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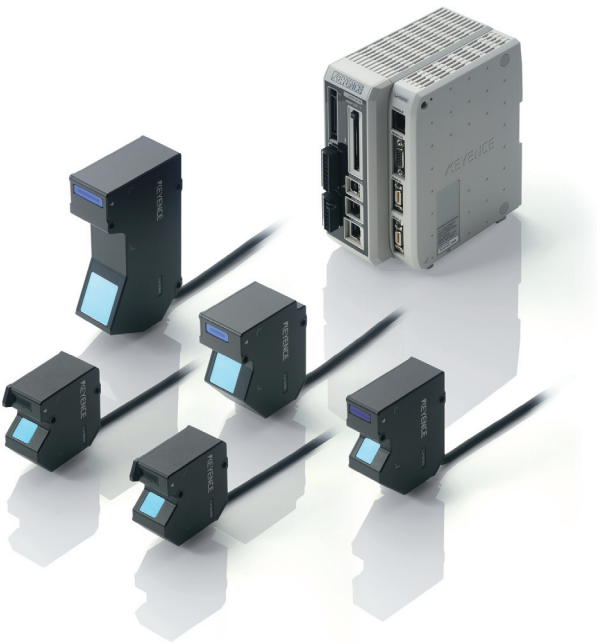
96M12273

High-accuracy 2D Laser Displacement Sensor

LJ-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.



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Introduction

This manual describes the operations and hardware functions of the LJ-G Series.
Read this manual carefully to ensure the optimum performance and full function of the LJ-G Series before use.
Keep this manual in a safe place after reading it so that it can be used at any time.
Ensure that the end user of this product receives this manual.

Symbols

The following symbols are used to alert you to safety precautions and to prevent human injury and/or damage to property when using this product.

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

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

⚠ CAUTION
Failure to follow these instructions may lead to damage to this or other units.

► Note
Indicates things to take note of to ensure the maximum use of this device, as well as operations that may easily be done improperly.

Reference
Provides advanced and useful information for operation.

This manual covers version 1.5. Please check the version of your controller or LJ-H1W (LJ-Navigator) before use. For detail on each version, see "Precautions about Specification".

"Precautions about Specifications" (Page 10)

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Safety Precautions

General Cautions

- At startup and during operation, be sure to monitor the functions and performance of the LJ-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 LJ-G Series or use it in any way other than as described in the specifications. If the LJ-G Series is modified or used other than as described, the warranty will be voided.
- When the LJ-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 this product for the purpose to protect a human body or part of a human body.
- This product is not intended for use as an explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.
- Do not allow the temperature to change sharply around the LJ-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 open or modify the unit. Doing so may cause fire or electric shock.

Handling abnormalities

Turn the power off 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 or chemicals, or debris enters the unit.
- If the unit is dropped or the case is damaged.
- If abnormal smoke or odor is present.

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⚠ 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. Failure to do so could result in damage.
- Do not turn off the power while writing to the memory during operations such as setting items. Part or all of the set data may be lost. Refer to "Memory Structure" for details.

  "Memory Structure" (Page 11-10)
- Do not block the vent holes on the unit. Increase of internal temperature could cause failure.
- The USB connector and other I/O circuits are internal common with the 24 V DC (-) power supply terminal. Take care that a potential difference does not occur between the internal common terminals due to a positive grounding environment or a potential difference between the equipment. Otherwise, it may cause a malfunction in the LJ-G Series or a malfunction in the connected computer or other external device.

  "Isolation between I/O circuits" (Page 8-12)
- We recommend backing up the settings on the memory card or LJ-Navigator in case there are problems with the device.

Installation environment

To use the LJ-G Series correctly and safely, avoid installing it in the following locations. Doing so may cause damage.

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

Corrective action for noise

Do not install the LJ-G Series near a power source or high-voltage cable, otherwise noise may cause the LJ-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 head. Use a single core shielded cable for the analog output cable.

Setting memory

This device comes equipped with FLASH memory for saving settings. This memory has an expected lifetime of one hundred thousand writes. If the auto-zero or program No. switching functions are changed over the communication link regularly, use the save off function and use the R1 command to measure and send results without saving settings.

"Auto-zero" (Page 3-15)
"Switching Program Nos." (Page 3-17)
"Settings save operations for flash memory (Save)" (Page 6-5)
"Outputting Measurements and Changing Settings via Commands" (Page 9-5)
"Memory Structure" (Page 11-10)

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▶ Note

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.

Warming up

Wait approximately 30 minutes after the power is turned on before using the LJ-G Series. Otherwise, the measured value may gradually fluctuate because the circuit is not immediately stable after the power is turned on.

Operating ambient light intensity level

Do not operate this device near lighting fixtures. If the unit must be used in such a location, install a light shielding board or similar device so that the light will not affect the measurement.

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.

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 could change the color or shape of the unit. If the unit has a large amount of dirt on it, wipe it off with a cloth moistened with a mild detergent, then wipe with a soft dry cloth.

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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 area with an appropriate enclosure.
- Agitate the air between the measurement point and the workpiece more strongly with a fan.

Precautions on CE Marking

This device complies with the essential requirements of EMC Directives. Users must fulfill the following conditions when the LJ-G Series is going to be used in EU member states. The applicable standards (EMC Directive) are explained as follows:
EN61326-1, Class A

- All cables used for power, communication or other functions should be kept with a length of 30 m or less.
- For USB cables connected to the controller port, wind the cable around the following ferrite core twice at the position 200 mm or less from the connector.
  Model: ZCAT2035-0930 (Product of TDK)

Safety Precautions on Laser Products

The LJ-G Series is classified in the following terms of laser class:

Model		LJ-G015/LJ-G015K/LJ-G030/LJ-G080//LJ-G200
Wavelength		655 nm
FDA (CDRH)	Output	0.95 mW
Part 1040.10	Laser class	Class II Laser Product
IEC60825-1	Output	0.95 mW
	Laser class	Class 2 Laser Product

⚠ WARNING

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

Cautions for Class II/2 devices

Follow the instructions mentioned in this manual. Otherwise, injury to the human body (eyes and skin) may result.
Precautions on class II/2 laser products

- Do not stare into the beam.
- Do not direct the beam at other people or into areas where other people unconnected with the laser work might be present.
- Be careful of the path of the laser beam.
  If there is a danger that the operator may be exposed to the laser beam reflected by specular or diffuse reflection, block the beam by installing an enclosure with the appropriate reflectance.
- Install the products so that the path of the laser beam is not as the same height as that of human eye.
- Do not disassemble this product.
  Laser emission from this product is not automatically stopped when it is disassembled.

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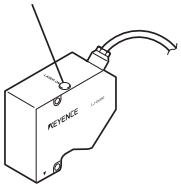
The LJ-G Series is equipped with the following items at the laser safety point of view.

Laser radiation emission indicator

Lights or flashes while the LJ-G Series device is in operation.

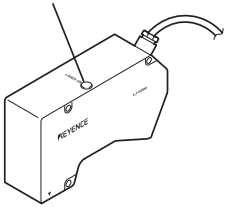
LJ-G015(K)/LJ-G030/LJ-G080

Laser radiation emission indicator



LJ-G200

Laser radiation emission indicator



Laser remote interlock terminal

The laser emission stops upon opening the circuit between the REMOTE terminal and the COM_IN1 terminal.

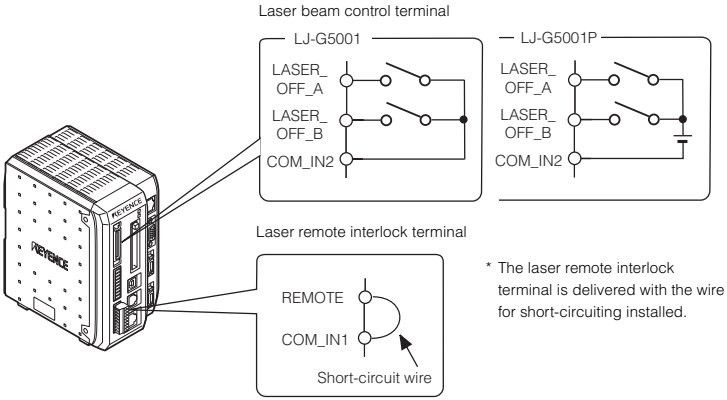
"Input Terminal Block" (Page 8-2)

Laser beam control terminal

The laser will be turned off during the following operations.

- LJ-G5001 (NPN): Short-circuiting the connection between the LASER_OFF terminal and the COM_IN2 terminal
- LJ-G5001P (PNP): By applying a positive voltage (24VDC) to the LASER_OFF terminal and a negative voltage (0VDC) to the COM_IN2 terminal

"Expansion Connector" (Page 8-4)



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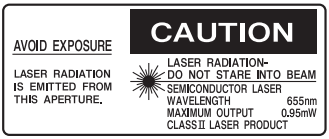
Warning labels

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) labels are supplied with the unit. Attach the other label(s) to the appropriate locations for the destinations of the product.

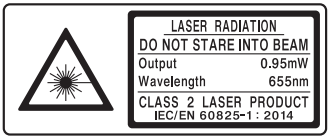
Warning label display content

LJ-G015/LJ-G015K/LJ-G030/LJ-G080/LJ-G200

FDA (CDRH)



IEC (English)



DIN (German)



CEI (French)



CEI (Italian)



JIS (Japanese)



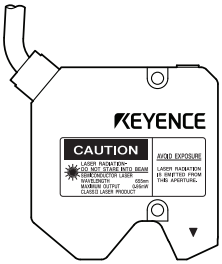
GB (Simplified Chinese)

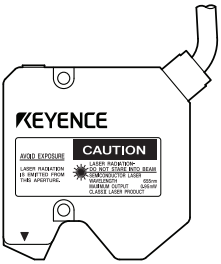


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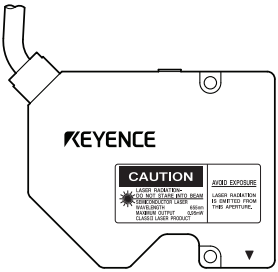
Warning label attachment positions

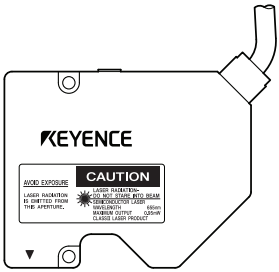
LJ-G015/LJ-G015K



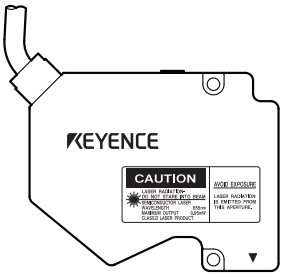


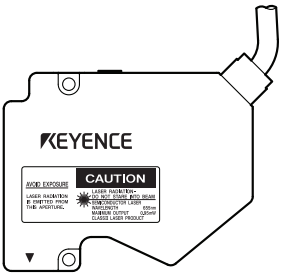
LJ-G030



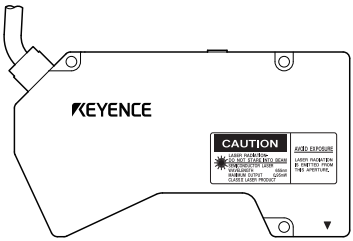


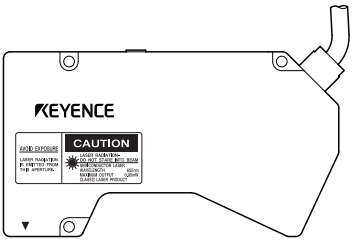
LJ-G080





LJ-G200





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Precautions about Specifications

The High-accuracy 2D Laser Displacement Sensor LJ-G Series includes the following changes to the specifications. Please note the changes to the information in this manual, as well as the changes to the versions and specifications of the controller (LJ-G5001/LJ-G5001P) and the setup support software (LJ-H1W (LJ-Navigator)).

Checking the version number

Controller: Check the serial number noted on the left side of the controller. (The version number cannot be checked on the controller screen.)

Setup support software: Check the version number that is written on the face of the CD-ROM.

Version	Controller serial number	Description
1.0	• Number does NOT start with "#" Ex: 12345678 • Number starts with "#", and the second character is NOT "F", "G", or "H". Ex: #12345678	The initial release version. Please note that there are slight differences from the information noted in this manual. The corresponding version of LJ-H1W (LJ-Navigator) is "1.0x" (where "x" represents any number). For more details, contact your nearest KEYENCE office (listed at the end of the manual).
1.1	First two characters are "#F" Ex: #F12345678	The version covered by this manual. The corresponding version of LJ-H1W (LJ-Navigator) is "1.1x" (where "x" represents any number). **Differences from Version 1.0** **Specification changes** Evaluation/binary selection output (BIN_SEL) terminal has been added and corresponding changes have been made to the number of bits for binary output and the terminal wiring for the OUT number outputs. **Added functions** • Added the "Save the image of the measurement screen" function The measurement screen can be saved to the memory card as an image file. • Added the "ANG correction" function When measuring warpage or a height difference, this function corrects the target so that a reference surface becomes level for measurement.

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1.5	First two characters are "#G" or "#H" Ex: #G12345678	The version covered in this manual. The corresponding version of LJ-H1W (LJ-Navigator) is "1.5x" (where "x" represents any number). **Difference from version 1.1** **Added functions** • Added the "ASAP trigger" function This function enables more stable measurement for the target that has high reflectivity or great color change in the X-axis direction of the profile. • Added the "Inflexion point measurement" function This function enables measurement of the height and position of the flexion point of a straight line. • Added a measurement item to the "Angle measurement" function The function that measures the angle between the X-axes of the target and the head has been added.

Compatibility

The compatibility of the controller and LJ-H1W (LJ-Navigator) is as follows:

		Version of LJ-H1W (LJ-Navigator)		
		1.0	1.1	1.5
Version of the controller	1.0	○	○*1	○*1
	1.1	×	○	○*1
	1.5	×	×*2	○

*1 Program setting files saved with LJ-H1W (LJ-Navigator) will be saved as the file format of the version of LJ-H1W (LJ-Navigator). Added function cannot be used.
*2 Available when none of the added functions of version 1.5 is used.

The compatibility of a program setting file (extension: cfg) is as follows:

		Version of the controller to read the file		
		1.0	1.1	1.5
Version of the controller or LJ-H1W that saved the file	1.0	○	×*1	×*2
	1.1	×	○	×*2
	1.5	×	×*3	○

*1 It can be used by reading on version 1.1x of LJ-H1W (LJ-Navigator) and saving as Version 1.1 files.
*2 It can be used by reading on version 1.5x of LJ-H1W (LJ-Navigator) and saving as Version 1.5 files.
*3 Available when none of the added functions of version 1.5 is used.

"Content that can be Saved and Read" (Page 7-4)

For more details, contact your nearest KEYENCE office (listed at the end of the manual).

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Table of contents

Introduction 2
Safety Precautions 3
General Cautions 3
WARNING 3
CAUTION 4
Note 5
Precautions on CE Marking 6
Safety Precautions on Laser Products 6
Precautions about Specifications 10
Table of contents 12

Chapter 1 Before Use

System Configuration 1-1
Checking the Package Contents 1-2
LJ-G5001/LJ-G5001P 1-2
LJ-G015/LJ-015K/LJ-G030/LJ-G080/LJ-G200 1-2
LJ-GC2/LJ-GC5/LJ-GC10/LJ-GC20/LJ-GC30 1-2
Part Names and Functions 1-3
Controller 1-3
Remote Control Console 1-4
Sensor Head 1-6
Installation and Connection 1-10
Installing the Head 1-10
Mounting the Controller 1-12
Connecting 1-14
Using the Terminal Block 1-17

Chapter 2 Overview and Basic Operations

Outline of the Screen and Operations 2-1
Operational Setting Flow 2-2
Basic Operations for Settings 2-3
Cursor 2-3
Using the [ENTER] Key 2-3
Selecting an Item 2-4
Selecting from a Pull-down Menu 2-4
Entering a Value 2-5
Entering Characters 2-5
Drawing an Area with the Cursor 2-6
Drawing an Area by Entering Values 2-7
Returning the LJ-G Series to the Factory Default Settings 2-9

Chapter 3 Operations and Functions during Measurement

Measurement Screen 3-2
Description of the Measurement Screen 3-2
Operating the Measurement Screen 3-4
Value Display Screen 3-6
Profile Display Screen 3-7
Saving the Image of the Measurement Screen 3-8
Display Setting Menu 3-9
Viewing the Display Setting Menu 3-9
Operations and Functions of the Display Setting Menu 3-9
Hold Function 3-14
Trigger Function 3-14
Auto-zero 3-15
Auto-offset 3-16
Switching Program Nos. 3-17
Keylock 3-18
Storage 3-19
Data Storage 3-19
Profile Storage 3-21

Chapter 4 Program Function

Saving and Loading the Measurement Conditions 4-1

Chapter 5 Setting Measurement Conditions

Making Measurement Condition Settings 5-1
Measurement Conditions and Measurement Data Flow 5-2
Setting the Measurement Conditions to Meet Your Needs 5-3
Default Values and Setting Ranges for Setting Items 5-4
Function Limits and Selecting Setting Items 5-10
Head Settings 5-11
Displaying the Head Settings Screen 5-11
Trigger Settings 5-11
Trigger Mode 5-12
Mutual Interference Prevention 5-13
Trigger Synchronization 5-14

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Multiple Trigger 5-15
ASAP trigger 5-16
Head A / Head B Settings 5-18
Measurement Range 5-19
MFL 5-21
Mask Setting 5-26
Profile Alarm 5-28
Tilt Correction 5-30
Height Correction 5-32
Profile Settings 5-34
Displaying the Profile Settings Screen 5-34
Calculations 5-35
Head Delay Count 5-41
Stabilizing Profiles 5-42
Profile Correction 5-44
Master Registration 5-48
Registering a Master 5-48
Position Adjustment 5-50
Overview of Position Adjustment 5-50
Types of Position Correction 5-51
Displaying the Position Adjustment Settings Screen 5-51
Profile Correction 5-52
Edge Correction 5-54
Overview of Edge Adjustment 5-54
X Correction 5-57
Z Correction 5-59
X-Z Correction 5-60
Z-X Correction 5-60
ANG Correction 5-61
Overview of ANG Correction 5-61
ANG Correction 5-62
X ANG correction 5-64
ANG X correction 5-64
OUT Settings 5-65
Overview of OUT Settings 5-65
Displaying the OUT Settings Screen 5-65
OUT Name 5-66
Overview of Measurement Modes 5-67
Measurement Mode (Setting measurement conditions) 5-67
Setting the Measurement Area 5-71
Displaying the Measurement Mode Settings Screen 5-82
No Measurement 5-82
Height 5-83
Position 5-84
Step 5-85
Width 5-86
Center Position 5-88
Cross-Sectional Area 5-89
Intersection 5-91
Angle 5-92
Profile Comparison 1 5-94
Profile Comparison 2 5-95
Profile Tracking 1 5-96
Profile Tracking 2 5-98
Calculations 5-99
Average 5-101
Measurement Alarm 5-102
Comparative Measurement Mode 5-103
Offset 5-105
Minimum Display Unit 5-106
Scaling 5-107
Tolerance 5-109
Copying Settings 5-110
Common Settings 5-111
Overview of Common Settings 5-111
Displaying the Common Settings Screen 5-111
TIMING Terminal 5-112
ZERO Terminal 5-113
Binary Output 5-114
Analog Output 5-114
Storage 5-118
Automatic Transmission 5-120
Data Output Timing 5-121

Chapter 6 Environment Settings

Basic General Device Settings 6-1
Changing Environment Settings 6-2
Environment Settings Items 6-3

Chapter 7 Saving to / Reading from a Memory Card

Overview of Saving and Reading 7-1
Displaying the Memory Card Screen 7-2
Inserting or Removing a Memory Card 7-3
Inserting a Memory Card 7-3
Removing a Memory Card 7-3
Saving and Reading 7-4
Content that can be Saved and Read 7-4
File Format 7-4
Saving to a Memory Card 7-5
Reading from a Memory Card 7-6

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Deleting Files 7-7
Formatting Memory Cards 7-8
Uploading a Program from the Memory Card and Taking Measurements 7-9
Saving Storage Data to the Memory Card from the Input Terminal 7-9

Chapter 8 I/O Terminals

Identifying Names and Functions of the I/O Terminals 8-2
Input Terminal Block 8-2
Output Terminal Block 8-3
Expansion Connector 8-4
I/O Signal Functions 8-6
I/O Circuit and Electrical Specifications 8-10
LJ-G5001 8-10
LJ-G5001P 8-11
LJ-G5001/LJ-G5001P Common 8-12

Chapter 9 RS-232C

Specifications 9-2
Connector Pin Layout 9-2
Communication Specifications 9-2
Connections and Settings 9-3
Connecting to a PC or PLC Link Unit 9-3
Communication Specification Settings 9-3
Outputting Measurements 9-4
Outputting Measurements and Changing Settings via Commands 9-5
Command Types and Reception 9-5
Command Format 9-7
Mode Change Commands 9-9
Overview of Measurement Control Commands 9-10
Measurement Control Command Details 9-11
Overview of Setting Content Change Commands 9-16
Details of Setting Content Change Commands 9-18
Check Parameter Commands 9-30
Outputting Measurement Values in External Synchronization 9-32
Settings 9-32
Output Format 9-33
Output Method 9-33
Reference 9-34
ASCII Code Table 9-34

Chapter 10 Timing Chart and Response Times

Continuous Trigger 10-2
Overview of Continuous Trigger 10-2
Details of Continuous Trigger 10-8
Remote Trigger 10-10
Single Trigger 10-10
Multi (Internal) Trigger 10-13
Input and Output Details 10-15
Evaluation/Binary Output 10-15
Strobe Output 10-16
GO Output (Total Evaluation Output) 10-17
Analog Profile Output 10-17
Laser Control Input 10-19
Memory Card Control Input (S_SAVE Input) 10-20
Measurement Response Time 10-21
Trigger Interval and Measurement Time 10-21
Averaging Response Time 10-24
Multiple Heads Response Time 10-26
Power ON Reset Time 10-26
RS-232C Interface 10-27
Sending & Receiving Commands Response Time 10-27
Automatic Output Response Time 10-28

Chapter 11 Specifications

Specifications 11-2
Controller 11-2
Head-to-Controller Cable 11-3
Measurement Head 11-3
Dimensions 11-4
Status Table 11-8
Memory Structure 11-10
Characteristics 11-11
Spot Diameter 11-11
Mutual Interference 11-12

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Appendix

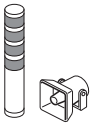
List of Optional Products Appendix-2
Error Messages Appendix-4
Troubleshooting Appendix-9
Index Appendix-13
Revision History

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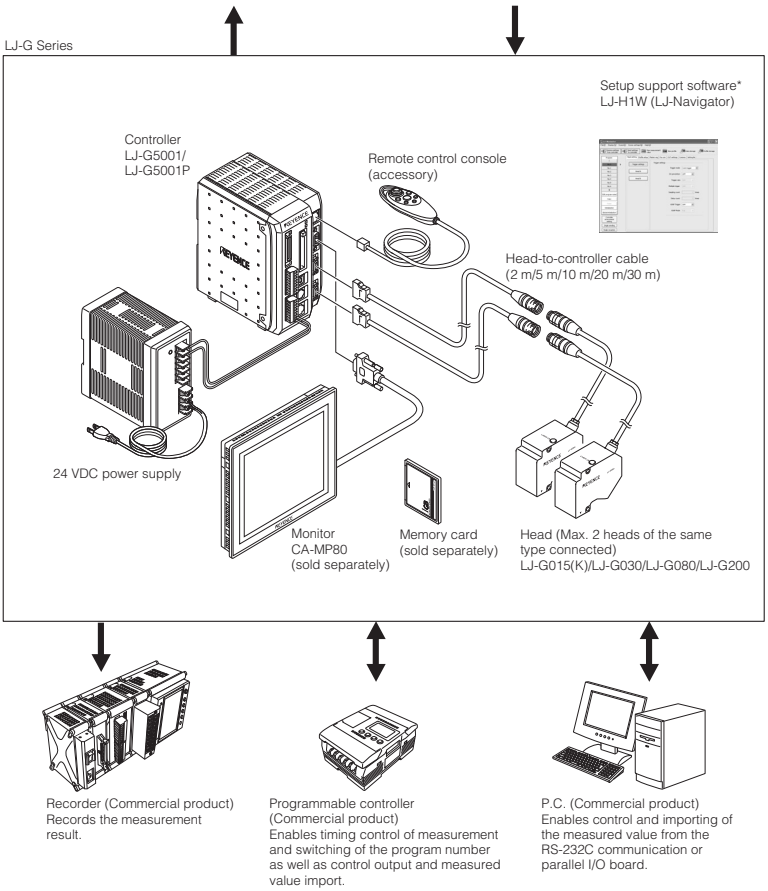
System Configuration



Indicator, light, buzzer, etc. (Commercial product)
Produces an alarm sound depending on the evaluation result output



Photoelectric sensor, proximity sensor, etc. (Commercial product)
Transmits a signal to the timing input when the sensor detects a target.



* For the details of the setup support software "LJ-H1W" (LJ-Navigator), see the "LJ-Navigator User's Manual" (The PDF file is stored in the CD-ROM).

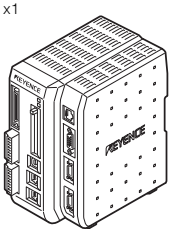
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Checking the Package Contents

The LJ-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. For information about the optional products, see "List of Optional Products" (Page Appendix-2).

LJ-G5001/LJ-G5001P

Controller
LJ-G5001/LJ-G5001P
x1



Remote controle
console x1



User's manual
(this manual)
x1

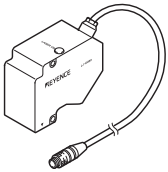
Screwdriver x1



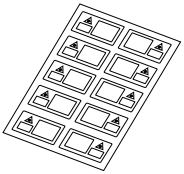
Setup support software
(separate package)
LJ-H1W (LJ-Navigator)
• CD-ROM x1

LJ-G015/LJ-G015K/LJ-G030/LJ-G080/LJ-G200

Head x1



Sheet of warning labels



Hexagon socket bolt
LJ-G015(K) : (M4x40) x2
LJ-G030 : (M4x40) x2
LJ-G080 : (M4x50) x2
LJ-G200 : (M4x45) x3



LJ-GC2/LJ-GC5/LJ-GC10/LJ-GC20/LJ-GC30

Head-to-controller cable
x1



LJ-GC2: 2 m cable
LJ-GC5: 5 m cable
LJ-GC10: 10 m cable
LJ-GC20: 20 m cable
LJ-GC30: 30 m cable

► Note

When using an LJ-GC30, set the cable extension mode in the environmental settings to ON.

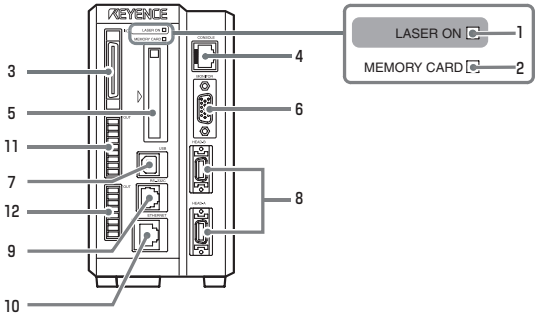
"Setting cable extension mode" (Page 6-4)

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Part Names and Functions

Controller

Terminal panel



	Name	Description	Reference page
1	Laser emission LED	Lights green while the LJ-G Series operates.	-
2	Memory card LED	Indicates the status of the memory card. Green: The card is in the slot or before an ejecting operation. Red: The card is being accessed. Unlit: The card is not in the slot or after an ejecting operation.	7-3
3	Expansion connector	Used for inputting and outputting control signals.	8-4
4	Console connector	Connects the remote control console.	1-16
5	Memory card slot	Memory cards are inserted here.	7-3
6	Analog RGB monitor output connector	The external monitor is connected here. (Analog RGB 15-pin connector)	1-16
7	USB connector	Use a USB cable to connect to the computer when using the LJ-Navigator setup support software. (Type B connector)	-
8	Head connector	Connects the sensor head. There are two connectors, head A (bottom) and head B (top).	1-15
9	RS-232C connector	Connects to the computer or PLC with an RS-232C cable. (Modular 6-pin connector)	9-2
10	Ethernet connector	Use a LAN cable to connect to the computer when using the LJ-Navigator setting and support software.ÅiRJ-11 connector)	-
11	Output terminal block	Used to output control signals.	8-3
12	Input terminal block	Used for control signal input and to connect to the power source (24 VDC).	8-2

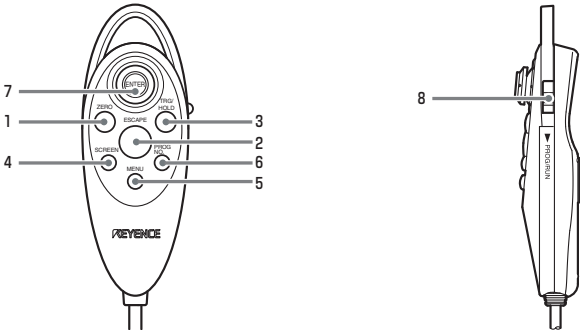
⚠ CAUTION

Each I/O connector or I/O circuit in the terminal block is internal common with the 24 V DC (-) power supply terminal. Take care that a potential difference does not occur between the internal common terminals due to a positive grounding environment or a potential difference between the equipment. Otherwise, it may cause a malfunction in the LJ-G Series or a malfunction in the connected computer or other external device.

"Isolation between I/O circuits" (page 8-12)

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Remote Control Console



	Name	Status	Function
1	[ZERO] key	While measuring	Press the [ZERO] key to use the auto-zero function. Press for three seconds to cancel auto-zero. This command has the same function as the ZERO input terminal. "Auto-zero" (page 3-15)
		While setting	Press while entering a numeric value to change the value to zero. "Entering a Value" (page 2-5)
2	[ESCAPE] key	While measuring	This command has the same function as the RESET input terminal. "Measurement control input/output" (page 8-6)
		While setting	Press the [ESCAPE] key to return to the previous display or operation.
3	[TRG/HOLD] key	While measuring	Holds the measurement value when using the continuous trigger. This command has the same function as the TIMING input terminal. "Hold Function" (page 3-14) Allows trigger input when using an external trigger. This command has the same function as the TRG input terminal. "Trigger Function" (page 3-14)
		While setting	Inputs a trigger via head settings or master registration while making settings.
4	[SCREEN] key	While measuring	Swaps the displayed image or measurement cursor. "Switching the measurement screen" (page 3-5) "Measurement cursor" (page 3-11) Saves the image of the measurement screen. Used together with the [ENTER] key. "Saving the Image of the Measurement Screen" (page 3-8)
		While setting	Press the [SCREEN] key to switch the selection status. "Drawing an Area with the Cursor" (page 2-6)
5	[MENU] key		The display setting menu appears. "Display Setting Menu" (page 3-9)
6	[PROG No.] key		The program No. selection screen appears. "Switching Program Nos." (page 3-17)
7	[ENTER] key		Fix the selected item by pressing the key straight down.
	[△], [▽], [◁], or [▷] key		Select the items by tilting the [ENTER] key up, down, right, or left.

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	Name	Status	Function
8	[Prog/Run] switch		Slide in the direction of the arrow to switch between settings and measurements. Sliding the switch changes modes. "Outline of the Screen and Operations" (page 2-1)

Reference

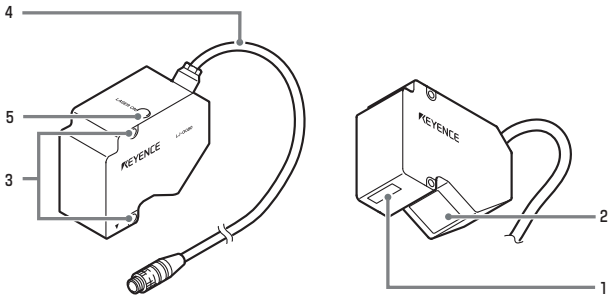
- Key numbers 1 to 6 are engraved on the console keys.
- This is displayed throughout this document as the [TRG] key or the [HOLD] key.
- Refer to the following page for more information on the state during measurement and setting.

"Outline of the Screen and Operations" (page 2-1)

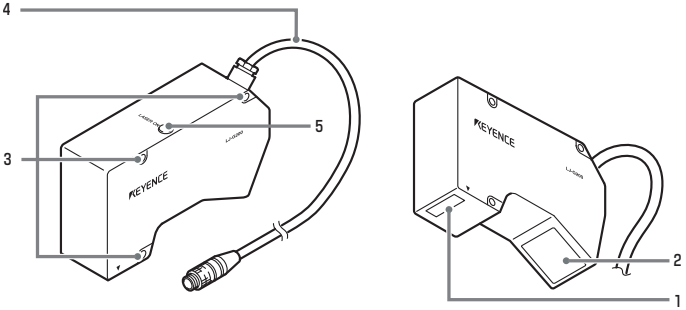
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Sensor Head

LJ-G015(K)/LJ-G030/LJ-G080



LJ-G200



	Name	Function
1	Sensor (transmitter)	Emits the laser beam for measurement. Protected by a glass cover.
2	Sensor (receiver)	Receives the laser beam for measurement. Protected by a glass cover.
3	Installation hole	Use the hexagon socket bolt (included) to affix the head. "Installing the Head" (page 1-10)
4	Connecting cable	Connected to the head-to-controller cable. "Connecting" (page 1-14)
5	Laser radiation emission indicator	Lights or flashes while the LJ-G Series device is in operation. Green: The target is within the allowed range*1. Orange: The target is within the allowed range*1. Orange flashing: ・The target is not within the allowed range. ・An alarm has occurred in the controller. ・The laser has turned off.

*1 "Measurement range" (page 1-7)

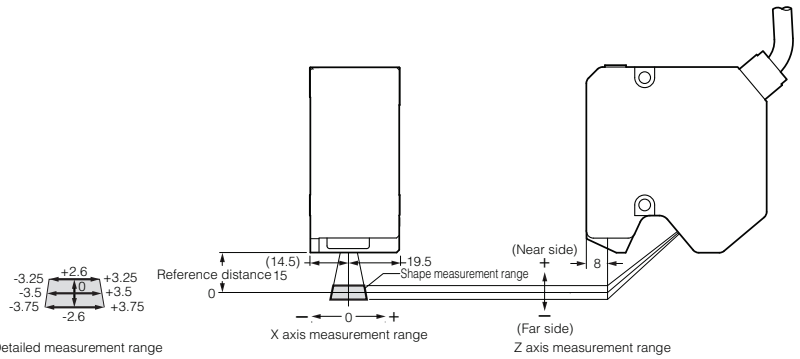
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Measurement range

The measurement range for this device is shown below. The device measures the target within the area defined by the Z and X axis measurement ranges.

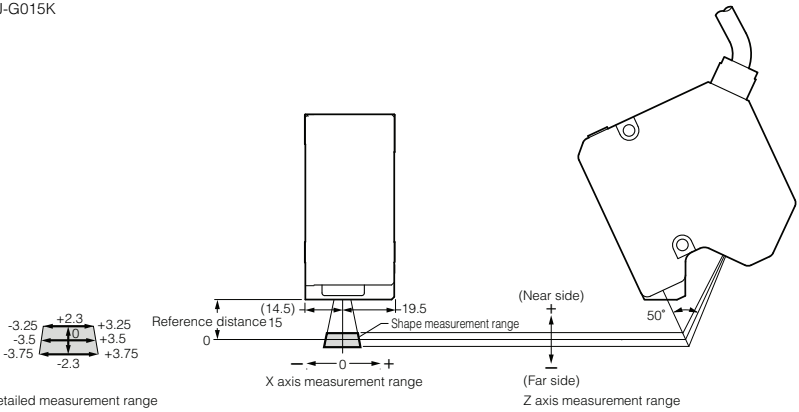
LJ-G015

Unit: mm



LJ-G015K

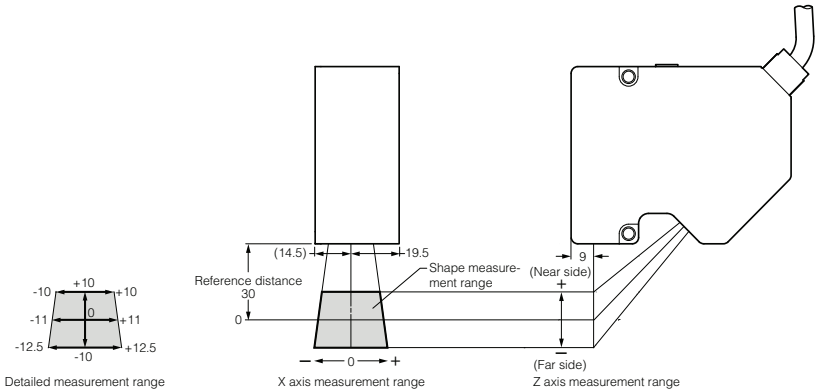
Unit: mm



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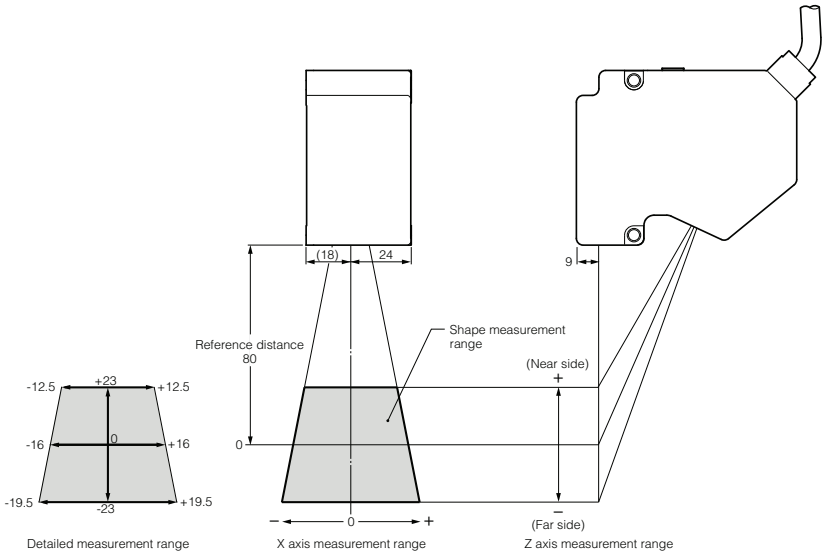
LJ-G030

Unit: mm



LJ-G080

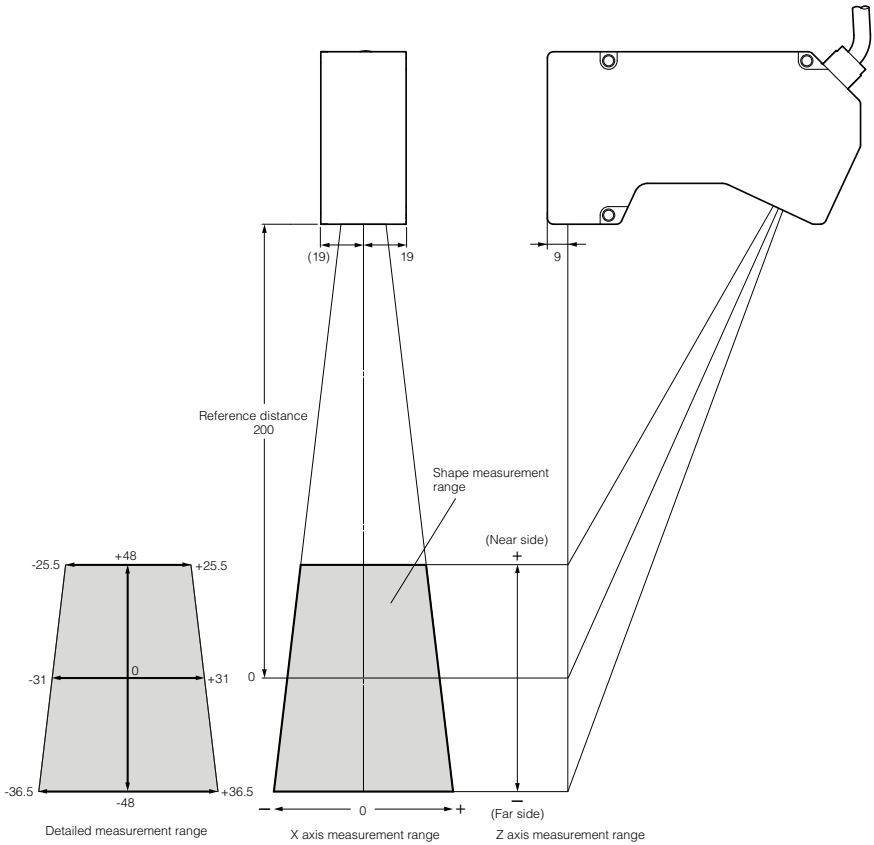
Unit: mm



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LJ-G200

Unit: mm



Laser radiation emission indicator

The light status of the Laser radiation emission indicator is determined by the average height of the valid profile data within the "Indicator light X-axis range".
When the average height is within "Green light Z-axis range", the indicator lights green. When it is within Z-axis range other than that, it lights orange. Any values outside the Z-axis measurement range will cause the light to blink orange.

Model	Indicator light X-axis range	Green light Z-axis range
LJ-G015	Approx. ±0.1 mm	Approx. ±0.13 mm
LJG-015K	Approx. ±0.1 mm	Approx. ±0.12 mm
LJ-G030	Approx. ±0.25 mm	Approx. ±0.5 mm
LJ-G080	Approx. ±0.4 mm	Approx. ±1.15 mm
LJ-G200	Approx. ±0.8 mm	Approx. ±2.4 mm

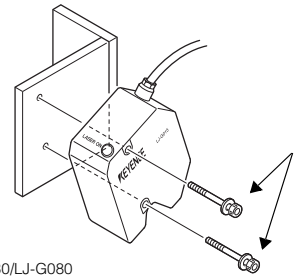
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Installation and Connection

Installing the Head

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

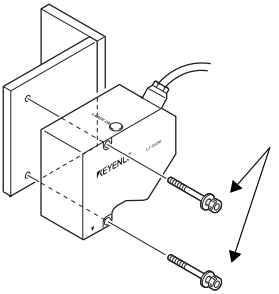
LJG-015K



► Note

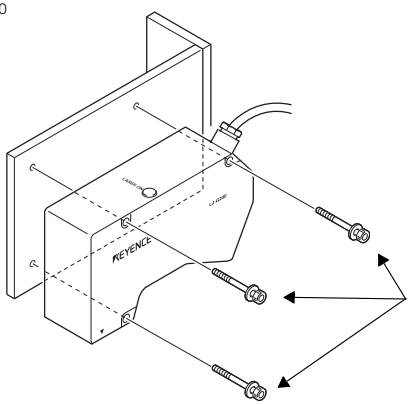
Install the head so that it faces the measuring target in the direction of specular reflection. If the angle is not correct at this time, the linearity in the Z-axis and the X-axis direction is greatly influenced.

LJ-G015/LJ-G030/LJ-G080



(The illustration shows LJ-G080)

LJ-G200

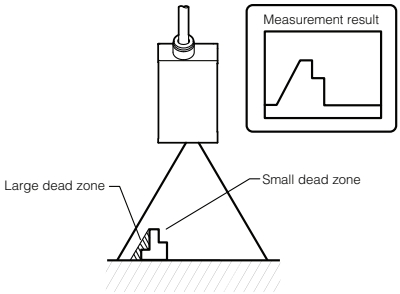


- For information about mounting dimensions, see "Dimensions" (Page 11-5).
- To use two heads, see "Mutual Interference" (Page 11-12), "Mutual Interference Prevention" (Page 5-13).
- There are functions that adjust the angle of the installation.
  - "Tilt Correction" (Page 5-30)
  - "Height Correction" (Page 5-32)

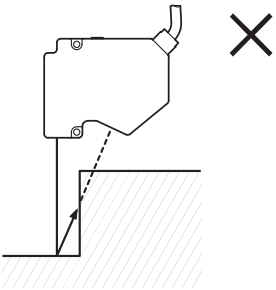
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Installations for specific targets

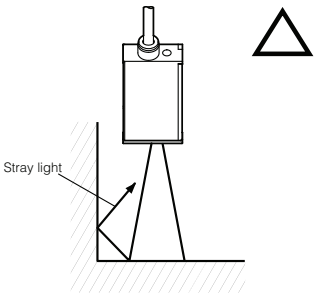
The shapes of some targets may cause dead areas in the measurement range. Make sure that the dead space does not affect the measurement.
The laser light used in this device fans out as it travels to the target. An optical photoreceptor receives the light. Therefore, the dead zone is smallest around the center of the X axis range.

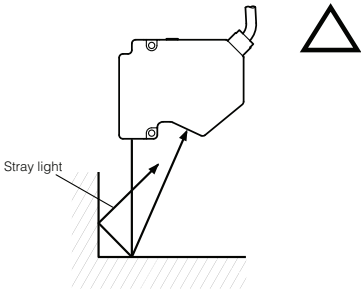


Install the device so that walls or other obstacles do not block the laser light projected to the target or the laser light reflected on the target into the receiver.
"Sensor Head" (Page 1-6)
"Measurement range" (Page 1-7)



Make sure that your measurements are not affected by stray laser light reflected off of walls or other objects.
"Mask Setting" (Page 5-26)





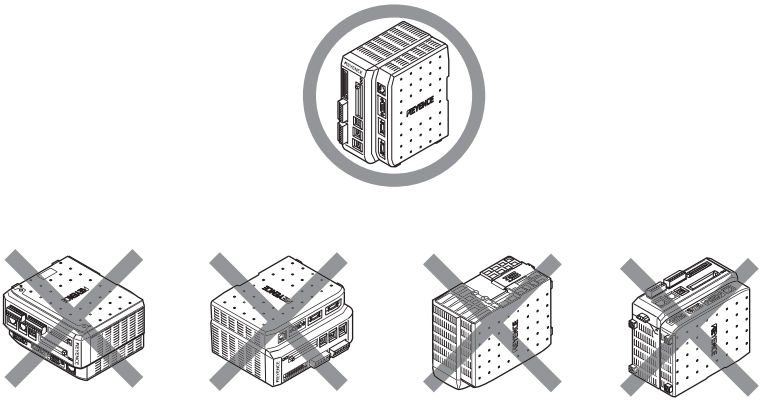
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Mounting the Controller

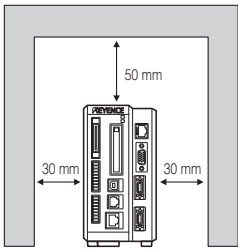
Mount the controller to the DIN rail or secure it on the bottom with screws.

Notes on the mounting direction

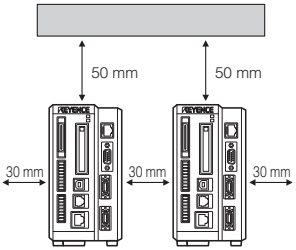
Install the controller in the orientation shown in the following figure with a circle. Do not install in any orientation other than that shown.



For ventilation, secure free space of 50 mm or more above the controller and 30 mm or more for both sides.
In addition, to ensure the safe connection of the cable, secure 90 mm or more of free space in front of the terminal panel of the controller.



When two or more controllers are installed side by side, secure free space of 30 mm or more between controllers, and 50 mm or more on top of both controllers.

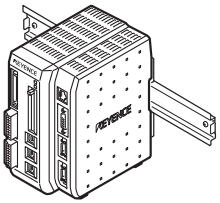


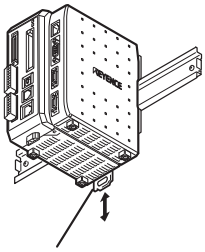
⚠ CAUTION

- Do not cover the ventilating holes on the top and the bottom of the controller. The heat becomes trapped 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 creating more room around the system.

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Mounting on a DIN rail

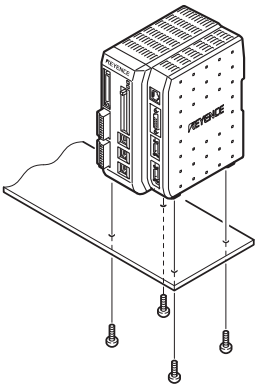




Clip

Pull this clip before installing or removing the device.
Press the clip again to fix the device.

Mounting on the bottom of the controller

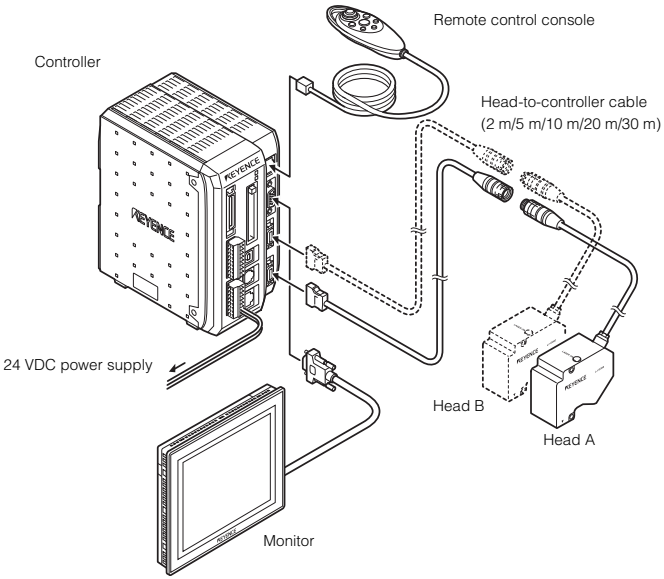


M4 screw x 4 (screw depth 6 mm)

For information about mounting dimensions, see "Dimensions" (Page 11-4).

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Connecting



⚠ CAUTION

- Be sure to turn off the power to the controller before connecting/disconnecting cables. Failure to do so may cause malfunction.
- Ensure that the orientation of the connector is correct. Otherwise a pin could break, which may lead to system breakdown.
- When using an LJ-GC30 (30 m cable), set the cable extension mode (6-4) in the environmental settings to ON.
- Be sure to connect the frame ground pin on the 24 VDC power supply to the Class D earth.

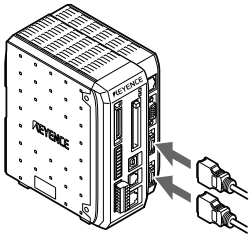
► Note

When mounting two heads, make sure that head A and head B are of the same type. Measurement is not possible if two different types of heads are connected.

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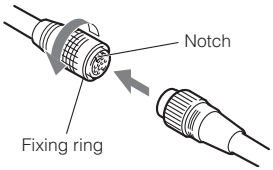
1 **Connect the head-to-controller cable to the controller head connector.**

If connecting only a single head, attach it to the head A connector.
Check that a clicking sound is heard, indicating that the cables are securely fixed.
When removing the cables, pull them out while pressing the buttons on both sides of the connector.



2 **Connect the head to the head-to-controller cable.**

Align the connector, then while turning the fixing ring press on the connector so that it goes deep into the socket but does not break any pins.

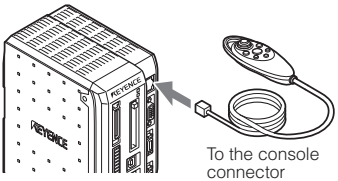


⚠ CAUTION

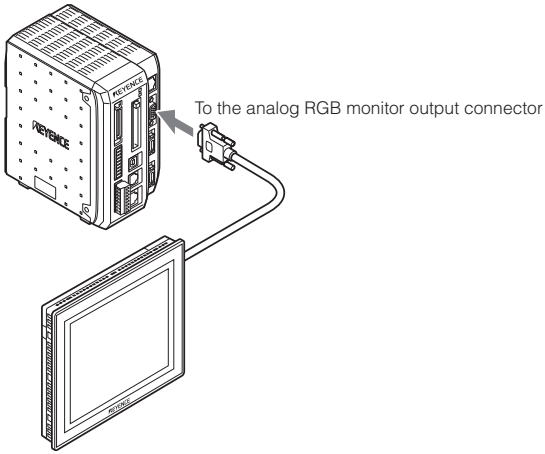
Check the connector orientation before connecting. Otherwise the pin could break, which may lead to system breakdown.

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3 **Connect the remote control console to the console connector of the controller.**



4 **Connect the monitor to the analog RGB monitor output connector of the controller.**



Note

When using RGB analog monitors designed for markets that do not use SVGA size (800 x 600 pixels), the image may be degraded, or displayed improperly depending on the specifications of the monitor. (Recommended monitor: CA-MP81)

5 **Connect the 24 VDC power supply to terminal Nos. 7 and 8 of the input terminal block.**

For details on connection methods to the terminal block, see "Using the Terminal Block" (page 1-17).

Reference

The pins for REMOTE (NO.2) and COM_IN1 (NO.1) on the input terminal block must be short-circuited to turn on the laser.

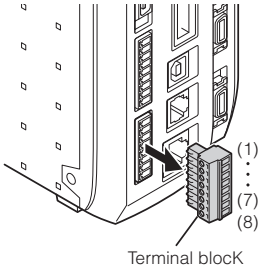
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Using the Terminal Block

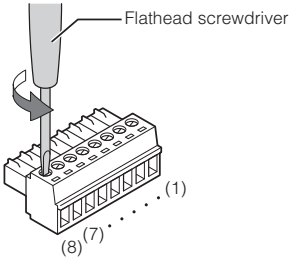
► Note

- Tighten the screws on the terminal block with the flathead screwdriver included in the package.
- Use an AWG16 through AWG28 power cable.

1 Remove the terminal block from the controller unit.



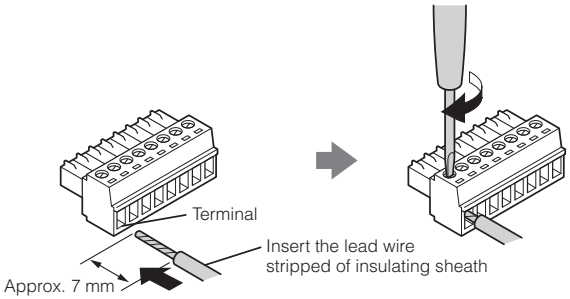
2 Use the included flathead screwdriver to loosen the screws on the terminal block.



3 After stripping the insulating sheath by about 7 mm, insert the lead wires into the terminal, and then tighten the screws.

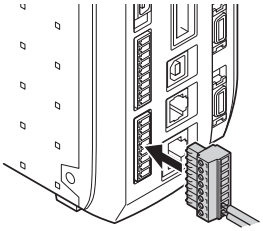
► Note

- Make sure that the uncoated lead does not come in contact with another conductor and cause a short.
- Use a tightening torque of 0.25 N·m or less to tighten the screws.



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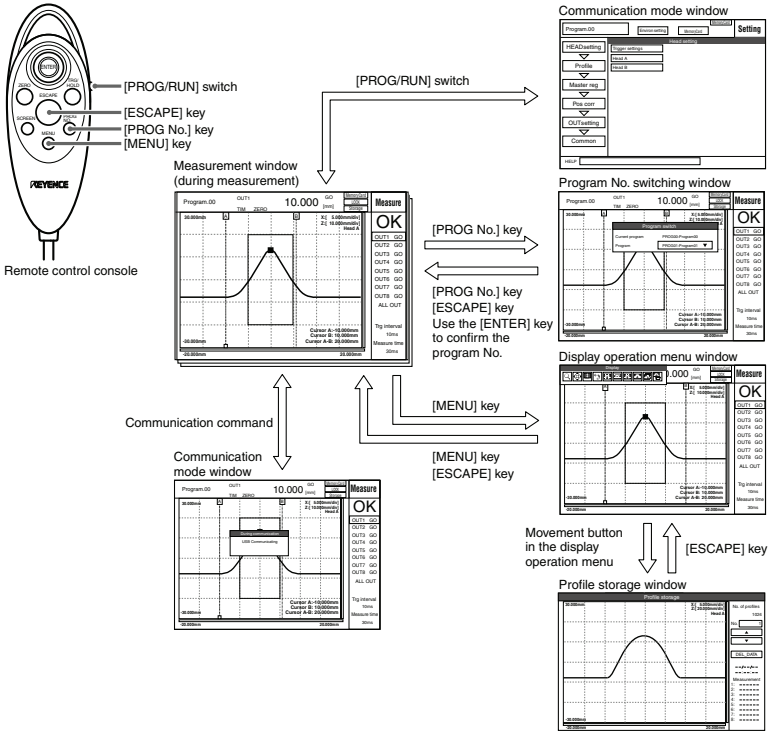
4 **After all of the necessary wires have been connected, press the terminal block firmly back into the controller.**



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Chapter
2
Overview and Basic Operations

Outline of the Screen and Operations



Operation status	Equipment and operation method	Reference page
Measurement window (During measurement)	This is the window displayed during measurement. The profile display and measurement value display windows can be selected. This window is displayed at startup.	3-2
Setting window (During setting)	While in the measurement window, slide the [PROG/RUN] switch downward on the remote control console to display this window. This turns off laser emission and measurement. Set the measurement conditions on this window.	-
Program No. switching window	While in the measurement window, press the [PROG No.] key on the remote control console to display this window. The screen stops refreshing but measurement continues. Up to 16 types measurement conditions can be saved.	3-17
Display setting menu screen	While in the measurement window, press the [MENU] key on the remote control console to display this menu. The screen stops refreshing but measurement continues. The profile window can be enlarged or reduced and the cursor can be displayed.	3-9
Profile storage window	While in the display operation menu, press the key to display this window. The measurement stops. The saved profiles can be verified.	3-21
Communication mode window	Use communication commands from the LJ-Navigator or PLC to display this window. The measurement stops. RS-232C communication mode, USB communication mode, and Ethernet communication mode are available.	9-9

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Operational Setting Flow

Preparation before measurement (Chapter 1)

Set the program functions (Chapter 4)

- O Save up to 16 types of measurement conditions (programs).
- O Naming programs.
- O Copy the settings between programs.

Set the measurement conditions (Chapter 5)

Set the head conditions

"Head settings"
- O Set the trigger conditions.
- O Set the optimal measurement conditions for the measurement target.

Adjust the profile

"Profile setting" "Master registration" "Position correction"
- O Set the calculation method when using two heads.
- O Set the profile for stability.
- O Set the position correction for the measurement target.

Set the measurement items

"OUT setting"
- O Set measurement items such as "measure height" for the acquired profile.
- O Set conditions for averaging, maximum, and other measurements.

Set the input/output conditions

"Common setting"
- O Set the conditions for the input terminal.
- O Set the conditions for the binary or analog output.
- O Set the conditions for saving the profile or measurement result in the internal memory.

Set the Controller Environment Settings (Chapter 6)

- O Set the communication conditions with the external device via RS-232C or Ethernet.
- O Configure settings such as language or strobe settings.

Measure (Chapter 3)

Switch to the measurement window and perform measurement.
- O Change the measurement display window, zoom in or out on the profile window, and display the cursor.
- O Save the measurement result in internal memory.

Output the measurement result (Chapters 7, 8, and 9)

- O Use binary or analog output to output the evaluation results or measurement values through RS-232C.
- O Take measurement results saved in data storage or profile storage and save them in the memory card.

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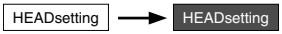
Basic Operations for Settings

Cursor

Move or select the cursor on the LJ-G Series by using the [ENTER] key and the [△], [▽], [◁], and [▷] keys on the remote control console. This section shows examples of the cursor.

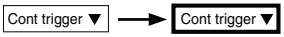
Setting item

Items selected by the cursor appear with reversed font colors and a blue background.



Pull-down menu

When pull-down menus are selected by the cursor, a blue frame is displayed.



Entering values or letters

When boxes for entering values or letters are selected by the cursor, a blue frame is displayed around the area for character entry.



When individual values or letters are selected by the cursor, the font appears with reversed colors and a blue background.



Area cursor

When drawing an area, the display cursor is moved to the drawing area. Use the [SCREEN] key to change the cursor selection.

"Remote Control Console" (Page 1-4)

Example of a rectangle



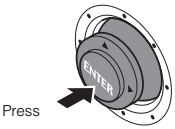
Example of a line



Using the [ENTER] Key

Pressing the key straight down

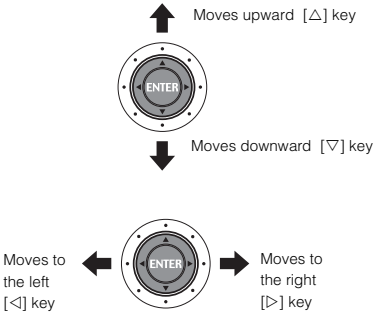
- For selecting a menu item
- For confirming a setting



Tilting the key up, down, right, or left

The key moves up, down, right, and left. This is used to perform the following operations:

- Moving to another item
- Entering a value, such tolerance



Reference

Tilting the [ENTER] key up or down is described as using the [△] or [▽] key in this manual.
Tilting the [ENTER] key right or left is described as using the [◁] or [▷] key.

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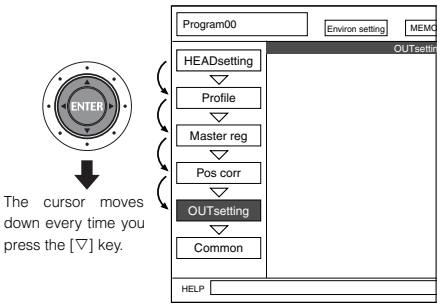
Selecting an Item

Use the following operations on the remote control console to select items or enter settings.

Reference

Using the operations described below to select an item and confirm the setting is described by the phrase "Select (item name)" in this manual.

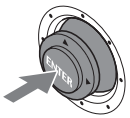
1 Place the cursor on the item you want to set by using the [△], [▽], [◁] or [▷] key.



The cursor moves down every time you press the [▽] key.

2 Press the [ENTER] key.

If there are more detailed selections under the selected item, the cursor moves to the next layer of items in the hierarchy. Another window may open.



3 Repeat the operations until the cursor is placed on the item that you want to set.

4 Press the [ENTER] key.

The item may appear slightly different when selected depending on what type it is.

- Selecting from a pull-down menu
- Entering a value
- Entering a character
- Drawing an area

Reference

To cancel the selection, pressing the [ESCAPE] key cancels the previous selection operation.

Selecting from a Pull-down Menu

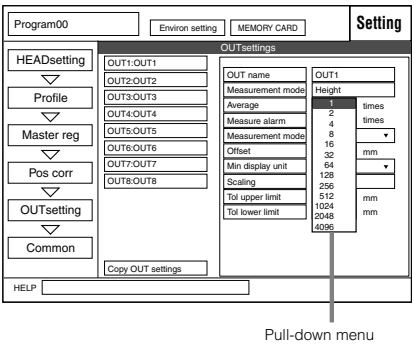
When selecting an item in a pull-down menu, use the following operations on the remote control console.

1 Place the cursor on the item with the pull-down menu by using the [△], [▽], [◁] or [▷] key.

2 Press the [ENTER] key.

The items that can be entered are displayed in the pull-down menu.

In this example, "Average" is selected in "OUT settings".



Pull-down menu

3 Press the [△] or [▽] key to move the cursor to the selection that you want to enter, and press the [ENTER] key.

The selection is fixed.

Reference

To cancel the selection, press the [ESCAPE] key before pressing the [ENTER] key. This cancels the previous selection operation.

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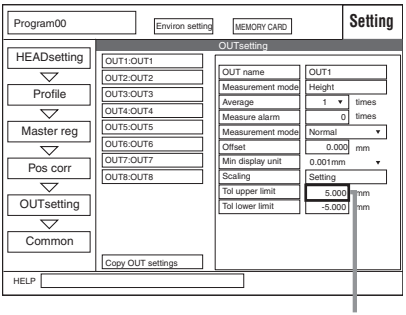
Entering a Value

When entering values for parameters, use the following operations on the remote control console.

1 Place the cursor on the item for which to enter a value by using the [△], [▽], [◁] or [▷] key.

2 Press the [ENTER] key.

The item switches to value input and the cursor moves to the value.
In this example, "Tol upper limit" is selected in "OUT settings".



3 Use the [△], [▽], [◁], or [▷] key to set the value.

The cursor moves left or right when you press the [◁] or [▷] key.
The [△] and [▽] keys change the values.



Reference

Press the [ZERO] key to set the value to 0.

4 Press the [ENTER] key after changing the value.

The specified value is fixed.

Reference

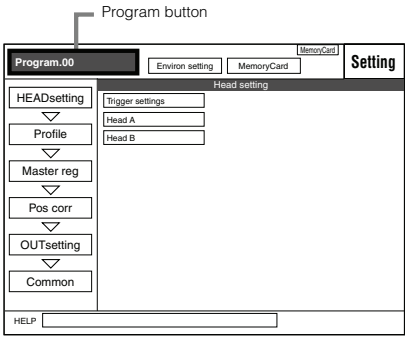
To cancel the changes to the entered value, press the [ESCAPE] key before pressing the [ENTER] key in Step 3 above.

Entering Characters

Characters can be entered for items such as the names of measurement targets. This section describes an example for saving a name in a program No.

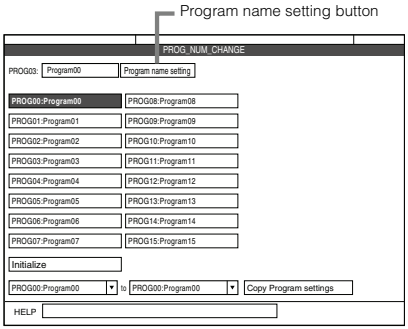
1 Move the cursor to the program button on the upper left corner of the setting window.

The current program name is displayed.



2 Press the [ENTER] key.

The "PROG_NUM_CHANGE" menu is displayed.

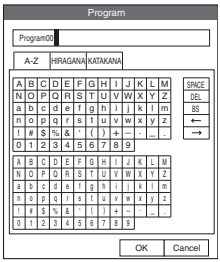


3 Select the program No. for which you want to register a name, and press the [ENTER] key.

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4 **Place the cursor on the "Program name setting" button and press the [ENTER] key.**

The Program window is displayed and the cursor moves to the program name.



As an example, change the name to "TEST1" and save the changes.

5 **Enter "TEST1" one character at a time.**

Use the [△], [▽], [◁], or [▷] keys as mentioned below.

Changing the position of character input

Select "←" or "→" on the right side of the character input screen and press the [ENTER] key to move the input position.

Deleting characters

After moving the position for character input, select "←" or "→" on the right side of the character input screen. Then, select "DEL" (deletes the selected character) or "BS" (deletes the character before the selected character) and press the [ENTER] key.

Reference

The [ZERO] key has the same function as the "BS".

Selecting the character type

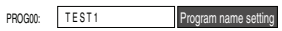
On the top of the screen, select the "A-Z", "HIRAGANA", or "KATAKANA" tabs.

Selecting characters

Place the cursor on the character that you want to enter and press the [ENTER] key. To enter a space, select "SPACE" on the right side of the character input screen and press the [ENTER] key.

6 **To end the input, select "OK" and press the [ENTER] key.**

The name of the program No. becomes "TEST1".

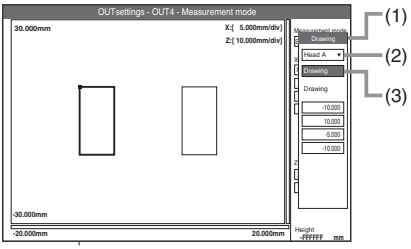


Drawing an Area with the Cursor

When setting measurement mode or correction, you need to draw an area.
This section describes the common setting procedure for drawing a rectangle in the "Height measurement area" set in the "Step" measurement by specifying the coordinates with the cursor.

"Step" (Page 5-85)
"Height measurement area" (Page 5-71)

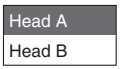
1 **When creating a new setting, the default rectangle area appears on the screen.**



(1) Drawing window
(2) Profile selection button
(3) Drawing button

2 **Use the [△] and [▽] keys to select the "Profile selection" button and press the [ENTER] key.**

The pull-down menu appears.



Note

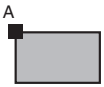
This item cannot be selected if only one head is used.

3 **Use the [△] and [▽] keys to select the profile for the area being drawn and press the [ENTER] key.**

The setting is confirmed.

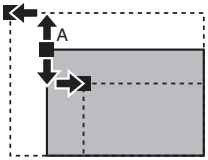
4 **Use the [△] and [▽] keys to select the "Drawing" button and press the [ENTER] key.**

The rectangle area is selected and the cursor is displayed at point A.



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5 **Use the [△], [▽], [◁], and [▷] keys to move the cursor, and then set the position for point A.**

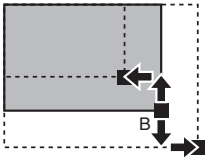


6 **Press the [SCREEN] key.**

The cursor position moves to point B.



7 **Use the [△], [▽], [◁], and [▷] keys to move the cursor, and then set the position for point B.**



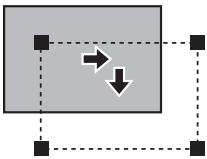
8 **Press the [SCREEN] key.**

Four cursors appear and the entire area is selected.



9 **Use the [△], [▽], [◁], and [▷] keys to move the entire area, and then set the position for the area.**

Press the [SCREEN] key and repeat steps 3 to 5.



10 **To complete drawing, press the [ENTER] key.**

The area cursors disappear and the cursor returns to the "Drawing" button.

11 **Press the [ESCAPE] key to complete the drawing.**

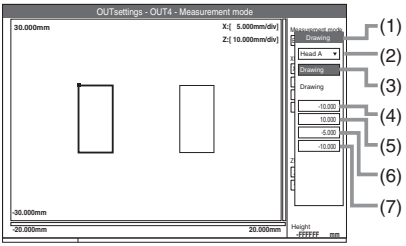
The drawing window closes.

Drawing an Area by Entering Values

When setting measurement mode or correction, you need to draw an area.
This section describes the common setting procedure for drawing a rectangle in the "Height measurement area" set in the "Step" measurement by specifying the coordinates by entering values.

"Step" (Page 5-85)
"Height measurement area" (Page 5-71)

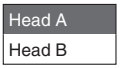
1 **When creating a new setting, the default rectangle area appears on the screen.**



(1) Drawing window
(2) Profile selection button
(3) Drawing button
(4) Point A, X
(5) Point A, Y
(6) Point B, X
(7) Point B, Y

2 **Use the [△] and [▽] keys to select the "Profile selection" button and press the [ENTER] key.**

The pull-down menu appears.



► Note

This item cannot be selected if only one head is used.

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3 **Use the [△] and [▽] keys to select the profile for the area being drawn and press the [ENTER] key.**

The setting is confirmed.

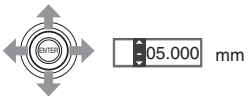
4 **Use the [△] and [▽] keys to move the cursor to "Point A, X".**

The cursor appears at point A.



5 **Press the [ENTER] key.**

The X coordinate for point A can be entered as a value.



6 **Enter the value by using the [△], [▽], [◁], and [▷] keys and press the [ENTER] key.**

The X coordinate for point A is confirmed.



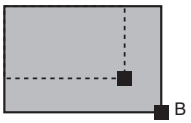
7 **Set "Point A, Z".**

Set the parameter by using the operations in steps 4 and 5.



8 **Set the coordinates for point B.**

Set the parameters by using the operations in steps 4 to 7.



9 **Press the [ESCAPE] key to complete the drawing.**

The drawing window closes.

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Returning the LJ-G Series to the Factory Default Settings

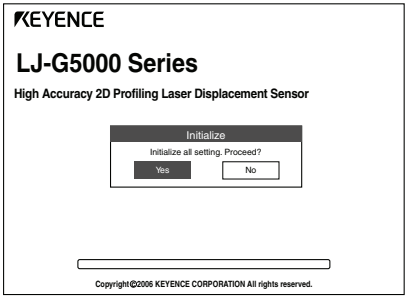
You can initialize all of the parameters and return them to the factory default settings.

► Note

Do not turn off the power to the controller while executing initialization.

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

The window prompting you to confirm the initialization appears.



2 Select "Yes" and press the [ENTER] key.

Initialization is executed and the controller restarts.

Reference

The interface language of the environment settings is not initialized.

"Environment Settings" (Page 6-1)

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MEMO

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Chapter

3

Operations and Functions during Measurement

This chapter describes the functions of the screens that are displayed during measurement and how to operate them.

Measurement Screen 3-2
- Description of the Measurement Screen 3-2
- Operating the Measurement Screen 3-4
- Value Display Screen 3-6
- Profile Display Screen 3-7
- Saving the Image of the Measurement Screen 3-8

Display Setting Menu 3-9
- Viewing the Display Setting Menu 3-9
- Operations and Functions of the Display Setting Menu 3-9

Hold Function 3-14

Trigger Function 3-14

Auto-zero 3-15

Switching Program Nos. 3-17

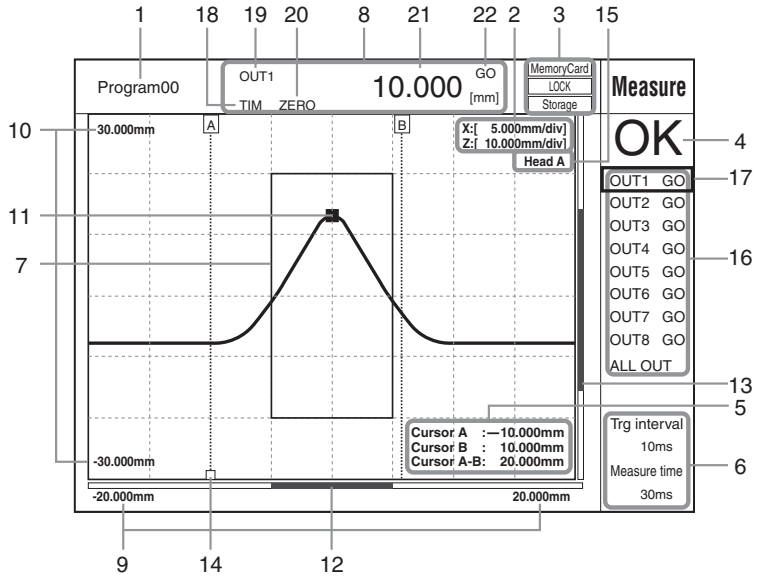
Keylock 3-18

Storage 3-19
- Data Storage 3-19
- Profile Storage 3-21

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Measurement Screen

Description of the Measurement Screen



Item		Description
1.	**Program name display**	Displays the name of the selected program No. "Naming a program No." (Page 4-3) "Change Program No. screen" (Page 4-2)
2.	**Grid scale**	Displays the scale of the grid along the X and Z axes. This can be zoomed in or out. "Zoom" (Page 3-10) "Display setting range and initial value" (Page 3-12)
3.	**Equipment information display**	Memorycard: Displayed when the memory card can be used. (Page 7-1) LOCK: Displayed when the keyboard is set to keylock. (Page 3-18) Storage: Displayed when using the storage function. (Page 3-19)
4.	**Total evaluation display**	Displays the evaluation output for the total evaluation. For more information on the display contents, see "Total evaluation" in "Status Table" (Page 11-8).
5.	**Measurement cursor information**	Displays the positions of the measurement cursors. Displays the individual positions of cursors A and B, as well as the distance between the two. This information is displayed when cursor display is turned on. "Measurement cursor" (Page 3-11)
6.	**Processing time display**	Displays the trigger interval and measurement time. "Trigger Interval and Measurement Time" (Page 10-21)
7.	**Measurement area**	Displays the measurement area for the OUT number that is selected in active OUT. "Measurement area"(Page 5-50)

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Item	Description
8. Active OUT No. display	Displays the status for the OUT number that is selected by the active OUT selection cursor.
9. X display range	Displays the positions of the left and right edges of the X axis on the profile display screen.
10. Z display range	Displays the positions of the upper and lower edges of the Z axis on the profile display screen.
11. Measurement result mark	Displays the measurement result for the OUT number that is selected in active OUT.
12. X display range bar **13. Z display range bar**	Displays the current display range and position with a blue bar.
14. Measurement cursor	Displays the value that you want to read on the waveform. The vertical cursor or horizontal cursor can be used. 📖 "Display Setting Menu" (Page 3-9)
15. Profile name	Displays the name of the currently displayed profile.
16. All OUT evaluation display	Displays the evaluation output for OUT1 to OUT8. 📖 "Tolerance" (Page 5-109)
17. Active OUT selection cursor	Select the OUT number displayed in the active OUT No. display. 📖 "Switching the active OUT No." (Page 3-4)
18. Timing display	Displayed when the timing input for the OUT number that is selected in active OUT is turned on. 📖 "Hold Function" (Page 3-14) 📖 "Comparative Measurement Mode" (Page 5-103)
19. OUT name display	Displays the name of the OUT number that is selected in active OUT. 📖 "OUT Name" (Page 5-66)
20. Auto-zero display	Displayed when the auto-zero for the OUT number that is selected in active OUT is turned on. 📖 "Auto-zero" (Page 3-15)
21. Measurement display	Displays the measurement result for the OUT number that is selected in active OUT. Value display: Displays the measurement result. FFFFFF: Overrange on the plus side.The measurement result is larger than the display range. -FFFFFF: • Overrange on the minus side. The measurement result is smaller than the display range. • Measurement alarm. Displayed when an error occurs and the measurement value cannot be calculated. ------: Evaluation standby. Displayed when the measurement value cannot be determined before measurement or internally during measurement. 📖 For information about the display range, see "Minimum Display Unit" (Page 5-106). 📖 "Troubleshooting" (Page Appendix-9)
22. Evaluation result display	Displays the evaluation result of the OUT number that is selected in active OUT. 📖 "Tolerance" (Page 5-109)

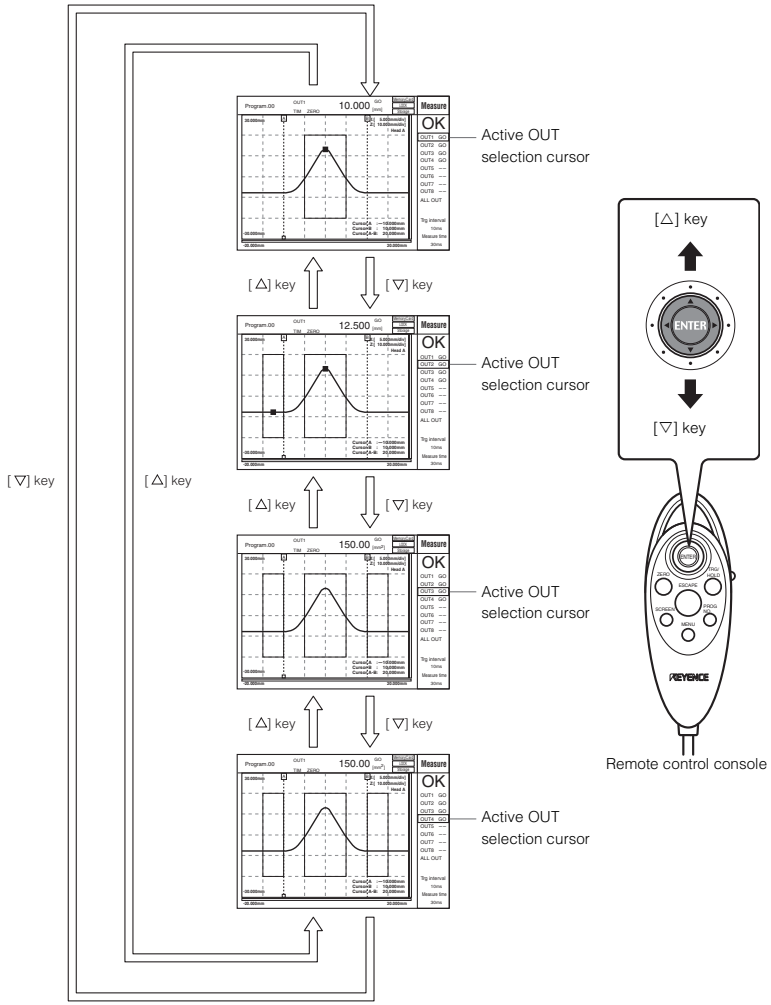
📖 For information about the OUT No., see "Overview of OUT Settings" (Page 5-65).

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Operating the Measurement Screen

Switching the active OUT No.

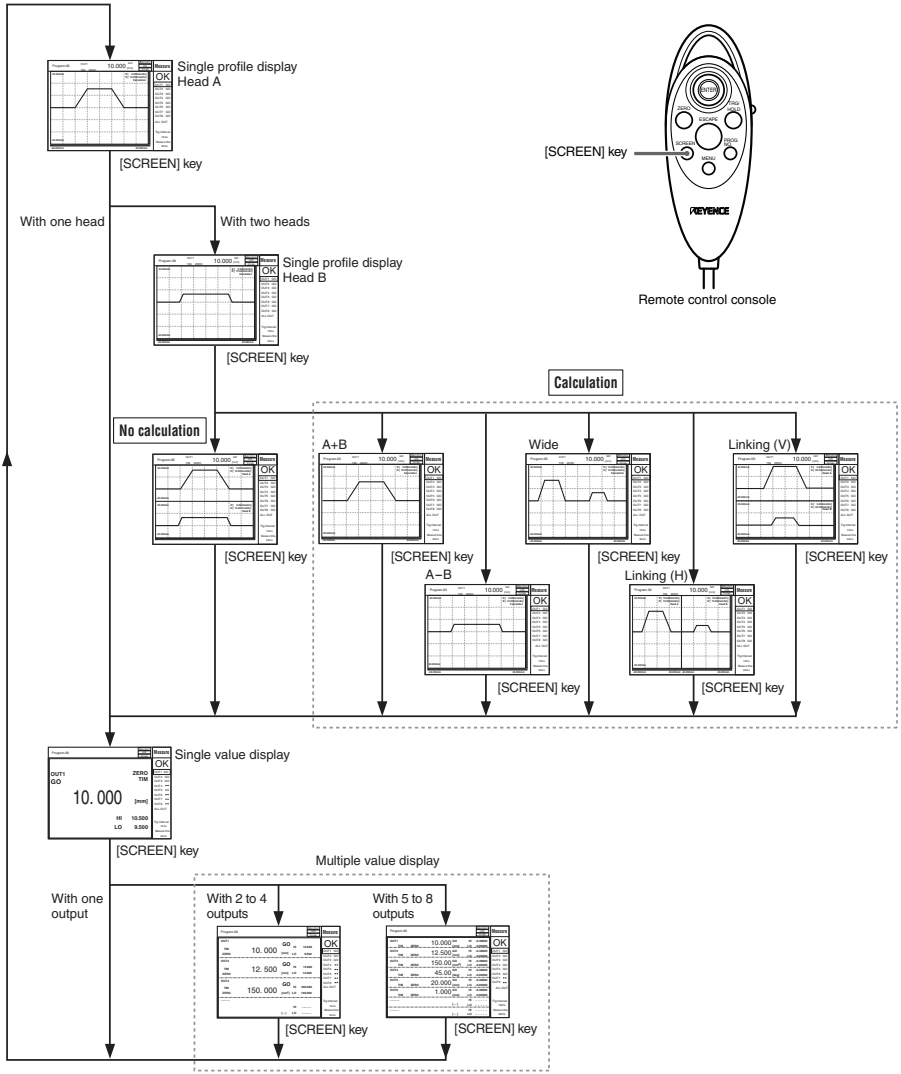
Move the active OUT selection cursor with the [△] and [▽] keys to select the OUT number displayed in the active OUT No. display.
An OUT No. cannot be selected when the measurement mode is set to "No measurement".



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Switching the measurement screen

The information displayed on the measurement screen differs depending on how many heads are being used, whether calculation is being used, and the number of set outputs.
Switch the screens by using the [SCREEN] key on the remote control console.



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Select a startup screen

The screen that is displayed after turning on the power can be selected.

1 **Select the screen to display upon startup with the [SCREEN] key.**

2 **Display the setting screen with the [PROG/RUN] switch.**

3 **Press the [PROG/RUN] switch again to return to the measurement screen.**

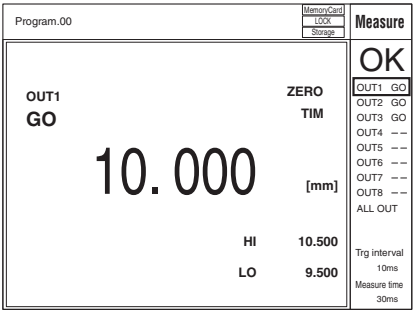
This saves the screen that is displayed upon startup. The next time that the LJ-G Series is turned on, the screen selected in Step 1 is displayed.

Value Display Screen

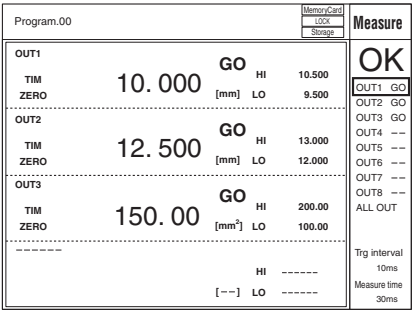
This screen displays the measurement result as a numerical value.
There are two types of screen: the single value display screen and the multiple value display screen (when 2 to 4 outputs or 5 to 8 outputs are set).
The multiple value display screen can be selected when two or more outputs are set.

"Outline of the Screen and Operations" (Page 2-1)

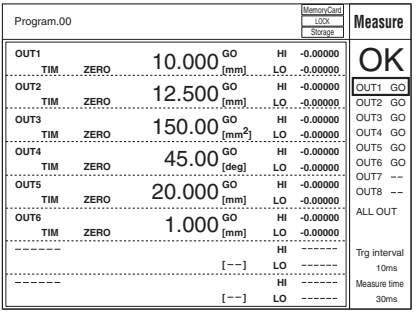
Single value display



Multiple value display screen (for 2 to 4 outputs)



Multiple value display screen (for 5 to 8 outputs)



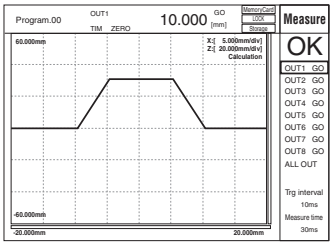
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Profile Display Screen

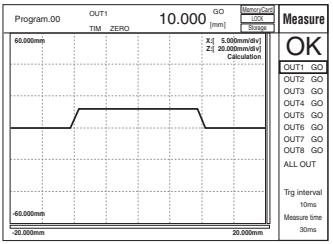
This screen displays the measured waveform (profile).
When using two heads, Head A is displayed before Head B.
When the calculation setting is turned on (A+B, A-B, Wide, Linking (H), Linking (V), the corresponding profile screen is displayed. The profile display uses a refresh rate of 5 times per second (depending on the settings).

"Calculations" (Page 5-99)

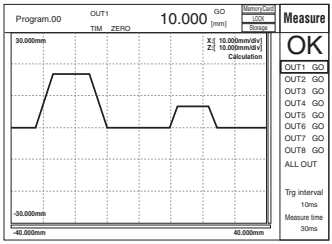
Calculation: A+B



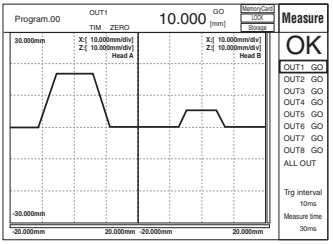
Calculation: A-B



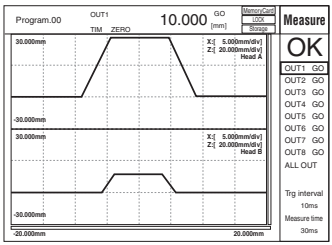
Calculation: Wide



Calculation: Linking (H)



Calculation: Linking (V)



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Saving the Image of the Measurement Screen

The image of the measurement screen can be saved in a memory card (image capture). The saved file can be opened or saved on a computer that has a memory card slot.

"Saving to / Reading from a Memory Card" (Page 7-1)

► Note

- Measurements cannot be taken while data is being saved to a memory card. The measurement value immediately before is held.
  "Status Table" (Page 11-8)
- The image cannot be saved when no memory card is inserted, or there is not enough free space. No error message appears at that time.
- The file name or the save folder is specified automatically.
  "File Format" (Page 7-4)
- The image cannot be saved with operations other than those done on the console.
- Screens other than the measurement screen (the Setting screen or the Display menu screen) cannot be saved.
  "Outline of the Screen and Operations" (Page 2-1)
- The whole measurement screen is saved.

Image saving procedure

1 Insert the memory card into the memory card slot.

"Inserting a Memory Card" (Page 7-3)

2 Display the measurement screen to be saved.

"Operating the Measurement Screen" (Page 3-4)

3 While pressing the [ENTER] key, press the [SCREEN] key.

The image is saved. The message window is displayed while saving the image.

"Remote Control Console" (Page 1-4)



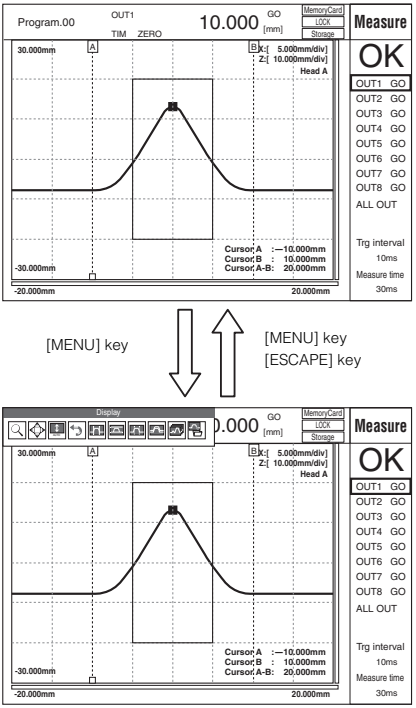
4 When the saving is completed, the message window disappears, and the unit returns to the measurement screen.

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Display Setting Menu
(Zooming in/out, moving the screen, or measuring with a cursor)

Viewing the Display Setting Menu

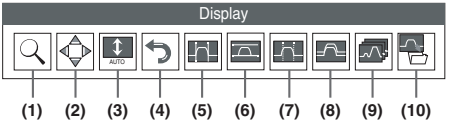
The display setting menu provides several functions, including zooming in or out on the profile and selecting points of measurement with the cursor.



Reference

- The screen stops refreshing while the display setting menu is displayed. Measurements still continue internally.
- Part of the display setting menu is displayed on the value display screen.
- Measurement stops when shifting from the profile storage screen to the display setting menu.
- The communication mode can be changed while displaying the display setting menu. The display setting menu closes after restoring.
- The options "Move to profile screen" and "Start/stop profile storage" are grayed out and cannot be selected unless they are selected under profile storage in the storage settings.

Operations and Functions of the Display Setting Menu



(1) Zoom button (Page 3-10)
This button zooms in or out on the displayed profile.

(2) Range movement button (Page 3-10)
This button moves the displayed profile in any direction.

(3) Automatic adjustment button
Select this button and press the [ENTER] key to show the displayed profile with maximum magnification.

(4) Initial value button
Select this button and press the [ENTER] key to return the displayed profile to the initial values.

(5) Measurement vertical cursor button (Page 3-11)
This button displays the measurement vertical cursor on the profile display screen.

(6) Measurement horizontal cursor button (Page 3-11)
This button displays the measurement horizontal cursor on the profile display screen.

(7) Hide measurement cursor button (Page 3-11)
Hide the measurement cursor during display.

(8) Master profile display button
Select this button and press the [ENTER] key to display the registered master profile in red on top of the displayed profile.

(9) Profile storage screen display button (Page 3-23)
This button displays the profile storage screen.

(10) Storage start/stop button (Page 3-20, Page 3-21)
This button starts or stops data storage or profile storage.

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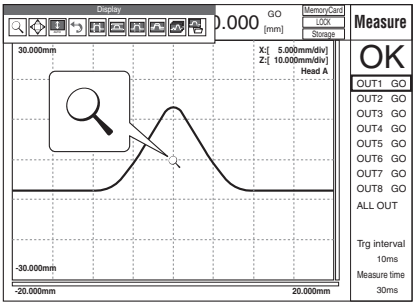
Zoom

Use the following steps to zoom in or out on the displayed profile.
For more information about the setting range or initial values of the grid scale, see "Display setting range and initial value".

"Display setting range and initial value" (Page 3-12)

1 Select the zoom icon in the display operation menu and press the [ENTER] key.

The zoom menu opens. An icon appears on the profile screen and enables operations.
Press the [ESCAPE] key during operations to return to the display setting menu.

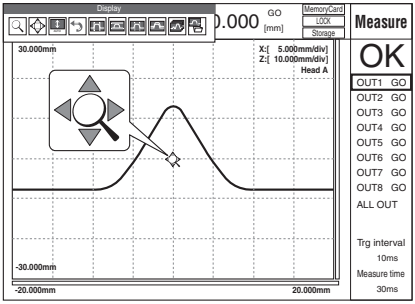


2 Set the center of the area where you want to zoom in or out with the [△], [▽], [◁], and [▷] keys.

The display zooms in or out around the icon.

3 Press the [ENTER] key.

The shape of the icon changes.



4 Zoom in or out with the [△], [▽], [◁], and [▷] keys.

△: Zoom in, Z direction
▽: Zoom out, Z direction
◁: Zoom in, X direction
▷: Zoom out, X direction
The grid scale, display range, and display range bar differ depending on the operations.

► Note

- When the screen is divided to display two profiles, the zoom in the Z direction only affects the profile where the icon is displayed.
- The zoom in the X direction affects both profiles in the same manner.

5 Press the [ESCAPE] key to return the icon to the state in Step 1.

The location for the zoom center can be reset.

6 Press the [ESCAPE] key to return to the display setting menu.

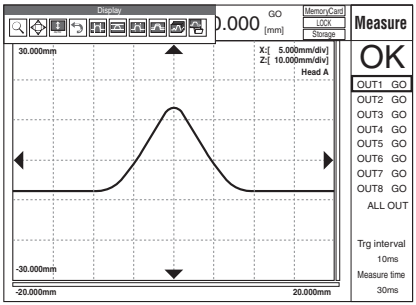
Range movement

Range movement moves the display while in the maximum display range.

For information about the maximum display range, see "Display setting range and initial value" (Page 3-12).

1 Select the range movement icon in the display operation menu and press the [ENTER] key.

The range movement menu opens.
An icon appears on the profile screen and enables operations.
Press the [ESCAPE] key during operations to return to the display operation menu.



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2 **Move the display range with the [△], [▽], [◁], and [▷] keys.**

△: Move along the Z-axis in the positive (+) direction
▽: Move along the Z-axis in the negative (-) direction
◁: Move along the X-axis in the positive (+) direction
▷: Move along the X-axis in the negative (-) direction

3 **Press the [ESCAPE] key to return to the display setting menu.**

Measurement cursor

This section explains how to display or hide the measurement cursor. The operations are the same for the vertical or horizontal measurement cursors. The measurement cursor can be used to easily measure the width and height of a profile.

1 **Select the vertical or horizontal measurement cursor in the display operation menu and press the [ENTER] key.**

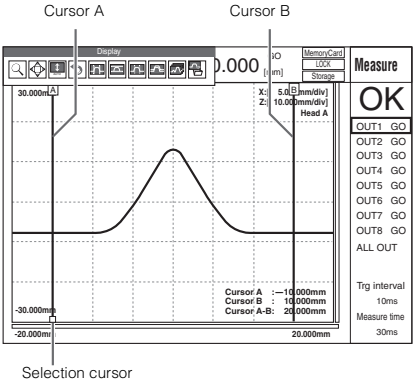
The display switches to either vertical or horizontal measurement cursor display.

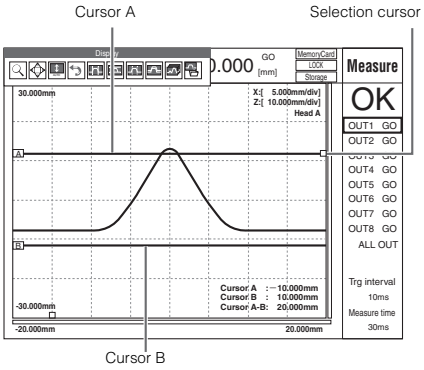
2 **The measurement cursor appears on the profile screen and enables operations.**

Press the [ESCAPE] key during operations to return to the display operation menu.
The value for cursor A or A-B changes at the bottom right corner of the screen.

Reference

The screen uses zoom or range movement display when the measurement cursor is not displayed.





3 **Select the measurement cursor to move with the [SCREEN] key.**

Every time the [SCREEN] key is pressed, the selection cursor toggles between cursor A, cursor B, and both cursors A and B.

4 **Move the selected measurement cursor with the [△], [▽], [◁], and [▷] keys.**

[◁] or [▷]: Moves the vertical measurement cursor.
[△] or [▽]: Moves the horizontal measurement cursor.

5 **Repeat Steps 3 and 4.**

6 **After determining the position of the measurement cursor, press the [ESCAPE] key.**

Hiding the measurement cursor

1 **Move the selection to "Hide cursor" in the "Display" menu.**

2 **Press the [ENTER] key.**

The displayed cursor disappears.
The cursor disappears from view, but the position is memorized.

Reference

To display the cursor again, use the [◁] or [▷] keys to select vertical or horizontal measurement cursor display.
Press the [ENTER] key to display the previously set cursor.

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Display setting range and initial value

The display conditions (zoom, display range) for the profile display screen differ depending on the model of the head and the type of profile display screen.

"Grid scale" (Page 3-2)
"X display range" (Page 3-3)
"Z display range" (Page 3-3)
"Profile Display Screen" (Page 3-7)
"Zoom" (Page 3-10)
"Range movement" (Page 3-10)

LJ-G015/LJG-015K

Profile display screen	Axis	Grid scale [mm/div]		Display range [mm]	
		Setting range	Initial value	Max. display range	Initial value
Single display	X-axis	0.050 to 2.000	1.000	±8.000	±4.000
	Z-axis	0.050 to 2.000	1.000	±6.000	±3.000
No calculation (2 head display) Calculation (Junction (Vertical))	X-axis	0.050 to 2.000	1.000	±8.000	±4.000
	Z-axis	0.100 to 4.000	2.000	±6.000	±3.000
Calculation (A+B, A-B)	X-axis	0.050 to 2.000	1.000	±8.000	±4.000
	Z-axis	0.050 to 2.000	2.000	±6.000	±6.000
Calculation (Wide)	X-axis	0.050 to 2.000	2.000	±8.000	±8.000
	Z-axis	0.050 to 2.000	1.000	±6.000	±3.000
Calculation (Junction (Horizontal))	X-axis	0.100 to 4.000	2.000	±8.000	±4.000
	Z-axis	0.050 to 2.000	1.000	±6.000	±3.000

Detailed information about the grid scale range

- 0.050 to 2.000 : 0.050/0.100/0.200/0.500/1.000/2.000
- 0.100 to 4.000 : 0.100/0.200/0.400/1.000/2.000/4.000

LJ-G030

Profile display screen	Axis	Grid scale [mm/div]		Display range [mm]	
		Setting range	Initial value	Max. display range	Initial value
Single display	X-axis	0.500 to 10.000	3.300	±40.000	±13.200
	Z-axis	0.500 to 10.000	5.000	±30.000	±15.000
No calculation (2 head display) Calculation (Junction (Vertical))	X-axis	0.500 to 10.000	3.300	±40.000	±13.200
	Z-axis	1.000 to 20.000	10.000	±30.000	±15.000
Calculation (A+B, A-B)	X-axis	0.500 to 10.000	3.300	±40.000	±13.200
	Z-axis	0.500 to 10.000	10.000	±30.000	±30.000
Calculation (Wide)	X-axis	0.500 to 10.000	5.000	±40.000	±20.000
	Z-axis	0.500 to 10.000	5.000	±30.000	±15.000
Calculation (Junction (Horizontal))	X-axis	1.000 to 20.000	6.600	±40.000	±13.200
	Z-axis	0.500 to 10.000	5.000	±30.000	±15.000

Detailed information about the grid scale range

- 0.500 to 10.000 : 0.500/1.000/2.000/3.300/5.000/10.000
- 1.000 to 20.000 : 1.000/2.000/4.000/6.600/10.000/20.000

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LJ-G080

Profile display screen	Axis	Grid scale [mm/div]		Display range [mm]	
		Setting range	Initial value	Max. display range	Initial value
Single display	X-axis	1.000 to 20.000	5.000	±80.000	±20.000
	Z-axis	1.000 to 20.000	10.000	±60.000	±30.000
No calculation (2 head display) Calculation (Linking (V))	X-axis	1.000 to 20.000	5.000	±80.000	±20.000
	Z-axis	2.000 to 40.000	20.000	±60.000	±30.000
Calculation (A+B, A-B)	X-axis	1.000 to 20.000	5.000	±80.000	±20.000
	Z-axis	1.000 to 20.000	20.000	±60.000	±60.000
Calculation (Wide)	X-axis	1.000 to 20.000	10.000	±80.000	±40.000
	Z-axis	1.000 to 20.000	10.000	±60.000	±30.000
Calculation (Linking (H))	X-axis	2.000 to 40.000	10.000	±80.000	±20.000
	Z-axis	1.000 to 20.000	10.000	±60.000	±30.000

Detailed information about the grid scale range

- 1.000 to 20.000 : 1.000/2.000/5.000/10.000/20.000
- 2.000 to 40.000 : 2.000/4.000/10.000/20.000/40.000

LJ-G200

Profile display screen	Axis	Grid scale [mm/div]		Display range [mm]	
		Setting range	Initial value	Max. display range	Initial value
Single display	X-axis	2.000 to 50.000	10.000	±200.000	± 40.000
	Z-axis	2.000 to 50.000	20.000	±150.000	± 60.000
No calculation (2 head display) Calculation (Linking (V))	X-axis	2.000 to 50.000	10.000	±200.000	± 40.000
	Z-axis	4.000 to 100.000	40.000	±150.000	± 60.000
Calculation (A+B, A-B)	X-axis	2.000 to 50.000	10.000	±200.000	± 40.000
	Z-axis	2.000 to 50.000	50.000	±150.000	±150.000
Calculation (Wide)	X-axis	2.000 to 50.000	20.000	±200.000	± 80.000
	Z-axis	2.000 to 50.000	20.000	±150.000	± 60.000
Calculation (Linking (H))	X-axis	4.000 to 100.000	20.000	±200.000	± 40.000
	Z-axis	2.000 to 50.000	20.000	±150.000	± 60.000

Detailed information about the grid scale range

- 2.000 to 50.000 : 2.000/5.000/10.000/20.000/50.000
- 4.000 to 100.000 : 4.000/10.000/20.000/40.000/100.000

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Hold Function
(Holding the measurement value)

This function displays the measurement value while retaining it.
Maximum value and minimum value can also be measured by using the hold function in combination with the measurement mode. The type of measured value that is retained with the holding function varies depending on the measurement mode.

"Comparative Measurement Mode" (Page 5-103)
"Overview of Continuous Trigger" (Page 10-2)

Use the following methods to hold the measurement value.

- Remote control console ([HOLD] key)
- External input terminal
- RS-232C interface

Remote control console

When the trigger mode is set to continuous trigger, the [TRG/HOLD] key becomes the [HOLD] key and has the same function as the timing signal. This holds the measurement value for the OUT No. that is selected for the active OUT display in the profile display screen or the value display screen.

1 Press the [HOLD] key of the remote control console in the measurement screen.

2 The measurement value is held and [TIM] is displayed.

The held value varies depending on the measurement mode.

Reference

Press the [ESCAPE] key to reset the measurement value.

3 Press the [HOLD] key again to hide [TIM].

The displayed value varies depending on the measurement mode.

External input terminal

The value can be held by shorting between the timing input terminal and COM terminal in the input terminal block or expansion connector.

"TIMING Terminal" (Page 5-112)
"Measurement control input/output" (Page 8-6)

RS-232C interface

The value can be held by sending a command from an external device through the RS-232C interface.

"Timing ON/OFF" (Page 9-12)

Trigger Function
(Performing measurement with set timing)

This function starts sampling by entering a trigger signal and displays or outputs the result.
When using the trigger function, set the trigger mode to external trigger.

"Trigger Mode" (Page 5-12)
"Remote Trigger" (Page 10-10)

Use the following methods to operate the function.

- Remote control console ([TRG] key)
- External input terminal
- RS-232C interface

Remote control console

When the trigger mode is set to external trigger, the [TRG/HOLD] key becomes the [TRG] key. It has the same function as the trigger input terminal. Press the [TRG] key to perform sampling once and display the measurement result.

External input terminal

The external trigger can be input by shorting between the trigger and COM terminal in the input terminal block or expansion connector.

"Measurement control input/output" (Page 8-6)

RS-232C interface

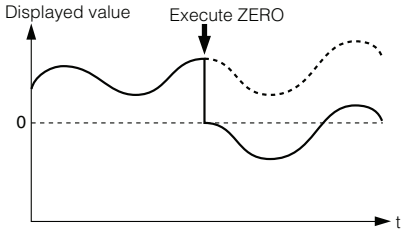
The external trigger can be input by sending a command from an external device through the RS-232C interface.

"Remote trigger input" (Page 9-12)

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Auto-zero
(Performing instantaneous zero point positioning)

The auto-zero function is used to perform zero point positioning as a reference point after the target position has changed.
Operate the [ZERO] key to instantly reset the current displayed value to "0". By considering this zero position as a reference, the increases and decreases are displayed as positive and negative values.



► Note

- Auto-zero cannot be set in the evaluation standby state (when "------" is displayed) or during states when numbers are not displayed, such as the over-range state. However, cancellation is possible.
- If the auto-zero function is set frequently, protect the FLASH memory by setting the save function in the environment settings to "OFF".
  "Save"(Page 6-5)
  "Setting memory" (Page 4)
  "Memory Structure" (Page 11-10)

Reference

- The auto-zero value is stored according to program No. and OUT No.
- When the measurement mode is set to an option other than normal, the evaluation standby state ("------") is established after auto-zero is set.
- Auto-zero is set for the setting value (display value) after measurement mode processing.
- The offset function can be used at the same time to adjust the master workpiece.
  "Auto-offset" (Page 3-16)
  "Offset" (Page 5-105)

Use the following methods to operate this function.
- Remote control console ([ZERO] key)
- External input terminal
- RS-232C interface

Remote control console

This sets auto-zero for the measurement value for the OUT No. that is selected for the active OUT display in the profile display screen or the value display screen.

1 Press the [ZERO] key of the remote control console in the measurement screen.

2 Auto-zero is set and "ZERO" is displayed.

3 Press and hold the [ZERO] key to cancel auto-zero.

External input terminal

The auto-zero can be set by shorting between the zero input terminal and COM terminal in the input terminal block or expansion connector.

"ZERO Terminal" (Page 5-113)
"Measurement control input/output" (Page 8-6)

Reference

- The measurement value becomes zero when the terminal is turned on.
- Auto-zero is canceled when the zero input terminal is turned on for two seconds or more.

RS-232C interface

The auto-zero can be set by sending a command from an external device through the RS-232C interface.

"Auto-zero ON/OFF" (Page 9-13)

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Auto-offset
(Performing instantaneous adjustment for a master workpiece)

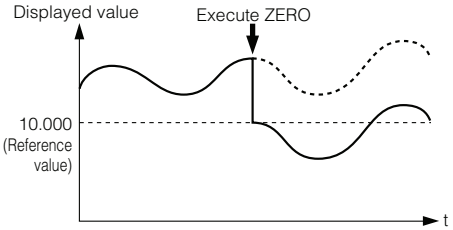
The auto-offset function is used to set a measurement value for a master workpiece. The size of the master workpiece can be set as the master value (reference value) by setting the size of the master workpiece as the offset value, and then using the auto-zero function while measuring the master workpiece.

"Auto-zero" (Page 3-15)

"Offset" (Page 5-105)

Example

When adjusting the master workpiece to 10.000, set the offset to 10.000 and perform auto-zero.



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Switching Program Nos.
(Changing the measurement conditions)

This section describes how to switch program numbers which changes measurement conditions.

"Program Function" (Page 4-1)

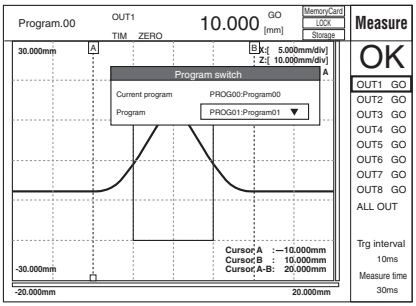
Use the following methods to operate this function.

- Remote control console ([PROG No.] key)
- External input terminal (P1 to P4)
- RS-232C interface

► Note

- The method for switching the program Nos. varies depending on the setting for "Program switching" in the environment settings.
  "Setting the program-switching method" (Page 6-5)
- If the program Nos. are switched frequently, protect the FLASH memory by setting the save function in the environment settings to "OFF".
  "Save"(Page 6-5)
  "Setting memory" (Page 4)
  "Memory Structure" (Page 11-10)

Remote control console



1 Press the [PROG No.] key on the remote control console in the measurement screen.

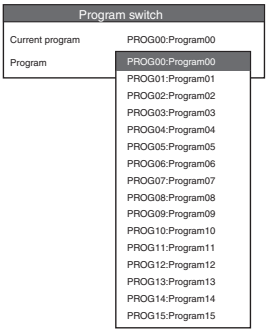
The program switching screen appears in the middle of the screen.

► Note

The program switching screen does not appear when the program switching is set to terminal instead of console.

2 Press the [ENTER] key.

A pull-down menu appears.



3 Use the [△] and [▽] keys to select the program No. and press the [ENTER] key.

The settings switch to the selected program No. and the screen returns to the measurement screen.

External input terminal

The program No. can be changed by using P1, P2, P3, and P4 of the expansion connector.

"Program No. switch input" (Page 8-7)

RS-232C interface

The program No. can be switched by sending a command from an external device through the RS-232C interface.

"Program" (Page 9-13)
"Uploading a Program from the Memory Card and Taking Measurements" (Page 7-9)

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Keylock

This function invalidates key input on the remote control console to prevent accidental key input during measurement.

The keylock function can be operated by using following means:
- Remote control console
- RS-232C interface

Keylock procedure

1 **Press the [MENU] key on the measurement screen to display the display operations screen.**

2 **Press and hold the [ZERO] and [TRG] keys at the same time.**

"LOCK" is displayed on the equipment information display and the LJ-G Series enters the keylock state.
During keylock, only the keys that cancel the keylock can be operated.

"Equipment information display" (Page 3-2)

Canceling keylock

1 **During the keylock state, press and hold the [ZERO] and [TRG] keys at the same time.**

"LOCK" disappears from the display and keylock is cancelled.

RS-232C interface

The keylock function can be set and cancelled by sending a command from an external device through the RS-232C interface.

"Keylock" (Page 9-13)

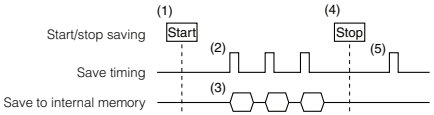
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Storage
(Saving the measurement value or profile to memory)

Data Storage

This function saves the measurement values for all of the measured OUT Nos. into the internal memory of the controller.

"Data storage" (Page 5-118)
"Memory Structure" (Page 11-10)
"LJ-Navigator User's Manual"



(1) The save process starts with "Conditions for starting the accumulation".
(2) The measurement values are confirmed with "Save timing".
(3) The measurement results are saved in the internal memory.
(4) The save process stops with "Conditions for stopping the accumulation".
(5) Measurement values obtained while stopping are not saved.

Save timing

Select one of the following three options for the timing of the save operation: Refreshing a profile, TIMING 1, or TIMING 2.
The save timing is set in the data output timing for common settings.
If TIMING is set, data is saved for each instance in the TIMING input.

"Data Output Timing" (Page 5-121)

- **Refreshing a profile**
  When performing sampling, data is saved after each OUT measurement is finished.
  - When multiple triggers are turned off with trigger mode set to continuous trigger or external trigger, data is saved after each sampling.
  - When trigger synchronization is turned off, the data is saved with the timing for trigger A.
  - When multiple triggers are turned on, the data is saved for the measurements from each of the multiple triggers.
- **TIMING 1 or TIMING 2**
  The confirmed measurement values are saved with timing input.
  - The values are saved for the timing during normal mode and hold mode according to the settings in measurement mode in OUT settings,
  - When multiple triggers are turned off with trigger mode set to continuous trigger or external trigger, data is saved after each timing input.
  - When multiple triggers are turned on, the data is saved for the measurements from each of the multiple triggers.

"Trigger Mode" (Page 5-12)
"Trigger Synchronization" (Page 5-14)
"Multiple Trigger" (Page 5-15)
"Comparative Measurement Mode" (Page 5-103)

Starting/stopping save process and clearing

Conditions for starting the accumulation

- Starting from the LJ-Navigator setup support software
  "LJ-Navigator User's Manual"
- Operating the "Storage" button in the display setting menu
  "Operating the "Storage start/stop" button" (Page 3-20)
- Start command from the RS-232 interface
  "Storage" (Page 9-14)

Conditions for stopping the accumulation

- When the preset amount of data has been accumulated
- Stopping from the LJ-Navigator setup support software
  "LJ-Navigator User's Manual"
- Operating the "Storage" button in the display setting menu
  "Operating the "Storage start/stop" button" (Page 3-20)
- Stop command from the RS-232 interface
  "Storage" (Page 9-14)

Conditions for clearing the accumulated data

The following operations clear the accumulated data while accumulation is stopped.

- Loading data
- Switching from the setting screen (configuring settings) to the measurement screen (during measurement)
  "Outline of the Screen and Operations" (Page 2-1)
- Initializing from the setup support software "LJ-Navigator"
  "LJ-Navigator User's Manual"
- Initialization command from the RS-232 interface
  "Storage" (Page 9-14)
- Changing the program No.
  "Switching Program Nos." (Page 3-17)
- Turning off the power

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Loading data

The following methods can load data that is saved in the internal memory of the controller.

- Loading from LJ-Navigator
  "LJ-Navigator User's Manual"
- Saving to the memory card
  Save data to the memory card by operating the remote control console or using external input terminal (S-SAVE).
  "Saving to a Memory Card" (Page 7-5)
  "Saving Storage Data to the Memory Card from the Input Terminal" (Page 7-9)

  Reference

  The file is saved in the dedicated binary format. To convert the file into the CSV format, use the LJ-Navigator.
  "LJ-Navigator User's Manual"
- Load command from the RS-232 interface
  "Storage" (Page 9-14)

Operating the "Storage start/stop" button

Data storage can be started or stopped with the "Storage start/stop" button on the display setting menu.
"Display Setting Menu" (Page 3-9)

■ Starting storage

1 Set "Storage" or "Data output timing" for the common settings.
"Data storage" (Page 5-118)
"Data Output Timing" (Page 5-121)

2 The "Display" menu appears.
"Viewing the Display Setting Menu" (Page 3-9)

3 Use the [◁] and [▷] keys to select the "Storage start/stop" button and press the [ENTER] key.
"Storage" is displayed on the equipment information display and the save process starts with the save timing.
"Equipment information display" (Page 3-2)

4 Press the [ESCAPE] key to return to the measurement screen.

■ Stopping storage

1 The "Display" menu appears.

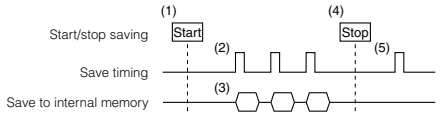
2 Use the [◁] and [▷] keys to select the "Storage start/stop" button and press the [ENTER] key.
"Storage" disappears from the equipment information display and the save process ends.
"Equipment information display" (Page 3-2)

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Profile Storage

This function saves the measured profile waveforms into the internal memory of the controller.

"Profile storage" (Page 5-119)
"Memory Structure" (Page 11-10)
"LJ-Navigator User's Manual"



(1) The save process starts with "Conditions for starting the accumulation".
(2) The save timing is generated according to the measurement.
(3) The profile is saved in the internal memory.
(4) The save process stops with "Conditions for stopping the accumulation".
(5) Profiles obtained while stopping are not saved.

Save timing

Select one of the following three options for the timing of the save operation: Always, NG, or manual. The save timing is set in storage conditions in profile storage under the common settings.

"Profile storage" (Page 5-119)

- **Always (initial setting)**
  All of the profiles are saved every time they are refreshed.
- **NG**
  The refreshed profiles are saved when the evaluation judgment is NG.
  "Total evaluation display" (Page 3-2)
- **Manual**
  Operate the remote control console to save a specified profile.

► Note

- When A+B, A-B, or wide are selected for the calculations in profile measurement, and the target profile is set to head A, head B, or both heads, the saved profile does not include profile correction.
- If "Calculation" in the profile setting is turned off or if the trigger synchronization is turned off, and calculation or both heads is selected for the target profile, invalid data will be saved.
  "Calculations" (Page 5-35)
  "Overview of Position Adjustment" (Page 5-50)
  "Trigger Synchronization" (Page 5-14)

Starting/stopping save process and clearing

Conditions for starting the accumulation

- Starting from the setup support software "LJ-Navigator"
  "LJ-Navigator User's Manual"
- Operating the "Storage" button in the display setting menu
  "Operating the Storage button"(Page 3-22)
- Start command from the RS-232 interface
  "Storage" (Page 9-14)

Conditions for stopping the accumulation

- When the preset number of profiles has been accumulated
- Stopping from the setup support software "LJ-Navigator"
  "LJ-Navigator User's Manual"
- Operating the "Storage" button in the display setting menu
  "Operating the Storage button" (Page 3-22)
- Stop command from the RS-232 interface
  "Storage" (Page 9-14)

Conditions for clearing the accumulated data

The following operations clear the accumulated data while accumulation is stopped.

- Loading profile data
- Switching from the setting screen (configuring settings) to the measurement screen (during measurement)
  "Outline of the Screen and Operations" (Page 2-1)
- Initializing from the LJ-Navigator setup support software
  "LJ-Navigator User's Manual"
- Initialization command from the RS-232 interface
  "Storage" (Page 9-14)
- Changing the program No.
  "Switching Program Nos." (Page 3-17)
- Turning off the power

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Loading profile data

The following methods can load profiles that were saved in the internal memory of the controller.

- Loading from LJ-Navigator
  "LJ-Navigator User's Manual"
- Saving to the memory card
  Save data to the memory card by operating the remote control console or using external input terminal (S-SAVE).
  "Saving to a Memory Card" (Page 7-5)
  "Saving Storage Data to the Memory Card from the Input Terminal" (Page 7-9)

Reference

The file is saved in the dedicated binary format. To convert the file into the CSV format, use the LJ-Navigator.
"LJ-Navigator User's Manual"

- Load command from the RS-232 interface
  "Storage" (Page 9-14)

Operating the "Storage start/stop" button (Always, NG)

The "Storage start/stop" button operates in the following manner when the save timing (storage conditions) is set to Always or NG.
"Display Setting Menu" (Page 3-9)

■ Starting storage (accumulation start condition)

1 Set "Storage" in the common settings.

Select "Always" or "NG only" for the storage conditions.
"Profile storage" (Page 5-119)

2 The "Display" menu appears.
"Viewing the Display Setting Menu" (Page 3-9)

3 Use the [◁] and [▷] keys to select the "Storage start/stop" button and press the [ENTER] key.

"Storage" is displayed on the equipment information display and the save process starts with the save timing.
"Equipment information display" (Page 3-2)
"Save timing" (Page 3-19)

4 Press the [ESCAPE] key to return to the measurement screen.

■ Stopping storage (accumulation stop condition)

1 The "Display" menu appears.

2 Use the [◁] and [▷] keys to select the "Storage start/stop" button and press the [ENTER] key.

"Storage" disappears from the equipment information display and the save process ends.
"Equipment information display" (Page 3-2)

Operating the "Storage start/stop" button (Manual)

Profile storage operates in the following manner when the save timing (storage conditions) is set to Manual.

1 Set "Storage" in the common settings.

Select "Manual" for the storage conditions. The measurement screen appears and "Storage" is displayed on the equipment information display. (accumulation start condition)
"Profile storage" (Page 5-119)
"Equipment information display" (Page 3-2)

2 The "Display" menu appears.
"Viewing the Display Setting Menu" (Page 3-9)

3 Use the [◁] and [▷] keys to select the "Storage start/stop".

4 Press the [ENTER] key.

Every time the [ENTER] key is pressed (save timing), the newest profile data is saved.

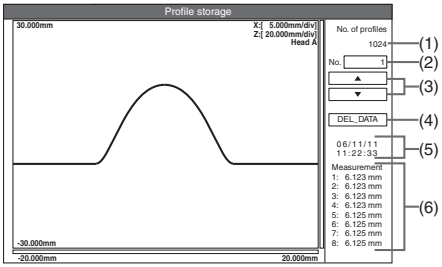
Reference

- The latest internal profiles are saved, not the profiles that are displayed on the profile display screen.
- To stop the accumulation, set the storage conditions to other than "Manual" (accumulation stop timing).

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Profile storage screen

The profile storage screen is the location where profile waveforms that were saved in profile storage can be loaded and confirmed. Unnecessary profile waveforms can also be deleted.



(1) Number of profiles
Displays the profile waveforms that are saved in internal memory with profile storage.

(2) Profile number
Displays the number for the profile that is displayed in the profile screen. The [ENTER] key can also be used to change the number of the displayed profile with number input.

(3) Profile No. change button
Changes the number of the displayed profile on the profile screen.

(4) Delete data
Unnecessary profiles can also be deleted.



- **All**
  Deletes all of the saved profiles.
- **Select**
  Deletes the displayed profile numbers.
- **Cancel**
  Does not delete any profiles.

(5) Save time and date
Displays the time and date that the displayed profile was saved.

(6) Measurement value
Displays the measurement result from the displayed profile.

■ Displaying the profile storage screen

1 Save the profile in the profile storage.

"Starting/stopping save process and clearing" (Page 3-21)

2 The "Display" menu appears.

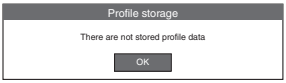
"Viewing the Display Setting Menu" (Page 3-9)

3 Use the [◁] and [▷] keys to select the "Profile storage screen display" button and press the [ENTER] key.

The profile storage screen appears.

► Note

If no profile data is saved (there are 0 profiles), an error message appears.



Close the message with the [ENTER] key.
Save the profile as mentioned in Step 1.

Reference

Refer to "Reading from a Memory Card" (Page 7-6) for more information on how to read the profile storage data saved in the memory card.

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MEMO

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Chapter

4

Program Function

Saving and Loading the Measurement Conditions

The measurement conditions set in the LJ-G Series can be saved to 16 different programs. Measurement conditions can be called based on previously saved target types to allow easy changes to settings.

Refer to "Setting Measurement Conditions" (Page 5-1) for more information on how to set the measurement conditions.

Actions with the program function

- Loading (selecting) or saving 16 types of measurement conditions (programs) (Page 4-3)
- Naming measurement conditions (programs) (Page 4-3)
- Copying measurement conditions (programs) (Page 4-4)
- Initializing measurement conditions (programs) (Page 4-5)
- Saving and loading the measurement conditions (programs) with a memory card (Page 4-5)

Settings that are saved in the program

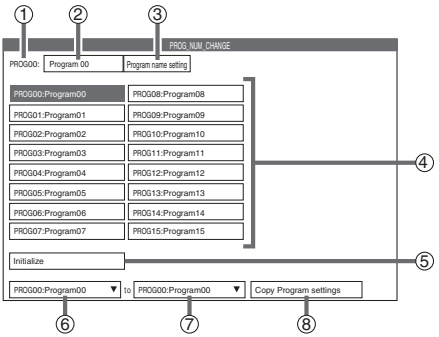
- Head Settings (Page 5-11)
- Profile Settings (Page 5-34)
- Master Registration (Page 5-48)
- Position Adjustment (Page 5-50)
- OUT Settings (Page 5-65)
- Common Settings (Page 5-111)
- Auto-zero (Page 3-15)
  (when the save function is ON)
  "Save" (Page 6-5)

► Note

Environment settings are not saved.

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Change Program No. screen



(1) Program No. display
The currently selected program No. appears.

(2) Program name display
The name of the currently selected program No. appears.

(3) Program name setting (Page 4-3)
Changes the program name.

(4) Select program No. button (Page 4-3)
Selects the program No.
The currently selected program No. appears in a pale green color.

(5) Initialize button (Page 4-5)
Initializes the settings for the currently selected program No.

(6) Copy from selection button (Page 4-4)
Selects the program No. to copy from the pull-down menu.

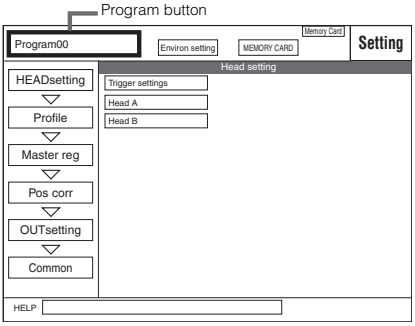
(7) Copy to selection button (Page 4-4)
Selects the program No. into which settings are copied from the pull-down menu.

(8) Copy Program settings button (Page 4-4)
Copies settings from the "Copy from" program No. to the "Copy to" program No.

Displaying the "PROG_NUM_CHANGE" Screen

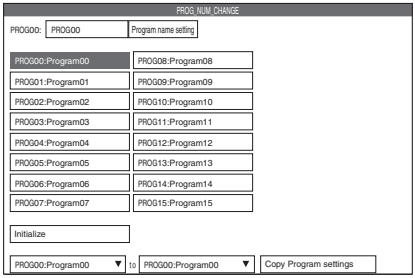
1 Display the "Setting" screen with the [PROG/RUN] switch.

"Outline of the Screen and Operations" (Page 2-1)



2 Use the [△], [▽], [◁], and [▷] keys to select the "Program" button on the upper left of the setting screen and press the [ENTER] key.

The "PROG_NUM_CHANGE" screen is displayed.



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Selecting the program No. (Loading)

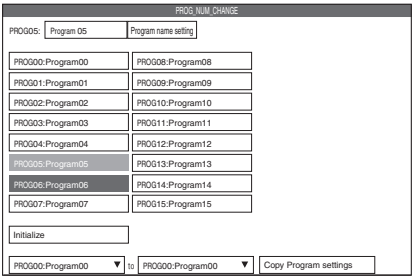
Select the program No. of the program with the settings that you want to change.

1 The "PROG_NUM_CHANGE" screen is displayed.

"Displaying the "PROG_NUM_CHANGE" Screen" (Page 4-2)

2 Use the [△], [▽], [◁], and [▷] keys to select the "Select program No." button and press the [ENTER] key.

The number and name of the selected program appear in program No. display and program name display.
The selected "Select program No." button turns pale green.



3 Press the [ESCAPE] key to complete the selection.

The "PROG_NUM_CHANGE" screen is closed.

Reference

For information about selecting other program Nos., see 3-17.

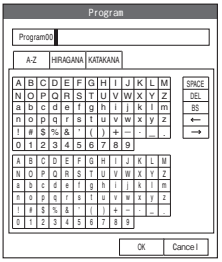
Naming a program No.

1 The "PROG_NUM_CHANGE" screen is displayed.

"Displaying the "PROG_NUM_CHANGE" Screen" (Page 4-2)

2 Use the [△], [▽], [◁], and [▷] keys to select the "Program name setting" button and press the [ENTER] key.

The "Program" screen is displayed and the cursor moves to the program name.



3 Enter the program name.

"Entering Characters" (Page 2-5)

Setting range

Up to 16 single-byte characters, and 8 double-byte characters.

4 After finishing input, use the [△], [▽], [◁], and [▷] keys to select the "OK" button and press the [ENTER] key.

This confirms the name of the program No.

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Copying the program No.

Use this function to copy the settings from one program No. to another program No.

► Note

When copying settings, the settings from the "Copy from" program No. overwrite the settings in the "Copy to" program No.

1 The "PROG_NUM_CHANGE" screen is displayed.

"Displaying the "PROG_NUM_CHANGE" Screen" (Page 4-2)

2 Select the "Copy from selection" button and press the [ENTER] key.

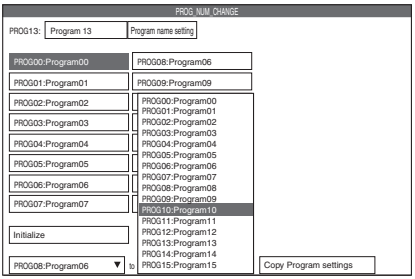
A pull-down menu appears.

3 Select the "Copy from" program No. and press the [ENTER] key.

This confirms the "Copy from" program No.

4 Select the "Copy to selection" button and press the [ENTER] key.

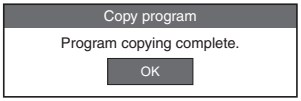
A pull-down menu appears.



5 Select the "Copy to" program No. and press the [ENTER] key.

6 Select the "Copy Program settings" button and press the [ENTER] key.

The settings are copied from the "Copy from" program to the "Copy to" program. After copying is complete, a confirmation message appears.



7 Press the [ENTER] key.

The message is closed.

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Initializing settings

This function initializes the settings in a selected program No.

► Note

Initializing a program number initializes all of the settings (including head and profile settings).

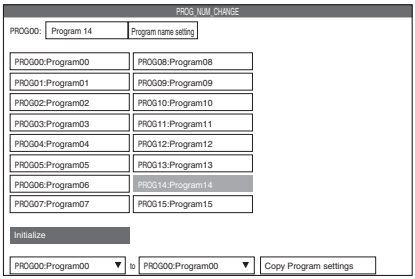
1 **The "PROG_NUM_CHANGE" screen is displayed**

"Displaying the "PROG_NUM_CHANGE" Screen" (Page 4-2)

2 **Select the program No. to initialize and press the [ENTER] key.**

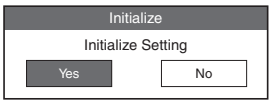
The selected "Select program No." button turns pale green.

3 **Select the "Initialize" button.**



4 **Press the [ENTER] key.**

A confirmation message appears for asking you whether to initialize.



5 **Select "Yes" and press the [ENTER] key.**

A message appears to confirm that the parameters will be initialized.



6 **Press the [ENTER] key.**

The message is closed.

Loading and saving with the memory card

Programs that are saved in the controller can be saved to the memory card. Programs saved in the memory card can be loaded back into the controller at a later time.

"Saving to a Memory Card" (Page 7-5)

"Reading from a Memory Card" (Page 7-6)

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MEMO

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Chapter
5
Setting Measurement Conditions

Making Measurement Condition Settings

HEADsetting

Setting the head sampling conditions

"Head Settings" (Page 5-11)

- Set the timing with which the target will be sampled.
- Set the optimal sampling method (sensing method) for the target.

Profile

Setting profile processing conditions

"Profile Settings" (Page 5-34)

- Set the calculation method when using 2 heads.
- Adjust the settings to stabilize the profile.
- Correct for any errors due to misaligned heads.

Master reg

Registering a target to be used as the measurement standard

"Master Registration" (Page 5-48)

Measure the object to be used as the measurement standard (master target). The waveform (profile) from this measurement becomes the standard (registered profile) for measurement mode settings and position adjustments.

Pos corr

Correcting the position and angle of the target

"Position Adjustment" (Page 5-50)

Automatic corrections can be made if the target moves during measurement or is inclined.

OUTsetting

Setting measurement items

"OUT Settings" (Page 5-65)

- Set the measurement type such as "Height measurement."
- Set the tolerance threshold, average setting, maximum value and other settings.

Common

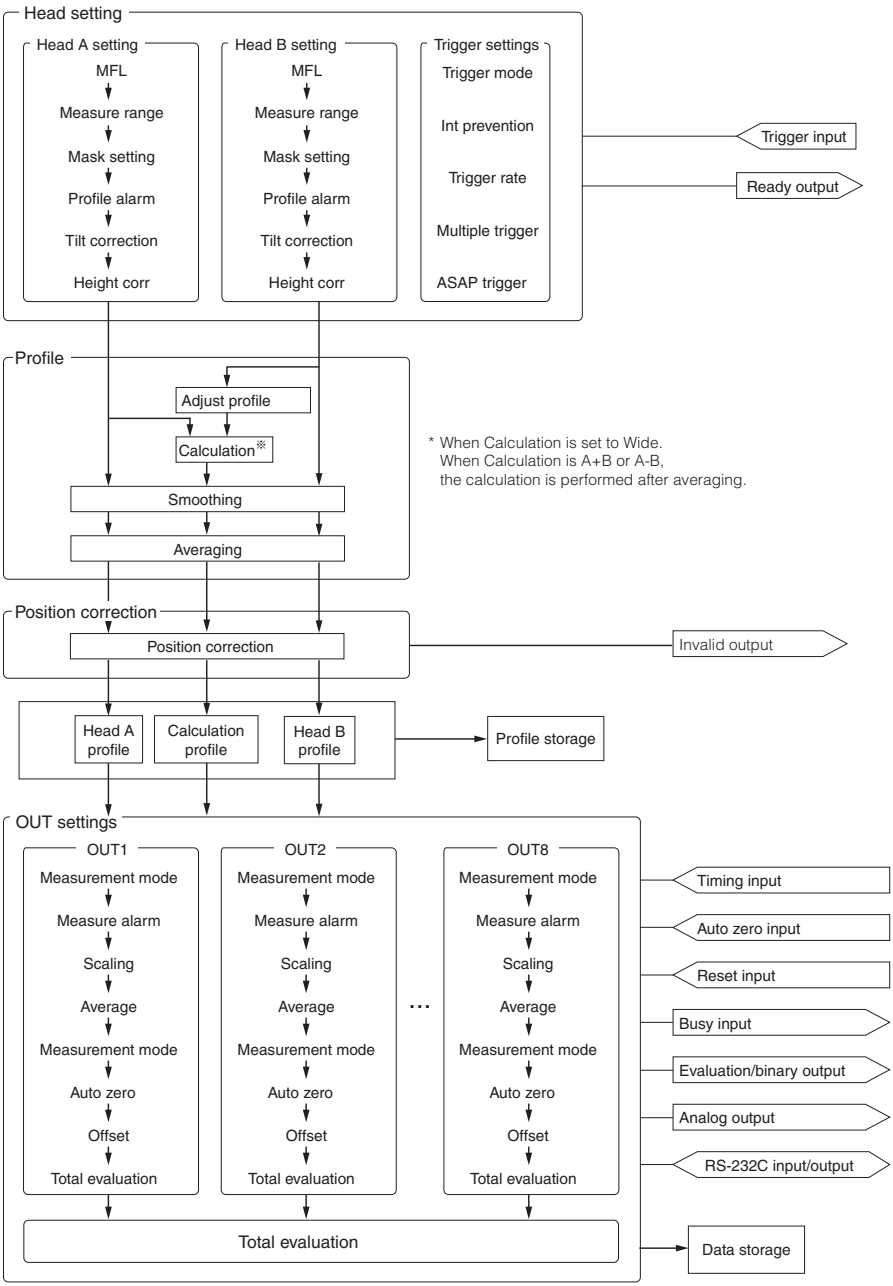
Setting input conditions

"Common Settings" (Page 5-111)

- Set the operating conditions for the input and output terminals.
- Set the conditions for saving measurement results to internal memory.

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Measurement Conditions and Measurement Data Flow



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Setting the Measurement Conditions to Meet Your Needs

	Reference page	Minimum required setting	Measurement value stabilization	Rapid Measurement	Measurement value correction	Control by input/output	Calculations with 2 heads
Head settings	5-11						
Trigger setting	5-11						
Trigger mode	5-12	◎		○		○	○
Mutual interference prevention	5-13		○				
Trigger rate	5-14					○	○
Multiple trigger	5-15		○				
ASAP trigger	5-16		◎				
Head A / Head B settings	5-18						
Measurement range	5-19			◎			
MFL	5-21		◎	○			
Mask setting	5-26		○				
Profile alarm	5-28		◎				
Tilt correction	5-30			△	○		
Height correction	5-32			△	○		
Profile settings	5-34						
Calculation	5-35						○
Head delay	5-41						○
Filter	5-42		○	△			
Smoothing	5-42		◎				
Averaging	5-43		○	△			
Profile correction	5-44						○
Master registration	5-48	◎					
Position adjustment	5-50		○	△	○		
OUT settings	5-65						
Measurement mode	5-67	◎		△			
Average	5-101		◎	△			
Measurement value alarm	5-102		○				
Measurement mode	5-103	○					
Offset	5-105				○		
Scaling	5-107				○		
Tolerance	5-109	○				○	
Common settings	5-111						
TIMING settings	5-112					○	
ZERO terminal	5-113					○	
Binary output	5-114			△		○	
Analog output	5-114			△		○	
Automatic transmission	5-120					○	
Data output timing	5-121					○	

○ : Set these in accordance with your needs. Start setting from ◎.

△ : Setting these will increase the measurement time.

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Default Values and Setting Ranges for Setting Items

■ List of setting ranges and default values for head settings

Item				Selectable range	Default value	Reference page
Trigger setting	Trigger mode			Continuous trigger / EXT trigger	Continuous trigger	5-12
	Mutual interference prevention			ON / OFF	OFF	5-13
	Trigger synchronization *1			ON / OFF	OFF	5-14
	Multiple trigger *1 *2			ON / OFF	OFF	5-15
	Sampling count *3			1 to 100	1	5-15
	Delay count *3			1 to 99	0	5-15
	ASAP trigger *2			ON / OFF	OFF	5-17
	ASAP mode *4			FULL / FAST	FULL	5-17
Head A / Head B settings	Measurement range	X axis		1 to 10, FULL	FULL	5-19
		Z-axis upper limit (Z-near)		1 to 10, FULL	FULL	
		Z-axis lower limit (Z-far)		1 to 10, FULL	FULL	
	MFL	Laser intensity	AUTO	AUTO / MANUAL	AUTO	5-23
			Maximum *5	1 to 99	99	
			Minimum *5	1 to 99	32	
		Effective range		Set the area width and position.	-	5-24
		Sampling time		0.3, 1 to 10 (units: ms)	2	5-25
	Mask setting	Top 1 through top 5		Rectangle / Triangle	Rectangle	5-26
				Set the area position and size.	-	
		Bottom 1 through bottom 5		Rectangle / Triangle	Rectangle	5-26
				Set the area position and size.	-	
	Profile alarm	Number of errors		0 to 255	64	5-28
		Alarm cut level		0 to 9	4	5-28
		Measurement target		Standard / first peak / multiple reflection	Standard	5-28
	Tilt correction			ON / OFF	OFF	5-30
	Height correction			ON / OFF	OFF	5-32

*1 Only available when the trigger mode is set to "EXT trigger."
*2 Both the multiple trigger and the ASAP trigger cannot be set to "ON" at the same time..
*3 Only available when the multiple trigger is set to "ON."
*4 Only available when ASAP trigger is set to "ON".
*5 Only available when the laser intensity is set to "MANUAL."
"Function Limits and Selecting Setting Items" (Page 5-10)

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■ List of setting ranges and default values for profile settings

Item		Selectable range	Default value	Reference page
Calculation		OFF / A+B / A-B / Wide / Linking (H) / Linking (V)	OFF	5-35
Head delay count		0 to 1023	0	5-41
Filter		OFF / F1 / F2	F1	5-42
Smoothing		1 / 2 / 4 / 8 / 16 / 32 / 64	8	5-42
Averaging	When multiple trigger is OFF*1	1 / 2 / 4 / 8 / 16 / 32 / 64	1	5-43
	When multiple trigger is ON*2	ON / OFF	OFF	
Profile correction	Inverted X axis	ON / OFF	OFF	5-44
	Inverted Z axis	ON / OFF	OFF	5-44
	X direction adjustment	LJ-G015K : -4.0 to + 4.0 (units: mm) LJ-G015 : -4.0 to + 4.0 (units: mm) LJ-G030 : -13.2 to + 13.2 (units: mm) LJ-G080 : -20 to +20 (units: mm) LJ-G200 : -40 to +40 (units: mm)	0	5-44
	Z direction adjustment	LJ-G015K : -2.3 to + 2.3 (units: mm) LJ-G015 : -2.6 to + 2.6 (units: mm) LJ-G030 : -10 to +10 (units: mm) LJ-G080 : -23 to +23 (units: mm) LJ-G200 : -48 to +48 (units: mm)	0	5-44

*1 Possible only when the following settings are made.
- The trigger mode under the trigger settings when the head setting is set to "Cont trigger"
- The trigger mode under the trigger settings when the head setting is set to "EXT trigger" and the multiple trigger is OFF.

*2 Only available when the trigger mode under the trigger settings when the head setting is set to "EXT trigger" and the multiple trigger is ON.

■ List of setting ranges and default values for registering a master

Item	Selectable range	Default value	Reference page
Master profile	Registering a Head A profile / head B profile / calculation profile.*1	Not registered	5-48

*1 The profiles that can be registered vary with different settings.

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■ **List of setting ranges and default values for position correction**

Item		Selectable range	Default value	Reference page
Profile to be corrected		Select head A, head B or calculations for correction.	-	5-52
Correction mode		OFF / Profile correction / X correction / Z correction / X-Z correction / Z-X correction	OFF	5-52
Profile correction	Profile area	Set the area position and size.	-	5-52
	Search area	Set the area position and size.	-	
	Correlation value	0 to 99	70(%)	
X correction	X area	Set the area position, size and edge level.	-	5-54 5-57
	Edge type	Rising / Falling	Rising	
	Edge direction	- direction / + direction	+ direction	
	Edge No.	1 to 10	1	
Z correction	Z area	Set the area position and size.	-	5-54 5-59
	Height types	Peak / bottom / average	Average	
ANG correction	ANG area2/1	Set the area position and size.	-	5-62
X-Z correction	X area	Set the area position, size and edge level.	-	5-55 5-60
	Edge type	Rising / Falling	Rising	
	Edge direction	- direction / + direction	+ direction	
	Edge No.	1 to 10	1	
	Z area	Set the area position and size.	-	
	Height type	Peak / bottom / average	Average	
Z-X correction	X area	Set the area position, size and edge level.	-	5-55 5-60
	Edge type	Rising / Falling	Rising	
	Edge direction	- direction / + direction	+ direction	
	Edge No.	1 to 10	1	
	Z area	Set the area position and size.	-	
	Height type	Peak / bottom / average	Average	
X ANG correction	ANG area 1/2	Set the area position and size.	-	5-54 5-57 5-61
	X area	Set the area position, size and edge level.	-	
	Edge type	Rising / Falling	Rising	
	Edge direction	- direction / + direction	+ direction	
	Edge No.	1 to 10	1	
ANG X correction	ANG area 1/2	Set the area position and size.	-	5-54 5-57 5-61
	X area	Set the area position, size and edge level.	-	
	Edge type	Rising / Falling	Rising	
	Edge direction	- direction / + direction	+ direction	
	Edge No.	1 to 10	1	

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■ List of setting ranges and default values for OUT settings

Item			Selectable range	Default value	Reference page
OUT1 to OUT8					5-65
Measurement mode			No measurement / height/ position / step / width / center position Cross-sectional area / angle / profile comparison 1 / Profile comparison 2 / profile tracking 1 / Profile tracking 2 / calculation	Height*1	5-67
Profile selection			Head A / head B / calculation	Head A	5-67
Height	Height measurement area		Set the area position and size.	-	5-67 5-83
	Height type		Peak / bottom / average / henkyoku	Average	
	Detection direction		- direction / + direction	+ direction	
	Detection number		No. 1 to No. 10	No. 1	
Position	Position setting area		Set the area position and size.	-	5-68 5-84
	Position type		Edge / peak / bottom / henkyoku	Edge	
	Edge type		Rising / Falling	Rising	
	Detection direction		- direction / + direction	+ direction	
	Detection number		No. 1 to No. 10	No. 1	
Step	Height measurement area 1/2		Set the area position and size.	-	5-68 5-85
	Height type 1/2		Peak / bottom / average / henkyoku	Average	
	Detection direction		- direction / + direction	+ direction	
	Detection number		No. 1 to No. 10	No. 1	
Width	Position measurement area 1/2		Set the area position and size.	-	5-68 5-86
	Position type		Edge / peak / bottom / henkyoku	Edge	
	Edge type		Rising / Falling	Rising *2	
	Detection direction		- direction / + direction	+ direction	
	Detection number		No. 1 to No. 10	No. 1	
Center position	Position measurement area 1/2		Set the area position and size.	-	5-68 5-88
	Position type		Edge / peak / bottom / henkyoku	Edge	
	Edge type		Rising / Falling	Rising *2	
	Detection direction		- direction / + direction	+ direction	
	Detection number		No. 1 to No. 10	No. 1	
Cross-sectional area	Cross sectional measurement area		Set the area position and size.	-	5-68 5-89
	Approximate line area 1/2		Set the area position and size.	-	
Cross point	Approximate line 1 Area 1/2		Set the area position and size.	-	5-69 5-91
	Approximate line 2 Area 1/2		Set the area position and size.	-	
	Coordinate		X coordinate / Z coordinate	X coordinate	
Angle	Approximate line 1 Area 1/2		Set the area position and size.	-	5-69 5-92
	Approximate line 2 Area 1/2		Set the area position and size.	-	
	Coordinate		0° to 180° / -90° to 90°	-90° to 90°	
Profile comparison 1	Area 1		Set the area position and size.	-	5-69 5-94

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Item			Selectable range	Default value	Reference page
	Profile comparison 2	Area 1	Set the area position and size.	-	5-69 5-95
	Profile tracking 1	Profile area	Set the area position and size.	-	5-70 5-96
		Search area	Set the area position and size.	-	
		Coordinate	X coordinate / Z coordinate	X coordinate	
	Profile tracking 2	Profile area1/2	Set the area position and size.	-	5-70 5-98
		Search area 1/2	Set the area position and size.	-	
		Measurement type	X / Z / D / X center / Z center	X	
	Average		1 / 2 / 4 / 8 / 16 / 32 / 64 / 128 / 256 /512 / 1024 / 2048 / 4096	1	5-101
	Measurement value alarm		0 to 255	0	5-102
	Measurement mode		Normal / peak hold 1 / Bottom hold 1 / Peak to-peak hold 1 / Average hold 1 / peak hold 2 / Bottom hold 2 / Peak to-peak hold 2 / Average hold 2 / sample hold	Normal	5-103
	Offset *3		-999.999 to 999.999 (units: mm)	0.000	5-105
	Minimum display unit*3		1mm / 0.1mm / 0.01mm / 0.001mm/ 1µm/ 0.1µm	0.001	5-106
	Scaling *3	Input value 1	-999.999 to 999.999 (units: mm)	0.000	5-107
		Display value 1	-999.999 to 999.999 (units: mm)	0.000	
		Input value 2	-999.999 to 999.999 (units: mm)	1.000	
		Display value 2	-999.999 to 999.999 (units: mm)	1.000	
	Tolerance *3	Tolerance upper limit	-999.999 to 999.999 (units: mm)	5.000	5-109
		Tolerance lower limit	-999.999 to 999.999 (units: mm)	-5.000	

*1 The default value when OUT1 is selected for the OUT number. The default value for OUT2 to OUT8 is "No measurement".

*2 When setting area 2, the default value is "falling"

*3 The settable range and the default value when the selected minimum display unit is "0.001 (mm)."The unit of measurement varies with the measurement mode settings.

- If the selected measurement mode is height, position, step, width, center position, intersection, profile comparison 1, profile tracking 1 or profile tracking 2, the unit of measurement will be "mm" or "µm."
- If the selected measurement mode is cross-sectional area or profile comparison 2, the unit of measurement is "mm^2."
- If the selected measurement mode is angle, the unit of measurement is "deg."

*4 The settable range and the default value when the selected measurement mode is height, position, step, width, center position, intersection, profile comparison 1, profile tracking 1 or profile tracking 2.

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■ List of setting ranges and default values for common settings

Item				Selectable range	Default value	Reference page
TIMING terminal		OUT1 to OUT8		Each OUT is set to TIMING1 or TIMING2	All TIMING1	5-112
ZERO terminal		OUT1 to OUT8		Each OUT is set to ZERO1 or ZERO2	All ZERO1	5-113
Binary output		Evaluation		ON (output) / OFF (do not output)	ON	5-114
		OUT1 to OUT8		Each OUT is set to ON (output) or OFF (do not output)	All OFF	
Analog output	CH1	Output selection		OUT1/ OUT2 / OUT3 / OUT4 / OUT5 / OUT6 / OUT7 / OUT8 / Head A profile / head B profile / calculation profile	OUT1	5-114
		Analog output Scaling	Measurement value 1	-999.999 to 999.999*1	-10.000*1	
			Output voltage 1	-10.500 to 10.500 (units: V)	-10.000	
			Measurement value 2	-999.999 to 999.999*1	10.000*1	
			Output voltage 2	-10.500 to 10.500 (units: V)	10.000	
	CH2	Output selection		OUT1/ OUT2 / OUT3 / OUT4 / OUT5 / OUT6 / OUT7 / OUT8 / head A profile / head B profile / calculation profile	OUT2	
		Analog output Scaling	Measurement value 1	-999.999 to 999.999*1	-10.000*1	
			Output voltage 1	-10.500 to 10.500 (units: V)	-10.000	
			Measurement value 2	-999.999 to 999.999*1	10.000*1	
			Output voltage 2	-10.500 to 10.500 (units: V)	10.000	
	Profile output update period			20 / 50 / 100 / 500 (units: µs)	20	5-115
Storage				OFF / data storage / profile storage	OFF	3-19 5-118
	Data storage	Data count		1 to 65536	65536	
		Filters		1 / 2 / 5 / 10 / 50 / 100	1	
	Profile storage	Target profile		Head A / head B / both heads / calculations	Head A	
		Profile count		1 to 1024	1024	
		Storage conditions		Normal / NG only / MANUAL	Normal	
Automatic Transmission		OUT1 to OUT8		Each OUT is set to ON (output) or OFF (do not output)	All OFF	5-120
Data output timing				Profile update time / TIMING1 / TIMING2	Profile update time	5-121

*1 This is the setting range and default value when the minimum display unit in the OUT setting is set to "0.001 (mm)."

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Function Limits and Selecting Setting Items

The following table shows the functional limitations due to the setting combinations of measurement conditions.

When one head is connected

Trigger setting					Profile settings		OUT settings	
Trigger mode Page 5-12	Mutual interference Page 5-13	Trigger synchronization Page 5-14	Multiple trigger Page 5-15	ASAP trigger Page 5-16	Calculation Page 5-35	Averaging Page 5-43	Average Page 5-101	Measurement mode Page 5-103
Continuous trigger	Disabled	-	-	Enabled	Disabled	Enabled (Select from 1 to 64 times)	Enabled	Enabled
EXT trigger		Disabled	OFF	Enabled				
			ON	OFF		OFF	Disabled (Operates via 1 time trigger input)	Enabled (limited) *
						ON		Disabled (Operates via average)

- Enabled means that the setting item can be set and that the setting of that item will effect operation.
- Disabled means that the setting item is set automatically and cannot be set by the user.
- Mutual interference, trigger synchronization and calculations can be set when there are 2 heads connected.
- The setting range for averaging varies depending on the multiple trigger setting.
- Average cannot be set when the multiple trigger is ON.
- Measurement mode has a limited setting range when the multiple trigger is ON and averaging is OFF.
- Measurement mode cannot be set when both the multiple trigger and averaging are ON.

* Only available with peak hold, bottom hold, peak-to-peak hold or average hold.

With 2 heads connected

Trigger setting					Profile settings		OUT settings	
Trigger mode Page 5-12	Mutual interference Page 5-13	Trigger synchronization Page 5-14	Multiple trigger Page 5-15	ASAP trigger Page 5-16	Calculation Page 5-35	Averaging Page 5-43	Average Page 5-101	Measurement mode Page 5-103
Continuous trigger	Enabled	-	-	Enabled	Enabled	Enabled (Select from 1 to 64 times)	Enabled	Enabled
EXT trigger	Disabled (Operates when OFF)	OFF	OFF	OFF	No calculations			
	Enabled	ON						
	OFF	OFF Enabled		ON				
	ON Enabled	OFF Disabled (Operates when ON)						
	Enabled	ON						
		Disabled (Operates when ON)		Enabled	Calculations			
			ON	OFF	Enabled	OFF	Disabled (1 time operation)	Enabled (limited) *
						ON		Disabled (Operates via average)

- Enabled means that the setting item can be set and that the setting of that item will effect operation.
- Disabled means that the setting item is set automatically and any settings made by the user are ignored.
- Trigger synchronization is ON when the continuous trigger is ON.
- Trigger synchronization is ON when calculation is not OFF (calculation).
- Trigger synchronization is ON when the multiple trigger is ON.
- The mutual interference setting is available when trigger synchronization is ON.
- The setting range for averaging varies depending on the multiple trigger setting.
- Average cannot be set when the multiple trigger is ON.
- Measurement mode has a limited setting range when the multiple trigger is ON and averaging is OFF.
- Measurement mode cannot be set when both the multiple trigger and averaging are ON.

* Only available with peak hold, bottom hold, peak-to-peak hold or average hold.

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Head Settings
(Setting the head sampling conditions)

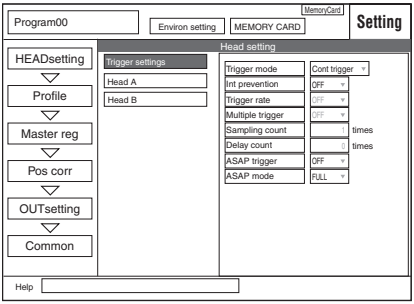
Set the optimal sampling (sensing) conditions in the sampling method settings for measuring various targets.
There are settings common to both head A and head B, as well as individual settings for each head.

"Measurement Conditions and Measurement Data Flow" (Page 5-2)
"Setting the Measurement Conditions to Meet Your Needs" (Page 5-3)
"List of setting ranges and default values for head settings" (Page 5-4)

Reference

This manual uses the term "sampling" to describe the process of sending laser light to the target, reflecting off the target and calculating the measured value.

Displaying the Head Settings Screen



1 Use the [PROG/RUN] switch to display the settings screen.

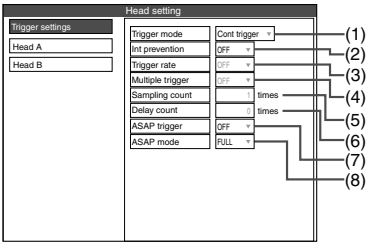
"Settings screen"(Page 2-1)

2 Select [HEADsetting] and press the [ENTER] key.

The head settings screen will be displayed and the cursor will move to "Trigger settings."

Trigger Settings
(Setting the trigger operating conditions)

The trigger is the signal to start sampling.
The trigger operating conditions for this device allow continuous sampling or custom sampling timing.
Set the trigger operating settings to match the target.



Setting item

1."Trigger Mode" (page 5-12)
Set the conditions for trigger signaling.

2."Mutual Interference Prevention" (page 5-13)
Eliminate mutual interference when using two heads.

3."Trigger Synchronization" (page 5-14)
Set the conditions needed for trigger activation when using 2 heads.

4."Multiple Trigger" (page 5-15)
Set the conditions for having 1 trigger input activate multiple samplings and calculate a result.

5."Sampling count" (page 5-15)
Set the conditions for activating the multiple trigger.

6."Delay count" (page 5-15)
Set the number of samplings that will not be used before calculating the measured value when using multiple trigger.

7."ASAP trigger" (page 5-17)
Set whether to enable or disable the ASAP trigger function.

8."ASAP mode" (page 5-17)
Set the operation condition for the ASAP trigger function.

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Trigger Mode
(Setting the conditions for trigger activation)

The trigger types are "continuous trigger," which automatically and continuously activates the trigger internally and "external trigger," which activates the trigger on receiving input from the remote input pin.

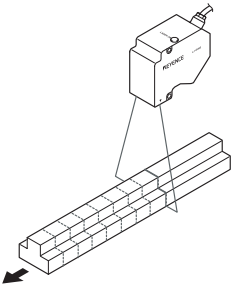
"Trigger Function" (Page 3-14)
"Function Limits and Selecting Setting Items" (Page 5-10)
"Continuous Trigger" (Page 10-2)
"Remote Trigger" (Page 10-10)

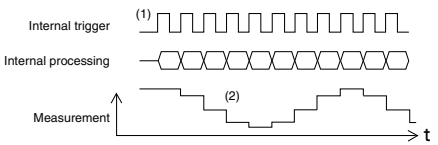
Setting range: continuous trigger / EXT trigger (default: continuous trigger)

- Continuous Trigger

  The internal trigger is automatically and continuously activated while sampling continues. Input from the external trigger is ignored.

Measurement example: Continuous measurement of the target





(1) The controller automatically activates the trigger at the minimum trigger period.
(2) Measurement and output are both continuous.

Reference

Measurement speed can be maximized by making the correct measurement mode settings.

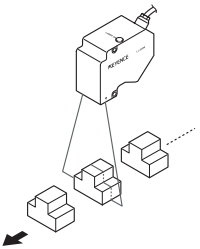
"Comparative Measurement Mode" (Page 5-103)

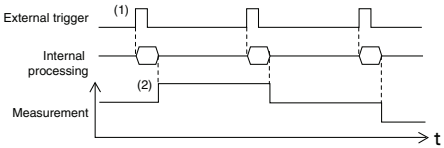
- EXT trigger

  Input from the console or external trigger input allows sampling at any time.
  Set the minimum time to match the movement of the target.
  One input will cause one sampling.
  Heads A and B can have separate trigger inputs.
  Please refer to the multiple trigger for operation when the multiple trigger is ON.

"Multiple Trigger" (Page 5-15)

Measurement example: Single measurement of the target





(1) Start sampling at the desired time with a trigger input.
(2) One measurement occurs for each trigger input.

1 Select "Trigger settings" under "Head setting" screen and press the [ENTER] key.

The [Trigger settings] screen appears.

"Displaying the Head Settings Screen" (Page 5-11)
"Trigger Settings" (Page 5-11)

2 Select "Trigger mode" and press the [ENTER] key.

A pull-down menu appears.



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3 **Select [Cont trigger] or [EXT trigger] with the [▽] and [△] keys, then press the [ENTER] key.**

When the selection is confirmed, the trigger will return to "Trigger mode."

4 **Press the [ESCAPE] key to finish making settings.**

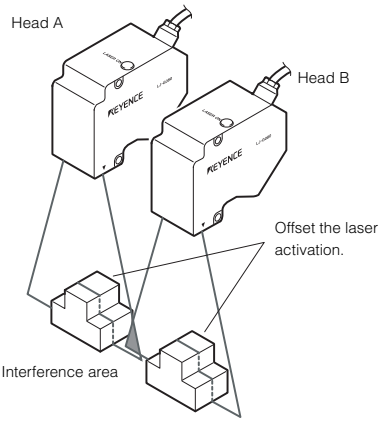
Mutual Interference Prevention
(Preventing mutual interference between 2 heads)

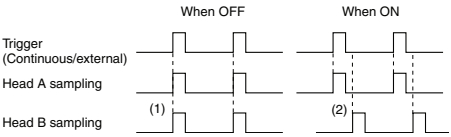
Mutual interference prevention eliminates the interference caused by installing heads A and B near to one another by changing the sampling, laser activation and timing.
This item cannot be set if only one head is used.

"Function Limits and Selecting Setting Items" (Page 5-10)
"Mutual Interference" (Page 11-12)

Setting range: OFF / ON (Default: OFF)

- OFF
  Activate both lasers at once when sampling.
- ON
  Activate the lasers with a small delay between them.





(1) When this is OFF, sampling is all simultaneous.
(2) When this is on, sampling for head B does not start until head A is finished.

► Note

This is enabled when the triggers are synchronized.

"Trigger Mode" (Page 5-12)
"Trigger Synchronization" (Page 5-14)

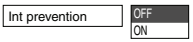
1 **Select "Trigger settings" under "Head setting" screen and press the [ENTER] key.**

The [Trigger settings] screen appears.

"Displaying the Head Settings Screen" (Page 5-11)
"Trigger Settings" (Page 5-11)

2 **Select "Int prevention" and press the [ENTER] key.**

A pull-down menu appears.



3 **Select [ON] or [OFF] with the [▽] and [△] keys, then press the [ENTER] key.**

When the selection is confirmed, the trigger will return to "Int prevention."

4 **Press the [ESCAPE] key to finish making settings.**

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Trigger Synchronization
(Synchronizing 2 heads)

When 2 heads are connected, trigger synchronization controls whether head A and head B measure at the same time with 1 trigger input. Turn this ON (synchronous) to measure with both heads at the same time. Turn this OFF (asynchronous) to trigger and measure with both heads independently.

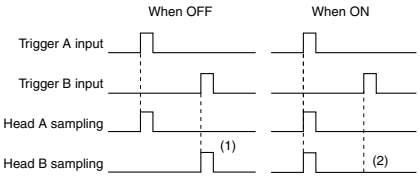
"Function Limits and Selecting Setting Items" (Page 5-10)

Setting range: OFF / ON (Default: OFF)

- OFF (asynchronous)

  Using a external trigger for head A and head B allows them to be activated and controlled separately.
- ON (synchronous)

  Synchronize head A and head B, then sample. If had A allows external trigger input, then head B does not.



(1) When trigger synchronization is OFF, head B samples when it receives trigger B input.
(2) When trigger synchronization is ON, head B samples when it receives trigger A input. Trigger B input is ignored.

► Note

This is only available when the trigger mode is "EXT trigger."

1 Select "Trigger settings" under "Head setting" screen and press the [ENTER] key.

The [Trigger settings] screen appears.

"Displaying the Head Settings Screen" (Page 5-11)
"Trigger Settings" (Page 5-11)

2 Set "Trigger mode" to "EXT trigger."

"Trigger Mode" (Page 5-12)

3 Select "Trigger rate" and press the [ENTER] key.

A pull-down menu appears.



4 Select [OFF] or [ON] with the [△] and [▽] keys, then press the [ENTER] key.

When the selection is confirmed, the trigger will return to "Trigger rate."

5 Press the [ESCAPE] key to finish making settings.

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Multiple Trigger
(Calculating multiple samples)

One signal from the external trigger will cause the set number of samples and a calculation. Calculations are average, maximum, minimum and range.
This is useful if there is a wide dispersion in measured values and you want to average multiple measurements or if you want to calculate the maximum in a given range for a moving target.
This cannot be used with ASAP trigger simultaneously.

"Function Limits and Selecting Setting Items" (Page 5-10)
"ASAP trigger" (page 5-17)
"Multi (Internal) Trigger" (Page 10-13)

Setting item

■ **Multiple trigger**

This is available when the trigger mode is set to EXT trigger.
Setting range: ON / OFF (Default: OFF)

■ **Sampling count**

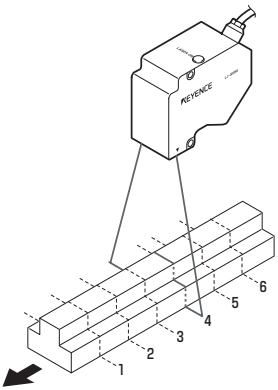
Set the number of samplings that will be caused by a signal from the external trigger.
Setting range: 1 to 100 (Default: 1)

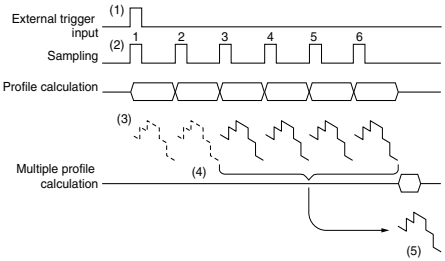
■ **Delay count**

This specifies the number of samplings after the first to be ignored when calculating the measurement results.
Samples taken when the sensing control is not stabilized can be ignored.
Setting range: 0 to 99 (Default: 0)

Setting restrictions
Delay count < Sampling count

Measurement example: Sampling count = 6, delay count = 2





(1) Sampling begins with input from the external trigger.
(2) The internal trigger activates the set number of times at the minimum trigger period.
(3) The set number of profiles is measured.
(4) The first sampling through the number of samplings corresponding to the delay count are ignored.
(5) The result of the specified calculation is output.

Reference

Refer to averaging and measurement mode for more information on calculation settings.

"Averaging" (Page 5-43)
"Comparative Measurement Mode" (Page 5-103)

1 Select "Trigger settings" under "Head setting" screen and press the [ENTER] key.

The [Trigger settings] screen appears.

"Displaying the Head Settings Screen" (Page 5-11)
"Trigger Settings" (Page 5-11)

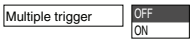
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2 **Set "Trigger mode" to "EXT trigger."**

"Trigger Mode" (Page 5-12)

3 **Select "Multiple trigger" and press the [ENTER] key.**

A pull-down menu appears.



4 **Select [ON] with the [△] and [▽] keys, then press the [ENTER] key.**

When the selection is confirmed, the trigger will return to "Multiple trigger."
The sampling count and delay count settings become available.

5 **Select "Sampling count" and press the [ENTER] key.**



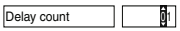
The device enters the value input state.

6 **Select a sample count, then press the [ENTER] key.**

"Entering a Value" (Page 2-5)

7 **Select "Delay count" and press the [ENTER] key.**

Follow the same steps as for setting the sampling count.



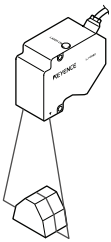
8 **Set the calculation method.**

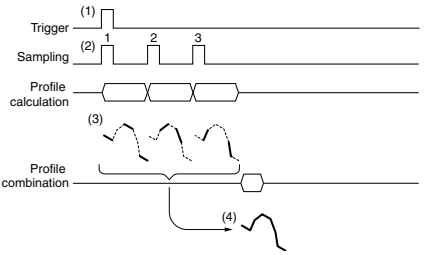
The calculation method can be set from averaging under the profile settings or measurement mode under OUT settings.

"Averaging" (Page 5-43)
"Comparative Measurement Mode" (Page 5-103)

ASAP trigger
(Stabilizing by combining multiple sampling)

The ASAP trigger function enables measurement of the stabilized profile by combining the most stably measured Z-axis displacement data for each pixel in the X-axis direction from multiple profiles under different conditions given by multiple samples obtained by changing the sampling conditions. This is useful when the profile alarm or measurement error has occurred due to the coexistence of the areas that are different in reflectivity or color in the X-axis direction of the target.





(1) Sampling begins with the continuous trigger or the external trigger.
(2) Sampling is performed multiple times by changing the sampling condition.
(3) A stable profile is measured for each area. The solid lines indicate stable areas. The dotted lines indicate unstable areas.
(4) The profile produced by combining stable areas is output.

► Note

- Trigger interval and measurement time become longer.
  "Trigger Interval and Measurement Time" (page 10-21)
- The multiple trigger function cannot be used at the same time.
  "Multiple trigger" (page 5-15)
- When the target moves, this function may be ineffective.
- The CMOS calibration, laser intensity, and effective range settings for MFL are disabled.
  "MFL" (page 5-21)

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Reference

- Sampling is performed multiple times with adjusting the detection characteristics of the CMOS and the laser power.
- This function is used when the CMOS calibration function is ineffective.
- Setting a longer sampling time for MFL increases the number of samplings. The target with lower reflectivity can be handled.

"Calibration" (page 5-22)

"Laser intensity (Setting the intensity of the laser light)" (page 5-23)

"Sampling time" (page 5-25)

Setting items

■ ASAP trigger

This is available when the multiple trigger is set to OFF.

Setting range: ON / OFF (Default: OFF)

■ ASAP mode

Set the operation conditions of the ASAP trigger function.

Setting range: FULL / FAST (Default: FULL)

Select FULL in normal cases.

When selecting FAST, the measurement time can be shortened by reducing the number of samplings.

1 Select "Trigger settings" under "Head setting" screen and press the [ENTER] key.

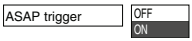
The [Trigger settings] screen appears.

Reference

When using ASAP trigger, both "continuous trigger" and "external trigger" can be selected at "Trigger mode".

2 Select "ASAP trigger" and press the [ENTER] key.

A pull-down menu appears.



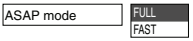
3 Select [ON] with the [△] and [▽] keys, then press the [ENTER] key.

When the selection is confirmed, the cursor will return to "ASAP trigger".

The ASAP mode becomes available.

4 Select "ASAP mode" and press the [ENTER] key.

A pull-down menu appears.



5 Select [FULL] or [FAST] with the [△] and [▽] keys, then press the [ENTER] key.

When the selection is confirmed, the cursor will return to "ASAP mode".

6 Press the [ESCAPE] key to finish making settings.

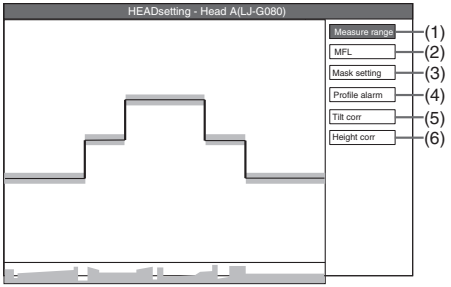
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Head A / Head B Settings
(Setting the head operating conditions)

The laser and CMOS operating conditions can be set from the "Head A" and "Head B" settings. Additionally, shape measurement stabilization settings and head tilt corrections can be found here.

Reference

The light emitting element in this device is a semiconductor laser (referred to hereinafter as the laser) while the photoreceptor is an E^3-CMOS (referred to hereinafter as the CMOS).
The E^3-CMOS is a wide dynamic range 2D image sensor.



Setting item

1."Measurement Range" (page 5-19)
Narrowing the setting range will speed the measurement time.

2."MFL" (page 5-21)
Set the sensing conditions to match the target. Set the CMOS calibration, laser intensity, valid range and sampling time.

3."Mask Setting" (page 5-26)
Mask the CMOS photoreceptor range to cancel the effect of stray light.

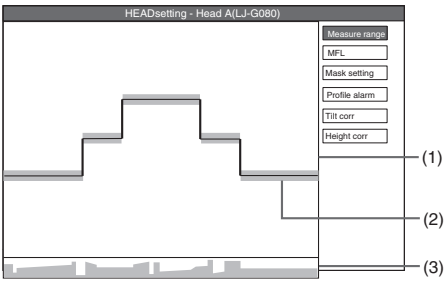
4."Profile Alarm" (page 5-28)
Set the processing method for data that cannot be measured.

5."Tilt Correction" (page 5-30)
Correct the tilt in the X direction due to head installation.

6."Height Correction" (page 5-32)
Correct the height difference in the Z direction due to head installation.

Displaying the CMOS Image

Set the sampling conditions while confirming the status of the CMOS photoreceptor for "Head A" and "Head B."
The CMOS photoreceptor status confirmation screen is called the "CMOS image."



(1) CMOS image display area
The CMOS image appears. This is a grayscale black-and-white image. Areas that are receiving intense laser light are white, areas that are receiving no laser light are black. Specify an area in the CMOS image range with setting items.

(2) Profile
The measured shape (profile) is displayed as a red line based on the sampled CMOS image in line with the settings under "Head settings." Confirm that the shape was measured correctly.
Settings after the profile settings are not reflected.

(3) Histogram display
The maximum light intensity for each line in the Z axis is displayed as a historgram. Confirm that the light intensity is neither too high nor too low.
Press the [MENU] key on the CMOS image to display the menu. Press the [MENU] key again to hide the menu.

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1 **Set the target within the measurement area.**

"Measurement range" (Page 1-7)

2 **Select "Head A" or "Head B" under "Head setting" screen and press the [ENTER] key.**

Select the head to set.
The setting screen for "Head A" or "Head B" will be displayed.

"Displaying the Head Settings Screen" (Page 5-11)
"Head A / Head B Settings" (Page 5-18)

3 **Press the [TRG] key.**

The laser activates and sampling starts.
The CMOS image and measurement result appear.

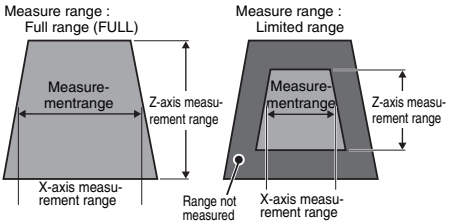
► Note

- It may take several seconds for these to display.
- It may take several presses of the [TRG] key to get the correct waveform to display.
- The image will update only when the [TRG] key is pressed. The display will be maintained until updated.
- The [TRG] key will be ignored in succeeding screens and states.
  While calibrating CMOS
  While drawing mask settings
  While drawing the valid range
  While setting the tilt correction
  While setting the height correction

Measurement Range
(Setting the CMOS measurement range)

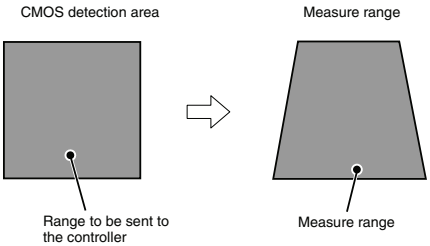
The data on the CMOS in the heads is sent to the controller for calculation.
Narrowing the actual measurement range under "Measure range" will reduce the size of the data sent from the CMOS and speed measurement time.

"Measurement range" (Page 1-7)

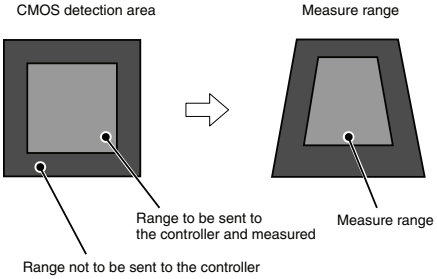


The CMOS detection area and measurement range

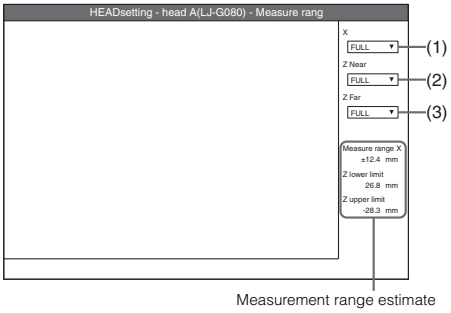
The laser light used in this device fans out as it travels to the target. An optical photoreceptor receives the light. Therefore, the rectangular CMOS detection area will take on a trapezoidal form as shown below.



The "Measure range" function allows the CMOS measurement range to narrowed step by step. The measurement range will be limited to match the limited CMOS range.



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Setting items

(1)X axis

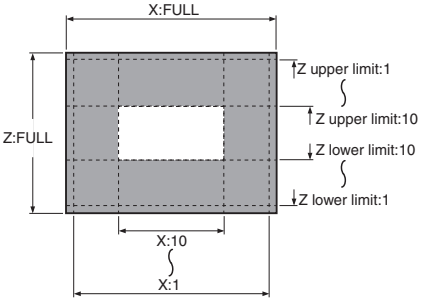
The measurement range of the X axis (width measurement) is narrowed equally on both sides.
Setting range: FULL, 1 to 10 (Default: FULL)

(2)Z axis upper limit

The range of measurement of the top (near) side in the Z direction (height measurement) is narrowed.
Setting range: FULL, 1 to 10 (Default: FULL)

(3)Z axis lower limit

The range of measurement of the bottom (far) side in the Z direction (height measurement) is narrowed.
Setting range: FULL, 1 to 10 (Default: FULL)



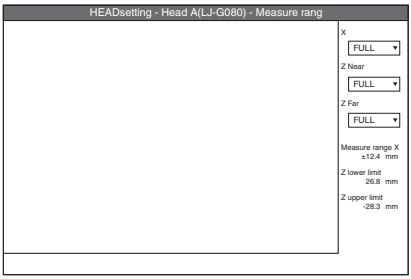
1 Select "Head A" or "Head B" under "Head setting" screen and press the [ENTER] key.

The setting screen for the selected head appears.
The setting items for "Head A" and "Head B" are the same.

"Head Settings" (Page 5-11)
"Head A / Head B Settings" (Page 5-18)

2 Select [Measure range] with the [△] and [▽] keys, then press the [ENTER] key.

The measurement range setting menu appears.



3 Set the target within the measurement area and display the CMOS image.

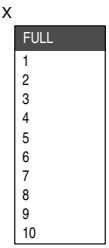
"Measurement range" (Page 1-7)
"Displaying the CMOS Image" (Page 5-18)

Reference

The measurement range can be set even without the CMOS image display.

4 Select [X] with the [△] and [▽] keys, then press the [ENTER] key.

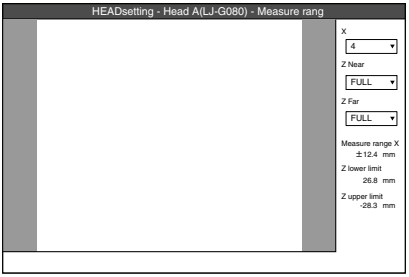
A pull-down menu appears.



5 Select a range with the [△] and [▽] keys, then press the [ENTER] key.

The measurement range is updated and the area that will not be measured turns green.
There is no effect on measurements made while reviewing the CMOS image and measurement range display.

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6 **Set "Z Near" and "Z Far."**

The settings are the same as for "X."

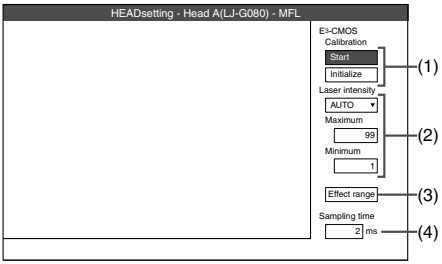
7 **Press the [ESCAPE] key to complete the "Measure range" settings.**

MFL

(Setting the sensing conditions to match the target)

This device determines the shape of the target by measuring the laser light reflected off of the target and received by the CMOS. The MFL function automatically makes the optimum operating conditions based on the shape and conditions (color, luster, and material) of the target surface. The MFL functions other than sampling time are not available when the ASAP trigger function is set to ON.

"ASAP trigger" (page 5-17)



Setting items

(1) CMOS calibration (Page 5-22)
Optimize the detection characteristics of the CMOS.

(2) Laser intensity (Page 5-23)
Adjust the intensity of the laser beam.

(3) Effective range (Page 5-24)
Set the effective range of the CMOS calibration and laser intensity.

(4) Sampling time (Page 5-25)
Set the time over which the CMOS will sample reflected light.

Displaying the MFL settings screen

1 **Select "Head A" or "Head B" under "Head setting" screen and press the [ENTER] key.**

The setting screen for the selected head appears. The setting items for "Head A" and "Head B" are the same.

"Head Settings" (Page 5-11)
"Head A / Head B Settings" (Page 5-18)

2 **Select [MFL] with the [△] and [▽] keys, then press the [ENTER] key.**

The MFL setting menu appears.

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Calibration
(Optimizing CMOS characteristics)

The CMOS calibration function optimizes the CMOS detection characteristics by measuring certain characteristics of the target before operation of the device. Reducing the profile alarm will stabilize measurement.

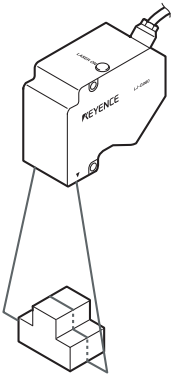
► Note

"Calibration" is not available when ASAP trigger function is set to ON.

"ASAP trigger" (page 5-17)

1 Set the target within the measurement area.

"Measurement range" (Page 1-7)

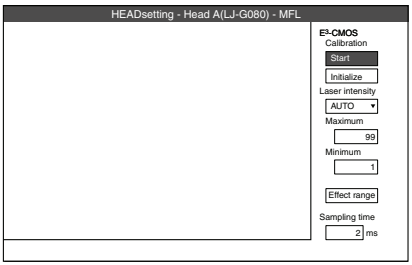


Reference

The laser will be activated by pressing the [TRG] key in step 4.

2 Display the MFL settings screen.

"Displaying the MFL settings screen" (Page 5-21)



3 Select [Start] on the calibration menu with the [△] and [▽] keys, then press the [ENTER] key.

The button will change to a stop button.
The device will enter a trigger-wait state for calibration.

4 Press the [TRG] key.

The laser will activate and there will be sampling to adjust the CMOS detection characteristics.

Reference

Move the target and press the [TRG] key multiple times to take multiple samples for optimal calibration.

5 Select [Stop] with the [△] and [▽] keys, then press the [ENTER] key.

The calibration ends and the optimal values are set.
Pressing "Cancel" will stop calibration.

- Calibration results can be confirmed.
- An error message will be displayed if calibration fails.

6 Press the [ESCAPE] key to complete the "MFL" settings.

■ Confirming calibration results

Calibration results can be confirmed via the CMOS image.

1 Calibration can be cancelled by pressing the "Stop" button.

"Calibration" (Page 5-22)

2 Press the [TRG] key.

The CMOS detection characteristics set by calibration are used to display the CMOS image and waveform (profile).

Reference

It takes several seconds after the [TRG] key is pressed for the result to be displayed.

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Initializing settings due to calibration

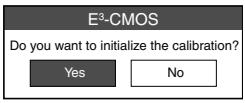
This resets the detection characteristics for the CMOS.

1 Display the MFL settings screen.

"Displaying the MFL settings screen" (Page 5-21)

2 Select [Initialization] with the [△] and [▽] keys, then press the [ENTER] key.

An initialization confirmation message appears.

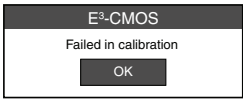


3 Select [Yes] and press the [ENTER] key.

The settings are initialized and the cursor returns to [Initialization].

■ When calibration fails

When calibration has been stopped by pressing the "Stop" button, an error message explaining that the calibration has failed will appear.



1 Pressing the [ENTER] key to close the message.

2 Confirm the cause and solutions to the problem, then calibrate again.

Cause: Target not loaded.
Solution: Correctly place the target in the measurement range.

"Measurement range" (Page 1-7)

Cause: The [TRG] key was not pressed after calibration started.
Sampling does not occur if the [TRG] key is not pressed, so settings cannot be optimized.
Solution: Refer to step 4 under "Calibration" and press the [TRG] key.

"Calibration" (Page 5-22)

Cause: The [TRG] key was not pressed enough.
There may not be enough information about the target to optimize the settings, based on the condition of the target.
Solution: Increase the number of times the [TRG] key is pressed after calibration starts.

Cause: The target has an area with very different reflectivity. The entire range cannot be measured at once.
Solution: Set the "Effective range" and set the calibration range.

"Effective range" (Page 5-24)

Laser intensity

(Setting the intensity of the laser light)

The intensity of the laser on this device can automatically adjust to the target while measuring. Set the intensity of the laser beam.

▶ Note

"Calibration" is not available when ASAP trigger function is set to ON.

"ASAP trigger" (page 5-17)

Setting items

■ Laser intensity

Setting range: AUTO / MANUAL (Default: AUTO)

- **AUTO**

  Automatically adjusts the light intensity to the optimum level. Select this in normal cases.

- **MANUAL**

  Adjust the laser intensity to be between the upper and lower intensity limits. Select this when the reflectivity of the target changes rapidly and drastically, or when only detection of the target is required. If the target has low reflectivity, increase the adjustment range. If the target has high reflectivity, decrease the adjustment range.

■ Maximum value

Set the upper adjustment limit when MANUAL is selected.

Setting range: 1 to 99 (Default: 99)

■ Minimum value

Set the lower adjustment limit when MANUAL is selected.

Setting range: 1 to 99 (Default: 32)

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Setting restrictions

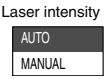
- The minimum and maximum value settings are available when laser intensity is set to MANUAL.
- Maximum value ≥ minimum value

1 **Display the MFL settings screen.**

"Displaying the MFL settings screen" (Page 5-21)

2 **Select [Laser intensity] with the [△] and [▽] keys, then press the [ENTER] key.**

A pull-down menu appears.



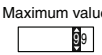
3 **Select [AUTO] or [MANUAL] with the [△] and [▽] keys, then press the [ENTER] key.**

Confirm the laser intensity.
If "AUTO" is selected, proceed to step 7.
If "MANUAL" is selected, proceed to step 4.

4 **Select [Max] with the [△] and [▽] keys, then press the [ENTER] key.**

The device goes into value entry mode.

"Entering a Value" (Page 2-5)

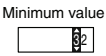


5 **Press the [ENTER] key after setting the maximum value.**

The maximum value is fixed.

6 **Select [Min] with the [△] and [▽] keys, then press the [ENTER] key.**

Set the minimum value by repeating the operations in steps 4 and 5.



7 **Press the [ESCAPE] key to complete the setting.**

Effective range

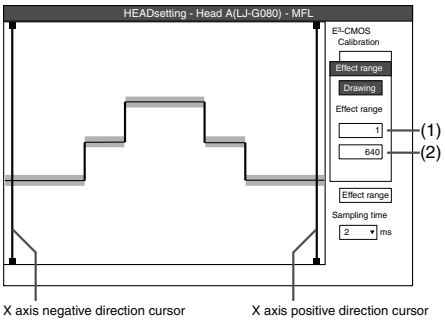
(Setting the effective range for adjustments)

The effective range of the CMOS calibration and laser intensity are controlled by "Effective range". If there is a part of the target that has very different reflective properties from the rest of the target, CMOS calibration and laser adjustment may not respond. In such a case adjust the measurement range from "Effective range" and measure again.

▶ Note

"Calibration" is not available when ASAP trigger function is set to ON.

"ASAP trigger" (page 5-17)



Setting items

(1) X axis negative direction

Setting range: 1 to 640 (Default: 1)

Set the effective range of the negative X direction (left side of the screen) .

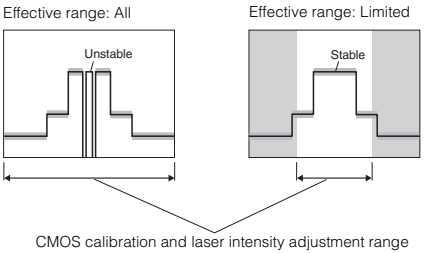
(2) X axis positive direction

Setting range: 1 to 640 (Default: 640)

Set the effective range of the positive X direction (right side of the screen) .

Setting restrictions

X axis negative < X axis positive



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1 **Display the MFL settings screen.**

"Displaying the MFL settings screen" (Page 5-21)

2 **Set the target within the measurement area and display the CMOS image.**

"Measurement range" (Page 1-7)
"Displaying the CMOS Image" (Page 5-18)

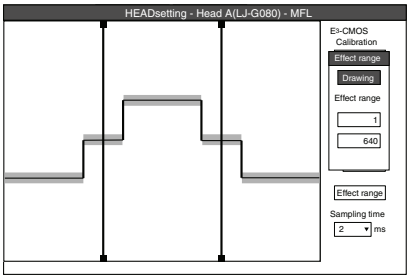
3 **Select [Effective range] with the [△] and [▽] keys, then press the [ENTER] key.**

The effective range specification cursor and window appear on the CMOS image.
In the default state, the specification cursor appears on the right and extreme left side of the CMOS image.

4 **Set the "Effective range" with the effective range cursor.**

There are two ways to set the cursor, "Drawing" and "Value input."

"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)



5 **Press the [ESCAPE] key to complete the cursor settings.**

Close the effective range window to make the effective range specification cursor disappear.

6 **Press the [ESCAPE] key to complete the setting.**

Sampling time
(Setting the CMOS sampling time)

The "Sampling time" is the time that the laser is activated and CMOS receives light.
For targets with low reflectivity, lengthen the sampling time to increase the amount of light hitting the photoreceptor.
For targets with high reflectivity, shorten the sampling time to decrease the amount of light hitting the photoreceptor.
Effective range: 0.3 ms, 1 to 10 ms (Default: 2ms)

"(3) Histogram display" (Page 5-18)

Reference

Setting a longer sampling time when ASAP trigger function is set to ON increases the number of samplings of the ASAP trigger function. The target with lower reflectivity can be handled.

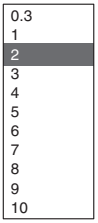
"ASAP trigger" (page 5-17)

1 **Display the MFL settings screen.**

"Displaying the MFL settings screen" (Page 5-21)

2 **Select [Sampling time] with the [△] and [▽] keys, then press the [ENTER] key.**

A pull-down menu appears.



3 **Select the sampling time with the [△] and [▽] keys, then press the [ENTER] key.**

Confirm the sampling time setting.

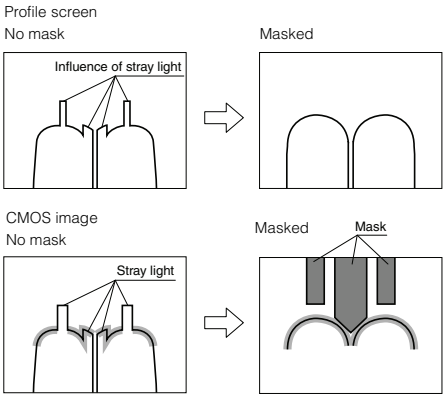
4 **Press the [ESCAPE] key to complete the setting.**

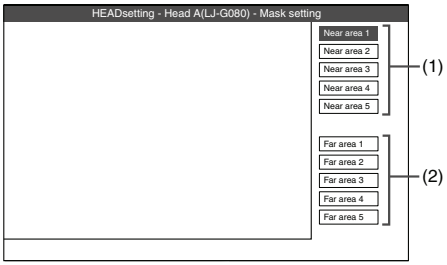
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Mask Setting

(Cancelling the effects of stray light)

Depending on the shape and surface condition of the target or the circumference of the measurement area, laser light from sources other than direct reflection from the target may hit the photoreceptor. This unnecessary light is called stray light. Stray light may prevent the shape of the target from being accurately determined.
"Mask setting" masks the stray light received by the CMOS, thus reducing its effect. This is set by defining the mask area on the CMOS image.





Setting items

(1) Top 1 through top 5

The mask area can be composed of up to 5 locations below the top of the CMOS image (the upper limit of the Z axis).
The shape of the mask area can be either a rectangle or a triangle.

(2) Bottom 1 through bottom 5

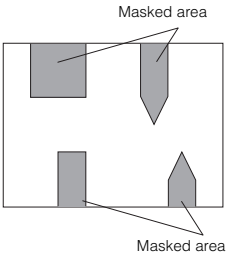
The mask area can be composed of up to 5 locations above the top of the CMOS image (the upper limit of the Z axis).
The shape of the mask area can be either a rectangle or a triangle.

The size of the mask area is set by coordinates on the CMOS image.

- X axis coordinate: 1 to 640
- Y axis coordinate: 1 to 480

"Measurement range" (Page 1-7)

CMOS image



1 Select "Head A" or "Head B" under "Head setting" screen and press the [ENTER] key.

The setting screen for the selected head appears. The setting items for "Head A" and "Head B" are the same.

"Head Settings" (Page 5-11)
"Head A / Head B Settings" (Page 5-18)

2 Select [Mask setting] with the [△] and [▽] keys, then press the [ENTER] key.

The mask setting menu appears.

3 Set the target within the measurement area and display the CMOS image.

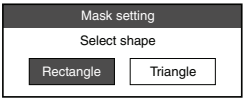
"Measurement range" (Page 1-7)
"Displaying the CMOS Image" (Page 5-18)

4 Select the mask selection area with the [△] and [▽] keys, then press the [ENTER] key.

Moving the cursor to a previously set mask area will cause the outline of that mask area to turn from light blue to blue.

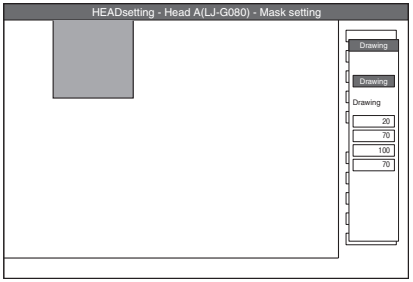
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- When selecting a new mask area, the shape selection window will open.
- If selecting a previously set area, proceed to step 6.



5 **Select a shape with the [◁] and [▷] keys, then press the [ENTER] key.**

The mask area and the drawing window appear.



Mask areas on the CMOS image can be drawn to mask unnecessary stray light.

"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

6 **Press the [ESCAPE] key to complete the mask area settings.**

The masked area will turn green when the drawing window is closed.

7 **Press the [ESCAPE] key to complete the setting.**

■ Clearing mask settings

Delete unnecessary mask areas.

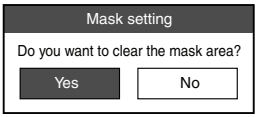
1 **Select the mask selection area to be cleared with the [△] and [▽] keys, then press the [ENTER] key.**

"Mask Setting" (Page 5-26)

The selected mask area will change from light blue to blue.

2 **Press the [ZERO] key**

A window prompting you to confirm that the mask area will be cleared .



3 **Select [Yes] and press the [ENTER] key.**

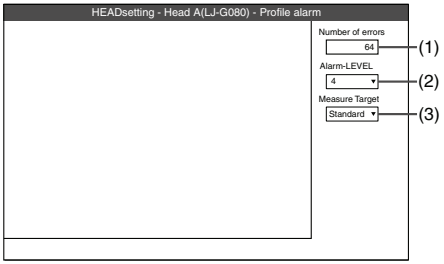
After the window is cleared, the display returns to the mask setting screen.

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Profile Alarm

(Setting the processing method for data that cannot be measured)

When measuring holes or slopes on the target, some parts may not be readable because of low light intensity or areas outside of the measurement range. Data that cannot be measured is called a profile alarm. The "Profile alarm" setting controls how data in profile alarms are handled.



Setting items

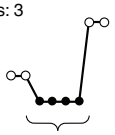
(1) Number of errors

Setting range: 0 to 255 (Default: 64)

A linear data interpolation will be created for data that has profile alarm status.
When the incident count is greater than or equal to the "amount of data with sequential profile alarms," a linear interpolation is created using the ends of the data. However, when both ends of the X axis are in a profile alarm status, the entire measurement will be a profile alarm.
When the incident count is less than or equal to the "amount of data with sequential profile alarms," the whole profile will be in an alarm status. This is ignored when the Number of errors is set to 255.

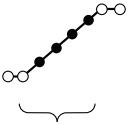
Example: when the profile alarm data count is 4

Number of errors: 3



Profile alarm data

Number of errors: 4



Replaced with linear interpolation data

○ : Normal measurement data

● : Non measurable data (Profile alarm))

(2) Alarm level

Setting range: 0 to 9 (Default: 4)
Sets the threshold level of the received light status to be judged as not measurable (profile alarm). This controls whether areas with unstable shapes becomes a profile alarm or not and whether measurement values will be displayed.
"0" is the least sensitive to the alarm, and "9" is the most sensitive.

► Note

Reducing this value will increase the influence of external and stray light.

(3) Measurement targets

Specify this in accordance with the shape and surface condition of the target to allow for more stable measurements.

Setting range: Normal (default) / first peak / multiple reflection

- **Normal**

  Select this setting for most cases.

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- **1st peak**

  If there are multiple peak absorbances detected, the one nearest the top (near side) of the Z axis will be measured.
  "Measurement range" (Page 1-7)

- **Multiple reflections**

  Use this when a varnished V portion or other feature causes multiple reflection and stray light.

1 **Select "Head A" or "Head B" under "Head setting" screen and press the [ENTER] key.**

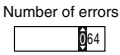
"Head Settings" (Page 5-11)
"Head A / Head B Settings" (Page 5-18)

2 **Select [Profile alarm] with the [△] and [▽] keys, then press the [ENTER] key.**

The program alarm setting screen appears.

3 **Select [Number of errors] with the [△] and [▽] keys, then press the [ENTER] key.**

The device goes into value entry mode.
"Entering a Value" (Page 2-5)

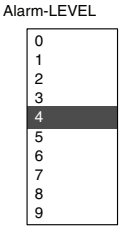


4 **Press the [ENTER] key after setting the incident count.**

The incident count is fixed.

5 **Select [Alarm-LEVEL] with the [△] and [▽] keys, then press the [ENTER] key.**

A pull-down menu appears.

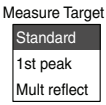


6 **Select the alarm cut level with the [△] and [▽] keys, then press the [ENTER] key.**

Fix the alarm cut level.

7 **Select [Measure Target] with the [△] and [▽] keys, then press the [ENTER] key.**

A pull-down menu appears.



8 **Select a target, then press the [ENTER] key.**

Confirm the target.

9 **Press the [ESCAPE] key to complete the setting.**

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Tilt Correction

(Correcting the slant of the X axis due to installation)

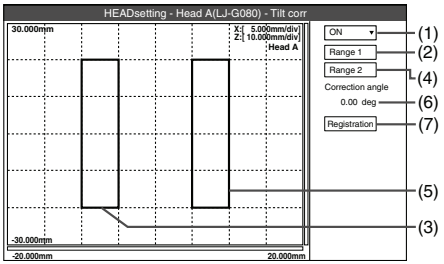
This corrects for slant in the X axis due to head placement or the measurement target.

"Installing the Head" (Page 1-10)

Reference

Use "Position corr" to correct for dispersion due to target placement during measurement.

"Position Adjustment" (Page 5-50)



Setting items

(1)Tilt correction

- **OFF (Default)**
  Do not correct for tilt.
- **ON**
  Correct for tilt.

(2) Range 1 button
Set the area correction range.

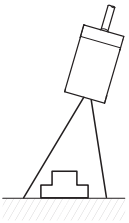
(3) Range 1 area
Displays the area of correction range 1.

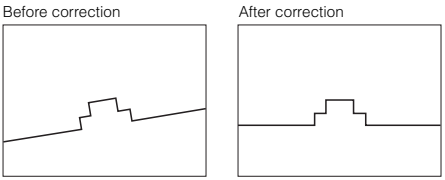
(4) Range 2 button
Set the area of correction range 2.

(5) Range 2 area
Displays the area of correction range 2.

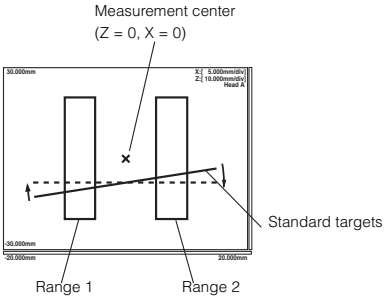
(6) Correction result
Displays the result of tilt correction.

(7) Registration button
Registers the tilt correction.





"Tilt correction" uses a measurement of a standard target to make corrections. The fit line calculated from the data within range 1 or range 2 is rotated to be horizontal. The measurement center is used as the pivot for rotation.



Correction range: -10° to 10° (Default: 0.00°)

▶ Note

- Errors due to dead zones are not corrected.
  "Installations for specific targets" (Page 1-11)
- When tilt correction effects the Z axis measurement value, near side count is used as the measurement value.
- The registered correction value (fixed value) is used to correct for tilt.
- Measurement time will increase.

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1 **The target used as a standard for tilt correction should be set in the measurement range.**

"Measurement range" (Page 1-7)

2 **Select "Head A" or "Head B" under "Head setting" screen and press the [ENTER] key.**

The setting screen for the selected head appears. The setting items for "Head A" and "Head B" are the same.

"Head Settings" (Page 5-11)
"Head A / Head B Settings" (Page 5-18)

3 **Select [Tilt correction] with the [△] and [▽] keys, then press the [ENTER] key.**

The "Tilt correction" screen appears.
The menu can be used from the "Tilt correction" screen.

"Display Setting Menu" (Page 3-9)

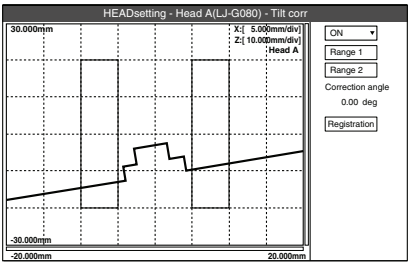
4 **Select whether tilt correction will be ON or OFF with the [△] and [▽] keys, then press the [ENTER] key.**

A pull-down menu appears.



5 **Select [ON] with the [△] and [▽] keys, then press the [ENTER] key.**

Setting items will become available and the correction range area will be displayed.



6 **Press the [TRG] key multiple times.**

Activate the laser to begin sampling.
The pre-correction outline will be displayed in yellow.

7 **Select "Range 1" with the [△] and [▽] keys, then press the [ENTER] key.**

The area of range 1 will appear in orange and the drawing window will appear.

8 **Draw the area of "Range 1."**

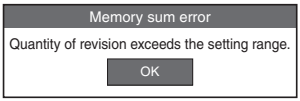
Set the area size and position to match the target.

"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

9 **Draw the area of "Range 2" as in steps 7 and 8.**

10 **Select [Registration] with the [△] and [▽] keys, then press the [ENTER] key.**

The correction will be fixed and the corrected profile will be displayed in red.
A setting error will be displayed if the correction range is exceeded. Adjust the head installations and correct for tilt again.



11 **Press the [ESCAPE] key to complete the "Tilt correction" settings.**

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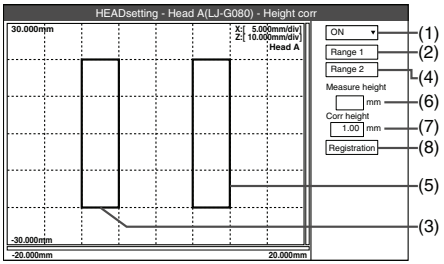
Height Correction
(Correcting the slant of the Z axis due to installation)

This corrects for height differences on the Z axis due to head placement or the measurement target.

Reference

- Height correction occurs after tilt correction.
- Use "Position corr" to correct for dispersion due to target placement during measurement.

"Position Adjustment" (Page 5-50)



Setting items

(1) Height correction
- **OFF (Default)**
  Do not correct for height differences.
- **ON**
  Correct for height differences.

(2) Range 1 button
Set the area correction range.

(3) Range 1 area
Displays the area of correction range 1.

(4) Range 2 button
Set the area of correction range 2.

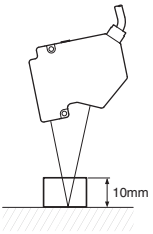
(5) Range 2 area
Displays the area of correction range 2.

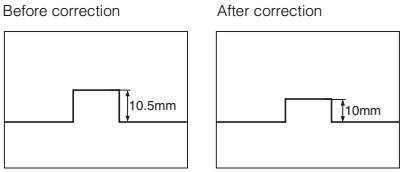
(6) Measured height
This displays the height before correction.

(7) Corrected height
This sets the height after correction.

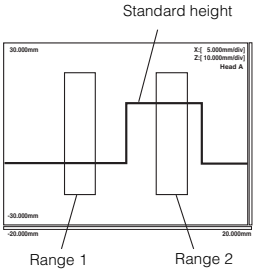
Setting range: 0 to 999.99 mm (Default: 1,000 mm)

(8) Register button
Registers the height correction.





"Height corr" uses a measurement of a target of known standard target to make corrections. The difference (height) between the average heights of "Range 1" and "Range 2" is used as the "Corr height" correction factor.



Correction range 0 to 10mm (Default: 1mm)

► Note

The registered correction value (fixed value) is used to correct the height.

1 The height difference used as the height correction standard is set within the measurement range.

"Measurement range" (Page 1-7)

2 Select "Head A" or "Head B" under "Head setting" screen and press the [ENTER] key.

The setting screen for the selected head appears. The setting items for "Head A" and "Head B" are the same.

"Displaying the Head Settings Screen" (Page 5-11)
"Head A / Head B Settings" (Page 5-18)

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3 **Select [Height corr] with the [△] and [▽] keys, then press the [ENTER] key.**

The height correction screen appears.
The menu can be used from the height correction screen.
"Display Setting Menu" (Page 3-9)

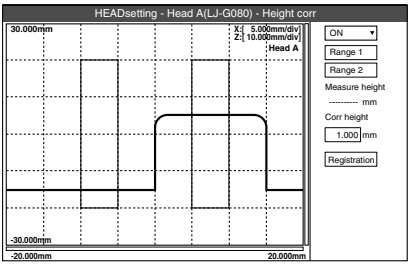
4 **Select whether height correction will be ON or OFF with the [△] and [▽] keys, then press the [ENTER] key.**

A pull-down menu appears.



5 **Select [ON] with the [△] and [▽] keys, then press the [ENTER] key.**

Setting items will become available and the correction range area will be displayed.



6 **Press the [TRG] key multiple times.**

Activate the laser to begin sampling.
The pre-correction outline will be displayed in yellow.

7 **Select "Range 1" with the [△] and [▽] keys, then press the [ENTER] key.**

The area of range 1 will appear in orange and the drawing window will appear.

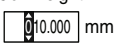
8 **Draw the area of "Range 1."**

Set the area size and position to match the target.
"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

9 **Draw the area of "Range 2" as in steps 6 and 7.**

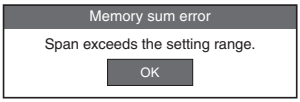
10 **Select [Corr height] with the [△] and [▽] keys, then press the [ENTER] key.**

Enter the corrected height.
For example, if the difference between the average of range 1 and the average of range 2 is 10 mm, the corrected height will be 10.000.
"Entering a Value" (Page 2-5)



11 **Select [Registration] with the [△] and [▽] keys, then press the [ENTER] key.**

The correction will be fixed and the corrected waveform will be displayed in red.
A setting value error will be displayed if the correction range is exceeded.
Adjust the installation of the heads. Alternatively, check the dimensions of the height difference. Then perform height correction again.



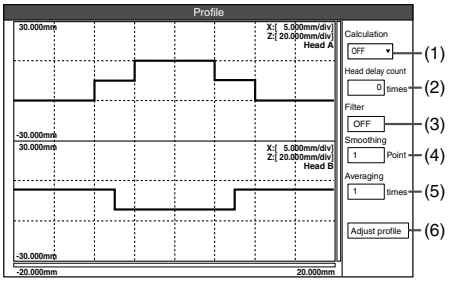
12 **Press the [ESCAPE] key to complete the "Height corr" settings.**

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Profile Settings
(Setting the profile processing conditions)

Profile settings are the settings that control calculation of profiles from head A and head B as well as profile stabilization.

"Measurement Conditions and Measurement Data Flow" (Page 5-2)
"Setting the Measurement Conditions to Meet Your Needs" (Page 5-3)
"List of setting ranges and default values for profile settings" (Page 5-5)



Setting items

(1) "Calculations" (page 5-35)
The calculates the difference between the profiles from heads A and B.

(2) "Head Delay Count" (page 5-41)
The calculates the difference between the sampling from heads A and B.

(3) "Filter" (page 5-42)
This removes noise from the profile.

(4) "Smoothing" (page 5-42)
This averages the profile along the X-axis.

(5) "Averaging" (page 5-43)
This averages the difference between profiles.

(6) "Profile Correction" (page 5-44)
This calculates the differences between the coordinate systems of profiles from heads A and B.

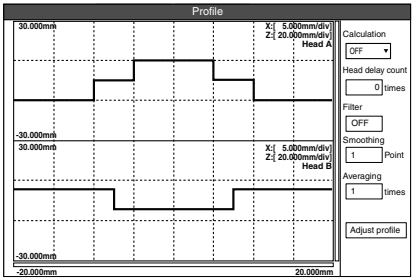
Displaying the Profile Settings Screen

1 Use the Prog/Run switch to display the settings screen.

"Settings screen" (Page 2-1)

2 Select [Profile] with the [△] and [▽] keys, then press the [ENTER] key.

The profile settings screen will be displayed and the cursor will move to "Calculation."



Reference

- Sampling occurs and a profile is displayed when the [TRG] key is pressed.
- The profile can be enlarged, shrunk or moved within the display settings menu.

"Display Setting Menu" (Page 3-9)

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Calculations
(Calculating the distance between profiles)

Calculations compares the profiles of heads A and B, then creates a post-calculation profile. It is possible to measure widths, thicknesses, heights and differences that cannot be measured with one head.
There are six types of calculations.

Setting range

- **OFF** (Page 5-35) (Default)
  No calculation is performed.
- **A+B** (Page 5-36)
  This adds the head A profile and the head B profile.
- **A-B** (Page 5-37)
  This subtracts the head A profile and the head B profile.
- **Wide** (Page 5-38)
  This lines up the profiles from heads A and B, then creates a single, connected post-calculation profile.
- **Linking (H)** (Page 5-39)
  This displays the profiles from heads A and B lined up horizontally.
- **Linking (V)** (Page 5-39)
  This displays the profiles from heads A and B lined up vertically.

► Note

- When calculation is not set to OFF, the trigger synchronization setting is ignored and operation continues with the triggers synchronized.
- The calculation settings are ignored when there is only 1 head connected.
- Changing the calculation settings voids all previous calculation settings.

"Function Limits and Selecting Setting Items" (Page 5-10)

OFF

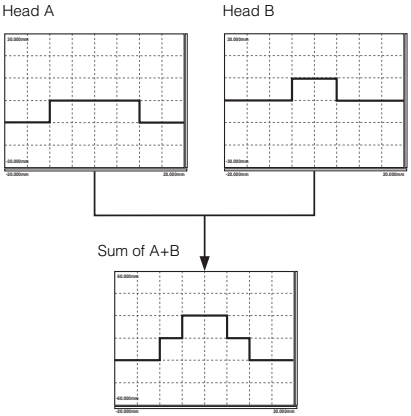
There are no calculations when calculation is turned OFF.

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A+B

This adds the profiles from heads A and B, then creates a post-calculation profile.

"Overview of Measurement Modes" (Page 5-67)



Reference

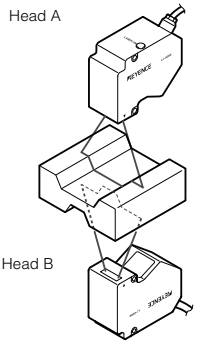
- The calculation of profiles from heads A and B can occur at the same time as profile correction. This corrects any discrepancies caused by head installation direction or misalignment slip.
  "Profile Correction" (Page 5-44)
- Adjustments required because heads A and B are installed on an incline are carried out in tilt and height correction.
  "Tilt Correction" (Page 5-30)
  "Height Correction" (Page 5-32)

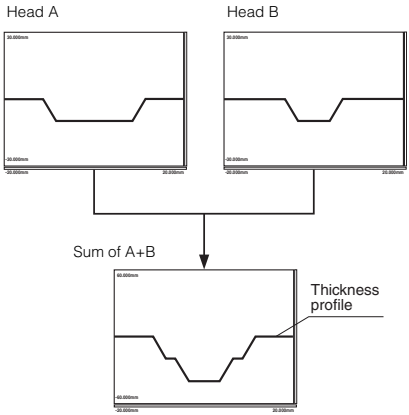
Measurement example:

Thickness profile measurement

The target is inserted between heads A and B and the thickness profile is measured.

"Overview of Measurement Modes" (Page 5-67)





Reference

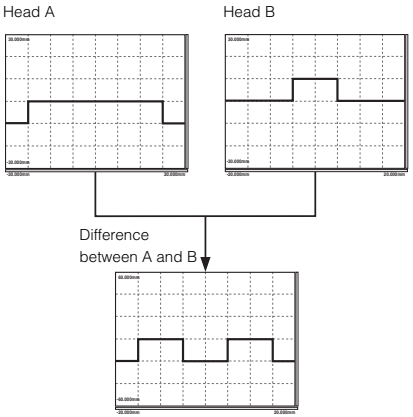
- The profile shown for head B in the diagram is the post-adjustment profile.
  "Profile Correction" (Page 5-44)
- When measuring the thickness, set the measurement mode to "Height".
  Thickness adjustment for a master workpiece uses the auto-offset function.
  "Height" (Page 5-83)
  "Auto-offset" (Page 3-16)

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A-B

This subtracts the profile of head B from that of head A, then creates a post-calculation profile.

"Overview of Measurement Modes" (Page 5-67)



Reference

- The calculation of profiles from heads A and B can occur at the same time as profile adjustment. This corrects any discrepancies caused by head installation direction or misalignment slip.

  "Profile Correction" (Page 5-44)
- Corrections required because heads A and B are installed on an incline are carried out in tilt and height correction.

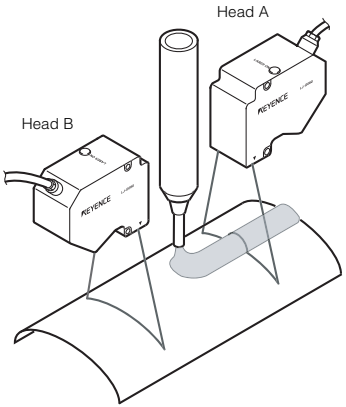
  "Tilt Correction" (Page 5-30)

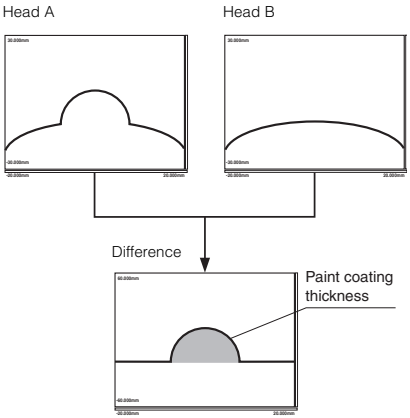
  "Height Correction" (Page 5-32)

Measurement example:

Paint coating thickness measurement

This is an example of measuring the thickness of a coat of paint applied to a surface. The profile of the unpainted surface (head B) is subtracted from the profile of the painted surface (head A).





Reference

- The profile shown for head B in the diagram is the post-adjustment profile.

  "Profile Correction" (Page 5-44)
- Set "Cross-Sectional Area" for the measurement mode.

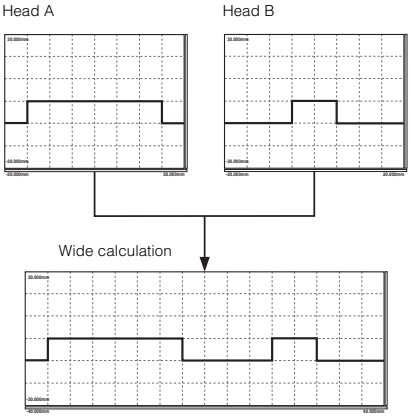
  "Cross-Sectional Area" (Page 5-89)

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Wide

This lines up the profiles from heads A and B, then creates a single, connected post-calculation profile.
When wide is selected, the range of the X-axis is doubled and the zero point becomes the boundary between heads A and B.

"Overview of Measurement Modes" (Page 5-67)



* This is an image used only to clarify the wide function. The actual size of the display is not changed.

► Note

The data in the area where the measurement areas of head A and B are not overlapped is alarm. To eliminate the alarm part, set the X correction of the profile correction function. The profile alarm function cannot be used.

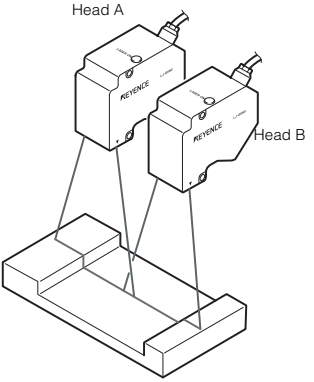
"Measurement range" (Page 1-7)
"Profile Correction" (Page 5-44)
"Profile Alarm" (Page 5-28)

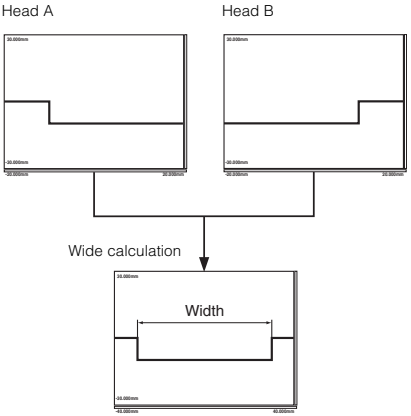
Reference

- The calculation of profiles from heads A and B can occur at the same time as profile adjustment. This corrects any discrepancies caused by head installation direction or misalignment slip.
  "Profile Correction" (Page 5-44)
- Corrections required because heads A and B are installed on an incline are carried out in tilt and height correction.
  "Tilt Correction" (Page 5-30)
  "Height Correction" (Page 5-32)

Measurement example:
Measuring the width of two heads

This example demonstrates the use of two heads to measure a target that is wider than the measurement range of a single head.





Reference

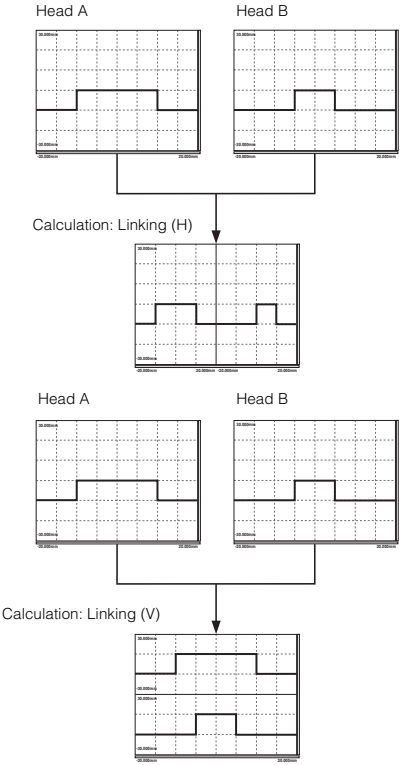
- The profile shown for head B in the diagram is the post-adjustment profile.
  "Profile Correction" (Page 5-44)
- Set "Width" for the measurement mode.
  "Width" (Page 5-86)

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Linking (H) / Linking (V)

This displays the profiles from heads A and B lined up either vertically or horizontally. This calculates the difference between the profiles from heads A and B, then measures in the selected measurement mode. The measurement modes that allow the difference between profiles to be calculated are step, width and center point.

"Overview of Measurement Modes" (Page 5-67)

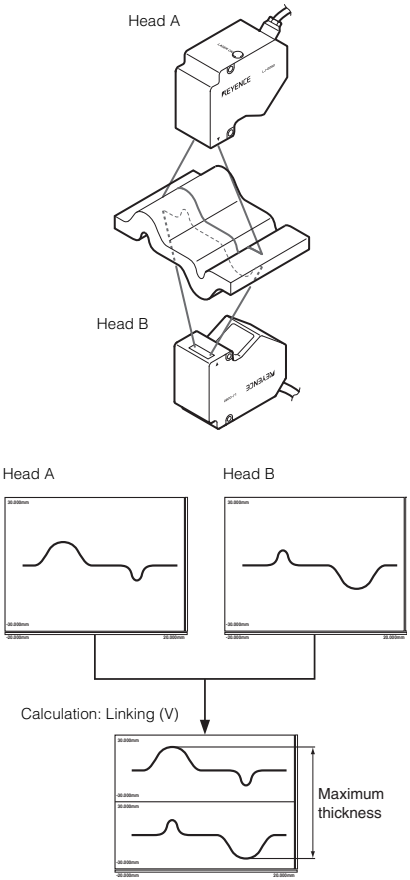


Reference

- The calculation of profiles from heads A and B can occur at the same time as profile adjustment. This corrects any discrepancies caused by head installation direction or misalignment slip.
  "Profile Correction" (Page 5-44)
- Corrections required because heads A and B are installed on an incline are carried out in tilt and height correction.
  "Tilt Correction" (Page 5-30)
  "Height Correction" (Page 5-32)

Measurement example:
Maximum thickness measurement

The target is inserted between heads A and B and the maximum thickness is measured.



Reference

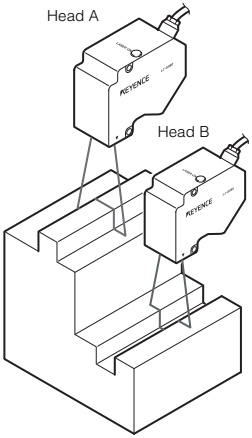
- The profile shown for head B in the diagram is the post-adjustment profile.
  "Profile Correction" (Page 5-44)
- Set "Step" for the measurement mode.
  "Step" (Page 5-85)

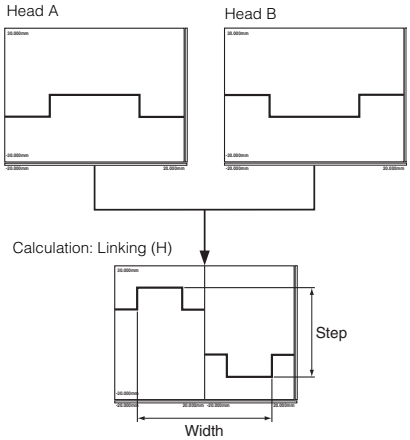
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Measurement example:

Width and step measurement with two heads

The target is positioned away from heads A and B and the width and step value of the target are measured.





Reference

Select "Width" and "Step" for the measurement mode.

"Width" (Page 5-86)

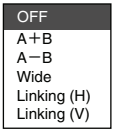
"Step" (Page 5-85)

1 **Display the "Profile setting" screen.**

"Displaying the Profile Settings Screen" (Page 5-34)

2 **Select [Calculation] with the [△] and [▽] keys, then press the [ENTER] key.**

The pull-down menu appears.



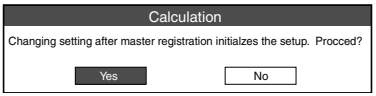
3 **Select a calculation method with the [△] and [▽] keys, then press the [ENTER] key.**

An initialization conformation message appears. The master registration, position correction and OUT settings are initialized.

"Master Registration" (Page 5-48)

"Position Adjustment" (Page 5-50)

"OUT Settings" (Page 5-65)



4 **Select [Yes] and press the [ENTER] key.**

The calculation will be fixed and the post-calculation profile will be displayed.

5 **Press the [ESCAPE] key to finish.**

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Head Delay Count

(Calculating the difference between the sampling from heads A and B)

"Head delay count" can only be calculated when two heads are connected. This feature allows the profile from head A and the profile from head B to be measured from the same measurement location. When sampling the profiles from heads A and B, calculations are based on measurements of a specified position, measured in terms of the time between when that position is read by head A and when it is read by head B, rather than being based on the measurements taken at the same time. The profile from head A is used as the standard and measurements from head B are delayed.
Setting range: 0 to 1023 times (Default: 0)

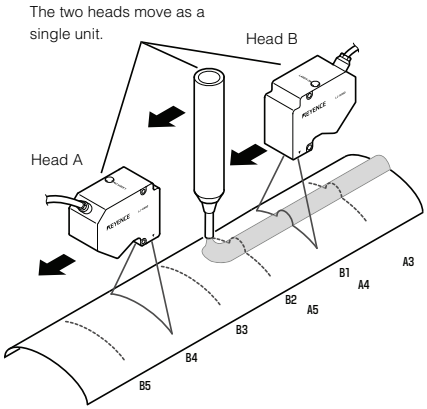
Measurement example:

Paint coating thickness measurement

Head A, head B and the nozzle move as a single unit. Head A will read a position 3 measurements after head B reads the base surface at the same position. This allows measurements of one position to be used when calculating the profile.

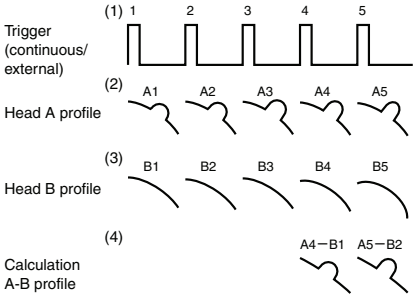
Reference

The head delay can be set to a maximum of 1023. Set this to match the distance between heads A and B as well as the speed a which they move.



Profiles A3 through A5 are measured as head A moves. Profiles B1 through B5 are measured as head B moves. A3 is sampled at the same time as B3. A4 is sampled at the same time as B4 and A5 is sampled at the same time as B5.

Head Delay Count: 3



(1) Sampling begins with input from the trigger (continuous or remote).
(2)The profile for head A is measured.
(3)The profile for head B is measured.
(4)The profile from head B (B1, removed by a number of measurements corresponding to the head delay value) and the profile from head A (A4) are calculated.

1 Display the "Profile setting" screen.

"Displaying the Profile Settings Screen" (Page 5-34)

2 This occurs when "Calculation" is not set to "OFF."

"Calculations" (Page 5-35)

► Note

Selecting "OFF" precludes the head delay from being set.

3 Select [Head delay count] with the [△] and [▽] keys, then press the [ENTER] key.

The device enters the value input state.



4 Input a "Head delay count" and press the [ENTER] key.

"Entering a Value" (Page 2-5)

The head delay count is fixed.

5 Press the [ESCAPE] key to complete the setting.

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Stabilizing Profiles

Depending on the shape and surface conditions of the target, the "filter," "smoothing" and "averaging" settings can be used to stabilize the profile.

Filter

(Removes noise from the profile)

Setting the "Filter" on a profile removes abnormal values and noise.

Setting range: OFF / F1 / F2 (Default: F1)

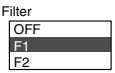
- **OFF**
  The filter is not used.
- **F1**
  5-point median processing is carried out.
- **F2**
  5-point median processing is carried out and the flat areas are smoothed.

1 **Display the "Profile setting" screen.**

"Displaying the Profile Settings Screen" (Page 5-34)

2 **Select [Filter] with the [△] and [▽] keys, then press the [ENTER] key.**

A pull-down menu appears.



3 **Select a filter setting with the [△] and [▽] keys, then press the [ENTER] key.**

The filter selection is fixed.

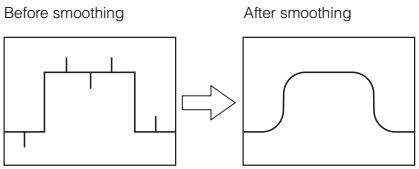
4 **Press the [ESCAPE] key to complete the setting.**

Smoothing

(Averaging a profile along the X-axis)

Smoothing takes the data for each point on the X-axis of a single sampling and uses it to compute a moving average.
Increasing the smoothing number will not change the response time, but will increase the resemblance of the smoothed profile to the original profile.

Setting range: 1 / 2 / 4 / 8 / 16 / 32 / 64 (Default: 8)

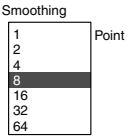


1 **Display the "Profile setting" screen.**

"Displaying the Profile Settings Screen" (Page 5-34)

2 **Select [Smoothing] with the [△] and [▽] keys, then press the [ENTER] key.**

A pull-down menu appears.



3 **Select a smoothing setting with the [△] and [▽] keys, then press the [ENTER] key.**

This fixes the smoothing count.

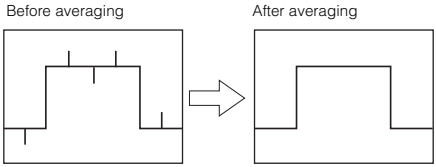
4 **Press the [ESCAPE] key to complete the setting.**

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Averaging
(Averaging multiple profiles)

Averaging takes the average of each point along the X-axis after a set number of profiles have been sampled. The setting range for averaging varies depending on the multiple trigger setting.

"Multiple Trigger" (Page 5-15)
"Function Limits and Selecting Setting Items" (Page 5-10)



When multiple trigger is OFF.

Setting range: 1 / 2 / 4 / 8 / 16 / 32 / 64 (Default: 1)
Averaging is not carried out if the range is set to 1. Specifying a larger averaging value does not change the resemblance of the averaged profile to the originals, but it will increase the response time.

When multiple trigger is ON.

Setting range: OFF / ON (Default: OFF)

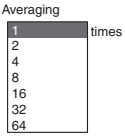
- **OFF**
  No averaging is carried out. Used in combination with the measurement mode settings.
  "Comparative Measurement Mode" (Page 5-103)
- **ON**
  Averaging is carried out over the number of samples specified in "Sampling count" under "Multiple trigger."

1 **Display the "Profile setting" screen.**

"Displaying the Profile Settings Screen" (Page 5-34)

2 **Select [Averaging] with the [△] and [▽] keys, then press the [ENTER] key.**

A pull-down menu appears.



3 **Select an averaging value with the [△] and [▽] keys, then press the [ENTER] key.**

This fixes the averaging count.

4 **Press the [ESCAPE] key to complete the setting.**

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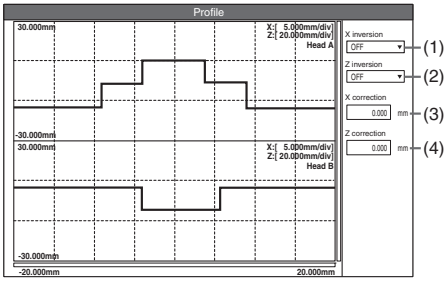
Profile Correction
(Adjusting the coordinate systems of heads A and B)

"Adjust profile" adjusts any discrepancies in the respective coordinate systems used by head A and head B caused by head installation or misalignment.
"Adjust profile" adjusts the profile from head B to match that of head A.

► Note

When the "Calculation" profile setting is OFF, the profile adjustment setting is ignored and no profile adjustment is carried out.

"Calculations" (Page 5-35)



Setting items

(1) X inversion (Page 5-44)
The X-axis of the profile from head B is inverted.

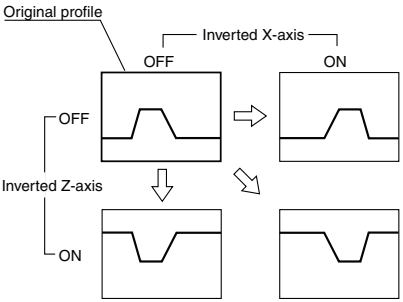
(2) Z inversion (Page 5-44)
The Z-axis of the profile from head B is inverted.

(3) X correction (Page 5-44)
A moving average of the profile from head B is calculated in the X direction.

(4) Z correction (Page 5-44)
A moving average of the profile from head B is calculated in the Z direction.

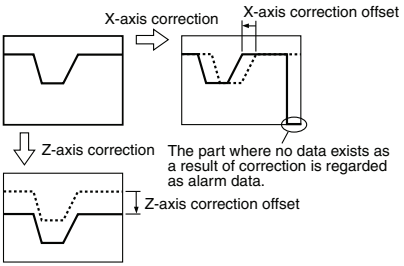
Inverted X-axis / inverted Z-axis

X-axis or Z-axis of the profile from head B is inverted.
Setting range: OFF/ ON (Default: OFF)



X correction / Z correction

The moving average of the profile from head B is computed along the X-axis or the Z-axis.
Setting range: Within the head measurement range (Default: 0 mm)



► Note

When "Wide" is selected in the Calculation function, the data in the area where the measurement areas of head A and B are not overlapped is alarm. To eliminate the alarm part in the gap, set the X correction.

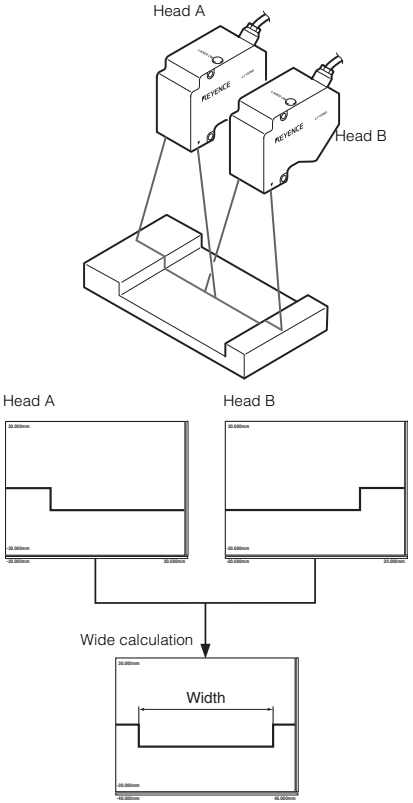
"Measurement range" (Page 1-7)
"Wide" (Page 5-38)

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Examples: Profile correction

Example 1:

"Measurement example: Measuring the width of two heads" (Page 5-38)



■ X inversion:OFF

Not used because the coordinate systems of the X-axes are in the same direction.

■ Z inversion:OFF

Not used because the coordinate systems of the Z-axes are in the same direction.

■ X correction:

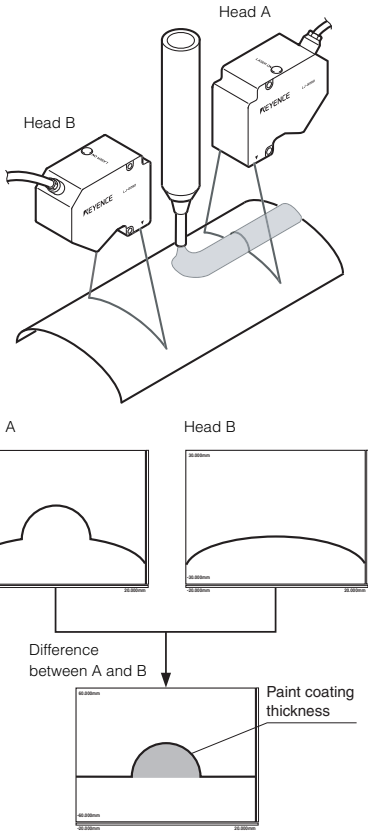
In use. This eliminates the alarm part in the gap between the profiles of head A and B, or reduces the overlapped part.

■ Z correction:

Use this when the profiles from heads A and B are not aligned in the Z direction.

Example 2:

"Measurement example: Paint coating thickness measurement" (Page 5-37)



■ X inversion: ON

The X-axis of the profile from head B is inverted because head B is facing head A.

■ Z inversion:OFF

Not used because the coordinate systems of the Z-axes are in the same direction.

■ X correction:

In use. Adjust the X-axes of the two coordinate systems so that they are aligned.

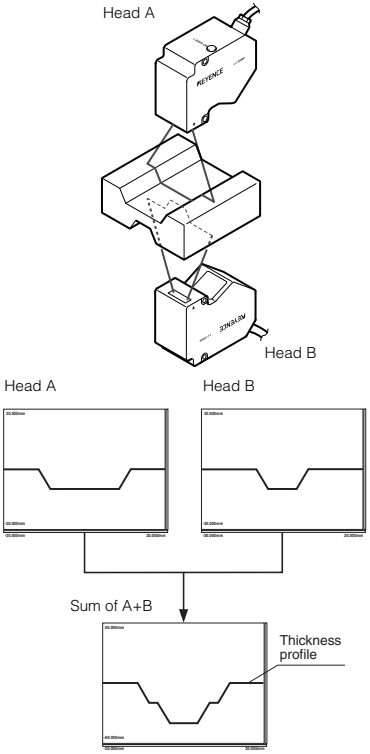
■ Z correction:

Use this when the profiles from heads A and B are not aligned in the Z direction.

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Example 3:

"Measurement example: Thickness profile measurement" (Page 5-36)



■ **X inversion: ON**

The X-axis of the profile from head B is inverted because head B is facing head A.

■ **Z inversion:OFF**

Set this to off so that increases in thickness for heads A and B do not result in a shift in the Z-axis.

■ **X correction:**

In use. Adjust the X-axes of the two coordinate systems so that they are aligned.

■ **Z correction:**

Adjust the zero point of Z-axis for head B so that the post-calculation thickness can be measured properly.

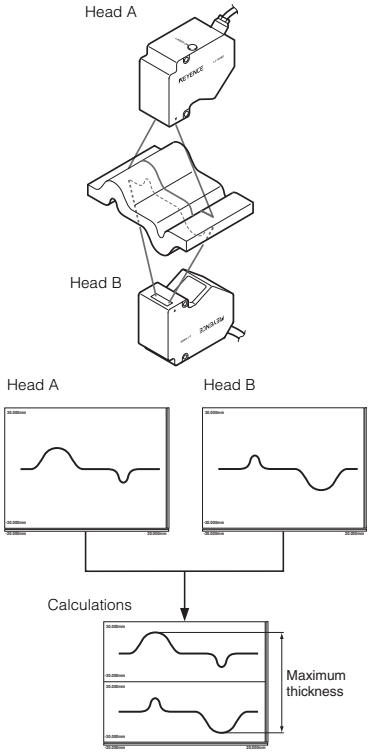
Reference

Correction can be handled by the auto-offset function if Z direction correction is not set.

"Auto-offset" (Page 3-16)

Example 4:

"Measurement example: Maximum thickness measurement" (Page 5-39)



■ **X inversion: ON**

The X-axis of the profile from head B is inverted because head B is facing head A.

■ **Z inversion: ON**

The Z-axis of head B is inverted to align with the Z-axis of head A.

■ **X correction:**

In use. Adjust the X-axes of the two coordinate systems so that they are aligned.

■ **Z correction:**

Not required. Thickness adjustment for a master workpiece uses the auto-offset function.

"Auto-offset" (Page 3-16)

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1 **Display the "Profile setting" screen.**

"Displaying the Profile Settings Screen" (Page 5-34)

2 **This occurs when "Calculation" is not set to "OFF."**

"Calculations" (Page 5-35)

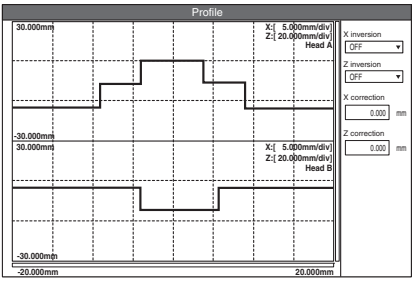
Note

Profile correction cannot be set if "Calculation" is set to "OFF."

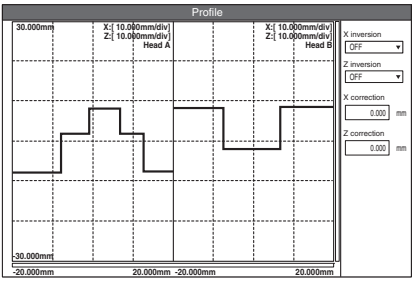
3 **Select [Adjust profile] with the [△] and [▽] keys, then press the [ENTER] key.**

The profile correction screen appears. The screen layout varies depending on the calculation settings.

For sum, difference or Linking (V)

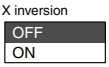


For wide or Linking (H)



4 **Select [X inversion] with the [△] and [▽] keys, then press the [ENTER] key.**

A pull-down menu appears.



5 **Select [OFF] or [ON] with the [△] and [▽] keys, then press the [ENTER] key.**

The selection is fixed. When "ON" is selected, the profile from head B is displayed with an inverted X-axis.

6 **Set "Z inversion."**

The steps for making these settings are the same as for setting "X inversion."

7 **Select "X correction" with the [△] and [▽] keys, then press the [ENTER] key.**

The device enters the value input state.

"Entering a Value" (Page 2-5)



8 **Input the "X correction," then press the [ENTER] key.**

Once the X direction correction is set, the profile from head B is displayed shifted along the X-axis.

9 **Set "Z correction."**

The steps for making these settings are the same as for setting "X correction."

10 **Press the [ESCAPE] key to complete the setting.**

Reference

- Press the [SCREEN] key to confirm the pre-adjustment and post-adjustment profiles. Each time the [SCREEN] button is pressed, the display alternates between the two profiles.
- Press the [MENU] key to display the display operation menu. Display contents: "Zoom in/out, move display range, auto-adjust, display initial value"

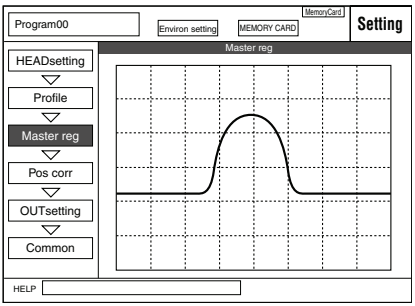
"Display Setting Menu" (Page 3-9)

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Master Registration
(Registering the profile of the target to be used as the measurement standard)

Measure the object to be used as the measurement standard (master target). The waveform (profile) from this measurement is registered. This is called "Master reg."
The recorded profile is called the master profile.
The master profile becomes the standard for measurement mode settings and position correction.

"Measurement Mode (Setting measurement conditions)" (Page 5-67)
"Position Adjustment" (Page 5-50)
"Measurement Conditions and Measurement Data Flow" (Page 5-2)
"Setting the Measurement Conditions to Meet Your Needs" (Page 5-3)
"List of setting ranges and default values for registering a master" (Page 5-5)



Measurements that require a master profile

A master profile is required for taking the following measurements.

- Measurements that use "Pos corr"
- Measurements made when any of the following selections are made under "Measurement mode"
  Profile comparison 1
  Profile comparison 2
  Profile tracking 1
  Profile tracking 2

"Position Adjustment" (Page 5-50)
"Measurement Mode (Setting measurement conditions)" (Page 5-67)

Settings that require a master profile

A master profile is required for using the following settings.

- Drawing an area with "Measurement mode"

"Measurement Mode (Setting measurement conditions)" (Page 5-67)

Registering a Master

1 Set the target to be used as the standard (masterwork) within the measurement area.

"Measurement range" (Page 1-7)

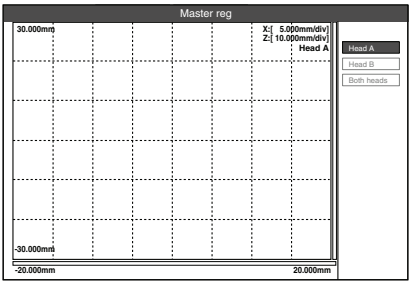
2 Use the [Prog/Run] switch to display the settings screen.

"Settings screen"(Page 2-1)

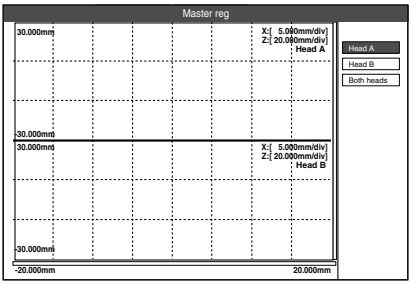
3 Select "Master reg" with the [△] and [▽] keys, then press the [ENTER] key.

A "Master reg" screen corresponding to the number of heads connected and the calculation setting appears. The cursor moves to the register button on a recordable profile.

- When there is one 1 head

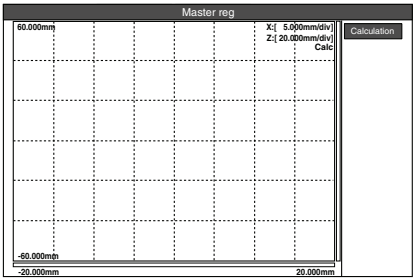


- When there are 2 heads and calculation is OFF

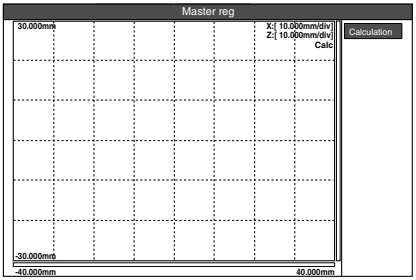


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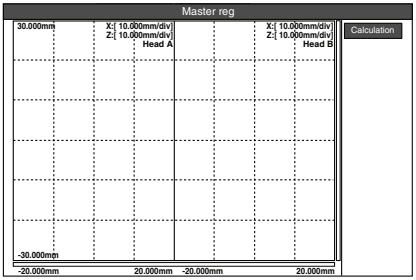
- When there are 2 heads and calculation is set to sum or difference



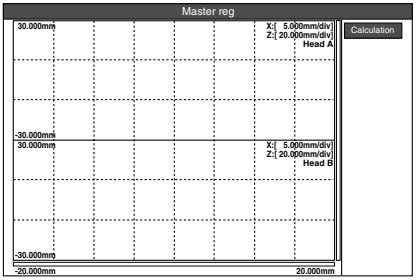
- When there are 2 heads and calculation is set to wide



- When there are 2 heads and calculation is set to Linking (H)



- When there are 2 heads and calculation is set to Linking (V)



4 Press the [TRG] key multiple times to take a measurement.

The measured waveform (profile) will be displayed in yellow.
If there are no error messages, proceed to step 5.
If there is an error message, change the waveform stabilization settings or the installation settings and measure again.

"Installing the Head" (Page 1-10)
"Head A / Head B Settings" (Page 5-18)
"Profile Settings" (Page 5-34)

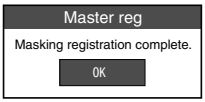
5 Use the [△] and [▽] keys to move the cursor to the register button for the head that will be registered.

- Register: Head A
- Register: Head B
- Register: Both heads
- Register: After calculation

Select one of the above.

6 Press the [ENTER] key.

The waveform is registered and a waveform registration confirmation window appears.
The profile registered as the master profile appears in red.



7 Press the [ENTER] key to close the window.

8 Press the [ESCAPE] key to complete master registration.

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Position Adjustment
(Correcting the position of the target and measuring)

Overview of Position Adjustment

If there is a variation in the target position (position slip), correct measurements may not be possible because the target may have moved out of the measurement area. "Pos corr" corrects the difference between the target and the master profile via the internal controller and allows correct measurements when there is position slip.

"Measurement Conditions and Measurement Data Flow" (Page 5-2)
"Setting the Measurement Conditions to Meet Your Needs" (Page 5-3)
"List of setting ranges and default values for position correction" (Page 5-6)

► Note

- Errors due to dead zones in the target are not corrected.
  "Installing the Head" (Page 1-10)
- The measurement time and trigger delay will increase.
  "Trigger Interval and Measurement Time" (Page 10-21)
- The display in the measurement screen tracks the position of the measurement area. The display of the profile is not adjusted.
- If position correction fails, the measurement alarm will activate. Position correction failure can be confirmed by the invalid output. Adjust the position correction settings and the target positioning sensitivity.
  "Invalid output" (Page 8-6)
- A master profile is required for position correction.
  "Master Registration" (Page 5-48)

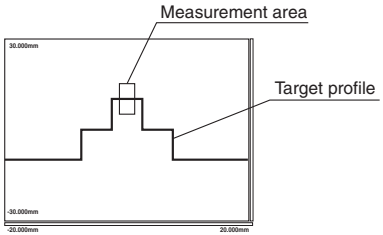
Reference

To correct the errors due to head placement or tilt of the target or that of the target stage, use "Tilt Correction" and "Height Correction".

"Tilt Correction" (Page 5-30)
"Height Correction" (Page 5-32)

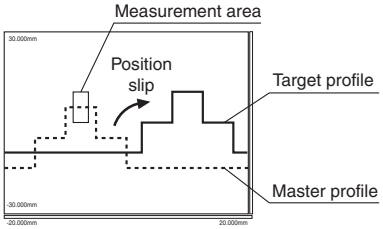
When there is no position slip

Correct measurements are possible because the target and the measurement area are aligned.



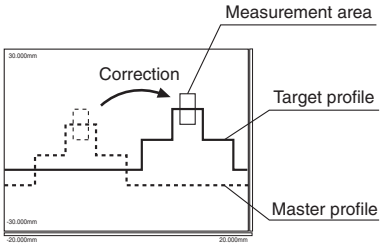
If there is position slip and no position correction.

If the target slips and falls outside of the measurement area, measurement will not be possible.



If there is position slip followed by position correction

If the target is in a different position, the difference between the target position and the master profile is calculated. The measurement area is adjusted by the amount of slip and a measurement is taken.



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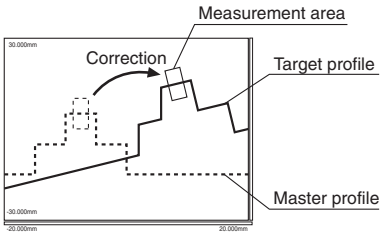
Types of Position Correction

There are three types of position correction, "Profile correction" that uses the shape, "Edge correction" that uses the edge, and "ANG correction" that corrects tilt.

Profile correction

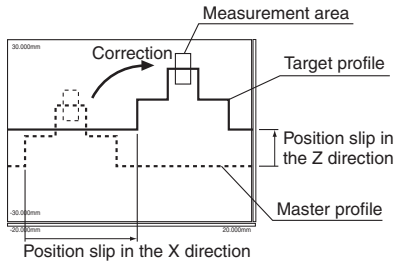
This corrects position slip using the shape of the target. Position correction can correct for position slip along the X-axis or Z-axis, or for tilt. Unlike "ANG correction", tilt can be adjusted to an angle. Because this requires a great deal of internal calculation, the measurement time will be longer.

"Profile correction" (Page 5-51)



Edge correction

Target edge faces and flat areas (called edges) are used to correct position slip. This corrects position slip in the X and Z directions. This does not correct for tilt. This operation is faster than profile correction.



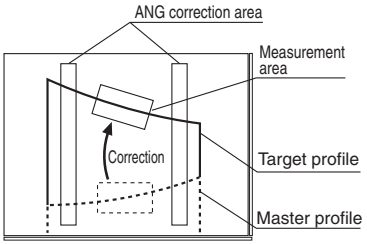
There are four types of edge correction.

- X correction (page 5-54)
- Z correction (page 5-54)
- X-Z correction (page 5-55)
- Z-X correction (page 5-55)

ANG correction

ANG correction adjusts the tilt of the target so that its flat area becomes level. Leveling the reference surface when measuring warpage measurement or step enables high accuracy measurement.
ANG correction is higher than profile correction in accuracy.

"ANG Correction" (Page 5-61)



Displaying the Position Adjustment Settings Screen

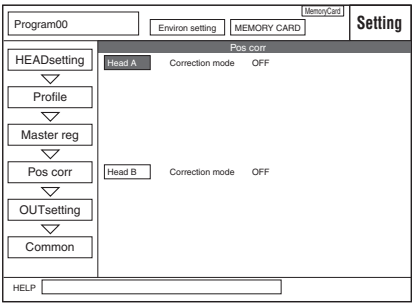
1 Use the [Prog/Run] switch to display the settings screen.

"Settings screen" (Page 2-1)

2 Select [Pos corr] with the [△] and [▽] keys, then press the [ENTER] key.

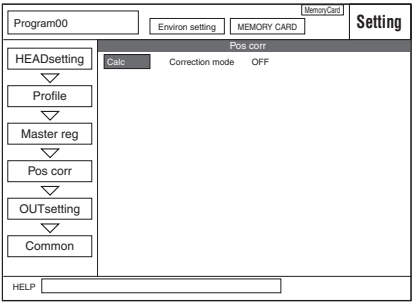
The [Pos corr] screen will be displayed and the cursor will move to "Calculation" or "Head A"

- When calculation is OFF or Linking (V) or Linking (H) is set



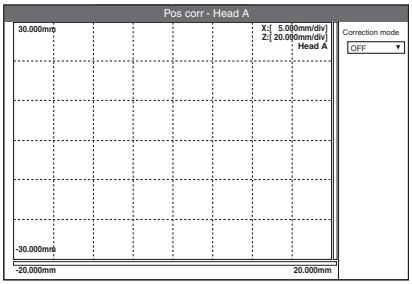
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- When sum, difference or wide is set



3 **Select a profile to correct with the [△] and [▽] keys, then press the [ENTER] key.**

The profile correction setting screen appears.

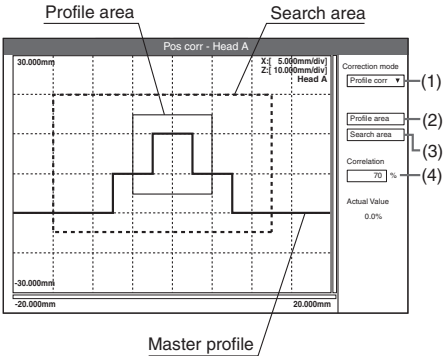


Profile Correction
(Correcting position by shape)

Profile correction adjusts the position of measured profiles to match the portion of the master profile with which they share the greatest similarity. Position correction can correct for position slip along the *Z*-axis or for tilt.

► Note

- The range for tilt correction is ±15°.
- Tilt detection operates by internally inclining the profile area within the search area, but the entire profile area must fall within the search area.



(1) Correction mode
Select a type of profile correction.

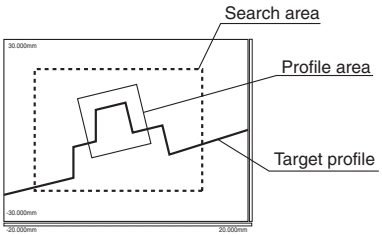
(2) Profile area
This records a shape set with the master profile in the profile area. Position is corrected with the registered profile.

(3) Search area
This specifies the range within the measured shape to search for a segment that matches the profile area.

(4) Correlation value
This is the amount by which the detected shape matches the registered profile. Increasing this value increases the sensitivity of the position correction, but also increases the chance of failure. Use the default value for most cases.
Setting range: 0 to 99% (Default: 70%)

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Profile correction operations during measurement



The "Target profile" defined in the "Profile area" is searched for in the "Search area". Position differences in the X direction, Z direction and tilt are calculated.
If a region matching the profile area to a degree equal to or greater than the "Correlation" is found, the set area is adjusted and measured. If no such match is found, position correction is considered to have failed and the measurement alarm is activated. Note that the search area and profile area are not displayed on the measurement screen.

1 **Register a master.**

"Master reg"(Page 5-48)

2 **Display the "Position corr" setting screen.**

"Displaying the Position Adjustment Settings Screen" (Page 5-51)

3 **Select "Correction mode" with the [△] and [▽] keys, then press the [ENTER] key.**

A pull-down menu appears.

Correction mode

OFF
Profile corr
X corr only
Z corr only
ANG corr only
XZ corr
ZX corr
X ANG corr
ANG X corr

4 **Select "Profile corr" with the [△] and [▽] keys, then press the [ENTER] key.**

The profile correction settings screen appears.

5 **Select "Profile area" with the [△] and [▽] keys, then press the [ENTER] key.**

The profile area drawing screen appears.

6 **Set the "Profile area."**

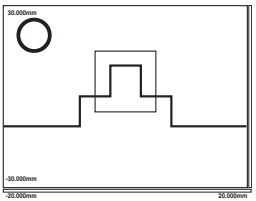
"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

Set the profile area smaller than the search area.

► Note

Set the profile area to be a distinctive region of the master profile. Position correction may not operate correctly. If the master profile has no distinctive regions, use edge correction.

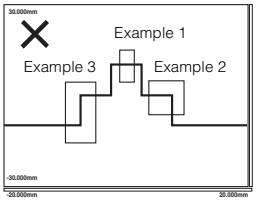
Good example: The profile includes a protrusion that does not appear in other parts of the profile and thus is suitable for position correction.



Bad example: The following examples are not suitable for position correction.

- Example 1: The flat portion that is selected is present in several other areas of the profile.
- Example 2: The full height of the step is not included in the profile area, thus there is not enough data about the profile. The shape will not be properly recognized and correction will not occur.
- Example 3: The specified shape exists in at least one other place.

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7 **Select "Search area" with the [△] and [▽] keys, then press the [ENTER] key.**

The search area setting screen appears.

8 **Set the "Search area."**

"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

Set the search area larger than the profile area.

9 **Select [Correlation] with the [△] and [▽] keys, then press the [ENTER] key.**

The device enters the value input state.

"Entering a Value" (Page 2-5)

Correlation

70 %

10 **Set the "Correlation".**

Use the default value for most cases.

11 **Press the [ESCAPE] key to finish position correction.**

Edge Correction
(Correcting position by edge correction)

Edge correction adjusts the position of measured profiles to match edges and flat areas of the master profile. This corrects position slip in the X and Z directions, then takes a measurement.

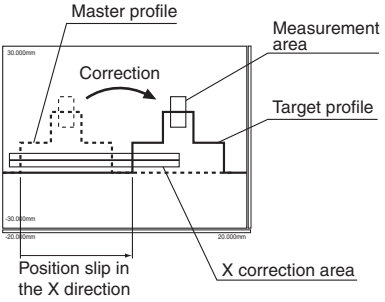
Overview of Edge Adjustment

Types of edge correction

There are four types of edge correction, based on the direction and order of corrections made.

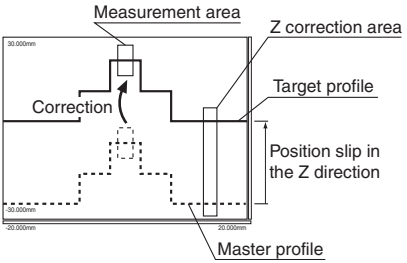
- **X correction**

  Corrects position in the X direction only.



- **Z correction**

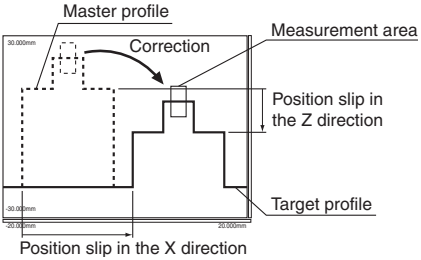
  Corrects position in the Z direction only.



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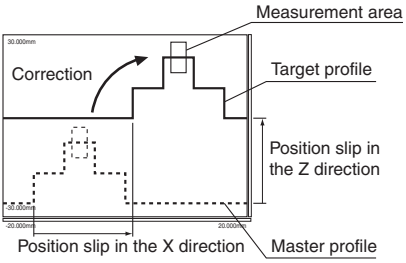
- **X-Z correction**

  This corrects position slip in the both X and Z directions. "X correction" is used to correct in the X direction, then "Z correction" is used to correct in the Z direction.



- **Z-X correction**

  This corrects position slip in the both X and Z directions. "Z correction" is used to correct in the Z direction, then "X correction" is used to correct in the X direction.



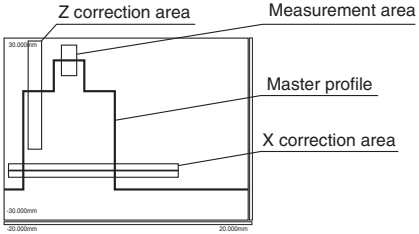
Example of X-Z correction

When necessary, X-Z correction corrects the in the X direction before correcting in the Z direction, based on the shape and position slip of the target

Settings and internal processing for X-Z correction

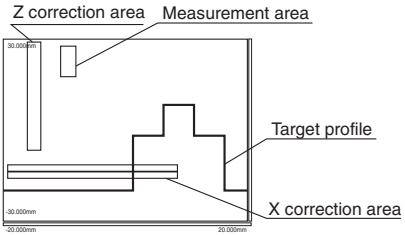
This section describes the settings and order of internal processing for X-Z correction.

1 **Set the correction area.**



Set the X correction and Z correction areas on the master profile.

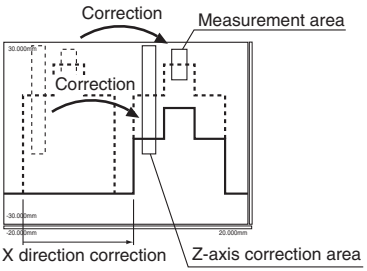
2 **Measure the target to be corrected.**



The measurement area is offset from the target position.

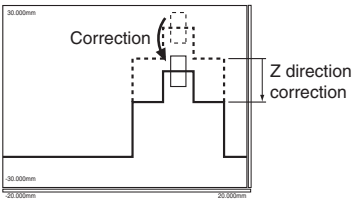
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3 **The X direction is corrected.**



The profile of the target is measured, then X correction is carried out. The Z-axis correction area and measurement area are adjusted with the X-axis.

4 **The Z direction is corrected.**

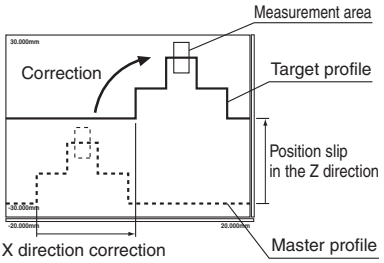


The measurement area is corrected in the Z direction and position correction completes.

5 **The target is measured.**

Example of Z-X correction

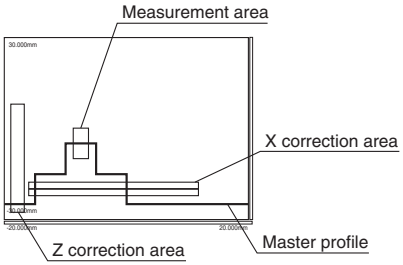
When necessary, Z-X correction corrects the in the Z direction before correcting in the X direction, based on the shape and position slip of the target.



Settings and internal processing for Z-X correction

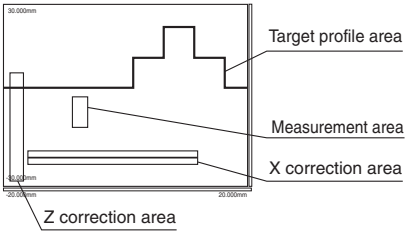
This section describes measurement and the order of internal processing for Z-X correction.

1 **Set the correction area.**



Set the X correction and Z correction areas on the master profile.

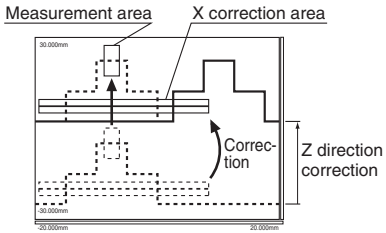
2 **Measure the target to be corrected.**



The measurement area is offset from the target position.

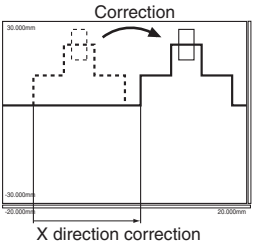
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3 **The Z direction is corrected.**



The profile of the target is measured, then Z correction is carried out. The X-axis correction area and measurement area are adjusted with the Z-axis.

4 **The X direction is corrected.**



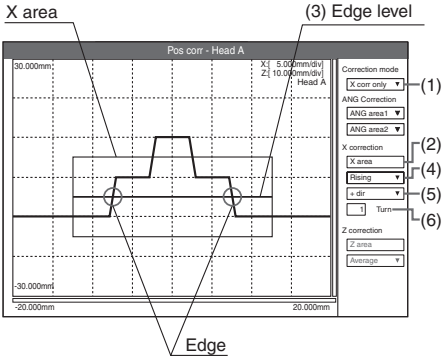
The measurement area is corrected in the X direction and position correction completes.

5 **The target is measured.**

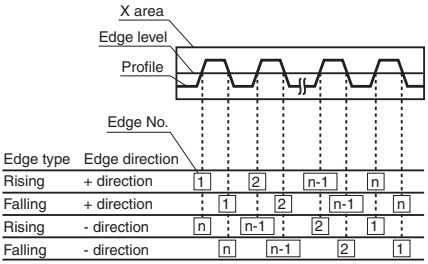
X Correction

(Correcting in the X direction)

Position correction along the X-axis sets an edge to be used as the standard. The difference between the two edges is corrected.



Edge settings are handled by edge number. The edge number sets the order of numbers based on the "Edge type" and "Edge direction."



X correction settings

(1) Correction mode
Select X correction.

(2) X area
Set the edge detection range.

(3) Edge level
Set the threshold value of edge detection. An edge will be detected when the profile and edge level cross.

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(4) Edge type

Set the direction in which the edge of the profile crosses over the edge level when the profile changes from the negative side to the positive side of the X axis.

- **Rising (default)**

  The edge level measures edges from bottom to top.
- **Falling**

  The edge level measures edges from top to bottom.

(5) Edge direction

Set the direction in which "Edge No." will count.

- **Positive (default)**

  Edges are counted in the positive direction (from left to right).
- **Negative**

  Edges are counted in the negative direction (from right to left).

(6) Edge No.

Set the standard edge with "Edge No." The method of edge counting based on the "Edge type" and "Edge direction."

Setting range: 1 to 10 (default: 1)

1 Register a master.

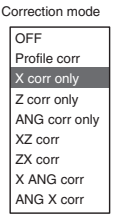
"Master reg"(Page 5-48)

2 Display the "Position corr" setting screen.

"Displaying the Position Adjustment Settings Screen" (Page 5-51)

3 Select "Correction mode" with the [△] and [▽] keys, then press the [ENTER] key.

A pull-down menu appears.



4 Select "X corr only" with the [△] and [▽] keys, then press the [ENTER] key.

The X correction settings are displayed.

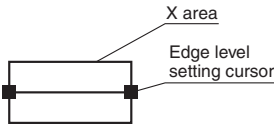
5 Select "X area" with the [△] and [▽] keys, then press the [ENTER] key.

The X area drawing screen appears.

6 Set the "X area" and "X level."

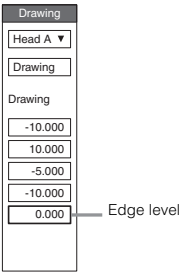
When drawing the edge level with the cursor, use the [SCREEN] key to display the edge level setting cursor, then use [△] and [▽] to make the setting.

"Drawing an Area with the Cursor" (Page 2-6)



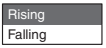
When drawing the edge level by entering a value, use the cursor to select "X level."

"Drawing an Area by Entering Values" (Page 2-7)



7 Select "Edge type" with the [△] and [▽] keys, then press the [ENTER] key.

A pull-down menu appears.



8 Select [Rising] or [Falling] with the [△] and [▽] keys, then press the [ENTER] key.

The edge type is set.

9 Select "Edge direction" with the [△] and [▽] keys, then press the [ENTER] key.

A pull-down menu appears.



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10 Select "+ dir" or "- dir" with the [△] and [▽] keys, then press the [ENTER] key.

The edge direction is set.

11 Select "Edge No." with the [△] and [▽] keys, then press the [ENTER] key.

The device enters the value input state.

"Entering a Value" (Page 2-5)

Turn

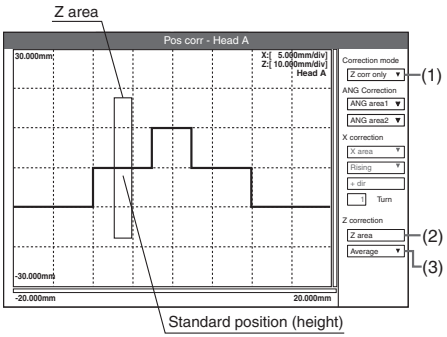
12 The edge number is set.

13 Press the [ESCAPE] key to finish position correction.

Z Correction

(Correcting in the Z direction)

Position correction along the Z-axis sets a position on the Z-axis (height) to be used as the standard. The difference between the two positions (heights) is corrected.



Z correction settings

(1) Correction mode

Select Z correction.

(2) Z area

Set the range for detecting the standard position in the Z direction.

(3) Height type

Set the height calculation method.

- **Average (default)**
  The average height is used as the standard.
- **Peak**
  The maximum height is used as the standard.
- **Bottom**
  The minimum height is used as the standard.

1 Register a master.

"Master Registration" (Page 5-48)

2 Display the "Position corr" setting screen.

"Displaying the Position Adjustment Settings Screen" (Page 5-51)

3 Select "Correction mode" with the [△] and [▽] keys, then press the [ENTER] key.

A pull-down menu appears.

Correction mode

OFF
Profile corr
X corr only
Z corr only
ANG corr only
XZ corr
ZX corr
X ANG corr
ANG X corr

4 Select "Z corr only" with the [△] and [▽] keys, then press the [ENTER] key.

The Z correction settings are displayed.

5 Select "Z area" with the [△] and [▽] keys, then press the [ENTER] key.

The Z area drawing screen appears.

6 Set "Z area."

"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

7 Select [Height type] with the [△] and [▽] keys, then press the [ENTER] key.

A pull-down menu appears.

Peak
Bottom
Average

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8 **Select "Average," "Peak" or "Bottom" with the [△] and [▽] keys, then press the [ENTER] key.**
The "Height type" is set.

9 **Press the [ESCAPE] key to finish position correction.**

X-Z Correction

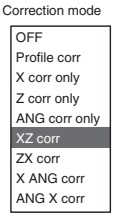
(Correcting in the X direction, then correcting in the Z direction)

"X-Z correction" requires settings for both "X correction" and "Z correction."
"X Correction" (Page 5-57)
"Z Correction" (Page 5-59)

1 **Register a master.**
"Master reg"(Page 5-48)

2 **Display the "Position corr" setting screen.**
"Displaying the Position Adjustment Settings Screen" (Page 5-51)

3 **Select "Correction mode" with the [△] and [▽] keys, then press the [ENTER] key.**
A pull-down menu appears.



4 **Select "XZ corr" with the [△] and [▽] keys, then press the [ENTER] key.**
The X-Z correction settings are displayed.
The settings for both "X correction" and "Z correction" are used.

5 **Set "X correction".**
"X Correction" (Page 5-57)

6 **Set "Z correction".**
"Z Correction" (Page 5-59)

7 **Press the [ESCAPE] key to finish position correction.**

Z-X Correction

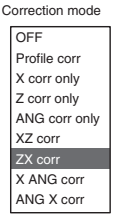
(Correcting in the Z direction, then correcting in the X direction)

"Z-X correction" requires settings for both "X correction" and "Z correction."
"X Correction" (Page 5-57)
"Z Correction" (Page 5-59)

1 **Register a master.**
"Master reg"(Page 5-48)

2 **Display the "Position corr" setting screen.**
"Displaying the Position Adjustment Settings Screen" (Page 5-51)

3 **Select "Correction mode" with the [△] and [▽] keys, then press the [ENTER] key.**
A pull-down menu appears.



4 **Select "ZX corr" with the [△] and [▽] keys, then press the [ENTER] key.**
The Z-X correction settings are displayed.
The settings for both "X correction" and "Z correction" are used.

5 **Set "Z correction".**
"Z Correction" (Page 5-59)

6 **Set "X correction".**
"X Correction" (Page 5-57)

7 **Press the [ESCAPE] key to finish position correction.**

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ANG Correction
(Leveling the tilt)

ANG correction levels the tilt of a target to match flat areas of the master profile. Correction in combination with the X correction of the edge correction is also possible.

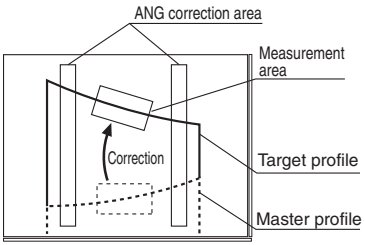
Overview of ANG Correction

Types of ANG correction

The following three types of corrections are available for ANG correction according to the different orders of correction process in combination with the edge correction.

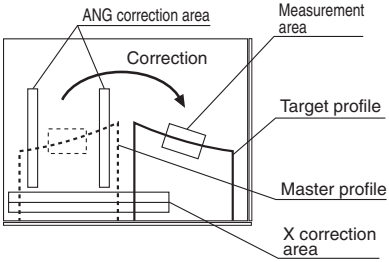
- **ANG correction**

  Levels the tilt. ANG correction also corrects position slip along the Z-axis at the same time.
  "ANG Correction" (Page 5-61)



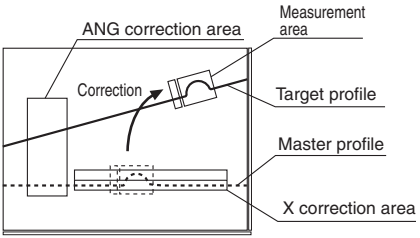
- **X ANG correction**

  Corrects both the X direction slip and tilt. After correcting the X direction slip with "X correction", the tilt is leveled with "ANG correction".
  "X ANG correction" (Page 5-64)



- **ANG X correction**

  Corrects both the X direction slip and tilt. After leveling the tilt is leveled with "ANG correction", the X direction slip is corrected with "X correction".
  "ANG X correction" (Page 5-64)



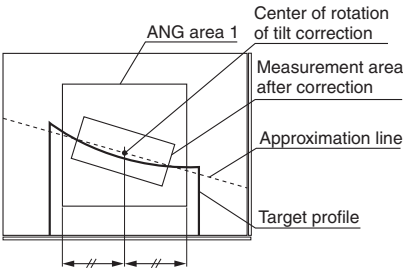
ANG correction operations during measurement

ANG correction corrects the tilt of the target and the Z direction slip from the master profile at the same time.

Leveling the tilt

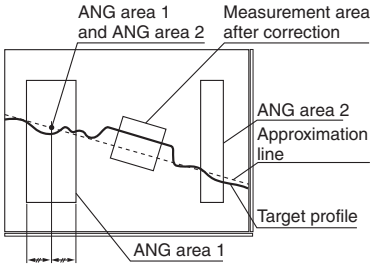
The tilt correction angle is determned by calculating the tilt of the approximation line from the profile data in the ANG area. The tilt of the measurement area is corrected by the calculated correction angle. The approximation line can be calculated either by ANG area 1 only, or by q area1 and ANG area 2. When calculating with the two areas, the profile data in each area is combined and a single approximation line is calculated.
The center of rotation of tilt correction is set to the intersection of the approximation line and the midpoint of ANG area 1.
If there is no profile in the ANG area, the measurement value becomes alarm based on the evaluation that the position correction has failed.

ANG area 1 only



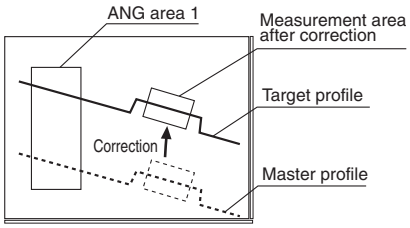
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ANG area 1 and ANG area 2



Correcting the Z direction slip

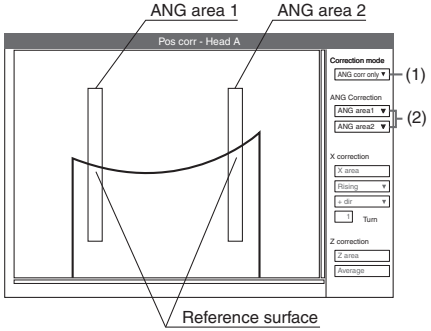
ANG correction corrects the position slip in the Z direction at the same time and makes evaluation. Correction is made by calculating the difference between the average height in ANG area 1 of the master profile and that of the target profile.



ANG Correction

(Leveling the tilt)

ANG correction sets a flat surface used as a reference in ANG area. This function corrects the amount of tilt of the measurement area so that the measured flat surface becomes level. The range for tilt correction is ±45°.



ANG correction setting items

(1) Correction mode

Select a type of ANG correction.

(2) ANG area 1/ANG area 2

Set the range of the reference surface used to calculate the approximation line for detecting the amount of tilt. The approximation line is calculated from the profile data within the specified range. When setting two areas, the profile data in each area is combined and one approximation line is calculated. If there is no profile in the area, the position correction fails.

1 Register a master.

"Master reg"(Page 5-48)

Reference

You do not need to register the master profile perfectly level. The master profile is leveled at the time of measurement.

2 Display the "Position corr" setting screen.

"Displaying the Position Adjustment Settings Screen" (Page 5-51)

3 Select "Correction mode" with the [△] and [▽] keys, then press the [ENTER] key.

A pull-down menu appears.

Correction mode

OFF
Profile corr
X corr only
Z corr only
ANG corr only
XZ corr
ZX corr
X ANG corr
ANG X corr

4 Select "ANG corr only" with the [△] and [▽] keys, then press the [ENTER] key.

The ANG correction settings are displayed.

5 Select "ANG area 1" with the [△] and [▽] keys, then press the [ENTER] key.

The ANG area 1 drawing screen appears.

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6 **Set the "ANG area 1" position and size.**

"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

7 **Set "ANG area2".**

- ANG area 2 is not used when correcting the tilt of only one area. Erase ANG area 2 if it is displayed.
  "Erasing the ANG area 2" (Page 5-63)
- Set ANG area 2 when correcting the tilt of two areas.
  "Setting ANG area2" (Page 5-63)

8 **Press the [ESCAPE] key to finish position correction.**

■ Setting ANG area2

Continued from setting step 7 of ANG correction.

1 **Select "ANG area 2" with the [△] and [▽] keys, then press the [ENTER] key.**

- The drawing menu window appears.
- ANG area 2 will be displayed as an orange rectangle and will become active.

2 **Set the "ANG area 2" position and size.**

"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

3 **Press the [ESCAPE] key to close the drawing window once the area has been set.**

The cursor returns to "ANG area 2."

4 **Return to the ANG correction setting step.**

■ Erasing the ANG area 2

ANG area 2 can be erased.
This is valid when the measurement mode is "ANG correction", "X ANG correction", or "ANG X correction".

1 **Display the "Position corr" setting screen.**

"Displaying the Position Adjustment Settings Screen" (Page 5-51)

2 **Select "ANG area 2" with the [△] and [▽] keys.**

Move the cursor. Do not press the [ENTER] key.

3 **Press the [ZERO] key**

An erase confirmation message window appears.



► Note

If the area cannot be erased, the [ZERO] key will be ignored.

4 **Select [Yes] and press the [ENTER] key.**

The approximation line area will be erased.

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X ANG correction

(Correcting in the X direction, then correcting the tilt)

"X ANG correction" requires settings for both "X correction" and "ANG correction."

"X Correction" (Page 5-57)
"ANG Correction" (Page 5-62)

1 Register a master.

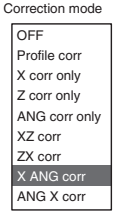
"Master reg"(Page 5-48)

2 Display the "Position corr" setting screen.

"Displaying the Position Adjustment Settings Screen" (Page 5-51)

3 Select "Correction mode" with the [△] and [▽] keys, then press the [ENTER] key.

A pull-down menu appears.



4 Select "X ANG corr" with the [△] and [▽] keys, then press the [ENTER] key.

The X ANG correction settings are displayed.
The settings for both "X correction" and "ANG correction" are used.

5 Set "Edge correction X."

"X Correction" (Page 5-57)

6 Set "Edge correction ANG."

"ANG Correction" (Page 5-62)

7 Press the [ESCAPE] key to finish position correction.

ANG X correction

(Correcting the tilt, then correcting in the X direction)

"ANG X correction" requires settings for both "ANG correction" and "X correction."

"X Correction" (Page 5-57)
"ANG Correction" (Page 5-62)

1 Register a master.

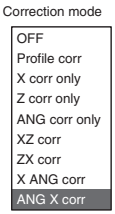
"Master reg"(Page 5-48)

2 Display the "Position corr" setting screen.

"Displaying the Position Adjustment Settings Screen" (Page 5-51)

3 Select "Correction mode" with the [△] and [▽] keys, then press the [ENTER] key.

A pull-down menu appears.



4 Select "ANG X corr" with the [△] and [▽] keys, then press the [ENTER] key.

The ANG X correction settings are displayed.
The settings for both "X correction" and "ANG correction" are used.

5 Set "Edge correction ANG."

"ANG Correction" (Page 5-62)

6 Set "Edge correction X."

"X Correction" (Page 5-57)

7 Press the [ESCAPE] key to finish position correction.

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OUT Settings
(Setting measurements)

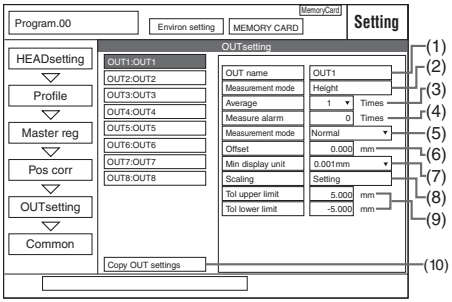
Overview of OUT Settings

OUT settings include the settings for height measurements, width measurements, averaging, offsets and scaling.
OUT settings allow eight different groups of output settings, OUT1 through OUT8, to be used at the same time. OUT1 through OUT8 are referred to as OUT numbers.

"Measurement Conditions and Measurement Data Flow" (Page 5-2)

"Setting the Measurement Conditions to Meet Your Needs" (Page 5-3)

"List of setting ranges and default values for OUT settings" (Page 5-7)



Setting items

(1) OUT name (Page 5-66)
Names can be assigned to OUT numbers. An example would be "Height of part A."

(2) Measurement mode (Page 5-67)
The 12 types of settings, such as "height" and "width," can be set, along with OUT number calculations.

(3) Average (Page 5-101)
This averages the measured values.

(4) Measurement alarm (Page 5-102)
This setting controls what happens when measurement is impossible.

(5) Comparative measurement mode (Page 5-103)
This controls functions such as continuous measurement, sampling period and determination of maximum and minimum values.

(6) Offset (Page 5-105)
This is the value automatically added to or subtracted from the measured value.

(7) Minimum display unit (Page 5-106)
This controls the smallest unit in which the measured value will be displayed. Changing the minimum display unit will cause a corresponding change in the display range.

(8) Scaling (Page 5-107)

(9) Tolerance (Page 5-109)
This controls the minimum and maximum tolerance values that are used for determining the validity of the measurement.

(10) Copy settings (Page 5-110)
This allows you to copy the settings of one OUT number to another OUT number.

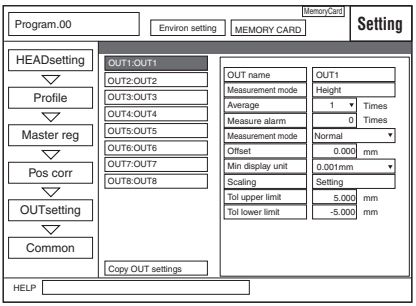
Displaying the OUT Settings Screen

1 Use the [Prog/Run] switch to display the settings screen.

"Settings screen" (Page 2-1)

2 Select "OUT settings" with the [▽] and [△] keys, then press the [ENTER] key.

The "OUT settings" screen is displayed with the cursor pointing to "OUT1" or the last changed setting.



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OUT Name
(Naming an OUT number)

Names can be assigned to OUT numbers OUT 1 though OUT 8.
An example would be "Height of part A."

Setting range: Up to 20 single-byte characters or 10 two-byte characters.

Reference

The OUT settings screen will abbreviate names longer than 18 single-byte characters to the first 15 characters.

1 **Display the "OUT settings" screen.**

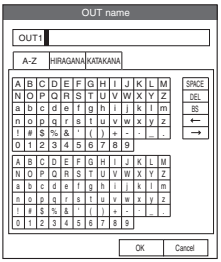
"OUT settings" screen(Page 5-65)

2 **Select an OUT number to name with the [▽] and [△] keys, then press the [ENTER] key.**

3 **Select "OUT name" with the [▽] and [△] keys, then press the [ENTER] key.**

The text entry window appears.

"Entering Characters" (Page 2-5)



4 **Enter the desired name.**

When you have finished entering the desired name, the name will be displayed in the OUT name display box.

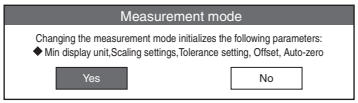
5 **Press the [OK] key to complete the setting.**

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Measurement Mode (Setting measurement conditions)

Measurement mode sets conditions such as "Height measurement" and "Width measurement" for the measured profile.
When the measurement mode is changed, the settings return to their default values. Additionally, the values for the minimum display unit, scaling, tolerance, offset and auto-zero are also reset to their default values.

"Minimum Display Unit" (Page 5-106)
"Scaling" (Page 5-107)
"Tolerance" (Page 5-109)
"Offset" (Page 5-105)
"Auto-zero" (Page 3-15)



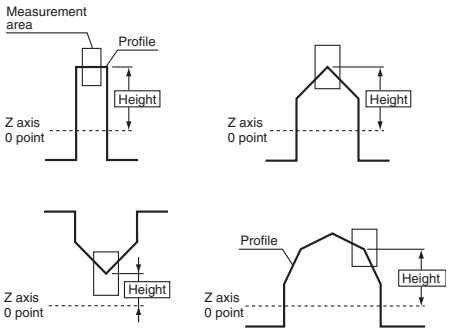
Register a master before setting a measurement mode. If no master is registered, no profile will be displayed when setting the measurement area. Additionally, profile comparison mode and profile tracking mode will be unavailable.

"Master Registration" (Page 5-48)
"Setting the Measurement Area" (Page 5-71)

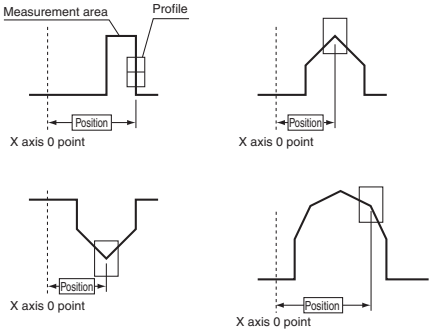
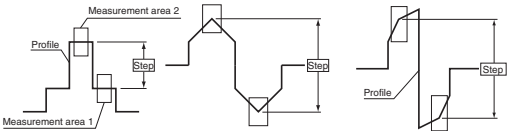
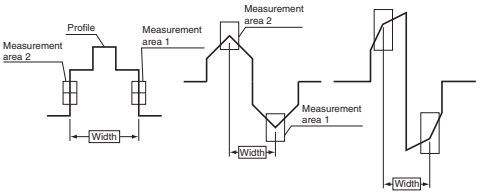
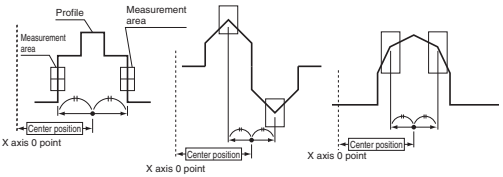
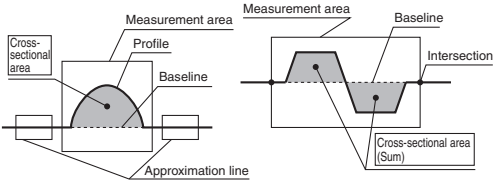
Overview of Measurement Modes

There are 13 different measurement modes. Set measurement areas such as "Height measurement area" over the profile in measurement mode.

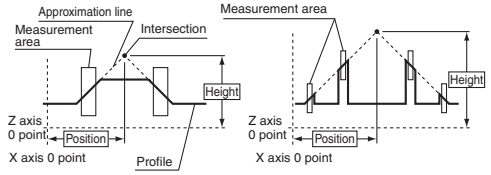
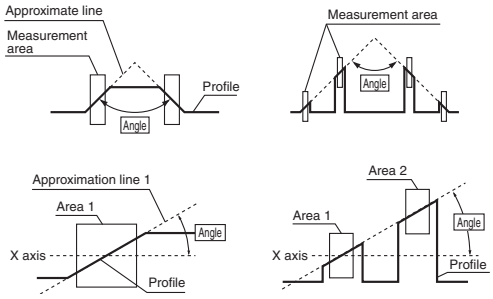
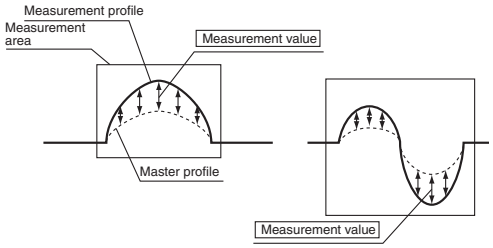
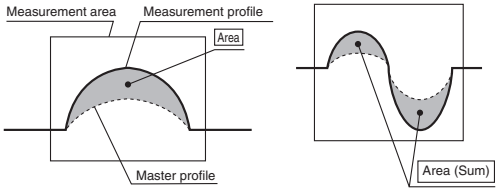
"Setting the Measurement Area" (Page 5-71)

Measurement mode	Measurement example	Measurement area to be set
No Measurement (Page 5-82) Set this when not measuring. OUT2 through OUT8 are initially set to not measure.	None	None
Height (Page 5-83) Measures the height from the zero point of the Z axis. Average height, maximum height, minimum height and inflexion point height can be measured.		Height measurement area (Page 5-71)

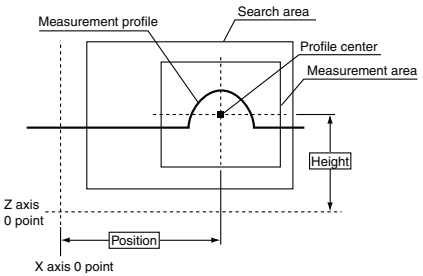
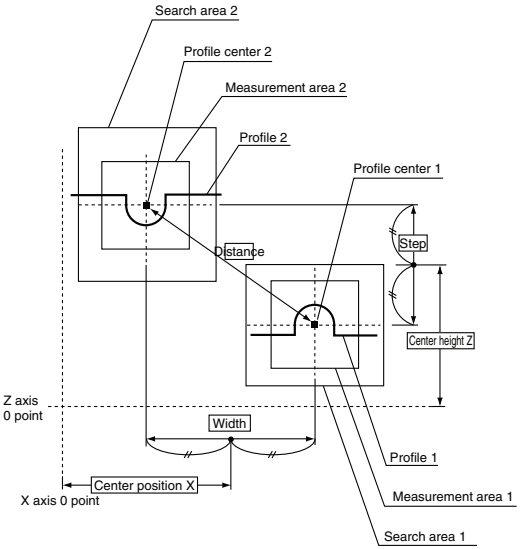
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Measurement mode	Measurement example	Measurement area to be set
Position (Page 5-84) Measures the position from the zero point of the X axis. Edge position, position at maximum height, position at minimum height and inflexion point height can be measured.		Position measurement area (Page 5-73)
Step (Page 5-85) This measures the difference in height between two locations. Average height, maximum height, minimum height, inflexion point height or a combination of these three can be used to make the comparison.		Height measurement area (Page 5-71)
Width (Page 5-86) This measures the difference in position between two locations. Edge position, position at maximum height, position at minimum height, inflexion point height or a combination of these three can be used to make the comparison.		Position measurement area (Page 5-73)
Center Position (Page 5-88) Measures the distance from the zero point of the X-axis to the midpoint between two locations. Edge position, position at maximum height, position at minimum height, inflexion point height or a combination of these three can be used to make the comparison.		Position measurement area (Page 5-73)
Cross-Sectional Area (Page 5-89) This measures the area of a region bounded by the profile and a baseline. The baseline is determined by the approximation line or by the intersection of the measurement area and the profile. If there are multiple regions being measured, the result is the sum of their areas.		• Cross-sectional measurement area (Page 5-76) • Approximation line area (Page 5-77)

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Measurement mode	Measurement example	Measurement area to be set
Intersection (Page 5-91) This measures the height of the intersection of two approximation lines.		Approximation line area (Page 5-77)
Angle (Page 5-92) This measures the angle between two approximation lines.		Approximation line area (Page 5-77)
Profile Comparison 1 (Page 5-94) This computes the difference between the master profile and the measured profile and determines the maximum difference in height. "Master Registration" (Page 5-48)		Profile measurement area (Page 5-79)
Profile Comparison 2 (Page 5-95) This measures the area of a region bounded by the master profile and the measured profile. If there are multiple regions being measured, the result is the sum of their areas. "Master Registration" (Page 5-48)		Profile measurement area (Page 5-79)

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Measurement mode	Measurement example	Measurement area to be set
Profile Tracking 1 (Page 5-96) This searches for a profile with the same shape as that of a profile previously defined in the profile measurement area, then measures the height and position of the center coordinate of the profile measurement area. "Master Registration" (Page 5-48)		• Profile measurement area (Page 5-79) • Search area (Page 5-81)
Profile Tracking 2 (Page 5-98) This searches for two profiles with the same shape as that of a profile previously defined in the profile measurement area, then measures the height, step, distance from baseline and center point position and height. "Master Registration" (Page 5-48)		• Profile measurement area (Page 5-79) • Search area (Page 5-81)
Calculations (Page 5-35) Performs a calculation with the specified OUT numbers. Either sum or difference can be selected.	• OUT1 + OUT2 • OUT3 - OUT4 Etc.	None

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Setting the Measurement Area

Overview of the measurement area

Measurement mode settings are handled in the measurement area. The measurement area is a rectangular area that covers part of the profile.

"Overview of Measurement Modes" (Page 5-67)

Set measurement conditions such as height and position for profile data inside the measurement area. There are 6 different types of measurement area.

- Height measurement area (Page 5-71)
- Position measurement area (Page 5-73)
- Cross-sectional measurement area (Page 5-76)
- Approximation line area (Page 5-77)
- Profile measurement area (Page 5-79)
- Search area (Page 5-81)

Selecting a profile to set the measurement area

Profiles that can be used to set the measurement area are as follows. They vary with the head connection state and the profile calculation settings.

"Calculation"(Page 5-35)

Head connection	Calculations	Available profiles
1 Head (Head A)	OFF	Head A
2 Heads (Head A / head B)	OFF	Head A or head B
	Sum, difference or wide	Calculated profile
	Linking (H), Linking (V)	Head A or head B

The profile from which the measurement area is set is selected from the measurement area drawing window.

"Drawing an Area with the Cursor" (Page 2-6)

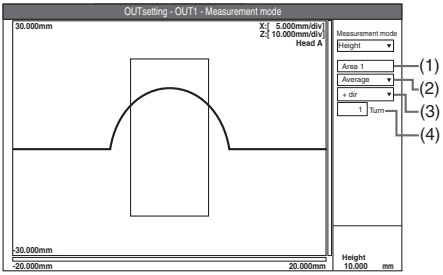
"Drawing an Area by Entering Values" (Page 2-7)

Height measurement area

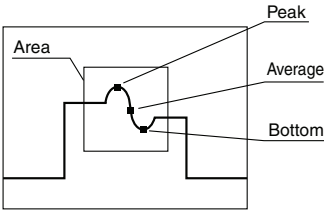
Set a "Height measurement area" to measure values in the Z direction, such as "Height" and "Step."

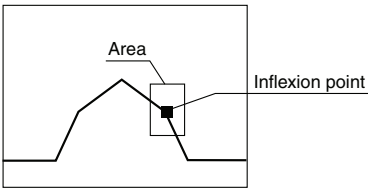
Available measurement modes

- Height (Page 5-83)
- Step (Page 5-85)

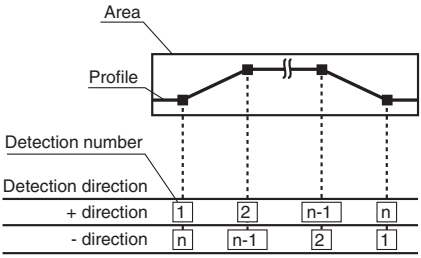


Height types





Detection direction and detection number



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Setting items

(1) Area

This sets the height detection range. The height is measured from the set profile data.
If there is profile data in only one part of the measurement area, that data from that region is used for measurements.
If there are no profiles in the measurement area, the measurement alarm will be activated.

(2) Height type

There are four methods for measuring the height of the profile in the measurement area.

- **Average (default)**
  The average height is measured.
- **Peak**
  The maximum value is used for the height.
- **Bottom**
  The minimum value is used for the height.
- **Henkyoku (inflexion point)**
  The inflected point of a straight line is used for the height.

► Note

The inflected point cannot be detected if there are little changes in the tilt of the straight line.

(3) Detection direction

This sets the direction in which inflexion points are counted.

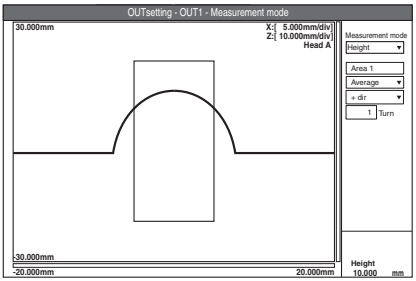
- **+ dir (default)**
  Inflexion points are counted in the positive direction (from left to right).
- **- dir**
  Inflexion points are counted in the negative direction (from right to left).

(4) Detection number

This sets the measuring inflexion point with "Detection number".
Set the method of detection No. based on the "Edge direction".
Setting range:1 to 10 (default: 1)

1 Refer to the procedure for setting "Height" or "Step" to display the "Height measurement area" setting screen.

"Height"(Page 5-83)
"Step"(Page 5-85)



This section describes the procedure for setting "Height" as an example.

2 Select "Area 1" with the [▽] and [△] keys, then press the [ENTER] key.

The "Drawing" menu window is displayed and the target area is displayed in orange.

3 Set the area size and position.

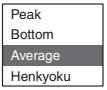
"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

4 Press the [ESCAPE] key to close the drawing window once the area has been set.

The cursor returns to "Area 1."

5 Select a height measurement type with the [▽] and [△] keys, then press the [ENTER] key.

A pull-down menu appears.



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6 **Select "Edge," "Peak", "Bottom", or "Henkyoku" with the [▽] and [△] keys, then press the [ENTER] key.**

The height measurement type is set.

- When "Average", "Peak", or "Bottom" is selected, continue to step 7.
- When "Henkyoku" is selected, continue to "Procedure for setting inflexion point".

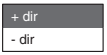
"Procedure for setting inflexion point" (Page 5-73)

7 **Return to the measurement mode setting procedure.**

■ Procedure for setting inflexion point

1 **Select [Detection direction] with the [▽] and [△] keys, then press the [ENTER] key.**

2 **A pull-down menu appears.**



3 **Select [+ dir] or [- dir], then press the [ENTER] key.**

"Detection direction" is confirmed.

4 **Select "Detection number" with the [▽] and [△] keys, then press the [ENTER] key.**

The device enters the value input state.



5 **Enter the "Detection number".**

"Entering a Value" (Page 2-5)

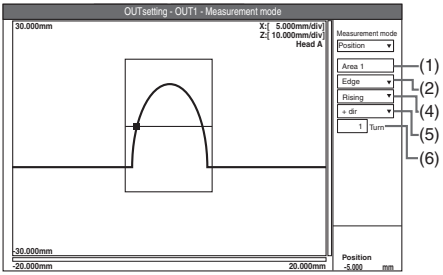
6 **Return to the measurement mode setting procedure.**

Position measurement area

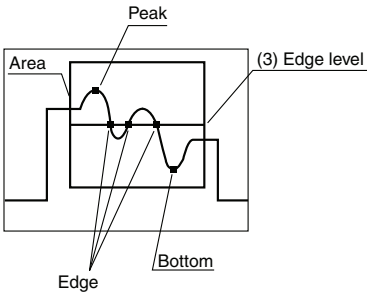
Set a "Position measurement area" to measure values in the X direction, such as "Position" and "Width."

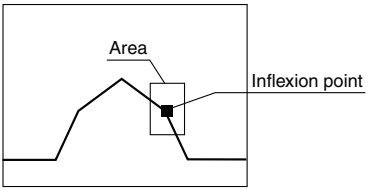
Available measurement modes

- Position (Page 5-84)
- Width (Page 5-86)
- Center position (Page 5-88)

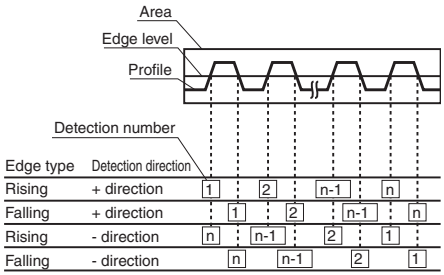


Position measurement area



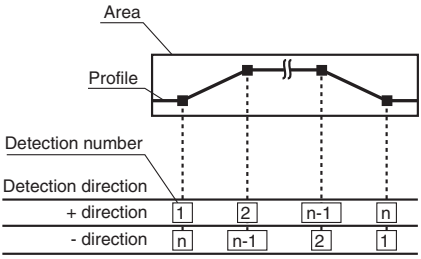


Detection direction and the detection number for edge



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Detection direction and the detection number for inflexion point



Setting items

(1) Area

Set the measurement area detection range. The position is measured from the set profile data that falls within the measurement area. If there are no profiles in the measurement area or no edges are detected in the measurement area, the measurement alarm will be activated.

(2) Position type

There are four methods for measuring the position of the profile in the measurement area.

- **Edge (default)**
  The position where the profile crosses the "Edge level" is measured. The method of edge counting is based on the "Edge level," "Edge type," "Edge direction" and "Edge No."
- **Peak**
  The maximum value is used for the position.
- **Bottom**
  The minimum value is used for the position.
- **Henkyoku**
  The inflected point of a straight line is used for the position.

► Note

The inflected point cannot be detected if there are little changes in the tilt of the straight line.

(3) Edge level

This sets the threshold value of edge detection. The position where the profile crosses the edge level is measured and considered an edge.

(4) Edge type

Set the direction in which the edge of the profile crosses over the edge level when the profile changes from the negative side to the positive side of the X axis.

- **Rising (default)**
  The edge level measures edges from bottom to top.
- **Falling**
  The edge level measures edges from top to bottom.

(5) Detection direction

This sets the direction in which detection numbers are counted.

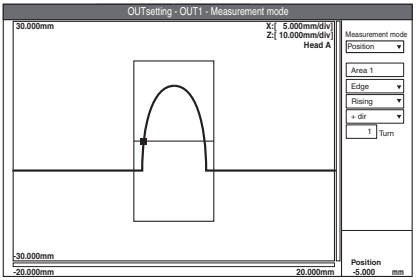
- **+ dir (default)**
  Detection numbers are counted in the positive direction (from left to right).
- **- dir**
  Detection numbers are counted in the negative direction (from right to left).

(6) Detection number

Set the measuring edge or inflexion point with "Detection No".
Set the method of edge counting based on the "Edge type" and "Edge direction."
Set the method of inflexion point counting based on the "Detection direction".
Setting range:1 to 10 (default: 1)

1 Refer to the procedure for setting "Position," "Width" or "Center" to display the "Position measurement area" setting screen.

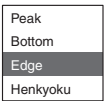
"Position" (Page 5-84)
"Width" (Page 5-86)
"Center Position" (Page 5-88)



This section describes the procedure for setting "Position" as an example.

2 Select [Position type] with the [▽] and [△] keys, then press the [ENTER] key.

A pull-down menu appears.



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3 **Select "Edge," "Peak", "Bottom", or "Henkyoku" with the [▽] and [△] keys, then press the [ENTER] key.**

The position type is set.

- **When "Edge" is selected**
  The edge level appears in the position measurement area.
  Continue to step 4.
- **When "Peak" or "Bottom" is selected**
  Continue with the procedure for setting "Peak" or "Bottom."
  "Setting "Peak" or "Bottom"" (Page 5-76)
- **When "Henkyoku" is selected**
  Continue to step 4.

4 **Select "Area 1" with the [▽] and [△] keys, then press the [ENTER] key.**

The drawing menu window is displayed and the target area is displayed in orange.

5 **Set the area size and position, and when "Edge" is selected, edge level.**

When "Henkyoku" is selected, the edge level is not set.

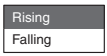
"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)
"Setting the edge level" (Page 5-75)

6 **Press the [ESCAPE] key to close the drawing window once the area has been set.**

The cursor returns to "Area 1."
When "Henkyoku" is selected, continue to step 9.

7 **Select "Edge type" with the [▽] and [△] keys, then press the [ENTER] key.**

A pull-down menu appears.



8 **Select [Rising] or [Falling] with the [▽] and [△] keys, then press the [ENTER] key.**

The "Edge type" is set.

9 **Select "Detection direction" with the [▽] and [△] keys, then press the [ENTER] key.**

A pull-down menu appears.



10 **Select "+ dir" or "- dir" with the [▽] and [△] keys, then press the [ENTER] key.**

The "Detection direction" is set.

11 **Select "Detection number" with the [▽] and [△] keys, then press the [ENTER] key.**

The device enters the value input state.



12 **Enter the "Detection number".**

"Entering a Value" (Page 2-5)

13 **Return to the measurement mode setting procedure.**

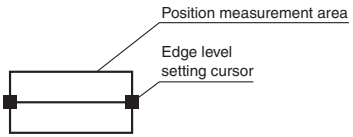
■ Setting the edge level

- **Setting with the cursor**

Set the edge level with the cursor while setting the area with the cursor.

"Drawing an Area with the Cursor" (Page 2-6)

Press the [SCREEN] key several times to move the cursor to edge level.



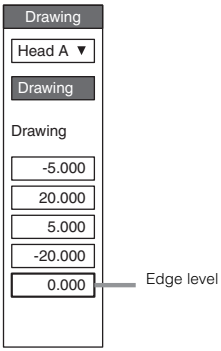
Use the [▽] and [△] keys to make the setting.

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- **Setting by direct input**

  Set the edge level by value input while setting the area by direct input.

  "Drawing an Area by Entering Values" (Page 2-7)



Use the [▽] and [△] keys to select edge level, then enter a value.

■ **Setting "Peak" or "Bottom"**

1 **Select "Area 1" with the [▽] and [△] keys, then press the [ENTER] key.**

The drawing menu window is displayed and the target area is displayed in orange.

2 **Set the area size and position.**

"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

3 **Press the [ESCAPE] key to close the drawing menu window once the area has been set.**

The cursor returns to "Area 1."

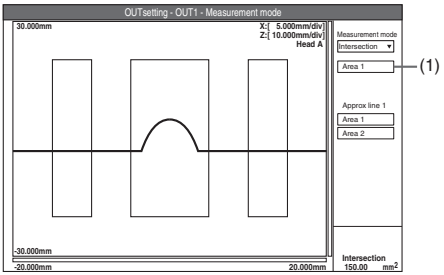
4 **Return to the measurement mode setting procedure.**

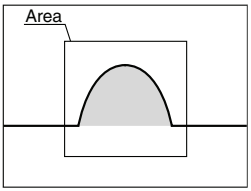
Cross-sectional measurement area

Set a "Cross-section measurement area" and the baseline to measure "Cross-section." The baseline uses the settings from "Approximate line area."

Available measurement modes

- Cross-Sectional Area (Page 5-89)





Setting items

(1) Area

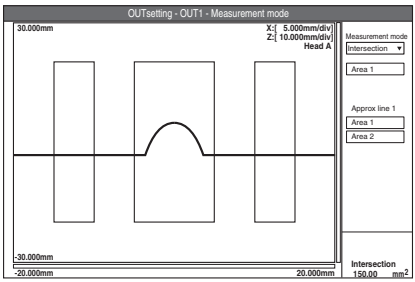
Set the cross-sectional area detection range. This measures the cross-sectional area of the space between the baseline and the profile data within the specified area. Refer to "Cross-section" or "Approximate line area" for details about the baseline. If there are no profiles in the measurement area, the measurement alarm will be activated.

"Cross-Sectional Area" (Page 5-89)
"Approximation line area" (Page 5-77)

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1 **Refer to the procedure for setting "Cross-section" to display the "Cross-section measurement area" setting screen.**

"Cross-Sectional Area" (Page 5-89)



2 **Select "Area 1" with the [▽] and [△] keys, then press the [ENTER] key.**

The drawing menu window is displayed and the target area is displayed in orange.

3 **Set the area size and position.**

"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

4 **Press the [ESCAPE] key to close the drawing window once the area has been set.**

The cursor returns to area 1.

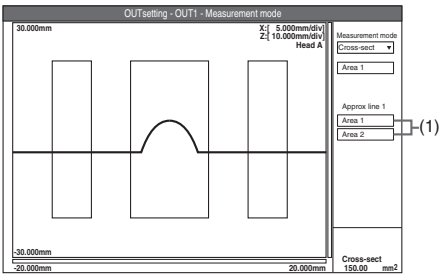
5 **Return to the measurement mode setting procedure.**

Approximation line area

"Approximate line area" is used to measure "Intersection" or "Angle."

Available measurement modes

- Cross-Sectional Area (Page 5-89)
- Intersection (Page 5-91)
- Angle (Page 5-92)

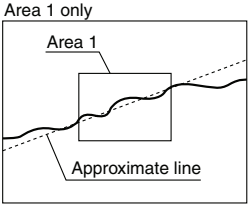


Setting items

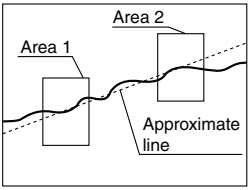
(1) Area

Set the approximation line area detection range. The approximation line is calculated from the profile data within the specified range. When setting two areas, the profile data the two areas are combined to make a single approximation line. If there are no profiles in the measurement area, the measurement alarm will be activated.

Area 1 only



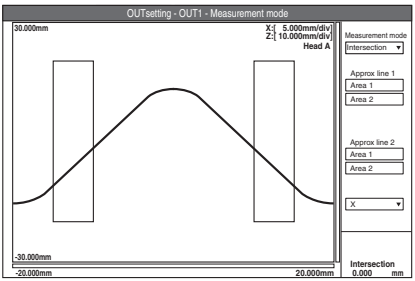
Area 1 and area 2



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1 Refer to the procedure for setting "Cross-section," "Intersection" or "Angle" to display the "Approximate line area" setting screen.

"Cross-Sectional Area" (Page 5-89)
"Intersection" (Page 5-91)
"Angle" (Page 5-92)



This section describes the procedure for setting "Intersection" as an example.

2 Select "Area 1" for approximation line 1 with the [▽] and [△] keys, then press the [ENTER] key.

The drawing menu window is displayed and the target area is displayed in orange.

3 Set the area size and position.

"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

4 Press the [ESCAPE] key to close the drawing menu window once the area has been set.

The cursor returns to area 1.

- When using one area to create an approximation line
  Return to the measurement mode setting procedure.
- When using two areas to create an approximation line
  Continue to the procedure for using two areas to create an approximation line.

"Using two areas to create an approximation line" (Page 5-78)

■ Using two areas to create an approximation line

Continue from step 4 of the approximation line area procedure.

1 Select "Approx line 1" or "Area 2" for approximation line 1 with the [▽] and [△] keys, then press the [ENTER] key.

- The drawing menu window appears.
- Area 2 will be displayed as an orange rectangle and will become active.

2 Set the area size and position.

"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

3 Press the [ESCAPE] key to close the drawing menu window once the area has been set.

- The cursor returns to area 2.
- Approximation line 1 is calculated from the profile data within areas 1 and 2.

4 Return to the measurement mode setting procedure.

■ Erasing the approximation line area

Approximation line areas can be erased. When the measurement mode is set to "Intersection" or "Angle," "Area 2" of approximation lines 1 or 2 can be erased. Setting "Angle" will erase "Area 2" of approximation line 1 and both "Area 1" and "Area 2" of approximation line 2. Setting "Cross-section" will erase both "Area 1" and "Area 2."

1 The "Approximate line area" settings screen appears.

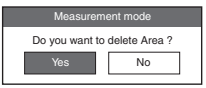
"Cross-Sectional Area" (Page 5-89)
"Intersection" (Page 5-91)
"Angle" (Page 5-92)

2 Select the area to be erased with the [▽] and [△] keys, then press the [ENTER] key.

The cursor moves to the setting item.

3 Press the [ZERO] key

An erase confirmation message window appears.



▶ Note

If the area cannot be erased, the [ZERO] key will be ignored.

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4 Select [YES] and press the [ENTER] key.

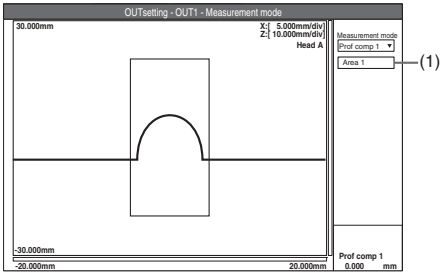
The approximation line area will be erased.

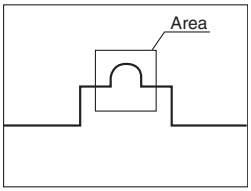
Profile measurement area

"Profile measurement area" is used for measurements of profile shape such as "Profile comparison" and "Profile tracking"

Available measurement modes

- Profile Comparison 1 (Page 5-94)
- Profile Comparison 2 (Page 5-95)
- Profile Tracking 1 (Page 5-96)
- Profile Tracking 2 (Page 5-98)





Setting items

(1) Area

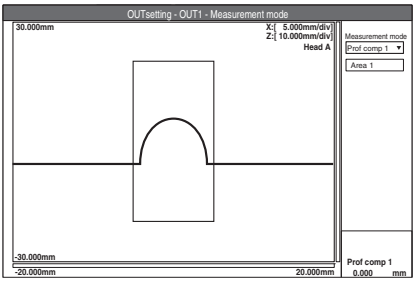
Set the profile area to be used for profile comparison or profile tracking. If there are no profiles in the measurement area for profile comparison, the measurement alarm will be activated. For profile tracking, the measurement alarm will be activated if there are no profiles in the measurement area for profile comparison or if the profile cannot be tracked.

Reference

When using profile tracking, the "Profile area" screen appears.

1 Refer to the procedure for setting "Profile comparison 1," "Profile comparison 2," "Profile tracking 1" or "Profile tracking 2" to display the "Profile measurement area" setting screen.

"Profile Comparison 1" (Page 5-94)
"Profile Comparison 2" (Page 5-95)
"Profile Tracking 1" (Page 5-96)
"Profile Tracking 2" (Page 5-98)



This section describes the procedure for setting "Profile comparison 1" as an example.

2 Select "Area 1" with the [▽] and [△] keys, then press the [ENTER] key.

The drawing menu window is displayed and the target area is displayed in orange.

Reference

When using profile tracking, select the "Profile area."

3 Set the area size and position.

"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

4 Press the [ESCAPE] key to close the drawing menu window once the area has been set.

The cursor returns to area 1.

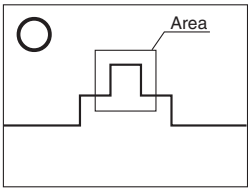
5 Return to the measurement mode setting procedure.

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■ **For profile tracking**

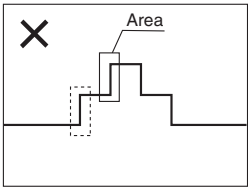
For profile tracking, select a profile area in the master profile that has a shape unique to that region of the profile. Otherwise, it is possible that profile tracking measurements will not be carried out correctly. Select another measurement mode if the master profile has no distinctive regions.

Example 1



The selected area of the profile has a protruding region and thus can be successfully tracked.

Example 2

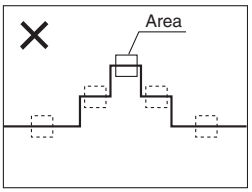


There are two regions with the same shape. It may not be possible to perform tracking correctly in this case.

- Set the profile search area to be smaller.
- Set the area again.

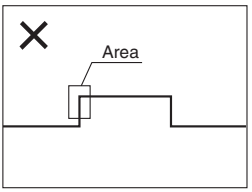
"Search area" (Page 5-81)

Example 3



There are many regions with the same shape. Set the area again or use a different measurement mode.

Example 4



The full height of the step is not included in the profile area, thus there is not enough data about the profile. The shape will not be properly recognized and tracking may not be possible. Example 4 will only look for the flat area, not the perpendicular portion, thus giving the same result as example 3.

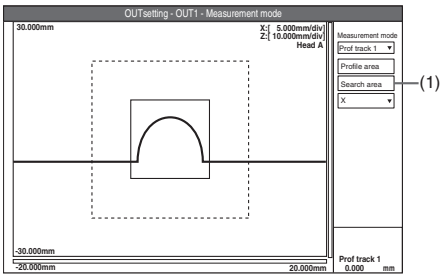
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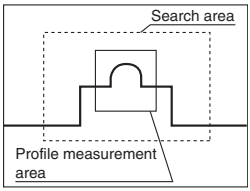
Search area

"Search area" is used when the measurement mode is "Profile tracking."

Available measurement modes

- Profile Tracking 1 (Page 5-96)
- Profile Tracking 2 (Page 5-98)





Setting items

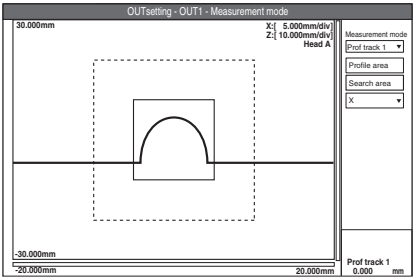
(1) Search area

This sets the region of the profile set by the "Profile measurement area" to be followed. Set the profile measurement area to include all of this.

"Profile measurement area" (Page 5-79)

1 Refer to the procedure for setting "Profile tracking 1" or "Profile tracking 2" to display the "Search area" setting screen.

"Profile Tracking 1" (Page 5-96)
"Profile Tracking 2" (Page 5-98)



This section describes the procedure for setting "Profile tracking 1" as an example.

2 Select "Search area" with the [▽] and [△] keys, then press the [ENTER] key.

The drawing menu window is displayed and the target area is displayed in orange.

3 Set the area size and position.

"Drawing an Area with the Cursor" (Page 2-6)
"Drawing an Area by Entering Values" (Page 2-7)

► Note

Set the profile "Search area" large enough to include the profile.

4 Press the [ESCAPE] key to close the drawing menu window once the area has been set.

The cursor returns to the search area.

5 Return to the measurement mode setting procedure.

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Displaying the Measurement Mode Settings Screen

1 **Register a master.**

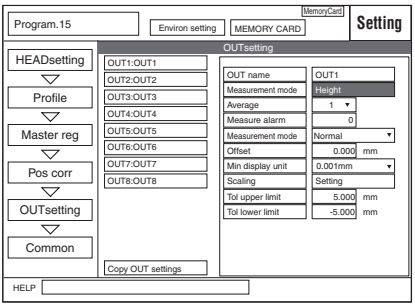
"Master reg"(Page 5-48)

2 **Display the "OUT settings".**

"Displaying the OUT Settings Screen" (Page 5-65)

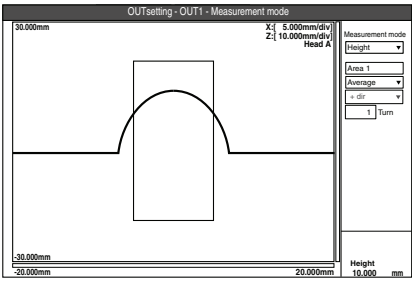
3 **Select the OUT number with the [▽] and [△] keys, then press the [ENTER] key.**

The cursor moves to the "OUT name" for the selected OUT number.



4 **Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.**

The measurement mode setting screen appears.

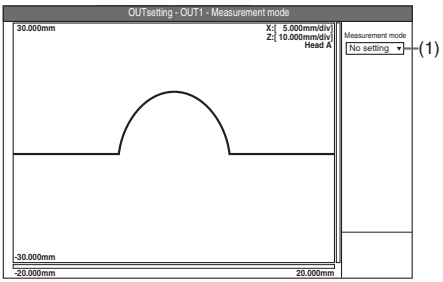


No Measurement
(Not setting any measurement conditions)

Use "No measurement" when there is no need to set any of the measurement items. OUT2 through OUT8 are initially set to not measure.

Reference

Unused OUT numbers are set to "No setting" to reduce the measurement time.



(1) Measurement Mode

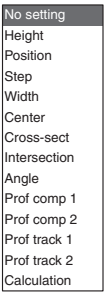
Select "No measurement."

1 **Display the "Measurement mode" setting screen.**

"Displaying the Measurement Mode Settings Screen" (Page 5-82)

2 **Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.**

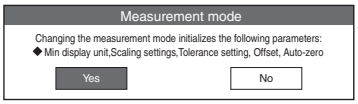
A pull-down menu appears.



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3 **Select "No measurement" with the [▽] and [△] keys, then press the [ENTER] key.**

If changing to "No measurement" from any other measurement mode, a message warning that all settings will be reset is displayed.



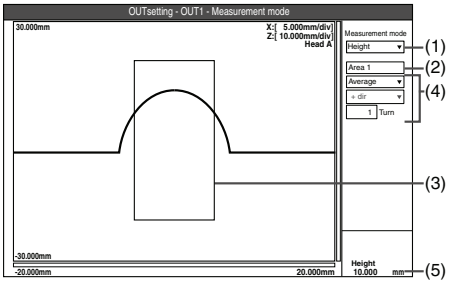
4 **Select "Yes" with the [◁] and [▷] keys, then press the [ENTER] key.**

- "No measurement" is set.
- Select "No" if you do not want the settings to be reset.

5 **Press the [ESCAPE] key to complete the setting.**

Height
(Measuring height)

"Height" measurement mode measures the height from the Z-axis zero point of the head to the "Height measurement area." "Height measurement area" sets one location. Average height, maximum height and minimum height can be measured.



Setting items

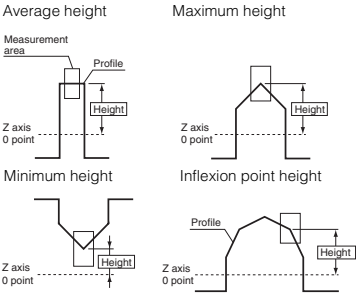
(1) Measurement mode
Select "Height."

(2) Area 1
Set "Height measurement area."

(3) Height measurement area
The position and size of area 1 are displayed in light blue.

(4) Measurement condition for the height measurement area
Set the measurement condition for area 1.

(5) Measurement result
This displays the "Height" measurement result of the master profile.

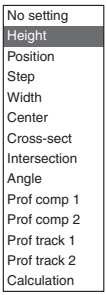


1 **Display the "Measurement mode" setting screen.**

"Displaying the Measurement Mode Settings Screen" (Page 5-82)

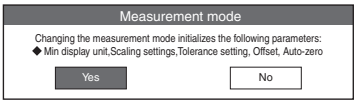
2 **Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.**

A pull-down menu appears.



3 **Select [Height] with the [▽] and [△] keys, then press the [ENTER] key.**

If changing to "No measurement" from any other measurement mode, a message warning that all settings will be reset is displayed.



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4 **Select "Yes" with the [◁] and [▷] keys, then press the [ENTER] key.**

- The "Height" setting menu appears.
- Select "No" if you do not want the settings to be reset.

5 **Set "Height measurement area."**

"Height measurement area" (Page 5-71)

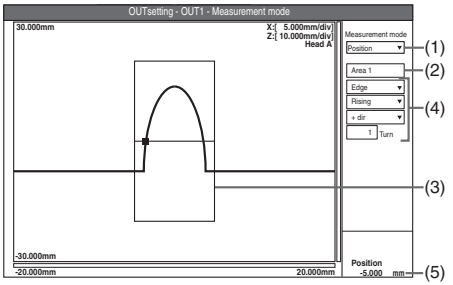
6 **Press the [ESCAPE] key to complete the "Height correction area " settings.**

Reference

Refer to the measurement results in the lower right portion of the screen while making these settings.

Position
(Measuring position)

"Position" measurement mode measures the distance from the X-axis zero point of the head at the "Position measurement area." "Position measurement area" sets one location. Edge position, position at maximum height and position at minimum height can be measured.



Setting items

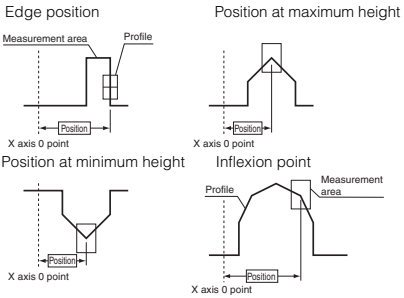
(1) Measurement mode
Select "Position."

(2) Area1
Set the position measurement area.

(3) Position measurement area
The position and size of area 1 are displayed in light blue.

(4) Position measurement area measurement conditions
This sets the measurement conditions for area 1.

(5) Measurement result
This displays the "Position" measurement result of the master profile.

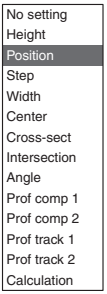


1 **Display the "Measurement mode" setting screen.**

"Displaying the Measurement Mode Settings Screen" (Page 5-82)

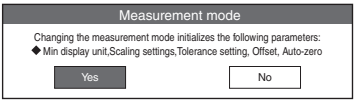
2 **Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.**

A pull-down menu appears.



3 **Select [Position] with the [▽] and [△] keys, then press the [ENTER] key.**

If changing to "No measurement" from any other measurement mode, a message warning that all settings will be reset is displayed.



4 **Select "Yes" with the [◁] and [▷] keys, then press the [ENTER] key.**

- The "Position" setting menu appears.
- Select "No" if you do not want the settings to be reset.

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5 **Set "Position measurement area."**

"Position measurement area" (Page 5-73)

6 **Press the [ESCAPE] key to complete the "Position measurement area" settings.**

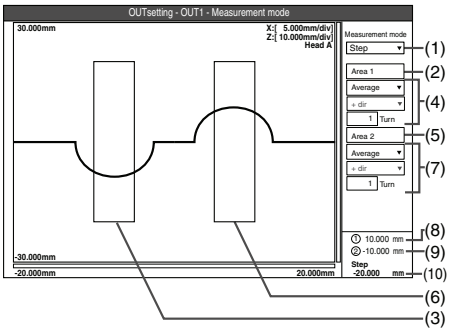
Reference

Refer to the measurement results in the lower right portion of the screen while making these settings.

Step
(Measuring the differences in height)

"Step" measurement mode measures the height difference between two "Height measurement areas." The average height, maximum height or minimum height within each "Height measurement areas," or a combination of these three, can be used to make the comparison.

"Step" subtracts the "Height" of area 1 from the "Height" of area 2.



Setting items

(1) Measurement mode
Select "Step."

(2) Area 1
Set the first "Height measurement area."

(3) Height measurement area 1
The position and size of area 1 are displayed in light blue.

(4) Measurement condition for height measurement area 1
Set the measurement condition for area 1.

(5) Area 2
Set the second "Height measurement area."

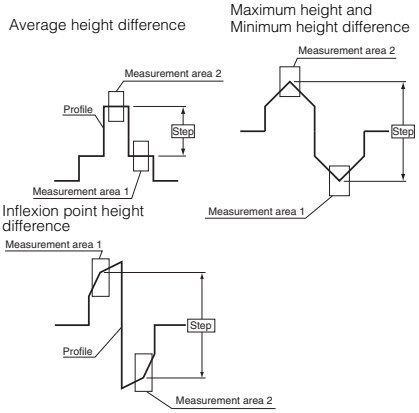
(6) Height measurement area 2
The position and size of area 2 are displayed in purple.

(7) Measurement condition for height measurement area 2
Set the measurement condition for area 2.

(8) Height measurement result 1
This displays the "Height" measurement result for area 1 of the master profile.

(9) Height measurement result 2
This displays the "Height" measurement result for area 2 of the master profile.

(10) Step measurement result
This displays the "Step" measurement result of the master profile.



Reference

Switching measurement area 1 and measurement area 2 inverts the symbol of the measurement value.

1 **Display the "Measurement mode" setting screen.**

"Displaying the Measurement Mode Settings Screen" (Page 5-82)

2 **Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.**

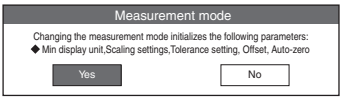
A pull-down menu appears.

No setting
Height
Position
Step
Width
Center
Cross-sect
Intersection
Angle
Prof comp 1
Prof comp 2
Prof track 1
Prof track 2
Calculation

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3 **Select [Step] with the [▽] and [△] keys, then press the [ENTER] key.**

If changing to "No measurement" from any other measurement mode, a message warning that all settings will be reset is displayed.



4 **Select "Yes" with the [◁] and [▷] keys, then press the [ENTER] key.**

- The "Step" setting menu appears.
- Select "No" if you do not want the settings to be reset.

5 **Set the first "Height measurement area" as "Area 1."**

"Height measurement area" (Page 5-71)

6 **Set the second "Height measurement area" as "Area 2."**

"Height measurement area" (Page 5-71)

7 **Press the [ESCAPE] key to complete the "Height correction area " settings.**

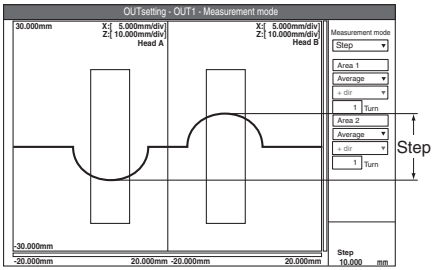
Reference

Refer to the measurement results in the lower right portion of the screen while making these settings.

■ Measuring height difference with the distance between heads

If "Calculation" is set to "Linking (H)" or "Linking (V)," setting head A to area 1 and head B to area 2 will allow the thickness and height difference between the two heads to be measured.

"Calculation"(Page 5-35)



Reference

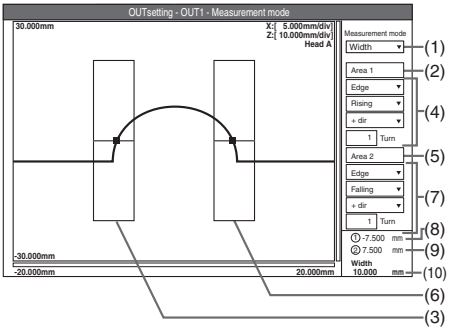
Measurement value correction uses the auto-offset function.

"Auto-offset" (Page 3-16)

Width
(Measuring differences in width)

"Width" measurement mode measures the distance between two "Position measurement areas". The edge position, position at maximum height and position at minimum height within each "Position measurement area," or a combination of these three, can be used to make the comparison.

"Width" subtracts the "Position" of area 1 from the "Position" of area 2.



Setting items

(1) Measurement mode
Select "Width."

(2) Area 1
Set the first "Position measurement area."

(3) Width measurement area 1
The position and size of area 1 are displayed in light blue.

(4) Width measurement area measurement conditions 1
This sets the position measurement conditions for area 1.

(5) Area 2
Set the second "Position measurement area."

(6) Width measurement area 2
The position and size of area 2 are displayed in purple.

(7) Width measurement area measurement conditions 2
This sets the position measurement conditions for area 2.

(8) Position 1
This displays the "Position" measurement result for area 1 of the master profile.

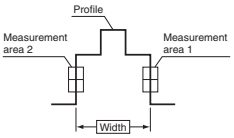
(9) Position 2
This displays the "Position" measurement result for area 2 of the master profile.

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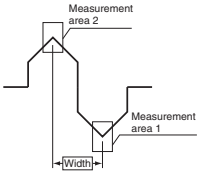
(10)Width measurement result

This displays the "Width" measurement result of the master profile.

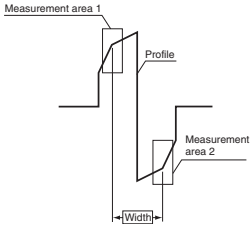
Width between edges



Width between position at maximum height and position at minimum height



Width between inflexion points



Reference

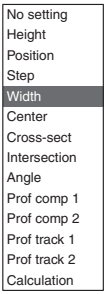
Switching measurement area 1 and measurement area 2 inverts the symbol of the measurement value.

1 Display the "Measurement mode" setting screen.

"Displaying the Measurement Mode Settings Screen" (Page 5-82)

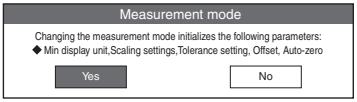
2 Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.

A pull-down menu appears.



3 Select [Width] with the [▽] and [△] keys, then press the [ENTER] key.

If changing to "No measurement" from any other measurement mode, a message warning that all settings will be reset is displayed.



4 Select "Yes" with the [◁] and [▷] keys, then press the [ENTER] key.

- The "Width" setting menu appears.
- Select "No" if you do not want the settings to be reset.

5 Set the first "Position measurement area" as "Area 1."

"Position measurement area" (Page 5-73)

6 Set the first "Position measurement area" as "Area 2."

"Position measurement area" (Page 5-73)

7 Press the [ESCAPE] key to complete the "Position measurement area" settings.

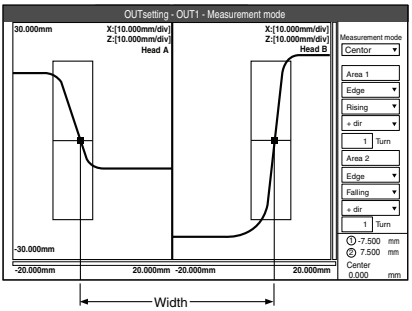
Reference

Refer to the measurement results in the lower right portion of the screen while making these settings.

■ Measuring width difference with the distance between heads

If "Calculation" is set to "Linking (H)" or "Linking (V)," setting head A to area 1 and head B to area 2 will allow the width between the two heads to be measured.

"Calculation"(Page 5-35)



Reference

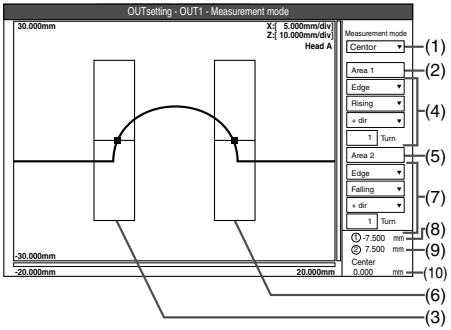
Measurement value correction uses the auto-offset function.

"Auto-offset" (Page 3-16)

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Center Position
(Measuring the Center Position)

"Center" measurement mode measures the distance from the X-axis zero point of the head to two different "Position measurement areas" and determines the center of that distance. The edge position, maximum position and minimum position within each "Position measurement area," or a combination of these three, can be used to make the comparison.



Setting items

(1) Measurement mode
Select "Center."

(2) Area 1
Set the first "Position measurement area."

(3) Position measurement area 1
The position and size of area 1 are displayed in light blue.

(4) Position measurement area measurement conditions 1
This sets the position measurement conditions for area 1.

(5) Area 2
Set the second "Position measurement area."

(6) Position measurement area 2
The position and size of area 2 are displayed in purple.

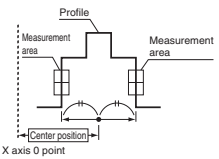
(7) Width measurement area measurement conditions 2
This sets the position measurement conditions for area 2.

(8) Position 1
This displays the "Position" measurement result for area 1 of the master profile.

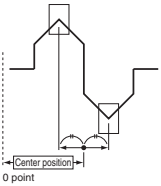
(9) Position 2
This displays the "Position" measurement result for area 2 of the master profile.

(10) Center position measurement result
This displays the "Center" measurement result of the master profile.

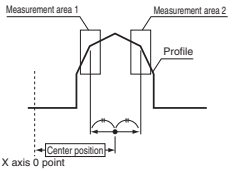
Center point between edges



The midpoint between the position at maximum height and the position at minimum height.



Center point between inflexion points

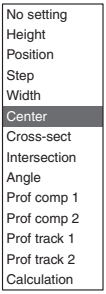


1 Display the "Measurement mode" setting screen.

"Displaying the Measurement Mode Settings Screen" (Page 5-82)

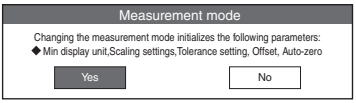
2 Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.

A pull-down menu appears.



3 Select [Center] with the [▽] and [△] keys, then press the [ENTER] key.

If changing to "No measurement" from any other measurement mode, a message warning that all settings will be reset is displayed.



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4 **Select "Yes" with the [◁] and [▷] keys, then press the [ENTER] key.**

- The "Center" setting menu appears.
- Select "No" if you do not want the settings to be reset.

5 **Set the first "Position measurement area" as "Area 1."**

"Position measurement area" (Page 5-73)

6 **Set the first "Position measurement area" as "Area 2."**

"Position measurement area" (Page 5-73)

7 **Press the [ESCAPE] key to complete the "Position measurement area" settings.**

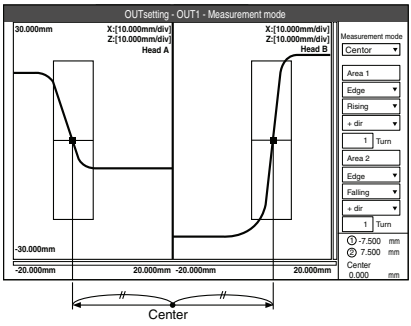
Reference

Refer to the measurement results in the lower right portion of the screen while making these settings.

■ Measuring the center point with the distance between heads

If "Calculation" is set to "Linking (H)" or "Linking (V)," setting head A to area 1 and head B to area 2 will allow the center point between the two heads to be measured.

"Calculation"(Page 5-35)



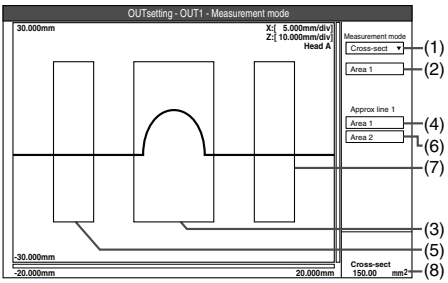
Reference

Measurement value correction uses the auto-offset function.

"Auto-offset" (Page 3-16)

Cross-Sectional Area
(Measuring a cross-sectional area)

"Cross-section" mode measures the area bordered by the baseline and profile and falling within the "Cross-section measurement area." The baseline can be set either by using the "Approximate line measurement area" or by using the intersection of the profile and the "Cross-section measurement area." If there are multiple regions being measured, the result is the sum of their areas.



Setting items

(1) Measurement mode
Select "Cross-section."

(2) Area 1
Set "Cross-section measurement area."

(3) Cross-sectional measurement area
The position and size are displayed in light blue.

(4) Area 1
Set the first "Approximate line area."

(5) Approximation line area 1
The position and size are displayed in purple.

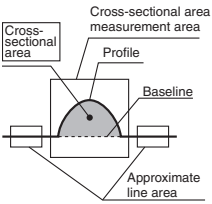
(6) Area 2
Set the second "Approximate line area."

(7) Approximation line area 2
The position and size are displayed in purple.

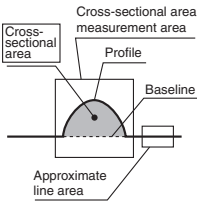
(8) Measurement result
This displays the "Cross-section" measurement result of the master profile.

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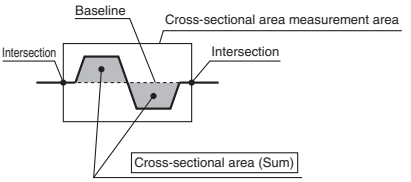
Two-location approximation line area measurement



One-location approximation line



Cross-sectional measurement area and Profile intersection measurement

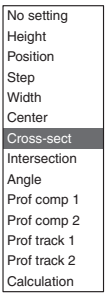


1 Display the "Measurement mode" setting screen.

"Displaying the Measurement Mode Settings Screen" (Page 5-82)

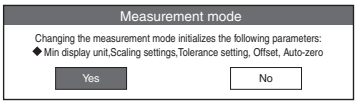
2 Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.

A pull-down menu appears.



3 Select [Cross-section] with the [▽] and [△] keys, then press the [ENTER] key.

If changing to "No measurement" from any other measurement mode, a message warning that all settings will be reset is displayed.



4 Select "Yes" with the [◁] and [▷] keys, then press the [ENTER] key.

- The "Cross-section" setting menu appears.
- Select "No" if you do not want the settings to be reset.

5 Set "Cross-section measurement area."

"Cross-sectional measurement area" (Page 5-76)

6 Set the "Approximate line area."

"Approximation line area" (Page 5-77)

The base line is set by the approximation line area.

- Set approximation line areas 1 and 2 when setting the baseline with two areas.
  "Using two areas to create an approximation line" (Page 5-78)
- Set approximation line area 1 or 2 when setting the baseline with one area.
  "Erasing the approximation line area" (Page 5-78)
- Delete approximation line areas 1 and 2 when setting the baseline with the intersection of the measurement area.
  "Erasing the approximation line area" (Page 5-78)

7 Press the [ESCAPE] key to complete the measurement area settings.

Reference

Refer to the measurement results in the lower right portion of the screen while making these settings.

► Note

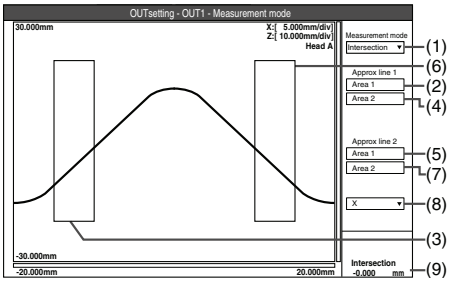
If "Calculation" is set to "Linking (H)" or "Linking (V)," set all measurement areas from the same head.

"Calculations" (Page 5-35)

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Intersection
(Measuring the height and position of an intersection)

"Intersection" measurement mode measures the height from the Z-axis zero point and the distance from the X-axis zero point of the intersection between "Approx line 1" and "Approx line 2."



Setting items

(1) Measurement mode
Select "Intersection."

(2) Area 1
Set "Area 1" for "Approx line 1."

(3) Approximation line 1 area 1
The position and size are displayed in light blue.

(4) Area 2
Set "Area 2" for "Approx line 1."

(5) Area 1
Set "Area 1" for "Approx line 2."

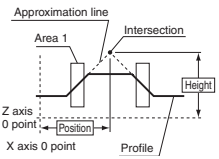
(6) Approximation line 2 area 1
The position and size are displayed in purple.

(7) Area 2
Set "Area 2" for "Approx line 2."

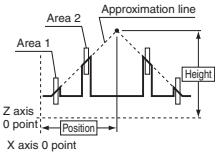
(8) Coordinate
Set the X coordinate (position) and the Z coordinate (height).

(9) Measurement result
This displays the "Intersection" measurement result of the master profile.

Measuring with area 1 only



Measuring with area 1 and area 2

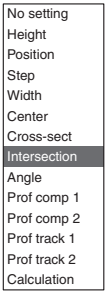


1 Display the "Measurement mode" setting screen.

"Displaying the Measurement Mode Settings Screen" (Page 5-82)

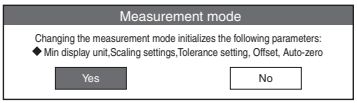
2 Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.

A pull-down menu appears.



3 Select "Intersection" with the [◁] and [▷] keys, then press the [ENTER] key.

If changing to "No measurement" from any other measurement mode, a message warning that all settings will be reset is displayed.



4 Select "Yes" with the [▽] and [△] keys, then press the [ENTER] key.

- The "Intersection" setting menu appears.
- Select "No" if you do not want the settings to be reset.

5 Set "Approx line 1."

"Approximation line area" (Page 5-77)

6 Set "Approx line 2."

"Approximation line area" (Page 5-77)

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7 **Select "Coordinate" with the [▽] and [△] keys, then press the [ENTER] key.**

A pull-down menu appears.



8 **Select "Position" or "Height" with the [▽] and [△] keys, then press the [ENTER] key.**

The coordinates are set.

9 **Press the [ESCAPE] key to complete the setting.**

Reference

- "Area 2" of either approximation line 1 or 2 will not be displayed if it is in the default state. Select "Area 2" with the [▽] and [△] keys, then press the [ENTER] key to set area 2.
- For details on clearing area 2, see "Erasing the approximation line area" (Page 5-78).
- Refer to the measurement results in the lower right portion of the screen while making these settings.

► Note

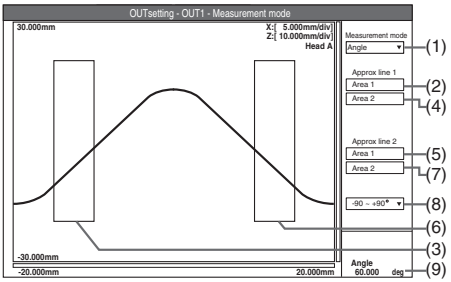
- If "Calculation" is set to "Linking (H)" or "Linking (V)," set all measurement areas from the same head.

"Calculations" (Page 5-35)

Angle

(Measuring the angle between two straight lines)

"Angle" measurement mode measures the angle at the intersection between two approximation lines. "Angle" measurement mode measures the angle at the intersection between two approximation lines, or between approximation line 1 and the X-axis of the head.



Setting items

(1) Measurement Mode

Select "Angle."

(2) Area 1

Set "Area 1" for "Approx line 1."

(3) Approximation line 1 area 1

The position and size are displayed in light blue.

(4) Area 2

Set "Area 2" for "Approx line 1."

This is not displayed in the default state.

(5) Area 1

Set "Area 1" for "Approx line 2."

Delete this item when measuring the angle from the X-axis of the head.

(6) Approximation line 2 area 1

The position and size are displayed in purple.

(7) Area 2

Set "Area 2" for "Approx line 2."

This is not displayed in the default state.

Delete this item when measuring the angle from the X-axis of the head.

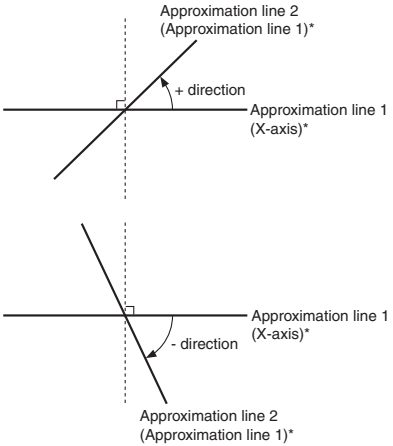
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(8) Coordinates

The measurement starts at "Approx line 1" and moves counterclockwise to "Approx line 2." This sets the coordinates for the measurement.
Setting range : -90 to +90°/ 0 to 180°
(default: -90 to +90°

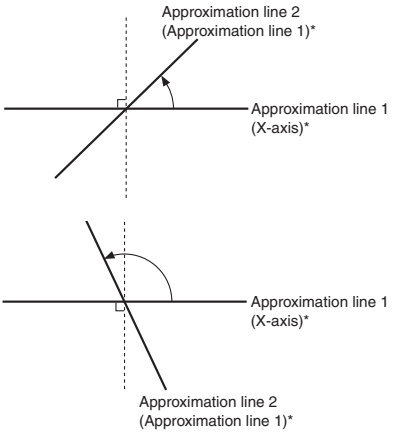
- **-90 to +90°**

  This reports angles in the range of ±90°.



- **0 to 180°**

  This reports angles in the range from 0 to180°.

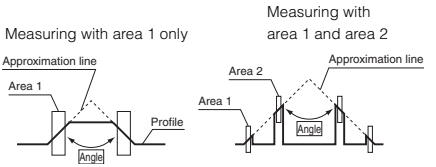


* Items in parentheses are for the angle measurement at the intersection between approximation line 1 and the X-axis of the head.

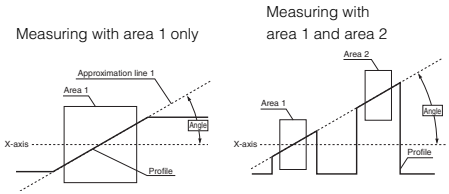
(9) Measurement result

This displays the "Angle" measurement result of the master profile.

Angle measurement at the intersection between approximation line 1 and approximation line 2



Angle measurement at the intersection between approximation line 1 and the X-axis of the head

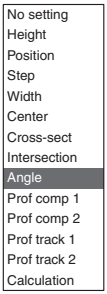


1 Display the "Measurement mode" setting screen.

"Displaying the Measurement Mode Settings Screen" (Page 5-82)

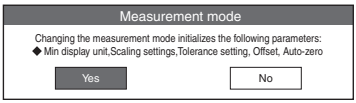
2 Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.

A pull-down menu appears.



3 Select "Angle" with the [▽] and [△] keys, then press the [ENTER] key.

If changing to "No measurement" from any other measurement mode, a message warning that all settings will be reset is displayed.



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4 **Select "Yes" with the [◁] and [▷] keys, then press the [ENTER] key.**

- The "Angle" setting menu appears.
- Select "No" if you do not want the settings to be reset.

5 **Set "Approx line 1."**

"Approximation line area" (Page 5-77)

6 **Set "Approx line 2."**

"Approximation line area" (Page 5-77)

Delete both "Area 1" and "Area 2" when measuring the angle from the X-axis of the head.

"Erasing the approximation line area" (Page 5-78)

7 **Select "Coordinate" with the [▽] and [△] keys, then press the [ENTER] key.**

A pull-down menu appears.



8 **Select "Coordinate" with the [▽] and [△] keys, then press the [ENTER] key.**

The coordinates are set.

9 **Press the [ESCAPE] key to complete the setting.**

► Note

If "Calculation" is set to "Linking (H)" or "Linking (V)," set all measurement areas from the same head.

"Calculations" (Page 5-35)

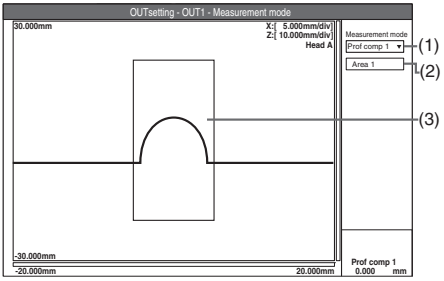
Reference

- Area 2 of either approximation line 1 or 2 will not be displayed if it is in the default state. Select "Area 2" with the [▽] and [△] keys, then press the [ENTER] key to set area 2.
- When measuring the angle from the X-axis of the head, clear both "Area 1" and "Area 2" of approximation line 2.
- For details on clearing area 1 or area 2, see "Erasing the approximation line area" (Page 5-78).
- Refer to the measurement results in the lower right portion of the screen while making these settings.

Profile Comparison 1
(Comparing shapes by step)

"Profile comparison 1" measurement mode compares the area of the master profile within the registered "Profile measurement area" to the measured profile and outputs the absolute value of the maximum height difference between the two.

"Master reg"(Page 5-48)



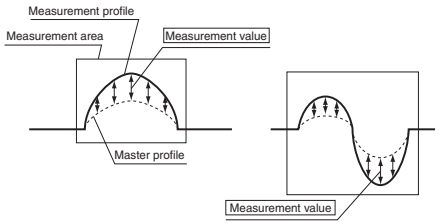
Setting items

(1) Measurement mode
Select "Profile comparison 1".

(2) Area 1
This sets the profile setting area.

(3) Profile measurement area
The position and size are displayed in light blue.

This measures the absolute value of the maximum height distance relative to the master profile.



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1 **Register the target to be used as the standard.**

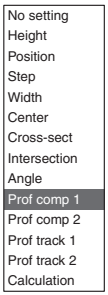
"Master reg"(Page 5-48)

2 **Display the "Measurement mode" setting screen.**

"Displaying the Measurement Mode Settings Screen" (Page 5-82)

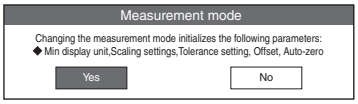
3 **Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.**

A pull-down menu appears.



4 **Select "Profile comparison 1" with the [▽] and [△] keys, then press the [ENTER] key.**

If changing to "No measurement" from any other measurement mode, a message warning that all settings will be reset is displayed.



5 **Select "Yes" with the [◁] and [▷] keys, then press the [ENTER] key.**

- The "Profile comparison 1" setting menu appears.
- Select "No" if you do not want the settings to be reset.

6 **This sets the "Profile measurement area".**

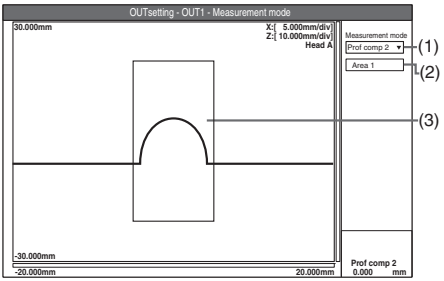
"Profile measurement area" (Page 5-79)

7 **Press the [ESCAPE] key to complete the measurement area settings.**

Profile Comparison 2
(Comparing shapes by area)

"Profile comparison 2" measurement mode measures the area bounded by the master profile within the registered "Profile measurement area" and the measured profile. If there are multiple regions being measured, the result is the sum of their areas.

"Master reg"(Page 5-48)



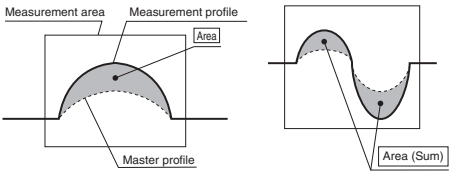
Setting items

(1) Measurement mode
Select "Profile comparison 2".

(2) Area 1
This sets the profile setting area.

(3) Profile measurement area
The position and size are displayed in light blue.

The total area between the two profiles is output without a sign.



1 **Register the target to be used as the standard.**

"Master reg"(Page 5-48)

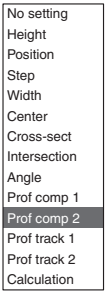
2 **Display the "Measurement mode" setting screen.**

"Displaying the Measurement Mode Settings Screen" (Page 5-82)

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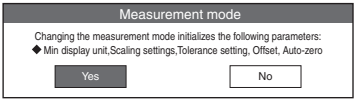
3 **Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.**

A pull-down menu appears.



4 **Select "Profile comparison 2" with the [▽] and [△] keys, then press the [ENTER] key.**

If changing to "No measurement" from any other measurement mode, a message warning that all settings will be reset is displayed.



5 **Select "Yes" with the [◁] and [▷] keys, then press the [ENTER] key.**

- The "Profile comparison 2" setting menu appears.
- Select "No" if you do not want the settings to be reset.

6 **This sets the "Profile measurement area".**

"Profile measurement area" (Page 5-79)

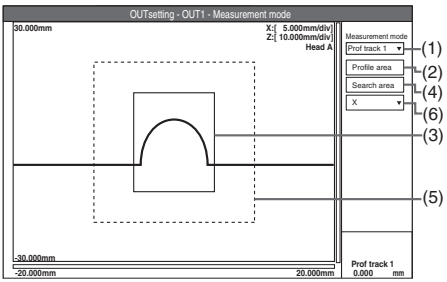
7 **Press the [ESCAPE] key to complete the measurement area settings.**

Profile Tracking 1

(Measuring the height and position along a profile)

"Profile tracking 1" measurement searches for a measured profile with the same shape as that in the "Profile measurement area" of the previously registered master profile. The height of the profile from the zero point of the Z-axis of the head and the distance of the profile from the zero point of the X-axis of the head are measured.

"Master reg"(Page 5-48)



Setting items

(1) Measurement mode
Select "Profile tracking 1".

(2) Profile area
Sets the profile setting area.

(3) Profile area region
The position and size are indicated by a solid light blue line.

(4) Search area
Set the search area.

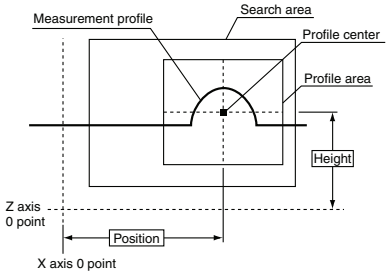
(5) Search area region
The position and size are indicated by a dotted, light blue line.

(6) Coordinate
Set the X coordinate (position) and the Z coordinate (height).

This searches for a profile with the same shape as that of a profile previously defined in the profile measurement area, then measures the height and position of the center coordinate of the profile measurement area.

"Master profile"(Page 5-48)

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1 **Register the target to be used as the standard.**

"Master reg" (Page 5-48)

2 **Display the "Measurement mode" setting screen.**

"Displaying the Measurement Mode Settings Screen" (Page 5-82)

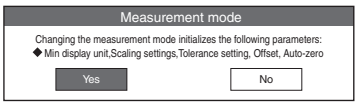
3 **Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.**

A pull-down menu appears.

No setting
Height
Position
Step
Width
Center
Cross-sect
Intersection
Angle
Prof comp 1
Prof comp 2
Prof track 1
Prof track 2
Calculation

4 **Select "Profile tracking 1" with the [▽] and [△] keys, then press the [ENTER] key.**

If changing to "No measurement" from any other measurement mode, a message warning that all settings will be reset is displayed.



5 **Select "Yes" with the [◁] and [▷] keys, then press the [ENTER] key.**

- The "Profile tracking 1" setting menu appears.
- Select "No" if you do not want the settings to be reset.

6 **This sets the "Profile measurement area".**

"Profile measurement area" (Page 5-79)

7 **Set the "Search area."**

"Search area" (Page 5-81)

8 **Select "Coordinate" with the [▽] and [△] keys, then press the [ENTER] key.**

X
Z

9 **Select "Position" or "Height" with the [▽] and [△] keys, then press the [ENTER] key.**

The coordinates are set.

10 **Press the [ESCAPE] key to complete the setting.**

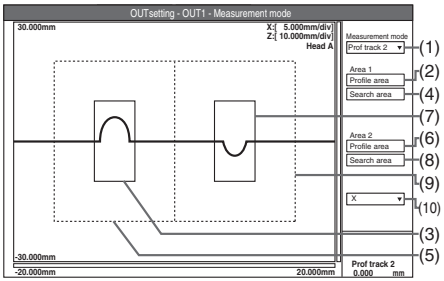
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Profile Tracking 2

(Measuring the height difference and width along a profile)

"Profile tracking 2" measurement searches for a measured profile with the same shape as that in the "Profile measurement area" of the previously registered master profile. Profiles will similar shapes to each other are searched. The width, height difference, linear distance and X-axis and Z-axis center points are measured.

"Master reg"(Page 5-48)



Setting items

(1) Measurement mode
Select "Profile tracking 2".

(2) Profile area 1
Sets "Profile measurement area" for area 1.

(3) Profile area region 1
The position and size of the "Profile measurement area" for area 1 are indicated by a solid light blue line.

(4) Search area1
Set the search area for area 1.

(5) Search area region 1
The position and size of the search area of area 1 are indicated by a dotted, light blue line.

(6) Profile area 2
Set the profile measurement area for area 2.

(7) Profile area region 2
The position and size of the position measurement area for area 2 are indicated by a solid purple line.

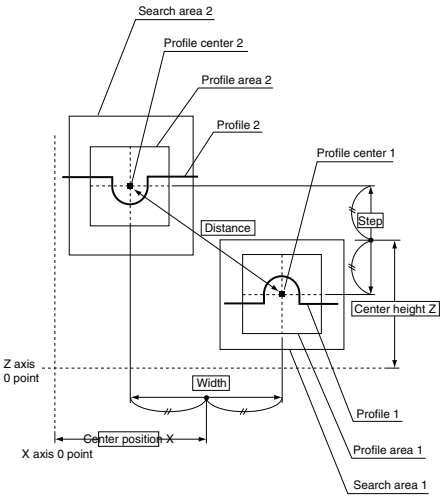
(8) Search area 2
Set the search area for area 2.

(9) Search area region 2
The position and size of the search area of area 2 are indicated by a dotted purple line.

(10)Measurement type
Set the feature to be measured between the two areas.

- **X (default)**
  Measures the width between the centers of the two profile measurement areas.
- **Z**
  Measures the height difference between the centers of the two profile measurement areas.
- **D**
  Measures the straight line distance between the centers of the two profile measurement areas.
- **X Center**
  Measures the midpoint between the center positions of the X-axes of the two profile measurement areas.
- **Z Center**
  Measures the midpoint between the center heights of the Z-axes of the two profile measurement areas.

This searches for two profiles with the same shape as that of a profile previously defined in the profile measurement area, then measures the height, step, distance from baseline and center point position and height of those profiles



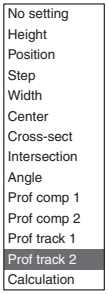
1 Display the "Measurement mode" setting screen.

"Displaying the Measurement Mode Settings Screen" (Page 5-82)

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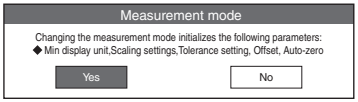
2 **Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.**

A pull-down menu appears.



3 **Select "Profile tracking 2" with the [▽] and [△] keys, then press the [ENTER] key.**

If changing to "No measurement" from any other measurement mode, a message warning that all settings will be reset is displayed.



4 **Select "Yes" with the [◁] and [▷] keys, then press the [ENTER] key.**

- The "Profile tracking 2" setting menu appears.
- Select "No" if you do not want the settings to be reset.

5 **Sets "Profile measurement area" for area 1.**

"Profile measurement area" (Page 5-79)

6 **Set the "Search area" for area 1.**

"Search area" (Page 5-81)

7 **Sets "Profile measurement area" for area 2.**

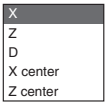
"Profile measurement area" (Page 5-79)

8 **Set the "Search area" for area 2.**

"Search area" (Page 5-81)

9 **Select "Measurement type" with the [▽] and [△] keys, then press the [ENTER] key.**

A pull-down menu appears.



10 **Select "Measurement type" with the [▽] and [△] keys, then press the [ENTER] key.**

The measurement type is set.

11 **Press the [ESCAPE] key to complete the setting.**

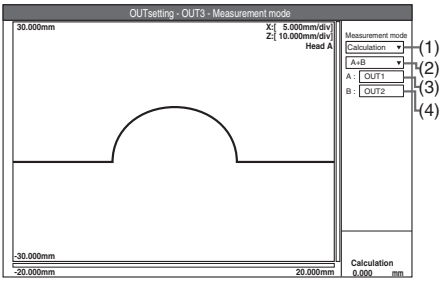
► Note

If "Calculation" is set to "Linking (H)" or "Linking (V)," set all measurement areas from the same head.

"Calculations" (Page 5-35)

Calculations
(Calculating the distance between OUTs)

"Calculation" measurement mode uses two OUT numbers from the calculation target and finds the sum or the difference of those two results.



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Setting items

(1) Measurement mode
Select "Calculation."

(2) Caculation type
Set the calculation type.

- **A + B**
  Adds the OUT numbers from "Calculation target A" and "Calculation target B."
- **A - B**
  Subtracts the OUT number of "Calculation target B" from the OUT number of"Calculation target A."

(3) Calculation target A
Set the OUT number to use in the calculation.

(4) Calculation target B
Set the OUT number to use in the calculation.

► Note

- The minimum display value uses the same setting as does "Calculation target A."
  "Minimum Display Unit" (Page 5-106)
- It is possible to use OUT numbers with a smaller value than the OUT number selected for the calculation. For example, OUT3 can receive the results of a calculation involving OUT1 and OUT2, but not a calculation involving OUT1 and OUT4.
- An attempt to perform a calculation between two OUT numbers that handle different measurements, i.e., one measuring height and one measuring angle, will result in a measurement alarm.
- OUT1 and OUT2 cannot be set to the calculation measurement mode.
- The calculation is performed based on the data before the minimum display unit process.

Reference

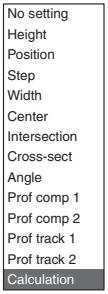
- OUT numbers set to calculation can used by other OUT numbers that are performing calculations.
- Scaling factors can be used in calculations by using the "Scaling function."
  "Scaling" (Page 5-107)
- "Calculation" calculates the measurement result of the OUT number of the calculation target for which measurement mode, measurement value alarm, scaling, average in the OUT setting are processed.
  "Measurement Conditions and Measurement Data Flow" (Page 5-2)

1 Display the "Measurement mode" setting screen.

"Displaying the Measurement Mode Settings Screen" (Page 5-82)

2 Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.

A pull-down menu appears.

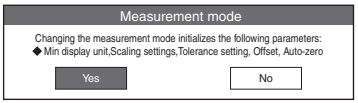


► Note

The calculation option is not displayed for OUT1 and OUT2.

3 Select "Calculation" with the [▽] and [△] keys, then press the [ENTER] key.

If changing to "No measurement" from any other measurement mode, a message warning that all settings will be reset is displayed.

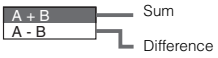


4 Select "Yes" with the [◁] and [▷] keys, then press the [ENTER] key.

- The "Calculation" setting menu appears.
- Select "No" if you do not want the settings to be reset.

5 Select a calculation type with the [▽] and [△] keys, then press the [ENTER] key.

A pull-down menu appears.



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6 **Select [A + B] or [A - B] with the [▽] and [△] keys, then press the [ENTER] key.**

The calculation type is set.

7 **Select "Calculation target A" with the [▽] and [△] keys, then press the [ENTER] key.**

A pull-down menu appears.



Reference

The OUT numbers displayed here will vary depending on the OUT number being set.

8 **Select the OUT number with the [▽] and [△] keys, then press the [ENTER] key.**

Calculation target A is set.

9 **Set "Calculation target B."**

The steps for making these settings are the same as steps 6 and 7 for setting calculation target A.

10 **Press the [ESCAPE] key to complete the setting.**

Average
(Using averaging for a more stable measurement)

This performs a moving-average for the measurement value within the range of 1 to 4096 times.

Setting range: 1/2/4/8/16/32/64/128/256/512/1024/2048/4096 (Default: 1)

► Note

- If the multiple trigger is on, the averaging setting is ignored.
  - "Multiple Trigger" (Page 5-15)
  - "Function Limits and Selecting Setting Items" (Page 5-10)
- The trigger delay, average time of measurement, and refresh rate vary depending on the settings.
  - "Trigger Interval and Measurement Time" (Page 10-21)
  - "Averaging Response Time" (Page 10-24)

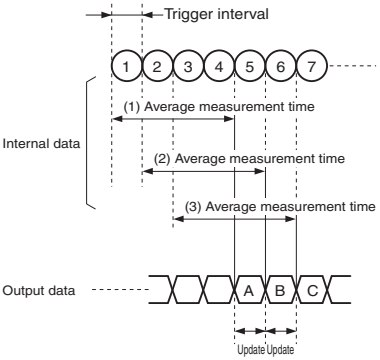
The following is the example of the process when averaging is set to 4.

For continuous trigger

When the continuous trigger is set, measurements occur at the frequency dictated by the trigger delay and are continuously output.

"Trigger Mode" (Page 5-12)

"Continuous Trigger" (Page 10-2)

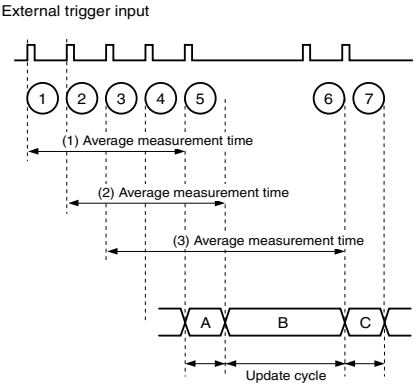


(1) Data 1 through 4 are averaged and output as data A.
(2) Data 2 through 5 are averaged and output as data B.
(3) Data 3 through 6 are averaged and output as data C.

When the remote multiple trigger is OFF

Input from the remote trigger is read in asynchronously. Averaged results are also output asynchronously.

"Trigger Mode" (Page 5-12)



(1) Data 1 through 4 are averaged and output as data A.

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(2) Data 2 through 5 are averaged and output as data B.
(3) Data 3 through 6 are averaged and output as data C.

1 **Display the "OUT settings" screen.**

"Displaying the OUT Settings Screen" (Page 5-65)

2 **Select the OUT number with the [▽] and [△] keys, then press the [ENTER] key.**

The cursor moves to the "OUT name" for the selected OUT number.

3 **Select "Average" with the [▽] and [△] keys, then press the [ENTER] key.**

A pull-down menu appears.

4 **Select an averaging count with the [▽] and [△] keys, then press the [ENTER] key.**

The number of measurement times for averaging is fixed.

5 **Press the [ESCAPE] key to complete the setting.**

Measurement Alarm
(Setting processing for impossible measurements.)

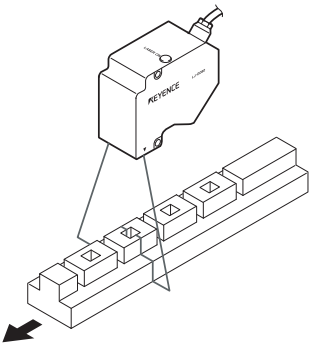
The measurement is disabled when conditions such as measurement over range, insufficient light or failed position correction occur. The measurement alarm specifies the number of samples to be returned with the last valid measurement value when measurement is impossible.
When the measurement continues to be impossible even after the specified number of samples is taken, the measured value is displayed as -FFFFFF.
The measurement value is held until the system is able to make a valid measurement up to the number of times specified in the alarm settings. When the processing number is set to "255", the value is always held until a valid measurement occurs again.

Setting range: 0 to 255 times (Default: 0)

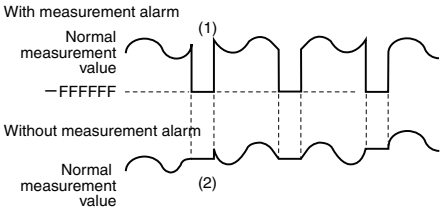
Reference

The laser LED on the head and the profile display are not held.

Example: The inability to measure due to a defect such as a hole can be cancelled.



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(1) The measurement result is displayed as -FFFFFF when measurement is not possible.
(2) Holds the previous value for the number of samples specified when measurement is not possible.

1 Display the "OUT settings" screen.

"Displaying the OUT Settings Screen" (Page 5-65)

2 Select the OUT number with the [▽] and [△] keys, then press the [ENTER] key.

The cursor moves to the "OUT name" for the selected OUT number.

3 Select "Measure alarm" with the [▽] and [△] keys, then press the [ENTER] key.

The device enters the value input state.



4 Press the [ENTER] key after setting the "Measure alarm."

"Entering a Value" (Page 2-5)

The measurement alarm value is fixed.

5 Press the [ESCAPE] key to complete the setting.

Comparative Measurement Mode (Measuring and holding)

How to output measured values can be selected from these options such as holding a peak value or a bottom value during a specified time.
The range for this setting varies with the multiple trigger and averaging settings.

"Function Limits and Selecting Setting Items" (Page 5-10)
"Trigger Mode" (Page 5-12)
"Multiple Trigger" (Page 5-15)
"Averaging" (Page 5-43)

Refer to the timing chart for details.

"Timing Chart and Response Times" (Page 10-1)

There are 10 different comparative measurement modes.

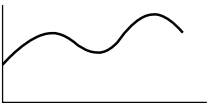
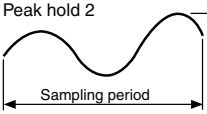
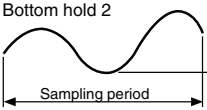
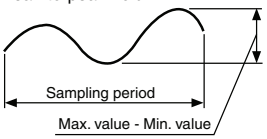
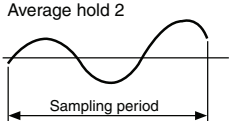
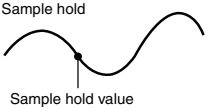
- Normal (Default)
- Peak hold 1
- Peak hold 2
- Bottom hold 1
- Bottom hold 2
- Peak to-peak hold 1
- Peak to-peak hold 2
- Average hold 1
- Average hold 2
- Sample-and-hold

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When the remote or multiple trigger is OFF

This controls the sampling period and comparative measurement mode processing for measurement values from profiles sampled with the continuous trigger or the external trigger when the multiple trigger is off.

"Trigger Mode" (Page 5-12)
"Multiple Trigger" (Page 5-15)
"Continuous Trigger" (Page 10-2)
"Single Trigger" (Page 10-10)

Normal		The measured result can be displayed or output as required.
Peak hold 1 / Peak hold 2		The maximum value during the specified period can be measured.
Bottom hold 1 / Bottom hold 2		The minimum value during the specified period can be measured.
Peak-to-peak hold 1 / Peak-to-peak hold 2		The difference between the maximum and minimum values during the specified period can be measured.
Average hold 1 / Average hold 2		The average value during the specified period can be measured.
Sample hold		The value at a specified moment can be measured.

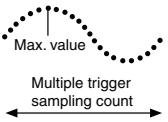
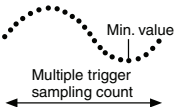
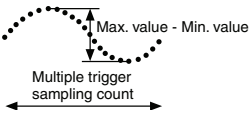
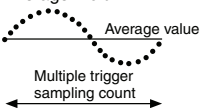
When multiple trigger is ON and averaging is OFF

This is comparative measurement mode processing for measured values of profiles sampled with the multiple trigger.

"Multiple Trigger" (Page 5-15)
"Averaging" (Page 5-43)
"Multi (Internal) Trigger" (Page 10-13)

► Note

Do not set the measurement mode to normal or sample hold. Doing so may cause instability in the measured values.

Peak hold 1 / peak hold 2		The maximum value obtained in the sampling can be measured.
Bottom hold 1 / bottom hold 2		The minimum value obtained in the sampling can be measured.
Peak-to-peak hold 1 / Peak-to-peak hold 2		The difference between the maximum and minimum values obtained in the sampling can be measured.
Average hold 1 / Average hold 2		The average value during sampling can be measured.

When multiple trigger is ON and averaging is ON

The profile averaged from the number of profiles specified in the sampling count is measured with the specified measurement mode.
The comparative measurement mode setting is ignored.

"Multiple Trigger" (Page 5-15)
"Averaging" (Page 5-43)
"Measurement Mode (Setting measurement conditions)" (Page 5-67)

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"Multi (Internal) Trigger" (Page 10-13)

1 **Display the "OUT settings" screen.**

"Displaying the OUT Settings Screen" (Page 5-65)

2 **Select the OUT number with the [▽] and [△] keys, then press the [ENTER] key.**

The cursor moves to the "OUT name" for the selected OUT number.

3 **Select "Measurement mode" with the [▽] and [△] keys, then press the [ENTER] key.**

The comparative measurement modes are displayed in a pull-down menu.

Measurement mode	Normal
	Peak hold1
	Bottom hold1
	P-to-p hold1
	Average hold1
	Peak hold2
	Bottom hold2
	P-to-p hold2
	Average hold2
	Sample hold

4 **Select the comparative measurement mode with the [▽] and [△] keys, then press the [ENTER] key.**

The comparative measurement mode is fixed.

5 **Press the [ESCAPE] key to complete the setting.**

Offset
(Measuring with offset)

Values can be added or subtracted 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 based on the measured value after comparative measurement mode processing and auto-zero processing.

Setting range: display range (Default: 0)
The display range varies with the minimum display unit setting.

Refer to "Minimum Display Unit" (Page 5-106) for more details about the display range.

1 **Display the "OUT settings" screen.**

"Displaying the OUT Settings Screen" (Page 5-65)

2 **Select the OUT number with the [▽] and [△] keys, then press the [ENTER] key.**

The cursor moves to the "OUT name" for the selected OUT number.

3 **Select "Offset" with the [▽] and [△] keys, then press the [ENTER] key.**

The device enters the value input state.

Offset	+00.000

4 **Press the [ENTER] key after inputting the offset value.**

"Entering a Value" (Page 2-5)

The offset is set.

5 **Press the [ESCAPE] key to complete the setting.**

Reference

Use this in combination with the auto-zero function to match profiles up with the master profile (auto-offset).

"Auto-offset" (Page 3-16)
"Auto-zero" (Page 3-15)

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

The units are different depending on whether length, area or angle is being measured. The smallest display unit can be set for each type of measurement. The minimum unit for length can be set (mm / µm)
Changing the minimum display unit will cause a corresponding change in the display range.

"Measurement Mode (Setting measurement conditions)" (Page 5-67)

► Note

- When the "Min display unit" setting is changed, scaling, offset, tolerance (maximum and minimum) and auto-zero settings are initialized.
  "Scaling" (Page 5-107)
  "Offset" (Page 5-105)
  "Tolerance" (Page 5-109)
  "Auto-zero" (Page 3-15)
- The measurement value can be acquired by rounding the first digit below the minimum display unit.

Default values and setting range

- Length

Minimum display unit	Display range
1 (mm)	-99999 to +99999 (mm)
0.1 (mm)	-99999.9 to +99999.9 (mm)
0.01 (mm)	-9999.99 to +9999.99 (mm)
0.001 (mm) (default)	-999.999 to +999.999 (mm)
1 (µm)	-999999 to +999999 (µm)
0.1 (µm)	-99999.9 to +99999.9 (µm)*1

*1 Only when the LJ-G015 / LJ-G015K is connected.

- Area

Minimum display unit	Display range
1 (mm^2)	-99999 to +99999 (mm^2)
0.1 (mm^2)	-99999.9 to +99999.9 (mm^2)
0.01 (mm^2) (default)	-9999.99 to +9999.99 (mm^2)
0.001 (mm^2)	-999.999 to +999.999 (mm^2)

- Angle

Minimum display unit	Display range
1 (deg)	-999999 to 999999 (deg)
0.1 (deg)	-99999.9 to +99999.9 (deg)
0.01 (deg) (default)	-9999.99 to +9999.99 (deg)

1 Display the "OUT settings" screen.

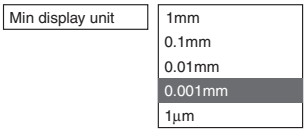
"Displaying the OUT Settings Screen" (Page 5-65)

2 Select the OUT number with the [▽] and [△] keys, then press the [ENTER] key.

The cursor moves to the "OUT name" for the selected OUT number.

3 Select "Min display unit" with the [▽] and [△] keys, then press the [ENTER] key.

A pull-down menu appears. The contents of display vary with the type of measurement.



4 Select "Min display unit" with the [▽] and [△] keys, then press the [ENTER] key.

The minimum display unit is set.

5 Press the [ESCAPE] key to complete the setting.

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Scaling
(Correcting measured values)

The displayed value for the measurement value can be scaled (corrected) as desired.
Scaling takes the values from two specified points and sets a measurement value for those points.

Setting range: Display range
The display range varies with the minimum display unit setting.

Refer to "Minimum Display Unit" (Page 5-106) for more details about the display range.

Default value:

Units	mm	μm	mm^2	deg
Input value 1	0	0	0	0
Display value 1	0	0	0	0
Input value 2	1	1000	1	10
Display value 2	1	1000	1	10

The default number of digits displayed varies with the minimum display unit setting.

► Note

If the following conditions are not met, a setting error will appear and you will not be able to complete the settings. Press the [ENTER] key to cancel the error, and set the scaling again.

Condition 1 : Input value 1 is not equal to input value 2

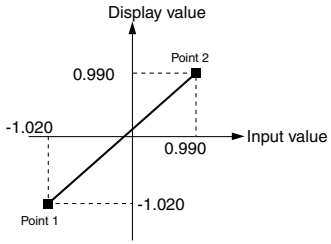
Condition 2 : $\left|\frac{\text{Display value 2 - Display value 1}}{\text{Input value 2 - Input value 1}}\right| < 10$

Setting scaling

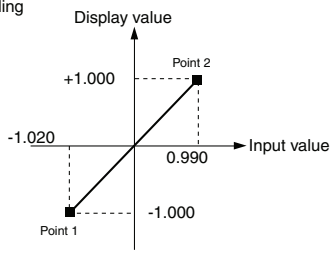
This section describes scaling settings, using the following values as examples.

Setting content		Setting value
Point 1	Original input value 1	-1.020
	Scaled display value 1	-1.000
Point 2	Original input value 2	+0.990
	Scaled display value 2	+1.000

Before scaling



After scaling



1 Display the "OUT settings" screen.

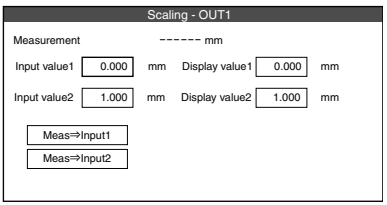
"Displaying the OUT Settings Screen" (Page 5-65)

2 Select the OUT number with the [△] keys, then press the [ENTER] key.

The cursor moves to the "OUT name" for the selected OUT number.

3 Select [Scaling] with the [▽] and [△] keys, then press the [ENTER] key.

The scaling window appears.



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4 **Select "Input value 1" with the [▽], [△], [◁] and [▷] keys, then press the [ENTER] key.**

The device enters the value input state.



5 **Set "Input value 1".**

Enter -1.020.

"Entering a Value" (Page 2-5)

6 **Set "Input value 2".**

Enter +0.990.

The steps for making this settings are the same as for setting "Input value 1."

7 **Set "Display value 1".**

Enter -1.000.

The steps for making this settings are the same as for setting "Input value 1."

8 **Set "Display value 2".**

Enter +1.000.

The steps for making this settings are the same as for setting "Input value 1."

9 **Press the [Escape] key once settings for "Input value 1" "Input value 2" "Display value 1" and "Display value 2" have been completed.**

- The scaling is set and the window closes.
- An error message will be displayed if the input conditions are not met. Redo the settings and try again.

"If the input conditions are not met" (Page 5-108)

10 **Press the [ESCAPE] key to complete the setting.**

Reference

Pressing the [TRG] key while the "Scaling window" is visible will cause a measurement to be taken and the measured value to be displayed in the box. Moving the cursor to either the "Input value1" button or the "Input value2" button and pressing the [ENTER] key will cause the measured value to be used as an input value.

If the input conditions are not met

If the following conditions are not met, a setting error will appear and you will not be able to complete the settings. Press the [ENTER] key to cancel the error, and set the scaling again.

Condition 1 : Input value 1 is not equal to input value 2

Condition 2 : $\left|\frac{\text{Display value 2 - Display value 1}}{\text{Input value 2 - Input value 1}}\right| < 10$

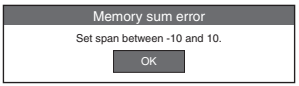
If condition 1 is not met



Press the [ENTER] key to close the message.

Cause : Condition 1 has not been met.
Remedy : Set input value 1 and input value 2 to different values.

If condition 2 is not met



Press the [ENTER] key to close the message.

Cause : Condition 2 has not been met.
Remedy : Reduce the difference between display value 1 and display value 2. Alternatively, increase the difference between input value 2 and input value 1 to meet condition 2.

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Tolerance
(Evaluating measured values)

This function determines the acceptability of measured values.
The acceptable range of measured values for this judgment is called tolerance.
The maximum and minimum acceptable values can be set.

"Description of the Measurement Screen" (Page 3-2)
"Binary Output" (Page 5-114)
"Evaluation output" (Page 8-6)
"Input and Output Details" (Page 10-15)
"Status Table" (Page 11-8)

The relationship between the HI, GO, and LO ranges and the setting value is shown below.

Evaluation	Range	Measurement value display screen
HI	Upper limit < measured value	The evaluation "HI" is displayed in red.
GO	Lower limit ≤ Measured value ≤ Upper limit	The evaluation "GO" is displayed in green.
LO	Measurement value < lower limit	The evaluation "LO" is displayed in red.
Evaluation standby	The measured value is displayed as "-----" and the evaluation is displayed as "--" Evaluation output turns OFF.	
Measured value Alarm	The measured value is displayed as "-FFFFFF" and the evaluation is displayed as "LO" Evaluation output turns HI and LO outputs ON.	

Default values and setting range

Setting items	Setting range	Default value		
		mm	mm^2	deg
Upper limit	Display range	+5.000	+5.00	+50.00
Lower limit		-5.000	-5.00	-50.00

The display range varies with the minimum display unit setting.

Refer to "Minimum Display Unit" (Page 5-106) for more details about the display range.

Reference

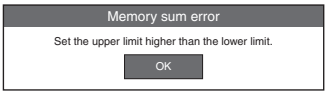
The total evaluation is calculated based on the evaluation result of each OUT number.
Refer to "Total evaluation" in "Status Table" for more information.

"Status Table" (Page 11-8)

▶ Note

If the following conditions are not met, a setting error will appear and you will not be able to complete the settings. Press the [ENTER] key to cancel the error, and set the tolerance again.

- Lower limit ≤ upper limit



Cause : The tolerance input condition has not been met.
Remedy: Set the limits so that the lower limit is less than or equal to the upper limit.

1 Display the "OUT settings" screen.

"Displaying the OUT Settings Screen" (Page 5-65)

2 Select the OUT number with the [▽] and [△] keys, then press the [ENTER] key.

The cursor moves to the "OUT name" for the selected OUT number.

3 Select [Tol upper limit] with the [▽] and [△] keys, then press the [ENTER] key.

The device enters the value input state.
Input the value, then press the [ENTER] key.



4 Set the "Tol upper limit."

Entering a Value (Page 2-5)

5 Set the "Tol lower limit."

The steps for making these settings are the same as for setting "Tol upper limit."

6 Press the [ESCAPE] key to complete the setting.

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Copying Settings
(Copying settings from one OUT number to another)

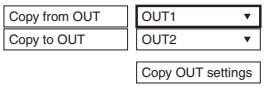
This function copies the settings from one OUT number to a different OUT number. This reduces the amount of work required to make similar settings.

1 **Display the "OUT settings" screen.**

"Displaying the OUT Settings Screen" (Page 5-65)

2 **Select [Copy settings] with the [△] keys, then press the [ENTER] key.**

The setting copy screen will be displayed and the cursor will move to "Copy source OUT."



3 **Press the [ENTER] key.**

A pull-down menu appears.

4 **Select the OUT number to be copied with the [△] keys, then press the [ENTER] key.**

The OUT number to be copied is set.

5 **Select "Copy destination OUT" with the [△] keys, then press the [ENTER] key.**

A pull-down menu appears.

6 **Select the OUT number to be copied to with the [△] keys, then press the [ENTER] key.**

The OUT number to be copied to is set.

7 **Select [Copy settings] with the [△] keys, then press the [ENTER] key.**

The settings are copied and completion confirmation window appears.



8 **Press the [ENTER] key to close the window.**

9 **Press the [ESCAPE] key to finish.**

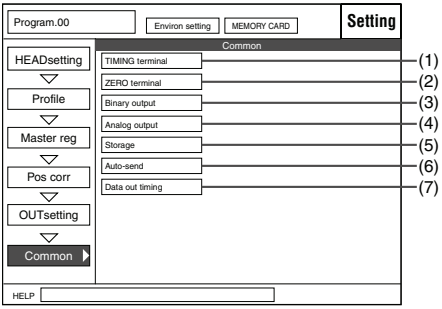
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Common Settings
(Setting input and output conditions)

Overview of Common Settings

Common Settings set the operating conditions for the input and output terminals as well as the operating conditions for saving measurement results in the internal memory.

"Measurement Conditions and Measurement Data Flow" (Page 5-2)
"Setting the Measurement Conditions to Meet Your Needs" (Page 5-3)
"List of setting ranges and default values for common settings" (Page 5-9)



Setting items

(1) TIMING terminal (Page 5-112)
This controls the assignment of the TIMING input terminal to an OUT number.

(2) ZERO terminal (Page 5-113)
This controls the assignment of the ZERO input terminal to an OUT number.

(3) Binary output (Page 5-114)
This controls the assignment of output from the evaluation / binary output terminal.

(4) Analog output (Page 5-114)
This controls the scaling and assignment of output from the analog output terminal.

(5) Storage (Page 5-118)
This controls the settings and operating conditions for saving data to internal memory.

(6) Auto-send (Page 5-120)
This controls assignment of OUT numbers for measurements auto-sent over the RS-232C interface.

(7) Data out timing (Page 5-121)
This sets the operating conditions for binary output, data storage and automatic transmission.

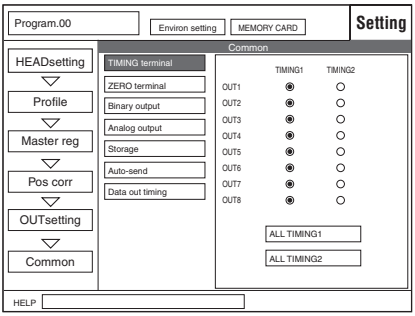
Displaying the Common Settings Screen

1 Use the [Prog/Run] switch to display the settings screen.

"Settings screen"(Page 2-1)

2 Select [Common] with the [△] and [▽] keys, then press the [ENTER] key.

The common settings screen will be displayed and the cursor will move to "TIMING terminal" or the last item set.

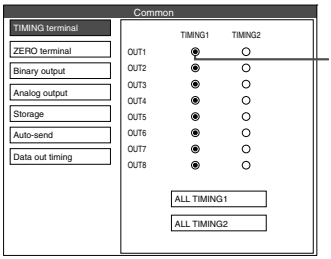


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TIMING Terminal
(Assigning the TIMING input terminal to an OUT number)

The timing input terminal used by the hold function on this device has 2 inputs (TIMING1 or TIMING2). "TIMING terminal" assigns each OUT number to either TIMING1 or TIMING2.

"Hold Function" (Page 3-14)
"Comparative Measurement Mode" (Page 5-103)
"Continuous Trigger" (Page 10-2)
"Timing input" (Page 8-6)



Setting range : TIMING1 / TIMING2 (Default: TIMING1)

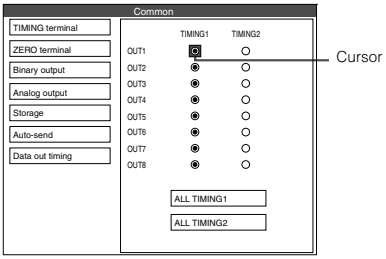
- **TIMING1**
  The OUT numbers indicated by the filled circles have the TIMING1 input terminal activated.
- **TIMING2**
  The OUT numbers indicated by the filled circles have the TIMING2 input terminal activated.

1 Display the "Common" screen.

"Displaying the Common Settings Screen" (Page 5-111)

2 Select "TIMING terminal" with the [△] and [▽] keys, then press the [ENTER] key.

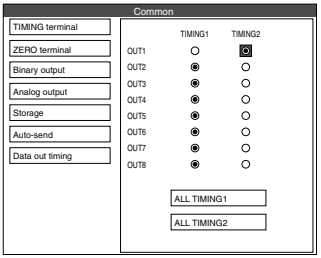
The "TIMING terminal" settings screen is displayed and the setting cursor appears.



3 Use the [△] and [▽] keys to move the cursor to the desired OUT number.

4 Use the [◁] and [▷] keys to move the cursor to the desired TIMING terminal, then press the [ENTER] key.

The circle will be filled in and the setting will be made.
The TIMING terminal indicated by the filled circle is selected.



5 Press the [ESCAPE] key to complete the setting.

Reference

- To set all OUT numbers to TIMING2, use the [△] and [▽] keys to select "ALL TIMING1," then press the [ENTER] key.
- To set all OUT numbers to TIMING2, use the [△] and [▽] keys to select "ALL TIMING2," then press the [ENTER] key.

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ZERO Terminal

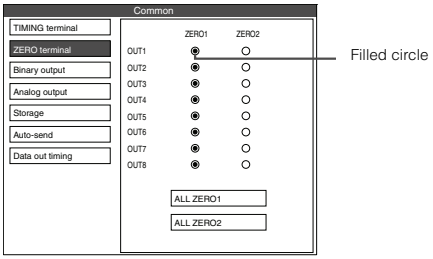
(Assigning the ZERO input terminal to an OUT number)

The zero input terminal (ZERO1 or ZERO2) used by the auto-zero function on this device has 2 inputs (ZERO1 or ZERO2). "ZERO terminal" assigns each OUT number (OUT1 through OUT8) to either ZERO1 or ZERO2.

"Auto-zero" (Page 3-15)
"Auto-zero input" (Page 8-6)

Setting range : ZERO1 / ZERO2 (Default: ZERO1)

- **ZERO1**
  The OUT numbers indicated by the filled circles have the ZERO1 input terminal activated.
- **ZERO2**
  The OUT numbers indicated by the filled circles have the ZERO2 input terminal activated.

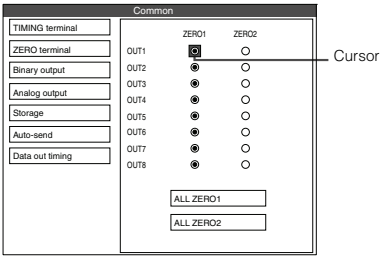


1 Display the "Common" screen.

"Displaying the Common Settings Screen" (Page 5-111)

2 Select "ZERO terminal" with the [△] and [▽] keys, then press the [ENTER] key.

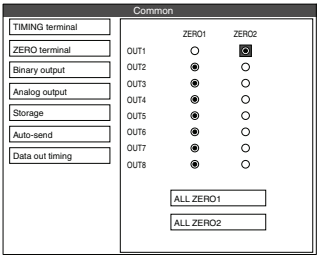
The "ZERO terminal" settings screen is displayed and the setting cursor appears.



3 Use the [△] and [▽] keys to move the cursor to the desired OUT number.

4 Use the [◁] and [▷] keys to move the cursor to the desired ZERO terminal, then press the [ENTER] key.

The circle will be filled in and the setting will be made.
The ZERO terminal indicated by the filled circle is selected.



5 Press the [ESCAPE] key to complete the setting.

Reference

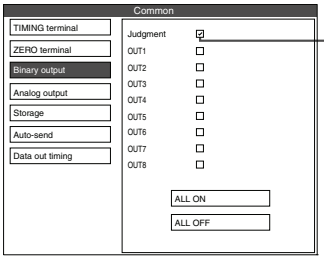
- To set all OUT numbers to ZERO1, use the [△] and [▽] keys to select "ALL ZERO 1," then press the [ENTER] key.
- To set all OUT numbers to ZERO2, use the [△] and [▽] keys to select "ALL ZERO 2," then press the [ENTER] key.

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Binary Output
(Selecting the contents of evaluation / binary output)

Evaluation output (HI, GO and LO for each OUT number) and the binary value for each OUT number can be selected for output from the evaluation / binary output terminal. If you select the multiple output items, the data is output in time sharing mode. The update time for time sharing output is set in the "Strobe time" setting in the environment settings.

"Data Output Timing" (Page 5-121)
"Setting the strobe time" (Page 6-4)
"Evaluation output" (Page 8-6)
"Binary output" (Page 8-8)
"Evaluation/Binary Output" (Page 10-15)
"Strobe Output" (Page 10-16)



Setting range : Do not output / Output

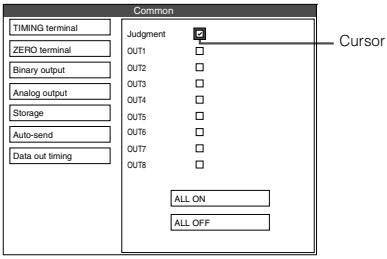
- **Do not output (default for OUT1 to OUT8)**
  OUT numbers that are not checked are not output. Evaluation is not output if it is not checked.
- **Output (default for evaluation)**
  Checked OUT numbers are output. Evaluation is output if it is checked.

1 Display the "Common" screen.

"Displaying the Common Settings Screen" (Page 5-111)

2 Select "Binary output" with the [△] and [▽] keys, then press the [ENTER] key.

The "Binary output" settings screen is displayed and the setting cursor appears.



3 Select evaluation or an OUT number with the [△] and [▽] keys, then press the [ENTER] key.

- The box will be checked and the setting will made.
- If the box is already checked, it will be unchecked.

4 Press the [ESCAPE] key to complete the setting.

Reference

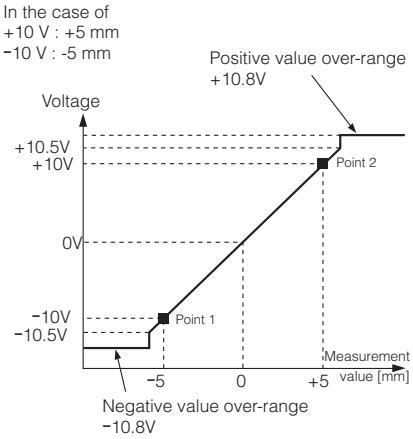
- To set all OUT numbers to evaluation / binary output, use the [△] and [▽] keys to select "All ON," then press the [ENTER] key.
- To unset evaluation / binary output for all OUT numbers, use the [△] and [▽] keys to select "All OFF," then press the [ENTER] key.
- There is no evaluation output when all OUTs are set to OFF.

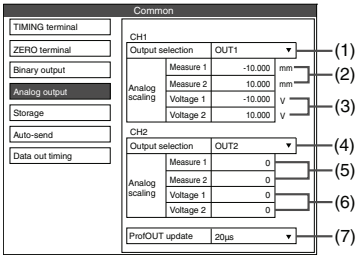
Analog Output
(Setting analog output conditions)

Analog voltage output (CH1/CH2) selects and outputs a profile waveform or an OUT number measurement. The voltage output can be scaled within the range of ±10.5 V.
The output period can be set when outputting profile waveforms.

"Output Terminal Block" (Page 8-3)
"Analog voltage output" (Page 8-12)
"Analog profile output" (Page 10-17)

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Setting items

(1) CH1 output selection
This selects the OUT number or profile waveform output to the CH1 terminal.
- **OUT1 to OUT2 (default: OUT1)**
  The measurement from the specified OUT number is scaled and then output.
- **Head A profile**
  The profile waveform for head A is output.
- **Head B profile**
  The profile waveform for head B is output.
- **Calculated profile**
  The post-calculation profile waveform is output.

(2) CH1, measurements 1 and 2
This scales the analog output from CH1. Set two measurements.

(3) CH1, output voltages 1 and 2
This scales the analog output from CH1. Set two output voltages.

(4) CH2 output selection
This selects the OUT number or profile waveform output to the CH2 terminal.
- **OUT1 to OUT2 (default: OUT2)**
  The measurement from the specified OUT number is scaled and then output.
- **Head A profile**
  The profile waveform for head A is output.
- **Head B profile**
  The profile waveform for head B is output.
- **Calculation profile**
  The post-calculation profile waveform is output.

(5) CH2, measurements 1 and 2
This scales the analog output from CH2. Set two measurements.

(6) CH2, output voltages 1 and 2
This scales the analog output from CH2. Set two output voltages.

(7) Output period
This sets the period for outputting data points on the X-axis when outputting profile waveforms.
Setting range: 20/50/100/500µs (Default: 20µs)
Refer to "Analog Profile Output" for more information on the timing at which to output the profile waveform.
"Analog Profile Output" (Page 10-17)

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Range and default values for measurements 1 and 2

The setting range and default values for each coordinate system are shown below. The units of measurement are different depending on whether length, area or angle is being measured.

"Measurement Mode (Setting measurement conditions)" (Page 5-67)

- Length (mm / µm)

Setting items	Setting range	Default value
Measurement 1	-999.999 to +999.999 mm	-10.000 mm
Measurement 2		+10.000 mm

- Area (mm^2)

Setting items	Setting range	Default value
Measurement 1	-9999.99 to +9999.99 mm^2	-100.00 mm^2
Measurement 2		+100.00 mm^2

- Angle (deg)

Setting items	Setting range	Default value
Measurement 1	-9999.99 to +9999.99 deg	-100.00 deg
Measurement 2		+100.00 deg

- Setting range and default values for output voltages 1 and 2

Setting items	Setting range	Default value
Output voltage 1	-10.5 to +10.5 V	-10.000 V
Output voltage 2		+10.000 V

► Note

Make sure that the settings meet the following conditions. A setting error will be displayed if either condition 1 or condition 2 is not met. Redo the settings and try again.

"If the input conditions are not met" (Page 5-117)

Condition 1: Measurement 1 is not equal to measurement 2

Condition 2: $\left|\frac{\text{Output voltage 2 - Output voltage 1}}{\text{Measurement value 2 - Measurement value 1}}\right| \leqq 10$

Output voltages are calculated in units of mV.
The units used in determining whether this condition is met depend on the units of measurements 1 and 2.
mm / µm: 0.01 µm
Angle : 0.001°
Area : 0.0001 mm^2

Condition 3: "Calc profile" under "Output selection" is only available when "Calculation" is set to "A+B," "A-B" or "Wide."

"Calculations" (Page 5-35)

Condition 4: If "Calculation" is set to "Wide," setting the "Output selection" of one CH to "Calc profile" will make the "Output selection" of the other CH unable to output a profile (head A, head B or calculated).

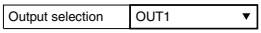
"Calculations" (Page 5-35)

1 Display the "Common" screen.

"Displaying the Common Settings Screen" (Page 5-111)

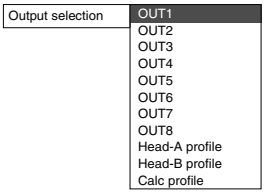
2 Select "Analog output" with the [△] and [▽] keys, then press the [ENTER] key.

The cursor moves to [Output selection] for CH1.



3 Select "Output selection" for CH1 with the [△] and [▽] keys, then press the [ENTER] key.

A pull-down menu appears.



4 Select an OUT number or profile with the [△] and [▽] keys, then press the [ENTER] key.

This sets the CH1 output.
If profile output is selected, set "Output cycle."

"Setting the profile output period" (Page 5-117)

5 Select "Measure 1" for CH1 analog output scaling with the [△] and [▽] keys, then press the [ENTER] key.

Analog scaling	Measure 1	± 000.000	mm
	Measure 2	10.000	mm
	Voltage 1	-10.0	V
	Voltage 2	10.0	V

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6 **Set "Measure 1".**

"Entering a Value" (Page 2-5)

7 **Set "Measure 2" for CH1 analog output scaling.**

The steps for making this settings are the same as for setting "Measure 1."

8 **Set "Voltage 1" for CH1 analog output scaling.**

The steps for making this settings are the same as for setting "Measure 1."

9 **Set "Voltage 2" for CH1 analog output scaling.**

The steps for making this settings are the same as for setting "Measure 1."

10 **This scales the analog output and output selection from CH2.**

The steps for making this settings are the same as for CH1 (steps 3 through 9).

11 **Press the [ESCAPE] key to complete the setting.**

- The analog output settings are completed.
- An error message will be displayed if the analog output scaling does not meet the input conditions. Redo the settings and try again.

"If the input conditions are not met" (Page 5-117)

■ Setting the profile output period

1 **Select "ProfOUT update" with the [△] and [▽] keys, then press the [ENTER] key.**

A pull-down menu appears.

	20µs
	50µs
	100µs
ProfOUT update	500µs

2 **Select an output period with the [△] and [▽] keys, then press the [ENTER] key.**

The output period is set.

If the input conditions are not met

Make sure that the settings meet the following conditions. A setting error will be displayed if either condition 1 or condition 2 is not met. Redo the settings and try again.

Condition 1: Measurement 1 is not equal to measurement 2

Condition 2: $\left|\frac{\text{Output voltage 2 - Output voltage 1}}{\text{Measurement value 2 - Measurement value 1}}\right| \leqq 10$

Output voltages are calculated in units of mV.
The units used in determining whether this condition is met depend on the units of measurements 1 and 2.
mm / µm: 0.01 µm
Angle : 0.001°
Area : 0.0001 mm^2

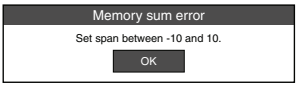
If condition 1 is not met



Press the [ENTER] key to close the window.

Cause : The values for "Measure 1" and "Measure 2" are the same for either CH1 or CH2.
Remedy: Make sure that "Measure 1" and "Measure 2" are different on both channels.

If condition 2 is not met



Press the [ENTER] key to close the window.

Cause : Either CH1 or CH2 does not meet condition 2.
Remedy: Increase the value of the difference between measurement 2 and measurement 1 for both CH1 and CH2 or decrease the difference between output voltage 2 and output voltage 1 for CH1 and CH2 to satisfy condition 2.

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Storage
(Saving profiles and measurements in storage)

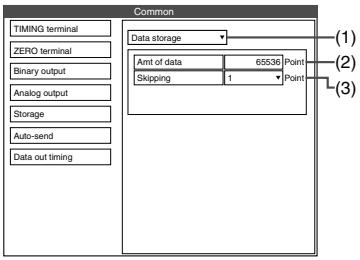
Measurements from each OUT and profile waveforms can be saved in the internal controller memory. This is called storage.
Saved data can be exported via LJ-Navigator, RS-232C or a memory card.
Refer to "Storage" for more information on saving and exporting.
"Storage" (Page 3-19)
"Memory Structure" (Page 11-10)

Setting range : OFF / data storage / Profile storage (Default: OFF)

- **OFF**
  The storage function is not used.
- **Data storage (Page 5-118)**
  The OUT measurements are saved.
- **Profile storage (Page 5-119)**
  This saves a profile waveform.

Data storage

A maximum of 65536 measurements from all OUT numbers can be saved.
Data can be saved after being filtered.
Save timing is set via data output timing.
"Data Storage" (Page 3-19)
"Data Output Timing" (Page 5-121)



Setting items

(1) Storage selection
This selects data storage.

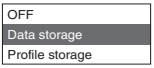
(2) Amount of data
This sets the amount of data to be stored. This is the same for all OUT numbers being measured.
Setting range : 1 through 65536 (default: 65536)

(3) Skipping
This sets how many multiples of the period set by data output timing must pass before a profile is stored.
Setting range : 1/2/5/10/20/50/100 (Default: 1)

1 **Display the "Common" screen.**
"Displaying the Common Settings Screen" (Page 5-111)

2 **Select "Storage" with the [△] and [▽] keys, then press the [ENTER] key.**
The storage setting screen appears.

3 **Select "Storage selection" with the [△] and [▽] keys, then press the [ENTER] key.**
A pull-down menu appears.



4 **Select "Data storage" with the [△] and [▽] keys, then press the [ENTER] key.**
The data storage settings screen will appear once the selection is confirmed.

5 **Select "Amt of data" with the [△] and [▽] keys, then press the [ENTER] key.**
The device enters the value input state.

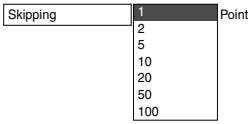


6 **Set "Amt of data."**
"Entering a Value" (Page 2-5)

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7 **Select "Skipping" with the[△] and [▽] keys, then press the [ENTER] key.**

A pull-down menu appears.



8 **Select the filter count with the [△] and [▽] keys, then press the [ENTER] key.**

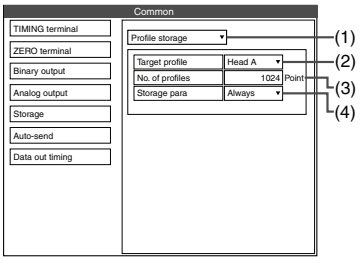
"Skipping count" is set.

9 **Press the [ESCAPE] key to complete the setting.**

Profile storage

Up to 1024 profile waveforms can be saved (1024 per head when using both heads).

"Profile Storage" (Page 3-21)



Setting items

(1) Storage selection

Select a type of profile storage.

(2) Target profile

This selects the profile to be saved.

Setting range : Head A / head B / both heads / calculations (default: head A)

- **Head A**
  The profile for head A is saved.
- **Head B**
  The profile for head B is saved.
- **Both heads**
  When calculation is OFF or is set to conjugated (horizontal) or conjugated (vertical), the profiles from both heads A and B are saved.
- **Calculations**
  The post-calculation profile is saved if calculation is set to A+B, A-B or wide.

"Calculations" (Page 5-99)

(3) No. of profiles

Measurement range : 1 to 1024 (Default: 1024)

This sets the number of profiles to be saved.

(4) Storage parameters

This sets the profile storage conditions (timing).

Setting range: Always / NG / manual (default: Always)

- **Always**
  This saves the profile every time it is updated.
- **NG**
  This saves only those profiles that are evaluated as NG.

"Total evaluation output" (Page 8-6)

- **Manual**
  This allows you to determine which profiles will be saved from the console.

"Operating the "Storage start/stop" button (Manual)" (Page 3-22)

► Note

- The minimum unit of the profile waveform data is 1 µm.
- The profile after the position adjustment is saved.
- The profile is saved before position correction when A+B, A-B or wide is selected in the profile calculation setting and "Target profile" is set to head A, head B or both heads.
- Invalid data is saved when the profile "Calculation" setting is OFF or "Trigger settings" is set to asynchronous and "Target profile" is set to calculation or both heads.

"Calculations" (Page 5-35)
"Position Adjustment" (Page 5-50)
"Trigger Settings" (Page 5-11)

1 **Display the "Common" screen.**

"Displaying the Common Settings Screen" (Page 5-111)

2 **Select "Storage" with the [△] and [▽] keys, then press the [ENTER] key.**

The storage setting screen appears.

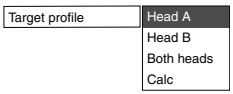
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3 **Select "Storage selection" with the [△] and [▽] keys, then press the [ENTER] key.**
A pull-down menu appears.



4 **Select "Profile storage" with the [△] and [▽] keys, then press the [ENTER] key.**
The profile storage settings screen will appear once the selection is confirmed.

5 **Select "Target profile" with the [△] and [▽] keys, then press the [ENTER] key.**
A pull-down menu appears.



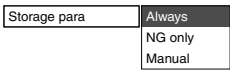
6 **Select a target profile with the [△] and [▽] keys, then press the [ENTER] key.**
The target profile is set.

7 **Select "No. of profiles" with the [△] and [▽] keys, then press the [ENTER] key.**
The device enters the value input state.



8 **Set the profile count.**
"Entering a Value" (Page 2-5)

9 **Select "Storage para" with the [△] and [▽] keys, then press the [ENTER] key.**
A pull-down menu appears.



10 **Select the storage condition with the [△] and [▽] keys, then press the [ENTER] key.**
The storage condition is set.

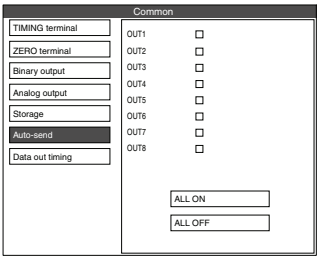
11 **Press the [ESCAPE] key to complete the setting.**

Automatic Transmission

Selecting an OUT number for automatic transmission over RS-232C)

This function selects an OUT number to output a measurement over the RS-232 interface synchronized with the remote input trigger.

"Data Output Timing" (Page 5-121)
"Setting auto-send" (Page 6-3)
"Outputting Measurements" (Page 9-4)
"Automatic Output Response Time" (Page 10-28)
"Outputting measurement values in external synchronization" (Page 9-4)



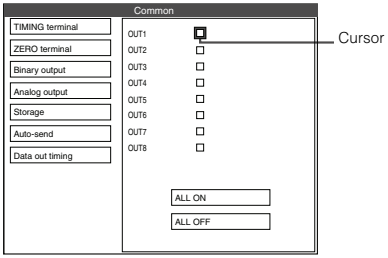
Setting range : No automatic transmission / Automatic transmission (default: No automatic transmission)

- **No automatic transmission**
  OUT numbers that are not checked are not transmitted automatically.
- **Automatic transmission**
  OUT numbers that are checked transmit automatically in accordance with the data output timing settings.
  "Data Output Timing" (Page 5-121)

1 **Display the "Common" screen.**
"Displaying the Common Settings Screen" (Page 5-111)

2 **Select "Auto-send" with the [△] and [▽] keys, then press the [ENTER] key.**
The automatic transmission settings screen is displayed and the setting cursor appears.

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3 **Select an OUT number with the [△] and [▽] keys, then press the [ENTER] key.**

- The box will be checked and the setting will made.
- If the box is already checked, it will be unchecked and automatic transmission will be stopped.

4 **Press the [ESCAPE] key to complete the setting.**

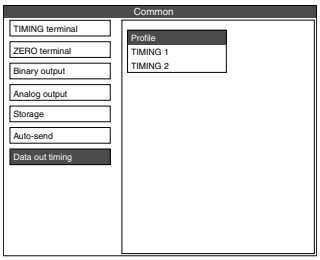
Reference

- To set all OUT numbers to use automatic transmission, use the [△] and [▽] keys to select "All ON," then press the [ENTER] key.
- To set all OUT numbers to not use automatic transmission, use the [△] and [▽] keys to select "All OFF," then press the [ENTER] key.

Data Output Timing

This sets the timing for Evaluation / binary output, data storage and automatic transmission.

"Binary Output" (Page 5-114)
"Data Storage" (Page 3-19)
"Automatic Transmission" (Page 5-120)



Setting range : Profile / TIMING 1 / TIMING 2
(Default: Profile)

- **Profile**
  Data can be saved or output after measurement has been completed for each OUT that is sampling. If the trigger is asynchronous, saving is done with the timing for TRG_A.
  "Trigger Settings" (Page 5-11)
- **TIMING 1**
  The measurement fixed by timing input 1 is output or saved.
- **TIMING 2**
  The measurement fixed by timing input 2 is output or saved.

1 **Display the "Common" screen.**

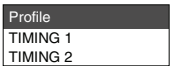
"Displaying the Common Settings Screen" (Page 5-111)

2 **Select "Data out timing" with the [△] and [▽] keys, then press the [ENTER] key.**

The data output timing setting screen appears.

3 **Press the [ENTER] key.**

A pull-down menu appears.



4 **Select the data output timing with the [△] and [▽] keys, then press the [ENTER] key.**

The data output timing is set.

5 **Press the [ESCAPE] key to complete the setting.**

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Chapter

6

Environment Settings

Basic General Device Settings

This section provides information on the basic settings that are common to all programs. These settings are broken into nine categories.

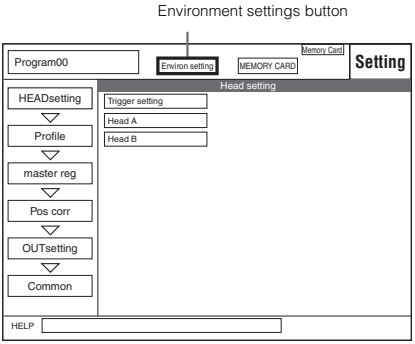
- RS-232C communication settings
- Ethernet communication settings
- Automatic transmission
- Strobe period
- Cable extension mode
- Language
- Date and time
- Changing programs
- Saving to FLASH memory

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Changing Environment Settings

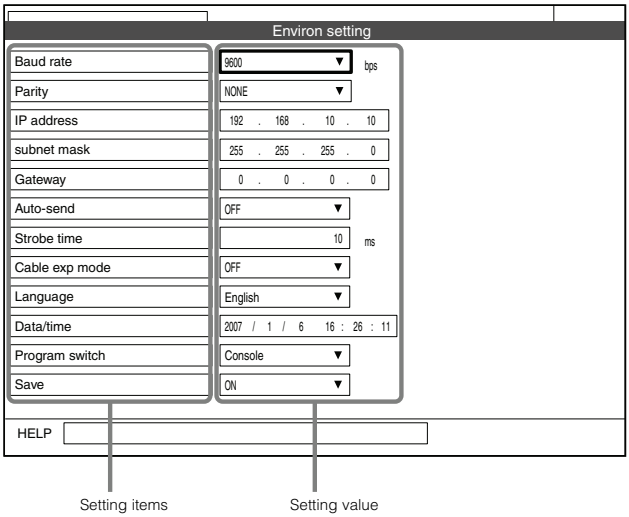
1 **Use the [Prog/Run] switch to display the settings screen.**

"Setting window (During setting)" (Page 2-1)



2 **Select "Environ setting" with the [◁] and [▷] keys, then press the [ENTER] key.**

The environment settings screen will be displayed and the cursor will move to "Baud rate."



3 **Select an item with the [▽] and [△] keys, then press the [ENTER] key.**

4 **Change the value with the pull-down menu or with direct input.**

"Selecting from a Pull-down Menu" (Page 2-4)
"Entering a Value" (Page 2-5)

5 **Press the [ESCAPE] key to finish.**

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Environment Settings Items

Setting the communication specifications for RS-232C

"Communication Specification Settings" (Page 9-3)

Item	Description	Setting range	Default value
Baud rate	Sets the communication speed of the data.	9600/19200/38400/57600/115200	9600
Parity	Sets the type of parity.	NONE / EVEN / ODD	NONE

Setting the communication specifications for Ethernet

This sets the communication specifications when using Ethernet to communicate with the LJ-Navigator.

"LK-Navigator Users' Manual"

► Note

If the settings are configured incorrectly, It could cause other devices on the network to cease working properly.

Item	Description	Setting range	Default value
IP address	This sets the IP address that the device uses.	***.***.***.*** *** can be from 0 to 255.	192.168.10.10
Subnet mask	This sets the subnet mask.		255.255.255.0
Gateway	This sets the IP address of the default gateway.		0.0.0.0

Setting auto-send

"Automatic Transmission" (Page 5-120)
"Data Output Timing" (Page 5-121)
"Outputting Measurements" (Page 9-4)
"Outputting measurement values in external synchronization" (Page 9-4)
"Automatic Output Response Time" (Page 10-28)

Item	Description	Setting range	Default value
Auto-send	This specifies whether the auto-send function is ON.	ON/OFF	OFF

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Setting the strobe time

"Binary Output" (Page 5-114)
"Data Output Timing" (Page 5-121)
"Evaluation output" (Page 8-6)
"Binary output" (Page 8-8)
"Input and Output Details" (Page 10-15)
"Strobe Output" (Page 10-16)

Item	Description	Setting range	Default value
Strobe time	This controls the output of multiple items in time sharing mode for evaluation/binary output in 1 ms increment.	2 through 100 (msec)	10 (msec)

Setting cable extension mode

"System Configuration" (Page 1-1)
"Connecting" (Page 1-14)

► Note

- The device may not operate properly if mistakes are made in the settings.
- New settings will take effect once the device has been restarted.
- Setting these to ON will increase the measurement time.

  "Trigger Interval and Measurement Time" (Page 10-21)
- When the system error is displayed and the settings cannot be changed, open the laser remote interlock terminal (REMOTE terminal), turn on the power and then change the settings.

  Refer to "Input Terminal Block" (Page 8-2) for more information on the REMOTE terminal assignment.

Item	Description	Setting range	Default value
Cable extension mode	Set this to ON when using a 30 m head-to-controller cord (LJ-GC30) .	ON: When using an LJ-GC30. OFF: When not using an LJ-GC30.	OFF

Changing languages

► Note

New settings will take effect once the device has been restarted.
The language setting is not initialized.

"Returning the LJ-G Series to the Factory Default Settings" (Page 2-9)

Item	Description	Setting range	Default value
Interface language	This sets the language used on the device display.	Japanese English German	Japanese

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Adjusting date and time

The time on the internal device clock is recorded when saving items such as settings or stored data to the memory card.

"Saving to / Reading from a Memory Card" (Page 7-1)
"Storage" (Page 3-19)

Item	Description	Setting range	Default value
Date/time	This sets the time on the internal clock .	Year / Month / Day Hours / Minutes / Seconds	Factory default.

Reference

The accuracy of Date/time is ± approx. 1 minute/month (at normal temperature).

Setting the program-switching method

"Switching Program Nos." (Page 3-17)

Item	Description		Setting range	Default value
Program switching	Set this to match the method for switching program Nos.	Console:	Switch via the console (device screen), RS-232C interface and the LJ-Navigator.	Console
		Terminal:	Switches via remote input terminals.	

Settings save operations for flash memory (Save)

"Auto-zero" (Page 3-15)
"Switching Program Nos." (Page 3-17)
"Setting memory" (Page 4)
"Memory Structure" (Page 11-10)

Item	Description		Setting range	Default value
Save	The device can save settings to FLASH memory. Set this to OFF when using Auto-zero or when changing program Nos. frequently to protect The FLASH memory.	ON:	When the method for switching program Nos. is set to "Console", the auto-zero setting and program Nos. are saved to FLASH memory. When the method for switching program Nos. is set to "Terminal", the auto-zero setting is saved to FLASH memory. These settings are preserved even after the power is turned OFF. "Setting the program-switching method" (Page 6-5)	ON
		OFF:	The auto-zero setting and program Nos. are not saved to FLASH memory. Settings are erased when the power is turned OFF.	

Reference

These settings including the auto-zero setting and the program Nos. will be saved to the FLASH memory when switching between the measurement screen and the settings screen regardless of save settings.

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Chapter

7

Saving to / Reading from a Memory Card

Overview of Saving and Reading

Saving and reading settings

This section describes saving and reading controller settings (program settings or environment settings) to or from a memory card.

- This serves as a backup of your settings in case there are problems with the device.
- These settings can be copied to multiple controllers.
- Reading previously saved settings from the same type of device allows for significant savings in man-hours when changing settings.

"Program Function" (Page 4-1)
"Environment Settings" (Page 6-1)

Saving and reading measurements

This section explains how to save or read measurements saved in the internal controller memory (SDRAM) by the storage function to or from a memory card.Saved measurement files can be read and confirmed with the LJ-Navigator. Additionally, files saved via profile storage can be read into the controller for confirmation.

- The measurement history can be saved.
- This allows analysis of profile waveforms marked as NG.

"Data Storage" (Page 3-19)
"Profile Storage" (Page 3-21)

Uploading a program from the memory card and taking measurements

If 16 saved programs in the controller is insufficient, this number of saved programs can be increased to 160 using a memory card. Commands can be sent via RS-232.

"Uploading a Program from the Memory Card and Taking Measurements" (Page 7-9)

Saving the measurement screen

You can save the measurement screen as an image file (image capture).

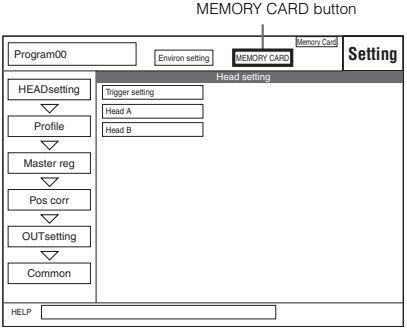
"Saving the Image of the Measurement Screen" (Page 3-8)

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Displaying the Memory Card Screen

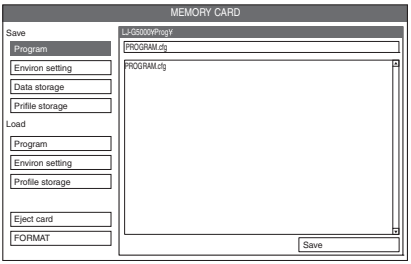
1 **Use the [Prog/Run] switch to display the settings screen.**

"Outline of the Screen and Operations" (Page 2-1)



2 **Select "MEMORY CARD" with the [◁] and [▷] keys, then press the [ENTER] key.**

The "MEMORY CARD" screen will be displayed and the cursor will move to "Program."



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Inserting or Removing a Memory Card

Usable memory cards

This device is compatible with the following memory cards: GR-M256 (256 MB) and NR-M1G (1 GB), each sold separately.

"List of Optional Products" (Page Appendix-2)

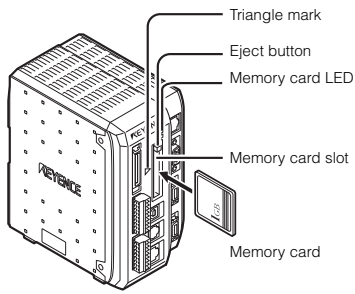
► Note

- This device supports FAT32 and VFAT formatting.
- Do not use standard commercial memory cards, as they may cause problems with device operation.

Inserting a Memory Card

Insert the memory card so that the face of the memory card is in the same direction as the triangle mark on the slot.

"Memory card slot" (Page 1-3)



► Note

- Make sure that the card is properly aligned before pushing it into the slot.The data on the memory card or the memory card itself may be damaged if the memory card is inserted into the slot incorrectly.
- Push the memory card all the way into the slot.
- The memory card LED will illuminate when there is a memory card inserted in the device.
  Green: A memory card is inserted and receiving power.
  Red: The memory card is being accessed.
  Off: The memory card is not receiving power. (The memory card can be removed).

Removing a Memory Card

► Note

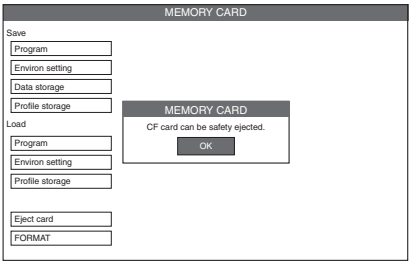
- Take the following precautions to protect the memory card and the data stored on it.
- Removing the memory card without taking these steps or turning off the power while the memory card is being accessed will interrupt file saving operations and may damage the data on the memory card or the memory card itself.

1 Display the "MEMORY CARD" screen.

"Displaying the Memory Card Screen" (Page 7-2)

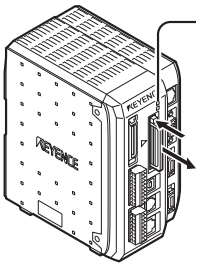
2 Select "Eject card" with the [▽] and [△] keys, then press the [ENTER] key.

The access lamp goes out and the "MEMORY CARD" window appears.



3 Press the [ENTER] key to close the "MEMORY CARD" window.

4 Press the eject button next to the memory card slot, then remove the memory card.



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Saving and Reading

Content that can be Saved and Read

- Program settings
  Settings for up to 16 program Nos. can be saved and read, each as a single file.
  "Program Function" (Page 4-1)

- Environment Settings
  Environment settings can be saved and read as a single file.
  "Environment Settings" (Page 6-1)

- Data storage
  Data saved in the internal memory by the data storage function can be saved to a memory card as a single file. This data cannot be read from the memory card back to the controller.
  "Data Storage" (Page 3-19)

- Profile storage
  Data saved in the internal memory by the profile storage function can be saved to or read from a memory card as a single file.
  "Profile Storage" (Page 3-21)

- Measurement screen image
  The measurement screen can be saved as an image file. You cannot read or delete it.
  "Saving the Image of the Measurement Screen" (Page 3-8)

File Format

File name

File names used to save data on the controller must be less than 16 single-bite characters or 8 double-byte characters and only in alphanumeric characters or katakana.
When no file name is specified, a file name will be provided automatically.
A file name with date and time will be provided for the measurement screen image automatically.

File extensions

The extensions used when saving files are shown below.

Program Settings	.cfg
Environment Settings	.env
Data Storage	.dat
Profile Storage	.dat
Measurement screen image	.bmp

Save folder

Files are saved in the folders shown below.

Program Settings	\LJ-G5000\Prog
Environment settings	\LJ-G5000\Env
Data Storage	\LJ-G5000\DataSt
Profile Storage	\LJ-G5000\ProfSt
Measurement screen image	\LJ-G5000\Img

Reference

Data saved to a memory card via data storage or profile storage will be saved in binary format.
To save in CSV format, read the file into "LJ-Navigator," then save it in CSV format.
"LK-Navigator Users' Manual"

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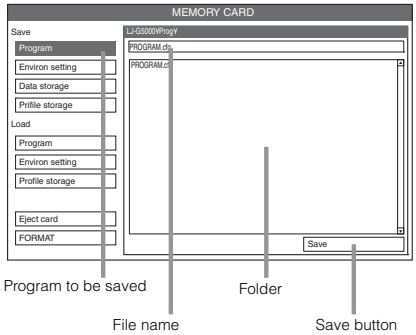
Saving to a Memory Card

This section describes saving data to a memory card using saving program settings from the controller as an example. The procedure for saving environment settings, data storage and profile storage to a file is the same.
Refer to "Saving the Image of the Measurement Screen" for more information on saving the measurement screen.

"Saving the Image of the Measurement Screen" (Page 3-8)

1 Display the "MEMORY CARD" screen.

"Displaying the Memory Card Screen" (Page 7-2)



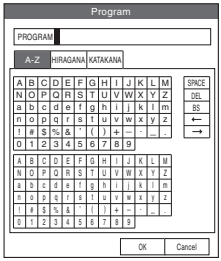
2 Select "Program" from the save menu with the [▽] and [△] keys, then press the [ENTER] key.

The cursor moves to the file name and the default file name is displayed. The folder display shows the files that already exist in the selected folder.

3 To change the file name to something other than the default, select a file name with the [▽] and [△] keys, then press the [ENTER] key.

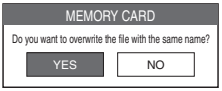
The file name input screen appears.Enter the desired file name.

"Entering Characters" (Page 2-5)



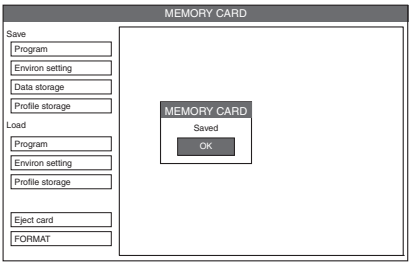
4 Enter the file name, then select "Save" with the [▽] and [△] keys, then press the [ENTER] key.

- The file is saved to memory.
- If there is a file with the same name, a message confirming whether youíd like to overwrite the file will be displayed.



Select [YES] and press the [ENTER] key to overwrite the file.

- A completion message appears when the save is finished.



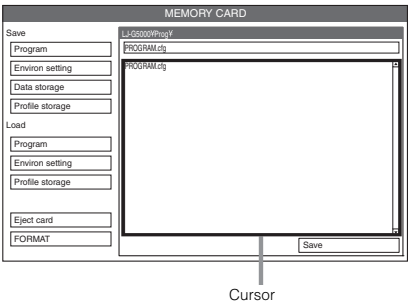
5 Press the [ENTER] key to close the "MEMORY CARD" window.

6 Press the [ESCAPE] key to finish.

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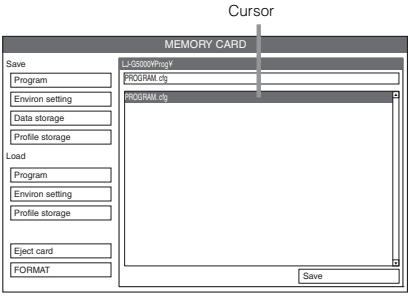
Overwriting a previously existing file

1 Select "Show folder" with the [▽] and [△] keys in step 3 of "Saving to a memory card."



2 Press the [ENTER] key.

The cursor will move to the file list in the folder display.



3 Select a file name to overwrite with the [▽] and [△] keys, then press the [ENTER] key.

The selected file name appears in the file name display and the cursor moves to the folder display.

4 Continue from step 4 of "Saving to a memory card."

Reading from a Memory Card

This section describes reading data from a memory card using reading program settings to the controller as an example.The procedure for reading environment settings and profile storage to a file is the same.

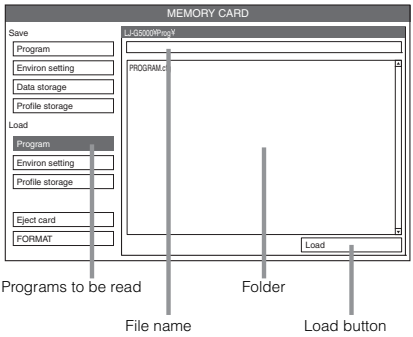
► Note

Set the storage setting to profile storage when reading profile storage data and confirming it on the profile storage screen.

"Displaying the profile storage screen" (Page 3-23)
"Storage" (Page 5-118)

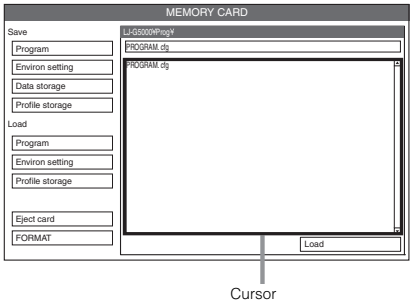
1 Display the "MEMORY CARD" screen.

"Displaying the Memory Card Screen" (Page 7-2)



2 Select "Program" from the read menu with the [▽] and [△] keys, then press the [ENTER] key.

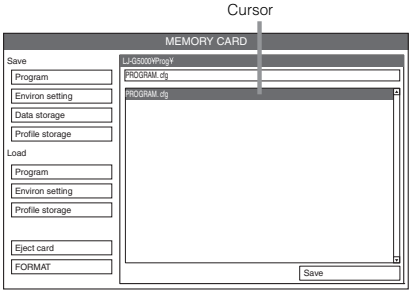
The cursor moves to the folder display and the name of the first file on the file list appears in the file name display.If you wish to use the file that is selected, proceed to step 5.



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3 **Select the folder display with the [▽] and [△] keys, then press the [ENTER] key.**

The cursor will move to the file list in the folder display.

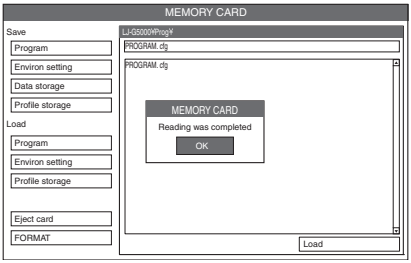


4 **Select a file to read with the [▽] and [△] keys, then press the [ENTER] key.**

The selected file name appears in the file name display and the cursor moves to the folder display.

5 **Select a file, then select "Load" with the [▽] and [△] keys, then press the [ENTER] key.**

The device will start reading from the memory card. A completion message appears when the save is finished.



6 **Press the [ENTER] key to close the "MEMORY CARD" window.**

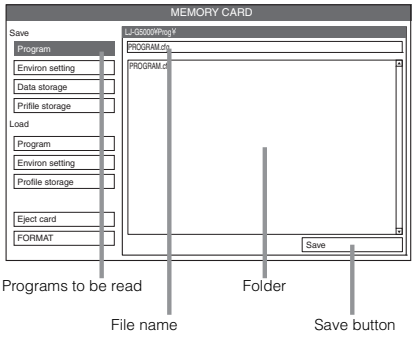
7 **Press the [ESCAPE] key to finish.**

Deleting Files

This section explains how to delete unneeded program settings from a memory card.The procedure for deleting environment settings and stored profiles is the same.

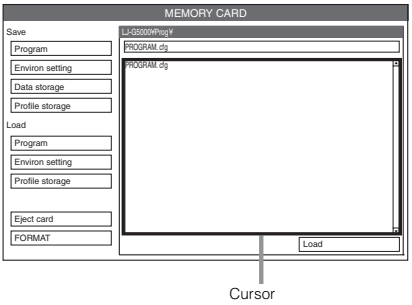
1 **Display the "MEMORY CARD" screen.**

"Displaying the Memory Card Screen" (Page 7-2)



2 **Select "Program" from the read menu with the [▽] and [△] keys, then press the [ENTER] key.**

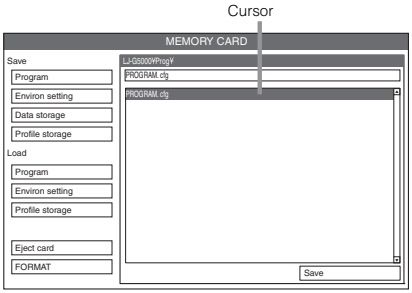
The cursor moves to the folder display.



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3 **Select the folder display with the [▽] and [△] keys, then press the [ENTER] key.**

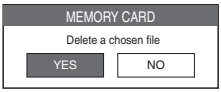
The cursor will move to the file list in the folder display.



4 **Use the [▽] and [△] keys to move the cursor to the file to be deleted.**

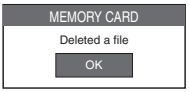
5 **Press the "ZERO" key.**

A message appears to confirm that the file will be deleted.



6 **Select [YES] and press the [ENTER] key.**

An message appears to inform you that the file has been deleted.



7 **Press the [ENTER] key to close the message.**

8 **Press the [ESCAPE] key to finish.**

Formatting Memory Cards

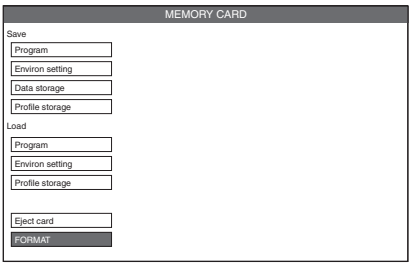
This section explains how to quickly format memory cards.

► Note

- If a memory card is formated, all the data in the memory card are erased.
- The memory card that is not formatted or whose file system is broken cannot be formatte

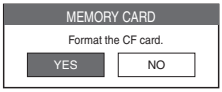
1 **Display the "MEMORY CARD" screen.**

"Displaying the Memory Card Screen" (Page 7-2)



2 **Select "FORMAT" with the [▽] and [△] keys, then press the [ENTER] key.**

A window appears to confirm the format.



3 **Select [YES] and press the [ENTER] key to format the memory card. Select [NO] and press the [ENTER] key to cancel the format.**

If "YES" is selected the memory card will be formatted. A format complete window appears when the format is completed. Continue to step 4.



If you selected "NO," the procedure is complete.

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4 **Press the [ENTER] key to close the window.**

5 **Press the [ESCAPE] key to finish.**

Uploading a Program from the Memory Card and Taking Measurements

This section explains how to read a program setting file from a memory card and then use that program No. to take measurements.
Up to 160 types (16 programs with 10 files each) of program Nos. can be uploaded. Use the RS-232C interface to do the uploading.

"Switching Program Nos." (Page 3-17)
"Program Function" (Page 4-1)
"Program" (Page 9-13)
"Sending & Receiving Commands Response Time" (Page 10-27)

Standard procedure

1 **Set the measurement conditions on this window.**

"Setting Measurement Conditions" (Page 5-1)

2 **Save the program setting file to a memory card.**

When saving, choose a file name from "Config00" to "Config09."The last character of the file name must be a digit from 0 to 9.

"Saving to a Memory Card" (Page 7-5)

► Note

Make sure to use the specified file name. Custom file names cannot be used when uploading.

Uploading procedure

1 **Switch to the measurement screen and take a measurement.**

"Outline of the Screen and Operations" (Page 2-1)

2 **Send a "Switch program No. on the memory card" command to the controller via the RS-232C interface.**

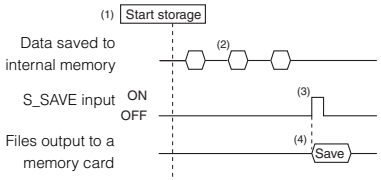
The specified program No. in the specified program is loaded and used for measurement.

"Program" (Page 9-13)

Saving Storage Data to the Memory Card from the Input Terminal

Use the external input terminal (S_SAVE) to save the storage data (data storage data or profile storage data) to the memory card.
Transfers the number of data points from the internal memory to a memory card. The number of points is limited to the value entered under the "Storage" setting.
Clearing internal memory allows storage to continue uninterrupted.

"Storage" (Page 3-19)



(1) Start of data storage.
(2) Data is saved to the internal memory in accord with the storage conditions.
(3) S_SAVE input turns on before storage halts.
(4) Data saved in the internal memory is saved to the memory card as a single file.The file name is assigned automatically.Internal memory is cleared.

Data storage function "Starting/stopping save process and clearing" (Page 3-19)
Profile storage function "Starting/stopping save process and clearing" (Page 3-21)

► Note

- Activate S_SAVE input before storage halts.
- Measurements cannot be taken while data is being saved to a memory card.

"Memory Card Control Input (S_SAVE Input)" (Page 10-20)

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Chapter

8

I/O Terminals

Identifying Names and Functions of the I/O Terminals . 8-2
- Input Terminal Block . 8-2
- Output Terminal Block . 8-3
- Expansion Connector . 8-4

I/O Signal Functions . 8-6
- Error output . 8-6
- Evaluation output . 8-6
- Measurement control input/output . 8-6
- Program No. switch input . 8-7
- Binary output . 8-8
- How to read the binary output . 8-8
- Description of OUT No. output . 8-8
- Laser emission control input . 8-9
- Memory card control input . 8-9

I/O Circuit and Electrical Specifications . 8-10
- LJ-G5001 . 8-10
- LJ-G5001P . 8-11
- LJ-G5001/LJ-G5001P Common . 8-12

Reference

Refer to "Timing Chart and Response Times" (Page 10-1) for more information on the timing chart and the response time of the I/O terminal.

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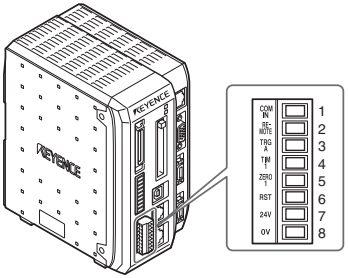
Identifying Names and Functions of the I/O Terminals

This section describes the names of the input/output terminals (input terminal block, output terminal block, and expansion connector) and the terminal assignment.

"Part Names and Functions" (Page 1-3)

Input Terminal Block

Conforming socket block: MC1.5/8-ST-3.5BK (Phoenix Contact)
Conforming cable specification: AWG16 to 28, length of pigtail cable end fabrication 7 mm



Pin No.	Signal name	Description	Circuit (Page 8-10)
1	COM_IN1	Input common	
2	REMOTE	Laser remote interlock terminal	Non-voltage input 1
3	TRG_A	Head A trigger input	Non-voltage input 2 (LJ-G5001) Voltage input 2 (LJ-G5001P)
4	TIMING1	Timing input 1	Non-voltage input 1 (LJ-G5001) Voltage input 1 (LJ-G5001P)
5	ZERO1	Zero input 1	
6	RESET	Reset input	
7	24 VDC (+)	24 VDC input for power	
8	24 VDC (-)	0 V input for power	

► Note

Part of each input/output circuit is common via a choke coil. Be careful not to generate a potential difference.

"Isolation between I/O circuits" (Page 8-12)

Reference

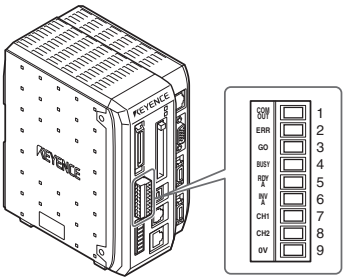
The connection between REMOTE and COM_IN1 is short-circuited at the time of factory shipment.

"I/O Signal Functions" (Page 8-6)
"I/O Circuit and Electrical Specifications" (Page 8-10)
"Using the Terminal Block" (Page 1-17)
"Timing Chart and Response Times" (Page 10-1)

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Output Terminal Block

Conforming socket block: MC1.5/9-ST-3.5BK (Phoenix Contact)
Conforming cable specification: AWG16 to 28, length of pigtail cable end fabrication 7 mm



Pin No.	Signal name	Description	Circuit (Page 8-10)
1	COM_OUT1	Output common	
2	ERROR	Error output (Normal closed (N.C.) opertion)	NPN open-collector output (LJ-G5001) PNP open-collector output (LJ-G5001P)
3	GO	Total evaluation result output	
4	BUSY	Busy output	
5	READY_A	Enable output for head A trigger input	
6	INVALID_A	Head A invalid output	
7	CH1	Analog voltage output (CH1/CH2) Output in the range of ±10.5 V with reference to the displayed value	
8	CH2		
9	0 V	Analog voltage output 0 V	

► Note

Part of each input/output circuit is common via a choke coil. Be careful not to generate a potential difference.

"Isolation between I/O circuits" (Page 8-12)

Reference

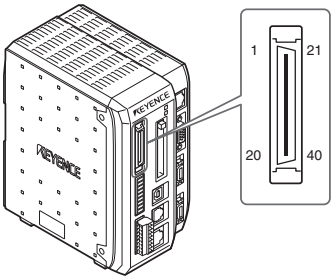
"I/O Signal Functions" (Page 8-6)
"I/O Circuit and Electrical Specifications" (Page 8-10)
"Using the Terminal Block" (Page 1-17)
"Timing Chart and Response Times" (Page 10-1)
"Analog Output" (Page 5-114)

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Expansion Connector

Conforming connector: FX2B series (HIROSE Electric Inc.)
Use a 3 m expansion connector cable (OP-51657) for use with the expansion connector.

"List of Optional Products" (Page Appendix-2)



Pin No.	Signal name	Description			Cable color
		During evaluation output	During binary output	Circuit (Page 8-10)	
1	COM_IN2	Input common			Brown
2	TRG_B	Head B trigger input		Non-voltage input 2 (LJ-G5001) Voltage input 2 (LJ-G5001P)	Red
3	TIMING2	Timing input 2		Non-voltage input 1 (LJ-G5001) Voltage input 1 (LJ-G5001P)	Orange
4	ZERO2	Zero input 2			Yellow
5	P1	Program No. switch input			Green
6	P2				Blue
7	P3				Purple
8	P4				Gray
9	S_SAVE	Memory card save input for storage data			White
10	LASER_OFF_A	Head A laser beam damping terminal			Black
11	LASER_OFF_B	Head B laser beam damping terminal			Brown

Continued on the next page.

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Pin No.	Signal name	Description			Cable color
		During evaluation output	During binary output	Circuit (Page 8-10)	
12	COM_OUT2	Output common			Red
13	HI1/Binary(0)(LSB)	OUT1 evaluation HI output	Binary output	NPN open-collector output (LJ-G5001) PNP open-collector output (LJ-G5001P)	Orange
14	GO1/Binary(1)	OUT1 evaluation GO output			Yellow
15	LO1/Binary(2)	OUT1 evaluation LO output			Green
16	HI2/Binary(3)	OUT2 evaluation HI output			Blue
17	GO2/Binary(4)	OUT2 evaluation GO output			Purple
18	LO2/Binary(5)	OUT2 evaluation LO output			Gray
19	HI3/Binary(6)	OUT3 evaluation HI output			White
20	GO3/Binary(7)	OUT3 evaluation GO output			Black
21	LO3/Binary(8)	OUT3 evaluation LO output			Brown
22	HI4/Binary(9)	OUT4 evaluation HI output			Red
23	GO4/Binary(10)	OUT4 evaluation GO output			Orange
24	LO4/Binary(11)	OUT4 evaluation LO output			Yellow
25	HI5/Binary(12)	OUT5 evaluation HI output			Green
26	GO5/Binary(13)	OUT5 evaluation GO output			Blue
27	LO5/Binary(14)	OUT5 evaluation LO output			Purple
28	HI6/Binary(15)	OUT6 evaluation HI output			Gray
29	GO6/Binary(16)	OUT6 evaluation GO output			White
30	LO6/Binary(17)	OUT6 evaluation LO output			Black
31	HI7/Binary(18)	OUT7 evaluation HI output			Brown
32	GO7/Binary(19)	OUT7 evaluation GO output			Red
33	LO7/Binary(20)(MSB)	OUT7 evaluation LO output			Orange
34	HI8/BIN_OUT1	OUT8 evaluation HI output	OUT No. output		Yellow
35	GO8/BIN_OUT2	OUT8 evaluation GO output			Green
36	LO8/BIN_OUT3	OUT8 evaluation LO output			Blue
37	BIN_SEL	Evaluation/binary selection output			Purple
38	STROBE	Strobe output for evaluation/binary output			Gray
39	READY_B	Enable output for head B trigger input			White
40	INVALID_B	Head B invalid output			Black

The cable color is the wire color for the expansion connector cable (OP-51657).

► Note

- Part of each input/output circuit is common via a choke coil. Be careful not to generate a potential difference.
  "Isolation between I/O circuits" (Page 8-12)
- The above terminal assignment covers version 1.1 and later. Evaluation/binary selection output (BIN_SEL) terminal has been added from version 1.1. In addition, the number of bits for binary output and the terminal wiring for the OUT number outputs has been changed. For detail on each version, see "Precautions about Specification".
  "Precautions about Specifications" (Page 10)

Reference

"I/O Signal Functions" (Page 8-6)
"I/O Circuit and Electrical Specifications" (Page 8-10)
"Timing Chart and Response Times" (Page 10-1)
"Binary Output" (Page 5-114)

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I/O Signal Functions

For more information about terminal assignment for the I/O signals, see pages 📖 8-2 to 8-5.

Error output

Name	Signal name	Description
Error output	ERROR	Output after turning on the power or when an error occurs. It uses normal closed (N.C.) operation.

📖 "Output Terminal Block" (Page 8-3)
📖 "Status Table" (Page 11-8)
📖 "System error messages" (Page Appendix-4)

Evaluation output

Name	Signal name	Description
Tolerance evaluation output	HI/GO/LO	Output according to the tolerance evaluation results for each OUT number. Binary output and time sharing are output.HI and LO turn on at the same time when the measurement alarm is issued.
Total evaluation output	GO	Output when all of the tolerance evaluation results are GO for the OUT numbers being used for measurement.
Strobe output	STROBE	Outputs when the evaluation and binary outputs are updated.
Evaluation/binary selection output	BIN_SEL	Checks the output status of the evaluation/binary output (evaluation output or binary output). Turns off during the evaluation output, and turns on during the binary output.

📖 "Output Terminal Block" (Page 8-3)
📖 "Expansion Connector" (Page 8-4)
📖 "Tolerance" (Page 5-109)
📖 "Binary Output" (Page 5-114)
📖 "Input and Output Details" (Page 10-15)
📖 "Status Table" (Page 11-8)

Measurement control input/output

Name	Signal name	Description
Trigger input	TRG_A/TRG_B	Inputs a trigger when external trigger is selected.
Ready output	READY_A/READY_B	Output when a trigger input can be received.
Invalid output	INVALID_A/INVALID_B	Output when position correction has failed.
Busy output	BUSY	Output while performing measurement.
Timing input	TIMING1/TIMING2	Inputs the external synchronization signal for the measurement mode.
Reset input	RESET	Resets the measurement values.
Auto-zero input	ZERO1/ZERO2	Sets the current measured value to zero.

📖 "Input Terminal Block" (Page 8-2)
📖 "Output Terminal Block" (Page 8-3)
📖 "Expansion Connector" (Page 8-4)
📖 "Trigger Mode" (Page 5-12)
📖 "Position Adjustment" (Page 5-50)
📖 "Timing Chart and Response Times" (Page 10-1)
📖 "Auto-zero" (Page 3-15)
📖 "Hold Function" (Page 3-14)
📖 "Status Table" (Page 11-8)

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Program No. switch input

Name	Signal name	Description
Program No. switching input	P1/P2/P3/P4	Changes the program No. by external Signal. To activate the program No. switching input, [Program Switch] in the environment settings should be changed to [Terminal].

"Expansion Connector" (Page 8-4)
"Setting the program-switching method" (Page 6-5)
"Switching Program Nos." (Page 3-17)
"Program Function" (Page 4-1)
"Timing Chart and Response Times" (Page 10-1)
"Status Table" (Page 11-8)

Keep the P1 to P4 terminals as the following status when switching the program Nos.

Program No.	P4	P3	P2	P1
00	OFF	OFF	OFF	OFF
01	OFF	OFF	OFF	ON
02	OFF	OFF	ON	OFF
03	OFF	OFF	ON	ON
04	OFF	ON	OFF	OFF
05	OFF	ON	OFF	ON
06	OFF	ON	ON	OFF
07	OFF	ON	ON	ON
08	ON	OFF	OFF	OFF
09	ON	OFF	OFF	ON
10	ON	OFF	ON	OFF
11	ON	OFF	ON	ON
12	ON	ON	OFF	OFF
13	ON	ON	OFF	ON
14	ON	ON	ON	OFF
15	ON	ON	ON	ON

- LJ-G5001 (NPN type)
  ON: Short-circuit state with the COM_IN2 terminal
  OFF: Open state
- LJ-G5001P (PNP type)
  ON: Applied voltage state
  OFF: Open state

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Binary output

Name	Signal name	Description
Binary output	Binary (0) to Binary (20)	The measurements for OUT1 to OUT8 are output as binary number data. Outputs two's complement in 21 bits. Negative logic (1 when the NPN or PNP open-collector output is ON) Outputs are time shared for the selected OUT number and evaluation output.
Strobe output	STROBE	Outputs when the evaluation and binary outputs are updated.
OUT No. output	BIN_OUT	Verifies the output OUT number during binary output updates.
Evaluation/ binary selection output	BIN_SEL	Checks the output status of the evaluation/binary output (evaluation output or binary output). Turns off during the evaluation output, and turns on during the binary output.

"Expansion Connector" (Page 8-4)
"Binary Output" (Page 5-114)
"Setting the strobe time" (Page 6-4)
"Input and Output Details" (Page 10-15)
"Status Table" (Page 11-8)

How to read the binary output

The binary output outputs the measurement value as a binary number (two's complement) of 21 bits. The decimal point is ignored. Regardless of the unit being used, the minimum display unit is 1LSB when the decimal point is ignored.

"Minimum Display Unit" (Page 5-106)

Status	Display	(Hexadecimal display)	Binary output (Binary)
Measured value	13.497mm 1349.7 mm 134.97 mm^2	0x0034B9	0 0000 0011 0100 1011 1001
	-13.497 mm -13.497 deg	0x1FCB47	1 1111 1100 1011 0100 0111
Evaluation standby	- - - - - -	0x100000	1 0000 0000 0000 0000 0000
Positive range over	FFFFFF	0x0FFFFF	0 1111 1111 1111 1111 1111
• Negative range over • Measurement alarm	-FFFFFF	0x100000	1 0000 0000 0000 0000 0000

Description of OUT No. output

The binary OUT No. output at that time can be checked by monitoring the status of the OUT No. output (BIN_OUT1 to BIN_OUT3).

	OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7	OUT8
BIN_OUT1	OFF	ON	OFF	ON	OFF	ON	OFF	ON
BIN_OUT2	OFF	OFF	ON	ON	OFF	OFF	ON	ON
BIN_OUT3	OFF	OFF	OFF	OFF	ON	ON	ON	ON

OFF: Turns off the NPN or PNP open collector output.
ON: Turns on the NPN or PNP open collector output.

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Laser emission control input

Name	Signal name	Description
Laser remote interlock terminal	REMOTE	The laser beam turns on when the terminal is short-circuited with COM_IN. Emission is stopped when the terminal opens. This is common to head A and B. It takes priority over the laser beam damping terminal.
Laser off input terminal	LASER_OFF_A / LASER_OFF_B	Controls the laser for each head. • LJ-G5001 (NPN type) The laser is turned off when short-circuited with COM_IN2, and turned on when open. • LJ-G5001P (PNP type) The laser is turned off when superimposed voltage is entered, and turned on when open.

"Input Terminal Block" (Page 8-2)
"Expansion Connector" (Page 8-4)
"Safety Precautions on Laser Products" (Page 6)
"Laser Control Input" (Page 10-19)

Memory card control input

Name	Signal name	Description
Storage data saving input	S_SAVE	Saves storage data to the memory card.

"Expansion Connector" (Page 8-4)
"Saving Storage Data to the Memory Card from the Input Terminal" (Page 7-9)
"Storage" (Page 3-19)

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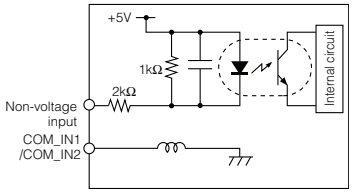
I/O Circuit and Electrical Specifications

LJ-G5001
(NPN type)

Refer to the following page for the arrangement and function of each I/O terminal.

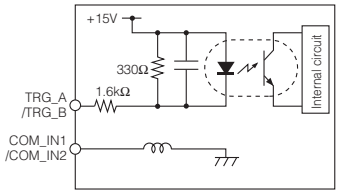
"Identifying Names and Functions of the I/O Terminals" (Page 8-2)
"I/O Signal Functions" (Page 8-6)

Non-voltage input 1



ON voltage	1 V or less
OFF current	0.3 mA or less
Short-circuit current (Typ.)	2 mA

Non-voltage input 2

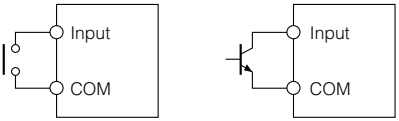


ON voltage	5 V or less
OFF current	1 mA or less
Short-circuit current (Typ.)	8.5 mA

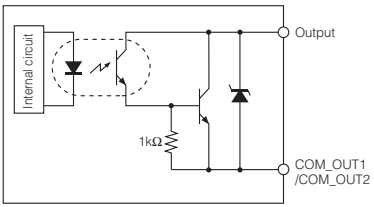
Reference

Compatible with the 2-wire proximity switch EV Series (KEYENCE).

Example of non-voltage input 1/non-voltage input 2 wiring



NPN open-collector output



Maximum applied voltage	30 V
Maximum sink current	50 mA
Residual voltage	1 V or less
Leakage current	0.1 mA or less

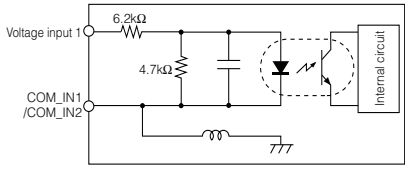
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LJ-G5001P
(PNP type)

Refer to the following page for the arrangement and function of each I/O terminal.

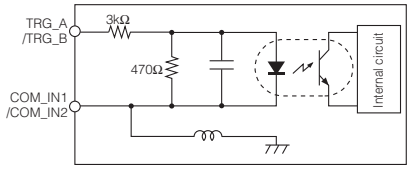
"Identifying Names and Functions of the I/O Terminals" (Page 8-2)
"I/O Signal Functions" (Page 8-6)

Voltage input 1



Input maximum rating	26.4 V
ON voltage	10.8 V or more
ON current (Typ.)	2 mA or greater
OFF voltage	3 V or less
OFF current	0.3 mA or less

Voltage input 2

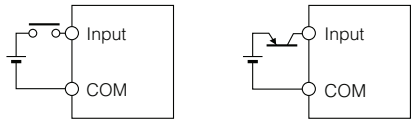


Input maximum rating	26.4 V
ON voltage	10.8 V or more
ON current (Typ.)	3 mA or greater
OFF voltage	5 V or less
OFF current	1 mA or less

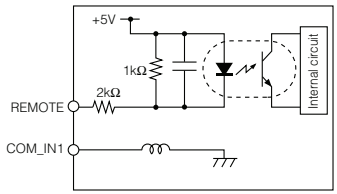
Reference

Compatible with the 2-wire proximity switch EV Series (KEYENCE). Note that 21.6 V or more of the input power source voltage is necessary when using the EV Series.

Example of voltage input 1/voltage input 2 wiring

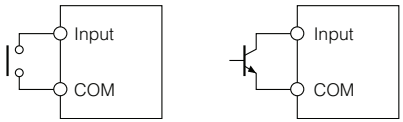


Non-voltage input 1



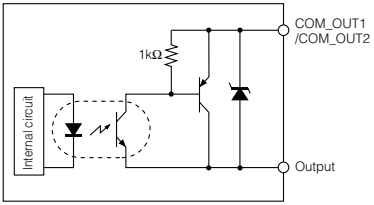
ON voltage	1 V or less
OFF current	0.3 mA or less
Short-circuit current (Typ.)	2 mA

Example of non-voltage input 1 wiring



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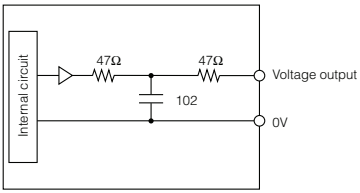
PNP open-collector output



Maximum applied voltage	30 V
Maximum source current	50 mA
Residual voltage	1 V or less
Leakage current	0.1 mA or less

LJ-G5001/LJ-G5001P Common

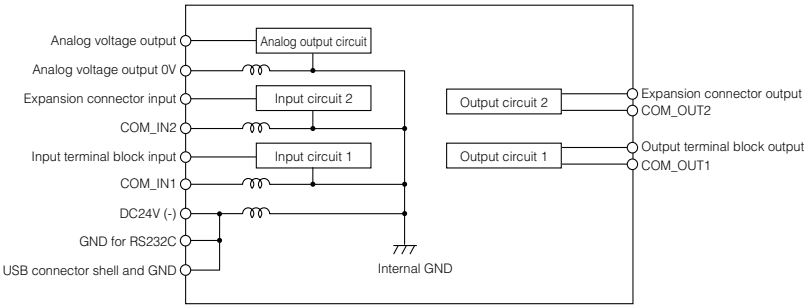
Analog voltage output



Output range	±10.8 V (Measurement data: ±10.5 V)
Resolution	2 mV
Accuracy	±0.05% of F.S. (F.S. = 20 V, accuracy in reference to the displayed value)
Output impedance	Approx. 100 Ω
Response delay time	Approx. 12 µs (after the measurement value has been updated)

Refer to "Output Terminal Block" (Page 8-3) for more information on terminal assignment.

Isolation between I/O circuits



⚠ CAUTION

- 24 V DC (-), COM_IN1, COM_IN2, and analog voltage output 0 V are all common via a choke coil. Also 24 V DC (-), SG (GND) on RS-232C, and the USB connector metal shell are each common with GND. Take care that a potential difference does not occur between the internal common terminals due to a positive grounding environment or a potential difference between the equipment. Otherwise, it may cause a malfunction in the LJ-G Series or a malfunction in the connected computer or other external device.
- COM_OUT1 and COM_OUT2 are each insulated separately. Use COM_OUT1 for the output terminal block output and use COM_OUT2 for the expansion connector output.

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Chapter

9

RS-232C

Specifications 9-2
- Connector Pin Layout 9-2
- Communication Specifications 9-2

Connections and Settings 9-3
- Connecting to a PC or PLC Link Unit 9-3
- Communication Specification Settings 9-3
- Outputting Measurements 9-4

Outputting Measurements and Changing Settings via Commands 9-5
- Command Types and Reception 9-5
- Command Format 9-7
- Mode Change Commands 9-9
- Overview of Measurement Control Commands 9-10
- Measurement Control Command Details 9-11
- Overview of Setting Content Change Commands 9-16
- Details of Setting Content Change Commands 9-18
- Check Parameter Commands 9-30

Outputting Measurement Values in External Synchronization 9-32
- Settings 9-32
- Output Method 9-33
- Output Format 9-33

Reference 9-34
- ASCII Code Table 9-34

Reference

Refer to "Timing Chart and Response Times" (Page 10-1) for more information on the timing chart and response time of RS-232C.

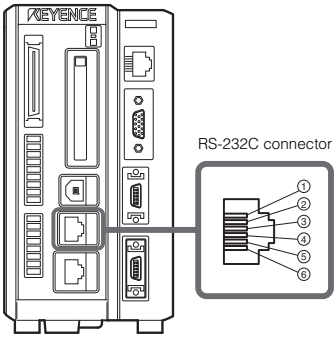
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Specifications

Connector Pin Layout

Matching connector specifications: Modular 6-pin plug connector. Use a 2.5 m RS-232C cable (OP-96368).

"List of Optional Products" (Page Appendix-2)



Pin No.	Signal name	Description
1	(Not used)	-
2	(Not used)	-
3	SD (TXD)	Receives signal from external devices (input)
4	SG (GND)	GND
5	RD (RXD)	Transmits signal to external devices (output)
6	(Not used)	-

* Do not use the unused terminal. Doing so may lead to breakdown of the unit.
* 24 VDC (-) and SG(GND) are common.
* Due to modem specifications, SD is used for receiving data (input into the device) and RD is used for sending data (outputting from the device).

Communication Specifications

EIA RS-232C compliant (Modem definition)

Communication method	Full duplex
Synchronization method	Asynchronous
Transmission code	ASCII
Data length	8 bit
Stop bit length	1 bit
Parity check *	None (default) / even / odd
Baud rate *	9600 (default) / 19200 / 38400 / 57600 / 115200 bps
Data delimiter	CR
Flow control	None

* "Setting the communication specifications for RS-232C" (Page 6-3)

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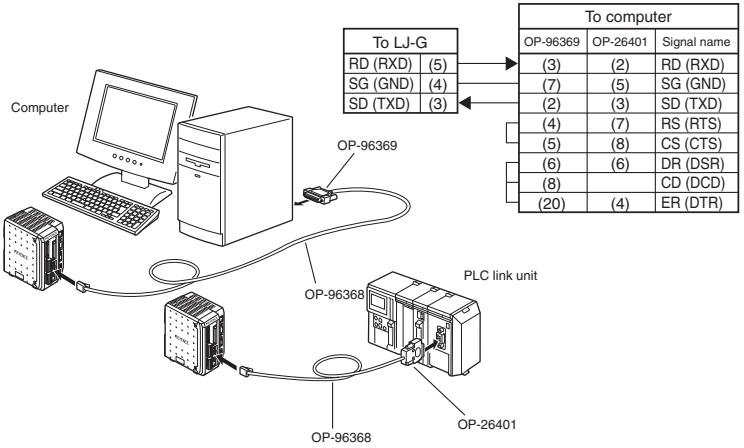
Connections and Settings

Connecting to a PC or PLC Link Unit

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

Refer to the instruction manual of the PC or PLC link unit when connecting those devices.

"List of Optional Products" (Page Appendix-2)



Communication Specification Settings

Set the communication specifications of the PC or PLC link unit to be the same as those of the LJ-G.

"Setting the communication specifications for RS-232C" (Page 6-3)

Refer to the instruction manual of the PC or PLC link unit for information on the communication specifications of each device.

Item	Setting value
Baud rate	9600 (default) / 19200 / 34800 / 57600 / 115200
Parity check	None (default) / even / odd

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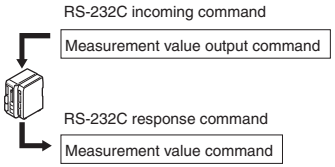
Outputting Measurements

There are two methods for outputting measurements to remote devices.

Outputting measurements via commands

Communication commands can be used to output measurements via no-handshake communication. When a measurement output command is received from a remote device, the device replies with a response command.

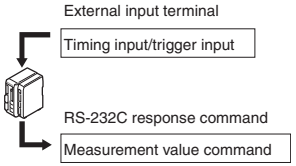
"Measurement output" (Page 9-11)



Outputting measurement values in external synchronization

Measurement value commands are sent at the same time measurements are fixed by the remote input pin (trigger input or timing input).
Turn automatic transmission ON when using measurement output from external synchronization.

"Outputting Measurement Values in External Synchronization" (Page 9-32)
"Automatic Transmission" (Page 5-120)
"Setting auto-send" (Page 6-3)
"Continuous Trigger" (Page 10-2)
"Remote Trigger" (Page 10-10)



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Outputting Measurements and Changing Settings via Commands

You can import measurements or change the parameters of the LJ-G Series by connecting it to a PC or PLC link unit.
The modes in which the device can receive a command (communication mode) vary depending on the type of command.

► Note

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

Command Types and Reception

Command types

There are four types of commands.

- **Mode change commands**
  These commands switch between the measurement screen (when measuring) and RS-232C communication mode.
  "Mode Change Commands" (Page 9-9)

- **Measurement control commands**
  These commands control measurement. These commands switch measurement output, timing input, auto-zero input and program No.
  "Overview of Measurement Control Commands" (Page 9-10)

- **Change parameter commands**
  These commands change the measurement conditions. Tolerance, averaging and measurement mode can be changed.
  These commands require use of RS-232C communication mode.
  "Overview of Setting Content Change Commands" (Page 9-16)

- **Check parameter commands**
  These commands confirm the measurement conditions.
  Check parameter commands require use of RS-232C communication mode.
  "Check Parameter Commands" (Page 9-30)

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Command reception

The following commands can be received, depending on the state of the device.
A status error is returned if the device receives a command it cannot process in its current status.

"Error response command format" (Page 9-7)
"Outline of the Screen and Operations" (Page 2-1)
"Status Table" (Page 11-8)

Status	Valid commands
Measurement window (During measurement) Displaying setting menu	Measurement control commands Command to change to RS-232C communication mode
RS-232C communication mode	Change parameter commands Check parameter commands Command to change to the measurement screen (while measuring)
Setting window (During setting) Profile storage window USB communication mode Ethernet communication mode	None (unable to receive RS-232 commands).

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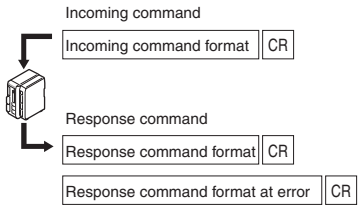
Command Format

The LJ-G Series performs the actions directed by incoming commands and sends responses to the connected external device.
Use CR (Carriage return) as a delimiter.

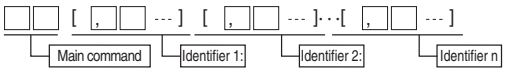
Reference

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 the command conditions.

"ASCII Code Table" (Page 9-34)



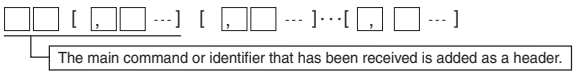
Incoming command format



Setting format may be included in the identifiers.

"Setting change format"(Page 9-8)
"Setting confirmation format"(Page 9-8)

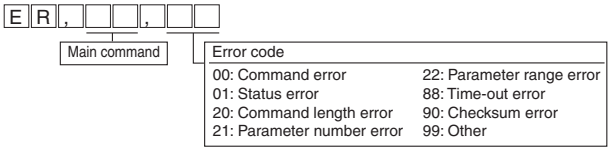
Response command format



Measurement format may be included in the identifiers.

"Measurement format"(Page 9-8)

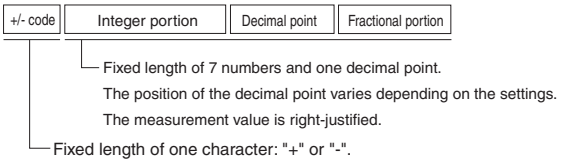
Error response command format



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Measurement format (h h h h h h h h)

Measurements are output in the format as shown below.



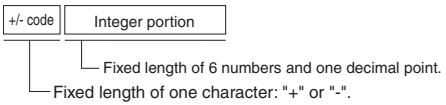
Several examples are shown below.

Display	Output format
+12 . 345	+ 0 1 2 . 3 4 5
-0 . 120	− 0 0 0 . 1 2 0
+1234 . 56	+ 1 2 3 4 . 5 6
-1 . 2	− 0 0 0 0 1 . 2
-------	X X X X X X X X
+ FFFFFF	+ F F F F F F F
- FFFFFF	− F F F F F F F

Setting change format (f f f f f f f)

Setting change commands have the following format.

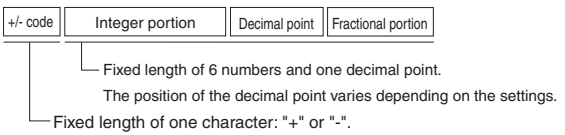
"Overview of Setting Content Change Commands" (Page 9-16)



Setting confirmation format (f f f f f f f f)

Setting confirmation commands have the following format.

"Check Parameter Commands" (Page 9-30)



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Mode Change Commands

This section describes the command format for switching between the "Measurement screen" and "RS-232C communication mode".

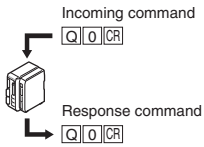
"Command Types and Reception" (Page 9-5)

Command list

Actions	Incoming command	Response command
Changing to RS-232C communication mode	Q 0 CR	Q 0 CR
Changing to the measurement screen (saving to FLASH memory)	R 0 CR	R 0 CR
Changing to the measurement screen (without saving to FLASH memory)	R 1 CR	R 1 CR

Changing to RS-232C communication mode

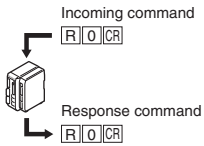
This changes to RS-232C communication mode.



Changing to the measurement screen

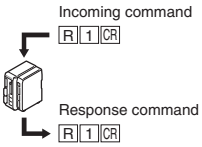
(saving to FLASH memory)

This changes to the measurement screen (measuring). This saves settings to the FLASH memory before changing modes. The settings will be preserved even if the power is turned off.



Changing to the measurement screen

(without saving to FLASH memory)



This changes to the measurement screen (measuring). This saves settings to the SRAM memory before changing modes. Nothing is saved to FLASH memory.These settings will be lost when power is turned off.

Note

- To preserve the FLASH memory, use the R 1 command if you change settings frequently.
  "Setting memory" (Page 4)
- This command is valid when saving is OFF.
  "Save"(Page 6-5)

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Overview of Measurement Control Commands

This section describes the structure of the reply command that is sent after processing of a valid measurement control command while displaying the measurement screen (measuring).

► Note

These commands are accepted only when the controller is in the "Measurement screen (Measuring)".

"Mode Change Commands" (Page 9-9)

Effect	Incoming command	Response command
Switch measurement screen	DC, g, CR	DC CR
Measurement output	Maaaaaaaaa CR	Maaaaaaaaa , hhhhhhhh [, hhhhhhhh] ⋮ [, hhhhhhhh] CR
Profile shape output	Pk CR	Pk, hhhhhhhh , hhhhhhhh ⋮ , hhhhhhhh , hhhhhhhh CR
Remote trigger input	Si CR	Si CR
Timing ON/OFF	Tp, aaaaaaaaa CR	Tp CR
Auto-zero ON	Vaaaaaaaaa CR	Vaaaaaaaaa CR
Auto-zero OFF	Waaaaaaaaa CR	Waaaaaaaaa CR
Reset	VR CR	VR CR
Keylock	KL, p CR	KL CR
Switch program No.	PW, oo CR	PW CR
Switch program No. on the memory card	PC, ff, oo CR	PC CR
Check program No.	PR CR	PR, oo CR
Start storage	AS CR	AS CR
Stop storage	AP CR	AP CR
Initialize storage	AQ CR	AQ CR
Storage state output	AN CR	AN, s, ddddd CR
Data storage data output	AO, D, b CR	AO, D, b [, hhhhhhhh] [, hhhhhhhh] ⋮ [, hhhhhhhh] CR

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Effect	Incoming command	Response command
Profile storage data output	A O , P , k , j j j j CR	A O , P , k , h h h h h h h h h , h h h h h h h h h ⋮ , h h h h h h h h h , h h h h h h h h h CR
Save storage data	S S CR	S S CR

The "□" portion indicates a parameter or a measurement.

Symbol			
aaaaaaaa: Specifies OUT number	b: Specifies OUT	ddddd: Stored data count	ff: File number
g: Screen type	hhhhhhhh: Measurement	i: Specifies head	jjjj: Data number
k: Specifies profile	o: Program number	p: Specifies ON/OFF	S: Storage state

Measurement Control Command Details

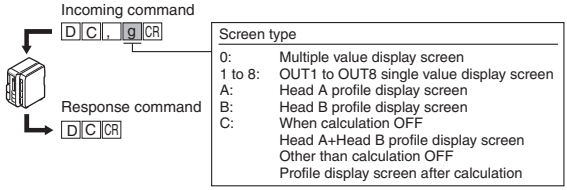
This section describes the details of the incoming commands and the response commands that are sent when the incoming commands are properly processed.

For details about responses to invalid commands, see "Command Format" (Page 9-7).

For details about response delays, see "Timing Chart and Response Times" (Page 10-1).

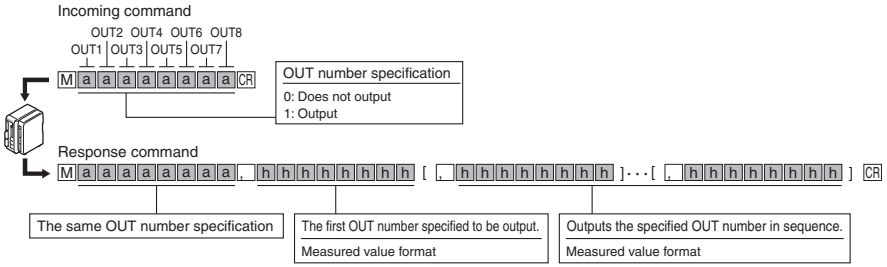
Switching the measurement screen

"Measurement Screen" (Page 3-2)



Measurement output

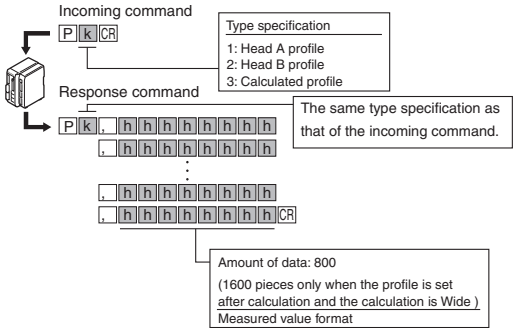
This outputs the measurement value in a specified OUT number.



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Profile shape output

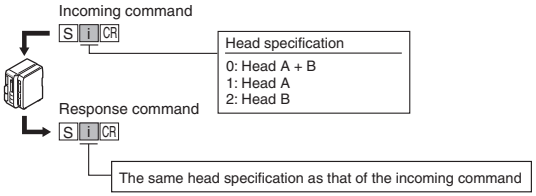
This outputs profile waveform data.



*The minimum unit of the profile shape waveform data is 1 µm.
*A status error is returned when no profile is acquired.
"Error response command format" (Page 9-7)

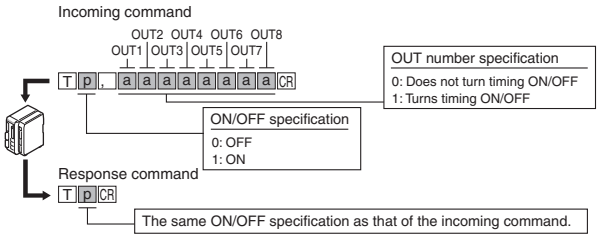
Remote trigger input

"Trigger Function" (Page 3-14)



Timing ON/OFF

"Hold Function" (Page 3-14)



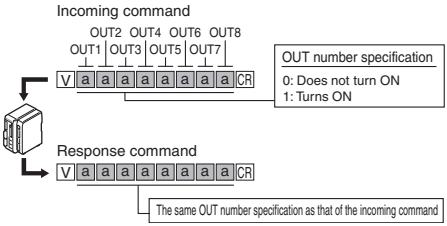
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Auto-zero ON/OFF

"Auto-zero" (Page 3-15)

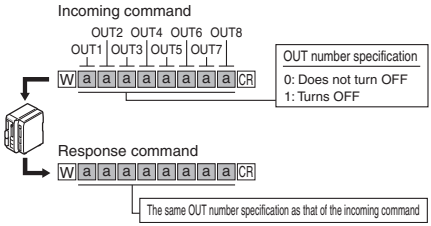
Auto-zero ON

This activates the auto-zero function.
When the auto-zero is ON this command reacquires the reference value.



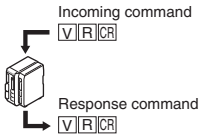
Auto-zero OFF

This deactivates the auto-zero function.
This command is ignored when the auto-zero function is OFF.



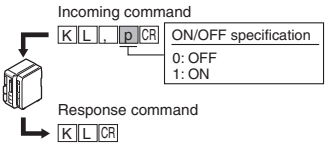
Reset

This resets the measured value.



Keylock

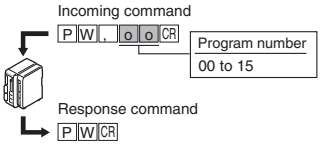
"Keylock" (Page 3-18)



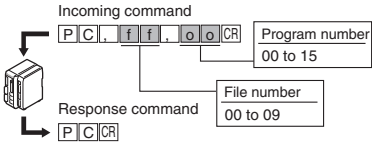
Program

"Switching Program Nos." (Page 3-17)

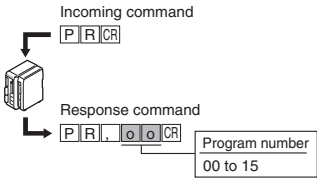
Program No. switching



Switch program No. on the memory card



Confirm program No.

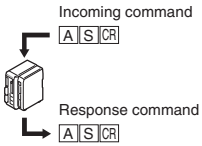


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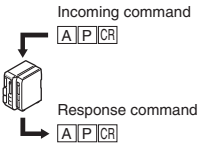
Storage

"Storage" (Page 3-19)

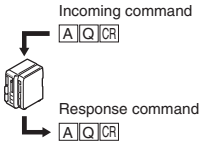
Start storage



Stop storage

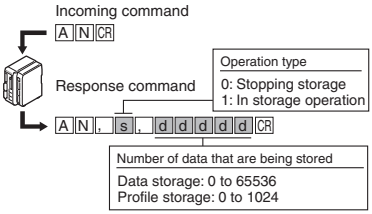


Initialize storage



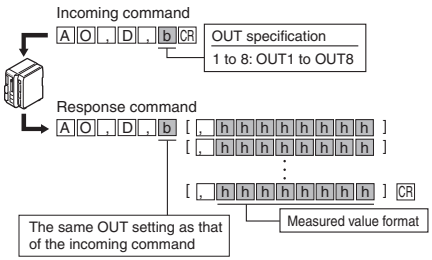
Storage state output

This confirms the storage operation of data storage and acquires the number of the accumulated data.



Data storage data output

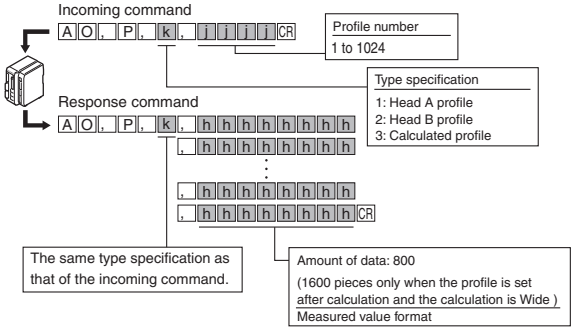
Acquires the data accumulated in the data storage.
When the data count is zero, only the main command is returned.



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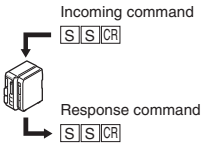
Profile storage data output

This acquires the data stored in profile storage.
When the data count is zero, only the main command is returned.



Save storage data

This saves the stored data to the memory card.
A reply command is only returned if data is saved without error.



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Overview of Setting Content Change Commands

This section describes the format of commands that change the parameters.

► Note

These commands are accepted only when the controller is in the "RS-232C communication mode".

"Mode Change Commands" (Page 9-9)

Setting items		Incoming command	Response command
Head Settings	Trigger mode	SW,TR,m CR	SW,TR CR
	Mutual interference prevention	SW,PF,s CR	SW,PF CR
	Trigger synchronization	SW,TR,S,s CR	SW,TR CR
	Multiple trigger ON / OFF	SW,TR,C,s CR	SW,TR CR
	Sampling count, Delay count	SW,TR,R,nnn,nn CR	SW,TR CR
	ASAP trigger	SW,TA,T,s CR	SW,TA CR
	ASAP mode	SW,TA,M,m CR	SW,TA CR
	Measurement range	SW,MA,h,m,m,m CR	SW,MA CR
	Cancel calibration	SW,FB,C,h CR	SW,FB CR
	Start calibration	SW,FB,S,h CR	SW,FB CR
	Finish calibration	SW,FB,P,h CR	SW,FB CR
	Initialize calibration	SW,FB,I,h CR	SW,FB CR
	Laser intensity adjustment method	SW,FB,M,h,m CR	SW,FB CR
	MANUAL control range	SW,FB,R,h,nn,nn CR	SW,FB CR
	Sampling time	SW,ST,h,nn CR	SW,ST CR
	Number of alarm warnings	SW,AL,N,h,nnn CR	SW,AL CR
	Alarm cut level	SW,AL,L,h,n CR	SW,AL CR
Profile Settings	Calculations	SW,HO,m CR	SW,HO CR
	Head delay count	SW,TD,nnnn CR	SW,TD CR
	Filter	SW,FL,m CR	SW,FL CR
	Smoothing	SW,SM,m CR	SW,SM CR
	Averaging	SW,AV,m CR	SW,AV CR

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Setting items			Incoming command	Response command
OUT Settings	Averaging		SW,OA,a,mCR	SW,OACR
	Measurement alarm		SW,OL,a,nnnCR	SW,OLCR
	Comparative measurement mode		SW,MS,a,mCR	SW,MSCR
	Offset		SW,OF,a,fffffffCR	SW,OFCR
	Minimum display unit		SW,UN,a,mCR	SW,UNCR
	Scaling		SW,SC,a,fffffff,fffffff,fffffffCR	SW,SCCR
	Tolerance settings		SW,LM,a,fffffff,fffffffCR	SW,LMCR
Common Settings	TIMING terminal		SW,TT,aaaaaaaaCR	SW,TTCR
	ZERO terminal		SW,TZ,aaaaaaaaCR	SW,TZCR
	Binary output		SW,BO,m,aaaaaaaaCR	SW,BOCR
	Analog output selection		SW,AO,O,m,iCR	SW,AOCR
	Analog output Scaling		SW,AO,S,m,fffffff,fffffff,fffffffCR	SW,AOCR
	Analog profile Output period		SW,AO,P,mCR	SW,AOCR
	Storage		SW,SR,mCR	SW,SRCR
	Data storage		SW,SD,nnnnnn,mCR	SW,SDCR
	Profile storage		SW,SP,j,nnnnn,mCR	SW,SPCR
Environment Settings	Ethernet Settings	IP address	SW,EN,I,nnnnnnnnnnnnnnnCR	SW,ENCR
		Subnet mask	SW,EN,M,nnnnnnnnnnnnnnnCR	SW,ENCR
		Gateway	SW,EN,G,nnnnnnnnnnnnnnnCR	SW,ENCR
	Strobe period		SW,EN,S,nnnCR	SW,ENCR
	Cable extension mode		SW,EN,C,sCR	SW,ENCR
	Interface language		SW,EN,L,mCR	SW,ENCR

The "□" portion indicates a parameter or a measurement. Refer to "Details of Setting Content Change Commands" (Page 9-18) for more information.

Symbol			
a: Specifies OUT	fffffff: Setting	h: Specifies head	i: Specifies analog output
j: Specifies profile	m: Setting selection	n: Unsigned value	s: Specifies ON/OFF

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Details of Setting Content Change Commands

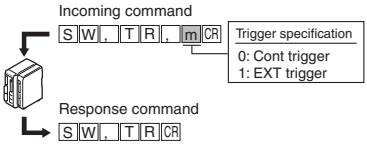
This section describes the details of the incoming commands and the response commands that are sent when the incoming commands are properly processed.

For details about responses to invalid commands, see "Command Format" (Page 9-7).

For details about response delays, see "Timing Chart and Response Times" (Page 10-1).

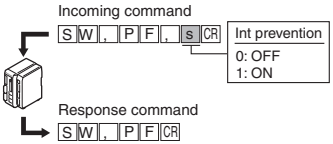
Trigger mode

"Trigger Mode" (Page 5-12)



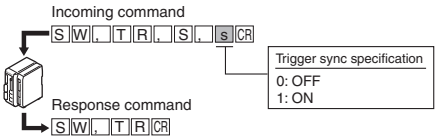
Mutual interference prevention

"Mutual Interference Prevention" (Page 5-13)



Trigger synchronization

"Trigger Synchronization" (Page 5-14)

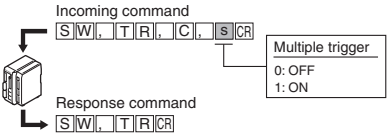


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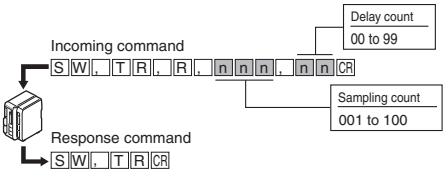
Multiple trigger

"Multiple Trigger" (Page 5-15)

Multiple trigger ON / OFF



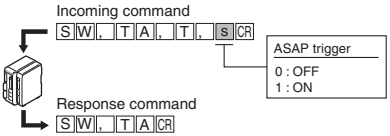
Sampling count, Delay countE



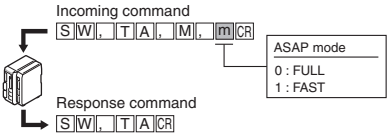
ASAP trigger

"ASAP trigger" (Page 5-16)

ASAP trigger ON / OFF



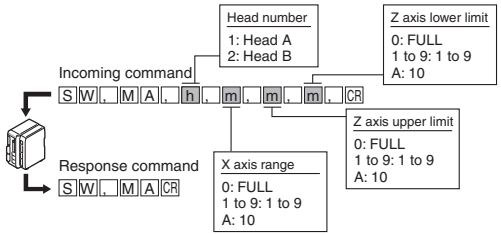
ASAP mode



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Measurement range

"Measurement Range" (Page 5-19)



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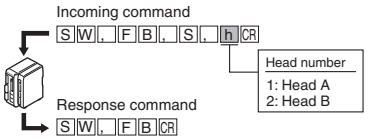
Calibration

"Calibration"(Page 5-22)

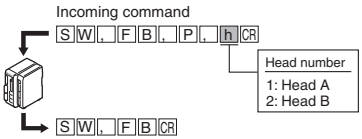
Use an external trigger input command for trigger input while tuning.

"Remote trigger input" (Page 9-12)

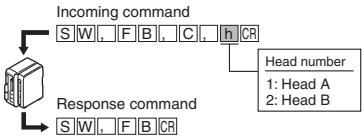
Start calibration



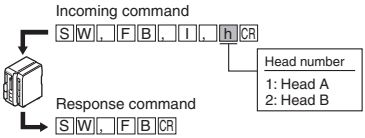
Finish calibration



Cancel calibration



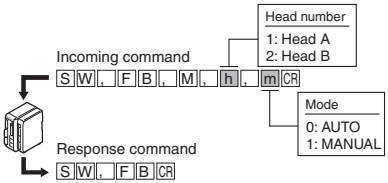
Initialize calibration



Laser intensity

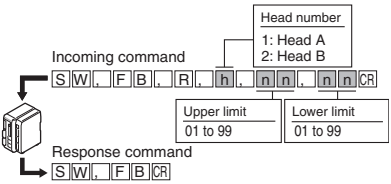
"Laser intensity" (Page 5-23)

Laser intensity adjustment method



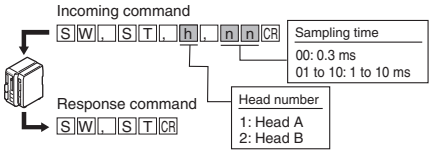
MANUAL control range

This sets the laser intensity control range.



Sampling time

"Sampling time" (Page 5-25)

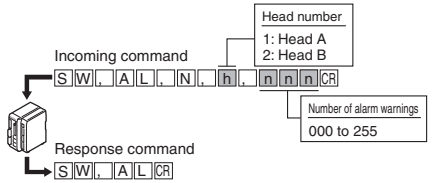


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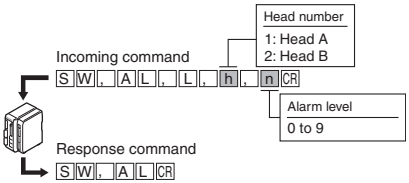
Profile alarm

"Profile Alarm" (Page 5-28)

Alarm count

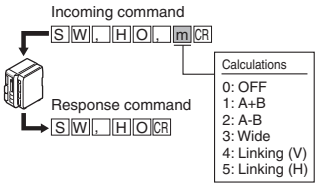


Alarm cut level



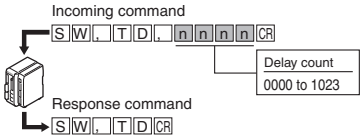
Calculations

"Calculations" (Page 5-35)



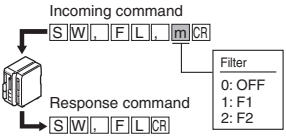
Head delay count

"Head Delay Count" (Page 5-41)



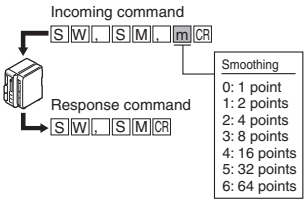
Filter

"Filter" (Page 5-42)



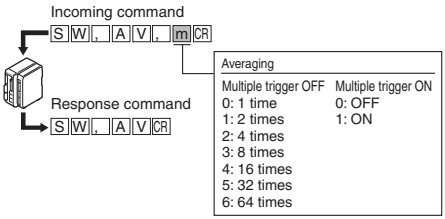
Smoothing

"Smoothing" (Page 5-42)



Averaging

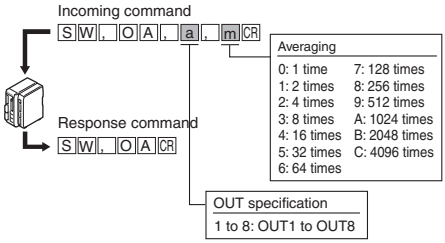
"Averaging" (Page 5-43)



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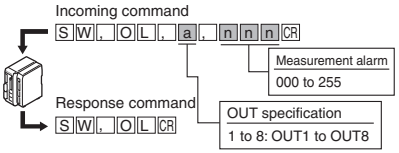
Average

"Average" (Page 5-101)



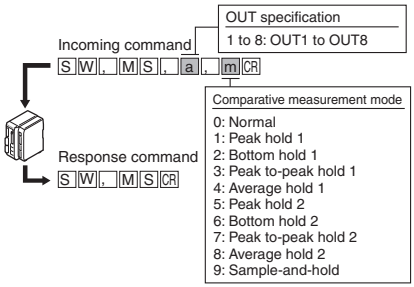
Measurement alarm

"Measurement Alarm" (Page 5-102)



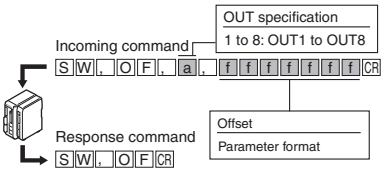
Comparative measurement mode

"Comparative Measurement Mode" (Page 5-103)



Offset

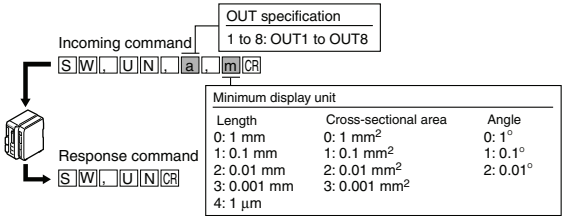
"Offset" (Page 5-105)



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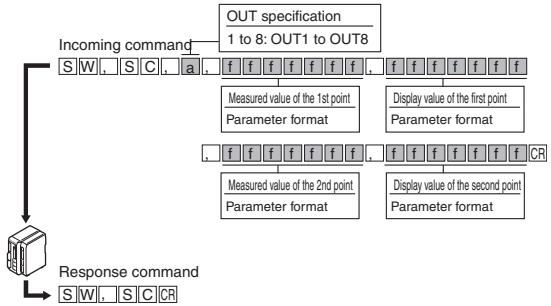
Minimum display unit

"Minimum Display Unit" (Page 5-106)



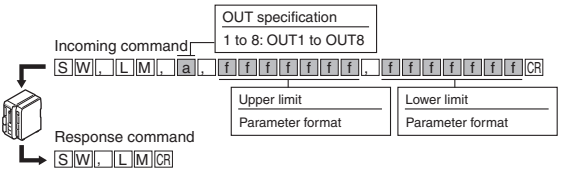
Scaling

"Scaling" (Page 5-107)



Tolerance

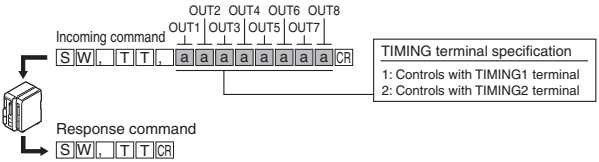
"Tolerance" (Page 5-109)



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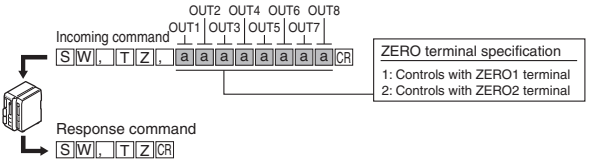
TIMING terminal

"TIMING Terminal" (Page 5-112)



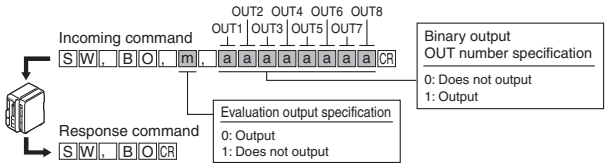
ZERO terminal

"ZERO Terminal" (Page 5-113)



Binary output

"Binary Output" (Page 5-114)

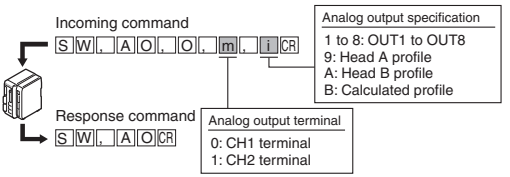


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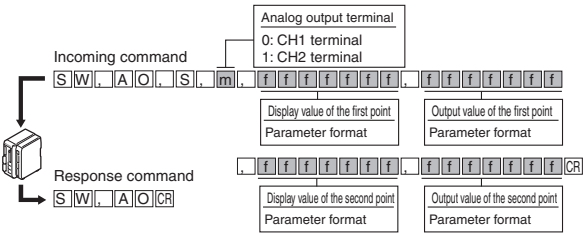
Analog output

"Analog Output" (Page 5-114)

Analog output selection

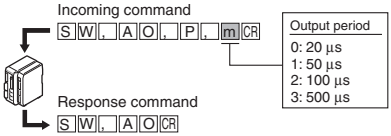


Analog output scaling



* Set the voltage in units of mV for the output value setting format.
  (Setting example) +10.000 V is specified as + 0 1 0 0 0 0

Analog profile output period

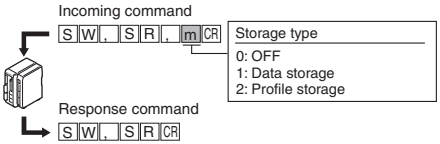


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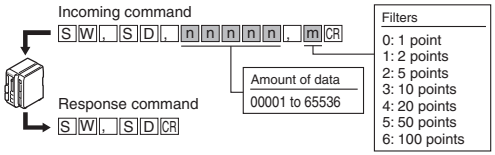
Storage

"Storage" (Page 5-118)

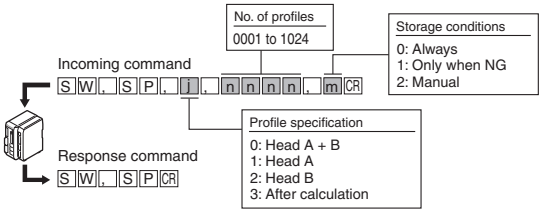
Storage types



Data storage



Profile storage

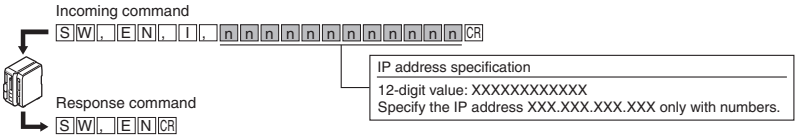


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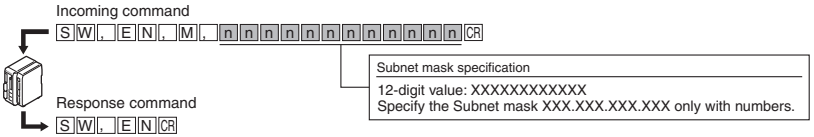
Ethernet settings

"Setting the communication specifications for Ethernet" (Page 6-3)

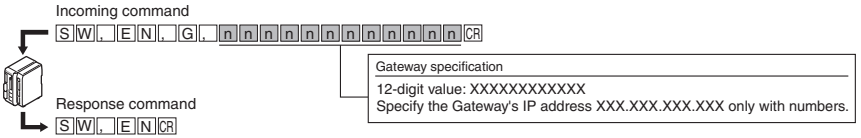
IP address



Subnet mask

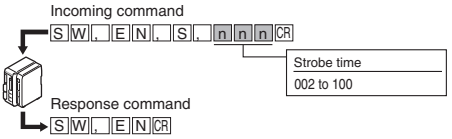


Gateway



Strobe period

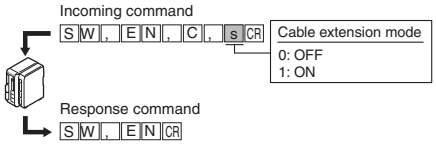
"Setting the strobe time" (Page 6-4)



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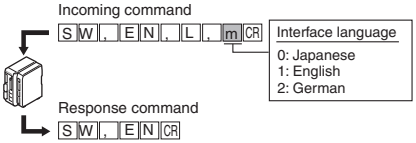
Cable extension mode

"Setting cable extension mode" (Page 6-4)



Interface language

"Changing languages" (Page 6-4)



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Check Parameter Commands

This section describes the format of the command to check the setting contents.

► Note

These commands are accepted only when the controller is in the "RS-232C communication mode".

Setting items		Incoming command	Response command
Head Settings	Trigger mode	[S][R][,][T][R][CR]	[S][R][,][T][R][,][m][CR]
	Mutual interference prevention	[S][R][,][P][F][CR]	[S][R][,][P][F][,][s][CR]
	Trigger synchronization	[S][R][,][T][R][,][S][CR]	[S][R][,][T][R][,][S][,][s][CR]
	Multiple trigger	[S][R][,][T][R][,][C][CR]	[S][R][,][T][R][,][C][,][s][CR]
	Sampling count, Delay count	[S][R][,][T][R][,][R][CR]	[S][R][,][T][R][,][R][,][n][n][n][,][n][n][CR]
	ASAP trigger ON / OFF	[S][R][,][T][A][,][T][CR]	[S][R][,][T][A][,][T][,][s][CR]
	ASAP mode	[S][R][,][T][A][,][M][CR]	[S][R][,][T][A][,][M][,][m][CR]
	Measurement range	[S][R][,][M][A][,][h][CR]	[S][R][,][M][A][,][h][,][m][,][m][,][m][CR]
	Laser intensity adjustment method	[S][R][,][F][B][,][M][,][h][CR]	[S][R][,][F][B][,][M][,][h][,][m][CR]
	MANUAL control range	[S][R][,][F][B][,][R][,][h][CR]	[S][R][,][F][B][,][R][,][h][,][n][n][,][n][n][CR]
	Sampling time	[S][R][,][S][T][,][h][CR]	[S][R][,][S][T][,][h][,][n][n][CR]
	Number of alarm warnings	[S][R][,][A][L][,][N][,][h][CR]	[S][R][,][A][L][,][N][,][h][,][n][n][n][CR]
	Alarm cut level	[S][R][,][A][L][,][L][,][h][CR]	[S][R][,][A][L][,][L][,][h][,][n][CR]
Profile Settings	Calculations	[S][R][,][H][O][CR]	[S][R][,][H][O][,][m][CR]
	Head delay count	[S][R][,][T][D][CR]	[S][R][,][T][D][,][n][n][n][n][CR]
	Filter	[S][R][,][F][L][CR]	[S][R][,][F][L][,][m][CR]
	Smoothing	[S][R][,][S][M][CR]	[S][R][,][S][M][,][m][CR]
	Averaging	[S][R][,][A][V][CR]	[S][R][,][A][V][,][m][CR]
OUT Settings	Averaging	[S][R][,][O][A][,][a][CR]	[S][R][,][O][A][,][a][,][m][CR]
	Measurement alarm	[S][R][,][O][L][,][a][CR]	[S][R][,][O][L][,][a][,][n][n][n][CR]
	Comparative measurement Mode	[S][R][,][M][S][,][a][CR]	[S][R][,][M][S][,][a][,][m][CR]
	Offset	[S][R][,][O][F][,][a][CR]	[S][R][,][O][F][,][a][,][f][f][f][f][f][f][f][f][CR]
	Minimum display unit	[S][R][,][U][N][,][a][CR]	[S][R][,][U][N][,][a][,][m][CR]

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Setting items			Incoming command	Response command
OUT Settings	Scaling		SR,SC,a CR	SR,SC,a,fffffffff,fffffffff,fffffffff CR
	Tolerance settings		SR,LM,a CR	SR,LM,a,fffffffff,fffffffff CR
Common Settings	TIMING terminal		SR,TT CR	SR,TT,aaaaaaaaa CR
	ZERO terminal		SR,TZ CR	SR,TZ,aaaaaaaaa CR
	Binary output		SR,BO CR	SR,BO,m,aaaaaaaaa CR
	Analog output selection		SR,AO,O,m CR	SR,AO,O,m,i CR
	Analog output scaling		SR,AO,S,m CR	SR,AO,S,m,fffffffff,fffffffff,fffffffff CR
	Analog profile output period		SR,AO,P CR	SR,AO,P,m CR
	Storage		SR,SR CR	SR,SR,m CR
	Data storage		SR,SD CR	SR,SD,nnnnnn,m CR
	Profile storage		SR,SP CR	SR,SP,j,nnnnn,m CR
Environment Settings	Ethernet Settings	IP address	SR,EN,I CR	SR,EN,I,nnnnnnnnnnnnnnn CR
		Subnet mask	SR,EN,M CR	SR,EN,M,nnnnnnnnnnnnnnn CR
		Gateway	SR,EN,G CR	SR,EN,G,nnnnnnnnnnnnnnn CR
	Strobe period		SR,EN,S CR	SR,EN,S,nnn CR
	Cable extension mode		SR,EN,C CR	SR,TR,C,s CR
	Interface language		SR,EN,L CR	SR,EN,L,m CR

The "□" portion indicates a parameter or a measurement.

Symbol			
a: Specifies OUT	fffffff: Setting	h: Specifies head	i: Specifies analog output
j: Specifies profile	m: Setting selection	n: Unsigned value	s: Specifies ON/OFF

The variable portions of received commands and response commands, excluding Ethernet setting format and setting value format, are the same as for setting change commands.
Ethernet format includes 3 periods appended to the end.

"Setting confirmation format ()" (Page 9-8)

"Details of Setting Content Change Commands" (Page 9-18)

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Outputting Measurement Values in External Synchronization

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

Reference

Commands for measurement value output and for setting change can be used even when the measurement value output is used for external synchronization (when the external trigger input is other than OFF).

► Note

Do not fix the next measurement value while the current measurement value is being output via RS-232C. Measurements fixed during output are not output.

Settings

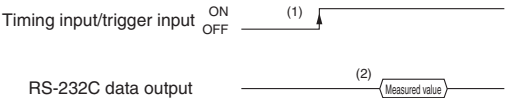
Set the trigger mode, measurement mode, common settings and environment settings as follows.

Settings	Setting items	Setting value	Remarks
Trigger Setting	Trigger mode	Set the continuous trigger or remote trigger.	
OUT Settings	Comparative measurement mode	Set this according to the measurements being taken.	
Common Settings	Automatic transmission (OUT1 to OUT8)	Set the OUT number to use for output.	Set individually for each OUT.
	Data output timing	Set the output timing to profile update, TIMING1 or TIMING2.	
Environment Settings	Automatic transmission	Set this to ON.	

"Trigger Mode" (Page 5-12)
"Comparative Measurement Mode" (Page 5-103)
Environment Settings"Setting the communication specifications for RS-232C" (Page 6-3)
Common Settings"Automatic Transmission" (Page 5-120)

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Output Method



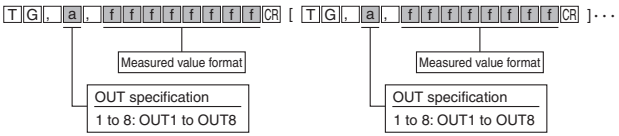
1. The remote input terminal (timing input or trigger input) turns ON.
2. The measurement, fixed in accordance with the settings, is output.

- If automatic transmission in the common settings is set to "Output," measurements from all OUT numbers will be output at the same time.(OUT numbers that have not had their measurements updated will also be output)
- The measurement set by the remote input terminal (TIMING1/2 or TRG_A/B) differs depending on the trigger mode, measurement mode and data output timing settings.

"Trigger Mode" (Page 5-12)
"Comparative Measurement Mode" (Page 5-103)
"Data Output Timing" (Page 5-121)

Output Format

The command format of the measurement value output is identified as follows.
The measurements from the fixed output numbers are output in the selected format.
When multiple out numbers are specified, the output is handled in ascending OUT number order.



Example: 3 OUT numbers selected.
When outputting OUT1(10.000mm), OUT2(-12.500mm), OUT3(150.00mm^2)

TG, 1, +0 1 0 . 0 0 0 CR TG, 2, -0 1 2 . 5 0 0 CR TG, 3, +0 1 5 0 . 0 0 CR

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Reference

ASCII Code Table

Low-order 4 bits \ High-order 4 bits	0	1	2	3	4	5	6	7
0	NUL	DLE	SP	0	@	P	`	p
1	SOH	DC1	!	1	A	Q	a	q
2	STX	DC2	”	2	B	R	b	r
3	ETX	DC3	#	3	C	S	c	s
4	EOT	DC4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	→	,	<	L	¥	l	|
D	CR	←	-	=	M	]	m	}
E	SO	↑	.	>	N	^	n	~
F	SI	↓	/	?	O	_	o	DEL

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Chapter

10

Timing Chart and Response Times

Continuous Trigger 10-2
- Overview of Continuous Trigger 10-2
- Details of Continuous Trigger 10-8

Remote Trigger 10-10
- Single Trigger 10-10
- Multi (Internal) Trigger 10-13

Input and Output Details 10-15
- Evaluation/Binary Output 10-15
- Strobe Output 10-16
- GO Output (Total Evaluation Output) 10-17
- Analog Profile Output 10-17
- Laser Control Input 10-19
- Memory Card Control Input (S_SAVE Input) 10-20

Measurement Response Time 10-15
- Trigger Interval and Measurement Time 10-21
- Averaging Response Time 10-24
- Multiple Heads Response Time 10-26

RS-232C Interface 10-27
- Sending & Receiving Commands Response Time 10-27
- Automatic Output Response Time 10-28

Reference

Refer to the following pages for the terminal assignment of each I/O, function, and specifications of the circuits.

"I/O Terminals" (Page 8-1)

"RS-232C" (Page 9-1)

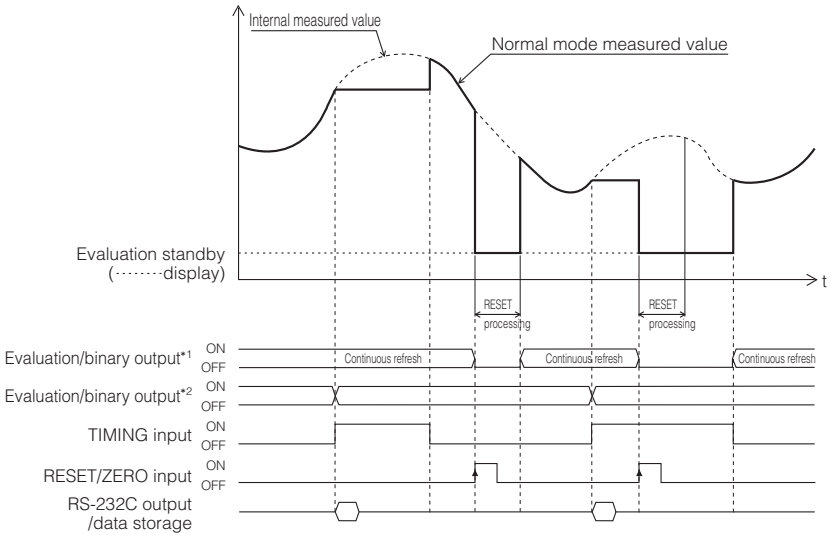
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Continuous Trigger

Overview of Continuous Trigger

Normal

Measurement is performed continuously, and the measurement value is displayed and output as required when in normal measurement mode.



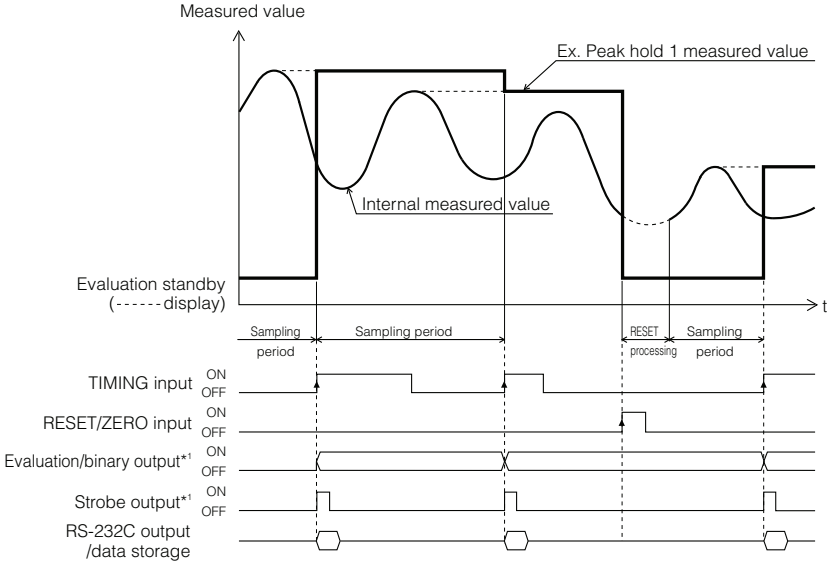
- The evaluation/binary output is continuously output in response to the measurement value refresh requests (Profile update) when "Data out timing" under the common settings is set to "Profile" (*1). When TIMING1 or TIMING2 are set, the timing input is output in synchronization (*2).
  "Data Output Timing" (Page 5-121)
- The RS-232C output is synchronized with the timing input when "Auto-send" in the Environment settings is set to ON and "Data out timing" in the common settings is set to TIMING1 or TIMING2.
  "Outputting Measurement Values in External Synchronization" (Page 9-32)
- The data storage is synchronized to the timing input and saved when "Data out timing" in the common settings is set to TIMING1 or TIMING2.
- Evaluation / binary output
  "Evaluation/Binary Output" (Page 10-15)
- If the RESET input is set to ON when the TIMING input is ON, the evaluation standby state (the display shows "------") is displayed until the TIMING input becomes OFF.
- The reset input resets the OUT measurement value. The profile averaging is not reset.
- The timing input, reset input and auto-zero can be controlled via RS-232C.
  "Overview of Measurement Control Commands" (Page 9-10)

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Peak hold 1 /bottom hold 1 /peak to peak hold 1 /average hold 1

The values within the period of time (sampling period) determined by the external timing input are measured, and the display and output are retained.

Measurement mode	Measured value
Peak hold 1	Measures the maximum value obtained over the sampling period.
Bottom hold 1	Measures the minimum value obtained over the sampling period.
Peak to-peak hold 1	Measures the differential value of the maximum and minimum values within the specified period of time (sampling period).
Average hold 1	Measures the average value obtained over the sampling period.



- The sampling period indicates the period of time from the moment the TIMING input turns on until the moment it turns on again. When the TIMING input turns ON, the measurement value from the previous sampling period is output.
- The internal measurement values are not reset when the timing input is turned on.
- In the following cases, the evaluation standby status (the display shows "------") is displayed until the first measured value is fixed.
  When the power is turned on, the settings or program number are changed, or if a reset or auto-zero command are input.
- The evaluation/binary output is continuously output in response to the measurement value refresh requests from TIMING input when "Data out timing" under the common settings is set to TIMING1 or TIMING2 (*1). When "Profile" is set, data is output continuously according to the profile update.
  "Data Output Timing" (Page 5-121)
- The RS-232C output is synchronized with the timing input when "Auto-send" in the Environment settings is set to ON and "Data out timing" in the common settings is set to TIMING1 or TIMING2.
  "Outputting Measurement Values in External Synchronization" (Page 9-32)

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- The data storage is synchronized to the timing input and saved when "Data out timing" in the common settings is set to TIMING1 or TIMING2.
- Evaluation / binary output or strobe output
  "Evaluation/Binary Output" (Page 10-15)
  "Strobe Output" (Page 10-16)
- 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 output by using the value immediately before the value being held.

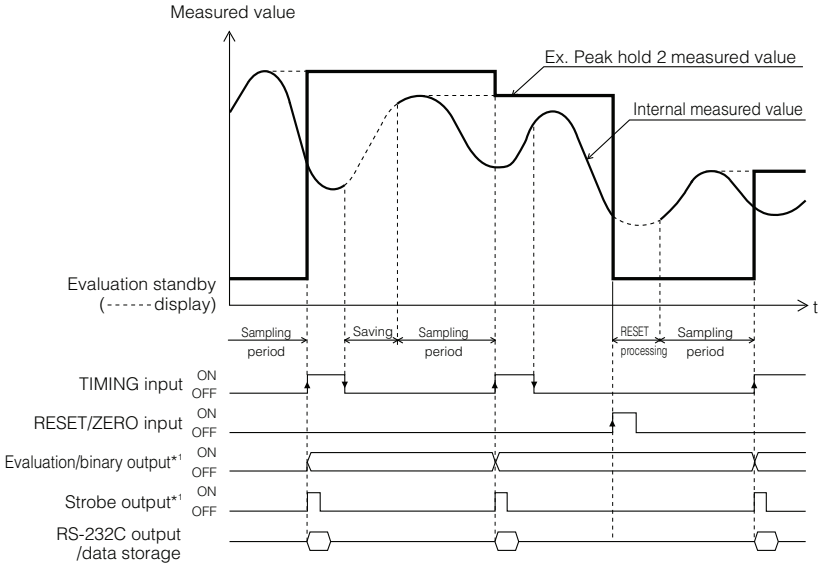
  Without hold: At the time of peak hold, outputs the measurement result while ignoring the alarm state period. The entire sampling period will return alarm results (-FFFFFF) if the device is in the alarm state. When not in the peak hold state, the measurement state will be the alarm (-FFFFFF).
- The timing input, reset input and auto-zero can be controlled via RS-232C.
  "Overview of Measurement Control Commands" (Page 9-10)
- The reset input resets the OUT measurement value. The profile averaging is not reset.
- Select 1 for the number of times for averaging when 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.

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Peak hold 2 /bottom hold 2 /peak to peak hold 2 /average hold 2

The values within the period of time (sampling period) determined by the external timing input are measured, and the display and output are retained.

Measurement mode	Measured value
Peak hold 2	Measures the maximum value obtained over the sampling period.
Bottom hold 2	Measures the minimum value obtained over the sampling period.
Peak to-peak hold 2	Measures the differential value of the maximum and minimum values within the specified period of time (sampling period).
Average hold 2	Measures the average value obtained over the sampling period.



- The sampling time is the time period in which the TIMING input is OFF. When the TIMING input turns ON, the measurement value in the sampling period immediately before is output.
- The internal measurement values are reset when the timing input is turned OFF.
- If the TIMING input becomes ON during the reset processing is in progress, the evaluation standby status (the display shows "------") is displayed.
- In the following cases, the evaluation standby status (the display shows "------") is displayed until the first measured value is fixed. When the power is turned on, the settings or program number are changed, or if a reset or auto-zero command are input.
- The evaluation/binary output is continuously output in response to the measurement value refresh requests from TIMING input when "Data out timing" under the common settings is set to TIMING1 or TIMING2 (*1). When "Profile" is set, data is output continuously according to the profile update.
  "Data Output Timing" (Page 5-121)
- The data storage is synchronized to the timing input and saved when "Data out timing" in the common settings is set to TIMING1 or TIMING2.

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- Evaluation / binary output or strobe output
  "Evaluation/Binary Output" (Page 10-15)
  "Strobe Output" (Page 10-16)
- When the internal measurement value becomes the alarm state, the measurement result varies depending on the settings of the alarm process.

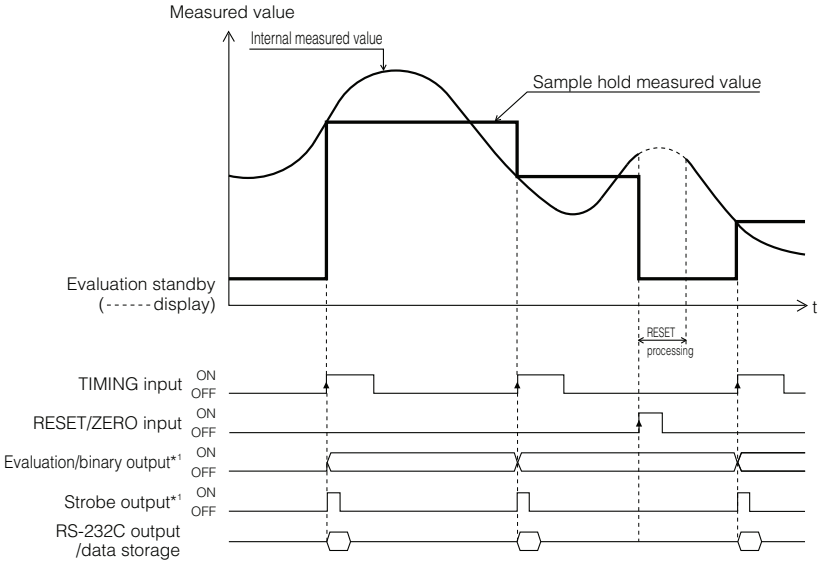
  With hold: The measurement result is outputted by using the value immediately before the value being held.

  Without hold: At the time of peak hold, outputs the measurement result while ignoring the alarm state period. The entire sampling period will return alarm results (-FFFFFF) if the device is in the alarm state. When not in the peak hold state, the measurement state will be the alarm (-FFFFFF).
- The timing input, reset input and auto-zero can be controlled via RS-232C.
  "Overview of Measurement Control Commands" (Page 9-10)
- The reset input resets the OUT measurement value. The profile averaging is not reset.
- Select 1 for the number of times for averaging when 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.

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Sample-and-hold

Holds the display or output of the measured value at the instant indicated by the external TIMING input.



- The internal measurement value when the TIMING input turns ON is retained and outputted.
- In the following cases, the evaluation standby status (the display shows "------") is displayed until the first measured value is fixed. When the power is turned on, the settings or program number are changed, or if a reset or auto-zero command are input.
- The evaluation/binary output is continuously output in response to the measurement value refresh requests from TIMING input when "Data out timing" under the common settings is set to TIMING1 or TIMING2 (*1). When "Profile" is set, data is output continuously according to the profile update.
  "Data Output Timing" (Page 5-121)
- The RS-232C output is synchronized with the timing input when "Auto-send" in the Environment settings is set to ON and "Data out timing" in the common settings is set to TIMING1 or TIMING2.
  "Outputting Measurement Values in External Synchronization" (Page 9-32)
- The data storage is synchronized to the timing input and saved when "Data out timing" in the common settings is set to TIMING1 or TIMING2.
- Evaluation / binary output or strobe output
  "Evaluation/Binary Output" (Page 10-15)
  "Strobe Output" (Page 10-16)
- The timing input, reset input and auto-zero can be controlled via RS-232C.
  "Overview of Measurement Control Commands" (Page 9-10)
- The reset input resets the OUT measurement value. The profile averaging is not reset.
- 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.

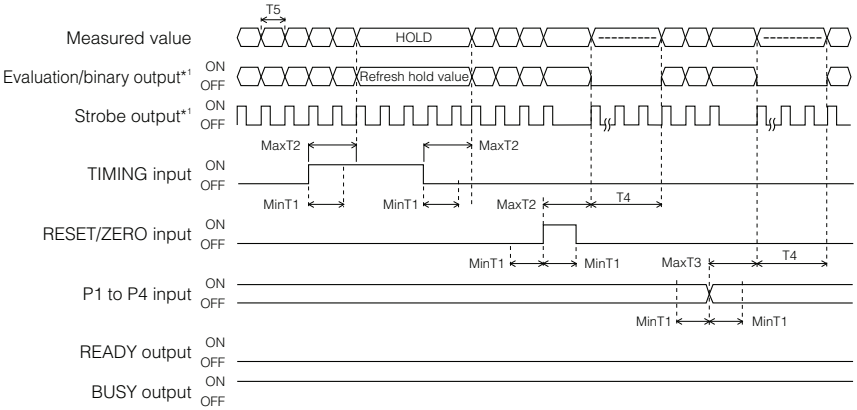
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Details of Continuous Trigger

The input and output for each measurement mode when the trigger mode is set to continuous trigger are detailed below.

Normal

In normal measurement mode

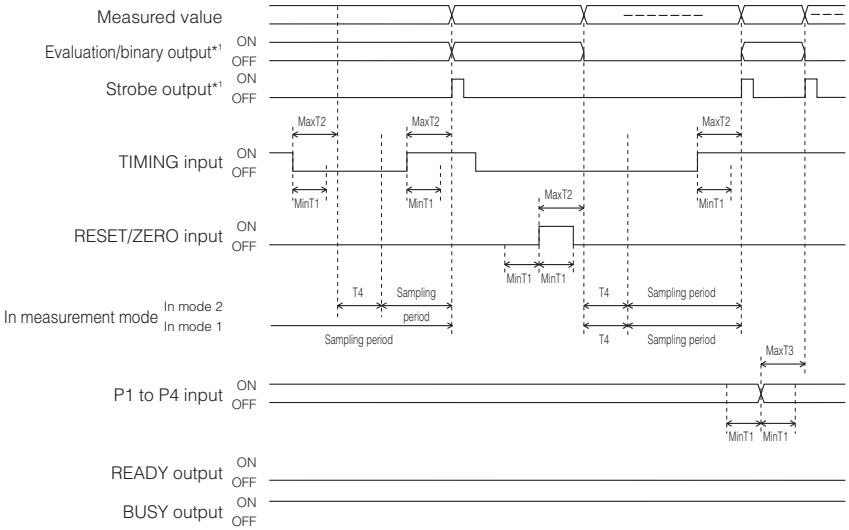


- The trigger period (T5), input response time (T2), RESET time (T4) and program No. change time (T3) vary depending on the settings.
- The minimum input time (T1) is 1 ms.
- Response times (examples) are as follows.T5 is trigger interval displayed on the measurement screen.
  - T2 = 1 ms x OUT + 8 ms (TIMING)
  - T2 = T1 + T5 x 2 (RESET)
  - T2 = T1 + T5 x 2 (when ZERO and save are OFF)
  - T2 = T1 + T5 x 2 + 300 ms (when ZERO and save are ON)
  - T3 = 350 ms (When save is OFF)
  - T3 = 500 ms (When save is ON)
  - T4 = (Average count - 1) x T5 (RESET, ZERO)
  - T4 = (Averaging count + Average count - 2) x T5 + Measurement time (P1 to P4)
- The response time for auto-zero input is longer when save is ON.
- Auto-zero is canceled when the auto-zero input is turned on for two seconds or more.
- The above evaluation or binary outputs are those when the output is set to one item.
- The strobe output ON time can be changed.
  "Setting the strobe time" (Page 6-4)
- The reset input resets measurement value for each OUT number. The profile averaging is not reset.
- The evaluation/binary output is continuously output in response to the measurement value refresh requests (Profile update) when "Data out timing" under the common settings is set to "Profile" (*1). When TIMING1 or TIMING2 is set, the timing input is output in synchronization.
  "Data Output Timing" (Page 5-121)
- The strobe output for one sample is output immediately after the program No. switching input. Afterwards, averaging processes are performed.
  "Averaging Response Time" (Page 10-24)

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Other than normal

When measurement mode is set to anything other than normal



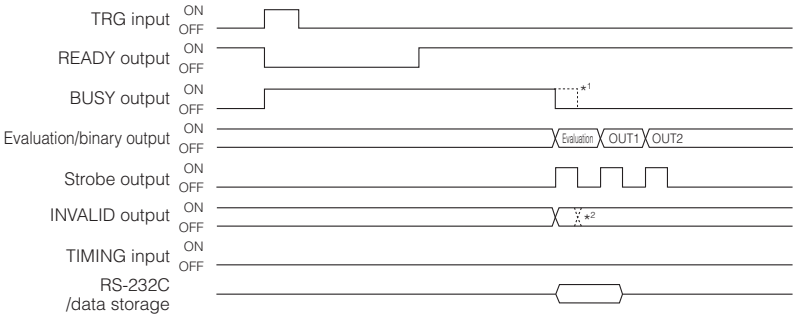
- Mode 1 is when the measurement mode is set to Peak hold 1 / bottom hold 1 /peak to peak hold 1 /average hold 1
  The sampling period is from the rising edge of the timing input (OFF to ON) until the next rising edge.
- Mode 2 is when the measurement mode is set to Peak hold 2 / bottom hold 2 /peak to peak hold 2 /average hold 2
  The sampling period is from the falling edge of the timing input (ON to OFF) until the next rising edge.
- The input response time (T2), RESET time (T4), and program No. change time (T3) vary depending on the settings.
- The minimum input time (T1) is 1 ms.
- Response times (examples) are as follows.T5 is trigger internal displayed on the measurement screen.
  T2 = 1 ms x OUT + 8 ms (TIMING)
  T2 = T1 + T5 x 2 (RESET)
  T2 = T1 + T5 x 2 (when ZERO and save are OFF)
  T2 = T1 + T5 x 2 + 300 ms (when ZERO and save are ON)
  T3 = 350 ms (When save is OFF)
  T3 = 500 ms (When save is ON)
  T4 = (Average count - 1) x T5 (RESET, ZERO)
  T4 = (Averaging count + Average count - 2) x T5 + Measurement time (P1 to P4)
- The response time for auto-zero input is longer when save is ON.
- Auto-zero is canceled when the auto-zero input is turned on for two seconds or more.
- The above evaluation or binary outputs are those when the output selection item is item 1.
- The strobe output ON time can be changed.
  "Setting the strobe time" (Page 6-4)
- The internal measurement value of the RESET input is determined after the RESET time (T4) has elapsed.
- The reset input resets measurement value for each OUT number. The profile averaging is not reset.
- The evaluation/binary output is continuously output in response to the measurement value refresh requests from TIMING input when "Data out timing" under the common settings is set to TIMING1 or TIMING2 (*1). When profile update is set, data is output continuously according to the profile update.
  "Data Output Timing" (Page 5-121)
- The strobe output for one sample is output immediately after the program No. switching input.

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Remote Trigger

Single Trigger

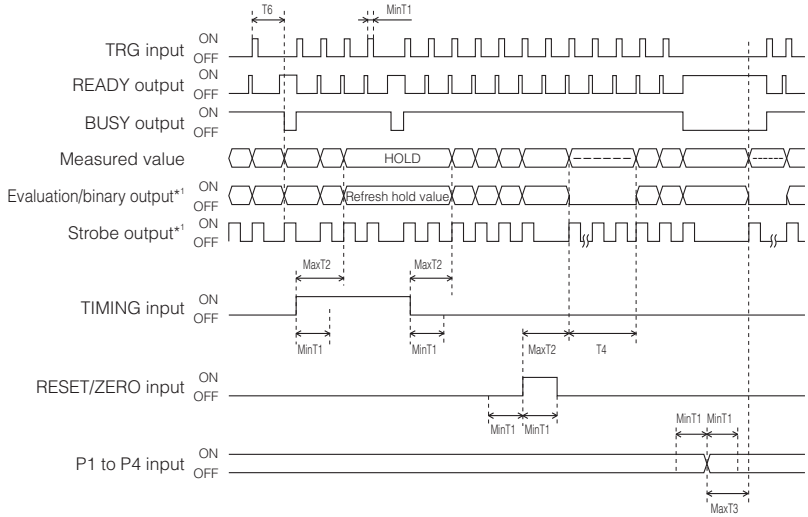
Basic operations



- The above are when the measurement mode is normal.
- The above evaluation or binary outputs are those when the output selection item is 3 items (evaluation, OUT1, OUT 2).
- The evaluation or binary output is continuously output in response to the measurement value refresh requests from TRG input when "Data out timing" under the common settings is set to "Profile".
  "Data Output Timing" (Page 5-121)
- When sampling is initiated via the trigger input, READY output is OFF and BUSY output is ON.
- READY output is ON when the device can receive the next trigger input. Trigger inputs received when the READY output is OFF will be ignored.
- BUSY output turns off when measurement is finished. It turns off with the rising or falling edge of the strobe output (*1).
- The strobe output ON time can be changed.
  "Setting the strobe time" (Page 6-4)
- INVALID output responds to the position correction results. It is output with the rising or falling edge of the strobe output (*2).
- By selecting the proper combination of timing input and measurement mode, you can retrieve the maximum and minimum values from a series of measurements activated by the external trigger.
- The RS-232C output is synchronized with the trigger input when "Auto-send" in the Environment settings is set to ON and "Data out timing" in the common settings is set to "Profile".
  "Outputting Measurement Values in External Synchronization" (Page 9-32)
- The data storage is synchronized to the trigger input and saved when "Data out timing" in the common settings is set to "Profile".
- The trigger input can be controlled via RS-232C.
  "Overview of Measurement Control Commands" (Page 9-10)

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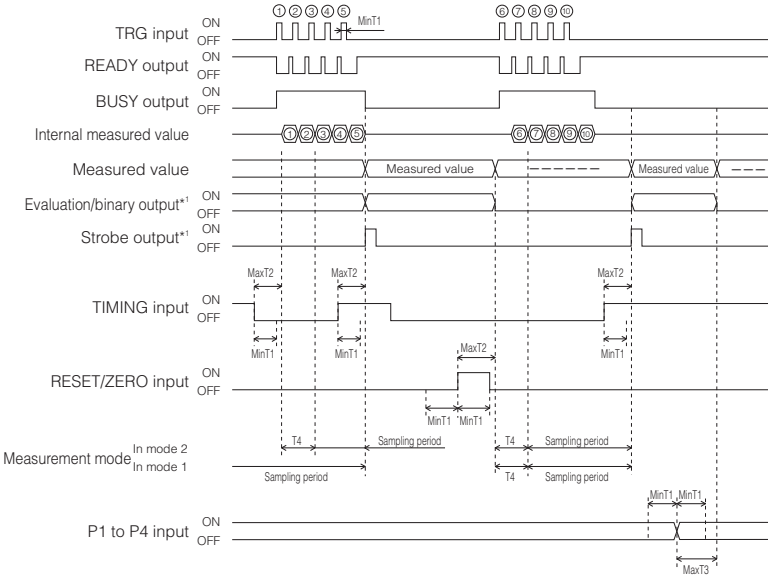
Detailed operation (when in normal measurement mode)



- The input response time (T2), RESET time (T4), program No. change time (T3) and measurement time (T6) vary depending on the settings.
- The minimum input time (T1) is 1 ms.
- Response times (examples) are as follows.T5 is trigger internal displayed on the measurement screen.T6 is the measurement interval displayed on the measurement screen.
  - T2 = 1 ms x OUT + 8 ms (TIMING)
  - T2 = T1 + T5 x 2 (RESET)
  - T2 = T1 + T5 x 2 (when ZERO and save are OFF)
  - T2 = T1 + T5 x 2 + 300 ms (when ZERO and save are ON)
  - T3 = 350 ms (When save is OFF)
  - T3 = 500 ms (When save is ON)
  - T4 = (Average count - 1) x T5 (RESET, ZERO)
  - T4 = (Averaging count + Average count - 2) x T5 + Measurement time (P1 to P4)
- The response time for auto-zero input is longer when save is ON.
- Auto-zero is canceled when the auto-zero input is turned on for two seconds or more.
- The above evaluation or binary outputs are those when the output is set to one item.
- The evaluation or binary output is continuously output in response to the measurement value refresh requests from TRG input when "Data out timing" under the common settings is set to "Profile". (*1)
  "Data Output Timing" (Page 5-121)
- The strobe output ON time can be changed.
  "Setting the strobe time" (Page 6-4)
- The measurement value when the TIMING input turns ON is held.
- If the RESET input is set to ON when the TIMING input is ON, the evaluation standby state (the display shows "------") is displayed until the TIMING input becomes OFF.
- The trigger input, timing input, reset input and auto-zero can be controlled via RS-232C.
  "Overview of Measurement Control Commands" (Page 9-10)
- The strobe output for one sample is output immediately after the program No. switching input.

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Detailed operation (when not in normal measurement mode)



- Mode 1 is when the measurement mode is set to Peak hold 1 / bottom hold 1 /peak to peak hold 1 /average hold 1. The sampling period is from the rising edge of the timing input (OFF to ON) until the next rising edge. The maximum, minimum, range and average of the data read by trigger input during the sampling period can be measured.
- Mode 2 is when the measurement mode is set to Peak hold 2 / bottom hold 2 /peak to peak hold 2 /average hold 2 The sampling period is from the falling edge of the timing input (ON to OFF) until the next rising edge. The maximum, minimum, range and average of the data read by trigger input during the sampling period can be measured.
- The input response time (T2), RESET time (T4), and program No. change time (T3) vary depending on the settings.
- The minimum input time (T1) is 1 ms.
- Response times (examples) are as follows.T5 is trigger interval displayed on the measurement screen.
  T2 = 1 ms x OUT + 8 ms (TIMING)
  T2 = T1 + T5 x 2 (RESET)
  T2 = T1 + T5 x 2 (when ZERO and save are OFF)
  T2 = T1 + T5 x 2 + 300 ms (when ZERO and save are ON)
  T3 = 350 ms (When save is OFF)
  T3 = 500 ms (When save is ON)
  T4 = (Average count - 1) x T5 (RESET, ZERO)
  T4 = (Averaging count + Average count - 2) x T5 + Measurement time (P1 to P4)
- The response time for auto-zero input is longer when save is ON.
- Auto-zero is canceled when the auto-zero input is turned on for two seconds or more.
- The above evaluation or binary outputs are those when the output is set to one item.
- The evaluation or binary output is continuously output in response to the measurement value refresh requests from TIMING input when "Data out timing" under the common settings is set to TIMING1 or TIMING2. (*1)
  "Data Output Timing" (Page 5-121)
- The strobe output ON time can be changed.
  "Setting the strobe time" (Page 6-4)
- The internal measurement value of the RESET input is determined after the RESET time (T4) has elapsed.
- The reset input resets measurement value for each OUT number. The profile averaging is not reset.
- The strobe output for one sample is output immediately after the program No. switching input.

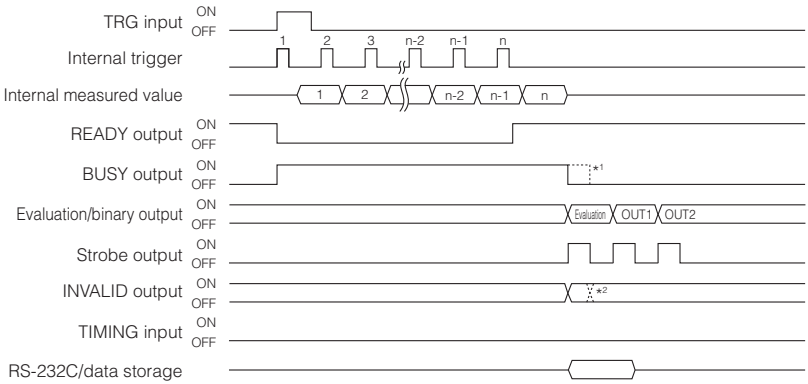
Reference

There is no need to set the measurement mode to sample hold. Use trigger input with normal measurement mode.

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Multi (Internal) Trigger

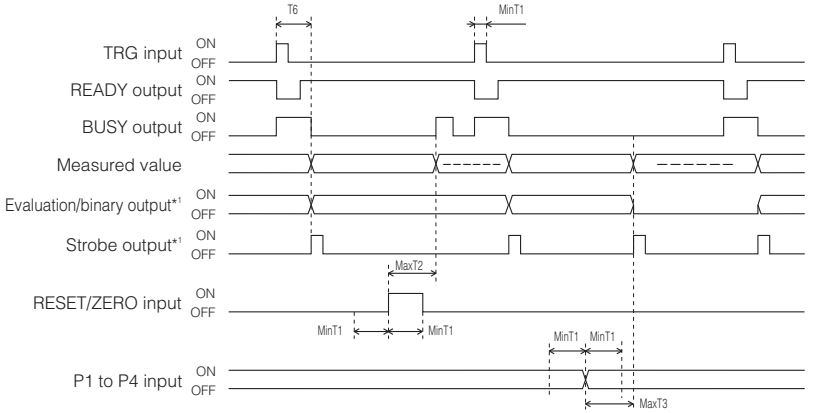
Basic operations



- The ON state of each output indicates that the NPN or PNP open-collector output is turned on.
- The ON state of each output indicates the short circuit to the COM terminal in the case of LJ-G5001 (NPN type) and the state where the voltage is applied over the COM terminal in the case of the LJ-G5001P.
- When averaging is ON
  The measurement is done in the measurement mode set for a profile that was averaged with a multiple trigger. The measurement mode setting is ignored.
- When averaging is OFF
  The settings of the measurement mode specified by each profile measured by the multiple trigger are used for measurements. Peak hold, bottom hold, peak-to-peak hold and average hold are all available in measurement mode. There is no difference between the functions of mode 1 and mode 2.
  The maximum, minimum, range and average can be measured.
- The above evaluation or binary outputs are those when the output selection item is 3 items (evaluation, OUT1, OUT 2).
- The evaluation or binary output is continuously output in response to the measurement value refresh requests from TRG input when "Data out timing" under the common settings is set to "Profile".
  "Data Output Timing" (Page 5-121)
- When the set number of samples is initiated via the trigger input, READY output is OFF and BUSY output is ON.
- READY output is ON when the device can receive the next trigger input. Trigger inputs received when the READY output is OFF will be ignored.
- BUSY output turns off when the final output is sent to OUT2 from evaluation / binary output.It turns off with the rising or falling edge of the strobe output (*1).
- The strobe output ON time can be changed.
  "Setting the strobe time" (Page 6-4)
- INVALID output responds to the position correction results. It is output with the rising or falling edge of the strobe output (*2).
- The RS-232C output is synchronized with the trigger input when "Auto-send" in the Environment settings is set to ON and "Data out timing" in the common settings is set to "Profile".
  "Outputting Measurement Values in External Synchronization" (Page 9-32)
- The data storage is synchronized to the trigger input and saved when "Data out timing" in the common settings is set to "Profile".
- The trigger input can be controlled via RS-232C.
  "Overview of Measurement Control Commands" (Page 9-10)

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Detailed operation



- The input response time (T2), RESET time (T4), program No. change time (T3) and measurement time (T6) vary depending on the settings.
- The minimum input time (T1) is 1 ms or less.
- Response times (examples) are as follows.T5 is trigger interval displayed on the measurement screen.T6 is the measurement interval displayed on the measurement screen.
  T2 = T1 + T5 x 2 (RESET)
  T2 = T1 + T5 x 2 (when ZERO and save are OFF)
  T2 = T1 + T5 x 2 + 300 ms (when ZERO and save are ON)
  T3 = 350 ms (When save is OFF)
  T3 = 500 ms (When save is ON)
- The response time for auto-zero input is longer when save is ON.
- Auto-zero is canceled when the auto-zero input is turned on for two seconds or more.
- The above evaluation or binary outputs are those when the output is set to one item.
- The evaluation or binary output is continuously output in response to the measurement value refresh requests from trigger input when "Data out timing" under the common settings is set to "Profile"(*1).
  "Data Output Timing" (Page 5-121)
- The strobe output ON time can be changed.
  "Setting the strobe time" (Page 6-4)
- The trigger input, timing input, reset input and auto-zero can be controlled via RS-232C.
  "Overview of Measurement Control Commands" (Page 9-10)
- When averaging is ON and RESET input or auto-zero input is received during sampling, the multiple trigger sampling is cancelled.
- When averaging is OFF and RESET input or auto-zero input is received during the multiple trigger sampling, the measurement mode is processed with the profile sampled after receiving the input.

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Input and Output Details

Evaluation/Binary Output

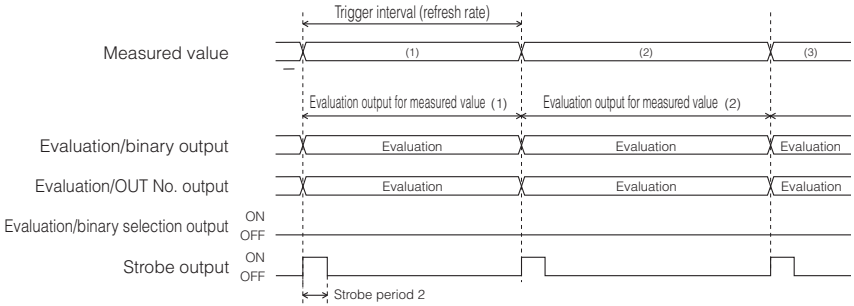
The output items (evaluation output, binary outputs OUT1 to OUT8) for evaluation/binary output can be selected under "Binary output" in the common settings. If you select the multiple output items, the data is output in time sharing mode. The period of the time sharing is can be set in the "Strobe time" setting in the configuration.

"Binary Output" (Page 5-114)
"Setting the strobe time" (Page 6-4)
"Data Output Timing" (Page 5-121)
"Strobe Output" (Page 10-16)

When the data output timing is set to profile update

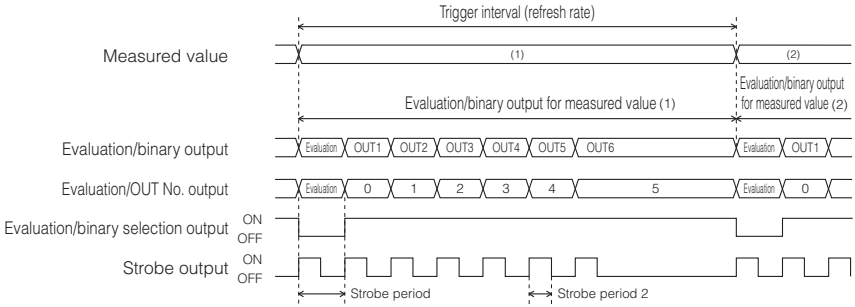
The trigger period (refresh period) can be changed in the settings. The trigger period, output items and strobe period settings may filter the evaluation/binary output.
If the data output timing is "Profile", output is synchronized with trigger A. Trigger B is ignored.

When there is 1 output item



- If the only output item is evaluation output or a single OUT, the trigger period (update period) will be synchronized with the Evaluation/binary output.

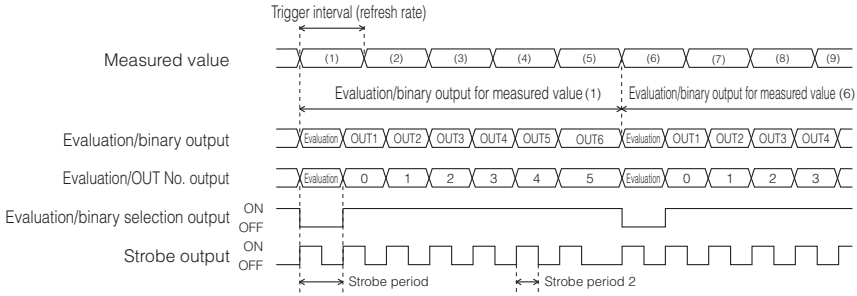
When evaluation/binary output time is shorter than measurement value update time (trigger interval)



- All measurement results can be output when the evaluation/binary output time is shorter than the trigger interval (update period).
- The diagram above shows an example with output from all 7 outputs, including evaluation and OUT1 to OUT6. The output at (1) finishes before the measurement value update due to the trigger interval at (2).

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When evaluation/binary output time is longer than measurement value update time (trigger interval)

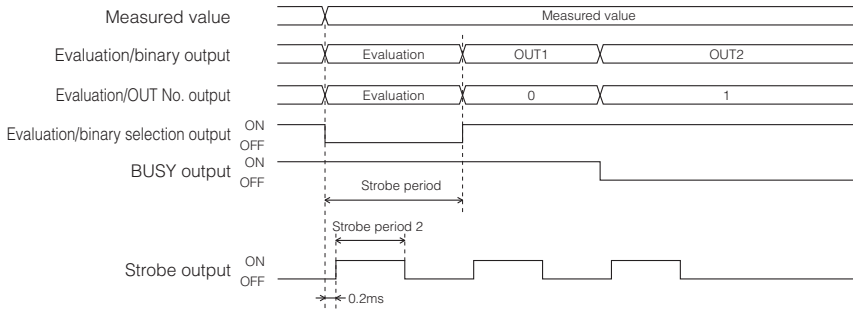


- Measurement results are thinned out before output when the Evaluation/binary output time is shorter than the trigger interval (update period).
- The diagram above shows an example with output from all 7 outputs, including Evaluation and OUT1 to OUT6. Because the Evaluation/binary output takes more time than the update of the measurement value due to trigger interval, the value output after measurement value 1 is measurement value (6). Measurement values (2) through (5) are filtered. Shortening the strobe time or reducing the number of output items will reduce the number of items filtered.

When the data output timing is set to TIMING1/TIMING2

When the measurement value is fixed by the timing input, the Evaluation/binary output will be output at the same time. All measurement results can be output when the Evaluation/binary output time is shorter than the measurement value update from the timing input.
Measurement results are filtered before output when the Evaluation/binary output time is shorter than the measurement value update from the timing input.

Strobe Output



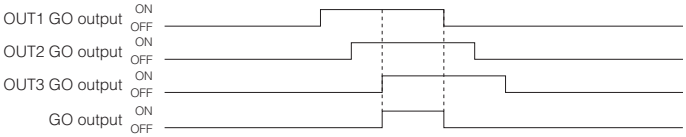
- Evaluation/binary output is output in a time duplex with a period set by the strobe length when multiple setting items are selected.

  "Setting the strobe time" (Page 6-4)
- Strobe output remains on an extra 0.2 ms while fixing Evaluation/binary output.
- The strobe output ON time is half of the strobe length.
- Whether the output item is evaluation output or binary output can be confirmed by the evaluation/binary selection output.
- The contents of binary output can be confirmed by the OUT outputs. 0 through 7 represent OUT1 through OUT8.

  "Description of OUT No. output" (Page 8-8)

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GO Output (Total Evaluation Output)



- GO output (total evaluation output) is output when all the results are GO, other than the evaluation standby state for the OUT No. for which measurement is set (the measurement mode is other than "No setting").
- GO output (total evaluation output) is refreshed according to the settings for "Data out timing" under the common settings. It is synchronized with the first strobe output for the evaluation/binary output, regardless of the settings for "Binary output" under the common settings.

  "Binary Output" (Page 5-114)
  "Data Output Timing" (Page 5-121)
  "Evaluation/Binary Output" (Page 10-15)
- The example in the diagram above shows measurement while OUT1 through OUT3 are set.

  "Measurement Mode (Setting measurement conditions)" (Page 5-67)

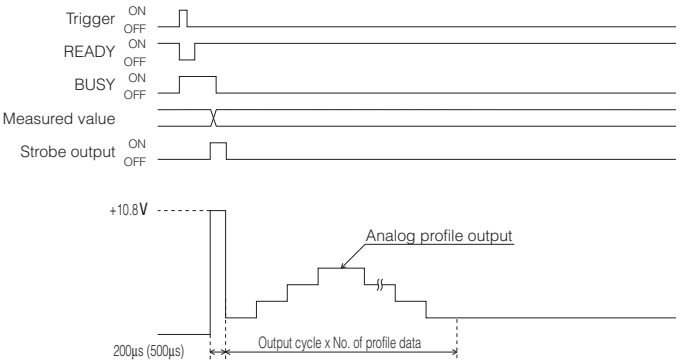
► Note

Import GO output in synchronization with the falling edge of a strobe output.

"Strobe Output" (Page 10-16)

Analog Profile Output

Profile waveforms can be output from the analog voltage output pin (CH1/CH2).



- The profile type that is output can selected from head A profile, head B profile and calculation profile.
- The minimum unit of the profile data is 1 µm.
- The voltage output can be scaled within the range of ±10.5 V.
- The X-axis profile data output period can be set to 20 µs, 50 µs, 100 µs, or 500 µs.
- The number of the profile data points varies depending on the measurement range and calculation setting.
- When the output period is 20 µs and is shorter than the analogue profile output time, the trigger interval will lengthen until the analogue profile output has finished. There is no filtering.
- When the output period is other than 20 µs and the trigger interval is shorter than the analog profile output time, the analog profile output is filtered.
- The header of the profile output includes +10.8 V output during a 200 µs period (500 µs when the output period is set to 500 µs). This can be used as the trigger voltage for the measurement device.
- Output will continue to the end if the program No. is changed while outputting the measurement profile.

Refer to "Analog Output" (Page 5-114) for more information on the profile type, scaling and output period setting.
"When outputting an analog profile" (Page 10-22)
"Profile data points" (Page 10-18)

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Profile data points

The number of profile data points, change with the output profile type and measurement range settings.

Head A profile / head B profile

Measurement range (X axis)	Profile data points
FULL	800
1	760
2	720
3	680
4	640
5	600
6	560
7	520
8	480
9	440
10	400

Calculation profile (A + B, A - B, Wide)

When set to A + B or A - B

- The number of points of data is set to the head with the narrowest measuring range.

When set to wide

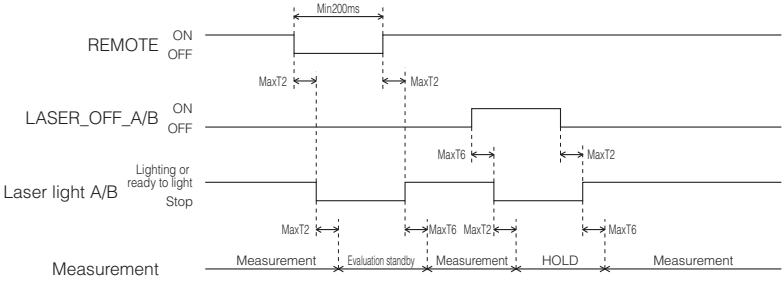
- The number of points of data is set to the head with widest measuring range + 800 more.
- The data at the negative or positive end of the X-axis narrowed in the measurement range setting are not output from the post-calculation profiles.
- The central part connected to a profile will output alarm data even if the measurement range is set to be narrow.

Output examples

Measurement range (X axis)		Profile data points	
Head A	Head B	A+B/A-B	Wide
FULL	FULL	800	1600 (800+800)
1	2	720	1560 (760+800)
3	2	680	1520 (720+800)
5	8	480	1400 (600+800)
10	10	400	1200 (400+800)

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Laser Control Input



- The input response time (T2) is 1 ms or less.
- The input response time (T6) is less than the measurement time displayed on the measurement screen.
- REMOTE input takes priority over LASER OFF input.
- REMOTE input will cancel any measurements taken when the REMOTE input is received and turn the laser off.
- LASER_OFF input will turn the laser off after the processing that was occurring when the LASER_OFF input was received.
- Trigger input is ignored while the laser is suspended.

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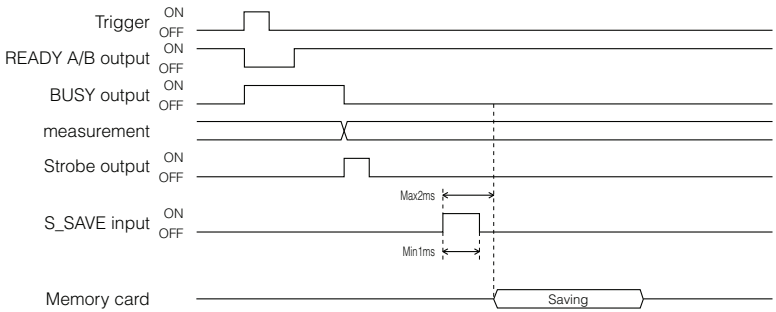
Memory Card Control Input (S_SAVE Input)

Storage (data or profile) saves the data in internal memory to a memory card and then clears the controllers internal memory.
A message window appears and measurement is suspended while saving. The previous measured value is held.
Example processing times:

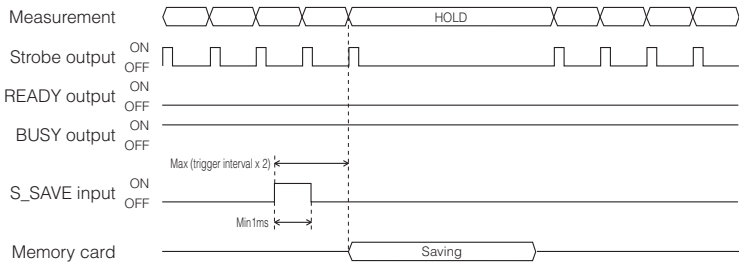
Data storage:	1.2 ms x data count + 800 ms
Profile storage:	13 ms x profile count + 800 ms (when not Head A, Head B or Calculation Wide)
	26 ms x profile count + 800 ms (for both Heads, Calculation Wide)

"Storage" (Page 3-19)
"Storage" (Page 5-118)
"Saving Storage Data to the Memory Card from the Input Terminal" (Page 7-9)
"Saving the memory card" in "Status Table" (Page 11-8)

For external trigger



For continuous trigger



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Measurement Response Time

Trigger Interval and Measurement Time

The measurement response times will vary with measurement condition settings on the device.
The measurement screen displays the Trg interval and the Measure time for the measurement conditions of the most recent measurement.

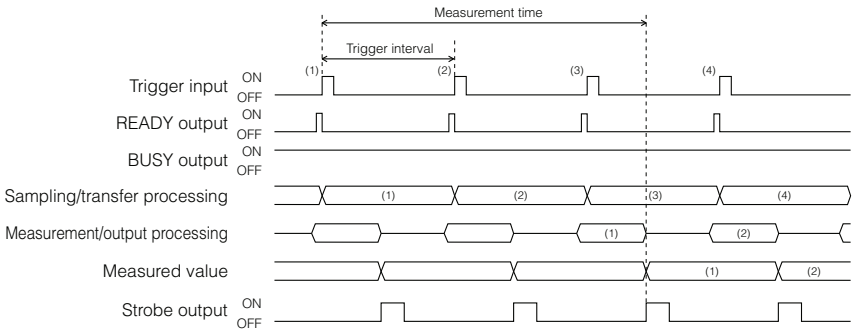
Trg interval: The shortest period for the continuous trigger or the external trigger is displayed on the screen as the trigger interval.

Measure time: The time required from the trigger input from the continuous trigger or the external trigger until the measurement result is output is displayed on the screen as the measurement time.

"Measurement Screen" (Page 3-2)

Because the device makes use of multiple buffers, a trigger input can be sent as soon as the READY output terminal is ON, even if the previous sampling has not finished and the results have not been output.
When the trigger mode is set to "Cont trigger", an internal trigger will automatically fire after every trigger interval.
When the trigger mode is "EXT trigger", synchronizing the READY terminal with the trigger input allows input at the trigger interval displayed on the screen.
When there are two heads attached, trigger synchronization is OFF and calculation is OFF, the trigger interval for head A is displayed.

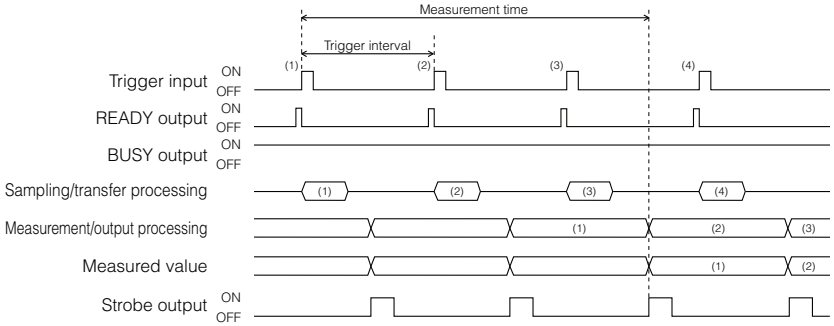
When the sampling/forwarding time is long



- Measurement time is the time from trigger input until sampling/forwarding processing and measurement/output processing are completed.
- When the sampling/forwarding processing time is longer than the measurement/output processing time, the sampling/forwarding time will be the same as the trigger interval.

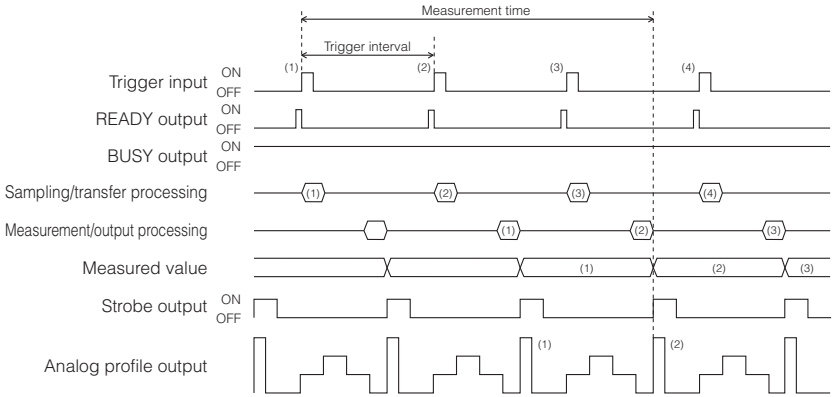
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When measurement/output processing time is long



- Measurement time is the time from trigger input until sampling/forwarding processing and measurement/output processing are completed.
- When the measurement/output processing time is longer than the sampling/forwarding processing time, the measurement/output processing time will be the same as the trigger interval.

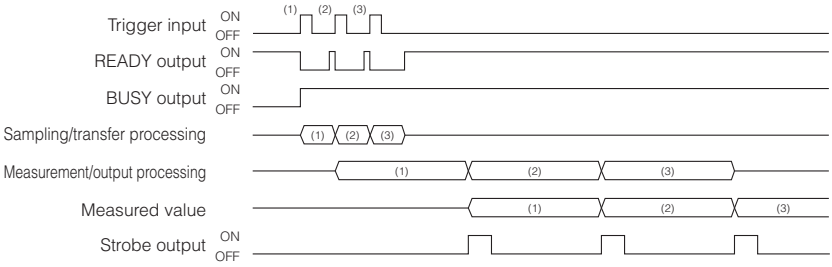
When outputting an analog profile



- Measurement time is the time from trigger input until sampling/forwarding processing and measurement/output processing or analog profile output are completed.
- When the output period is 20 µs and is shorter than the analogue profile output time, the trigger interval will lengthen until the analogue profile output has finished. There is no filtering.
- When the output period is set to longer than 20 µs and the trigger interval is shorter than the analog profile output time, the analog profile output is filtered.

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When the internal buffer is empty



- A trigger input is possible at the sampling/forwarding processing time when the internal buffer on the device is empty.
- A trigger input at an interval shorter than that displayed on the measurement screen is possible.
- The next trigger can be input when the READY output terminal turns ON.
- After measurement/output processing has completed, the measurement results will be output in order.

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Averaging Response Time

The averaging settings may lengthen the measurement response time.

Continuous trigger: (Averaging count + average count - 2) x trigger interval

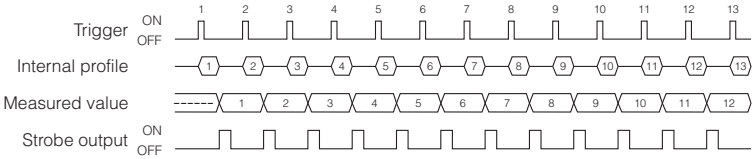
External trigger: (Averaging count + average count - 2) x trigger input count

The delay in measurement response times caused by averaging settings is not reflected in "Measure time". The reset input resets the OUT measurement value. The profile averaging is not reset.

"Averaging" (Page 5-43)

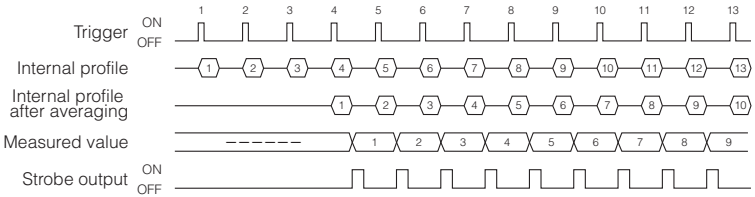
"Average" (Page 5-101)

When profile averaging is set to 1 and average is set to 1



- The measurement results from the trigger input are output as is.

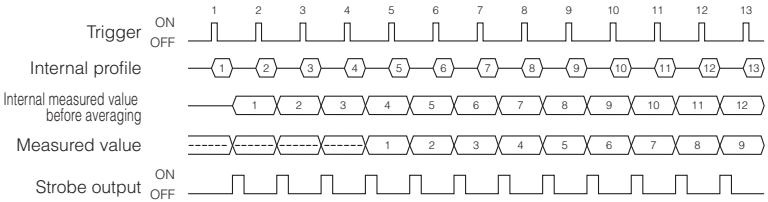
When profile averaging is set to 4 and average is set to 1



- A profile of one averaged waveform is output as measurement results for each trigger input, starting with the fourth.

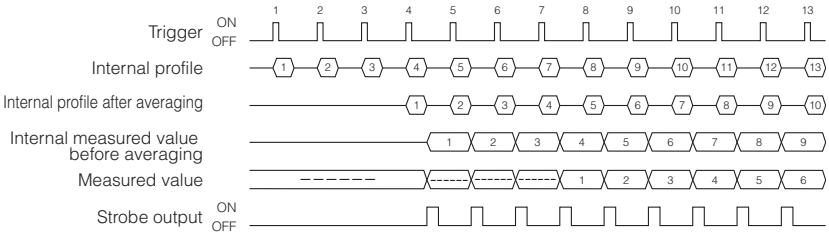
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When profile averaging is set to 1 and average is set to 4



- A profile is measured for each trigger input, with the results being averaged 4 times and then output.

When profile averaging is set to 4 and average is set to 4



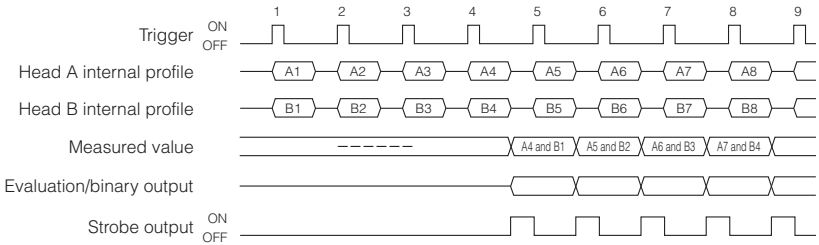
- A profile is measured for each trigger input starting with the fourth, with the results being averaged 4 times and then output.

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Multiple Heads Response Time

The head delay setting controls the difference in position between the head A profile and the head B profile used in a measurement.

"Head Delay Count" (Page 5-41)



- The above is the timing chart for a head delay of 3.
- The distance between the 4th profile from head A, called "A4", and the first profile from head B, called "B1", is calculated.
- When the delayed profiles number the same as the head delay setting (the display shows "------"), the device is in the evaluation standby state.
- The delay in measurement response times caused by head delay settings is not reflected in "Measure time".
- RESET input resets the OUT measurement value. RESET input does not reset head delay measurements.

Power ON Reset Time

This is the period of time it takes for the unit to be able to activate the measurement trigger after the power turns on.

Refer to "When the power is turned on" in "Status Table" (Page 11-8) for more information on the screen display and the conditions of input and output during the power ON reset.

No. of the connected heads	Cable extension mode	Power ON reset time
1 head	OFF	Approx. 15 s
	ON	Approx. 17 s
2 heads	OFF	Approx. 22 s
	ON	Approx. 26 s

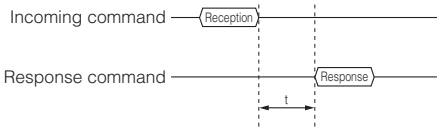
"Setting cable extension mode" (Page 6-4)

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RS-232C Interface

Sending & Receiving Commands Response Time

The delay for response commands to each command received is as follows.



The time, t, is as follows.

Command		t [ms]
Switching modes	Q0	800
	R0	800
	R1	300
Measurement control	DC	30
	P	20
	V, W, PW (Save ON)	500
	PW (Save OFF)	300
	PC	5000
	SS	By file size
	Storage control	30
	V, W (Save OFF) Other	3
Changing settings	SW,FB	120
	SW, EN	300
	S (While tuning)	1500
	Other	5
Program check		8

* The response speed slows during communication with the setup support software "LJ-Navigator".

Refer to the following pages for more information on command details.

"Mode Change Commands" (Page 9-9)
"Overview of Measurement Control Commands" (Page 9-10)
"Overview of Setting Content Change Commands" (Page 9-16)
"Check Parameter Commands" (Page 9-30)

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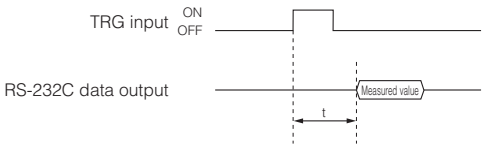
Automatic Output Response Time

The auto-transmission function outputs a measurement value command synchronized with the fixing of the measurement value by the external trigger (trigger input / timing input).
The auto-transmission OUT number is set via "Auto-send".
Auto-transmission timing is set via "Data out timing".

"Automatic Transmission" (Page 5-120)
"Data Output Timing" (Page 5-121)
"Outputting Measurement Values in External Synchronization" (Page 9-32)

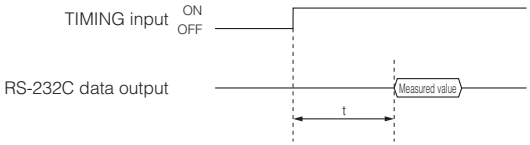
The timing chart for the "Data out timing" setting is as follows.

When updating a profile



- t = Measurement time (T6) + 1 ms x OUT count + 11 ms
  T6 is the measurement interval displayed on the measurement screen.
- The measurement results are output at the timing at which the profile is updated by the trigger.
- When the trigger mode is set to continuous trigger, the profile is updated continuously and output continuously at the timing at which the measurement results are fixed. Measurement results updated during output are filtered.
- When the trigger mode is set to external trigger, the profile is updated at the trigger input and the measurement results are fixed with the timing and output. Measurement results that are updated before output has finished are not output.

When using TIMING1/TIMING2



- t = 1 ms x OUT count + 11 ms
- The measurement value fixed by the timing input is output.
- 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, bottom, peak-to-peak, average or sample hold, turning the timing input on outputs the fixed measurement value.

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Chapter

11

Specifications

Specifications 11-2
- Controller 11-2
- Measurement Head 11-3
- Head-to-Controller Cable 11-3

Dimensions 11-4
- Controller 11-4
- Remote control console 11-4
- Sensor head 11-5
- Head-to-controller cable 11-6
- LCD monitor 11-7

Status Table 11-8

Memory Structure 11-10

Characteristics 11-11
- Spot Diameter 11-11
- Mutual Interference 11-12

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Specifications

Controller

Model		LJ-G5001	LJ-G5001P
Head compatibility		Available	
Connectable number of heads		Two heads max.	
Display	Minimum display unit	0.1 µm*1, 0.001 mm^2, 0.01°	
	Max. display range	±99999.9mm, ±999999mm^2, ±99999.9°	
Input terminal block	Laser remote interlock input	Non-voltage input	
	Trigger input	Head A non-voltage input	Head A voltage input
	Timing 1 input	Non-voltage input	Voltage input
	Auto-zero 1 input		
	Reset input		
Output terminal block	Analog voltage output	±10 V x 2 outputs, output impedance 100 Ω	
	Total evaluation output	NPN open-collector output	PNP open-collector output
	Error output	NPN open-collector output (N.C.)	PNP open-collector output (N.C.)
	Processing output	NPN open-collector output	PNP open-collector output
	Enable output for trigger input	NPN open-collector output for head A	PNP open-collector output for head A
	Correction error output		
Expansion connector	Timing 2 input	Non-voltage input	Voltage input
	Auto-zero 2 input		
	Trigger input	Head B non-voltage input	Head B voltage input
	Program switching input	Non-voltage input x 4 inputs	Voltage input x 4 inputs
	Memory card saving input	Non-voltage input	Voltage input
	Laser OFF input	Non-voltage input for head A/head B	Voltage input for head A/head B
	Evaluation/binary output*2	3-step evaluation output: OUT1 to OUT8 Total evaluation output Binary output: OUT1 to OUT8 Measurement data output (21 bits) NPN open-collector output	3-step evaluation output: OUT1 to OUT8 Total evaluation output Binary output: OUT1 to OUT8 Measurement data output (21 bits) PNP open-collector output
	Strobe output	NPN open-collector output	PNP open-collector output
	Enable output for trigger input	NPN open-collector output for head B	PNP open-collector output for head B
	Correction error output		
Analog RGB monitor output		SVGA (800 x 600 pixels)	
RS-232C interface		Measurement data output and control I/O (Selectable up to baud rate 115200 bits/s)	
USB interface		USB 2.0 HI-SPEED compatible (USB 1.1 Full-SPEED compatible)	
Ethernet interface		100BASE-TX/10BASE-T	
Memory card		Compatible with GR-M256 (256 MB), NR-M1G (1 GB) (FAT32)	
Main functions		Calculation between heads, profile adjustment, filters, smoothing, averaging, position correction, OUT name change, measurement mode selection (height, position, step, width, center position, cross-section, intersection, angle, profile comparison, profile tracking), scaling, average measurement, measurement, measurement alarm setting, tolerance setting, auto-zero, storage (data, profile), save to memory card, program memory, change trigger mode, interference protection, variable measurement range, calibration setting, laser intensity adjustment, sampling period setting, mask, profile alarm setting, tile correction, height correction, language switching, setup support software connection, trigger interval/measurement time display, etc.	
Rating	Power voltage	24 VDC ±10%, ripple (P-P): 10% max.	
	Max. current consumption	When connecting one measurement head: 800 mA max. When connecting two measurement heads: 1 A max.	
Environmental resistance	Ambient temperature	0 to +50°C	
	Relative humidity	35 to 85% RH (No condensation)	
Weight		Approx. 1050 g	

*1 When the LJ-G015 or LJ-G015K is connected. When another measurement head is connected, the minimum display unit is 1 µm.
*2 Evaluation results and binary measurement data are output with time-sharing output.
- The rating of the NPN open collector output is 50 mA (30 V or lower) max. and residual voltage is 1 V max.
- The rating of the PNP open collector output is 50 mA (30 V or lower) max. and residual voltage is 1 V max.
- The rating of the non-voltage input is ON voltage 1 V or lower and OFF current 0.6 mA or lower. (Trigger input terminal is ON voltage 1 V or lower and OFF current 1.0 mA or lower.)
- The rating of the voltage input is maximum rating 26.4 V, ON voltage 10.8 V or lower, and OFF current 0.6 mA or lower. (Trigger input terminal is maximum rating 26.4 V, ON voltage 10.8 V or lower and OFF current 1.0 mA or lower.)

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Measurement Head

Model			LJ-G015	LJ-G015K	LJ-G030	LJ-G080	LJ-G200
Reference distance			15 mm		30 mm	80 mm	200 mm
Measurement range	Z-axis (height)		±2.6 mm	±2.3 mm	±10 mm	±23 mm	±48 mm
	X-axis (width)	Near side	6.5 mm		20 mm	25 mm	51 mm
		Reference distance	7.0 mm		22 mm	32 mm	62 mm
		Far side	7.5 mm		25 mm	39 mm	73 mm
Light source			Red semiconductor laser				
		Wavelength	655 nm (visible light)				
		Laser class	Class 2 Laser Product (IEC60825-1), Class II Laser Product (FDA (CDRH) Part 1040.10)				
		Output	0.95 mW				
Spot shape (reference distance)			Approx. 32µm x 12 mm		Approx. 40 µm x 25 mm	Approx. 80 µm x 46 mm	Approx. 180 µm x 70 mm
Repeatability*1		Z-axis (height)*2	0.2 µm		1 µm	1 µm	2 µm
		X-axis (width)*3	2.5 µm		5 µm	10 µm	20 µm
Linearity		Z-axis (height)*2	±0.1% of F.S.				
Sampling cycle (trigger interval)*4			3.8 ms				
Temperature characteristics			0.02% of F.S./ °C				
Environmental resistance		Enclosure rating	IP67 (IEC60529)				
		Ambient light*5	Incandescent lamp/Fluorescent lamp: 5000 lx max.				
		Ambient temperature	0 to +50°C				
		Relative humidity	35 to 85% RH (No condensation)				
		Vibration	10 to 55 Hz, 1.5 mm double amplitude in the X, Y, and Z directions, 2 hours respectively				
Material			Aluminum				
Weight			Approx. 260 g		Approx. 290 g	Approx. 350 g	Approx. 480 g

*1 The value when averaging 64 measurements at the reference distance.
*2 The measurement target is the KEYENCE standard target. The value when the average full width is measured in height mode.
*3 The measurement target is a ϕ10 pin gauge. The value when measuring edge in position mode with smoothing set to 16 times.
*4 When using the initial settings and the minimum measurement range with smoothing set to 1 time.
*5 The ambient light through the receiver on the sensor head when measuring white paper.

Head-to-Controller Cable

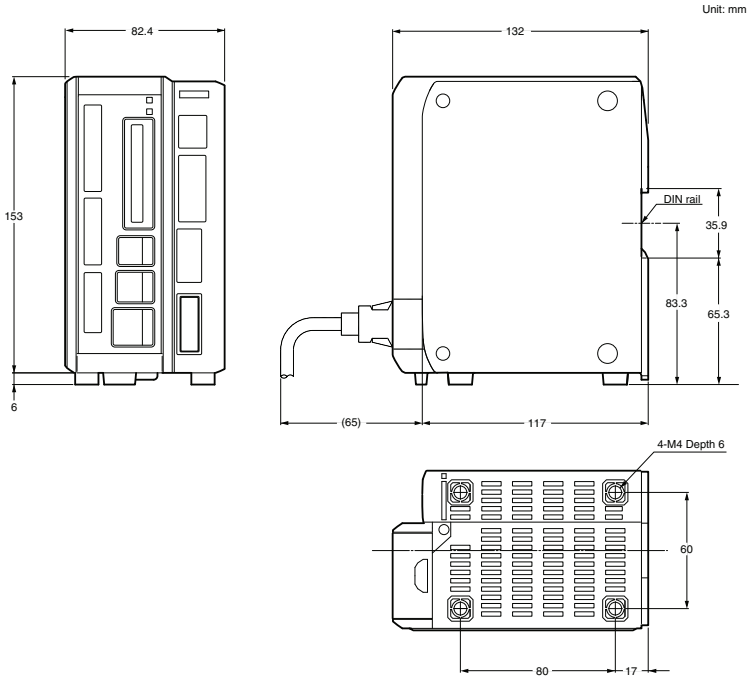
Model	LJ-GC2	LJ-GC5	LJ-GC10	LJ-GC20	LJ-GC30
Cable length	2 m	5 m	10 m	20 m	30 m
Weight	Approx. 200 g	Approx. 400 g	Approx. 750 g	Approx. 1400 g	Approx. 2000 g

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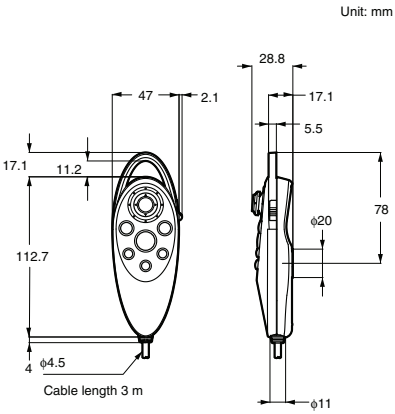
Dimensions

■ Controller

LJ-G5001/LJ-G5001P



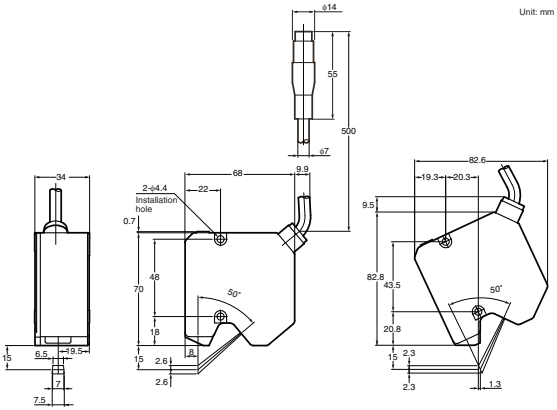
■ Remote control console



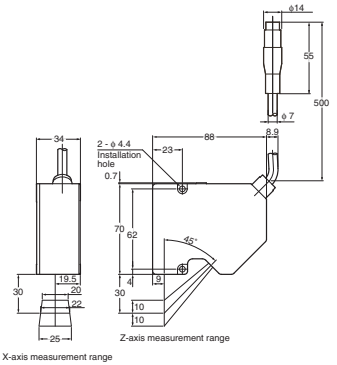
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■ Sensor head

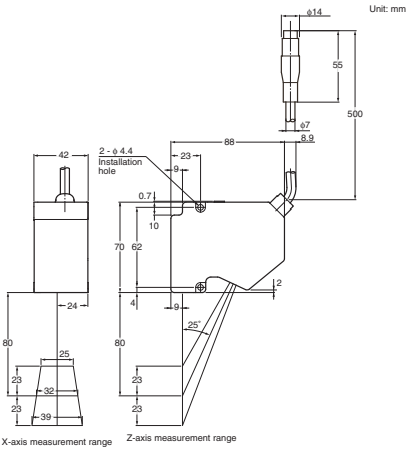
LJ-G015LJ-015K



LJ-G030

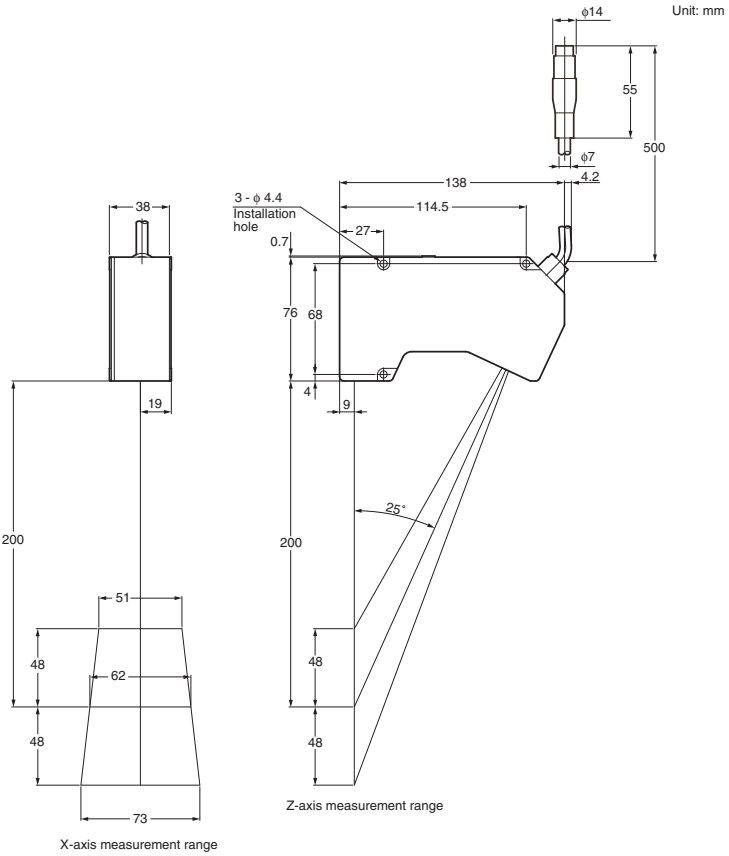


LJ-G080



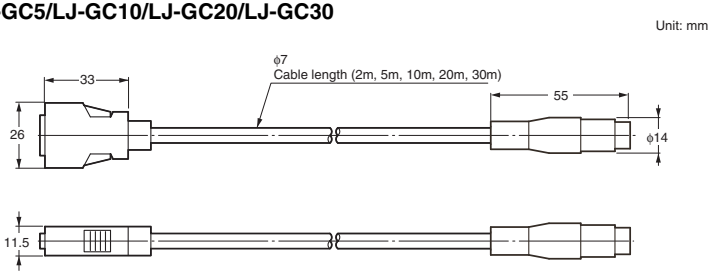
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LJ-G200



■ Head-to-controller cable

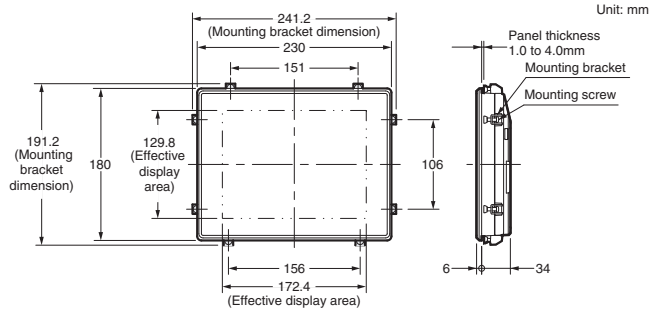
LJ-GC2/LJ-GC5/LJ-GC10/LJ-GC20/LJ-GC30



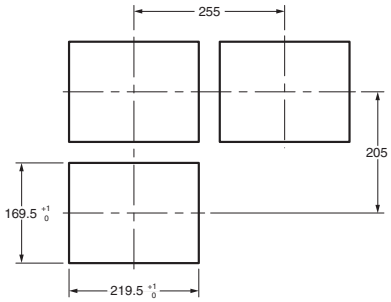
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■ LCD monitor

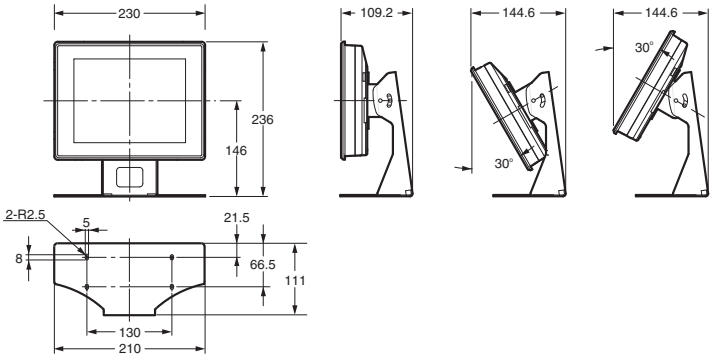
CA-MP81



Panel cutout dimensions



Monitor mounting stage (OP-42278)



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Status Table

Status			Display					Input				
			Screen update	Measured value	Profile	Evaluation		Trigger	Timing/ Reset	Auto zero	Program No. switching	Storage data save
						Each OUT evaluation	Total evaluation					
Measurement screen (During measurement)	Normal measurement value		Update according to measurement result	Measured value	Display *4	Evaluation Result	Total evaluation result *5	Yes *9	Yes	Yes	Yes	Yes
	Positive value range over			+FFFFFF		HI				No		
	Negative value range over			-FFFFFF		LO						
	Evaluation standby *1			------		--						
	Measured value Alarm *2	Alarm		-FFFFFF		LO						
		HOLD		HOLD		HOLD				Yes		
	Position correction error *3			Same as the measurement alarm						No		
Display setting menu			Stop	Display setting menu display				Same as the measurement screen (during measurement)				
Program No. switching screen				Program No.. Selection window display								
Saving the memory card *12				Message window display "Saving"				No	No	No	No	No
Reading storage data				Message window display "Reading storage data"								
Profile storage screen			Display the settings screen	Profile storage screen display								
Setting screen (During setting)				Setting screen display								
Communication mode Screen	RS-232C communication mode		Stop	Message window display "During RS-232C communication"								
	USB communication mode			Message window display "During USB communication"								
	Ethernet communication mode			Message window display "During LAN communication"								
When an error occurs				Error message display "Error Messages" (Page Appendix-4)								
When the power is turned on (Power ON reset)				Startup screen								

*1 In the following cases, the evaluation standby status 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
  - When the multiple triggers is OFF and the measurement mode is normal, the measurement value is fixed after the operations for averaging and the measurement times for averaging are complete.
  - When the multiple triggers is OFF and the measurement mode is other than normal, the measurement value is fixed with the timing control after the operations for averaging and the measurement times for averaging are complete.
  - When the multiple triggers is ON, the measurement value is fixed with the trigger input.
- When the profile delays by the number of times the delay between heads is set

*2 The measurement result becomes the measurement value alarm in the following cases:
- When there is no profile in the measurement area
- When Edge/width does not exceed the edge level
- When the reference line or the profile in the cross-section is not closed
- When the correlation value is 50% or less in profile tracking 1/2
- When the intersection cannot be calculated (parallel lines, etc.)

*3 The position correction error occurs when the position correction fails with the position correction set to ON.

"Position Adjustment" (Page 5-50)

*4 This is not displayed during the averaging process.

"Averaging" (Page 5-43)

"Averaging Response Time" (Page 10-24)

*5 The total evaluation result is based on the evaluation result of the OUT No. of which measurement more is set other than "No measurement".
OK: When the OUT Nos. other than the evaluation standby state are all GO
NG: When the OUT Nos. other than the evaluation standby state are not all GO
No display: When all the OUT Nos. are in the evaluation standby state

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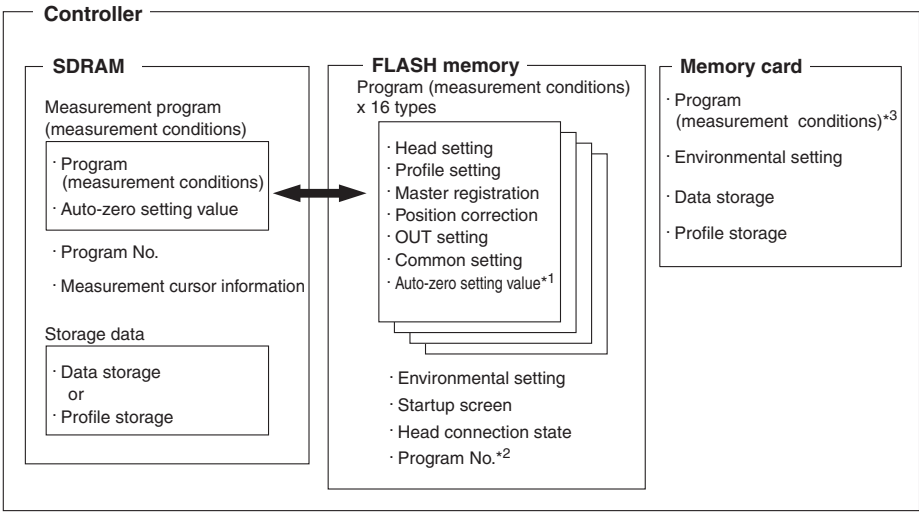
	Output										Communication		
	Evaluation/binary*6				Total evaluation	Analog voltage*7		Ready/ Busy	Invalid	Error (N.C.)	RS-232C	USB	Ethernet
	Evaluation	Binary	OUT No. output	Strobe		Measurement value output	Profile output						
	Evaluation result	Measurement result	OUT number during time-sharing output	Outputs in synchronism with time-sharing output	Turns on when the total evaluation result is GO*5	Voltage corresponding to the measurement value selected to be output ±10.8 V when the value exceeds ±10.5 V	Voltage corresponding to the profile selected to be output ±10.8 V when the value exceeds ±10.5 V	Output according to the measure-ment.	OFF	ON	Measurement control command	Measurement value display/ profile waveform display/storage operation (LJ-Navigator)	
	HI	0x0FFFFF				+10.8 V							
	LO	0x100000				-10.8 V							
	All OFF												
	HI and LO turns on at the same time												
	HOLD					HOLD							
	Same as the measurement alarm								ON				
	Same as the measurement screen (during measurement)									ON	Same as the measurement screen (during measurement)*10		
	HOLD						HOLD*8	HOLD	HOLD		Same as the measurement screen (during measurement)*11		
								OFF			Error	Error	Error
											Setting change/ confirmation command		
											Error	Sending and receiving settings	
												Error	Sending/ receiving settings
	All OFF				OFF	-10.8 V			OFF	OFF			Error
											No	No	No

*6 The evaluation/binary output outputs the measurement results in a time-sharing manner.
"Evaluation/Binary Output" (Page 10-15)
*7 When OUT No. or profile that has not been measured is selected for output, -10.8 V is output.
"Analog Output" (Page 5-114)
*8 The profile being output when the status has changed will be output to the last.
*9 The trigger input becomes valid when external trigger is selected for the trigger mode.
"Trigger Mode" (Page 5-12)
*10 The screen returns to the measurement screen after the communication mode screen.
*11 Processing takes place after the data has been saved or loaded.
*12 Saving the storage data or measurement screen.

ON/OFF indicates the ON/OFF status of the NPN or PNP open-collector output.
OK/NG indicates the validity/invalidity of input.
HOLD represents the state in which the normal value immediately before is being held.
USB/Ethernet indicates the communication using the Setup support software "LJ-Navigator".
The setting screen (during setting) indicates the setting screen (during setting) performed with the remote control console.
The communication mode indicates the status where setting is performed via RS-232C, USB communication, or Ethernet communication. RS-232C, USB and Ethernet cannot be used at the same time.
Moving to the communication mode and returning to the measurement screen through the USB or Ethernet communication are performed automatically on the Setup support software "LJ-Navigator".
Using RS-232C, USB or Ethernet in the measurement screen (during measurement) lowers the response speed.

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Memory Structure



- SDRAM is volatile memory. The stored data is erased when the power to the controller is turned off.
- The FLASH memory is non-volatile memory. The stored data is maintained even after the power to the controller is turned off.
- Turning on the power to the controller transfers the measurement conditions stored in the FLASH memory to the SDRAM, and the measurement is executed.
- The auto-zero setting is saved in the FLASH memory only when the save function is set to ON. (*1)
- The program Nos. are saved in the FLASH memory only when the save function is set to ON and the method for switching program Nos. is set to "Console". (*2)
- When moving from the setting screen to the measurement screen using the remote control console, the settings including the auto-zero setting and program Nos. are saved in the FLASH memory regardless of the save function setting.
- When saving a program (measurement condition) to a memory card, all 16 programs (measurement conditions) are saved as a single file. (*3)

"Auto-zero" (Page 3-15)
"Switching Program Nos." (Page 3-17)
"Setting the program-switching method" (Page 6-5)
"Settings save operations for flash memory (Save)" (Page 6-5)
"Saving to / Reading from a Memory Card" (Page 7-1)

► Note

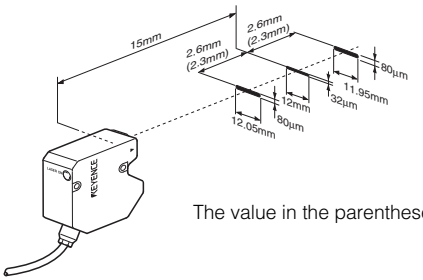
- The FLASH memory has an expected lifetime of 100,000 writes. If the auto-zero or program No. switching functions are changed over the communication link regularly, use the save off function to preserve the FLASH memory and use the mode change command (R1) command to measure and send results without saving settings.
  "Mode Change Commands" (Page 9-9)
- Do not turn off the power while writing to the FLASH memory or memory card. Part or all of the data may be lost, or system errors may be generated due to data errors.
  "System error messages" (Page Appendix-4)

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Characteristics

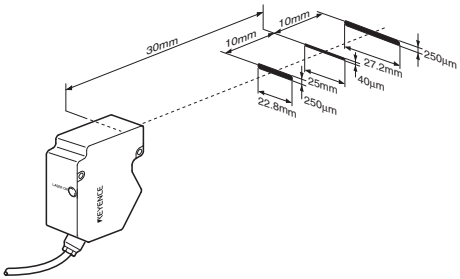
Spot Diameter

LJ-G015/LJ-G015K

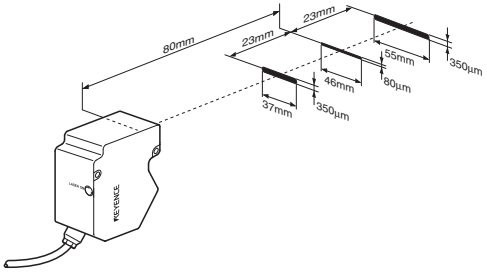


The value in the parentheses ( ) is for the LJ-G015K.

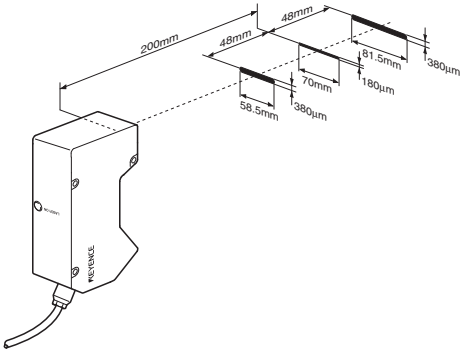
LJ-G030



LJ-G080



LJ-G200



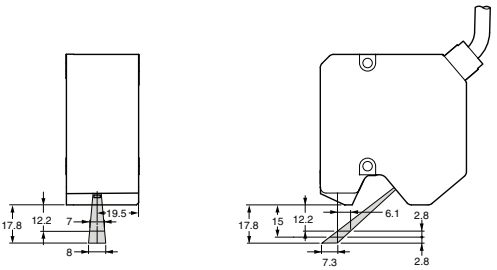
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Mutual Interference

No interference occurs if the laser light from another sensor is out of the shaded area in the figure (when measuring white paper).

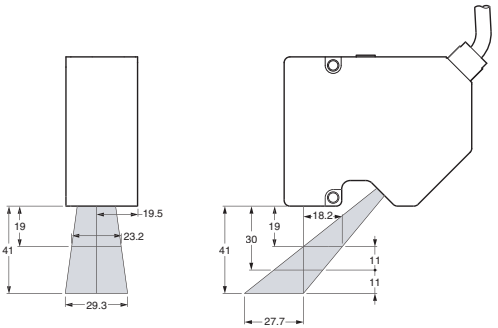
LJ-G015/LJ-G015K

Unit: mm



LJ-G030

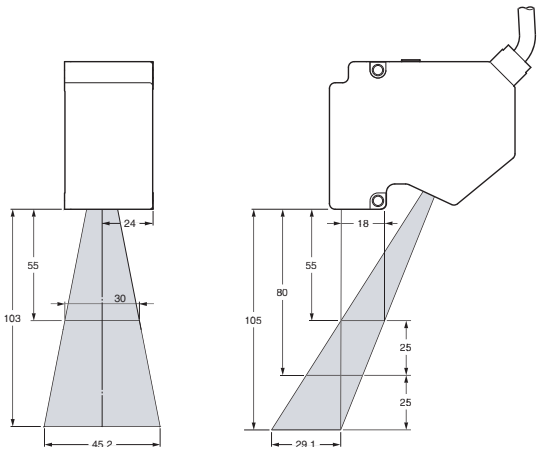
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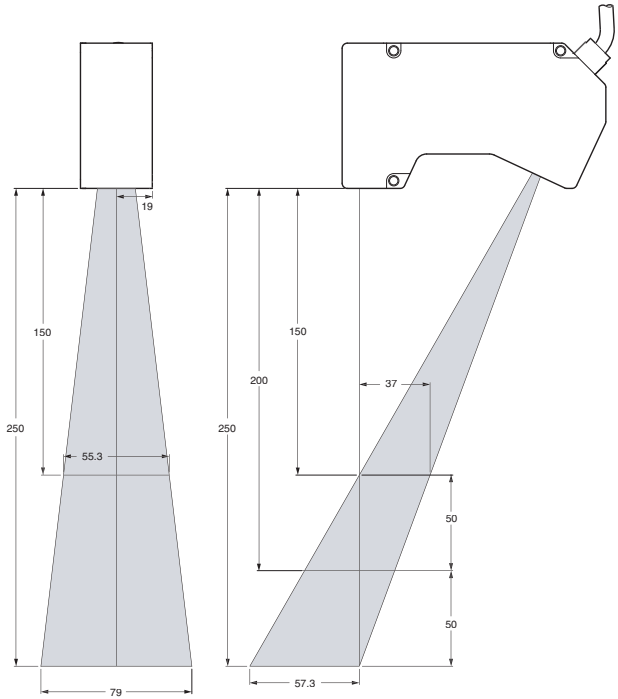
LJ-G080

Unit: mm



LJ-G200

Unit: mm



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MEMO

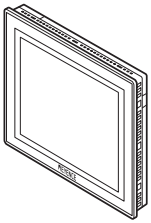
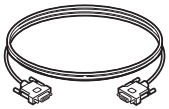
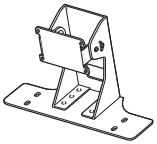
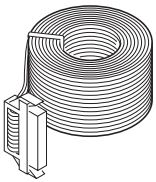
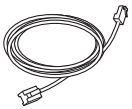
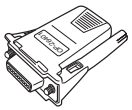
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Appendix

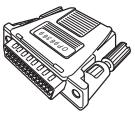
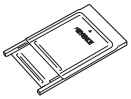
List of Optional Products Appendix-2
Error Messages Appendix-4
Troubleshooting Appendix-9
Index Appendix-13

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List of Optional Products

Name	Model	Figure	Description
8.4-inch color LCD monitor	CA-MP81		High-intensity, high resolution monitor. Used to display and operate the LJ-G Series. * The monitor cable (OP-66842) is required for connecting the controller.
Monitor cable	OP-66842		Cable (3 m) that connects the LJ-G Series and CA-MP81.
CA-MP81 mount	OP-42278		Mount used when not using panel mounting with CA-MP81.
Expansion connector cable	OP-51657		Cable for the expansion connector (3 m).
RS-232C cable	OP-96368		Communication cable for RS-232C (2.5 m).
Conversion adaptor for RS-232C	OP-26401		Conversion adaptor for the D-sub 9-pin connector. Use in the combination with OP-96368.

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Name	Model	Figure	Description
Conversion adaptor for RS-232C	OP-96369		Conversion adaptor for the D-sub 25-pin connector. Use in the combination with OP-96368.
USB cable	OP-66844		USB connection cable (2 m)
Memory card	GR-M256		256 MB memory card
	NR-M1G		1 GB memory card
	C-A1		PCMCIA adapter Memory card adapter

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Error Messages

System error messages

System error messages appear when an error occurs that stops measurement.

Display contents	Cause	Remedy
Head is not connected. Check the head connection and restart the power.	Displayed when there are not any heads connected.	Turn off the power and check the cable connecting the head and controller. After checking the cable, turn the power on again. If the error message appears again, contact your nearest KEYENCE office. "Connecting" (Page 1-14)
The models for Head A and Head B are different. Check the model of the head and restart the power.	Displayed when the two connected heads are different models.	When two heads are connected, use the same model.
• Head A internal error (****) • Head B internal error (****)	Displayed when Head A or Head B is not recognized correctly.	Turn off the power and check the cable connecting the head and controller. After checking the cable, turn the power on again. If the error message appears again, contact your nearest KEYENCE office.
Controller device error.(****)	Displayed when there is a controller internal error.	Contact your nearest KEYENCE office.
Parameter error (****)	Displayed when there is a data error in the parameters saved in FLASH memory. This may indicate that there is a data error due to the power being turned off while writing, a data error due to noise, or damage due to exceeding the number of times for writing.	• If the error disappears after restarting the power: Continue using the LJ-G Series as normal. • If the error appears again after restarting the power: Perform full initialization. "Returning the LJ-G Series to the Factory Default Settings" (Page 2-9) • If the error disappears after full initialization: Continue using the LJ-G Series as normal. Reconfigure the settings or load a backup file. (A backup file must be saved into a memory card or LJ-Navigator beforehand.) • If the error appears again after full initialization: There is a malfunction in the memory. Contact your nearest KEYENCE office. "Memory Structure" (Page 11-10)
CODE ****	• May be displayed when the cable extension mode setting is not correct. • Displayed when there is a head or controller internal error.	When using the 30 m cable for the cable connecting the head and controller, set the cable extension mode to ON. "Setting cable extension mode" (Page 6-4) Contact your nearest KEYENCE office.

- **** represents the specific error number.
- If other errors are displayed, contact your nearest KEYENCE office.

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Setting initialization messages

Setting initialization messages appear when part or all of the settings need to be initialized.

Display contents	Cause	Remedy
The head connection is different from the previous head connection. Initialize all settings. OK?	Displayed when the type of head connection changes in one of the following manners from the previous head connection: • When one head is connected and the head connector changes from Head A to Head B or from Head B to Head A. • When the number of connected heads changes. • When the model of the connected head changes.	Perform full initialization to use the new head connection. Select "Yes" and press the [ENTER] key. To not perform full initialization, turn off the power and return the connection to the previous state before turning the power on again. "Connecting" (Page 1-14)
Initialize all settings. OK?	Displayed when performing full initialization.	To perform full initialization, select "Yes" and press the [ENTER] key. To not perform full initialization, select "No" and press the [ENTER] key.
When changing the calculation settings, the parameters beyond master registration are initialized.	Displayed when changing the settings for calculation in the profile settings.	To perform initialization, select "Yes" and press the [ENTER] key. To not perform initialization, select "No" and press the [ENTER] key. The calculation settings are canceled. "Calculations" (Page 5-35)
When changing the measurement mode, the following settings are initialized. * Minimum display unit, scaling, tolerance settings, offset, auto-zero	Displayed when changing the measurement mode for OUT settings.	To perform initialization, select "Yes" and press the [ENTER] key. To not perform initialization, select "No" and press the [ENTER] key. The measurement mode settings are canceled. "Measurement Mode (Setting measurement conditions)" (Page 5-67)
When changing the minimum display unit setting, the following settings are initialized. * Scaling, tolerance settings, offset, auto-zero	Displayed when changing the minimum display unit for OUT settings.	To perform initialization, select "Yes" and press the [ENTER] key. To not perform initialization, select "No" and press the [ENTER] key. The minimum display unit settings are canceled. "Minimum Display Unit" (Page 5-106)

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Parameter error messages

Parameter error messages appear when a parameter is not set within the range or when settings have failed.

Setting item		Display contents	Cause	Remedy
Head settings	MFL	Calibration failed.	-	Reset the value to meet the calibration requirements. "When calibration fails" (Page 5-23)
	Tilt correction	The correction is set outside of the setting range.	Displayed when the correction exceeds the tilt correction range (±10°).	Adjust the head mounting angle within ±10° and recalculate the tilt correction. "Tilt Correction" (Page 5-30)
	Height correction	The value exceeds the span range.	Displayed when the correction exceeds the height correction range (span of 10x or less).	Adjust the height correction setting to a span of 10x or less and recalculate the height correction. "Height Correction" (Page 5-32)
Master registration		Master registration failed.	A profile cannot be found for master registration.	Press the [TRG] key to measure the profile, then press the Register button to register the master. "Master Registration" (Page 5-48)
Position correction		This setting cannot be configured because a master profile is not registered. Set a master profile in "Master registration".	Position correction can only be performed after master registration.	Set a master profile in "Master registration". "Master Registration" (Page 5-48)
OUT settings	Measurement mode	Set the profile area smaller than the search area.	In the measurement area settings, the profile area is set larger than the search area.	Reset the profile area so that it is smaller than the search area. "Profile measurement area" (Page 5-79) "Search area" (Page 5-81)
	Scaling	The same values cannot be set for the input values.	The scaling values do not meet the input conditions.	Reset the value to meet the input conditions. "If the input conditions are not met" (Page 5-108)
		Set the span smaller than 10.		
	Tolerance	Set the tolerance so that the lower limit value is equal to or smaller than the upper limit value.	The tolerance values do not meet the input conditions.	Reset the tolerance so that the lower limit value is equal to or smaller than the upper limit value. "Tolerance" (Page 5-109)
Common settings	Analog output	The same values cannot be set for the measurement values.	The analog output does not meet the input conditions.	Reset the value to meet the input conditions. "If the input conditions are not met" (Page 5-117)
		Set the span smaller than 10.		

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Setting item		Display contents	Cause	Remedy
Memory card	Overall	All error messages	A KEYENCE memory card (sold separately) is not in use.	To prevent operation errors, use a KEYENCE memory card (sold separately).
		A memory card is not inserted.	Displayed when attempting to operate the memory card while the memory card LED is unlit.	Check that a memory card is correctly inserted and the memory card LED is lit. If a memory card is inserted but the memory card LED is still unlit, remove the memory card and insert it again. "Inserting or Removing a Memory Card" (Page 7-3)
	Save	Enter the file name.	Displayed when the entered file name is not correct.	Correctly enter a file name. "File name" (Page 7-4)
		Failed to save file.	There is insufficient space in the memory card.	Delete unnecessary files to free space, or use a new memory card.
			The memory card has been damaged.	Format the memory card. If formatting does not fix the problem, use a new memory card.
			The memory card was removed while saving or immediately before confirming the save process.	Remove the memory card correctly.
		There is no stored data.	Displayed when there are no pieces of data stored in data storage or profile storage when attempting to save storage data.	When saving data stored in data storage or profile storage to the memory card, store at least one piece of data. "Storage" (Page 3-19)

Continued on the next page.

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Setting item		Display contents	Cause	Remedy
Memory card	Load	Failed to load the file.	The file has been damaged.	A damaged file cannot be read. (Making a backup file is recommended.)
			The memory card has been damaged.	Format the memory card. If formatting does not fix the problem, use a new memory card.
			The memory card was removed while loading a file or immediately before confirming the load process.	Remove the memory card correctly. "Inserting or Removing a Memory Card" (Page 7-3)
		The data does not agree with the model of the connected head or the type of head connection.	The type of head connection or the model of the head saved within the loaded program setting file is not the same as the actual state of the head connected to the controller.	Set the data so that the type of head connection or the model of the head saved within the loaded program setting file is the same as the head connected to the controller. "Connecting" (Page 1-14)
		Format is not the same.	The format in the file is not correct.	Use files that were saved correctly in the controller.
		The storage settings are different.	When loading profile storage files, the common settings for storage are not set in profile storage.	Set the profile storage settings when loading profile storage data. "Storage" (Page 5-118)
	Delete	Failed to delete file.	The memory card was removed while deleting the file or immediately before confirming the deletion.	Remove the memory card correctly.
	Format	Failed to format.	The memory card was removed while formatting or immediately before confirming the formatting.	Remove the memory card correctly.
			The memory card has been damaged.	Use a new memory card.
Profile storage screen		There is no saved profile data.	There are not any profiles saved in profile storage.	Save at least one profile in profile storage before displaying the profile storage screen.

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Troubleshooting

Problem	Checkpoints	Remedy	Reference page
Nothing is displayed on the monitor display.	Is the power cable properly connected to the monitor and controller?	Connect the power cable properly.	1-16
	Is the monitor cable properly connecting the controller and the monitor?	Properly connect the monitor cable.	1-16
Error message is displayed.	-	Address the problems according to the respective messages displayed on the screen.	Appendix -4
The remote control console does not function.	Is the remote control console properly connected?	Connect the remote control console properly.	1-16
	Is keylock turned on?	Turn off the keylock.	3-18
The laser does not turn on.	Is the cable properly connected between the head and controller?	Properly connect the cable between the head and controller.	1-15
	Is the power cable properly connected?	Properly connect the power cable.	1-16
	Is the input for the laser remote interlock input and/or the laser off input properly connected?	Properly connect the input.	7
	Are the trigger settings set properly?	Trigger input is required when using an external trigger.	5-12
The profile (profile waveform) is not displayed.	Is the measurement target placed within the measurement range?	Place the measurement target within the measurement range.	1-7 1-9
	Does the laser turn on?	See "The laser does not turn on" under Troubleshooting.	Appendix -9
	Is the profile display screen set?	Set the profile display screen on the measurement screen (during measurement).	3-5
	Are the trigger settings set properly?	Trigger input is required when using an external trigger.	5-12

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Problem	Checkpoints	Remedy	Reference page
The profile (profile waveform) is not displayed properly.	Is the measurement target placed within the measurement range?	Place the measurement target within the measurement range.	1-7 1-9
	Is the profile being affected by dead space?	Change the position of the measurement target.	1-11
	Is the profile being affected by stray light?	Change the position of the measurement target.	1-11
		Set the mask function.	5-26
	Is the measurement range for head setting properly set?	Properly set the measurement range for head setting.	5-19
	Are the mask settings for the head setting properly set?	Properly set the mask settings for the head setting.	5-26
	Is MFL (calibration, laser intensity, sampling period) set properly?	Properly set MFL (calibration, laser intensity, sampling period).	5-21
	Is the profile alarm set properly?	Properly set the profile alarm.	5-28
	Are filter, smoothing, and averaging set properly?	Properly set filter, smoothing, and averaging.	5-42
	Do the devices have mutual interference?	Use the mutual interference prevention function or the LASER OFF function.	5-13
	Is there strong ambient light?	Shield the ambient light.	5
		Set a shorter sampling period.	5-26
	Is the target covered in dirt, dust, water, or oil?	Remove the dust, dirt, water, and oil.	5
	Is the cover glass covered in dirt, dust, water, or oil?	Remove the dust, dirt, water, and oil.	5
	Are there splashes of water or oil in the operating atmosphere?	Remove the splashes through air purging or a similar process.	5
	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.	5
	Does the unit have condensation?	Install the unit in the proper operating environment.	3
	Does the measurement target or head vibrate?	Take appropriate countermeasures to prevent vibration.	5
The measurement value display remains in evaluation standby status (the display shows "------").	Are the trigger controls acting according to trigger mode?	Operate the trigger controls according to trigger mode.	5-12
	Is the timing control operating properly according to the measurement mode?	Operate the timing control according to the measurement mode.	5-103 10-1
	Is averaging set properly?	Properly set averaging.	5-43 10-24
	Is the number of times for averaging properly set?	Properly set the number of times for averaging.	5-101 10-24
	Is the delay between heads properly set?	Properly set the delay between heads.	5-41 10-26

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Problem	Checkpoints	Remedy	Reference page
The measurement value display shows the alarm state (-FFFFFF).	Is the profile displayed properly?	See "The profile (profile waveform) is not displayed properly." under Troubleshooting.	Appendix -10
	Is the measurement mode properly set?	Properly set the measurement mode.	5-67
	Is the position correction properly set?	Properly set the position correction. If position correction fails, the measurement value shows an alarm.	5-50
Displayed measurement values fluctuate.	Is the profile displayed properly?	See "The profile (profile waveform) is not displayed properly." under Troubleshooting.	Appendix -10
	Is the position correction properly set?	Properly set the position correction.	5-50
	Is the number of times for averaging properly set?	Properly set the number of times for averaging.	5-101
	Is the measurement value alarm properly set?	Properly set the measurement value alarm.	5-102
Displayed measurement values deviate.	Is the profile displayed properly?	See "The profile (profile waveform) is not displayed properly." under Troubleshooting.	Appendix -10
	Is the measurement target tilted or displaced?	Place the measurement target within the measurement range.	1-7 1-9
		Set the tilt correction and height correction.	5-30 5-32
		Properly set the position correction.	5-50
	Is the scaling properly set?	Properly set the scaling.	5-107
Auto-zero does not operate correctly.	Is the ZERO terminal properly connected?	Properly connect the ZERO terminal.	3-15 5-113
	Is the offset value properly set?	Properly set the offset value.	5-105
Cannot change the program No.	Is program switching in the environment settings properly set?	Properly set the program selection according to the program switching method.	6-5
	Is keylock turned on?	Set the keylock to OFF.	3-18
	Is the setting screen (configuring settings) or the communication mode turned on?	Switch to the measurement screen (during measurement).	2-1
	Is the program name properly set in the memory card?	When using the program No. switching function in the memory card, use the correct program file name.	7-9
Evaluation output cannot be output properly.	Is the unit properly wired?	Check the output circuit and wiring, and connect properly.	8-4
	Is the tolerance properly set?	Properly set the tolerance.	5-109
	Is the binary output in the common settings properly set?	Select the evaluation output for binary output in the common settings.	5-114
	Is the data output timing in the common settings properly set?	Properly set the data output timing in the common settings.	5-121
	Is the import timing properly set?	Use strobe output to enable importing in a proper timing.	10-16

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Problem	Checkpoints	Remedy	Reference page
Analog output cannot be output properly.	Is the unit properly wired?	Check the wiring and connect properly.	8-3
	Is the voltage greater than +10.8 V or lower than -10.8 V?	Set the analog scaling properly according to the measurement value.	5-114
	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 output properly.	Is the unit properly wired?	Check the output circuit and wiring, and connect properly.	8-4
	Is the logic properly set?	Check the output settings. Negative logic is used in the output.	8-8
	Is the input timing properly set?	Use the strobe output to enable proper input timing.	8-8 6-4 10-16
	Is the binary output in the common settings properly set?	Select the OUT number for binary output in the common settings.	5-114
	Is the data output timing in the common settings properly set?	Properly set the data output timing in the common settings.	5-121
	Is the strobe time in environment settings properly set?	Properly set the strobe time in environment settings.	6-4
Cannot communicate via the RS-232C.	Is the communication cable properly connected?	Connect the communication cable properly.	9-3
	Does the type of the communication cable conform to the specifications?	Check the type of communication cable used.	9-3
	Are the communication specifications properly set?	Set the communication specifications of the LJ-G Series the same as for the external device.	9-2
	Is the appropriate communication program used?	Check whether the command and the delimiter is properly sent or received.	9-7
		After recognizing the reply command from the LJ-G Series, send the next command.	9-7
	Is the LJ-G Series ready to receive commands?	Send commands when the LJ-G Series is in the correct state.	9-5
	Are the communication settings properly set according to the communication method or external devices?	Set the auto transmission properly.	5-120 9-4
The memory card cannot be read or written correctly.	-	Address the problems according to the respective messages displayed on the screen.	1-3 7-3 Appendix-7

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Index

Symbols

Cross-Sectional Area (Measuring a Cross-Sectional Area) 5-89
Step (Measuring differences in height) 5-85

Numerics

1st peak 5-29

A

A+B 5-36
A-B 5-37
Active OUT No. display 3-3
Adjusting date and time 6-5
Adjustment for the master workpiece 3-16
All OUT evaluation display 3-3
Analog Output 5-114, 9-26
Analog output scaling 5-115
Analog profile output period 5-115
Analog voltage output 8-12
ANG Correction 5-51, 5-61, 5-62
ANG correction operations during measurement 5-61
ANG X correction 5-64
Angle 5-92
ASCII Code Table 9-34
AUTO 5-23
Auto-zero 3-15
Automatic Transmission 5-120
Auto-offset 3-16
Auto-zero display 3-3
Averaging 5-43, 5-101, 9-22, 9-23

B

Basic General Device Settings 6-1
Basic Operations for Settings 2-3
Binary Output 5-114, 9-25
Binary output 8-8

C

Initialization 2-9
Calculations 5-35, 9-22
Calculations (Calculating the distance between OUTs) 5-99
Calibration (Optimizing CMOS characteristics) 5-22
CA-MP81 11-7
Center Position (Measuring the Center Position) 5-88
Change parameter commands 9-5
Change program No. screen 4-2
Changing languages 6-4
Changing to RS-232C communication mode 9-9
Changing to the measurement screen (saving to FLASH memory) 9-9
Changing to the measurement screen (without saving to FLASH memory) 9-9
Characteristics 11-11
Check parameter commands 9-5, 9-30
Checking the Package Contents 1-2
CMOS image 5-18
Command Format 9-7
Command list 9-9
Command reception 9-6
Command types 9-5
Command Types and Reception 9-5
Common Settings 5-111
Communication Specification Settings 9-3
Communication Specifications 9-2
Comparative Measurement Mode 5-103, 9-23
Confirm program No. 9-13
Connecting 1-14
Connecting to a PC or PLC Link Unit 9-3
Connections and Settings 9-3
Connector Pin Layout 9-2
Content that can be Saved and Read 7-4
Controller 1-3, 11-4
Copying Settings 5-110
Copying the program No. 4-4
Correction mode 5-52
Correlation value 5-52
Cross-sectional measurement area 5-76
Cursor 2-3

D

Data Output Timing 5-121
Data Storage 3-19
Data storage 5-118, 9-27
Default Values and Setting Ranges for Setting Items 5-4
Delay count 5-15

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Deleting Files 7-7
Details of Setting Content Change Commands 9-18
Dimensions 11-4
Display range 5-107
Display Setting Menu 3-9
Displaying the "Change Program No." Screen 4-2
Displaying the CMOS Image 5-18
Displaying the Common Settings Screen . 5-111
Displaying the Head Settings Screen 5-11
Displaying the MFL settings screen 5-21
Displaying the Measurement Mode Settings Screen 5-82
Displaying the Memory Card Screen 7-2
Displaying the OUT Settings Screen 5-65
Displaying the Position Adjustment Settings Screen 5-51
Displaying the Profile Settings Screen 5-34
Displaying the profile storage screen 3-23
Drawing an Area by Entering Values 2-7
Drawing an Area with the Cursor 2-6
During measurement 2-1, 11-8
During setting 2-1, 11-8

E

E^3-CMOS 5-18
Edge correction 5-51
Edge Correction X 5-57
Edge correction X 5-54
Edge correction Z 5-54
Edge correction, Z then X 5-55
Edge correction, X then Z 5-55
Effective Range (Setting the effective range for adjustments) 5-24
EIA RS-232C compliant (Modem definition) ... 9-2
Entering a Value 2-5
Entering Characters 2-5
Environment Settings 6-1
Equipment information display 3-2
Erasing the approximation line area 5-78
ERROR output 8-6
Error output 8-6
Error response command format 9-7
Ethernet settings 9-28
Evaluation output 8-6
Evaluation result display 3-3
Evaluation standby 3-3, 11-8, Appendix-10
Example of non-voltage input 1 wiring 8-11
Example of non-voltage input 1/ non-voltage input 2 wiring 8-10
Example of voltage input 1/2 wiring 8-11
Example of X-Z correction 5-55
Example of Z-X correction 5-56
Expansion connector 8-4

G

-FFFFFF 3-3, 11-8, Appendix-11
FFFFFF 3-3, 11-8
File extensions 7-4
File Format 7-4
File name 7-4
Filter 9-22
For profile tracking 5-80
Formatting Memory Cards 7-8
Function Limits and Selecting Setting Items 5-10

G

Grid scale 3-2

H

Head 1-6, 11-5
Head A / Head B Settings 5-18
Head Delay Count 5-41, 9-22
Head Settings 5-11
Head Specifications 11-3
Head-to-controller cable 11-6
Height (Measuring height) 5-83
Height Correction 5-32
Height measurement area 5-71
Histogram display 5-18
Hold Function 3-14
How to Use the [ENTER] Key 2-3

I

I/O Circuit and Electrical Specifications 8-10
I/O Signal Functions 8-6
If the input conditions are not met . 5-108, 5-117
Incline Correction 5-30
Incoming command format 9-7
Initializing settings 4-5
Input terminal block 8-2

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Inserting a Memory Card 7-3
Inserting or Removing a Memory Card 7-3
Installation and Connection..... 1-10
Installing the Head 1-10
Insulation between I/O circuits..... 8-12
Interface language 9-29
Intersection..... 5-91
IP address 9-28

K

Keylock..... 3-18, 9-13

L

Laser emission control input 8-9
Laser intensity 5-23, 9-21
LCD monitor 11-7
Linking (H) / Linking (V)..... 5-39
List of Optional Products..... Appendix-2
LJ-G015/LJ-J015K 11-5
LJ-G030..... 11-5
LJ-G080..... 11-5
LJ-G200..... 11-6
LJ-G5001..... 11-2, 11-4
LJ-G5001 (NPN type)..... 8-9, 8-10
LJ-G5001/LJ-G5001P common..... 8-12
LJ-G5001P 11-2, 11-4
LJ-G5001P (PNP type)..... 8-9, 8-11
LJ-GC10 11-6
LJ-GC2 11-6
LJ-GC20 11-6
LJ-GC30 11-6
LJ-GC5 11-6
Loading and saving with the memory card.. 4-5
Loading data 3-20
Loading profile data 3-22

M

MANUAL 5-23
Mask Setting..... 5-26
Master Registration 5-48
Measurement Alarm 5-102, 9-23
Measurement alarm 3-3
Measurement area 3-2
Measurement Conditions and Measurement Data Flow 5-2
Measurement Control Command Details ... 9-11
Measurement control commands 9-5
Measurement control input/output..... 8-6
Measurement cursor..... 3-3, 3-11
Measurement cursor information 3-2
Measurement display 3-3
Measurement format..... 9-8
Measurement Mode..... 5-67
Measurement Range 5-19, 9-20
Measurement range..... 1-7
Measurement result mark 3-3
Measurement screen 3-2
Memory card control input..... 8-9
Memory Structure 11-10
MFL..... 5-21
Minimum Display Unit 9-24
Minimum display unit 5-106
Mode change commands..... 9-5, 9-9
Mounting on a DIN rail 1-13
Mounting on the bottom of the controller.... 1-13
Mounting the Controller 1-12
Movement 3-10
Multiple reflections..... 5-29
Multiple Trigger..... 5-15, 9-19
Mutual Interference..... 11-12
Mutual interference prevention 5-13, 9-18

N

Names and Wiring of the I/O Terminals..... 8-2
Naming a Program No. 4-3
No Measurement (Not setting any measurement conditions). 5-82
Non-voltage input 1 ..... 8-10, 8-11
Non-voltage input 2 8-10
Normal 5-28
Notes on the mounting direction..... 1-12
NPN open-collector output 8-10

O

Offset 5-105, 9-23
Operating the "Storage" button 3-20
Operating the "Storage" button (Always, NG)..... 3-22
Operating the "Storage" button (Manual).... 3-22
Operating the Measurement Screen 3-4
Operations and Functions of the Display Setting Menu..... 3-9
Operations from Settings until Measurement 2-2

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OUT Name (Naming an OUT number) 5-66
OUT name display 3-3
OUT No. 3-3
OUT Settings 5-65
Outline of the Screen and Operations 2-1
Output Format 9-33
Output Method 9-33
Output terminal block 8-3
Outputting Measurement Values in External Synchronization 9-4, 9-32
Outputting Measurements 9-4
Outputting Measurements and Changing Settings via Commands 9-5
Outputting measurements via commands 9-4
Overview of ANG Correction 5-61
Overview of Common Settings 5-111
Overview of Edge Adjustment 5-54
Overview of Measurement Control Commands 9-10
Overview of Measurement Modes 5-67
Overview of OUT Settings 5-65
Overview of Position Adjustment 5-50
Overview of Saving and Reading 7-1
Overview of Setting Content Change Commands 9-16
Overview of the measurement area 5-71
Overwriting a previously existing file 7-6

P

Parameter error messages Appendix-6
Part Names and Functions 1-3
PNP open-collector output 8-12
Position (Measuring position) 5-84
Position Adjustment 5-50
Position measurement area 5-73
Processing time display 3-2
Profile 5-18
Profile Alarm 5-28, 9-22
Profile area 5-52
Profile Comparison 1 5-94
Profile Comparison 2 5-95
Profile Correction 5-44, 5-52
Profile correction 5-51
Profile correction operations during measurement 5-53
Profile Display Screen 3-7
Profile measurement area 5-79
Profile name 3-3
Profile Settings 5-34
Profile shape output 9-12
Profile storage 5-119, 9-27
Profile Storage Function 3-21
Profile storage screen 3-23
Profile Tracking 1 5-96
Profile Tracking 2 5-98
Program 9-13
Program name display 3-2
Program No. switch input 8-7
Program No. switching 9-13

R

Range movement 3-10
Reading from a Memory Card 7-6
Registering a Master 5-48
Remote control console 1-4, 11-4
Remote trigger input 9-12
Removing a Memory Card. 7-3
Reset 9-13
Response command format 9-7
Returning the LJ-G Series to the Factory Default Settings 2-9

S

Sampling count 5-15
Sampling time 5-25
Save 6-5
Save folder 7-4
Save timing 3-19, 3-21
Saving and Loading the Measurement Conditions 4-1
Saving Storage Data to the Memory Card from the Input Terminal 7-9
Saving to a Memory Card 7-5
Scaling 5-107, 9-24
Search area 5-52, 5-81
Selecting a profile to set the measurement area 5-71
Selecting an Item 2-4
Selecting from a Pull-down Menu 2-4
Selecting the program No. (Loading) 4-3
Setting "Peak" or "Bottom" 5-76
Setting auto-send 6-3
Setting cable extension mode 6-4
Setting change format 9-8
Setting confirmation format 9-8

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Setting initialization messages Appendix-5
Setting the communication specifications for Ethernet 6-3
Setting the communication specifications for RS-232C 6-3
Setting the edge level 5-75
Setting the Measurement Area 5-71
Setting the Measurement Conditions to Meet Your Needs 5-3
Setting the program-switching method 6-5
Setting the strobe time 6-4
Settings save operations for flash memory (Save) 6-5
Smoothing 5-42, 9-22
Specifications 11-2
Specifications of the Controller 11-2
Specifications of the Head-to-Controller Cable 11-3
Spot diameter 11-11
Stabilizing Profiles 5-42
Starting/stopping save process and clearing 3-19, 3-21
Status Table 11-8
Subnet mask 6-3
Storage 3-19, 9-14, 9-27
Storage types 9-27
Strobe period 9-28
Switch program No. on the memory card .. 9-13
Switching Program Nos. 3-17
Switching the active OUT No. 3-4
System Configuration 1-1

T

Timing display 3-3
Timing ON/OFF 9-12
TIMING terminal 5-112
Tolerance 5-109, 9-24
Total evaluation display 3-2
TRG input 8-6
Trigger Function 3-14
Trigger input 8-6
Trigger Mode 5-12, 9-18
Trigger Setting 5-11
Trigger Synchronization 5-14, 9-18
Troubleshooting Appendix-9
Types of ANG correction 5-61
Types of edge correction 5-54
Types of Position Correction 5-51

U

Uploading a Program from the Memory Card and Taking Measurements 7-9
Using the Terminal Block 1-17

V

Value Display Screen 3-6
Viewing the Display Setting Menu 3-9
Voltage input 1 8-11
Voltage input 2 8-11

W

Wide 5-38
Width (Measuring differences in width) 5-86

Y

X ANG correction 5-64
X Correction 5-57
X display range 3-3
X display range bar 3-3
X-Z Correction 5-60

Z

Z Correction 5-59
Z display range 3-3
Z display range bar 3-3
ZERO terminal 5-113, 8-6
Zoom 3-10
Z-X Correction 5-60

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