connector becomes invalid.</td>
</tr>
</tbody>
</table>

Refer to "Chapter 4 Input/Output Terminals" (page 4-1).
Setting the output form of the tolerance comparator

The output form of the tolerance comparator can be set. The following three types are available.

1. Hold down the \textit{key}, and select "\textit{opt on}" with the \textit{key}.
2. Set the common settings.

3. Press the \textit{key}, and select function "d" with the \textit{key}.
   Set the output form of the tolerance comparator.

4. Press the \textit{key} to register the setting. Press the \textit{key} to return to the measurement state.

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Output form</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>d-0</td>
<td>normal</td>
<td>Normal Outputs according to the tolerance comparator.</td>
</tr>
<tr>
<td>d-1</td>
<td>hold</td>
<td>HOLD Holds the output that is turned ON. Releases the holding when the measurement value is reset.</td>
</tr>
<tr>
<td>d-2</td>
<td>delay</td>
<td>Off-delay Off-delay of 60ms is applied to the Normal output. Releases the holding when the measurement value is reset.</td>
</tr>
</tbody>
</table>
Setting the Strobe Output Time

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

Setting procedure of the pulse width of the strobe signal

1. Hold down the key, and select "on" with the key.
2. Press the key, and select function "E" with the key.
3. Set the pulse width to "10" ms.
4. Press the key to register the setting. Press the key to return to the measurement state.

If the Measurement Mode is set to normal, the strobe signal is output for the specified period only when the measurement value is held. If the measurement value is not held, the strobe signal is output for half the period of sampling cycle.

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Function (Strobe output time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-0</td>
<td>2 ms</td>
</tr>
<tr>
<td>E-1</td>
<td>5 ms</td>
</tr>
<tr>
<td>E-2</td>
<td>10 ms</td>
</tr>
<tr>
<td>E-3</td>
<td>20 ms</td>
</tr>
</tbody>
</table>

Refer to "Timing Chart" (4-12 page) for the timing chart.
Refer to "Binary output" (4-15 page) for details of binary output.
Function Settings

Accumulating the Measurement Value in the Memory (Data Storage Function)

Up to 131072 measurement values of OUT1 and OUT2 (65536 values for each OUT1 and 2) can be stored in the internal memory for every accumulation rate. The accumulated data can be read by using the "RS-232C interface" or "LK-Navigator".

The setting contents of the function No. and the sub-function are as follows.

- The data to be accumulated is the measurement value of OUT1 or of OUT2 after data processing such as the one in the measurement mode. (page 3-2)
- The accumulating operation stops when the number of accumulated data exceeds the specified number.
- The accumulation time can be calculated by "sampling rate x accumulation rate x number of data".
- The data is accumulated at the sampling rate even when the refresh rate is longer than the sampling rate, which is set in the setting of the average number of times. In such a case, the same measurement value continues to be accumulated until the measurement value is updated.
- The accumulation continues without clearing the accumulated data even if [Auto-zero] or [RESET] is performed.
- When the starting and finishing operation are repeated, the new data is accumulated after the old data.

Starting/finishing the accumulation and clearing the data

Function No.

<table>
<thead>
<tr>
<th>Selection of the accumulated data</th>
</tr>
</thead>
<tbody>
<tr>
<td>f-d0</td>
</tr>
<tr>
<td>f-d1</td>
</tr>
<tr>
<td>f-d2</td>
</tr>
<tr>
<td>f-d3</td>
</tr>
</tbody>
</table>

Conditions for starting the accumulation
- Start command from the RS-232 interface.
- Operation from the setup support software "LK-Navigator".

Conditions for finishing the accumulation
- Stop command from the RS-232 interface.
- Operation from the setup support software "LK-Navigator".

Conditions for clearing the accumulated data
- Following operations while stopping the accumulation:
  - When moving to the measurement mode from the setting mode or communication mode
  - When initialization command is sent from the RS-232 interface
  - Initializing operation from the setup support software "LK-Navigator"
  - When the power is turned off
  - When the program No. is changed

Sub-function

<table>
<thead>
<tr>
<th>Accumulation rate selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>f-F0</td>
</tr>
<tr>
<td>f-F1</td>
</tr>
<tr>
<td>f-F2</td>
</tr>
<tr>
<td>f-F3</td>
</tr>
<tr>
<td>f-F4</td>
</tr>
<tr>
<td>f-F5</td>
</tr>
<tr>
<td>f-F6</td>
</tr>
<tr>
<td>f-F7</td>
</tr>
<tr>
<td>f-F8</td>
</tr>
<tr>
<td>f-F9</td>
</tr>
</tbody>
</table>
Function Settings

1. Hold down the key, and select "Opt on" with the key.
2. Press the key, and select function "F" with the key.
3. Press the key, and set the data to accumulate with the key. "OUT 1" is set in this example.
4. Press the key, and set the number of data to accumulate with the keys. The number of data is set as "1000" in this example.
5. Press the key, and set the accumulation rate with the key. "50" times is set in this example.
6. Press the key to register the setting. Press the key to return to the measurement state.
This section describes the operation settings of the equipment.

List of Functions and Function Nos.

The following five types of setting are available for the Environment settings. The function and setting value of each type is shown below.

* The shaded cells are set by default.

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>A</td>
</tr>
<tr>
<td>1</td>
<td>RS-232C</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
</tr>
<tr>
<td>4</td>
<td>D</td>
</tr>
<tr>
<td>5</td>
<td>E</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
</tr>
<tr>
<td>7</td>
<td>G</td>
</tr>
<tr>
<td>8</td>
<td>H</td>
</tr>
<tr>
<td>9</td>
<td>I</td>
</tr>
<tr>
<td>10</td>
<td>J</td>
</tr>
<tr>
<td>11</td>
<td>K</td>
</tr>
<tr>
<td>12</td>
<td>L</td>
</tr>
<tr>
<td>13</td>
<td>M</td>
</tr>
<tr>
<td>14</td>
<td>N</td>
</tr>
<tr>
<td>15</td>
<td>O</td>
</tr>
<tr>
<td>16</td>
<td>P</td>
</tr>
<tr>
<td>17</td>
<td>Q</td>
</tr>
<tr>
<td>18</td>
<td>R</td>
</tr>
<tr>
<td>19</td>
<td>S</td>
</tr>
<tr>
<td>20</td>
<td>T</td>
</tr>
<tr>
<td>21</td>
<td>U</td>
</tr>
<tr>
<td>22</td>
<td>V</td>
</tr>
<tr>
<td>23</td>
<td>W</td>
</tr>
<tr>
<td>24</td>
<td>X</td>
</tr>
<tr>
<td>25</td>
<td>Y</td>
</tr>
<tr>
<td>26</td>
<td>Z</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Setting</th>
<th>Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Panel Terminal</td>
<td>input</td>
</tr>
<tr>
<td>B</td>
<td>Program Copy</td>
<td>Initialization</td>
</tr>
<tr>
<td>C</td>
<td>Panel lock</td>
<td>OFF ON 3-53</td>
</tr>
<tr>
<td>D</td>
<td>Eco mode</td>
<td>OFF Eco-half Eco-all 3-54</td>
</tr>
</tbody>
</table>
### Function Settings

List of Default Values and Setting Ranges

The function settings (default) at the time of shipment and the settable ranges are as follows.

<table>
<thead>
<tr>
<th>Function</th>
<th>Item</th>
<th>Settable range</th>
<th>Default value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>Baud rate</td>
<td>9600 bps</td>
<td>NON/EVEN/ODD NON/OFF/OUT1/OUT2 OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parity</td>
<td>NON/EVEN/ODD NON/OFF/OUT1/OUT2 OFF</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Auto transmission</td>
<td>OFF/OUT1/OUT2/OUT1.2 OFF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>Setting Selection Panel operation/external terminal Panel</td>
<td>Panel operation/external terminal Panel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d</td>
<td>Program Copy/initialization</td>
<td>Panel operation/external terminal Panel</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>d</td>
<td>Panel lock</td>
<td>ON/OFF OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
<td>Eco mode</td>
<td>None/Eco-half/Eco-all None</td>
</tr>
</tbody>
</table>
Function Settings

List of the Environment Setting Screens

OUT1

OUT2

Environment RS-232C Setting Selection

Program

Panel lock

Eco mode

Baud rate

Parity

Auto

Panel

Terminal input

Copy

Initialization

Off

Eco-half

Eco-all
Function Settings
Setting the Communication Specifications of the RS-232C

The communication specifications and the output operations of the RS-232C interface are set.

### Setting procedure of the communication specifications of the RS-232C

1. Press the `key`, and select "Env" with the `key`. Set the environment settings.
2. Press the `key`, and select function "A" by the `key`. Set the output conditions and the output performance of the RS-232C.
3. Press the `key`, and select "A-b2" with the `key`. The baud rate is set as "38400 bps" in this example.
4. Set the parity and auto transmission in the same manner.
5. Press the `key` to register the setting. Press the `key` to return to the measurement state.

Refer to "Chapter 5 RS-232C" (page 5-1). for RS-232C.

<table>
<thead>
<tr>
<th>Setting No.</th>
<th>Setting content</th>
<th>Selection Item</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-b0 to A-b4</td>
<td>Sets the communication speed of the data.</td>
<td>9600/19200/38400/57600/115200</td>
<td>Unit: bps</td>
</tr>
<tr>
<td>A-P0 to A-P2</td>
<td>Sets the type of parity.</td>
<td>None (NON)/Even (EVEN)/Odd (ODD)</td>
<td></td>
</tr>
<tr>
<td>A-S0 to A-S3</td>
<td>Auto transmission</td>
<td>OFF/OUT1/OUT2/OUT1.2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>HI</th>
<th>GO</th>
<th>LO</th>
<th>TIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUT1</td>
<td>HI</td>
<td>GO</td>
<td>LO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OUT2 TIM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>HI</th>
<th>GO</th>
<th>LO</th>
<th>TIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUT1</td>
<td>HI</td>
<td>GO</td>
<td>LO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OUT2 TIM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Setting the Program Switching Method

Whether the program No. is switched from the display panel or from the external terminal input is set.

Setting procedure of the program switching method

1. Press the key, and select "Env" with the key. Set the environment settings.
2. Press the key, and select function "b" with the key. Set the program switching method.
3. Press the key, and select "b-0" with the key. The operation from the panel is set in this example.
4. Press the key to register the setting. Press the key to return to the measurement state.

To switch the program No. by using the command from the RS-232C, set this setting to "Panel operation".
### Function Settings

#### Copying/Initializing the Program

Copying and initializing of the program are performed.

**■ Copying procedure of the program**

1. Press the **[Env]** key, and select "**Env**" with the **[Env]** key.
   - Set the environment settings.
2. Press the **[GO]** key, and select function "**GO**" with the **[GO]** key.
   - Perform copying/initialization of the program.
3. Press the **[LO]** key, and select "**-0**" with the **[LO]** key.
   - Copying process of the program starts.
4. Press the **[HI]** key, and specify the original program No. with the **[HI]** key.
   - Program No. 1 is specified as the source in this example.

**Function No.**

<table>
<thead>
<tr>
<th>Process</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copy</td>
<td>Performs copying by specifying the source program No. and destination program No.</td>
</tr>
<tr>
<td>Erase</td>
<td>Initializes the program of the specified program No.</td>
</tr>
</tbody>
</table>

**OUT1 TIM**

**OUT2 TIM**
3-52

Function Settings

Press the □ key, and specify the program No. of the copy destination with the □ key. Program No. 2 is specified as the destination in this example.

Press the □ key to check the program Nos. of the copy source and destination.

Press the □ key to perform copying. Press the □ key to return to the measurement state.

Initializing the program

Select the program No. to be initialized beforehand.
Perform the steps 1 and 2 of copying procedure of the program.

1. Press the □ key, and select "□" with the □ key. The initialization process of the program starts.
2. Press the □ key. Program No. 3 is initialized in this example.
3. Press the □ key to initialize. Press the □ key to return to the measurement state.
Function Settings

Preventing Erroneous Operation on the Panel (Panel Lock)

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

■ Setting procedure of the panel lock

1. Press the \texttt{Set} key, and select "Env" with the \texttt{Set} key. Set the environment settings.
2. Press the \texttt{Set} key, and select function "d" with the \texttt{Set} key. Set the panel lock.
3. Press the \texttt{Set} key, and select "d-1" with the \texttt{Set} key. "ON (Lock)" is set in this example.
4. Press the \texttt{Set} key to register the setting. Press the \texttt{Set} key to return to the measurement state.

■ Canceling the panel lock

1. Press the \texttt{Set} key for two seconds or more. The setting screen of the panel lock is displayed.
2. Press the \texttt{Set} key, and select "d-0". Release the lock.
3. Press the \texttt{Set} key to register the setting. Press the \texttt{Set} key to return to the measurement state.
Reducing the Power Consumption (Eco Mode)

The power consumption can be reduced by turning off the display on the controller. The Eco mode is activated in 10 seconds after the last key operation during the measurement mode. The normal mode returns when any key is pressed.

The Eco mode has the following types.

* The LASER ON LED is out of the effect of the Eco mode.

---

**Setting procedure of the Eco mode**

1. Press the \( \text{Function} \) key, and select “Env” with the \( \text{Set} \) key. Set the environment settings.
2. Press the \( \text{Function} \) key, and select function “E” with the \( \text{Set} \) key. Set the Eco mode.
3. Press the \( \text{Function} \) key, and select “E-1” with the \( \text{Set} \) key. “Eco-half” is set in this example.
4. Press the \( \text{Function} \) key to register the setting. Press the \( \text{Return} \) key to return to the measurement state.

---

**Function No.**

<table>
<thead>
<tr>
<th>Function</th>
<th>Judgment output LED</th>
<th>Timing LED</th>
<th>Measured value display LED</th>
<th>Head status display LED*</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-0</td>
<td>oFF</td>
<td>On</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>E-1</td>
<td>xalF</td>
<td>On</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>E-2</td>
<td>All</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
</tbody>
</table>

**OUT1**

<table>
<thead>
<tr>
<th></th>
<th>HI</th>
<th>GO</th>
<th>LO</th>
<th>TIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUT1</td>
<td>HI</td>
<td>GO</td>
<td>LO</td>
<td>TIM</td>
</tr>
<tr>
<td>OUT2 TIM</td>
<td>HI</td>
<td>GO</td>
<td>LO</td>
<td>TIM</td>
</tr>
</tbody>
</table>
This chapter describes the specifications of the input/output terminals and timing chart.

Identifying Names and Functions of the Input/Output Terminals

Timing Chart
This section describes the names and functions of the input/output terminals (12-pin I/O terminal block, 6-pin I/O terminal block, and expansion connector).

### Functions of the Input/Output Terminals

#### 12-pin I/O terminal block
- Used for the comparator output and control input of OUT1.

#### Pin No. | Signal name | Description
---|---|---
1 | COM IN | COM for input
2 | REMOTE | Laser remote interlock input (NPN type)
3 | ZERO1 OUT | OUT1 ZERO input
4 | RESET1 OUT | OUT1 RESET input
5 | TIMING1 OUT | OUT1 TIMING input
6 | COM OUT | COM for output
7 | ALARM 1 OUT | OUT1 alarm (NPN type, NPN open-collector output)
8 | OUT1 L | OUT1 comparator LO output
9 | OUT1 G | OUT1 comparator GO output
10 | OUT1 H | OUT1 comparator HI output
11 | 24 V DC (+) | 24 V DC input for power
12 | 24 V DC (-) | 0 V input for power
Input/Output Terminals

• NPN type
24 V DC (-), COM OUT and COM IN are all common via a choke coil. Also, they are common to 0 V of the 6-pin I/O terminal and COM of the expansion connector via a choke coil. Be careful not to generate a potential difference.

• PNP type
24 V DC (-) and COM IN are common via a choke coil. Also, they are common to 0 V of the 6-pin I/O terminal and COM IN of the expansion connector via a choke coil. Be careful not to generate a potential difference. COM OUT and COM OUT of the extension connector are common.

• Refer to page 4-10 for the electrical specifications.
• Refer to page 4-12 for the timing chart.

Note

Reference
Input/Output Terminals

- **6-pin I/O terminal block**
  - Used for the analog monitor output.
  - Matching cable specification: AWG28 to 16, Approximately 6.5mm of the insulation should be stripped from the cable.
  - 0 V of pin Nos. 1 and 4 are common.
  - 24 V DC (–) for the 12-pin I/O terminal block and 0 V are common via a choke coil. Be careful not to generate a potential difference.

- Refer to page 4-10 for the electrical specifications.
- Refer to page 3-34 for the scaling procedures of the analog output.

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>OUT1 (V) Analog voltage output of OUT1</td>
<td>Outputted in the range of ±10.8 V with reference to the displayed value.</td>
</tr>
<tr>
<td>5</td>
<td>OUT1 (A) Analog current output of OUT1</td>
<td>Outputted in the range of 3.36 mA to 20.64 mA with reference to the displayed value.</td>
</tr>
<tr>
<td>4</td>
<td>OUT1 0V 0V terminal for OUT1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>OUT2 (V) Analog voltage output of OUT2</td>
<td>Outputted in the range of ±10.8 V with reference to the displayed value.</td>
</tr>
<tr>
<td>2</td>
<td>OUT2 (A) Analog current output of OUT2</td>
<td>Outputted in the range of 3.36 mA to 20.64 mA with reference to the displayed value.</td>
</tr>
<tr>
<td>1</td>
<td>OUT2 0V 0V terminal for OUT2</td>
<td></td>
</tr>
</tbody>
</table>

**Note**

Reference
<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal name</th>
<th>Description</th>
<th>Cord color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OUT2 comparator HI</td>
<td>OUT2 comparator HI output (NPN type)</td>
<td>Brown</td>
</tr>
<tr>
<td>2</td>
<td>OUT2 comparator GO</td>
<td>OUT2 comparator GO output</td>
<td>Red</td>
</tr>
<tr>
<td>3</td>
<td>OUT2 comparator LO</td>
<td>OUT2 comparator LO output</td>
<td>Orange</td>
</tr>
<tr>
<td>4</td>
<td>OUT1 alarm (N.C.)</td>
<td>OUT2 alarm output</td>
<td>Yellow</td>
</tr>
<tr>
<td>5</td>
<td>COM OUT</td>
<td>COM for output</td>
<td>Green</td>
</tr>
<tr>
<td>6</td>
<td>TIMING2 OUT2</td>
<td>TIMING input</td>
<td>Non-voltage input (NPN type)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Voltage input (PNP type)</td>
</tr>
<tr>
<td>7</td>
<td>RESET2 OUT2</td>
<td>RESET input</td>
<td>Purple</td>
</tr>
<tr>
<td>8</td>
<td>ZERO2 OUT2</td>
<td>ZERO input</td>
<td>Gray</td>
</tr>
<tr>
<td>9</td>
<td>P rogram No. switch input</td>
<td></td>
<td>White</td>
</tr>
<tr>
<td>10</td>
<td>P</td>
<td></td>
<td>Black</td>
</tr>
<tr>
<td>11</td>
<td>P3</td>
<td></td>
<td>Brown</td>
</tr>
<tr>
<td>12</td>
<td>COM IN</td>
<td>COM for input</td>
<td>Red</td>
</tr>
<tr>
<td>13</td>
<td>Binary (0) (LSB)</td>
<td>Binary output (NPN type)</td>
<td>Orange</td>
</tr>
<tr>
<td>14</td>
<td>Binary (1)</td>
<td></td>
<td>Yellow</td>
</tr>
<tr>
<td>15</td>
<td>Binary (2)</td>
<td></td>
<td>Green</td>
</tr>
<tr>
<td>16</td>
<td>Binary (3)</td>
<td></td>
<td>Blue</td>
</tr>
<tr>
<td>17</td>
<td>Binary (4)</td>
<td></td>
<td>Purple</td>
</tr>
<tr>
<td>18</td>
<td>Binary (5)</td>
<td></td>
<td>Gray</td>
</tr>
<tr>
<td>19</td>
<td>Binary (6)</td>
<td></td>
<td>White</td>
</tr>
<tr>
<td>20</td>
<td>Binary (7)</td>
<td></td>
<td>Black</td>
</tr>
</tbody>
</table>
Input/Output Terminals

* COMs for output of pin Nos. 5 and 36 are common.
* COMs for input of pin Nos. 12 and 40 are common.
* The cord color is the wire color of the extension connector cable (OP-51657).

- **NPN type**
  - COM OUT and COM IN are common via a choke coil. Also, 24 V DC (–), COM OUT and COM IN of the 12-pin I/O terminal block are all common via a choke coil. Be careful not to generate a potential difference.

- **PNP type**
  - COM IN and 24 V DC (–) are common via a choke coil. Also, 24 V DC (–), and COM IN of the 12-pin I/O terminal are common via a choke coil. Be careful not to generate a potential difference. COM OUT and COM OUT of the 12-pin I/O terminal are common.

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal name</th>
<th>Description</th>
<th>Cord color</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>Binary (8)</td>
<td>Binary output NPN open-collector</td>
<td>Brown</td>
</tr>
<tr>
<td>22</td>
<td>Binary (9)</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Binary (10)</td>
<td>Orange</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Binary (11)</td>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Binary (12)</td>
<td>Green</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Binary (13)</td>
<td>Blue</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Binary (14)</td>
<td>Purple</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Binary (15)</td>
<td>Gray</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Binary (16)</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Binary (17)</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Binary (18)</td>
<td>Brown</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Binary (19)</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Binary (20)</td>
<td>(MSB) Orange</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>STROBE</td>
<td>STROBE output</td>
<td>Yellow</td>
</tr>
<tr>
<td>35</td>
<td>OUT1/OUT2</td>
<td>OUT OUT1/OUT2 selection output</td>
<td>Green</td>
</tr>
<tr>
<td>36</td>
<td>COM OUT</td>
<td>COM for output</td>
<td>Blue</td>
</tr>
<tr>
<td>37</td>
<td>OUT1/OUT2 SEL</td>
<td>OUT1/OUT2 selection input</td>
<td>Non-voltage input (NPN type)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Voltage input (PNP type)</td>
</tr>
<tr>
<td>38</td>
<td>LASER OFF A</td>
<td>LASER OFF A input</td>
<td>Gray</td>
</tr>
<tr>
<td>39</td>
<td>LASER OFF B</td>
<td>LASER OFF B input</td>
<td>White</td>
</tr>
</tbody>
</table>
## Functions of the Input and Output Signals

The following table shows a list of program numbers and how they relate to the status of terminals P1 through P3.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparator output</td>
<td>Outputted according to the tolerance comparator results.</td>
<td>Page 4-5</td>
</tr>
<tr>
<td>Alarm output</td>
<td>Turned on when “–FFFFFF” is displayed due to the alarm processing (the NPN or PNP open-collector output transistor is off). Turned off when the normal value is being held.</td>
<td>Page 4-2</td>
</tr>
<tr>
<td>TIMING input</td>
<td>Performs an external synchronization input of the measurement mode.</td>
<td>Page 4-2</td>
</tr>
<tr>
<td>RESET input</td>
<td>Resets the measurement value.</td>
<td>Page 4-2</td>
</tr>
<tr>
<td>ZERO input</td>
<td>Sets the current measurement value to zero.</td>
<td>Page 4-2</td>
</tr>
<tr>
<td>P1, P2, P3</td>
<td>Changes the program No. by external commands.</td>
<td>Page 4-5</td>
</tr>
</tbody>
</table>
The following table shows a list of program numbers and how they relate to the status of terminals P1 through P3:

<table>
<thead>
<tr>
<th>Program No.</th>
<th>P3</th>
<th>P2</th>
<th>P1</th>
<th>Status</th>
<th>NPN type</th>
<th>PNP type</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>1</td>
<td>F</td>
<td>F</td>
<td>N</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>2</td>
<td>F</td>
<td>F</td>
<td>N</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>N</td>
<td>N</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
</tbody>
</table>

Binary output

Outputs the measured value as binary data. Outputs two's complement in 21 bits. Negative logic (1 when the NPN or PNP open-collector output is ON).

Comparator standby status (all digits have a negative (-) sign): 0x100000

Over range at positive side: 0x0FFFFF

Over range at negative side: 0x100000

Alarm: 0x100000

STROBE output

Strobe output of the binary output

OUT1/OUT2

OUT output

You can identify through which OUT number the data is currently being output.

OFF: OUT1

ON: OUT2

OUT1/OUT2 SEL input

Select the OUT number to output in binary.

OFF: OUT1

ON: OUT2
### How to read the binary output

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

**Example:** When the measurement value is 

```
+134.97
```

→ 0 0000 0011 0100 1011 1001 (binary)

**Example 2:** When the measurement value is 

```
–134.97
```

→ 1 1111 1100 1011 0100 0111 (binary)

### LASER OFF input

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>LASER OFF input</td>
<td>Controls the laser for each head. For NPN type, the laser is turned off when short-circuited with COM, and turned on when open. For PNP type, the laser is turned off when the voltage is applied, and turned on when the circuit is open. “LASER OFF A” controls the head A, and “LASER OFF B” controls the head B.</td>
<td>Page 4-6</td>
</tr>
</tbody>
</table>

### REMOTE

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>REMOTE</td>
<td>This is the laser remote interlock terminal. The laser beam is emitted when the terminal is short-circuited with COM, and emission is stopped when the terminal is open. The terminal is common to head A and B, and takes priority over the LASER OFF input.</td>
<td>Page 4-2</td>
</tr>
</tbody>
</table>
This section describes the electrical specifications and circuit diagram of the input/output terminals.

**■ Non-voltage input**

- **Input**
  - +5V
  - 2.2k Ω
  - 1k Ω

- **COM for input**
  - Internal circuit
  - +5V
  - 1k Ω

**■ NPN open-collector output**

- **Output**
  - 4.7k Ω
  - 10k Ω

- **COM for output**
  - Internal circuit
  - +5V

**Specifications**

- **ON voltage** 1 V or less
- **OFF current** 0.6 mA or less
- **Short-circuit current** (Typ.) 2 mA
- **Maximum applied voltage** 40 V
- **Maximum sink current** 50 mA
- **Residual voltage** 0.5 V or less
- **Leakage current** 0.1 mA or less

**Input or COM**

- **Input**
- **COM**
This section describes the electrical specifications and circuit diagram of the input/output terminals.

**Voltage input**

**PNP open-collector output**

**Electrical specifications common to NPN type and PNP type**

- Analog voltage output / analog current output
- **Voltage output**
  - Output range: ±10.8V (Measurement data: ±10.5V)
  - Resolution: 2 mV
  - Accuracy: ±0.05% of F.S. (F.S. = 20 V, accuracy with reference to the displayed value)
- **Output impedance**
  - about 100Ω
- **Response Delay Time**
  - about 10 µs (after the measurement value has been updated)

**Input**

1.5kΩ / 4.7kΩ

**Internal circuit**

+5V / 47Ω

**Output**

10kΩ

**Internal circuit**

+5V / 47Ω

**Voltage output**

47Ω

**Current output**

0V

**Max. input voltage rating**

26.4V

- ON voltage: 10.2V or more
- OFF current: 0.6 mA or less

- Short-circuit current (Typ.): 2 mA

**Maximum applied voltage**

30 V

- Maximum sink current: 50 mA
- Residual voltage: 0.5 V or less
- Leakage current: 0.1 mA or less

- Output range: 3.36 to 20.64 mA (Measurement data: 3.6 to 20.4 mA)
- Resolution: 3 µA
- Accuracy: ±0.25% of F.S. (F.S. = 16 mA, accuracy with reference to the displayed value)

**Matching load**

350Ω max.

**Response delay time**

about 10 µs (after the measurement value has been updated)
This section describes the timing of the input and output signals.

- The minimum input time ($T_1$) is 600 µs. The minimum input time ($T_1$), input response time ($T_2$), RESET time ($T_4$), refresh rate ($T_5$), sampling rate ($T_6$), and program No. change time ($T_7$) vary depending on the settings.
- The STROBE time ($T_3$) at the time of hold can be changed.
- Auto-zero is canceled when the ZERO input is turned on for two seconds or more.
- This is the chart of when the average number of times is 4096. At this time, the refresh rate ($T_5$) equals the sampling rate ($T_6$).
- When the average number of times is 16384, 65536, or 262144, the refresh rate exceeds the sampling rate ($T_6$). However, the STROBE output is outputted at the sampling rate. Refer to page 4-17.
- Refer to page 3-43.

### Comparator output

- **ON**
- **OFF**

### Binary output

### STROBE output

### TIMING input

- **RESET**
- **ZERO**
- **P1 to P3 inputs**
**Input/Output Terminals**

- **Peak hold/bottom/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.**

- **The STROBE time (T3) can be changed.**

- **Auto-zero is canceled when the ZERO input is turned on for two seconds or more.**

- **The internal measurement value of the RESET input is determined after the RESET time (T4) has elapsed.**

Refer to page 4-17.

Refer to page 3-43.

---

**Comparator output**

<table>
<thead>
<tr>
<th>ON</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Binary output**

**STROBE output**

**TIMING input**

**RESET/ZERO input**

**P1 to P3 inputs**

At Trigger 2

At Trigger 1

- **0.2ms T3**
- **Min T1**
- **Max T2**
- **Min T1**
- **Max T2**
- **Sampling period**
- **Sampling period T4**
- **Min T1**
- **T4**
- **T4**
- **Sampling T4**
- **Sampling period**
- **Sampling period**
- **T1**
- **T7**
Input/Output Terminals

- Sample hold (trigger 2): The measurement value is determined after the sampling period (T4) has elapsed by using the timing input ON as a trigger.
- Minimum input time (T1), input response time (T2), sampling period (T4), and program No. change time (T7) vary depending on the settings.
- STROBE time (T3) can be changed.
- Auto-zero is canceled when the ZERO input is turned on for two seconds or more.
- If you turn on the RESET input or the ZERO input during the sampling period, the sampling stops and the comparator standby state is established.

Refer to page 4-17.
Refer to page 3-43.
Input/Output Terminals

Binary output

- OUT1 and OUT2 are updated asynchronously depending on the filter settings or the options specified in the measurement mode.
- This timing chart is the example of the state other than OUT1: Normal, and OUT2: Normal.
- Output of either OUT1 or OUT2 can be selected for binary output by "OUT1/OUT2 SEL input".
- You can check whether the present binary output is OUT1 or OUT2 by "OUT1/OUT2 OUT output".
- Synchronize the binary data with the STROBE output signal to import.
- The input response time (T2) and refresh rate (T5) vary depending on the settings.
- The STROBE time (T3) can be changed.

Refer to page 4-17.

Refer to page 3-43.
**Input/Output Terminals**

- **LASER REMOTE/LASER OFF**

* T6 is a sampling rate. (page 3-39)
* T2 is the input response time. (page 4-17)

The alarm status can be changed with the alarm settings (page 3-8).

- **As for the REMOTE input, the open state is ON, and the short-circuited state is OFF.**
- **As for the LASER OFF A/B input, the open state is OFF, and the short-circuited state is ON for NPN type.**
  For PNP type, ON when the voltage is applied and OFF for the open state.

**Emit**

**Stop**

Laser emission

Measurement value

ON

T2

Measurement Alarm Measurement

T2

T6 × 6

OFF

REMOTE input

LASER OFF A/B input
### Input/Output Terminals

#### Timing details

- **Minimum input time (T1)** and **input response time (T2)**
  
  The sampling rate can be changed according to the setting. Refer to page 3-39.

  The measurement response time, measurement average time, **RESET time (T4)**, and refresh rate vary depending on the sampling rate. Furthermore, when the mutual interference prevention function is turned on, calculate the value after doubling the sampling rate (T6 = T6 × 2).

- **Average measurement time**, **RESET time (T4)**, and **refresh rate (T5)**
  
  When the mutual interference prevention function is turned on, calculate the value after doubling the sampling rate (T6 = T6 × 2).

- **Program No. change time (T7)**
  
  When the mutual interference prevention function is turned on, calculate the value after doubling the sampling rate (T6 = T6 × 2).

<table>
<thead>
<tr>
<th>Sampling rate (T6)</th>
<th>Minimum input time (T1)</th>
<th>Input response time (T2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 µs</td>
<td>1000 µs</td>
<td>1000 µs + T6 × 2</td>
</tr>
<tr>
<td>50 µs</td>
<td>100 µs</td>
<td>200 µs</td>
</tr>
<tr>
<td>200 µs</td>
<td>500 µs</td>
<td>1000 µs + T6 × 2</td>
</tr>
<tr>
<td>500 µs</td>
<td>1000 µs</td>
<td>2000 µs + T6 × 2</td>
</tr>
<tr>
<td>1000 µs</td>
<td>2000 µs</td>
<td>2000 µs + T6 × 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of heads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single head</td>
</tr>
<tr>
<td>Two heads</td>
</tr>
</tbody>
</table>

- **Other than 20 µs**

  - **Single head**: 60 ms (T6 × 10) + 50 ms
  - **Two heads**: 50 ms (T6 × 10) + 60 ms
This chapter describes how to connect external devices and the communication functions for external operation.

Specifications ........................................................................5-2
Outputting Measurement Values and Changing Settings through Commands ................................5-4
Outputting Measurement Values in External Synchronization.....................................................5-22
Matching connector specifications: Modular 6-pin plug connector

* Do not use the unused terminal. Doing so may lead to breakdown of the unit.

**Communication Specifications**

- EIA RS-232C compliant (Modem definition)

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Terminal name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(Not used)</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>(Not used)</td>
<td>–</td>
</tr>
<tr>
<td>3</td>
<td>SD (TXD)</td>
<td>Receives signal from external devices (input)</td>
</tr>
<tr>
<td>4</td>
<td>SG (GND)</td>
<td>GND</td>
</tr>
<tr>
<td>5</td>
<td>RD (RXD)</td>
<td>Transmits signal to external devices (output)</td>
</tr>
<tr>
<td>6</td>
<td>(Not used)</td>
<td>–</td>
</tr>
</tbody>
</table>

- Communication method: Full duplex
- Synchronization method: Start-stop synchronous
- 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 Communication Specifications of the RS-232C" (page 3-49) for setting the communication specifications.*
**Communication Performance and Communication Mode in the Measurement State**

Complete the series of input or output of commands before moving to the tolerance or function settings from the measurement state.

**Overview of the Settings According to External Devices**

Perform "Auto transmission settings" according to the external device to be connected as shown in the following table.

> *"Outputting Measurement Values and Changing Settings through Commands" is also valid when Auto transmission is ON.*

**Normal mode**
- **During measurement:** Receives the measurement control command. Commands such as for writing or reading the setting values are not accepted.
- **During tolerance/function setting:** Communication is not accepted. The measurement stops.

**Communication mode**
- **Upon receiving the command [Q], [0] or [CR], the mode changes to the communication mode, and the setting values are written or read.**
- **The measurement stops during the communication mode.**

Refer to "Setting the Communication Specifications of the RS-232C" (page 3-49). For details on usage, refer to the page given in the table.

<table>
<thead>
<tr>
<th>External device</th>
<th>Auto transmission</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-procedural communication with a PC and a PLC link unit (the communication command is required.)</td>
<td>OFF</td>
<td>&quot;Outputting Measurement Values and Changing Settings through Commands&quot; (page 5-4)</td>
</tr>
<tr>
<td>Communication with a PC or a PLC link unit (the measurement value is outputted by being synchronized with the external timing.)</td>
<td>ON</td>
<td>&quot;Outputting Measurement Values in External Synchronization&quot; (page 5-22)</td>
</tr>
</tbody>
</table>

**Note**
Outputting Measurement Values and Changing Settings through Commands

You can import the measurement value or change the parameters of the LK-G Series by connecting it to a PC or PLC link unit.

Connecting the PC or PLC Link Unit

Combine the dedicated cables OP-96368 (2.5-m straight cord), OP-26401 (D-sub 9-pin), or OP-96369 (D-sub 25-pin) for connection.

Environment Settings Parameters

Set the functions according to the PC or PLC link unit to be connected. Refer to the instruction manual of the PC or PLC link unit at the time of connection. Refer to “Setting the Communication Specifications of the RS-232C” (page 3-49).

<table>
<thead>
<tr>
<th>Item</th>
<th>Setting Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud rate</td>
<td>9600/19200/38400/57600/115200</td>
<td>Set the parameter according to the external devices to be connected.</td>
</tr>
<tr>
<td>Parity check</td>
<td>None/Even/Odd</td>
<td></td>
</tr>
<tr>
<td>RD (RXD)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>SD (TXD)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>SG (GND)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>RS (RTS)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>CS (CTS)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>DR (DSR)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>CD (DCD)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>ER (DTR)</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PC side</th>
<th>LK-G side</th>
<th>Signal name</th>
<th>OP-26401</th>
<th>OP-96369</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>+</td>
<td>RD (RXD)</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>-</td>
<td>+</td>
<td>SD (TXD)</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>SG (GND)</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>RS (RTS)</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>CS (CTS)</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>-</td>
<td>+</td>
<td>DR (DSR)</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>CD (DCD)</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>ER (DTR)</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>
Outline of the command format

The LK-G Series controls the incoming command that has been received and sends back the response command to the external device.

Use [CR] to delimit the data in incoming/response command format.

To create the control program, confirm the response command from the LK-G Series before sending the next command.

Both upper-case and lower-case characters can be used in the commands.

The presence or absence of the brackets [ ] in the command format depends on a condition.

## Incoming command format

<table>
<thead>
<tr>
<th>Main command</th>
<th>Identifier1</th>
<th>Identifier2</th>
<th>Identifier3</th>
</tr>
</thead>
</table>

The main command or identifier that has been received is added as a header.

## Response command format

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00 :</td>
<td>Command error</td>
</tr>
<tr>
<td>01 :</td>
<td>Status error</td>
</tr>
<tr>
<td>20 :</td>
<td>Command length error</td>
</tr>
<tr>
<td>21 :</td>
<td>Parameter count error</td>
</tr>
<tr>
<td>22 :</td>
<td>Invalid parameter error</td>
</tr>
<tr>
<td>88 :</td>
<td>Timeout error</td>
</tr>
<tr>
<td>99 :</td>
<td>Other errors</td>
</tr>
</tbody>
</table>

## Error response command format
The measurement value format is outputted in the given format as shown below.

The example of the format is shown below.

**Setting value format**
- Fixed length format consisting of one character and a six-digit numerical value. It has no decimal point.

**Setting check format**
- Fixed-length format consisting of one character, a six-digit numerical value, and one decimal point.

**Display Output format**

+ 1.2345
0 1 2 3 4 5
– 0.0120
0 0 0 0 0 . 2

+ 1234.56
1 2 3 4 . 5 6
– 1.2
0 0 0 0 0 0 . 2

– – – – – – –
X X X X X X X

+ FFFFFF
F F F F F F F
– FFFFFF
F F F F F F F

**+- code**
- Integer portion
- Decimal point
- Fractional portion

**Fixed length**
- Single character: "+" or "–"
- Fixed length data consisting of seven characters. The decimal point is a single character.
- The presence/absence and the position of the decimal point vary depending on the settings.
- The measurement value is aligned to the right.
This section describes the command format to switch between the "Normal mode" and "Communication mode".

Command list
Refer to page 5-3 for the normal mode and communication mode.

<table>
<thead>
<tr>
<th>Incoming command</th>
<th>Operation</th>
<th>Response command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q 0 CR</td>
<td>Moving to the communication mode.</td>
<td></td>
</tr>
<tr>
<td>R 0 CR</td>
<td>Moving to the normal mode.</td>
<td></td>
</tr>
</tbody>
</table>

Moving to the communication mode
The mode changes to the communication mode.

Moving to the normal mode
The mode changes to the normal mode.
This section describes the command format to control the measurement such as incoming commands that the LK-G Series can receive during the measurement, and the response commands that are to be sent after properly processing the incoming commands. These commands are accepted only when the controller is in the "Normal mode".

### Measurement Value Output

- Symbol: `M` or `MA` followed by `CR`, `[ ]`, `M` followed by `CR`

### Clearing Statistics

- Symbol: `DQ` followed by `CR`, `DQ`, `CR`

### Timing ON/OFF

- Symbol: `Tp` followed by `CR`, `Tp`, `CR`

### Auto-zero ON

- Symbol: `Va` followed by `CR`, `Va`, `CR`, `Wa`, `CR`

### Reset

- Symbol: `VR`, `CR`, `VR`, `CR`

### Panel lock

- Symbol: `KL`, `p`, `CR`, `KL`, `CR`

### Program change

- Symbol: `PW`, `o`, `CR`, `PW`, `CR`

### Program check

- Symbol: `PR`, `CR`, `PR`, `o`, `CR`

### Statistical Result Output

- Symbol: `DO`, `CR`, `DO`, `CR`, `AO`, `[ ]`, `AO`, `[ ]`, `AO`, `[ ]`, `AO`, `[ ]`

### Starting the data storage

- Symbol: `AS`, `CR`, `AS`, `CR`

### Stopping the data storage

- Symbol: `AP`, `CR`, `AP`, `CR`

### Initializing the data storage

- Symbol: `AQ`, `CR`, `AQ`, `CR`

### Outputting the data storage data

- Symbol: `AN`, `CR`, `AN`, `CR`

The shaded cells indicate the setting values or measurement values.
This section describes the details of the incoming commands and the responses that are sent when the incoming commands are properly processed.

### Measurement value output
Outputs a measurement value.

### Timing ON/OFF
Refer to "Outline of the command format" (page 5-5) for the response command when an abnormality has occurred. Refer to "Timing Chart" (page 5-21) for the response delay time of the response command.

<table>
<thead>
<tr>
<th>Incoming command</th>
<th>Response command</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR</td>
<td>0 : OUT1+OUT2</td>
</tr>
<tr>
<td></td>
<td>1 : OUT1</td>
</tr>
<tr>
<td></td>
<td>2 : OUT2</td>
</tr>
</tbody>
</table>

The same OUT number as that of the incoming command.

### Measurement value format

<table>
<thead>
<tr>
<th>Measurement value format</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
</tr>
<tr>
<td>h</td>
</tr>
<tr>
<td>h</td>
</tr>
<tr>
<td>h</td>
</tr>
<tr>
<td>h</td>
</tr>
<tr>
<td>h</td>
</tr>
<tr>
<td>h</td>
</tr>
<tr>
<td>h</td>
</tr>
<tr>
<td>h</td>
</tr>
<tr>
<td>CR</td>
</tr>
</tbody>
</table>

### CRT command

<table>
<thead>
<tr>
<th>CRT command</th>
<th>ON/OFF number</th>
<th>OUT number</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT</td>
<td>0 : OFF</td>
<td>0 : OUT1+OUT2</td>
</tr>
<tr>
<td>p, a</td>
<td>1 : ON</td>
<td>1 : OUT1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 : OUT2</td>
</tr>
</tbody>
</table>

The same ON/OFF setting as that of the incoming command.
Auto-zero ON/OFF

Auto-zero ON

Incoming command

Response command

CRV

OUT number
0 : OUT1+OUT2
1 : OUT1
2 : OUT2

The same ON/OFF setting as that of the incoming command.

Incoming command

Response command

CRW

OUT number
0 : OUT1+OUT2
1 : OUT1
2 : OUT2

The same ON/OFF setting as that of the incoming command.
Starting the data storage

Initializing the data storage

Stopping the data storage

Acquires the data accumulated in the data storage.

When the number of data is zero, only the main command is returned.

Incoming command

Response command

CRA

S

CRA

Q

CRA

P

OUT number

1 : OUT1
2 : OUT2

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>OUT number</td>
</tr>
<tr>
<td>c</td>
<td>Function No.</td>
</tr>
<tr>
<td>ddddd</td>
<td>Number of data</td>
</tr>
<tr>
<td>e</td>
<td>Function code</td>
</tr>
<tr>
<td>fffffff</td>
<td>Setting value</td>
</tr>
<tr>
<td>h</td>
<td>Head No.</td>
</tr>
<tr>
<td>i</td>
<td>Data interval</td>
</tr>
<tr>
<td>m</td>
<td>Mode</td>
</tr>
<tr>
<td>nnn</td>
<td>Numerical value without code</td>
</tr>
<tr>
<td>o</td>
<td>Data setting</td>
</tr>
<tr>
<td>p</td>
<td>Program No.</td>
</tr>
<tr>
<td>xx</td>
<td>Control range</td>
</tr>
<tr>
<td>y</td>
<td>OUT and head numbers</td>
</tr>
</tbody>
</table>

The shaded cells indicate the setting values or measurement values.
This section describes the details of the incoming commands and the response commands that are sent when the incoming commands are properly processed.

- **Display panel switch**: Switches the content displayed on the display panel.
- **Tolerance setting**: Sets the tolerance.

*The head of the hysteresis is not a character but "0" (zero).

Refer to "Outline of the command format" (page 5-5) for the error response command.

Refer to "Timing Chart" (page 5-21) for the response delay time of the response command.

### Incoming command: CRD, CRa
- **OUT number**: 0 : OUT1+OUT2
  1 : OUT1
  2 : OUT2

### Incoming command: S, SM, LW
- **Setting value format**

### Hysteresis
- **Upper limit**
- **Lower limit**
- **Setting value format**

### OUT number
- 1 : OUT1
- 2 : OUT2
RS-232C

Sets ABLE.

Sets the control range of ABLE.

Incoming command

Response command

S

A

H

W

0

S

W

H

A

M

h

CR

Upper limit

control range date

01 to 99

Lower limit

control range date

01 to 99  01 to 99

Head number

1 : Head A

2 : Head B

Mode

0 : AUTO

1 : MANUAL

Head number

1 : Head A

2 : Head B

Mode

0 : Normal

3 : Transparent object2

1 : Translucent object

4 : Multi-reflective object

Number of times of alarm processing

Sets the number of times of alarm processing.

Alarm level

Sets the level of alarm.

Incoming command

Response command

S

C

H

W

0

S

W

H

C

N

h

n

CR

CR

Head number

1 : Head A

2 : Head B

Numerical value

without code

000 to 999

Incoming command

Response command

S

C

H

W

0

S

W

H

C

L

h

c

CR

CR

Head number

1 : Head A

2 : Head B

Alarm level

0 to 9
Even when specifying a value from 0 to 3 for the calculation method, specify dummy data for the calculation between waveforms.

**Incoming command**

**Response command**

S, A, O, W, CR

OUT number

1 : OUT1    2 : OUT2

**Calculation method**

0 : Head A
1 : Head B
2 : Head A + Head B
3 : Head A – Head B
4 : Head A transparent object
5 : Head B transparent object

**Waveform calculation**

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

**Starting the ABLE calibration**

**Stopping the ABLE calibration**

**Finishing the ABLE calibration**

**Mounting mode**

**Incoming command**

**Response command**

S, D, H, W, CR

**Head number**

1 : Head A
2 : Head B

**Incoming command**

**Response command**

S, D, H, C, CR

**Incoming command**

**Response command**

S, E, H, W, CR, c, CR

**Head number**

1 : Head A
2 : Head B

**Mode**

0 : Diffuse reflection
1 : Mirror reflection
<table>
<thead>
<tr>
<th>Incoming command</th>
<th>Response command</th>
</tr>
</thead>
<tbody>
<tr>
<td>ScOW, ScW, ScOc, ac,c CR</td>
<td>OUT number 1 : OUT1 2 : OUT2</td>
</tr>
<tr>
<td>Function code</td>
<td>Number of times of averaging Cutoff frequency</td>
</tr>
<tr>
<td>0 : 1 times 0 : 1000Hz</td>
<td>1 : 4 times 1 : 300Hz</td>
</tr>
<tr>
<td>2 : 16 times 2 : 100Hz</td>
<td>3 : 64 times 3 : 30Hz</td>
</tr>
<tr>
<td>4 : 256 times 4 : 10Hz</td>
<td>5 : 1024 times 5 : 3Hz</td>
</tr>
<tr>
<td>6 : 4096 times 6 : 1Hz</td>
<td>7 : 16384 times 7 : 0.3Hz</td>
</tr>
<tr>
<td>8 : 65536 times 8 : 0.1Hz</td>
<td>9 : 262144 times</td>
</tr>
</tbody>
</table>

Filter mode

0 : Average 1 : Low-pass filter 2 : High-pass filter
LK-G-M-NO5-E

RS-232C

Trigger mode

Offset

Analog output scaling

* Set the voltage value in mV for the setting value format of the output value.

Incoming command
Response command

S
E
O
W,

S
W,
O
E,
M,
a,
c

CR

OUT number

1 : OUT1
2 : OUT2

Trigger mode

0 : Trigger 1
1 : Trigger 2

Incoming command
Response command

S
F
O
W,

S
W,
O
F,
a,
f

CR

OUT number

1 : OUT1
2 : OUT2

Setting value format

OUT number

1 : OUT1
2 : OUT2

Incoming command
Response command

S
H
O
W,

S
W,
O
H,
a,
f

CR

First point display value

Setting value format

First point output value

Setting value format

+010.000
### Data setting

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Accumulation rate</th>
<th>Number of data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>×16</td>
<td>00000 to 65536</td>
</tr>
<tr>
<td>1</td>
<td>×100</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>×200</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>×500</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>×1000</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>×50</td>
<td></td>
</tr>
</tbody>
</table>

### Function code

<table>
<thead>
<tr>
<th>Function code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Measurement mode</td>
</tr>
<tr>
<td>G</td>
<td>Minimum display unit</td>
</tr>
<tr>
<td>I</td>
<td>Analog-through</td>
</tr>
</tbody>
</table>

The same function code as that of the incoming command.

### OUT number

<table>
<thead>
<tr>
<th>OUT number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OUT1</td>
</tr>
<tr>
<td>2</td>
<td>OUT2</td>
</tr>
</tbody>
</table>

### Function No.

<table>
<thead>
<tr>
<th>Measurement mode</th>
<th>Minimum display unit</th>
<th>Analog-through</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>0.01mm</td>
<td>OFF</td>
</tr>
<tr>
<td>Peak hold</td>
<td>0.001mm</td>
<td>ON</td>
</tr>
<tr>
<td>Bottom hold</td>
<td>0.0001mm</td>
<td></td>
</tr>
<tr>
<td>Peak-to-peak hold</td>
<td>0.00001mm</td>
<td></td>
</tr>
<tr>
<td>Sample hold</td>
<td>0.1µm</td>
<td></td>
</tr>
<tr>
<td>Average hold</td>
<td>0.01µm</td>
<td></td>
</tr>
</tbody>
</table>

### Incoming command

```
CRS W, O, a, c
```

### Response command

```
S, CR
```

### Function code

<table>
<thead>
<tr>
<th>Function code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Sampling rate</td>
</tr>
<tr>
<td>D</td>
<td>Comparator output form</td>
</tr>
<tr>
<td>B</td>
<td>Mutual interference</td>
</tr>
<tr>
<td>E</td>
<td>Strobe time</td>
</tr>
<tr>
<td>C</td>
<td>Timing synchronization</td>
</tr>
</tbody>
</table>

The same function code as that of the incoming command.
Check Parameter Command Format

This section describes the format of the command to check the setting contents. These commands are accepted only when the controller is in the "Communication mode." If the LK-G Series receives the response command for the change parameter command as an incoming command, the parameter will be sent back. The setting value format is returned with a decimal point.

**Note**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>OUT number</td>
</tr>
<tr>
<td>c</td>
<td>Function No.</td>
</tr>
<tr>
<td>d</td>
<td>Number of data</td>
</tr>
<tr>
<td>e</td>
<td>Function code</td>
</tr>
<tr>
<td>f</td>
<td>Setting value</td>
</tr>
<tr>
<td>h</td>
<td>Head No.</td>
</tr>
<tr>
<td>m</td>
<td>Mode</td>
</tr>
<tr>
<td>i</td>
<td>Data interval</td>
</tr>
<tr>
<td>o</td>
<td>Data setting</td>
</tr>
<tr>
<td>y</td>
<td>OUT and head numbers</td>
</tr>
<tr>
<td>b</td>
<td>Trigger mode</td>
</tr>
<tr>
<td>y</td>
<td>Measurement mode</td>
</tr>
<tr>
<td>a</td>
<td>Mounting mode</td>
</tr>
<tr>
<td>m</td>
<td>Tolerance setting</td>
</tr>
<tr>
<td>b</td>
<td>Scaling</td>
</tr>
<tr>
<td>c</td>
<td>Calculation method</td>
</tr>
<tr>
<td>d</td>
<td>Data storage</td>
</tr>
<tr>
<td>y</td>
<td>Sampling rate, mutual interference, timing synchronization, comparator output, strobe time</td>
</tr>
</tbody>
</table>

The shaded cells indicate the setting values or measurement values.
The timing chart of the incoming/response command is shown below.

The t-time is identified as follows. [ms]

* The response speed slows during the communication with the Setup support software "LK-Navigator".

<table>
<thead>
<tr>
<th>Command</th>
<th>Sampling rate (T)</th>
<th>Other than 20 µs</th>
<th>Measurement control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>M8 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When connecting one head 60 (T x 10)+50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When connecting two heads 50 (T x 10)+60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DO 20 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other than above 10 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Setting/check S W , H D 60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other than above 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mode change Q0 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R0 70</td>
</tr>
</tbody>
</table>
Outputting Measurement Values in External Synchronization

This section describes how to synchronize the measurement value with the measurement performed by the commands from the input terminal (TIMING input) and output it from the RS-232C interface.

This method does not use any incoming command, so it is used when the measurement value is only imported or when the unit is connected to a device such as a data logger that cannot send a command.

Commands for measurement value output and for setting change are available even when the measurement value output is in use in external synchronization (when the external trigger input is other than OFF).

Do not fix the next measurement value while the current measurement value is outputted via RS-232C. That next measurement value will not be outputted.

### Environment Settings Parameters

Set the environment settings as follows.

#### Output

The measurement value that is fixed in the external synchronization (TIMING1 and 2 input) is outputted.

The output content becomes as follows depending on the setting of auto transmission.

Refer to "Setting the Communication Specifications of the RS-232C" (page 3-49) for Environment settings.

<table>
<thead>
<tr>
<th>Item</th>
<th>Setting value</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud rate</td>
<td>9600/19200/38400/57600/115200 bps</td>
<td>Set the parameter according to the external devices to be connected.</td>
</tr>
<tr>
<td>Parity check</td>
<td>None/Even/Odd</td>
<td></td>
</tr>
<tr>
<td>Auto transmission</td>
<td>OUT1/OUT2/OUT1 + OUT2</td>
<td>Select one of them according to the output method.</td>
</tr>
</tbody>
</table>

### Auto transmission

- **OFF**: Does not output the measurement values in external synchronization.
- **OUT1**: Outputs only OUT1.
- **OUT2**: Outputs only OUT2.
- **OUT1 + OUT2**: Outputs OUT1 and OUT2 at the same time.

### Reference

Note
### Timing Chart

**When the measurement mode is other than sample hold (trigger 2)**

- When the measurement mode is set to normal, the measurement value of when the timing input turns on is outputted.
- When the measurement mode is peak hold, bottom hold, peak-to-peak hold, average hold or sample hold (trigger 1), the measurement value that is fixed by turning on the timing input is outputted.

**When the measurement hold is sample hold (trigger 2)**

- After the timing input turns on, the measurement value fixed after the sampling period $+t$ ms is outputted.

The $t$-time is identified as follows:

- Sampling rate 20 µs: $t = T_2 + 4$ ms
- Other than 20 µs: $t = T_2 + 3$ ms

Refer to page 4-16 for $T_2$ (input response time).

<table>
<thead>
<tr>
<th>TIMING input</th>
<th>Measurement value</th>
<th>Sampling period + $t$ ms</th>
<th>RS-232C data output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The command format of the measurement value output is identified as follows. Regardless of the setting of the timing synchronization, the fixed measurement value of each OUT number is outputted in this format.

### Measurement value format

<table>
<thead>
<tr>
<th>OUT number</th>
<th>First 4 bit</th>
<th>Last 4 bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: OUT1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: OUT2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ASCII Code Table (Reference)**

<table>
<thead>
<tr>
<th>Character</th>
<th>ASCII Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>0x9</td>
</tr>
<tr>
<td>a</td>
<td>0x61</td>
</tr>
<tr>
<td>CR</td>
<td>0x0D</td>
</tr>
<tr>
<td>f</td>
<td>0x66</td>
</tr>
<tr>
<td>G</td>
<td>0x47</td>
</tr>
<tr>
<td>Measurement value</td>
<td>Date</td>
</tr>
<tr>
<td>OUT number</td>
<td>Time</td>
</tr>
</tbody>
</table>

**Notes:**
- **NUL** (0x00)
- **DLE** (0x1B)
- **SP** (0x20)
- **0@P** (0x00)
- **SOH** (0x01)
- **DC1** (0x1C)
- **STX** (0x02)
- **DC2** (0x1D)
- **ETX** (0x03)
- **DC3** (0x1E)
- **EOT** (0x04)
- **DC4** (0x1F)
- **ENQ** (0x05)
- **NAK** (0x16)
- **ACK** (0x06)
- **SYN** (0x17)
- **BEL** (0x07)
- **ETB** (0x18)
- **BS** (0x08)
- **CAN** (0x19)
- **HT** (0x09)
- **EM** (0x1A)
- **LF** (0x0A)
- **SUB** (0x1B)
- **VT** (0x1C)
- **ESC** (0x1D)
- **FF** (0x1E)
- **C** (0x1F)
- **CR** (0x20)
- **SO** (0x21)
- **XON** (0x22)
- **XOFF** (0x23)
- **XOA** (0x24)
- **XOF** (0x25)
- **XONP** (0x26)
- **XOFFP** (0x27)

**Special Characters:**
- **BL** (0x0B)
- **NL** (0x0C)
- **DS** (0x0E)
- **DC6** (0x1F)
- **ES** (0x0F)
- **FS** (0x7F)
- **GS** (0x78)
- **RS** (0x7D)
- **US** (0x7E)

**Binary Codes:**
- **0x00** (NUL)
- **0x01** (SOH)
- **0x02** (STX)
- **0x03** (ETX)
- **0x04** (EOT)
- **0x05** (ENQ)
- **0x06** (ACK)
- **0x07** (BEL)
- **0x08** (BS)
- **0x09** (HT)
- **0x0A** (LF)
- **0x0B** (VTS)
- **0x0C** (VTI)
- **0x0D** (VT0)
- **0x0E** (DS)
- **0x0F** (DC1)
- **0x10** (DC2)
- **0x11** (DC3)
- **0x12** (DC4)
- **0x13** (DC5)
- **0x14** (DC6)
- **0x15** (DC7)
- **0x16** (DC8)
- **0x17** (DC9)
- **0x18** (DC10)
- **0x19** (DC11)
- **0x1A** (DC12)
- **0x1B** (DC13)
- **0x1C** (DC14)
- **0x1D** (DC15)
- **0x1E** (DC16)
- **0x1F** (DC17)
- **0x20** (SP)
- **0x21** (BEL)
- **0x22** (BS)
- **0x23** (HT)
- **0x24** (LF)
- **0x25** (VT)
- **0x26** (VTI)
- **0x27** (VT0)
- **0x28** (DS)
- **0x29** (DC1)
- **0x2A** (DC2)
- **0x2B** (DC3)
- **0x2C** (DC4)
- **0x2D** (DC5)
- **0x2E** (DC6)
- **0x2F** (DC7)
- **0x30** (0)
- **0x31** (1)
- **0x32** (2)
- **0x33** (3)
- **0x34** (4)
- **0x35** (5)
- **0x36** (6)
- **0x37** (7)
- **0x38** (8)
- **0x39** (9)
- **0x3A** (0)
- **0x3B** (1)
- **0x3C** (2)
- **0x3D** (3)
- **0x3E** (4)
- **0x3F** (5)
- **0x40** (6)
- **0x41** (7)
- **0x42** (8)
- **0x43** (9)
- **0x44** (A)
- **0x45** (B)
- **0x46** (C)
- **0x47** (D)
- **0x48** (E)
- **0x49** (F)
- **0x4A** (0)
- **0x4B** (1)
- **0x4C** (2)
- **0x4D** (3)
- **0x4E** (4)
- **0x4F** (5)
- **0x50** (6)
- **0x51** (7)
- **0x52** (8)
- **0x53** (9)
- **0x54** (A)
- **0x55** (B)
- **0x56** (C)
- **0x57** (D)
- **0x58** (E)
- **0x59** (F)
- **0x5A** (0)
- **0x5B** (1)
- **0x5C** (2)
- **0x5D** (3)
- **0x5E** (4)
- **0x5F** (5)
- **0x60** (6)
- **0x61** (7)
- **0x62** (8)
- **0x63** (9)
- **0x64** (A)
- **0x65** (B)
- **0x66** (C)
- **0x67** (D)
- **0x68** (E)
- **0x69** (F)
- **0x6A** (0)
- **0x6B** (1)
- **0x6C** (2)
- **0x6D** (3)
- **0x6E** (4)
- **0x6F** (5)
- **0x70** (6)
- **0x71** (7)
- **0x72** (8)
- **0x73** (9)
- **0x74** (A)
- **0x75** (B)
- **0x76** (C)
- **0x77** (D)
- **0x78** (E)
- **0x79** (F)
- **0x7A** (0)
- **0x7B** (1)
- **0x7C** (2)
- **0x7D** (3)
- **0x7E** (4)
- **0x7F** (5)
This chapter describes the specifications of the controller and the head, outside dimensions, and characteristics such as spot diameter.
Specifications of the Controller

Model
- Single unit type: LK-G3001V, LK-G3001PV
- Separate type: LK-G3001/LK-GD500, LK-G3001P/LK-GD500

Head compatibility: Compatible

Connectable number of heads: Two heads max.

Display
- Minimum display unit: 0.01 µm
- Display range: ±9999.99 mm to ±9999.99 µm (selectable from six steps)
- Display cycle: 10 times/sec.

Terminal block
- Analog voltage output: ±10 V x 2 outputs, output impedance 100 Ω
- Analog current output: 4 to 20 mA x 2 outputs, maximum load resistance 350 Ω

Timing input
- Non-voltage input for OUT1
- Voltage input for OUT1

Reset input

Auto-zero input

Laser remote interlock input

Non-voltage input

Comparator output
- NPN open-collector output for OUT1
- PNP open-collector output for OUT1

Alarm output
- NPN open-collector output (N.C.) for OUT1
- PNP open-collector output (N.C.) for OUT1

Optional connector

Timing input
- Non-voltage input for OUT2
- Voltage input for OUT2

Reset input

Auto-zero input

Program switch input
- Non-voltage input x 3 inputs
- Voltage input x 3 inputs

Laser OFF input
- Non-voltage input for head A/head B
- Voltage input for head A/head B

Comparator output
- NPN open-collector output for OUT2
- PNP open-collector output for OUT2

Alarm output
- NPN open-collector output (N.C.) for OUT2
- PNP open-collector output (N.C.) for OUT2

Binary
- Measurement data output (21 bits) OUT1/OUT2 selectable

Strobe output
- NPN open-collector output
- PNP open-collector output

Binary selection

output

Binary selection input
- Non-voltage input
- Voltage input
Specifications of the LK-G Series

• The LK-G3001 can be used independently. The measurement value display and the setting change can be performed on the display panel (LK-GD500) or the Setup support software (LK-H1W).

• The output rating of the NPN open-collector
  50 mA Max. (40 V or less), residual voltage: 0.5 V or less

• The output rating of the PNP open-collector
  50 mA Max. (30 V or less), residual voltage: 0.5 V or less

• Non-voltage input rating
  ON voltage: 1 V or less, OFF current: 0.6 mA or less

• Voltage input rating
  Maximum input rating: 26.4 V, ON voltage: 10.2 V, OFF current: 0.6 mA

RS-232C interface
Measurement data output and control I/O (selectable up to the baud rate of 115200 bit/s)

USB interface
USB Revision 2.0, Full speed (USB1.1 compatible) compliant

Main functions
2-OUT simultaneous measurement function, Calculation function, Averaging function, Filter function, Calibration function, Measurement function, Auto-zero function, Sampling rate setting function, Mutual interference prevention function, Data storage function, 8-program memory function, Eco mode, ABLE setting function, Measurement target setting function, ABLE calibration function, Transparent object measuring surface selection function, Statistical computation function, Setup support software connection function, Head installation selection function, and others

Rating
Power voltage 24 V DC ±10%. Ripple (P-P): 10% max.

Maximum current consumption
When connecting one measurement head 500 mA or less/
When connecting two measurement heads 600 mA or less

Environmental resistance
Operating ambient temperature 0 to +50 °C
Operating ambient humidity 35 to 85% RH (No condensation)

Weight
Approx. 480 g (LK-G3001V/LK-G3001PV)
Approx. 370 g (LK-G3001/LK-G3001P)/Approx. 60 g (LK-GD500)

Model
Single unit type
LK-G3001V
LK-G3001PV

Separate type *1
LK-G3001/LK-GD500
LK-G3001P/LK-GD500
Specifications of the LK-G Series

Specifications of the Head

■ LK-G15/LK-G10

*1 When the sampling rate is 20 µs, the value becomes +0.37 (FAR side) to –1 mm (NEAR side) at the time of the diffuse reflection.

*2 The value when measuring the KEYENCE standard target (ceramic) in the standard mode

*3 The value when measuring the KEYENCE standard target (SUS) 4096 times average at the reference distance.

The value in parenthesis ( ) indicates the typical value when measured with the number of averaging times of 16384.

<table>
<thead>
<tr>
<th>Model</th>
<th>LK-G15/LK-G10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference distance</td>
<td>10 mm</td>
</tr>
<tr>
<td>Measurement range</td>
<td>±1 mm</td>
</tr>
<tr>
<td>Light source</td>
<td>Red semiconductor laser</td>
</tr>
<tr>
<td>Wavelength</td>
<td>650 nm (visible light)</td>
</tr>
<tr>
<td>Class</td>
<td>IEC60825-1 class I (CDRH)</td>
</tr>
<tr>
<td>Output</td>
<td>0.3 mW max.</td>
</tr>
<tr>
<td>Spot diameter</td>
<td>Approx. 20 x 500 µm (G15)</td>
</tr>
<tr>
<td></td>
<td>Approx. ø20 µm (G10)</td>
</tr>
<tr>
<td>Linearity</td>
<td>±0.03% of F.S.</td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.02 µm (0.01 µm)</td>
</tr>
<tr>
<td>Sampling rate</td>
<td>20/50/100/200/500/1000 µs (Selectable among six steps)</td>
</tr>
<tr>
<td>LED indication</td>
<td>Near the center of measurement range: Lights in green</td>
</tr>
<tr>
<td></td>
<td>Within the measurement range: Lights in orange</td>
</tr>
<tr>
<td></td>
<td>Outside the measurement range: Flashes in orange</td>
</tr>
<tr>
<td>Temperature</td>
<td>0.01% of F.S./°C (F.S. = ±1 mm)</td>
</tr>
<tr>
<td>Characteristics</td>
<td></td>
</tr>
<tr>
<td>Environmental</td>
<td></td>
</tr>
<tr>
<td>Enclosure rating</td>
<td>IP67 (IEC60529)</td>
</tr>
<tr>
<td>Operating ambient light</td>
<td>10000 lux max.</td>
</tr>
<tr>
<td>Operating ambient temperature</td>
<td>0 to +50 °C</td>
</tr>
<tr>
<td>Operating ambient humidity</td>
<td>35 to 85% RH (No condensation)</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes</td>
</tr>
<tr>
<td>Material</td>
<td>Aluminum die-cast</td>
</tr>
<tr>
<td>Weight (including cable)</td>
<td>Approx. 190 g</td>
</tr>
</tbody>
</table>
Specifications of the LK-G Series

■ LK-G15H/LK-G10H

*1 When the sampling rate is 20 µs, the value becomes +0.37 (FAR side) to –1 mm (NEAR side) at the time of the diffuse reflection.

*2 The value when measuring the KEYENCE standard target (ceramic) in the standard mode

*3 The value when measuring the KEYENCE standard target (SUS) 4096 times average at the reference distance.

<table>
<thead>
<tr>
<th>Model</th>
<th>LK-G15H/LK-G10H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference distance</td>
<td>10 mm</td>
</tr>
<tr>
<td>Measurement range *1</td>
<td>±1 mm</td>
</tr>
<tr>
<td>Light source</td>
<td>Red semiconductor laser</td>
</tr>
<tr>
<td>Wavelength</td>
<td>650 nm (visible light) class I (IEC60825-1) class 2 (CDRH)</td>
</tr>
<tr>
<td>Output</td>
<td>0.3 mW max.</td>
</tr>
<tr>
<td>Spot diameter (at reference distance)</td>
<td>Approx. 20 x 500 µm (G15H)</td>
</tr>
<tr>
<td></td>
<td>Approx. ø20 µm (G10H)</td>
</tr>
<tr>
<td>Linearity *2</td>
<td>±0.03% of F.S.</td>
</tr>
<tr>
<td>Repeatability *3</td>
<td>0.3 µm</td>
</tr>
<tr>
<td>Sampling rate</td>
<td>20/50/100/200/500/1000 µs (Selectable among six steps)</td>
</tr>
<tr>
<td>LED indication</td>
<td>Near the center of measurement range: Lights in green</td>
</tr>
<tr>
<td></td>
<td>Within the measurement range: Lights in orange</td>
</tr>
<tr>
<td></td>
<td>Outside the measurement range: Flashes in orange</td>
</tr>
<tr>
<td>Temperature characteristics</td>
<td>0.01% of F.S./°C (F.S. = ±1 mm)</td>
</tr>
<tr>
<td>Environmental resistance</td>
<td>IP67 (IEC60529)</td>
</tr>
<tr>
<td>Operating ambient light</td>
<td>Incandescent lamp or fluorescent lamp: 10000 lux max.</td>
</tr>
<tr>
<td>Operating ambient temperature</td>
<td>0 to +50 °C</td>
</tr>
<tr>
<td>Operating ambient humidity</td>
<td>35 to 85% RH (No condensation)</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes</td>
</tr>
<tr>
<td>Material</td>
<td>Aluminum die-cast</td>
</tr>
<tr>
<td>Weight (including cable)</td>
<td>Approx. 190 g</td>
</tr>
<tr>
<td>Model</td>
<td>Setting mode</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>LK-G35/LK-G30</td>
<td>Diffuse reflection</td>
</tr>
<tr>
<td></td>
<td>Specular reflection</td>
</tr>
</tbody>
</table>

*1 When the sampling rate is 20 µs, the value becomes +1.8 (FAR side) to –5 mm (NEAR side) at the time of the diffuse reflection, and +1.6 (FAR side) to –4.5 mm (NEAR side) at the time of the specular reflection.

*2 The value when measuring the KEYENCE standard target (ceramic) in the standard mode

*3 The value when measuring the KEYENCE standard target (SUS) 4096 times average at the reference distance.

The value in parenthesis (  ) indicates the typical value when measured with the number of averaging times of 16384.
### Specifications of the LK-G Series

<table>
<thead>
<tr>
<th>Model</th>
<th>Setting mode</th>
<th>Diffuse reflection</th>
<th>Specular reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>LK-G35/LK-G30H</td>
<td>Reference distance 30 mm</td>
<td>±5 mm</td>
<td>±4.5 mm</td>
</tr>
<tr>
<td></td>
<td>Measurement range *1</td>
<td>±0.05% of F.S.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Linearity</td>
<td>±0.3 µm</td>
<td></td>
</tr>
<tr>
<td>Light source</td>
<td>Output 4.8 mW max.</td>
<td>Wavelength 650 nm (visible light)</td>
<td>class 3R (IEC60825-1)</td>
</tr>
<tr>
<td></td>
<td>Spot diameter</td>
<td>Approx. 30 x 850 µm (G35H)</td>
<td>Approx. ø30 µm (G30H)</td>
</tr>
<tr>
<td></td>
<td>Temperature characteristics</td>
<td>0.01% of F.S./°C (F.S. = ±5 mm)</td>
<td></td>
</tr>
<tr>
<td>Environmental resistance</td>
<td>Enclosure rating</td>
<td>IP67 (IEC60529)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operating ambient light</td>
<td>Incandescent lamp or fluorescent lamp: 10000 lux max.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operating ambient temperature</td>
<td>0 to +50 °C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operating ambient humidity</td>
<td>35 to 85% RH (No condensation)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vibration resistance</td>
<td>10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Weight (including cable)</td>
<td>Aluminum die-cast</td>
<td>Approx. 280 g</td>
</tr>
</tbody>
</table>
# Specifications of the LK-G Series

## Model
- **Model**: LK-G37/LK-G32

## Setting Mode
- **Diffuse Reflection**
- **Specular Reflection**

## Reference Distance
- **Setting**: 30 mm
- **Specular Reflection**: 23.5 mm

## Measurement Range
- **Diffuse Reflection**: ±5 mm
- **Specular Reflection**: ±4.5 mm

## Light Source
- **Wavelength**: 650 nm (visible light) class 2 (IEC60825-1) class 2 (CDRH)
- **Output**: 0.95 mW max.

## Spot Diameter
- **Approx.**: 30 x 850 µm (G37)
- **Approx.**: ø30 µm (G32)

## Linearity
- **Value**: ±0.05% of F.S. (F.S. = ±5 mm)

## Repeatability
- **Value**: 0.05 µm

## Sampling Rate
- **Options**: 20/50/100/200/500/1000 µs
  -Selectable among six steps-

## LED Indication
- **Near the Center of Measurement Range**: Lights in green
- **Within the Measurement Range**: Lights in orange
- **Outside the Measurement Range**: Flashes in orange

## Temperature Characteristics
- **Value**: 0.01% of F.S./°C (F.S. = ±5 mm)

## Environmental Resistance
- **Enclosure Rating**: IP67 (IEC60529)

## Operating Ambient Light
- **Incandescent Lamp or Fluorescent Lamp**: 10000 lux max.

## Operating Ambient Temperature
- **Value**: 0 to +50 °C

## Operating Ambient Humidity
- **Value**: 35 to 85% RH (No condensation)

## Vibration Resistance
- **Value**: 10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes

## Material
- **Aluminum Die-Cast**

## Weight (Including Cable)
- **Value**: Approx. 280 g
### Specifications of the LK-G Series

#### LK-G37H/LK-G32H

<table>
<thead>
<tr>
<th>Setting mode</th>
<th>Diffuse reflection</th>
<th>Specular reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference distance</td>
<td>30 mm</td>
<td>23.5 mm</td>
</tr>
<tr>
<td>Measurement range</td>
<td>±5 mm</td>
<td>±4.5 mm</td>
</tr>
<tr>
<td>Light source</td>
<td>Red semiconductor laser</td>
<td></td>
</tr>
<tr>
<td>Wavelength</td>
<td>650 nm (visible light) class 2 (IEC60825-1) class</td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>0.95 mW max.</td>
<td></td>
</tr>
<tr>
<td>Spot diameter (at reference distance)</td>
<td>Approx. 30 x 850 µm (G37H)</td>
<td>Approx. ø30 µm (G32H)</td>
</tr>
<tr>
<td>Linearity</td>
<td>±0.05% of F.S. (F.S. = ±5 mm)</td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.3 µm</td>
<td></td>
</tr>
<tr>
<td>Sampling rate</td>
<td>20/50/100/200/500/1000 µs (Selectable among six steps)</td>
<td></td>
</tr>
<tr>
<td>LED indication</td>
<td>Near the center of measurement range: Lights in green</td>
<td>Within the measurement range: Lights in orange</td>
</tr>
<tr>
<td>Outside the measurement range: Flashes in orange</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature characteristics</td>
<td>0.01% of F.S./°C (F.S. = ±5 mm)</td>
<td></td>
</tr>
</tbody>
</table>

### Environmental resistance

- **Enclosure rating**: IP67 (IEC60529)
- **Operating ambient light**: Incandescent lamp or fluorescent lamp: 10000 lux max.
- **Operating ambient temperature**: 0 to +50 °C
- **Operating ambient humidity**: 35 to 85% RH (No condensation)
- **Vibration resistance**: 10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes
- **Material**: Aluminum die-cast
- **Weight (including cable)**: Approx. 280 g
### Specifications of the LK-G Series

#### Model: LK-G85/LK-G80

<table>
<thead>
<tr>
<th>Setting mode</th>
<th>Diffuse reflection</th>
<th>Specular reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference distance</td>
<td>80 mm</td>
<td>75.2 mm</td>
</tr>
<tr>
<td>Measurement range</td>
<td>±15 mm</td>
<td>±14 mm</td>
</tr>
<tr>
<td>Light source</td>
<td>Red semiconductor laser</td>
<td></td>
</tr>
<tr>
<td>Wavelength</td>
<td>650 nm (visible light) class 3R (IEC60825-1)</td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>4.8 mW max.</td>
<td></td>
</tr>
<tr>
<td>Spot diameter</td>
<td>Approx. 70 X 1100 µm (G85)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Approx. ø70 µm (G80)</td>
<td></td>
</tr>
<tr>
<td>Linearity</td>
<td>±0.05% of F.S.</td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.2 µm</td>
<td></td>
</tr>
<tr>
<td>Sampling rate</td>
<td>20/50/100/200/500/1000 µs (Selectable among six steps)</td>
<td></td>
</tr>
<tr>
<td>LED indication</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Near the center of measurement range: Lights in green</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Within the measurement range: Lights in orange</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outside the measurement range: Flashes in orange</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>0.01% of F.S./°C</td>
<td></td>
</tr>
<tr>
<td>Environmental</td>
<td></td>
<td></td>
</tr>
<tr>
<td>resistance</td>
<td>IP67 (IEC60529)</td>
<td></td>
</tr>
<tr>
<td>Operating ambient light</td>
<td>10000 lux max.</td>
<td></td>
</tr>
<tr>
<td>Operating ambient temperature</td>
<td>0 to +50 °C</td>
<td></td>
</tr>
<tr>
<td>Operating ambient humidity</td>
<td>35 to 85% RH (No condensation)</td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Aluminum die-cast</td>
<td></td>
</tr>
<tr>
<td>Weight (including cable)</td>
<td>Approx. 380 g</td>
<td></td>
</tr>
</tbody>
</table>
### Specifications of the LK-G Series

**Model**
- LK-G87/LK-G82

<table>
<thead>
<tr>
<th>Setting mode</th>
<th>Diffuse reflection</th>
<th>Specular reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference distance</td>
<td>80 mm</td>
<td>75.2 mm</td>
</tr>
<tr>
<td>Measurement range</td>
<td>*1 ±15 mm</td>
<td>±14 mm</td>
</tr>
<tr>
<td>Light source</td>
<td>Red semiconductor laser</td>
<td></td>
</tr>
<tr>
<td>Wavelength</td>
<td>650 nm (visible light) class 2 (IEC60825-1) class 2 (CDRH)</td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>0.95 mW max.</td>
<td></td>
</tr>
<tr>
<td>Spot diameter (at reference distance)</td>
<td>Approx. 70 X 1100 µm (G87)</td>
<td>Approx. ø70 µm (G82)</td>
</tr>
<tr>
<td>Linearity</td>
<td>*2 ±0.05% of F .S. (F.S. = ±15 mm)</td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>*3 0.2 µm</td>
<td></td>
</tr>
<tr>
<td>Sampling rate</td>
<td>20/50/100/200/500/1000 µs (Selectable among six steps)</td>
<td></td>
</tr>
<tr>
<td>LED indication</td>
<td>Near the center of measurement range: Lights in green</td>
<td>Within the measurement range: Lights in orange</td>
</tr>
<tr>
<td>Temperature characteristics</td>
<td>0.01% of F .S./°C (F.S. = ±15 mm)</td>
<td></td>
</tr>
</tbody>
</table>

#### Environmental resistance
- Enclosure rating: IP67 (IEC60529)
- Operating ambient light: Incandescent lamp or fluorescent lamp: 10000 lux max.
- Operating ambient temperature: 0 to +50 °C
- Operating ambient humidity: 35 to 85% RH (No condensation)
- Vibration resistance: 10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes

#### Material
- Aluminum die-cast

#### Weight (including cable)
- Approx. 380 g
## Specifications of the LK-G Series

### Model: LK-G155/LK-G150

<table>
<thead>
<tr>
<th>Setting mode</th>
<th>Diffuse reflection</th>
<th>Specular reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference distance</td>
<td>150 mm</td>
<td>147.5 mm</td>
</tr>
<tr>
<td>Measurement range</td>
<td>±40 mm</td>
<td>±35 mm</td>
</tr>
<tr>
<td>Light source</td>
<td>Red semiconductor laser</td>
<td></td>
</tr>
<tr>
<td>Wavelength</td>
<td>650 nm (visible light)</td>
<td>class 3R (IEC60825-1)</td>
</tr>
<tr>
<td>Output</td>
<td>4.8 mW max.</td>
<td></td>
</tr>
<tr>
<td>Spot diameter</td>
<td>Approx. 120 x 1700 µm (G155)</td>
<td>Approx. ø120 µm (G150)</td>
</tr>
<tr>
<td>Linearity</td>
<td>±0.05% of F.S.</td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.5 µm</td>
<td></td>
</tr>
<tr>
<td>Sampling rate</td>
<td>20/50/100/200/500/1000 µs (Selectable among six steps)</td>
<td></td>
</tr>
<tr>
<td>LED indication</td>
<td>Near the center of measurement range: Lights in green</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Within the measurement range: Lights in orange</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outside the measurement range: Flashes in orange</td>
<td></td>
</tr>
<tr>
<td>Temperature characteristics</td>
<td>0.01% of F.S./°C (F.S. = ±40 mm)</td>
<td></td>
</tr>
<tr>
<td>Enclosure rating</td>
<td>IP67 (IEC60529)</td>
<td></td>
</tr>
<tr>
<td>Ambient light</td>
<td>Incandescent lamp or fluorescent lamp: 10000 lux max.</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0 to +50 °C</td>
<td></td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>35 to 85% RH (No condensation)</td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Aluminum die-cast</td>
<td></td>
</tr>
<tr>
<td>Weight (including cable)</td>
<td>Approx. 290 g</td>
<td></td>
</tr>
</tbody>
</table>
### Specifications of the LK-G Series

<table>
<thead>
<tr>
<th>Model</th>
<th>LK-G155H/LK-G150H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting mode</td>
<td>Diffuse reflection Specular reflection</td>
</tr>
<tr>
<td>Reference distance</td>
<td>150 mm 147.5 mm</td>
</tr>
<tr>
<td>Measurement range</td>
<td>±40 mm ±35 mm</td>
</tr>
<tr>
<td>Light source</td>
<td>Red semiconductor laser</td>
</tr>
<tr>
<td>Wavelength</td>
<td>650 nm (visible light) class 3R (IEC60825-1) class 3a (CDRH)</td>
</tr>
<tr>
<td>Output</td>
<td>4.8 mW max.</td>
</tr>
<tr>
<td>Spot diameter (at reference distance)</td>
<td>Approx. 120 x 1700 µm (G155H) Approx. ø120 µm (G150H)</td>
</tr>
<tr>
<td>Linearity</td>
<td>±0.05% of F.S. (F.S. = ±40 mm)</td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.6 µm</td>
</tr>
<tr>
<td>Sampling rate</td>
<td>20/50/100/200/500/1000 µs (Selectable among six steps)</td>
</tr>
<tr>
<td>LED indication</td>
<td>Near the center of measurement range: Lights in green Within the measurement range: Lights in orange Outside the measurement range: Flashes in orange</td>
</tr>
<tr>
<td>Temperature characteristics</td>
<td>0.01% of F.S./°C (F.S. = ±40 mm)</td>
</tr>
<tr>
<td>Environmental resistance</td>
<td>IP67 (IEC60529)</td>
</tr>
<tr>
<td>Operating ambient light</td>
<td>Incandescent lamp or fluorescent lamp: 10000 lux max.</td>
</tr>
<tr>
<td>Operating ambient temperature</td>
<td>0 to +50 °C</td>
</tr>
<tr>
<td>Operating ambient humidity</td>
<td>35 to 85% RH (No condensation)</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes</td>
</tr>
<tr>
<td>Material</td>
<td>Aluminum die-cast</td>
</tr>
<tr>
<td>Weight (including cable)</td>
<td>Approx. 290 g</td>
</tr>
<tr>
<td>Model</td>
<td>Setting mode</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------</td>
</tr>
<tr>
<td>LK-G157/LK-G152</td>
<td>Diffuse</td>
</tr>
<tr>
<td></td>
<td>reflection</td>
</tr>
<tr>
<td></td>
<td>Specular</td>
</tr>
<tr>
<td></td>
<td>reflection</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Temperature characteristics:** 0.01% of F.S./°C (F.S. = ±40 mm)

**Environmental resistance:** IP67 (IEC60529)

**Operating ambient light:** Incandescent lamp or fluorescent lamp: 5000 lux max.

**Operating ambient temperature:** 0 to +50 °C

**Operating ambient humidity:** 35 to 85% RH (No condensation)

**Vibration resistance:** 10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes

**Material:** Aluminum die-cast

**Weight (including cable):** Approx. 290 g
### Specifications of the LK-G Series

<table>
<thead>
<tr>
<th>Model</th>
<th>Setting mode</th>
<th>Diffuse reflection</th>
<th>Specular reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>LK-G157H/LK-G152H</td>
<td>Reference distance</td>
<td>150 mm</td>
<td>147.5 mm</td>
</tr>
<tr>
<td></td>
<td>Measurement range</td>
<td>±40 mm</td>
<td>±39 mm</td>
</tr>
<tr>
<td>Light source</td>
<td>Red semiconductor laser</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wavelength</td>
<td>650 nm (visible light) class 2 (IEC60825-1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>0.95 mW max.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spot diameter</td>
<td>Approx. 120 x 1700 µm (G157H)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Approx. ø120 µm (G152H)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linearity</td>
<td>±0.05% of F.S. (F.S. = ±40 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.6 µm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sampling rate</td>
<td>20/50/100/200/500/1000 µs (Selectable among six steps)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LED indication</td>
<td>Near the center of measurement range: Lights in green</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Within the measurement range: Lights in orange</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outside the measurement range: Flashes in orange</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature characteristics</td>
<td>0.01% of F.S./°C (F.S. = ±40 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental resistance</td>
<td>Enclosure rating: IP67 (IEC60529)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating ambient light</td>
<td>Incandescent lamp or fluorescent lamp: 5000 lux max.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating ambient temperature</td>
<td>0 to +50 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating ambient humidity</td>
<td>35 to 85% RH (No condensation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Aluminum die-cast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (including cable)</td>
<td>Approx. 290 g</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Specifications of the LK-G Series

- **Model**: LK-G405/LK-G400
- **Setting mode**: Diffuse reflection, Specular reflection
- **Reference distance**: 400 mm, 398 mm
- **Measurement range**:
  - ±100 mm (Diffuse reflection)
  - ±99 mm (Specular reflection)
- **Light source**: Red semiconductor laser
- **Wavelength**: 650 nm (visible light) class 3R (IEC60825-1)
- **Output**: 4.8 mW max.
- **Spot diameter**:
  - Approx. 290 X 8300 µm (G405)
  - Approx. ø290 µm (G400)
- **Linearity**:
  - ±0.05% of F.S. (F.S. = ±100 mm)
- **Repeatability**:
  - 2 µm
- **Sampling rate**: 20/50/100/200/500/1000 µs (Selectable among six steps)
- **LED indication**:
  - Near the center of measurement range: Lights in green
  - Within the measurement range: Lights in orange
  - Outside the measurement range: Flashes in orange
- **Temperature characteristics**: 0.01% of F.S./°C (F.S. = ±100 mm)

**Environmental resistance**:
- **Enclosure rating**: IP67 (IEC60529)
- **Operating ambient light**: Incandescent lamp or fluorescent lamp: 10000 lux max.
- **Operating ambient temperature**: 0 to +50 °C
- **Operating ambient humidity**: 35 to 85% RH (No condensation)

**Vibration resistance**:
- 10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes

**Material**: Aluminum die-cast

**Weight (including cable)**: Approx. 380 g
### Specifications of the LK-G Series

<table>
<thead>
<tr>
<th>Model</th>
<th>Setting mode</th>
<th>Reference distance</th>
<th>Measurement range *1</th>
<th>Light source</th>
<th>Wavelength</th>
<th>LED indication</th>
<th>Temperature characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>LK-G407/LK-G402</td>
<td>Diffuse reflection</td>
<td>400 mm</td>
<td>±100 mm</td>
<td>Red semiconductor laser</td>
<td>650 nm (visible light) class 2 (IEC60825-1)</td>
<td>Near the center of measurement range: Lights in green</td>
<td>0.01% of F.S./°C (F.S. = ±100 mm)</td>
</tr>
<tr>
<td></td>
<td>Specular reflection</td>
<td>398 mm</td>
<td>±99 mm</td>
<td></td>
<td></td>
<td>Within the measurement range: Lights in orange</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Outside the measurement range: Flashes in orange</td>
<td></td>
</tr>
</tbody>
</table>

- **Sampling rate**: 20/50/100/200/500/1000 µs (Selectable among six steps)
- **Repeatability** *3**: 2 µm
- **Spot diameter (at reference distance)**: Approx. 290 X 8300 µm (G407)
- **Spot diameter (G402)**: Approx. ø290 µm
- **Linearity** *2*: ±0.05% of F.S. (F.S. = ±100 mm)
- **Environmental resistance**: IP67 (IEC60529)
- **Operating ambient light**: Incandescent lamp or fluorescent lamp: 5000 lux max.
- **Operating ambient temperature**: 0 to +50 °C
- **Operating ambient humidity**: 35 to 85% RH (No condensation)
- **Vibration resistance**: 10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes
- **Material**: Aluminum die-cast
- **Weight (including cable)**: Approx. 380 g
### Specifications of the LK-G Series

**Model:** LK-G505/LK-G500

<table>
<thead>
<tr>
<th>Setting mode</th>
<th>Diffuse reflection</th>
<th>Specular reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference distance</td>
<td>500 mm</td>
<td>497.5 mm</td>
</tr>
<tr>
<td>Measurement range</td>
<td>-250 mm to +500 mm</td>
<td>-249 mm to +498 mm</td>
</tr>
<tr>
<td>Light source</td>
<td>Red semiconductor laser</td>
<td></td>
</tr>
<tr>
<td>Wavelength</td>
<td>650 nm (visible light) class 3R (IEC60825-1)</td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>4.8 mW max.</td>
<td></td>
</tr>
<tr>
<td>Spot diameter (at reference distance)</td>
<td>Approx. 300 X 9500 µm (G505)</td>
<td>Approx. ø300 µm (G500)</td>
</tr>
<tr>
<td>Linearity<strong>2</strong></td>
<td>±0.05% of F.S. (-250 to +250 mm)</td>
<td></td>
</tr>
<tr>
<td>Long range:</td>
<td>±0.1% of F.S. (-250 to +500 mm)</td>
<td></td>
</tr>
<tr>
<td>High-accuracy range:</td>
<td>±0.02% of F.S. (-250 to -50 mm)</td>
<td></td>
</tr>
<tr>
<td>(F.S.=±250 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability <strong>3</strong></td>
<td>2 µm</td>
<td></td>
</tr>
<tr>
<td>Sampling rate</td>
<td>20/50/100/200/500/1000 µs</td>
<td></td>
</tr>
<tr>
<td>LED indication</td>
<td>Near the center of measurement range: Lights in green</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Within the measurement range: Lights in orange</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outside the measurement range: Flashes in orange</td>
<td></td>
</tr>
<tr>
<td>Temperature characteristics</td>
<td>0.01% of F.S./°C (F.S. = ±250 mm)</td>
<td></td>
</tr>
<tr>
<td>Environmental resistance</td>
<td>Enclosure rating: IP67 (IEC60529)</td>
<td></td>
</tr>
<tr>
<td>Operating ambient light</td>
<td>Incandescent lamp or fluorescent lamp: 10000 lux max.</td>
<td></td>
</tr>
<tr>
<td>Operating ambient temperature</td>
<td>0 to +50 °C</td>
<td></td>
</tr>
<tr>
<td>Operating ambient humidity</td>
<td>35 to 85% RH (No condensation)</td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Aluminum die-cast</td>
<td></td>
</tr>
<tr>
<td>Weight (including cable)</td>
<td>Approx. 380 g</td>
<td></td>
</tr>
</tbody>
</table>
### Specifications of the LK-G Series

**LK-G507/LK-G502**

<table>
<thead>
<tr>
<th>Setting mode</th>
<th>Diffuse reflection</th>
<th>Specular reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference distance</td>
<td>500 mm</td>
<td>497.5 mm</td>
</tr>
<tr>
<td>Measurement range</td>
<td>-250 mm to +500 mm</td>
<td>-249 mm to +498 mm</td>
</tr>
<tr>
<td>Light source</td>
<td>Red semiconductor laser</td>
<td></td>
</tr>
<tr>
<td>Wavelength</td>
<td>650 nm (visible light) class 2 (IEC60825-1)</td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>0.95 mW max.</td>
<td></td>
</tr>
<tr>
<td>Spot diameter (at reference distance)</td>
<td>Approx. 300 X 9500 µm (G507)</td>
<td>Approx. ø300 µm (G502)</td>
</tr>
<tr>
<td>Linearity*2</td>
<td>±0.05% of F.S. (-250 to +250 mm)</td>
<td>Long range: ±0.1% of F.S. (-250 to +500 mm)</td>
</tr>
<tr>
<td>Repeatability *3</td>
<td>2 µm</td>
<td></td>
</tr>
<tr>
<td>Sampling rate</td>
<td>20/50/100/200/500/1000 µs (Selectable among six steps)</td>
<td></td>
</tr>
<tr>
<td>LED indication</td>
<td>Near the center of measurement range: Lights in green</td>
<td>Within the measurement range: Lights in orange</td>
</tr>
<tr>
<td>Temperature characteristics</td>
<td>0.01% of F.S./°C (F.S. = ±250 mm)</td>
<td></td>
</tr>
<tr>
<td>Environmental resistance</td>
<td>Enclosure rating: IP67 (IEC60529)</td>
<td></td>
</tr>
<tr>
<td>Operating ambient light</td>
<td>Incandescent lamp or fluorescent lamp: 5000 lux max.</td>
<td></td>
</tr>
<tr>
<td>Operating ambient temperature</td>
<td>0 to +50 °C</td>
<td></td>
</tr>
<tr>
<td>Operating ambient humidity</td>
<td>35 to 85% RH (No condensation)</td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 55 Hz, double amplitude 1.5 mm, 2 hours for each of XYZ axes</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Aluminum die-cast</td>
<td></td>
</tr>
<tr>
<td>Weight (including cable)</td>
<td>Approx. 380 g</td>
<td></td>
</tr>
</tbody>
</table>
### Specifications of the LK-G Series

**Head-to-Controller Cable**

<table>
<thead>
<tr>
<th>Model</th>
<th>Cable length</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>LK-GC2</td>
<td>2 m</td>
<td>Approx. 200 g</td>
</tr>
<tr>
<td>LK-GC5</td>
<td>5 m</td>
<td>Approx. 400 g</td>
</tr>
<tr>
<td>LK-GC10</td>
<td>10 m</td>
<td>Approx. 750 g</td>
</tr>
<tr>
<td>LK-GC30</td>
<td>30 m</td>
<td>Approx. 2000 g</td>
</tr>
</tbody>
</table>

### Display Panel

<table>
<thead>
<tr>
<th>Output / Input</th>
<th>RS-232C</th>
<th>USB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure-Measurement</td>
<td>Voltage</td>
<td>(Analog current)</td>
</tr>
<tr>
<td>Comparator</td>
<td>ALARM</td>
<td>Comparator</td>
</tr>
<tr>
<td>Binary TIMING</td>
<td>RESET</td>
<td>P1/P2/P3</td>
</tr>
<tr>
<td>ZERO</td>
<td>Normal Measurement result</td>
<td>Comparator result</td>
</tr>
<tr>
<td>Voltage</td>
<td>Corresponding to the measurement value</td>
<td></td>
</tr>
<tr>
<td>Valid</td>
<td>Measurement value</td>
<td>Control command</td>
</tr>
</tbody>
</table>

Over range at positive (+) side:
- HI: +10.8 V (20.64 mA)
- LO: 1048575 (0x0FFF FF)
- Invalid

Over range at negative (-) side:
- LO: –10.8 V (3.36 mA)
- HI: –1048576 (0x1000 00)
- Invalid

### Comparator Standby

| Comparator standby | All OFF | All ON |

### During RESET Processing

- Dark/Bright: Enters the alarm state.
- Measurement mode: Measurement value display, Received light waveform display, Statistics operation, Data storage operation.
* ON/OFF indicates the ON/OFF status of the NPN or PNP open-collector output.
* Valid/Invalid indicates the validity/invalidity of input.
* HOLD represents the state in which the normal value immediately before is being held.
* The RESET processing is performed after the mode is changed to the measurement mode, program number is changed, auto-zero processing is completed, and RESET input is accepted.
* USB indicates the communication using the Setup support software "LK-Navigator".
* The setting mode indicates the state where setting is performed by key operations on the display panel.
* The communication mode indicates the status where setting is performed via RS-232C or USB communication. RS-232C and USB cannot be used at the same time.
* Moving to the communication mode and returning to the measurement mode are performed automatically on the Setup support software "LK-Navigator".
* Using RS-232C and USB at the same time in the measurement mode lowers the response speed.

<table>
<thead>
<tr>
<th>Setting mode</th>
<th>Setting item</th>
<th>Depending on setting</th>
<th>HOLD</th>
<th>Valid/Invalid</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication mode</td>
<td>RSS-232C communication</td>
<td>All OFF</td>
<td>Error</td>
<td>–10.8V (3.36 mA)</td>
<td>OFF 0 (0x000000)</td>
</tr>
<tr>
<td></td>
<td>USB communication</td>
<td>Error</td>
<td>Error</td>
<td>–1048576 (0x100000)</td>
<td>Error</td>
</tr>
</tbody>
</table>

* Display Panel: Output, Input, Measurement value, Comparator analog voltage (analog current), ALARM (N.C.), Comparator binary, TIMING, RESET, P1/P2/P3, ZERO, Setting data transmission.
Specifications of the LK-G Series

Response Delay Time

■ Measurement response time
This is the period of time until the unit recognizes the change in the target and outputs the signal. This is calculated by the following formula.

• Measurement response time = measurement average time + refresh rate + internal processing time (T6 x 4)

■ Power ON reset time
This is the period of time until measurement starts after turning on the power.

• Power ON reset time = approx. 5 sec.

Outside Dimensions

Unit (mm)

Controller
LK-G3001V/LK-G3001PV

4-M4 screw, depth: 6

62 117 (65)

33 70

43

9.5

124
<table>
<thead>
<tr>
<th>Specification</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specifications of the LK-G Series</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LK-G3001/ LK-G3001P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panel cutout</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIN rail mounting portion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M4 screw, depth: 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panel attachment ring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panel thickness</td>
<td>80 91</td>
<td>46 62</td>
</tr>
<tr>
<td>8.5 74.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5 to 5mm</td>
<td>25 100</td>
<td>75 175</td>
</tr>
<tr>
<td>45 +0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 +0.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Specifications of the LK-G Series

#### Head
- LK-G15/LK-G10
- LK-G15H/LK-G10H
- LK-G35/LK-G35H/LK-G30/LK-G30H
- LK-G37/LK-G37H/LK-G32/LK-G32H

<table>
<thead>
<tr>
<th>Reference level</th>
<th>9 to 11</th>
<th>11.5 to 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø 7</td>
<td>22.8</td>
<td>25 to 35</td>
</tr>
<tr>
<td>ø 12.6</td>
<td>71.7</td>
<td>25 to 35</td>
</tr>
<tr>
<td>2-ø4.4</td>
<td>71</td>
<td>25 to 35</td>
</tr>
</tbody>
</table>

#### Installation

<table>
<thead>
<tr>
<th>Ø 7</th>
<th>Ø 12.6</th>
<th>43</th>
<th>500</th>
<th>2825</th>
<th>776</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>9 to 11</td>
<td>9</td>
<td>22.8</td>
<td>71.7</td>
<td>22.2</td>
</tr>
<tr>
<td>13</td>
<td>11.5</td>
<td>19</td>
<td>0.8</td>
<td>71</td>
<td>22.2</td>
</tr>
</tbody>
</table>

#### Diffuse reflection setup

- Specular

#### Specular reflection setup
Specifications of the LK-G Series

• LK-G85/LK-G80/LK-G87/LK-G82

<table>
<thead>
<tr>
<th>Installation hole</th>
<th>2-ø4.5</th>
<th>100.4</th>
<th>25.5</th>
<th>14.5</th>
<th>90.6</th>
<th>65.4</th>
<th>9.3</th>
<th>1813.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diffuse reflection setup</td>
<td>25°</td>
<td>76</td>
<td>67</td>
<td>0.6</td>
<td>25</td>
<td>95</td>
<td>4</td>
<td>ø12.6</td>
</tr>
<tr>
<td>Specular reflection setup</td>
<td>61.2 to 89.2</td>
<td>65 to 95</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Specifications of the LK-G Series

• LK-G155/LK-G150
• LK-G155H/LK-G150H

At reference distance

<table>
<thead>
<tr>
<th>Model</th>
<th>Diffuse reflection setup</th>
<th>Specular reflection setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>LK-G155</td>
<td>17° 10.1 mm 86.6°</td>
<td>17° 10.1 mm 86.6°</td>
</tr>
<tr>
<td>LK-G150</td>
<td>17° 10.1 mm 86.6°</td>
<td>17° 10.1 mm 86.6°</td>
</tr>
<tr>
<td>LK-G155H</td>
<td>17° 10.1 mm 86.6°</td>
<td>17° 10.1 mm 86.6°</td>
</tr>
<tr>
<td>LK-G150H</td>
<td>17° 10.1 mm 86.6°</td>
<td>17° 10.1 mm 86.6°</td>
</tr>
</tbody>
</table>

Installation hole 2-Ø4.4 mm
Specifications of the LK-G Series

- LK-G405/LK-G400/LK-G407/LK-G402

<table>
<thead>
<tr>
<th>Model</th>
<th>Beam Angle</th>
<th>Power Consumption</th>
<th>Operating Voltage</th>
<th>Current</th>
<th>Operating Current</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Installation hole
- Diffuse reflection setup
- Specular reflection setup
Specifications of the LK-G Series

• LK-G505/LK-G500/LK-G507/LK-G502

250 to 1000
248.5 to 995.5

Diffuse reflection setup
Specular reflection setup

Installation hole

ø 7
ø 12.6
75.7
91.9
6.8
20.1
111.3
10.2

ø 4.4
0.7

°
10.2
°
### Specifications of the LK-G Series

<table>
<thead>
<tr>
<th>Controller-to-head cable</th>
<th>Cable length (2m, 5m, 10m, 30m)</th>
<th>ø</th>
</tr>
</thead>
<tbody>
<tr>
<td>LK-GC2/LK-GC5/LK-GC10/LK-GC30</td>
<td>26, 33, 43</td>
<td>11.5, 12.6</td>
</tr>
</tbody>
</table>
Specifications of the LK-G Series

Characteristics

- LK-G15/LK-G15H
- LK-G10/LK-G10H
- LK-G35/LK-G37
- LK-G30/LK-G32
- LK-G35H/LK-G37H
- LK-G30H/LK-G32H
- LK-G85/LK-G87
- LK-G80/LK-G82
Specifications of the LK-G Series

- LK-G155/LK-G157
- LK-G150/LK-G152
- LK-G155H/LK-G157H
- LK-G150H/LK-G152H
- LK-G405/LK-G407
- LK-G400/LK-G402
- LK-G505/LK-G507
- LK-G500/LK-G502
Specifications of the LK-G Series

Mutual Interference

No interference occurs if the beam spot of another sensor is out of the shaded area in the figure.

■ LK-G30/LK-G35/LK-G37/LK-G32
■ LK-G30H/LK-G35H/LK-G37H/LK-G32H
■ LK-G85/LK-G80/LK-G87/LK-G82

13mm 3mm
10mm ± 1mm
LK-G35
3mm
25mm 3mm
65mm
95mm
95mm
13.5mm
17mm
21mm
3mm 4mm
18mm
LK-G85
<table>
<thead>
<tr>
<th>Specifications of the LK-G Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>■ LK-G155/LK-G150</td>
</tr>
<tr>
<td>■ LK-G155H/LK-G150H</td>
</tr>
<tr>
<td>■ LK-G405/LK-G400/LK-G407/LK-G402</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LK-G155</th>
<th>27mm</th>
<th>7mm</th>
<th>5mm</th>
<th>5mm</th>
<th>44mm</th>
<th>92mm</th>
<th>192mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>29mm</td>
<td>6mm</td>
<td></td>
<td></td>
<td>41mm</td>
<td>295mm</td>
<td>505mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LK-G400</th>
<th>5mm</th>
<th>5mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Specifications of the LK-G Series

<table>
<thead>
<tr>
<th>Model</th>
<th>Width</th>
<th>Height</th>
<th>Depth</th>
<th>Height (with stand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LK-G505</td>
<td>58mm</td>
<td>9mm</td>
<td>227mm</td>
<td>245mm</td>
</tr>
<tr>
<td>LK-G500</td>
<td>8mm</td>
<td>8mm</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LK-G507</td>
<td>100mm</td>
<td>5mm</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

[Diagram of LK-G Series]
This section describes the possible problems and their solutions for LK-G Series operation.

### Symptom: Nothing is displayed on the monitor display.
- Are the controller and the display panel cable of the display panel properly connected?
- Is the power cable properly connected?
  - Connect the power cable and display panel cable properly. (page 1-6)
- Is the ECO mode turned on? Change the setting as required. (page 3-54)

### Symptom: Error message is displayed.
- Address the problems according to the respective messages displayed on the screen. (A -5)

### Symptom: The measured value is not displayed.
- Is the measurement target placed within the measurement range?
  - Place the measurement target within the measurement range. (page 1-8)
- Is the head setting properly set? Set it up properly. (page 3-3)
- Does the cover glass have dust or dirt on it?
  - Remove the dust and dirt. (page 1-7)
- Does the cover glass have flaw or crack?
  - Replacement of the cover glass is required. Because this replacement requires KEYENCE repair service, contact your nearest Sales Office.
- Is the timing control properly set according to the measurement mode?
  - Set the timing control according to the measurement mode. (page 3-41)
- Does the unit have condensation?
  - Install the unit in the proper operating environment. (page 2)

### Symptom: The laser is not emitted.
- Is the head-to-controller cable properly connected?
- Is the power cable properly connected?
  - Connect the head-to-controller cable and the power cable properly. (page 1-16)
- Are the laser remote interlock input and the LASER OFF inputted properly?
  - Check wiring connections. (page 5)
Displayed measurement values fluctuate. Is the number of times for averaging properly set? Set the number of times for averaging properly. (page 3-22)

Does the cover glass have dust or dirt on it? Remove the dust and dirt. (page 1-7)

Does the cover glass have flaw or crack? Replacement of the cover glass is required. Because this replacement requires KEYENCE repair service, contact your nearest Sales Office.

Does the ambient operation conditions have splash of water or oil? Remove the splash by air purging or the like.

Is there another LK-G sensor head nearby creating mutual interference? Use the mutual interference prevention function or the LASER OFF function. (page 3-40)

Change the mounting position of the sensor head. Is there strong extraneous light? Shield the extraneous light.

Does the measurement target or the sensor head vibrate? Take appropriate countermeasures such as isolating the sensor from the vibration. Is the head setting properly set? Check head settings. (page 3-3)

Displayed measurement values deviate. Is the measurement target slanted or displaced? Place the measurement target within the measurement range. (page 1-8)

Is the proper calibration value set? Perform the calibration setting again. (page 3-20)

Does the ambient operating temperature significantly change? Keep the ambient operating temperature constant. (page 2)

Cannot change the program No. Is the program selection properly set? Set the program selection according to the program change method. (page 3-50)

Is keylock set to ON? Set the keylock to OFF. (page 3-53)

Is the setting mode or the communication mode turned on? Change the program setting mode to the measurement mode.

Comparator output cannot be outputted properly. Is the unit properly wired? Check the output circuit and wiring, and connect properly. Is the tolerance properly set? Perform the tolerance setting again. (page 2-3)

Is the comparator output form properly set? Set it up properly. (page 3-42)
Analog output cannot be outputted properly. Is the unit properly wired? Check the wiring and connect properly. Does the voltage exceed +10.8V or lower -10.8V? Set the analog scaling properly according to the measurement value.

Is an oscilloscope or a high-speed A/D board used? The resolution may decrease if these devices are used. Change the analog scaling so that the effect should be minimized.

Binary output cannot be outputted properly. Is the unit properly wired? Check the output circuit and wiring, and connect properly. Is the logic properly set? Negative logic is used in output. Is the import timing properly set? Use strobe output to enable importing in a proper timing.

Is the OUT1/OUT2 SEL input inputted properly? Input it correctly.

Cannot communicate via the RS-232C. Is the communication cable properly connected? Connect the communication cable properly.

Does the type of the communication cable conform to the specifications? Check the connection of the communication cable.

Are the communication specifications properly set? Set the communication specifications of the LK-G Series as those of the external devices.

Is the appropriate communication program used? Check whether the command and the delimiter is properly sent or received.

Is the setting properly set according to the communication method or external devices? Set the auto transmission properly.

The operation key does not work. Is the display panel properly connected? Connect the display panel properly.

Is keylock set to ON? Set the keylock to OFF.
<table>
<thead>
<tr>
<th>Error</th>
<th>Description</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Err-0</td>
<td>Head connection error</td>
<td>Check the head connection.</td>
</tr>
<tr>
<td>Err-1</td>
<td>Head-A error</td>
<td></td>
</tr>
<tr>
<td>Err-2</td>
<td>Head-B error</td>
<td></td>
</tr>
<tr>
<td>Err-3</td>
<td>Head-A/B error</td>
<td></td>
</tr>
<tr>
<td>Err-4</td>
<td>Controller error</td>
<td>Contact your nearest KEYENCE Office.</td>
</tr>
<tr>
<td>Err-5</td>
<td>Display panel error</td>
<td>Check the connection of the display panel cable.</td>
</tr>
<tr>
<td>Err-6</td>
<td>SRAM Sum error</td>
<td>Restore the power or perform initialization.</td>
</tr>
<tr>
<td>Err-7</td>
<td>Numerical value input error</td>
<td>Cancel the error with the [ENT] key and set the specifications again.</td>
</tr>
</tbody>
</table>
# List of Optional Products

These are the optional products supported by the LK-G Series.

<table>
<thead>
<tr>
<th>Name</th>
<th>Model</th>
<th>Appearance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ND filter LK-F1</td>
<td>LK-G3</td>
<td></td>
<td>Used when the mirror surface is measured at a mirror reflection setup.</td>
</tr>
<tr>
<td></td>
<td>LK-G8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LK-F2</td>
<td>LK-G15</td>
<td></td>
<td>Used when the mirror surface is measured at a mirror reflection setup.</td>
</tr>
<tr>
<td></td>
<td>LK-G40</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LK-G50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display panel fixing case</td>
<td></td>
<td></td>
<td>Used when combining the display panel (LK-GD500) and the controller (LK-G3001/LK-G3001P).</td>
</tr>
<tr>
<td>Display panel cable OP-51653</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 cm OP-51654</td>
<td></td>
<td></td>
<td>The connection cable for the display panel (LK-GD500) and the controller (LK-G3001/LK-G3001P).</td>
</tr>
<tr>
<td>3 m OP-51655</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 m OP-51656</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expansion connector cable</td>
<td></td>
<td></td>
<td>(3 m) The cable for the expansion connector (3 m).</td>
</tr>
<tr>
<td>Name</td>
<td>Model</td>
<td>Appearance</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------</td>
<td>------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>RS-232C cable</td>
<td>OP-96368</td>
<td></td>
<td>The communication cable for RS-232C (2.5 m)</td>
</tr>
<tr>
<td>USB cable</td>
<td>OP-35331</td>
<td></td>
<td>The cable for the USB connection (3 m).</td>
</tr>
<tr>
<td>Index</td>
<td>Alpha-numerical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12-pin I/O terminal block............... 1-7, 4-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6-pin I/O terminal block................. 1-7, 4-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ABLE calibration function ....................3-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ABLE function........................................3-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alarm output .........................................4-7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alarm process .......................................3-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analog current output..........................4-11</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analog monitor output ...........................4-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analog voltage output .........................4-11</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analog-through....................................3-36</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASCII code ..........................................5-24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attachment holes for the ND filter ........1-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attaching the ND filter ........................1-15</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Auto offset function...................... 2-6, 3-32</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Auto-zero function ....................... 2-6, 3-32</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Auto-zero input ......................................4-7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average hold .................... 3-25, 3-28, 4-13</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average measurement time ................4-17</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Averaging function ..............................3-22</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Beam stop ................................................6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Binary output ................................. 4-5, 4-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bottom hold ...................... 3-25, 3-28, 4-13</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calculation between heads.................3-19</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CE Marking...............................................3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Change Parameter Command ............5-13</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Characteristics ....................................6-30</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check Parameter Command Format ..5-20</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Combining the separate type controller..............................................1-20</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Command format ..................................5-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Common functions ............................... 3-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Common settings ............................... 1-25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Communication mode .......................... 5-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Communication Specifications............. 5-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Communication specifications of the RS-232C ................................... 3-49</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comparator output ............................... 4-7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comparator standby ............................ 2-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conditions of the measurement value output ................................................. 3-13</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connection ......................................... 1-22</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connecting the terminal block .... 1-23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connecting the power .................. 1-23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connecting the display panel ...... 1-23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connecting the head.................... 1-22</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Copying and Initializing the Program.............................................. 3-51</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Corrective action for noise........................2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Storage Function........................ 3-44</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decimal point position.......................... 1-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diffuse reflection........................ 1-10, 3-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display panel................................. 1-4, 1-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display panel connector ...................... 1-7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dual display.......................................... 2-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eco mode ........................................... 3-54</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environment Setting Screens ............. 3-48</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environment Settings................. 1-25, 3-46</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Error Messages .................................... A-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expansion connector..................... 1-7, 4-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>External synchronization .................... 5-22</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>External Timing Input.......................... 3-41</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Filtering............................................... 3-22</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Function of the high-pass filter ........... 3-23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Function of the Tolerance Settings ....... 2-3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Revision history

<table>
<thead>
<tr>
<th>Date of printing</th>
<th>Version</th>
<th>Revision contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>March, 2006</td>
<td>Official release</td>
<td></td>
</tr>
</tbody>
</table>
Introduction

This Instruction Manual describes the basic operations and hardware functions of the LK-G Series. Read this manual carefully to ensure the optimum performance and full function of the LK-G Series before use. Keep this manual in a safe place for future reference. Be sure that the person who will finally operate this product receives this manual.

Symbols

These symbols alert you to matters concerning the prevention of human injury and product damage.

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

⚠️ WARNING
Failure to follow the instructions may lead to injury.

⚠️ CAUTION
Failure to follow the instructions may lead to product damage or failure of the product.

⚒ Note
Provides additional information on proper operations that can be easily mistaken.

📖 Reference
Provides advanced and useful information for operation.

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High-speed, High-accuracy CCD Laser Displacement Sensor

LK-G Series

User’s Manual

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Read this manual before using the system in order to achieve maximum performance.
Keep this manual in a safe place for future reference.